

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

**GENERAL**

**CHILING INJURY**

Peng, J. et. al. 2013. Managing **chilling injury** in fruits. Acta Hort. 1012: 1087 - 1096.

**Abstract**

Most tropical and subtropical fruits are susceptible to chilling injury, mainly manifested as pitting, surface or internal browning, failure to ripening, development of a woolly or leathery texture, and decay. The development of these chilling injury symptoms negatively affects fruit quality and thus shortens storage life. Chilling injury of fruits can be alleviated by physical techniques such as low temperature conditioning, heat treatment, controlled or modified atmosphere storage, waxing, and UV-C irradiation, by chemical treatments with methyl jasmonate (MeJA), methyl salicylate (MeSA),  $\gamma$ -amino butyric acid (GABA), 1-methylcyclopropene (1-MCP), nitric oxide, oxalic acid, or other natural compounds and genetic engineering. Treatment with MeJA enhances antioxidant activity, increases endogenous GABA and proline content and maintains a higher degree of unsaturation of membrane lipid in loquat fruit. GABA treatment enhances the accumulation of endogenous GABA and proline, induces higher antioxidant activity, and maintains higher adenosine triphosphate (ATP) content and energy charge in peaches. The combination of heat with MeJA or MeSA treatment has a synergistic effect on alleviating chilling injury and inducing higher antioxidant activity in peach fruit. For loquat, avocado, pineapple, and persimmon fruits whose chilling injury is enhanced by increased ethylene production, 1-MCP can be used to reduce its development. Low temperature conditioning activates the expression of membrane lipid modification enzymes such as fatty acid desaturase (FAD) and lipid transfer protein (LTP), whereas heat treatment induces the expression of various stressrelated genes, including heat shock proteins (HSPs), dehydrin and universal stress protein (USP), increases antioxidant activity and maintains membrane stability in citrus fruits. Genetic engineering has the potential to enhance chilling tolerance by generation of genetically-modified fruits with overexpressed genes that encode HSPs and antioxidant enzymes.

**Keywords:** /Chilling Injury/ /Low Temperature Storage/ /Postharvest Treatments/ / Fruit Quality/

Wang, C.Y. 2013. Managing **chilling injury** in vegetables. Acta Hort. 1012: 1081 - 1086

**Abstract**

Common vegetables that are susceptible to chilling injury include asparagus, beans, cucumbers, eggplants, ginger, jicama, okra, peppers, potatoes, pumpkins, sweet potatoes, tamarillos, tomatoes, and zucchini squashes. Most of the susceptible crops are either fruit vegetables or root vegetables. Chilling injury symptoms vary depending on the commodity, but generally manifest as pitting, discoloration, internal breakdown, and decay. Images from nuclear magnetic resonance revealed that signals on the peripheral of cells in chilled zucchini tissues were much more intense than those in non-chilled tissues, indicating that cell membranes were damaged by chilling which leads to the increased permeability and solute leakage. Several postharvest techniques have been demonstrated to be effective in managing chilling injury in vegetables, including temperature preconditioning, intermittent warming, high oxygen atmosphere, heat treatment, modified atmosphere packaging, and treatment with growth regulators or natural products as well as harvesting at proper maturity. Treatment with certain naturally occurring compounds such as methyl jasmonate (MJ) or methyl salicylate (MS) increased activities of alternative oxidase (AOX) in the respiratory pathway of sweet pepper and enhanced amounts of high and low molecular weight heat shock proteins (HSP) and pathogenesis-related proteins (PRP) in tomatoes. Temperature preconditioning treatment elevated antioxidant content and antioxidant enzyme activities, and augmented s-adenosylmethionine (SAM) decarboxylase activities and increased the levels of spermidine and spermine in

zucchini squash. These defense responses induced by these treatments might be part of the mechanisms that protected and prevented tissues from chilling injury. Promising techniques and new methods such as genetic engineering and transgenic skill need to be exploited for better management of chilling injury.

**Keywords:** /Chilling Injury/ /Vegetables/ /Postharvest/ /Temperature/ /Storage/

## **CHITOSAN**

Zahid, N. et. al. 2013. In vitro control of *Colletotrichum gloeosporioides* by using chitosan loaded nanoemulsions. Acta Hort. 1012: 769 - 774.

### **Abstract**

Anthrachnose is a major devastating disease of many fruits including dragon fruit and vegetables especially in tropical regions of the world. Anthracnose is commonly controlled with synthetic fungicides. However, due to certain harmful effects of synthetic fungicides on human health and environment, there is a need to look for some safe alternatives. In this context, a present study was designed to evaluate a natural product such as chitosan to control anthracnose caused by the fungus *Colletotrichum gloeosporioides* (Penz.) Penz & Sacc isolated from dragon fruit plants. Chitosan was used in the form of nanoemulsions which is a novel technology. Nanoemulsions of different droplet sizes (200, 400, 600, 800, 1000 nm) were prepared using two types of chitosans (low molecular weight and locally prepared chitosan) at 1.0% concentration and evaluated in vitro to control the growth of conidia, dry weight of mycelia and sporulation of *C. gloeosporioides*. The results regarding in vitro studies showed that low molecular weight chitosan at 1.0% concentration with 600 nm droplet size showed the best results in terms of inhibiting conidial germination, reducing dry weight of mycelia and sporulation as compared to the locally prepared chitosan and untreated control. The results of the present study suggest that chitosan in the form of nanoemulsions could be used as a biofungicide for controlling anthracnose of dragon fruit plants in the future.

**Keywords:** /Chitosan/ /Anthracnose/ /Dragon Fruit/

## **DYNAMIC CONTROLLED ATMOSPHERE (DCA)**

DeLong, J.M. 2013. History, current situation and future prospects for dynamic controlled atmosphere (DCA) storage of fruits and vegetables, using chlorophyll. Acta Hort. 1012: 905 - 916.

### **Abstract**

The use of chlorophyll fluorescence in fruit and vegetable storage (HarvestWatch™) was first introduced at the ISHS CA symposium in 2001 in Rotterdam, The Netherlands and was first commercially adopted in the 2003-2004 storage season in Washington State, USA and South Tyrol, Italy. Although there are many potential postharvest applications for chlorophyll fluorescence that will be reviewed, research and commercial adoption has focussed primarily on its use in optimising the O<sub>2</sub> concentration in dynamic controlled-atmosphere (DCA) storage of fruits and vegetables. This is achieved through a novel method of detection of a sudden change in fluorescence at the lower O<sub>2</sub> limit (LOL). The reasons for its adoption are: real-time monitoring and control of product, pesticide-free technique, accurate determination of LOL, control of storage disorders, especially superficial scald in susceptible apple and pear cultivars without use of pesticides such as diphenylamine (DPA), improved retention of quality, possible flavour enhancement and detection of senescence, decay or incorrect storage conditions, i.e., temperature. A summary of the current use of HarvestWatch™ will be presented. Preliminary results from applications in other high value fruits, e.g., extension of green-life in banana, 'programmed DCA' for avocado, will be presented as evidence of possible future applications.

**Keywords:** /Dynamic Controlled Atmosphere/ /Fruits and Vegetables/ /Chlorophyll/

## EDIBLE COATING

Malmiria, Jafarideh, H., et. al. 2013. Developing a new antimicrobial **edible coating** formulation based on carboxymethyl cellulose-silver nanoparticles for tropical fruits and an in Vitro evaluation of its antimicrobial antimicrobial properties. Acta Hort. 1012: 705 – 710.

### Abstract

Tropical fruits including papaya are highly perishable especially during agents as an alternative packaging method have been employed widely in fruits to provide additional protection against postharvest diseases and prolong their shelf life. Silver nanoparticles (SNPs) have attracted intensive research interest due to their high antimicrobial properties. In the present study, antibacterial properties of edible surface coating based on sodium carboxymethyl cellulose (Na-CMC) incorporated with SNPs were investigated against *Escherichia coli* and *Staphylococcus aureus*. Results obtained indicated that the minimum bactericidal concentration of SNPs was 60 ppm. In vitro evaluation of antifungal properties of edible coating comprising of Na-CMC (1.32% w/w) – Na-caseinate (0.40% w/w) – glycerol (0.86% w/w) – SNPs (60 ppm) against *Colletotrichum musae*, indicated that this coating formulation significantly ( $p < 0.05$ ) inhibited the growth of this fungus as compared to the same coating formulation without SNPs. Thus, these results indicated that Na-CMC-based coating formulation conjugated with SNPs can be employed as a new antimicrobial coating for tropical fruits to control diseases caused by microorganisms.

**Keywords:** /Edible Coating/ /Tropical Fruits/

## ETHYLENE

Elmi, F., Cools, K. & Terry L.A. 2013. The use of it's fresh! **Ethylene** remover technology with **e+®** active as a practical means for preserving postharvest fruit quality. Acta Hort. 1012: 1205 - 1210.

### Abstract

The presence of ethylene in a storage environment can undermine both quality and postharvest life, often generating significant waste and associated economic losses. A demand for discovering alternative technologies capable of scavenging ethylene has led to the development of a new material, e+® active, which has significant ethylene adsorption capacity. The material has been shown to remove ethylene to below physiologically active levels during fruit storage at 0-20°C and consequently extend postharvest life for a variety of fresh produce types. Different formats have been evaluated. For example, "It's Fresh!" sheets containing e+® active were shown to be a highly efficacious format for suppressing ethylene and extending storage life of imported avocado and pluot plums in a series of trials. Indeed, It's Fresh! Technology has also been shown to have profound effects on non-climacteric fruit types such as strawberry where quality-related attributes were affected. The mode of action of It's Fresh! Technology with e+® active and the implications of scavenging ethylene in both non-climacteric and climacteric systems are discussed.

**Keywords:** /Ethylene/ / Postharvest Fruit Quality/ /Strawberry/

## FUNGAL PATHOGENS

Droby, S. et.al. 2013. Biochemical and transcriptomic analysis of host responses to yeast biocontrol agents of postharvest pathogens. Acta Hort. 1012: 671 - 680.

### Abstract

Although the biocontrol activity of antagonistic yeasts has been demonstrated on a variety of commodities, the mode of action of these microbial biocontrol agents has not been fully elucidated. Antagonistic yeasts of

postharvest pathogens have been reported to induce several biochemical defense responses in host tissues of surface-wounded fruit. The interaction of yeast cells with fruit tissue resulted in major responses of the fruit that included enhanced production of ROS, phytoalexins, fungal cell wall degrading enzymes and the formation of structural barriers such as deposition of papillae and lignin in host cell walls. We have also shown that interaction of yeast cells with fruit tissue alters the volatile profile by down-regulation or up-regulation of certain compounds. To gain a better understanding of the molecular changes taking place in fruit tissue following the application of the yeast *Metschnikowia fructicola*, microarray analysis was performed on grapefruit surface wounds. The data indicated that 1007 putative unigenes showed significant expression changes following wounding and yeast application compared to wounded controls. Microarray results of select genes were validated by RT-qPCR. The data indicated that yeast application induced expression of *Rbo*, *MAPK* and *MAPKK*, G-proteins, *CHI*, *PAL*, *CHS*, *4CL*. In contrast, three genes *POD*, *SOD* and *CAT* were down-regulated in grapefruit peel tissue treated with the yeast cells. Suppression was correlated with significantly higher levels of hydrogen peroxide, superoxide anion and hydroxyl radical production in yeast-treated surface wounds. This study provides the first global Apicture of gene expression changes in grapefruit in response to yeast antagonists.

**Keywords:** /Fungal Pathogens/ /Grapefruit/

Rouissi, W. Mari, M. & Bertolini, P. 2013. Activity of secondary metabolites from *Penicillium expansum* R82 strain against postharvest **fungal pathogens**. Acta Hort. 1012: 601 - 608.

#### **Abstract**

In search for alternative means to conventional fungicides for postharvest disease control, a *Penicillium expansum* strain (R82) was assayed for its inhibitory activity against mycelial growth and conidial germination of some fungal pathogens. For this purpose a sterile fungal filtrate (SFF) was prepared from malt extract broth previously inoculated with R82 and incubated at 20°C for 10 days. The SFF was tested in vitro for inhibition of mycelium dry weight (DMW) or conidial germination of *Botrytis cinerea*, *Colletotricum acutatum*, *Monilinia laxa* and six *P. expansum* strains. All pathogens showed a significant decrease of DWM when grown in SFF of R82 with respect to the control. The highest growth inhibition was observed in *P. expansum* strains (-75.5%) followed by *M. laxa* (-63%), *C. acutatum* (-58%) and *B. cinerea* (-56%). The conidial germination of the six *P. expansum* strains was not inhibited by SFF and in some cases was stimulated. In all tested strains, microscopic observations of germinated conidia showed a consistent increase of the length of the germ tube compared to the control, however, the treated germ tubes appeared to be abnormal. Since the thin-layer chromatography tests revealed that the extracts from R82 SFF have no inhibitory activity against the target pathogens, a possible action of volatile organic compounds (VOCs) was supposed. The VOCs produced by R82 strain fully inhibited mycelial growth of *B. cinerea*, *C. acutatum* and *M. laxa*, while a growth reduction occurred in *P. expansum* strains. Conidial germination of *B. cinerea*, *C. acutatum* and *M. laxa* were completely inhibited, while in *P. expansum* ranged 18.1 to 32%, compared to the control. The potential of VOCs produced by *P. expansum* R82 strain as biofumigant is discussed.

**Keywords:** /Fungal Pathogens/ /Botrytis Cinerea/

#### **MARKETING**

Norsida, M. & Nurul Farhana M.D. 2013. Acceptance of 3P's (Packaging, Labeling and Grading) regulation among vegetable producers, wholesalers and exporters. Acta Hort. 1012: 1211 - 1216.

#### **Abstract**

A 3P's (Grading, Packaging and Labelling) Regulation is a program to improve the quality of agriculture produce through grading, packaging and labelling. The regulations require that all agricultural produce are graded, packaged and labelled before they are marketed (domestic, export or import). The objectives of this program is basically to enhance the efficiency and effectiveness of the marketing of local produce in order to retain their competitiveness and to maintain current market share to expand both domestic and overseas market access in line with the changes in global trade. The implementation of 3P's can give the impact on socioeconomics of the

implementers like as productivity, income and value-added of produces. However, level of participation, implementation, and effectiveness of extension activities in promoting 3P's will influence success of the program. The objectives of study are: to examine the respondent profile; to identify the level of 3P's practices among the implementers. The study targeted vegetable producers (40 respondents) in Pahang and Selangor. The survey result revealed that many of the respondents still not fully practice the 3P's Regulation. For labelling especially, the level of implementation of 3P's is still at low level. This may be due to problem faced by the respondents and also lack of knowledge in managing 3P's practices. Besides, wholesalers become the important factor in marketing activities and uncertain market price becomes a problem.

**Keywords:** /Marketing/ /FAMA's Regulation/ /Fresh Vegetable/

Rozhan, A.D., et. al. 2013. **Marketing** channels for fresh vegetables and fruits in Malaysia. Acta Hort. 1012: 1371-1378.

#### **Abstract**

Rapid economic growth and urbanization have transformed the retail food sector in developing countries, including Malaysia. The number of modern retail stores is increasing with a higher growth rate. A survey involving 770 respondents was carried out in Peninsular Malaysia to investigate consumer perceptions and preferences towards marketing channels for fresh vegetables and fruits in Malaysia. This study revealed that the wholesale market was the most preferred marketing channel for fresh agriculture produce, followed by hypermarket/supermarket, the night market and the agro-market. In general, Malaysian consumers were not loyal to a specific outlet. The main factors that influenced the consumer to patronize a specific outlet to buy fresh agricultural produces were "cleanliness of a store", "parking space" and "safety during shopping". On the other hand, consumers were particular with "the convenience to visit the outlet", "store operation time" and "good services offered by the store workers". Consumers from rural areas were more influenced by "distance of outlet" as compared to urban consumers who were more indifferent. Besides store ambience, price and information of the product were also important to consumers when deciding on patronage of an outlet.

**Keywords:** /Marketing/ /Fresh Vegetables/ /Fresh Fruits/ /Consumer Preferences/

#### **MINIMALLY PROCESSED**

Latifah, M.N., et. al. 2013. New approaches in improving the quality and safety maintenance of selected **minimally processed** tropical fruit for marketing distribution. Acta Hort. 1012: 1229 - 1234

#### **Abstract**

The demand for minimally processed fruits is the result of the twin desires of consumers for convenience and quality. Consumer demand for healthful and convenient food began to merge with advances in postharvest technology and handling that improve the quality, product presentation, and shelf life during markets distribution and at the retail outlets. Intensive research had been conducted in developing the handling technology for minimally processed jackfruit, durian and pineapple. The suitability of these fruits to be marketed in fresh-cut forms is greater as compared to the temperate fruits due to fruits size and difficulties in getting the edible portions. Appropriate method for product preparation is obligatory in order to maintain their freshness. Depending on fruit types, the preparation involves cleaning, washing, pre-cooling, trimming, isolating the fruitlets, slicing and other related steps of which many of these processes hasten the products to perish. However, with the new approaches during the intensive research activities, the quality of the selected minimally processed fruits namely for jackfruit, durian and pineapple had been improved. Commercialization of these minimally processed fruits is now ready not only for local distributions but also for export to distant markets. Successful export trials by using different modes of transportations had been achieved to various destinations: air shipment to The Netherlands (2006) for jackfruit and pineapple, sea shipment to Hong Kong (2008) for durian, road transportation to Singapore (2009) for durian, jackfruit and pineapple, air shipment to Dubai (2010) for jackfruit and Perth (2011)

for pineapple. This paper discusses the approaches developed to the minimally processed jackfruit, durian and pineapple. Commercialization requirements covering quality maintenance and safety aspects of the minimally processed produce will be emphasized.

**Keywords:** /Minimally Processed/ /Active Packaging/ /Preservative Treatments/ /Quality/ /Safety/

### **MODIFIED ATMOSPHERE PACKAGING**

González-Buesa, Jaime, et.al. 2013. Alternative method for determining O<sub>2</sub> and CO<sub>2</sub> transmission rates through microperforated films for modified atmosphere packs. Packaging Technol. & Sci. 26: 413 – 421.

#### **Abstract**

Most experimental systems for measuring the permeability of microperforated polymeric films are static, mainly because in dynamic systems the small differences in pressure on both sides of the perforation may result in serious errors in the measurements. The O<sub>2</sub> and CO<sub>2</sub> transmission rate through microperforations of different sizes (from 40\_30 to 350\_110 mm) were determined in a static and in a dynamic system. In the latter case, rather than the diffusive flow, the hydrodynamic flow generated by the difference in pressure was measured (between 5 and 90mbar). This was determined by applying Bernoulli's theorem and an experimental equation potentially relating the area of the microperforation with the transmission rate. A comparison of the transmission rates obtained in both cases gives coefficients of determination close to one (>0.993). This means that measuring the hydrodynamic flow can be considered as an alternative for the quantification of the diffusive flow through a microperforation. This is a simple and quick methodology that does not require expensive equipment. Furthermore, this feature enables commercial leak detection equipment to be used to quantify diffusive transmission rates through microperforations.

**Keywords:** /Modified Atmosphere Packaging/

### **PHYTOCHEMICALS**

Kanellis, A.K. & Manganaris, G.A. 2013. Contribution of molecular biotechnology and analytical approaches to understanding and enhancing the bio-fortification of horticultural crops with health-promoting substances. Acta Hort. 1012: 797 - 800.

#### **Abstract**

Fruit and vegetables constitute a rich source of bioactive compounds with health-promoting properties. Therefore, apart from acceptable qualitative and sensorial attributes, horticultural commodities with proven high nutritional and bioactive content are gaining a significant place in the market. Interestingly, apart from the significant differences in bioactive compounds among different commodities, great variability within cultivars/genotypes of the same species have been monitored, with special reference to 'forgotten' and/or indigenous cultivars; such differences may also be attributed to environmental factors and/or to different postharvest treatments. The understanding of bio-fortification enhancement in horticultural crops with health-promoting substances is of prime importance. In the current study, particular attention is given to a special tomato cultivar, grown in the island of Santorini, Greece that has been used together with the model cultivar 'Ailsa Craig' for comparative purposes with the aim to further elucidate and simultaneously enhance vitamin C content in tomato fruits. Further, this communication underlines the necessity of the employment of state-of-the-art chromatographic and spectroscopic methodologies in order to define the phytochemical composition of fresh produce. Lastly, the fingerprinting of fruit extracts via frequently applied efficient protocols coupled with system biology approaches may shed further light in the elucidation of such properties with the aim of enhancing their bioactive content.

**Keywords:** /Phytochemicals/ /Molecular Biotechnology/ /Horticultural Crops/

## POSTHARVEST

East, A.R., Jabbar, A. & Heyes, J.A. 2013. Approaches to prediction of storage out-turn for units of fresh produce. Acta Hort. 1012: 1303 - 1310

### Abstract

The field of postharvest horticulture has traditionally focused on establishing the 'optimal' combination of harvest timing, postharvest treatments and storage technologies which results in the greatest longevity of fresh products. While much has been achieved in reducing crop losses and facilitating global trade of fresh produce, product losses in the postharvest environment which impact on industry profitability still occur, including in 'developed' industries. Many of these losses in established industries are a result of the inherent variability which is observed between batches of the same product. An improved ability to predict storage outturn would allow improved 'inventory management' so particular batches of product could be targeted to the most appropriate market and maximize industry profitability. Irrespective of whether the mode of product failure is decay, chilling injury or development of advanced senescence, the ability to understand the physiology underlying batch variability and predict the behaviour of each batch would be a powerful tool in stock management. A number of different postharvest approaches including metabolomics, mathematical modelling, non-destructive testing and accelerated libraries have the potential to contribute to improved prediction of storage out-turn. This paper provides examples of each of these approaches and suggests the potential for synergies in ideology and data handling methodologies which may apply across all horticultural industries.

**Keywords:** /Postharvest/ /Storage/

Kader, A.A. 2013. Opportunities for international collaboration in postharvest education and extension activities. Acta Hort. 1012: 1363 - 1370.

### Abstract

One of the key strategies for reducing postharvest food losses and waste is to inform all those involved in marketing about the best food handling practices for use between the production sites and the retail markets and to inform consumers about proper food handling at home. Through the ISHS postharvest workgroups we should develop standard contents and teaching materials for online postharvest biology and technology courses that would serve the needs of students in Biological and Agricultural Engineering, Food Science and Technology, Horticulture, and Plant Biology. We should also collaborate on developing learning modules that can be included in appropriate courses at the secondary school and junior college levels. We need to collaborate on extending relevant information via modern communication tools, including applications for smart mobile telephones and use of various social media and the internet to reach the largest possible audience. There is a wealth of information about postharvest quality and safety maintenance on the internet, but the challenge is to identify those science-based, unrestricted sites that have the most useful and regularly updated information ([http://postharvest.ucdavis.edu/Most\\_Useful\\_Postharvest\\_Websites/](http://postharvest.ucdavis.edu/Most_Useful_Postharvest_Websites/)). I recommend selecting and translating the most relevant information from these resources into the language of the target audience in each country or region. One excellent example of international collaboration is the 2004 edition of the US Department of Agriculture Handbook 66 (<http://www.ba.ars.usda.gov/hb66/index.html>) on "Commercial Storage of Fruits, Vegetables and Florist and Nursery Stocks". Another example is the translation of the "Small-scale Postharvest Handling Practices Manual" by Kitinoja and Kader into 10 languages (<http://postharvest.ucdavis.edu/libraries/>). Also, the translation of the UC Postharvest Technology Center's "Produce Facts" into Arabic, French, and Spanish (<http://postharvest.ucdavis.edu/PF/>) has expanded availability of such information. It would be useful to translate these "Produce Facts" into other languages. We should support the training activities of the Postharvest Education Foundation (<http://www.postharvest.org/>), including those through LinkedIn.com (<http://www.linkedin.com/groups/Postharvest-Training-3770124>) to help train the next generation of food quality and safety professionals.

**Keywords:** /Postharvest/ /Postharvest Education/

### **POSTHARVEST FUNGAL PATHOGENS**

Rouissi, W., et. al. 2013. Control of postharvest fungal pathogens by antifungal compounds from *Penicillium expansum*. J. Food Prot. 76: 1879 - 1886.

#### **Abstract**

The fungicidal effects of secondary metabolites produced by a strain of *Penicillium expansum* (R82) in culture filtrate and in a double petridish assay were tested against one isolate each of *Botrytis cinerea*, *Colletotrichum acutatum*, and *Monilinia laxa* and six isolates of *P. expansum*, revealing inhibitory activity against every pathogen tested. The characterization of volatile organic compounds released by the R82 strain was performed by solid-phase microextraction–gas chromatographic techniques, and several compounds were detected, one of them identified as phenethyl alcohol (PEA). Synthetic PEA, tested in vitro on fungal pathogens, showed strong inhibition at a concentration of 1,230 mg/ml of airspace, and mycelium appeared more sensitive than conidia; nevertheless, at the concentration naturally emitted by the fungus (0.726 ± 0.16 mg/ml), commercial PEA did not show any antifungal activity. Therefore, a combined effect between different volatile organic compounds produced collectively by R82 can be hypothesized. This aspect suggests further investigation into the possibility of exploiting R82 as a nonchemical alternative in the control of some plant pathogen fungi.

**Keywords:** /Postharvest Fungal Pathogens/ /Antifungal Compounds/

### **POSTHARVEST HANDLING**

Florkowski, W.J., et. al. 2013. Fruit and vegetable consumption frequency to urban households in Ghana – implications for postharvest handling. Acta Hort. 1012: 1387 - 1392.

#### **Abstract**

The paper examines the frequency of eating fruits and vegetables in three major cities in Ghana applying survey data collected by authors in 2011. Results based on responses provided by over 1,000 households indicate that tomato and orange were the most often eaten vegetable and fruit, respectively. However, there are substantial regional differences implying the importance of climatic differences and availability of specific types of produce. The paper also reports differences in purchased fruits and vegetables between those spending below or above the sample average on these two food categories and reports on differences in the selection of retail outlet type in shopping for fruits and vegetables. Knowledge of the identified differences has direct implications for the suppliers and distributors of fresh fruits and vegetables in Ghana.

**Keywords:** /Postharvest Fungal Pathogens/ /Postharvest Handling/ /Fruit and Vegetable/

### **POSTHARVEST LOSSES**

Wang, S.Y. 2013. Postharvest for wealth and health. Acta Hort. 1012: 785 - 796

#### **Abstract**

Postharvest research plays an important role in increasing the wealth of farmers, growers, shippers and those involved in the fresh produce industry. An important goal of postharvest research is to reduce losses of fruits and vegetables after harvest. Postharvest losses have been a serious problem in every country of the world. The magnitude of postharvest losses varies in different regions depending on location, climate, commodity, and handling systems. The reduction of postharvest losses results in an increase of quantity available to consumers,

thus increasing production without using more land. Therefore, reducing losses is crucial for food security in countries especially where land is scarce. The increased quantity available to consumers due to reduced losses is also made without any additional use labour, fertilizers, water and other resources. This translates to more profit and wealth to farmers, as well as more preservation of natural resources and the environment. Another goal of postharvest research is to maintain quality of fresh produce after harvest. An increasingly important aspect of produce quality is its nutritional value. Consumption of fruits and vegetables has been linked to a reduction in the risk of cardiovascular disease, cancer, diabetes, and age-related disorders. In addition to vitamins, minerals and other nutrients, fruits and vegetables are a source of many phytochemicals, which are responsible for health protection and disease prevention. Significant increases in the concentration of phytochemicals and nutritional quality of fruits and vegetables are certainly achievable through proper postharvest handling. Several postharvest techniques have been demonstrated to not only maintain but also enhance levels of flavonoids, carotenoids and other antioxidants. Postharvest research, thus, is important for improving our wealth and health.

**Keywords:** /Fruits/ /Vegetables/ /Postharvest Losses/ /Postharvest Techniques/ /Phytonutrients/

## **POSTHARVEST TECHNOLOGY**

Ait-Oubahou, A. 2013. **Postharvest technologies** in sub-Saharan Africa: status, problems and recommendations for improvements. Acta Hort. 1012: 1273 - 1282.

### **Abstract**

Limited access to appropriate pre- and postharvest technologies in sub-Saharan Africa is one of the major causes of food losses. FAO/World Bank have estimated losses in the grain sector of over US\$ 4 billion. Perishable loss value in Africa may reach 3 to 4 times higher. High losses are often reported for staple major crops in Africa such as cassava, yam, sweet potato, and various fruits, vegetables and leafy crops. Causes are related to low access to improved technical and technological means for the preservation of quality. In some cases crops geared for export in some countries are produced and handled correctly. However, most of the crops oriented for local consumption are generally of poor quality due to mishandling during harvesting, transport, storage, marketing and processing and due to the lack of good infrastructure, such as roads, transport vehicles and insufficient know-how. The use of good postharvest technologies, such as cold storage and processing units, is limited due to high cost, as most of it is imported, to maintenance problem and unavailability of spare parts and to the inexistent and/or intermittent daily availability of electricity supply. Development of postharvest technologies in sub-Saharan Africa should be placed among the top priorities of governments, professional and international organizations, NGOs and the private sector to combat poverty. These technologies already exist in many parts of the world but need to be introduced and adapted to the country's conditions. The governments should act as facilitators by providing infrastructure and easy access to bank loans, cost-sharing and other means in accordance with their policies.

**Keywords:** /Postharvest Losses/ /Fruit and Vegetables/ /Postharvest Technologies/ /Food Security/

Forney, C.F. 2013. Impact of **postharvest technologies** on the flavour of fresh produce. Acta Hort. 1012: 1191 – 1204.

### **Abstract**

A wide variety of postharvest technologies have been developed to prolong the storage and market-life of fresh fruits and vegetables. However, typically these technologies have been developed to optimize appearance, maintain firmness, and prevent decay while often neglecting product flavour. The complex and dynamic nature of produce flavour contributes to the challenge of its assessment and optimization during postharvest handling, storage and marketing. Flavour change is a result of metabolic and diffusional processes in the fresh product. Postharvest technologies have varying impacts on these processes. Technologies to slow or stimulate ripening of fruit can inhibit or enhance flavour and aroma. Postharvest treatments, storage environments and minimal processing may alter normal metabolism or diffusional processes resulting in flavour changes. In some cases,

extreme atmospheres or other stresses can induce fermentation that leads to the formation of objectionable off-flavours. The interactions of volatile flavour components with packaging may also impact product flavour. Supplying fruit with flavour compounds or precursor for their synthesis also show potential for providing fruit with enhanced or novel flavours. Developing marketing can slow senescence, inhibit decay, and reduce dehydration. Edible coatings as postharvest technologies that maintain or enhance product flavour are needed to meet consumer demands and expectations.

**Keywords:** /Postharvest Technology/ /Controlled Atmosphere/ /Packaging/ /Edible Coatings/

Tonuttia, P. 2013. Innovations in storage technology and postharvest science. Acta Hort. 1012: 323 – 330.

#### **Abstract**

Novel or improved postharvest technologies have been developed in the last 10-15 years. Some of them (e.g., 1-MCP) are already being used in several storage facilities and commercial applications, others (e.g., DCA) are just targeted for specific horticultural crops, some others are still at a preliminary or pilot-scale level and currently under evaluation. The integration of different treatments and the optimization of already existing protocols, a trend observed for the storage of several commodities, need to be assessed and validated through the combination of basic and applied research with the aim of elucidating metabolic processes and regulatory mechanisms affected by the imposed postharvest conditions. The development of “omics” technologies and the increasing number of horticultural crop genomes that have been sequenced and annotated are facilitating this new approach in postharvest science. Information and descriptions of storage-related processes at the level of transcripts, proteins and metabolites are starting to be available concerning the responses to low temperature storage including the different aptitudes to develop chilling injuries. Similarly, the biological basis of the effects of hypoxic conditions on the maintenance of quality and the onset of the related physiological disorders (superficial scald, browning) are going to be elucidated by means of integrated and systemic approaches.

**Keywords:** /Postharvest Technology/ /Chilling Injury/ /Controlled Atmosphere/

Wills, R .B .H. 2013. **Postharvest technology**: why, what and who for? Acta Hort. 1012: 1265 - 1272.

#### **Abstract**

Cool chain management and synthetic chemical usage have been important postharvest tools but environmental and consumer pressures will place pressure on future usage. Technologies exist for the non-refrigerated long distance of fruit such as bananas while more consumer friendly options such as essential oils, nitric oxide, hot and cold water treatment and UV irradiation are potential replacements for synthetic chemicals. Greater emphasis by researchers on the commercialization of technology is needed to bring such innovations to fruition.

**Keywords:** /Postharvest Technology/

#### **REFRIGERATED SHIPPING CONTAINER**

Dodd, M.C. 2013. Managing airflow inside reefer containers benefits produce quality. Acta Hort. 1012: 1159 - 1166.

#### **Abstract**

Refrigerated shipping containers are becoming the preferred means of transporting fresh produce to distant markets, with their market share over specialised refrigerated ships, increasing year on year to a global usage figure of around 60%. The design of these reefer containers originated in the 1980s and there have been no fundamental changes to the internal architecture of these containers in the ensuing years. The product temperatures and relative humidity within the containers often deviates from the ideal simply due to the

limitations of the design and the way the packaging material interacts with the air delivery system. The product temperature management within specialised refrigerated ships is known to be more even and accurate when compared to that in containers. In an effort to improve this shortcoming, ways of bettering the delivery and return airflow within containers have been tested. Trials have been conducted in a container in which the internal architecture has been changed to redirect the way the chilled air is delivered to the product and how the return air is collected. During these trials measurements were conducted to see how this modification impacted on fruit temperatures, storage air relative humidity and quality of fruit post shelf life. These changes, when compared in back to back trials with a standard container, show that the pulp temperatures of various fruit kinds can be kept closer to the optimum set point. In addition the relative humidity levels within the storage air can be increased to over 90%. These improvements in storage conditions inside a container benefit the storage quality of various fruits. Results from trials on apples and citrus fruits are discussed. The results show that by focussing the direction of the delivery and return airflow inside a reefer container the temperature management of the fruit is improved resulting in better quality management.

**Keywords:** /Refrigerated Shipping Containers/ /Airflow/ /Fruit Quality/

## **VALUE CHAIN**

Rahim, M.A. 2013. Improving the value chain and linking the market for fruit growers in quality management of postharvest systems in Bangladesh. Acta Hort. 1012: 1303 - 1398.

### **Abstract**

The demand for food in Bangladesh and the world is changing rapidly. Driven by economic growth, rising incomes and urbanization, demand is shifting away from traditional staples toward high-value fruit commodities. In Bangladesh, additional demand for these commodities is projected to be worth about USD 10 billion by 2020. More than 80% of the people in rural areas are living on less than USD 2 a day. This spatial distribution of poverty makes capitalizing on the opportunities afforded by high value fruit production and value additions an important strategic priority for those seeking to reduce poverty in the country. Insufficient processing capacity, the lack of cold storage facilities or a functioning cold chain, and the persistence of transport bottlenecks are significant constraints to reduce postharvest losses and adding value to selected fruits in Bangladesh. The promise of generating higher income and increased export revenues by accessing international markets is matched by the challenges of meeting the exacting quality and safety standards that apply in those markets and by the prospect of having to compete with high quality imports from those markets. Some of the major fruits of Bangladesh have limited processing potential to value addition but most of the minor fruits do not have any processing or value addition. Recently, a number of agro-processing industry have embarked on processing Bangladeshi fruits into various forms for marketing at home and to some extent to export. Most of the farmers do not have adequate knowledge on postharvest matter, value addition as well as processing facilities. This paper mainly deals with the fruit status, value addition, processing and marketing of fruits in Bangladesh. Recommendations are also made for the improvement of the fruits value chain, market access and household income.

**Keywords:** /Value Chain/ /Market/ /Fruit Growers/ /Postharvest Systems/

## **FRUITS**

### **AVOCADO**

Hofman, P.J. et.al. 1013. Interaction between production characteristics and postharvest performance and practices for fresh fruit. Acta Hort. 1012: 55 – 70.

### **Abstract**

Significant interactions have been demonstrated between production factors and postharvest quality of fresh fruit. Accordingly, there is an attendant need for adaptive postharvest actions to modulate preharvest effects. The most significant preharvest effects appear to be mediated through mineral nutrition influences on the physical characteristics of fruit. Examples of specific influencers include fertilisers, water availability, rootstock, and crop load effects on fruit quality attributes such as skin colour, susceptibility to diseases and physiological disorders, and fruit nutritional composition. Also, rainfall before and during harvest can markedly affect fruit susceptibility to skin blemishes, physical damage, and diseases. Knowledge of preharvest-postharvest interactions can help determine the basis for variability in postharvest performance and thereby allow refinement of postharvest practices to minimise quality loss after harvest. This knowledge can be utilised in predictive management systems. Such systems can benefit from characterisation of fruit nutritional status, particularly minerals, several months before and/or at harvest to allow informed decisions on postharvest handling and marketing options. Other examples of proactive management practices include adjusting harvesting and packing systems to account for rainfall effects before and/or during harvest. Improved understanding of preharvest-postharvest interactions is contributing to the delivery of consistently higher quality of fruit to consumers. This paper focuses on the state of knowledge for sub-tropical and tropical fruits, in particular avocado and mango.

Keywords: /Avocado/ /Fruit Quality/ /Mango/ /Preharvest/

## **BANANA**

Bugaud, C., et. al. 2013. Modelling and pH and titratable acidity in **banana** fruit based on acid and mineral composition. Acta Hort. 1012: 1223 - 1228.

### **Abstract**

pH and titratable acidity are important indicators of banana fruit quality, since they are involved in the perception of sourness and sweetness. To understand which chemical components drive these parameters of acidity in banana pulp, they were modelled by solving a set of equations (conservation, dissociation, and ionic balance) representing acid/base reactions. The weak acids used in the model were malic, citric, oxalic, isocitric and phosphoric acids. Mineral cations taken into account were potassium and magnesium. The mineral anion chloride was taken into account as it neutralizes cations. The pH and titratable acidity were calculated based on the known acid and mineral composition of the 46 banana samples from 17 cultivars. The model was validated by comparing observed and calculated pH. The prediction of pH and titratable acidity by taking organic acids (malic, citric, oxalic, and isocitric acids), phosphoric acids, potassium, magnesium and chloride was insufficient. Adding a weak acid at a content of 1.5 meq 100 g<sup>-1</sup> of fresh weight in the model considerably improved the prediction. The titratable acidity was best predicted with the same input data when titration endpoint was at a pH of 6.5 rather than at a pH of 8.1.

Keywords: /Banana/ /Fruit/ /Acidity/

Ding, P. and Y.K. Tee. 2013. Physico-chemical quality characteristics of 'Rastali' **banana** (*Musa* AAB) harvested at two maturity stages. Acta Hort. 1012: 183 – 192.

### **Abstract**

'Rastali' banana (*Musa* AAB) is one of the favourite dessert bananas in Malaysia. It is a climacteric fruit where mature green banana can be initiated to ripening using exogenous ethylene gas. In postharvest, different maturity stages at harvest may affect the fruit characteristics after ripening. Therefore a study was carried out to determine physico-chemical quality characteristics of 'Rastali' banana harvested at 11 and 12 weeks after first hand emergence. Fruit bunches were tagged when first hand (basal fruit at the top) emerged and was considered as day 1 (D1). Banana bunches were harvested when the fruit reached maturity at week 11 (D77) and week 12 (D84). Six hands within a bunch of 'Rastali' banana were used in this study and hands were numbered from the top to the bottom (hand 1: basal fruit at the top; hand 6: distal hand at the bottom). Three fingers from either the upper or

lower whorls of each hand were selected randomly as sub-samples for each ripening days (six hands × three fingers × four ripening days = 72 fingers per tree). The experimental design was a randomised complete block design. Results showed that there were significant interactions between harvesting week × days after ripening in peel and pulp  $h^{\circ}$  values, firmness and ethylene production. 'Rastali' banana harvested at week 11 showed significantly higher  $h^{\circ}$  values in banana peel colour on ripening days 0, 3 and 5 as compared to week 12 fruit. At day 5 after ripening initiation, banana fruit harvested at week 11 had higher pulp  $h^{\circ}$  values than week 12 fruit. Banana pulp harvested at week 12 was significantly softer than fruit harvested at week 11 on days 0 and 1 after ripening. 'Rastali' banana harvested at week 12 showed significantly higher ethylene production than banana harvested at week 11 at days 3 and 5 after ripening. It can be concluded that 'Rastali' banana harvested at week 12 ripened and reached the senescence stage faster than banana at week 11.

**Keywords:** /Banana/ /Quality/ /Maturity/

Jitareerata, I.P. and A. Uthairatanakij. 2913. Integrated control of crown rot disease in 'Kluai Hom Thong' **banana**. Acta Hort. 1012: 719 - 726.

### Abstract

*Collectotrichum musae*, *Lasiodiplodia theobromae* and *Fusarium* spp. are the causal agents of banana crown rot disease, a major problem for domestic and export markets. Combined effects of heated potassium sorbate (PS) treatment with modified atmosphere packaging on the control of crown rot disease were investigated. 'Kluai Hom Thong' bananas were harvested from Good Agricultural Practices (GAP) orchards. Banana crowns were inoculated with a mixture of three spore suspensions of the above mentioned pathogens for 6 h before the banana hands were immersed in hot water (HW) at 45°C for 20 min or in a heated solution of 0.5% (w/v) PS at 45°C for 20 min. All treated banana hands were packed into perforated polyethylene (PPE) bags or active packaging (AP, M4 film) bags. Banana hands were treated with 500-ppm thiabendazole (fungicide) for 20 min, then packed in PPE bags were used as the control. All treated banana hands were stored in a cold room at 13°C for 28 days to simulate storage life, then transferred to an ambient temperature of 25±2°C for 3 days to simulate shelf life. Disease severity and quality of bananas were then determined. The heated PS solution treatment delayed the severity of crown rot disease, as did the thiabendazole treatment, up to 21 days at 13°C only, whereas banana hands treated with HW prior to packing in PPE or AP bags showed the highest disease severity throughout storage and shelf life. Retardation of disease severity using heated PS treatment and thiabendazole was related to increased chitinase activity, while the activities of peroxidase (POD) and polyphenol oxidase (PPO) were not significantly different among treatments. The AP bags had the ability to delay banana ripening as evidenced by maintained flesh firmness and delayed changes in peel colour and total soluble solids content. This was particularly in the heated PS solution treatment, which showed the greatest effect in delaying banana ripening.

**Keywords:** /Banana/ /Crown Rot Disease/

Maqbool, M. et.al. 2013. Controlling postharvest anthracnose of **banana** using novel edible composite coatings by stimulating defence-related enzymes. Acta Hort. 1012: 639 – 644.

### Abstract

Anthracnose is an important postharvest disease on various tropical fruits and vegetables. Chitosan is reported to have antifungal effects against several fungi. In this study the potential of chitosan combined with gum arabic as an edible coating was investigated. Banana fruit were dipped in various concentrations of gum Arabic (5, 10, 15 and 20%) incorporated with 1.0% chitosan solutions along with an untreated control and stored at 25°C and 60% RH for 15 days. Disease incidence and the activities of defence-related enzymes were recorded during storage. Compared with untreated control fruit, edible composite coating treatments significantly reduced the disease incidence in fruit inoculated with *Colletotrichum musae*. The activities of defence-related enzymes such as polyphenol oxidase (PPO), peroxidase (POD), phenylalanine ammonia lyase (PAL) and total phenolics were all

significantly enhanced in 10% gum arabic plus 1.0% chitosan treated banana as compared to the control and 5% gum arabic plus 1.0% chitosan treatment. Therefore, it could be suggested that postharvest decay in banana can be minimised by gum arabic plus chitosan composite coating on a commercial scale.

**Keywords:** /Banana/ /Biofungicide/

Mirshekari, A. et.al. 2013. Combination of hot water dipping and fungicide treatment to prolong postharvest life of 'Berangan' banana. Acta Hort. 1012: 551 – 558.

#### **Abstract**

The postharvest life of banana is limited by physiological deterioration which leads to decay by disease development. Generally, delaying some reactions associated with ripening in harvested fruit can prolong storage and shelf life. This study was carried out to examine the effects of hot water temperature at 50°C dipped for 0 (control), 10 and 20 min in combination with or without fungicide (Benomyl) on the quality characteristics and anthracnose rot of 'Berangan' banana during ripening. Fruit dipped in hot water at 50°C for 10 and 20 min retarded peel colour ( $L^*$ ,  $C^*$  and  $h^\circ$ ) changes and slowed down fruit softening process. Regardless of fungicide, fruit dipped in hot water for 10 and 20 min developed desirable colour and firmness characteristics. Hot water dip did not affect fruit pulp colour, titratable acidity and pH. The soluble solids concentration of treated fruit without or with fungicide decreased as dipping time increased. Meanwhile, hot water dipping (50°C) for 10 and 20 min with or without addition of fungicide slowed down respiration and ethylene production in 'Berangan' banana. The results clearly demonstrated that dipping 'Berangan' banana fruit in hot water at 50°C for 10 and 20 min without fungicide was able to delay fruit ripening. It is suggested that hot water dipping at 50°C for 10 min without fungicide could be used as a treatment to extend postharvest life of 'Berangan' banana for export. The heat treatment provides an alternative to exporters to minimize the use of chemicals during postharvest handling.

**Keywords:** /Banana/ /Hot Water Treatment/ /Fungicide/ /Postharvest/ /Shelf Life/

#### **BLUEBERRIES**

Hashmia, M.S. et.al. 2013. Hypobaric treatment reduces fungal rots in blueberries. Acta Hort. 1012: 609 – 614.

#### **Abstract**

Postharvest fungal rot contributes significantly to fresh produce losses. Conventionally, fungicides have been used to minimise fruit decay. However, increased concerns over the negative effects of fungicide application motivated a search for alternative options to extend storage life of fresh produce. While temperature control reduces the chance of fungal rot, a physical treatment at a time soon after harvest may further increase storage life. Previous studies have suggested that a postharvest hypobaric treatment is a potential non-chemical method for the control of fungal rots in some fresh produce. In this study the effect of hypobaric treatment (50 kPa.a, 4 h) on the subsequent rot development and quality of blueberries held at 20 and 0°C was assessed. The results obtained show that prestorage low pressure treatment of blueberries slightly reduced postharvest rot incidence arising from natural infections at 20°C. In addition, firmness and respiration rate of the fruit were not affected by low pressure treatment. The small reduction in rot incidence in hypobaric treated fruit has been ascribed to either direct effect of low oxygen; indirect activation of induced resistance; or removal of free water from the surface of the produce. Should hypobaric treatments be found to be effectual they could eventually facilitate the development of a new cost-effective method of physical treatment to reduce postharvest fungal decay.

**Keywords:** /Blueberries/ /Hypobaric/ /Fungal Rots/

Zhou, Q., et. al. 2014. Changes in antioxidative metabolism accompanying pitting development in stored blueberry fruit. Postharvest Biol. & Technol. 88: 88 - 95.

## Abstract

Blueberries (*Vaccinium* spp. 'LanFeng') are harvested and consumed at maturation and have a short storage life at room temperature. Changes in blueberry quality and physiological parameters differ under room or low temperature storage conditions. The storage life of blueberries can be extended at low temperature, but pitting can develop associated with refrigeration, especially during subsequent shelf-life. The objective of this research was to understand the antioxidative metabolism accompanying pitting development of stored blueberry fruit, involving reactive oxygen species and antioxidant systems. Physiological and metabolic disorders, including low firmness, increased cell membrane electrolyte leakage and malondialdehyde (MDA) content, and changes in enzyme activity, were observed in pitting blueberries. Blueberries were stored at 20°C and 0°C for 10 days and 60 days, respectively. Hydrogen peroxide and superoxide radical production rate increased more rapidly during shelf-life after cold storage than at room temperature. On the other hand, blueberries during shelf-life after cold storage, when pitting occurred, had lower activity of antioxidant-related enzymes, including superoxide dismutase (SOD), catalase (CAT), and ascorbate peroxidase (APX), than those stored at room temperature. The severity of pitting was paralleled by higher cell membrane electrolyte leakage and MDA content, and lower SOD, CAT, and APX activities.

**Keywords:** /Blueberries/ /Antioxidative Metabolism/

## CANTALOUPE

Abidin, M., et. al. 2013. Effect of storage period and postharvest calcium salt treatment on microbial growth of fresh-cut cantaloupe (*Cucumis melo* L. *reticulatus* 'Glamour'). Acta Hort. 1012: 1043 - 1048.

## Abstract

The growth of microorganisms in fresh-cut fruits is a common biological change when they are subjected to storage for a few days. The application of calcium salts as part of the fresh-cut treatment is possible to delay the undesirable biological changes. The effects of calcium chloride and calcium lactate were observed on the total plate count (TPC) and the yeast and mould (YM) of fresh-cut cantaloupe after 19 days of storage at 2°C and 87% relative humidity (RH). Before processing, one group of cantaloupe was stored for less than 24 hours and another group was stored for three weeks at 10°C and 90±5% RH. After their respective storage periods, both groups were prepared as fresh-cut samples, which were treated with 1% calcium chloride and 1% calcium lactate. The growth rates of the total plate count (TPC) and yeast and mould (YM) of the calcium treated fresh-cut cantaloupe were found to increase throughout the 19 days of storage. However, the TPC and YM growth of the fresh-cut cantaloupe treated with calcium lactate increased at a slow rate. Therefore, 1% of calcium lactate was found to be sufficient to reduce the growth rate of microbes.

**Keywords:** /Cantaloupe/ /Storage Period/ /Postharvest Calcium Salt Treatment/

Abidin, M., et. al. 2013. Influence of postharvest storage on appearance changes in fresh-cut cantaloupe. Acta Hort. 1012: 1043-1048.

## Abstract

The degree of fruit ripeness during postharvest storage considerably affects the biochemical properties of fresh-cut product. Appearance and texture are two important properties affecting the quality of fresh-cut fruit during purchasing activity. In this study, colour and firmness of fresh-cut cantaloupe processed after different postharvest storage durations were observed to evaluate the quality retention of the product. Untreated and 1% calcium chloride treated samples were used to investigate the effectiveness of calcium salt as a firming agent in fresh-cut cantaloupe. Prepared samples were stored at 2°C and 87% relative humidity (RH) for 19 days to evaluate chromaticity, hue angle, and firmness. As expected, the firmness of the treated samples remained unchanged throughout storage. The hue angle of both samples was not affected by the treatment and storage duration while

the chromaticity of the treated sample was significantly lower than the control. Different postharvest storage durations also did not cause any quality changes in both samples.

**Keywords:** /Cantaloupe / /Postharvest Storage/

Lignou, S., et. al. 2014. Sensory and instrumental analysis of medium and long shelf-life charantais cantaloupe melons (*Cucumis melo* L.) harvested at different maturities. Food Chem. 148: 218 - 229.

#### **Abstract**

The flavour profiles of two genotypes of Charentais cantaloupe melons (medium shelf-life and long shelflife), harvested at two distinct maturities (immature and mature fruit), were investigated. Dynamic headspace extraction (DHE), solid-phase extraction (SPE), gas chromatography–mass spectrometry (GC–MS) and gas chromatography–olfactometry/mass spectrometry (GC–O/MS) were used to determine volatile and semi-volatile compounds. Qualitative descriptive analysis (QDA) was used to assess the organoleptic impact of the different melons and the sensory data were correlated with the chemical analysis. There were significant, consistent and substantial differences between the mature and immature fruit for the medium shelf-life genotype, the less mature giving a green, cucumber character and lacking the sweet, fruity character of the mature fruit. However, maturity at harvest had a much smaller impact on the long shelf-life melons and fewer differences were detected. These long shelf-life melons tasted sweet, but lacked fruity flavours, instead exhibiting a musty, earthy character.

**Keyword:** /Cantaloupe/ /Shelf-life/ /Maturity/

#### **CARAMBOLA**

Emanuel, M.A., et.al. 2013. Variation of saccharides and fructo-oligosaccharides (FOS) in carambola (*Averrhoa carambola*) and June plum (*Spondias dulcis*) during ripening stages. Acta Hort. 1012: 77 – 82.

#### **Abstract**

The changes in glucose, fructose, sucrose, and fructo-oligosaccharides (FOS) (1-kestose and nystose) of carambola (*Averrhoa carambola*) and june plum (*Spondias dulcis*) were assessed during three ripening stages. Glucose and fructose showed similar pattern by decreasing slightly during stage 2 but increased during stage 3, in both carambola and june plum, while sucrose decreased during the ripening stages in both fruits. Total saccharides showed similar pattern to those of glucose and fructose with a decrease during stage 2 and an increase during stage 3. Surprisingly, two fructo-oligosaccharides, namely 1-kestose (G-F2, 1F- $\beta$ -D-fructofuranosylsucrose) and nystose ([G-F3, 1F(1- $\beta$ -D-fructofuranosyl)<sub>2</sub> sucrose]) were detected in these two fruits. The variation of these two polymers showed similar pattern to that of glucose and fructose, with a decrease during stage 2 and an increase during stage 3. However, the content of these two FOS was low in comparison with the content of the saccharides.

**Keywords:** /Carambola/ /Averrhoa Carambola/ /Ripening/

#### **CITRUS**

Moscoso-Ramírez, P. A., et.al.201.Effect of ethylene degreening on the development of citrus postharvest green and blue molds. Acta Hort. 1012: 633 – 638.

#### **Abstract**

Research was conducted to elucidate the effect of commercial degreening with ethylene gas on the development of postharvest green (GM) and blue (BM) molds on artificially inoculated 'Clemenules' mandarins. Fruit were harvested with three different rind color index (CI=-6.5, -3.6, 2.2) and wound inoculated in the fruit equator with conidial suspensions of *Penicillium digitatum* or *P. italicum* at a concentration of 105 spores/ml. Each

fungus was inoculated in different lots of fruit. Inoculated fruit were degreened for 3 days in a local packinghouse (exposure to 2 µl/L ethylene at 21°C and 95-100% RH) or kept at the same environmental conditions in a control room without ethylene. Four replicates of 10 fruit each were used per treatment. Then, degreened and non-degreened (control) fruit were stored at either 20°C and 90% RH for 7 days or 5°C and 90% RH for 14 days. Incidence (%) and severity (diameter of lesion in mm) of the molds and pathogen sporulation (%) were assessed after storage. No significant effect of commercial degreening was observed on the incidence of both GM and BM. In contrast, degreening significantly increased the severity of these molds with the exception of mandarins with an initial CI of -6.5. On fruit with a CI of -3.6 incubated at 20°C for 7 days, GM severity was 146 and 118 mm and BM severity was 56 and 46 mm on degreened and nondegreened fruit, respectively. Likewise, these values were 105 and 90 mm for GM and 40 and 35 mm for BM, respectively, on mandarins with an initial CI of 2.2. On mandarins cold-stored at 5°C for 14 days, disease severity was also significantly higher on degreened than on control fruit.

**Keywords:** /Citrus/ /Degreening/ /Blue Molds/

## **DRAGON FRUIT**

Aifaaa, Nor Hanis, Y. et. al. 2013. Effect of *Cymbopogon nardus* on incidence of anthracnose disease and post-harvest quality of **dragon fruit** during storage. Acta Hort. 1012: 735 – 738.

### **Abstract**

The industry is under pressure to minimize the use of synthetic fungicides employed at postharvest to control disease on fruits. Essential oils are reported to have some fungicidal properties against certain postharvest diseases of tropical fruits and vegetables and more safe for the environment than synthetic. The effects of *Cymbopogon nardus* oil on quality of dragon fruit during storage in cold room (10°C, RH 85-90%) for 21 days were determined using six concentrations of *Cymbopogon nardus* oil (0.5, 1, 2, 3, 4 and 5%). The *Cymbopogon nardus* oil Treatment delayed the disease incidence and maintained the quality during storage. However, some phytotoxic effects were observed on fruits treated with higher concentration (2-5%). It can thus be concluded that the concentration below 2% can be used for extending the storage life of dragon fruit for up to 14 days without affecting the physicochemical properties.

**Keywords:** /Dragon Fruit/ /Postharvest Quality/

Cho, J.L.Y., et.al. 2013. Pollen load affects quality of red-fleshed **dragon fruit** (*Hylocereus polyrhizus*). Acta Hort. 1012: 253 - 258.

### **Abstract**

Dragon fruits are graded and priced according to fruit weight. Large fruit is not necessarily demanded by consumers especially small families. Currently the demanded size for dragon fruit is about 300 g per fruit. However, current practice could easily produce fruit weight about 600 g. Number of seeds could affect fruit size. Seeds are formed from successful fusion of male (pollen) and female gametes (ovule) during double fertilization. Thus, a study to determine the effects of pollen load on fruit development and postharvest qualities of red-fleshed dragon fruit was carried out. Hand-cross pollination treatments were done at night by using the collected pollen grains of 0.001, 0.05, 0.10, 0.15 and 0.20 g. The usual pollen load applied by the grower was used as control. Fruits formed from all treatments exhibited sigmoid growth pattern. Results indicated that pollen load of 0.001 g produced the smallest fruit in term of fruit weight, length and diameter as compared to other treatments. There were no significant differences in carbon dioxide and ethylene production, peel and pulp colour and chemical characteristic using different pollen load except for 0.001 g. Fruits of 0.001 g pollen load had significantly higher carbon dioxide production and soluble solids concentration. In conclusion, fruit weight of red-fleshed dragon fruit could be manipulated by the amount of pollen grains applied during pollination.

**Keywords:** /Dragon Fruit/

Izalin, M.Z., et. al. 2013. Optimization of pectin extraction from dragon fruit peel. Acta Hort. 1012: 1443 - 1450

#### **Abstract**

Hot acid extraction was applied for pectin extraction from dragon fruit (*Hylocereus polyrhizus*) peel powder and the extraction conditions were optimized using response surface methodology. Twenty treatments were assigned based on the central composite design (CCD) at five variation levels with blocked design which allowed the estimation of individual and interaction factors effects independently. Three independent variables studied were temperature (50-85°C), time (40-150 min) and pH (2.5-4.0). The experimental data were fitted to a second-order polynomial equation using regression analysis. The results indicated that pH was the main factor influencing the pectin yield which increased with decreasing pH, and increasing temperature and time. Based on the 3-D response surface and contour plots, the optimum conditions for extraction of pectin from dragon fruit peel were at 67.7°C for 77 min and at pH 2.0. The experimental value of 30.08% pectin yield was statistically compared with the predicted value of 30.19% yield given by the model. Hence, the experimental value was found to be in agreement with the predicted value.

**Keywords:** /Dragon Fruit/ /Pectin Extraction/

Zahid, N., et. al. 2013. Dual mode of action of ethanolic extract of propolis (EEP) for the control of postharvest anthracnose in dragon fruits. Acta Hort. 1012: 711 - 718.

#### **Abstract**

The in vitro and in vivo study was conducted to evaluate the potential of ethanolic extract of propolis (EEP) against postharvest anthracnose of dragon fruits caused by *Colletotrichum gloeosporioides*. Four different concentrations (0.25, 0.5, 0.75 and 1.0%) of EEP along with untreated control were used during the study. All EEP treatments showed a significant ( $P<0.05$ ) decrease in mycelial growth and conidial germination. EEP concentrations at 0.5, 0.75 and 1.0% gave the most promising results and more than 60% inhibition in radial mycelial growth and conidial germination was observed. EEP treatments slowed down the onset of disease symptoms resulting in a delay of disease development and maintaining quality. Induction of anthracnose resistance was also studied in relation with the enhanced activation of inducible compounds [peroxidase (POD), polyphenol oxidase (PPO), and phenylalanine ammonia lyase (PAL)]. An increase in activity of these enzymes was recorded at 0.5, 0.75 and 1.0% EEP concentrations. But some phytotoxic effects were observed on fruits treated with higher concentrations of EEP (0.75 and 1.0%). Thus, it can be concluded that 0.5% of EEP concentration can be used for the management of postharvest anthracnose in dragon fruits.

**Keywords:** /Dragon Fruit/ /Anthracnose/

#### **DURIAN**

Latifah, M.N., et.al. 2013 Sea shipment of ready-to-eat durian in Hong Kong. Acta Hort. 1012: 1299 - 302.

#### **Abstract**

Durian (*Durio zibethinus* Murray) is a popular seasonal fruit in South East Asia. The uniqueness of the fruit lies on its smooth and creamy yellow or white pulp with strong flavour and odour. The quality of the fruit pulp varies greatly and cannot be determined externally. Development of physiological disorders such as granulation of the fruit pulp, internal browning of the pulp core, wet core and tip burn problems affect the quality severely. The fruit soften, turns slimy and deteriorates rapidly, resulting in off-flavour and astringent odour being produced. Effective bulk packing system had been developed by MARDI and successfully applied during the sea shipment trial to Hong Kong. The unique smell of durian was scented upon opening the lid of the bulk packing. The quality of the packed product was evaluated immediately upon arrival (after 6 days sailing), followed by subsequent daily

observation on the products stored at 2°C. The fruit sweetness was still high at 30-32°Brix with no significant colour changes as noted on the L (70-74) and b (44-46) values. Lower microbial counts were observed until the end of the storage period as strict quality assurance protocols have been implemented during the handling operations. Consumer studies undertaken by 200 respondents indicated that the quality of the packed durian was still good and well accepted. The temperature in the package remained at 0°C for 60 hours, increased to 3°C after 72 hours (day 3) and later maintained at 10°C at the end of the sailing time (day 6).

**Keywords:** /Durian/ /Quality/ /Microbial Count/

## FIG

Kurubar, Ar.R., et. al. 2013. Effect of pre- and postharvest application of different chemicals on quality traits of 'poona fig' **fig** (*Ficus carica* L.). Acta Hort. 1012: 91 - 96.

### Abstract

Fig fruits 'Poona Fig' after harvesting were stored at room temperature of 24 to 28°C. A combination of preharvest and postharvest treatments consisting of a spray of 2% calcium chloride 20 days prior to harvest followed by dipping successively in 50 ppm of kinetin and then in 0.1% carbendazim were found most effective in enhancing the quality. This treatment slows the increase in TSS, total sugar, reducing sugar and non-reducing sugar content and reduces the decline in fruit acidity over the storage period. The same treatment in comparison with other treatments has reduced the rate of changes of the physico-chemical constituents and allowed maximum TSS, total sugar, calcium and minimum acidity in the treated fruits. Therefore, the fig fruit that received this treatment could be stored up to four days at the indicated temperature of 24 to 28°C.

**Keywords:** /Fig/ /Postharvest/ /Quality/

## GRAPE

Silva, R.S., et. al. 2013. Influence of 1-mcp on berry drop and quality of 'isabel' grape. Acta Hort. 1012: 509 – 514.

### Abstract

'Isabel' grapes are very susceptible to berry drop. The aim of this work was to evaluate the influence of 1-MCP on berry dropping and postharvest quality of 'Isabel' grapes during storage under modified atmosphere and room conditions. Fruits were harvested in the commercial maturity and four doses of 1-MCP (0, 500, 1000 and 2000 nl L-1) were applied during 12 h in sealed plastic boxes kept under room conditions. Two clusters of grapes from each treatment were placed in trays and wrapped with 12 µm PVC film and stored under room conditions (25±2°C and 75±2% RH) for 12 days. The experiment was carried out in a completely randomized design, in a factorial scheme 4×7 (4 doses of 1-MCP and 7 evaluation periods), with three replications (1 tray/rep). The evaluations were soluble solids (SS), titratable acidity (TA), SS/TA ratio, ascorbic acid, total anthocyanins, incidence of decay, berry firmness, and berry drop index. 1-MCP treatment influenced retention of ascorbic acid and total anthocyanins contents and maintenance of firmness. The berry drop index decreased as the doses of 1-MCP increased, suggesting that it has a role on alleviating berry dropping of 'Isabel' grape.

**Keyword:** /Grape/ /Berry Drop/

Yuan, X., et. al. 2014. Biochemical and proteomic analysis of 'Kyoho' **grape** (*Vitis labruscana*) berries during cold storage. Postharvest Biol. & Technol. 88: 79 - 87.

Abstract

Low temperature storage is widely used to maintain the quality of postharvest fruit and extend their shelf-life. In this study, changes in specific metabolites and protein expression profiles of grape berries under cold storage were investigated by liquid chromatography and proteomic studies, respectively. During cold storage, total soluble solids and reducing sugars accumulation was accompanied by a decline inorganic acids and phenols contents. A comparative analysis of the proteomes of grape berries during cold storage was performed using a two-dimensional electrophoresis (2-DE) proteomic approach. Seventy-nine differentially regulated proteins during cold storage were successfully identified by matrix-assisted laser desorption/ionization time of flight (MALDI-TOF) mass spectrometry, and classified into eight main categories based on their biological function. Down-regulation of proteins associated with glycolysis and the Krebs cycle, and up-regulation of cell wall polysaccharide degradation-related enzymes provided molecular evidence that soluble sugar and carbohydrate metabolism play a crucial role in postharvest regulation. In addition, cold storage increased the expression abundance of several stress related proteins such as heat shock proteins, proteasome and antioxidant enzymes, suggesting a physiological adaptation to low temperature was induced in grape berries. This study contributes to a better understanding of the cellular events in grape berries under cold storage and provides potentially useful information for maintaining fruit quality and minimizing postharvest losses.

**Keywords:** /Grape/ /Cold Storage/

## **GUAVA**

Sopthornvit, R. 2013. Effect of edible coating on the qualities of fresh **guava**. Acta Hort. 1012: 453 - 460.

### **Abstract**

Guava is a perishable fruit. Edible coating might help prolonging the quality of guava. The objective of this study was to determine the effect of glucomannan (G) or konjac edible coating incorporated with beeswax (BW) and guava leaf extract (E) on the quality of fresh guava compared with water coating (W) and control (C) or uncoated stored at room temperature (29°C) and 95% RH. It was found that guava coated with GBW significantly reduced weight loss and firmness ( $p < 0.05$ ) and extended the shelf-life of guava for 13 days compared with uncoated guava. Water coated guava had higher weight loss compared with uncoated guava. Total soluble solid (TSS) of guava increased significantly in all coating types ( $p < 0.05$ ) during storage. Guava coated with water had the highest TSS. The pH of guava increased during storage and it depended on edible coating types as well. However, the hue angle value of guava had a significant decrease during storage ( $p < 0.05$ ). Using either beeswax or guava leaf extract alone to the glucomannan edible coating might extend the shelf-life of fresh guava. However, the combination of beeswax and guava leaf extract based-glucomannan edible coating did not enhance significantly on the quality shelf-life of fresh guava.

**Keywords:** /Guava/ /Edible Coating/

## **JACKFRUIT**

Hasida, M.R., et. al. 2013. Microbial changes of minimally processed **jackfruit** after UV-C treatment. Acta Hort. 1012: 1025 - 1030

### **Abstract**

This study aimed at evaluating the microbial reduction effect on minimally processed (MP) jackfruit when exposed to 240 nm UV radiation at different time and way of exposure. Samples were divided into; i) Treat A: without UV exposure (control), ii) Treat B: 5 min direct UV exposure, iii) Treat C: 5 min UV exposure on sealed polypropylene container + lid, iv) Treat D: 10 min direct UV exposure, and Treat E: 10 min UV exposure on sealed polypropylene container + lid. Microbiological attributes ((total plate count (TPC), total coliforms (TC) and total yeast and moulds (TYM)) were assessed throughout the 2 weeks of storage at 5°C. Different time and way of

exposure affected the microbial population throughout storage. Treat B effectively reduced TPC and TC but not TYM as compared to the control. UV treatment was found less effective towards reducing TYM as shown by high number of population (3.1-3.2 logs) compared to the control (2.7 logs). High microbe population was determined from MP jackfruit treated with Treat E. Overall results recommended that 5 min direct UV radiation is necessary which can efficiently reduce TPC and TC in MP jackfruit. Taking into safety account and quality attributes, the shelf life of minimally processed jackfruit could be stabilized for 14 days at 5°C.

**Keywords:** /Jackfruit/ /UV-C Treatment/

## **KIWIFRUIT**

Latocha, P., et. al 2014. Changes in postharvest physiochemical and sensory characteristics of hardy **kiwifruit** (*Actinidia arguta* and its hybrid) after cold storage under normal versus controlled atmosphere. *Postharvest Biol. & Technol.* 88: 21 - 33.

### **Abstract**

Changes in sensory and physicochemical characteristics of fruit of *Actinidia arguta* and its hybrid after cold storage (1°C and 85%RH) in air (AS) versus controlled atmosphere (CA) with low oxygen concentration(1.5%O<sub>2</sub>+ 1.5%CO<sub>2</sub>) were examined over a period of four and eight weeks. The investigation was carried out on two cultivars, 'Ananasnaya' (*A. arguta*) and 'Bingo' (*Actinidia purpurea* × *A. arguta*) harvested at two stages of maturity (6.5–8% and 8–9.5% soluble solids, respectively). During long-term storage the strongest changes in fruit characteristics were in fruit firmness and acidity. Air storage was an adequate method of refrigerated storage of fruit over a short period of 4 weeks. Application of CA can be very useful for storing hardy kiwifruit over a longer, 8 week period. The sensory characteristics of fruit stored in CA and then ripened during simulated shelf-life were similar to those of vine ripe fruit. The most significant negative change in the sensory characteristics of fruit after long-term cold storage was the increase in the intensity of their bitter taste.

**Keywords:** /Kiwifruit/ /Cold Storage/ / Postharvest/

Yildirim, I. and Bayir, A. 2013. Effects of different storage techniques on the antioxidant capacity, total phenolics and flavonoids of 'Hayward' **kiwifruit**. *Acta Hort.* 1012: 808 - 814.

### **Abstract**

Phenolic compounds are broadly distributed in the plant kingdom and are the most abundant secondary metabolites found in plants. These compounds have many favourable effects on human health such as the lowering of human low-density lipoprotein reduction of heart disease and cancer. In this study, the effects controlled atmosphere storage (CA, 2% O<sub>2</sub>/5% CO<sub>2</sub>), prestorage 1-MCP treatment and ethylene control during storage on the antioxidant capacity, flavonoids and total phenolic compounds content of 'Hayward' kiwifruit were evaluated. 'Hayward' kiwifruits were stored at 0°C for 6 months. The total flavonoid content remained quite constant during storage in all treatments, while total phenolics were better preserved in CA stored kiwifruits. A decrease in the total antioxidant activity was observed during storage in all treatments. The results showed that there is a significant correlation with total phenolic compounds content and antioxidant capacity.

**Keywords:** /Kiwifruit/ /Antioxidant/ /Phenolics/ /Flavonoids/

## **LEMON**

Mathaba, N. et. al. 2013. Effect of hot water and molybdenum dips on endogenous polyamines and heat shock protein (HSP70) in **lemon** flavedo and their ability to alleviate chilling injury during cold storage. *Acta Hort.* 1012: 1103 - 1110

## Abstract

Polyamines (putrescine, spermine and spermidine) are cations which bind to negatively charged cellular compounds such as proteins, DNA and membrane phospholipids. The function of antioxidants, proteins (including heat shock proteins), and membranes is improved when highly conjugated with polyamines. Heat shock proteins (HSPs) are molecular chaperones re-directing damaged proteins towards proteolysis. They have been shown to act synergistically to polyamines in mitigating plant stress. Furthermore, hot water enhances heat shock protein and previous studies have shown hot water plus molybdenum to reduced chilling injury in citrus fruit. Therefore, the aim of this work was to investigate the potential role of hot water and molybdenum to mitigate chilling injury by enhancing heat shock protein (HSP70) and possible relationship between HSPs and polyamine during cold storage. Fruit from different sources, commonly chilling susceptible or resistant, were pre-conditioned for 2 min with hot water dip (HWD) 47 or 53°C in combination with a subsequent soak in 1 or 10 µM Na<sub>2</sub>MoO<sub>4</sub> solution for 30 min. Fruit were subsequently stored at -0.5°C for 7, 14, 21 or 28 days, then moved to ambient temperature for a week and evaluated for chilling injury symptoms. Lemon fruit treated with HWD 53°C; 1 µM Mo; 10 µM Mo plus HWD 53°C showed enhanced HSP70 as compared with control or HWD 47°C which correlated with increased soluble-conjugated polyamine and therefore, reduced chilling injury symptoms.

**Keywords:** /Lemon/ /Polyamines/ /Heat Shock/Chilling Injury/

## LOQUAT

Besada, C., et. al. 2013. Relationship between peel color and physiological changes during loquat maturation: comparison between 'algeri' and 'xirlero'. Acta Hort. 1012: 193 – 200.

## Abstract

'Algeri' is the most important cultivar of loquat grown in Spain. Recently, a spontaneous mutation called 'Xirlero' has caught the interest of the loquat industry since the fruit grow to a larger size than 'Algeri' loquats. To ensure that the fruit reaches the consumers at the optimum quality, it is necessary to determine the optimum state of harvest. Thus, the present study establishes the relationship between peel color and the physiological changes that take place during the development and maturation of both loquat cultivars. The changes in color during fruit maturation were associated with a decrease in firmness, acidity and astringency as well as increase in soluble solid content and fruit size. Eight stages of maturity (SI to SVIII) have been defined based on the external color of the fruit with the color index (CI=1000a/Lb; L, a, b Hunter parameters) ranging from -14 to +10. To ensure an optimum stage of maturity that meets consumer expectations, our results showed that the 'Algeri' loquat should be harvested after reaching maturity stage SVI (CI=+6) while the 'Xirlero' fruit reach commercial maturity at stage SVIII (CI=+10). The factors limiting an earlier harvest of 'Algeri' and 'Xirlero' loquat were the levels of acidity and astringency, respectively.

**Keywords:** /Loquat/ /Peel Color/

## MANDARIN

Guo, J. et al. 2014. Inhibition of green mold disease in mandarins by preventive applications of methyl jasmonate and antagonistic yeast *Cryptococcus laurentii*. Postharvest Biol. & Technol. 88: 72 - 78.

## Abstract

The objective of this study was to evaluate the preventive activity of methyl jasmonate (MeJA) alone and in combination with antagonistic yeast in suppressing green mold decay in citrus fruit, and to explore the mechanisms involved. At 100 µmol/L, MeJA inhibited disease incidence and lesion diameter of mold decay compared with the control (P < 0.05). The preventive application of *Cryptococcus laurentii* at 1 × 10<sup>8</sup> cells/mL

combined with 100  $\mu$ mol/L MeJA reduced green mold incidence compared to the control and the other treatment groups ( $P < 0.05$ ) when tested in wounded citrus fruit inoculated with *Penicillium digitatum*. MeJA and *C. laurentii* induced higher activity of polyphenol oxidase, peroxidase and catalase than control. Moreover, treatment with MeJA and *C. laurentii* induced a rise in the mRNA expression level of PR5 (pathogenesis-related protein family 5), which was stronger than in the single-treatment groups and the control. In addition, 100  $\mu$ mol/L MeJA improved the rapid proliferation of *C. laurentii* in citrus fruit wounds. This combined treatment can induce natural resistance and stimulate the proliferation of antagonistic yeast on the fruit surface.

**Keywords:** /Mandarin/ /Green Mold Disease/

Hong, P., et. al. 2014. Combination of hot water, *Bacillus amyloliquefaciens* HF-01 and sodium bicarbonate treatments to control postharvest decay of mandarin fruit. *Postharvest Biol. & Technol.* 88: 96-102.

#### **Abstract**

An antagonistic isolate *Bacillus amyloliquefaciens* HF-01, sodium bicarbonate (SBC) and hot water treatment (HW) were investigated individually and in combination against green and blue mold and sour rot caused by *Penicillium digitatum*, *P. italicum* and *Geotrichum citri-aurantii* respectively, in mandarin fruit. Populations of antagonists were stable in the presence of 1% or 2% SBC treatment, and spore germination of pathogens in potato dextrose broth was greatly controlled by the hot water treatment of 45°C for 2 min. Individual application of sodium bicarbonate at low rates and hot water treatment, although reducing disease incidence after 8 weeks or 4 weeks of storage at 6°C or 25°C respectively, was not as effective as the fungicide treatment. The treatment comprising *B. amyloliquefaciens* combined with 2% SBC or/and HW (45°C for 2 min) was as effective as the fungicide treatment and reduced decay to less than 80% compared to the control. *B. amyloliquefaciens* HF-01 alone or in combination with 2% SBC or/and HW significantly reduced postharvest decay without impairing fruit quality after storage at 25°C for 4 weeks or at 6°C for 8 weeks. These results suggest that the combination of *B. amyloliquefaciens* HF-01, SBC and HW could be a promising method for the control of postharvest decay on citrus while maintaining fruit quality after harvest.

**Keywords:** /Mandarin/ / Postharvest Decay/

Sdiri, S., et. al. 2013. Optimization of degreening of early-season spontaneous mutations of 'oronules' mandarins. *Acta Hort.* 1012: 1065-1070.

#### **Abstract**

Degreening is a postharvest treatment during which citrus fruit are exposed to ethylene in order to accelerate external color change and so render the fruit more acceptable for marketing. However, ethylene can promote alterations associated to senescence specially in the area of calyx. Recently, new degreening treatments combining different periods with and without ethylene exposure have been reported to be effective in reducing the calyx disorders of early-season citrus fruit. In the present study, fruit from 'Oronules' mandarins and four of its mutations – 'Prenules', 'Basol', 'Clemenrubi' and 'Orogros', were degreened during different periods with and without ethylene application over a total of 120 h at 21°C, and 90- 95% RH. Afterwards, fruit were submitted to a cold-quarantine treatment (1°C, 16 d) plus shelf-life (20°C, 95% RH for 7 d). In all cultivars, the shorter time of exposure to ethylene, the lower incidence of calyx disorders. Treatment comprising 48 h ethylene exposure and 72 h without ethylene was sufficient to reach a commercially acceptable external color (CCI > +6). However, to obtain the typical color of the cultivar, treatment with 72 h with ethylene plus 48 h without ethylene is needed. At this degreening condition, 'Prenules', 'Basol' and 'Clemenrubi' cultivars showed lower susceptibility to calyx senescence than 'Oronules'. None of the treatments affected the internal fruit quality of any cultivar.

**Keywords:** /Mandarin/ / Degreening/ /Mutation/

Sen, F., et. al. 2013. Effect of preharvest gibberellic acid and calcium applications on on-tree storage of satsuma mandarins. Acta Hort. 1012: 233-240.

#### **Abstract**

Late harvest of 'Satsuma' mandarin fruit may affect the quality and promote fruit drop. This study carried out for two years was aimed at determining the effect of preharvest gibberellic acid (GA3) and calcium applications on on-tree storage of Satsuma fruit. Gibberellic acid (GA3, 10 ppm) and Ca (CaCl<sub>2</sub>.2H<sub>2</sub>O, 2%), their combined application and GA3 application repeated twice were tested on Satsuma mandarin (*Citrus unshiu* Mar. 'Owari') budded onto trifoliolate orange rootstock. GA3 was applied two weeks before the color break and at color break whereas Ca was applied at color break stage. Control trees were sprayed with surfactant added water. The first harvest was performed at the usual harvest period for the region, and additional two harvests were made at monthly intervals. At each harvest, fruit samples were analyzed for specific gravity, peel color, chemical composition of fruit juice and electrolytic leakage of peel. Starting from the second harvest, fruit number was determined, and fruit drop rate was calculated. Some of the significant quality losses including puffiness were reduced on trees treated with GA3 twice. Fruit drop could also be prevented with GA3 treatments. Fruit skin color advanced rather slowly in GA3 applied trees however this effect became non-significant towards the end of the storage period. Ca applications alone did not exert major effects. On the other hand, all treatments with GA3 had positive effects in terms of on-tree storage.

**Keywords:** /Mandarin/ /Gibberellic Acid/

#### **MANGO**

Abdullah, F., et. al. 2013. Preliminary study on fruit variability of 'chok anan' mango (*Mangifera indica* L.). Acta Hort. 1012: 281-286.

#### **Abstract**

'Chok Anan' is one of the popular mango cultivars in Northern Peninsular Malaysia. However, due to variability in fruits at harvest, we conducted a preliminary study to evaluate the fruit characteristics of this type of mango. During 2008 fruiting season, fruits of 'Chok Anan' mango were harvested from known trees source at commercial mango plot at Bukit Tangga MARDI Research Station, Kedah, Malaysia. Fruit characteristics such as fruit weight, size (length, width and thickness) and total soluble solid (TSS) were measured and recorded. The relationship between fruit characteristics was also assessed. Results showed that fruit weight, size and TSS of 'Chok Anan' mango at harvest varied greatly within trees. Fruit weight at harvest ranged from 144 to 315 g. In addition, TSS also varied from 16.3 to 21.2°Brix. Furthermore, highly significant correlation was found between fruit weight, size and TSS. These observations have important implications for improvement of 'Chok Anan' mango for breeding as well as postharvest handling purposes.

**Keywords:** /Mango/ / Fruit Characteristics/

Azhar, H., et. al. 2013. Variation study on morphological characters among *Mangifera indica* L. 'chok anan' for development of superior mango clone. Acta Hort. 1012: 305-314.

#### **Abstract**

'Chok Anan' (MA 224) is an oval-shaped mango with medium fruit size (250- 350 g), golden-yellow skin, orange-yellow flesh, sweet taste (TSS: 14-16%), pleasant aroma, slightly fibrous and high yield (60-100 fruits per tree). The objective of this research is to evaluate, identify and select promising 'Chok Anan' variants to obtain superior 'Chok Anan' clones. Research was conducted on MADA, Tobiar plot planted with 'Chok Anan' mango at six years of age. The sources of 'Chok Anan' planting materials were obtained from different nurseries. Based on preliminary assessments, 34 out of 2,000 accessions planted in the plot were identified as containing the required

variations. The 34 accessions were further evaluated comprehensively, in terms of their fruit yield, fruit quality, plant growth and anthracnose incidence. From data collection, 8 promising accessions were suggested to be selected as superior 'Chok Anan' clones. Accessions CV24, CV27 and CV34 had high fruit yield, desirable fruit size, high total soluble solids (TSS) and slight tolerance to anthracnose infection. In addition, accession CV34 also showed attractive fruit skin color (yellowish green) even before ripening stage. Accessions CV09 and CV11 had high fruit yield and slight tolerance to anthracnose infection. Accession CV12 had high fruit yield, desirable fruit size and high TSS. Accessions CV22 and CV27 showed the dwarf plant height, while accession CV15 had high fruit yield and moderate fruit size.

**Keywords:** /Mango/ / Fruit Quality/

Ho, B.T., et. al. 2013. Ethylene gas from an ethylene- $\alpha$ -cyclodextrin inclusion complex powder ripens 'calypso' mango fruit. Acta Hort. 1012: 331 - 336.

#### **Abstract**

A novel ethylene- $\alpha$ -cyclodextrin inclusion complex powder was produced and tested for ripening 'Calypso' mango fruit. Ethylene was released from the powder under controlled humidity and temperature. Admixture with deliquescent calcium chloride (CaCl<sub>2</sub>) salt gave fast release of ethylene gas over 24 h. Ethylene gas released from the powder triggered mango ripening ascertained as fruit firmness and colour changes in a temporal manner similar to as for conventional ethylene gassing as compared to non-ethylene treated control fruit. The novel powder formulation has demonstrated promise for commercial application to ripen mango fruit.

**Keywords:** /Mango/ /Fruit Color Change/ / Fruit Firmness/

Jha, S.N., et. al. 2014. Nondestructive prediction of maturity of mango using near infrared spectroscopy. J. Food Eng. 124: 152 – 157

#### **Abstract**

This study proposes a formula for prediction of maturity index (Im) using physico-chemical characteristics and overall acceptability (OA) of a sensory panel for mangoes from orchards of nine Indian states. Computed Im values were found to be in agreement with both OA scores and the perceptions of experienced farmers. NIR spectra of 1180 mangoes were acquired. Multiple-linear regression (MLR) and partial least square (PLS) models were developed in the wavelength range of 1200–2200 nm to predict Im. The best prediction was achieved using PLS model after MSC data treatment in the wavelength range of 1600–1800 nm. Multiple correlation coefficients (R) for calibration and validation of PLS model were 0.74 and 0.68, respectively. Lower difference in standard errors of calibration (0.305) and prediction (0.335), indicated the potential of NIRS in prediction of the maturity non-destructive.

**Keywords:** /Mango/ /Maturity/ /Infrared Spectroscopy/

Kumar, A.K., et. al. 2013. Influence of postharvest chemical treatments on shelf life and quality of 'baneshan' mango harvested at different maturity stages. Acta Hort. 1012: 405 – 412.

#### **Abstract**

An investigation was carried out on the effect of postharvest chemical treatments on shelf life and fruit quality of 'Baneshan' mango with a view on enhancing its export potential. Two different maturity stages (7-8°B TSS, M1 and 8-9°B TSS, M2) were considered for this purpose. Fruits were treated with 1-methylcyclopropene (1-MCP) at 1000 and 2000 ppb and with 1.0 mM spermine. Untreated fruits served as the control. After treatment, fruits were stored at 12.5±1°C. A proportion of packages were removed every 14 days (14th, 28th and 42<sup>nd</sup> day) and exposed to ambient temperatures for ripening. During ripening, samples were taken at four days interval and

tested for physical and chemical changes (physiological loss in weight (PLW), firmness, visual colour score, pH, total soluble solids (TSS), acidity, reducing and total sugars). Results suggested that after 14 and 28 days of cold storage, PLW was lower, firmness was higher and colour attainment was better in 1-MCP-treated mangoes than the spermine-treated and control fruits. Other quality parameters like pH, TSS and total sugars were higher in 1000 ppb 1-MCP treated fruits followed by 1-MCP 2000 ppb than the rest of the treatments. Between the two maturity stages, TSS and total sugars were higher in M2 treated with 1-MCP than the M1 stage. It was concluded that 1-MCP delayed the ripening process and the shelf life was extended up to 28 days at 12.5±1°C and 4 days at ambient conditions.

**Keywords:** /Mango/ /Shelf life/ /Quality/

Lakshmi, B.K.M., et. al. 2013. Mitigating postharvest losses caused by anthracnose disease in mango by using bio agents, botanicals and ISR chemicals. Acta Hort. 1012: 661 – 670.

#### **Abstract**

Anthrachnose caused by *Colletotrichum gloeosporioides* is the major pre- and postharvest disease in mango. To reduce fungicide usage in the management of anthracnose disease, eco-friendly alternative methods such as biocontrol agents, botanicals and ISR chemicals were evaluated. Native microbial isolates were collected from mango canopy and evaluated along with commercially available biocontrol products against *C. gloeosporioides* in vitro. Among the 14 isolates of fungi, bacteria and yeast, the native isolate of *Trichoderma viride* (Tv1) collected from mango leaves recorded maximum growth reduction of *C. gloeosporioides* and this isolate was compatible with commonly used non systemic fungicides such as copper oxychloride, mancozeb and propineb in mango. However, all the isolates were highly sensitive to systemic fungicides carbendazim and hexaconazole even at low concentrations. Among different botanicals tested against the anthracnose pathogen eucalyptus oil at 1 and 0.5% recorded 100% control of *C. gloeosporioides* mycelia growth. In the group of inducing systemic resistance (ISR) chemicals preharvest spraying of salicylic acid at 100 ppm recorded maximum disease reduction compared to control treatment. To reduce the postharvest anthracnose disease losses in mango fruits, different combinations of treatments were tried, of them the minimum disease incidence of (14.8%) was recorded in the treatment (T7), which received the preharvest spraying with salicylic acid (100 ppm), followed by postharvest fruit dip in eucalyptus oil (1%) followed by *Trichoderma viride* (2%) reduced 56.6% anthracnose incidence over control.

**Keywords:** /Mango/ /Postharvest Severity/ /Biocontrol/

Malik, A.U., et. al. 2013. Phytosanitary irradiation treatments in relation to desapping and processing types affect mango fruit quality. Acta Hort. 1012: 681 – 692.

#### **Abstract**

Irradiation has now become an acceptable market access protocol for fruit fly disinfestation for many countries including the USA. It also improves the microbiological safety and shelf-life of fresh produce. This study evaluated the response of three commercial mango cultivars ('Sindhri', 'Samar Bahisht Chaunsa' and 'Sufaid Chaunsa') of Pakistan to varying doses of gamma irradiation in combination with two types of desapping (physical vs. lime) and cleaning methods (brushed vs. non-brushed). Irradiation had significant effects on both physically and lime-desapped 'Sindhri' mangoes stored under ambient (30±2°C; 50-60% RH) and low temperature (13±1°C; 80-85% RH) conditions. Fruit subjected to high irradiation doses (700 and 1000 Gy) had significantly lesser peel colour development as compared to lower doses (250 and 400 Gy). No significant effect was found on firmness, lenticels, weight loss, biochemical and organoleptic properties. Moreover, irradiation did not significantly reduce disease development resulting in lower marketability index at ripe stage in mangoes stored for 4 weeks at low temperature. Lime-desapped 'S.B. Chaunsa' fruit irradiated at 400 Gy exhibited higher firmness and better organoleptic characteristics than physically-desapped mangoes. Regardless of processing type, irradiation at 700 Gy resulted in significantly better firmness at the ripe stage in 'Sufaid Chaunsa' mangoes kept under ambient conditions and slow colour development during storage at 11±1°C; 80-85% RH. However, under ambient

conditions, brushed fruit had significantly better peel colour and TSS:acidity as compared to non-brushed fruit. Overall, brushed 'Sufaid Chaunsa' mangoes irradiated at 700 Gy had significantly higher lenticels development and poor colour under both storage conditions. In conclusion, irradiation at higher dose caused less colour development and more lenticels spotting. However, the response varied with cultivars. Between desapping types, lime desapping (0.5% lime solution; 2-3 min dip) caused more lenticels spotting compared with physical desapping. In the case of processing type, brushed mangoes had more lenticels spots compared with non-brushed mangoes when irradiated at 400 Gy, the dose required as per USA protocol.

**Keywords:** /Mango/ /Quarantine/ /Quality/ / Storage/

Motomura, Y., T. Nishizawa and N. Kumpoun. 2013. Changes in peel color and cuticle components of mango skin affected by temperature treatment after harvest. Acta Hort. 1012: 155 – 160.

#### **Abstract**

Mangoes (*Mangifera indica* L.) were harvested at young, immature, and mature stages, and separated into three groups: harvested, kept at 5°C for 15 days, and at 25°C for 7 days. Peel colors of the fruits at harvest, those kept at 5°C, and those kept at 25°C were green, pale green with pale brown flecks, and yellow, respectively. Relative oxidation rates of the sesquiterpene-like substances (such as  $\alpha$ -farnescene and its oxidation products) in hexane extracts were estimated based on the relative ratio of UV absorbance at 269/232 nm. The ratio at 269/232 nm of the fruits kept at 5°C were lower than those at harvest and kept at 25°C. The fatty acid composition of the hexane extracts of fruit peel was determined by gas chromatography. The predominant fatty acid was palmitic acid, which increased after harvest regardless of the temperature. The relative ratio of stearic acid in the fruits kept at 5°C was significantly higher than those at harvest and 25°C. The relationship between the peel color and peel components was speculated.

**Keywords:** /Mango/ /Maturity/ /Ripening/ /Peel Color/

Suhanna, A., et. al. 2013. *Trichoderma* sp. as a biological control agent in the postharvest treatment of mango stem-end rot. Acta Hort. 1012: 775 – 782.

#### **Abstract**

Stem-end rot caused by *Botryodiplodia theobromae* is one of the most economically important diseases of mango. Currently the disease is controlled by fungicides. Due to the residual effect and biosafety issues to the health and environment caused by fungicides, this study was initiated to investigate the potential use of fungal antagonist (*Trichoderma* sp.) against *B. theobromae* and its effectiveness as compared to fungicides. The mango cultivar 'Sala' was used in this study. Treatments applied were propiconazole sprayed at 500 ppm and three different spore concentrations at  $1 \times 10^3$ ,  $1 \times 10^6$  and  $1 \times 10^8$  conidia/ml of *Trichoderma* sp. with and without inoculation of *B. theobromae*. The severity of the disease was determined at 0, 2, 4, 6 and 8 days post inoculation based on disease lesion. When *B. theobromae* inoculated on mango, spore concentration of *Trichoderma*  $1 \times 10^6$  and  $1 \times 10^8$  conidia/ml showed good potential to control stem-end rot but control levels was not as high as using propiconazole. All the fruits without inoculation with *B. theobromae* did not develop any disease symptom until day 4 for all treatments. Treating the mangoes by spraying with three different spore concentrations of *Trichoderma* sp. and 500 ppm propiconazole did not have significant effect as compared to untreated (control) mango. Disease started to develop at day 6 for fruit sprayed with all the three concentrations. All treatments including control showed that the percentage of lesion had a value ranging from 0-2%. This study revealed that fungal antagonist of *Trichoderma* sp. with spore concentration of  $1 \times 10^8$  and  $1 \times 10^6$  conidia/ml has the potential for postharvest disease control and thus needs further evaluation.

**Keywords:** /Mango/ / Biological Control/

#### **MELON**

Dos-Santos,N., et. al. 2013. Aroma volatiles as biomarkers of textural differences at harvest in non-climacteric near-isogenic lines of melon. Food Res. Int'l. 54: 1801 – 1812.

#### **Abstract**

The texture and aroma volatiles of two non-climacteric near-isogenic lines (NILs) of melon (*Cucumis melo* L.), SC10-2 and SC7-1, containing introgressions of the Korean cultivar 'Shongwan Charmi' accession PI161375 (SC) in the Spanish cultivar 'Piel de Sapo' (PS) were studied. Data were examined using different supervised and unsupervised univariate and multivariate statistical techniques in order to determine the aroma volatiles most closely associated with differences in melon texture. SC10-2 showed 65% higher flesh firmness, a higher level of pellet juice content and lower flesh juiciness than PS and was harvested at least 7 days later. In SC7-1, only the textural trait, whole fruit hardness, was lower (by 34%) than in PS. About eleven quantitative trait loci for aroma volatiles were mapped in linkage group VII and other nineteen in group X. The aroma compounds discriminated SC10-2 from PS better than SC7-1, as revealed by Partial least squares-discriminant analysis and, to a lesser extent, by Random forest analysis. Around seven aroma volatile compounds, mostly ketones, aldehydes and alcohols, consistently lent support to the discrimination irrespective of the methodology used. Higher levels of several aldehydes (e.g. 2,4-dimethylbenzaldehyde, 2-methylpropanal and 2-methylbutanal), not present in PS, discriminated SC10-2 from PS. Also, SC10-2 lacked some ketones (e.g. 1-phenylethanone), alcohols (e.g. 1-phenylethanol) and one acid (e.g. 2-phenylpropanoic acid) compared with higher content in PS. The former aldehydes and other compounds, such as 3-methylsulfanylpropanal, were the volatiles with the closest association with flesh firmness harvest, and form part of the phenylalanine, leucine, valine, isoleucine or methionine metabolism and the benzenoid biosynthetic pathway. A negative correlation with the former discriminative compounds of SC7-1 and PS and whole fruit hardness was established. SC7-1 stood out mainly for its higher content of one sulfur-derived compound (S-methyl ethanethioate), one acetate ester (benzyl acetate) and two alcohols (octan-1-ol and (2R, 3S)-3-ethylheptan-2-ol) compared with PS, and one ketone (pentane-2,3-dione), which was absent in PS, but none of these were associated with flesh textural traits.

**Keywords:** /Melon/ /Aroma Volatiles/

#### **NECTARINES**

Hale, G., et. al. 2013. Using non-destructive methods to correlate chilling injury in nectarines with fruit maturity. Acta Hort. 1012: 83 – 90.

#### **Abstract**

Nectarine physiological maturity at harvest may have an important effect on the development and expression of chilling injury during cold storage. Prior to cold storage, two non-destructive instruments, an acoustic firmness sensor (AWETA), and a vis/NIR DA-meter, were used to classify 'August Fire' nectarines into maturity stages based on both fruit firmness and ethylene production. Both non-destructive parameters were also correlated with Effegi penetrometer firmness. DA meter readings were found to be strongly correlated to physiological maturity of nectarine as expressed by the rate of fruit ethylene production ( $r^2=0.74$ ), and only moderately correlated with penetrometer fruit firmness ( $r^2=0.52$ ). Acoustic firmness measurements were strongly correlated with penetrometer firmness ( $r^2=0.76$ ). Three significantly distinct fruit maturity classes specific to this cultivar were identified based on measured ethylene production and fruit firmness measured by AWETA. Chilling injury (CI) severity increased during cool storage at 5°C with fruit maturity having a significant effect on CI expression after 34 days storage. The main symptoms observed were flesh bleeding, browning and a reduction in expressible juice. Chilling injury severity was found to be dependent on fruit maturity as assessed by both non-destructive methods with mature, post-climacteric fruit being less susceptible. Maturity classification using both the DA-meter and AWETA firmness sensor may allow prediction of CI development during cold storage.

**Keywords:** /Nectarine/ /Firmness/ /Maturity Stages/ /Cold Storage/

Zapata, P.J., et. al. 2013. Preharvest application of *Aloe vera* gel exhibits antimicrobial activity by reducing yeast, mould, and aerobic counts at harvest in several *Prunus* spp. Acta Hort. 1012: 121 - 126.

#### **Abstract**

Stone fruits including sweet cherry, peach and nectarine, are highly appreciated by consumers due to their excellent organoleptic quality but they are perishable produce after harvest and thus, their shelf life is reduced. One of the main problems leading to deterioration and quality losses is occurrence of fungal decay. The aim of this work was to evaluate the influence of preharvest treatments with two *Aloe vera* gels, one commercial and one home-made and freshly prepared on stone fruits: sweet cherry ('Prime Giant' and 'Skeena'), peach ('Rich Lady') and nectarine ('Garrofa'). Treatments were applied one day (T1) before harvest and 1 and 7 days (T2) before picking the fruit. Fruit were picked at commercial ripening stage and quality parameters (firmness, colour, acidity, soluble solids and respiration rate) and microbial counts were determined. Results showed that treatment did not significantly modify the fruit quality, but microbial counts were significantly reduced, especially in the sweet cherry cultivars, for which 2-log reduction was obtained as compared to the controls, while for nectarine and peach, 1-log reduction was obtained. With these results, we can conclude that *Aloe vera* gel applied at preharvest treatment could be a good alternative to the use of synthetic fungicides for controlling fruit spoilage in stone fruits.

**Keywords:** /Nectarine/ /Sweet Cherry/ /Ripening/ /Respiration/

#### **PAPAYA**

Azlin, Nur, R., et. al. 2013. Effect of hot water treatment on physico-chemical properties of **papaya** (*Carica papaya* 'Sekaki') during ripening. Acta Hort. 1012: 479 – 484.

Acta Hort. 1012: 479 – 484.

#### **Abstract**

This study was conducted to evaluate the effect of hot water treatment on physico-chemical properties of papaya (*Carica papaya* 'Sekaki') during ripening. The experiment was done by dipping the papaya twice in hot water that reached a temperature of 42°C for 30 min and 49°C for 20 min, whilst the untreated papaya was considered as the control. Physico-chemical characteristics namely pH, total titratable acidity, ascorbic acid content, total soluble solid, colour, texture, weight loss, general appearances, disease, respiration rate, ethylene production and ACC oxidase activity were observed during storage at ambient (25°C). During ripening process at ambient, the physico-chemical parameters of papaya were changed significantly ( $p < 0.05$ ). However, there were no significant differences ( $p > 0.05$ ) between treatments in all parameters except for general appearances. The hot water treatment gave better appearance which maintained smooth skin better than the control which developed rough skin- and symptom-like senescence spot after storage for several days. 'Sekaki' papaya treated with hot water treatment was free from anthracnose disease while control papaya developed anthracnose disease after 6 days of ripening. The results seemed to suggest that hot water treatment did not affect the physico-chemical changes of 'Sekaki' papaya but maintained the good appearance and prevented from diseases during ripening.

**Keywords:** /Papaya/ /General Appearance/ /Ripening/

Del Carmen, D.R., et. al. 2013. Understanding consumers preferences for fresh table-ripe **papaya** using survey and conjoint methods of analyses. Acta Hort. 1012: 1379 – 1386.

#### **Abstract**

In today's dynamic market, firms in the supply chain must determine with certainty the attributes consumers look for in a product when making purchase decisions so that they can deliver what is really valued. A usual consumer survey and conjoint methods of analyses were used to determine the relevant attributes

considered by consumers in buying fresh table-ripe papaya. The survey results showed that the top four papaya attributes considered by consumers in their purchase decisions are sweetness, overall quality (external and internal qualities), color and price. These attributes were used to construct the design for conjoint analysis. The level of importance that the consumers attached to the papaya attributes exhibited similar patterns in both the survey and conjoint analysis methods. The order of importance of the attributes is: 1) absence of decay/damage, 2) sweetness, 3) maturity and 4) price. Two market segments were also identified from the conjoint analysis data using the cluster analysis: first is the aesthetic conscious group, who gives premium to blemished-free peel; and second is the taste sensitive group who desires sweet tasting papaya. The two clusters preferred best papaya quality (no decay/damage, very sweet and full yellow), however, only the taste-sensitive group indicated willingness to pay for a higher price. Results of the two survey methods can be a sound basis for firms in identifying and implementing quality improvements so that the country's papaya industry will remain competitive and viable.

**Keywords:** /Papaya/ /Consumer Preference/ /Conjoint Analysis/

Ding, P. and Z.A.L. 2013. Prolonging postharvest life of 'Frangi' papaya using shrink film. Acta Hort. 1012: 1347 – 1352.

#### **Abstract**

A study was conducted to determine the effects of modified atmosphere packaging on postharvest life extension of 'Frangi' papaya (*Carica papaya* L.). The packaging materials used in the study were paper (control), shrink film wrap and Xtend® film. Fruit of maturity index 2 was wrapped with the three different types of packaging material. Twelve of these wrapped fruits were placed in a storage box. Immediately, the storage box was transferred to a chamber of 12±2°C/85% RH for 3 weeks. Nine fruits of each packaging treatment was taken out from the cold chamber at weeks 0, 1, 2 and 3 and allowed to ripen naturally in a room of 27°C with 70% RH. Fruit quality was evaluated at days 0, 3 and 6 during ripening. The three packaging materials did not affect peel and flesh L\* values, flesh C\* values, titratable acidity and vitamin C of papaya. In contrast, peel C\* and h° values, flesh h° values, fruit firmness, soluble solids concentration (SSC) and pH were significantly (P≤0.05) affected by packaging materials. As storage duration progressed, the L\*, C\* and h° values of peel, h° values of flesh, fruit firmness, SSC and pH were affected significantly (P≤0.05). Shrink film wrapped fruit had better postharvest quality where the fruit were well-preserved compared to the other two packaging materials. In conclusion, shrink film can be used to prolong 'Frangi' papaya postharvest life.

**Keywords:** /Papaya/ /Postharvest/ / Titratable Acidity/ /Shrink Film/

Hamizah, H. et. al. 2013. Screening of antagonistic yeast for biological control activity against anthracnose (*Colletotrichum gloeosporioides*) in 'frangi' papaya. Acta Hort. 1012: 739 – 744.

#### **Abstract**

Postharvest decay causes decreased in both quantity and quality of fruits. It is also one of the major constraints in papaya production and exports. Anthracnose caused by *Colletotrichum gloeosporioides* was the most prevalent postharvest fungal disease attacking 'Frangi' papaya, where disease incidence and severity was recorded as 90-98 and 25-38%, respectively and the magnitude increased as the fruits ripened. Conventional fungicide treatment is losing popularity due to high residual problem and detrimental to the environment. Thus, a study was conducted to look for a suitable strain of yeast that can substitute fungicides in controlling the disease with the objectives to select and test the ability of epiphytic yeast isolated from papaya fruit, leaf, petiole and trunk in controlling anthracnose onset after harvest. A total of 110 different strains of yeasts were obtained and 29 yeasts isolated showed antagonistic activities against *C. gloeosporioides* in vitro. Out of 29 yeasts, only five strains YK, YC, YT, YA and YW showed highest percentages inhibition of radial growth (70.3, 60.8, 59.5, 59.5 and 59.5%, respectively) in dual culture assay. Further assays were done in vitro and in vivo in order to confirm the antagonist activities of the yeasts by referring to percentage of disease reduction and inhibition of mycelial growth. Only two strains, YA and YK showed higher potential in controlling anthracnose in in vivo and in vitro test. Based on these

results, additional studies on identification and modes of action of the most potential antagonistic yeast(s) to control postharvest anthracnose disease will be conducted.

**Keywords:** /Papaya/ /Biocontrol/ /Antagonistic yeast/

Hamzah, H.M., et. al. 2013. Quality changes of **papaya** (*Carica papaya* L. 'Eksotika') as affected by different concentrations of chitosan and glycerol. Acta Hort. 1012: 439 – 444.

#### **Abstract**

Edible coatings are well known to be one of the methods used for preserving fresh produce especially fruits. These coatings are used on many products to control moisture transfer, gas exchange and oxidation process. Plasticizers such as glycerol are added into edible formulations to improve coating properties. Chitosan is a polysaccharide that has the ability to form semi-permeable coatings that can modify the internal atmosphere, and thus reduce respiration rates and consequently delay ripening of fruits. Therefore, the aim of this study was to evaluate the effects of different concentrations of chitosan and plasticizer (glycerol) on changes in the quality aspects of 'Eksotika' papaya. Coating formulations made of different concentrations of chitosan and glycerol ranging from 0.5-2.5% w/v and 0-2% w/v respectively were used to coat the papaya. The papayas were kept at ambient ( $26\pm 1^{\circ}\text{C}$ ;  $70\pm 10\%$  RH) condition and evaluated for changes in weight loss, firmness, colour and total soluble solids (TSS) after 5 days of storage. Results obtained show that combination of chitosan and glycerol at different concentrations gave significant ( $p < 0.05$ ) effect to all parameters tested. In general, increase in chitosan concentration with combination of lower glycerol concentration gave desirable changes to the responses tested. They were able to reduce changes in weight loss, firmness, peel colour and TSS of 'Eksotika' papaya. However, increasing glycerol concentration at fixed amount of chitosan gave negative effects. Thus, the findings of this study suggest that chitosan in combination with lower glycerol concentration can be used to prolong the shelf life and maintaining the quality of fruit during storage.

**Keywords:** /Papaya/ /Edible Coatings/ /Quality/

Hasan, M F., et. al. 2013. Control of postharvest anthracnose disease and quality of **papaya** using *Bacillus subtilis* strain B34 enhanced with sodium bicarbonate and *aloe vera* Gel. 1012: 653 – 660.

#### **Abstract**

The potentials of using *Bacillus subtilis* by itself or enhanced with sodium bicarbonate (SBC) and *Aloe vera* gel (aloe gel) for the control of postharvest anthracnose disease of papaya fruit, and subsequently their effects on postharvest quality of fruit were investigated. *B. subtilis* B34 showed antagonistic activity against *C. gloeosporioides*, which was isolated from papaya fruit surface. However, *B. subtilis* B34 when supplemented with 2% SBC and 20% aloe gel showed a greater control by reducing 98.2% of the disease during storage for 14 days at  $12^{\circ}\text{C}$  and 95% RH, which was superior to that obtained using fungicide, benocide®. Furthermore, the combination of SBC-aloe gel with *B. subtilis* significantly managed the fruit quality by maintaining fruit firmness, delaying the changes in external color without impairing any other fruit quality parameters during another storage experiment at  $12^{\circ}\text{C}$  and 95% RH for 28 days. Therefore, the combination of *B. subtilis* strain B34, SBC and *Aloe vera* gel could be an alternative to synthetic fungicides for the control of postharvest anthracnose disease as well as quality of papaya.

**Keywords:** /Papaya/ /Disease Incidence/ /Disease Severity/ /Shelf Life/ /Fruit Quality/

Idnan, F., U.F., A. Osman, and N. Saari. 2013. Changes in texture and total soluble solids (tss) content of 'sekaki' and 'eksotika' **papaya** during storage at different temperatures. Acta Hort. 1012: 851 – 856.

#### **Abstract**

Papaya is a tropical, climacteric fruit that undergoes ripening significantly after harvest. The ripening process is the result of several physico-chemical changes in fruits and is affected by storage temperatures. The aim of this study was to evaluate changes in the total soluble solids (TSS) content and texture of papaya cultivars 'Sekaki' and 'Eksotika' during storage at four different temperatures (10, 15, 20 and 30°C). The results showed that total soluble solids content of 'Sekaki' and 'Eksotika' papaya increased as a function of storage time and temperature. TSS content for 'Sekaki' papaya stored at 10 and 15°C (14 days), 20°C (7 days) and 30°C (6 days) increased from 7.1±0.80 Brix to 9.4±0.63, 10.9±0.4, 10.1±0.44, and 10.4±0.50 Brix, respectively. On the other hand, TSS content of 'Eksotika' papaya increased from 8.8±0.46 to 10.4±0.95, 11.45±0.78, 12.33±0.35, and 13.12±0.62 Brix after storage at 10 and 15°C (16 days), 20°C (9 days) and 30°C (8 days), respectively. There were significant differences (P<0.05) in TSS content among fruits stored at 10, 20 and 30°C. Texture of 'Sekaki' and 'Eksotika' papaya significantly (p<0.05) decreased for fruits stored at 20°C (7 and 9 days, respectively for 'Sekaki' and 'Eksotika') and 30°C (6 and 8 days, respectively for 'Sekaki' and 'Eksotika'). For 'Sekaki' papaya, it decreased significantly (p<0.05) from 18.58±0.61 to 3.89±0.96 and 5.10±1.01 N respectively, while for 'Eksotika' papaya it decreased significantly (p<0.05) from 20.33±0.52 to 4.50±0.87 N when stored at 20 and 30°C. No significant difference in fruit texture was observed when the fruits were stored at 10 and 15°C for both cultivars. The results of this study indicated that high storage temperatures (20 and 30°C) affected significantly the changes in TSS and texture of 'Sekaki' and 'Eksotika' papaya. On the other hand, low storage temperatures (10 and 15°C) affected changes in TSS content but not the texture.

**Keywords:** /Papaya/ /Physical and Chemical Changes/ /Storage Temperature/

Madani, Babak, et.al. 2014. Effect of pre-harvest calcium chloride applications on fruit calcium level and post-harvest anthracnose disease of papaya. Crop Protection 55: 55 – 60.

#### **Abstract**

Anthracnose disease of papaya, caused by *Colletotrichum gloeosporioides* Penz, can cause extensive postharvest losses. The goal of this research was to use pre-harvest calcium applications to reduce anthracnose disease. Six pre-harvest foliar calcium sprays were applied biweekly to papaya trees in experimental orchards at Universiti Putra Malaysia. Additional in vitro and in vivo tests were carried out to test the effect of calcium on fruit calcium content, spore germination, mycelial growth and disease severity. Calcium chloride at 1%, 1.5% and 2.0% concentrations significantly decreased spore germination. Calcium content of papaya fruit was significantly increased by calcium sprays at a concentration of 2.0% in 2012 and 2013. In vivo studies showed that increasing calcium content in fruit by calcium sprays at 1.5 and 2.0% concentrations significantly reduced anthracnose incidence of fruits during five weeks storage at 12 \_ 2 \_C, and delayed initiation of disease symptoms by four weeks.

**Keywords:** /Papaya/ /Anthracnose/ /

Ong, M.K., A. Ali and F.K. Kazi. 2013. Effect of gaseous ozone exposure on the control of *Colletotrichum gloeosporioides* of papaya during ambient storage. Acta Hort. 1012: 727 -734.

#### **Abstract**

The effect of gaseous ozone to control postharvest decay of papaya, particularly anthracnose caused by fungus *Colletotrichum gloeosporioides* was investigated. Different concentrations of ozone (0 (control), 1.5, 2.5, 3.5 and 5 ppm) were applied for 96 h at room temperature (25±3°C) in a completely randomized design setup with four replications. Radial mycelial growth and conidial germination were evaluated in vitro after fungal exposition to different doses. The effects of ozone on disease incidence and severity of papaya inoculated with *C. gloeosporioides* during ambient storage (25±3°C, 60% relative humidity) for 14 days were also determined. Significant (p<0.05) inhibition in radial mycelial growth of *C. gloeosporioides* was observed in all treatments of ozone compared to the control during eight days of incubation at room temperature (25±3°C). However, the maximum inhibition in radial mycelial growth and conidial germination was observed in petri plates exposed to 5

ppm of ozone for 96 h (41.20%) and (100%), respectively. Microscopic analysis showed that ozone exposure to 5 ppm caused disintegration of spore. Exposure of fruits to ozone also leads to significant suppression of disease incidence and severity in papaya. Therefore, these results supported that application of gaseous ozone as a safe non-thermal food preservation technique for papaya, which can be used successfully as an alternative to chlorination.

**Keywords:** /Papaya/ /Anthracnose/ /Mycelial Growth/ /Conidial Germination/

Razali, M., Z.M. Ali and R. Othman. 2013. 1-methylcyclopropene (1-mcp) and heat treatment affected weight loss and ethylene biosynthesis of 'sekaki' **papaya** stored at low temperature. Acta Hort. 1012: 375 – 382.

#### **Abstract**

The effects of 1-methylcyclopropene (1-MCP) and heat treatments on weight loss and ethylene biosynthesis on 'Sekaki' papaya fruits stored for 28 days at 10°C and after being held at ambient temperature (28°C) for up to five days were investigated. The weight loss of fruits in all treatments increased very slowly during storage at 10°C and increased at faster rates during holding period at ambient following 28 days of low temperature storage. The trends in weight loss, ethylene production, 1-aminocyclopropane-1-carboxylic acid (ACC), ACC synthase (ACS) and ACC oxidase (ACO) activities were similar in all treatments although significant differences were observed between the treatments on the respective holding periods at ambient. Generally, a combination of heat treatment and 1-MCP was found to be effective in inhibiting the ethylene biosynthesis and reduced percentage of weight loss of 'Sekaki' papaya stored for 4 weeks at 10°C and also after being held at ambient temperature until the fruit reached a complete ripening.

**Keywords:** /Papaya/ /Synthetic Cyclopropene/ /Ripening/ /Storage/

#### **PEACH**

Alizadeh-Salteh, S., et. al. 2013. Savory essential oil effect on postharvest control of rhizopus rot on packaged **peaches** in polyethylene films. Acta Hort. 1012: 759 – 762.

#### **Abstract**

Postharvest diseases limit the storage period and marketing life of peaches. Rhizopus rot, caused by *Rhizopus stolonifer* (Ehrenb. Fr) Vuill., is one of the most destructive postharvest diseases of stone fruits. The aim of this investigation was to evaluate the antifungal effects of the herbal essential oil of savory (*Satureja hortensis*) against *Rhizopus stolonifer*, causal agent of Rhizopus rot on peach. In in vitro trials, the activity of savory oil was tested against pathogen mycelium growth. Essential oil was added to the medium (ranging from 120 to 360 µl/L), or to a filter paper (ranging from 1, 3, 6, 12, 24 and 48 µl/L) inserted on the lid of petri dish to assay its volatility. In in vivo experiments, four concentrations of Savory oil (0, 120, 240 and 360 µl/L) were tested by dipping and seven doses (0, 50, 100, 200, 400, 800 and 1600 µl/L) were applied as vapour phase on 'J.H. Hale' peaches artificially inoculated with the pathogen (106 conidia ml/L). Fruit were stored at 25 or 1°C for 20 and 45 days respectively. In in vitro results the concentrations of 360 µl/L used in medium and that of 24 µl/L used as volatile showed the highest activity against *Rhizopus* growth. In in vivo trials, the most effective concentration of essential oil was 360 µl/L used by dipping and 24 µl/L used as biofumigant. More investigation is in progress to evaluate the practical application of savory oil.

**Keywords:** /Peach/ /Essential Oil/ /Postharvest/

Nanni, V., et. al. 2013. The **peach** (*Prunus persica*) defensin ppdfn1 displays antimicrobial activity against fungal pathogens through specific lipid binding and membrane permeabilization. Acta Hort. 1012: 699 – 704.

#### **Abstract**

Plant defensins are a large family of small, cationic, cysteine rich peptides playing crucial role in the plant innate immunity. These small proteins are secreted into the extracellular environment upon recognition of a signal sequence, which is typically located N-terminal to the mature peptide. Mature defensins are fairly divergent in primary sequence, with the exception of the typical conserved cysteine pattern. Defensins are very interesting targets for agrobiotechnology applications because of their broad range antimicrobial activity against important plant fungal pathogens. Here we report on the expression of *PpDFN1* (*Prunus persica* DFN1) gene in peach flower and fruits at different ripening stages. The recombinant PpDFN1 was expressed in *E. coli* and purified and its antimicrobial activity characterized, together with its localization on the surface of fungal hyphae and its interaction with fungal membranes.

**Keywords:** /Peach/ /Antimicrobial Peptides/ /Postharvest Fungal Pathogens/

Valero, D., et. al. 2013. Vacuum impregnation of *aloe vera* gel maintains postharvest quality of **peach** and sweet cherry fruit. Acta Hort. 1012: 399 – 404.

#### **Abstract**

Although peach is a climacteric fruit and sweet cherry a non-climacteric fruit both are considered as perishable with a reduced shelf life, and then refrigeration under proper temperature is not enough to delay the quality losses and prolong the storability. For this reason in this work commercial *Aloe vera* gel at several concentrations (0, 33, 66 and 100% v/v) was used for postharvest treatment through vacuum impregnation at 0.2 mbar for 5 min on 'Rich Lady' peach and 'Prime Giant' sweet cherry. Following treatments fruit were stored at 2°C and RH 90%. Samples were taken from chamber at regular intervals and quality traits were determined. Results showed that *Aloe vera* gel was able to delay the postharvest ripening process of both peach and sweet cherry fruit by retarding weight loss, colour changes, firmness loss, the increase of total soluble solids, and the decrease in total acidity. In addition, respiration rate and ethylene production was also delayed. For most quality parameters the effect was concentration-dependent. Overall, results suggest that *Aloe vera* gel at 100% was the best concentration to maintain postharvest quality of both peach and sweet cherry.

**Keywords:** /Peach/ /Sweet Cherry/ /Respiration/ /Quality/

#### **PEAR**

Javanmard, M., S. Ojnordi and M. Esfandyari. 2013. Effect of edible coating based on whey protein and *Zataria multiflora* bioextract on the shelf life of 'shah mive' **pear** (*Pyrus communis*). Acta Hort. 1012: 427 – 434.

#### **Abstract**

The goal of coating development was to improve quality and increase durability of product. Application of edible coatings is a suitable method to maintain quality and reduce from wasting in fresh vegetables and fruits. In this study, durability of pear during 21 days of storage was investigated by using a coating based on whey protein (2.5-5%), *Zataria multiflora* extract (0-500 µl) and glycerol (0.375-2.25 g). *Zataria multiflora* extract was prepared by hydrodistillation. This coating was a solution of concentrated whey protein (85% protein content) in distilled water and glycerol as plasticizer. The pear was coated by immersion at 20°C and after the coating was dried it was put in to a disposable dish without a cap and maintained at 6°C and relative humidity of 78-80% for 21 days. A group of uncoated fruit was used as a control. Some measurements such as weight loss, spoilage evaluation, titratable acidity, and soluble solids were determined weekly. The results were investigated in the form of central composite design and were modeled and analysed by response surface methodology. Soluble solid, titratable acidity and weight loss at the end of storage period were 0.9317, 0.9225, and 0.9067, respectively. The results showed that weight loss and pH (fruit juice) of pear coated by high concentration of whey protein, *Zataria multiflora* extract and glycerol was less than the other pears. Edible coatings preserved the amount of total soluble solids to a greater amount compared with uncoated fruits. According to variance dissociation tables it was

recognized that whey protein was the effective factor in the coating process and the influence of *Zataria multiflora* extract and glycerol was less than whey. In conclusion 4.99 g of whey protein, 500 µl of *Zataria multiflora* Boiss extract and 2.44 g of glycerol per 100 ml of coating solution was optimized coating solution. Achieving a coating with maximum effect on shelf life improvement of pear are: 4.99 g of whey protein, 500 µl of *Zataria multiflora* extract and 2.24 g/100 ml water of glycerol.

**Keywords:** /Pear/ /Edible Coating/ /Whey Protein/

Li, Y.C., et. al. 2013. Effect of preharvest ga3 spray, postharvest hot water dips and individual film wrapping alone or in combination on skin browning of **pear** ('pingguoli') during storage at 15 and 1°C. Acta Hort. 1012: 1125 – 1132.

#### **Abstract**

Skin browning of pear is a major postharvest physiological disease that significantly reduces the fruit appearance by showing many dark brown spots. Effects of hot water dips (HWD), individual fruit wrapping (IFW) or preharvest GA3 sprays at 50 mg/L, alone or in combination, on skin browning and storage quality of 'Pingguoli' pears stored at ambient (15±5°C) and low temperature (0±1°C) were studied. GA3, HWD and IFW treatments alone or in combination all significantly decreased incidence of skin browning of fruit during ambient and low temperature storage. The lowest incidence of skin browning was found after treatment with GA3 + HWD; its incidence was 20.9% after 35 d at ambient and 30.8% after 120 d low temperature storage of the control. Moreover, the treatments increased soluble solids content, maintained higher firmness and titratable acid change.

**Keywords:** /Pear/ /Hot Water Dipping/ /Skin Browning/ /Individual Firm Wrapping/

Saeed, M., et. al. 2013. Characterization of determinants of friction discolouration in **pears**. Acta Hort. 1012: 1111 – 1118.

#### **Abstract**

Friction discolouration (FD) of pears is an important postharvest disorder responsible for significant consumer discontent in markets because of the unattractive appearance of the fruit surface. Control of this problem is essential to increase profitability of the pear industry. There is no single factor known to act as a limiting factor in incidence of FD; however, certain biochemical constituents (polyphenol oxidase, phenolic compounds and ascorbic acid) and skin anatomy have been reported to play important roles in this mechanism. Identification of determinants likely to play a role in the incidence of FD is a prerequisite for identifying molecular markers which can be used in pear breeding programmes to identify susceptible individuals and discard them early in the breeding cycle. For this purpose, 250 seedlings from two segregating populations for FD derived from interspecific crosses between Asian and European pear were selected. Out of 22 variables studied, a few consistent predictors were observed in relation to FD index of seedlings. All these variables were phenolic compounds. The study showed that the concentrations of procyanidin dimer B2 and isorhamnetin 3-galactoside/ glucoside were negatively correlated, while epicatechin and quercetin-3-O-glucoside were positively correlated, with susceptibility to FD. In addition, there was clear evidence of the influence of environmental factors (fruit size, harvest date, time in storage) on FD. These data will be used to accelerate the search for molecular markers which can be used to reduce FD-susceptibility in the pear breeding programme.

**Keywords:** /Pear/ /Browning/

#### **PERSIMMON**

Khademi, O., et. al. 2013. Hot water treatment maintains postharvest quality of 'karaj' **persimmon** fruit during cold storage. Acta Hort. 1012: 485 – 490.

## Abstract

There is not enough information about effects of hot water treatments on astringent type persimmons. Therefore in this study, the 'Karaj' astringent type persimmon was harvested at mature stage and treated with hot water at 45 and 50°C for 10, 20 and 30 min, along with control fruit treated at 25°C for 20 min. Then, the fruits were stored at 1°C for 4 months and selected fruit traits were monitored monthly. Results showed that colour properties ( $a^*$ ,  $b^*$ ,  $L^*$ ) of fruit decreased significantly throughout storage but this decrease in color properties at hot water treatment of 50°C for 20 and 30 min was lower than that of other applications and the highest decrease was recorded at control fruits. Disease incidence of control fruits increased significantly during storage, whereas in hot water treated fruits no noticeable disease symptom was recorded during the experiment. Following hot water treatments, no detectable browning disorder was observed on the fruits, but during storage, in fruit treated with hot water at 50°C for 20 and 30 min, in contrast with other treatments, skin-browning index increased significantly. Applied hot water treatments, in comparison to control, reduced fruit softening during storage, and among them, treated with hot water at 50°C for 20 and 30 min maintained fruit firmness better than that of other treatments. Generally, according to this study, hot water treatments of 45°C for 10, 20 and 30 min and 50°C for 10 min controlled fruit softening, disease incidence and colour loss of 'Karaj' persimmon without any negative effects on the fruit during storage, and therefore they can be recommended for increasing postharvest life of this cultivar in alternative with cold storage.

**Keywords:** /Persimmon/ /Browning/ /Firmness/

Novillo, P., et. al. 2013. influence of the level of astringency in the incidence of flesh browning disorder in persimmon. Acta Hort. 1012: 1097 – 1102.

## Abstract

'Rojo Brillante' persimmons are astringent at harvest due to their high content of soluble tannins. In order to commercialize fruit with crisp texture, 'Rojo Brillante' persimmons are routinely subjected to deastringency treatments with high concentrations of CO<sub>2</sub> which leads to tannins insolubilization and loss of astringency. External flesh browning is one of the major disorders that limit the marketing of 'Rojo Brillante' persimmon. This alteration is mainly caused by the mechanical impacts received by the fruit throughout the packing process. The aim of this work was to study the influence of astringency level of the fruit in the manifestation of flesh browning in persimmon fruit. Fruit with four different levels of astringency were subjected to packing line operations; control fruit was manually packed to avoid mechanical damage. Only the fruit subjected to packing displayed flesh browning, which confirmed that mechanical damage is the trigger of browning disorder. A clear relation among astringency and browning incidence was observed; the lower the level of astringency at the moment of fruit mechanically impacted throughout the packing line the higher the incidence of browning disorder during the commercialization period.

**Keywords:** /Persimmon/ /Enzymatic Process/ /Mechanical Damage/ /Disorder/

Sanchiz, E., et. al. 2013. extending shelf life of fresh-cut persimmon 'rojo brillante': effect of antibrowning agents and controlled atmospheres storage. Acta Hort. 1012: 1071 – 1078.

## Abstract

The aim of this work was to study the effect of antibrowning agents combined with controlled atmosphere storage to improve the quality of fresh-cut persimmon. 'Rojo Brillante' persimmons were harvested with an external color index (CI) of -0.57 (where,  $CI=1,000*a/L*b$ ). After removing fruit astringency by application of levels of CO<sub>2</sub>, samples were cleaned, peeled, and cut in sections. Persimmon pieces were dipped in 1% ascorbic acid (AA), 1% citric acid (CA), or in water as control. Fruit samples were then placed in 3 different atmospheres (Atm-A = 21 kPa O<sub>2</sub> + 0.03 kPa CO<sub>2</sub>; Atm-D = 5 kPa O<sub>2</sub> + 10 kPa CO<sub>2</sub>; Atm-F = 5 kPa O<sub>2</sub>) during nine days at 5°C.

Color (CIE L\*a\*b\*), firmness, weight loss and visual quality were determined during storage. Control samples had lower L\* and higher a\* values than antioxidant-treated samples. In untreated control samples, Atm-D was the most effective reducing enzymatic browning; whereas, antioxidant-treated samples stored in Atm-F had lower hue values than those stored in the other atmospheres. In general, the firmness decreased during storage for all the treatments. Samples stored in Atm-A had the highest weight loss. In visual quality the judges ranked control samples as the most browned under all the storage conditions. Pieces treated with 1% CA and stored in Atm-A and Atm-D reached the limit of marketability after 7 days of storage, whereas the combination of 1% CA and Atm-F was evaluated above that limit during the 9 days of storage. Samples treated with 1% AA and those stored in Atm-D induced some darkening of the tissue (non-enzymatic browning), which limited the shelf life of fresh-cut persimmon and reducing the limit for application commercially. The results show that atmospheres with low O<sub>2</sub> combined with application of 1% CA could reduce the enzymatic and non-enzymatic browning and maintain shelf life up to nine days of storage.

**Keywords:** /Persimmon/ /Antioxidants/ /Controlled Atmosphere/ /Enzymatic Browning/ /Fresh-Cut/

## PINEAPPLE

Azarakhsh, A., et. al. 2014. Lemongrass essential oil incorporated into alginate-based edible coating for shelf-life extension and quality retention of fresh-cut pineapple. *Postharvest Biol. & Technol.* 88: 1 - 7.

### Abstract

The effects of different concentrations (0.1%, 0.3% and 0.5%, w/v) of lemongrass essential oil incorporated into an alginate-based [sodium alginate 1.29% (w/v), glycerol 1.16% (w/v) and sunflower oil 0.025%(w/v)] edible coating on the respiration rate, physicochemical properties, and microbiological and sensory quality of fresh-cut pineapple during 16 days of storage (10 ± 1°C, 65 ± 10% RH) were evaluated. Coated fresh-cut pineapple without lemongrass and uncoated fresh-cut pineapple were stored under the same conditions and served as the controls. The results show that yeast and mould counts and total plate counts of coated samples containing 0.3 and 0.5% (w/v) lemongrass were significantly (p < 0.05) lower than other samples. However, the incorporation of 0.5% (w/v) lemongrass in coating formulation significantly (p < 0.05) decreased the firmness and sensory scores (taste, texture and overall acceptability) of fresh-cut pineapples. Therefore, the results indicate that an alginate-based edible coating formulation incorporated with 0.3% (w/v) lemongrass has potential to extend the shelf-life and maintain quality off resh-cut pineapple.

**Keywords:** /Pineapple/ /Lemongrass/ /Essential Oil/ /Edible Coating/ /Shelf-life/ /Quality/

Azarakhsh, N., et. al. 2013. Effect of limonene incorporation into gellan-based edible coating on the changes in microbiological and sensory characteristics of fresh- cut pineapple during cold storage. *Acta Hort.* 1012: 999 – 1004.

### Abstract

The microbiological stability of fresh-cut fruits is still one of the most challenging problems in the fresh-cut fruit industry. Essential oils have been used recently as natural antimicrobial agents. Incorporating natural antimicrobial agents into edible coatings provides a novel way to increase the shelf life and to maintain the quality of fresh-cut fruits. The aim of this work was to study the effect of different concentrations of limonene (0.1, 0.3 and 0.5% w/v) incorporated into gellan-based edible coating on the microbiological stability and sensory characteristics of fresh-cut 'Josapine' pineapple during 16 days storage at 10±1°C; 65±10% RH. Coated fresh-cut pineapple without limonene and uncoated fresh-cut pineapple were stored under the same conditions and served as the controls. The gellan-based edible coating formulation was an aqueous solution of gellan gum (0.56% w/v), glycerol (0.89% w/v) and sunflower oil (0.025% w/v). The results show that total plate count increased significantly (p<0.05) during storage for all treatments. Total plate count for edible coating formulations with 0.3 and 0.5% (w/v) limonene were significantly (p<0.05) lower than other formulations. There was no significant difference

between total plate count for gellan-based coating without limonene and uncoated samples. The results for sensory evaluation showed that the scores for taste and overall acceptability were significantly ( $p < 0.05$ ) lower in gellan-based coated samples with 0.5% (w/v) limonene in comparison with other coated samples. Therefore, results of this study indicate that gellan-based edible coating formulation incorporated with 0.3% (w/v) limonene significantly ( $p < 0.05$ ) reduced total plate count and maintained the sensory characteristics of fresh-cut pineapple.

**Keywords:** /Pineapple/ /Fresh-Cut/ /Edible Coating/ /Limonene/

Azlin, Nur, R. 2013. Evaluation of the browning activity of fresh cut **pineapple** stored in super atmospheric condition. Acta Hort. 1012: 1021 – 1024.

#### **Abstract**

This study was conducted to investigate the effect of super atmospheric condition on the browning activity of minimally processed (MP) pineapple stored at 10°C for 15 days. The MP pineapples cut in longitudinal shapes (5 cm) were packed in biaxially oriented polypropylene (BOPP) packaging. The packages were flushed with 60 (T1), 80 (T2) and 99.98% (T3) oxygen. Untreated sample was used as control (T0). Samples were evaluated for colour ( $L^*$ ,  $a^*$ ,  $b^*$  and hue), pH and titratable acidity (TTA). Activity of polyphenol oxidase (PPO) was also monitored. Results showed that the PPO activity of the samples treated with 80% oxygen was significantly lower compared to the control. This finding was supported by hue value which showed that samples treated with 80% oxygen had the lowest value. Furthermore, sample treated with 80% oxygen also had the highest TA. No significant difference was observed on the pH of the treated and control samples until the end of the storage period.

**Keywords:** /Pineapple/ /Enzymatic Browning/ / Super Atmospheric/

Del Aguila, Saavedra, I., et. al. 2013. Compression damage as the principal factor in mechanical injury of **pineapple** postharvest. Acta Hort. 1012: 1181 – 1188.

#### **Abstract**

The pineapple, besides presenting numerous sensorial qualities, shows high dietary value. The purpose of this work was to evaluate some physicochemical changes of 'Pérola' pineapple subjected to different types of mechanical injuries, simulating the main damages suffered for this fruit from harvest to marketing. Fruit were subjected to the following treatments: T1: non-injured fruit (control); T2: one 60 cm free fall; T3: four longitudinal cuts (70 mm long and 2 mm deep); T4: eight perforations (3×2 mm) in the fruit base; and T5: compression for 30 min (equivalent force of 160 Newton). After treatments, the fruit were stored for 15 days at 11°C and 85% RH. Every five days, the fruits were evaluated for firmness (N), pulp translucency (in scale from 0 to 4, where 0 = opaque, 4 = 100% of translucent pulp), juice percentage (%), ratio of soluble solids/titratable acidity, ascorbic acid (mg ascorbic acid 100 g<sup>-1</sup>) and pulp color ( $L^*$ ,  $a^*$  and  $b^*$ ). The compression treatment showed a significant loss of firmness during storage, reaching 48% after 15 days. The translucency was not significantly different between the treatments. The juice percentage that was initially 51.8% decreased to a level between 41 and 45% after 15 days of storage. The ratio of soluble solids/titratable acidity that initially was 26.35 decreased to around 18. The ascorbic acid increased in all treatments along the storage. The values of  $L^*$ ,  $a^*$  and  $b^*$  were not significantly different between treatments. It was considered the compression was the more important factor in mechanical injury of 'Perola' pineapple at postharvest, which usually happens during transportation.

**Keywords:** /Pineapple/ /Harvest and Transport/ /Storage/ /Fruit Quality/

Hasida, Bizura, M.R., et. al. 2013. Quality evaluation of fresh-cut 'josapine' **pineapple** coated with hydrocolloid based edible coating using gelatin. Acta Hort. 1012: 1037 – 1042.

#### **Abstract**

The quality of fresh-cut 'Josapine' pineapple coated with hydrocolloid based edible coating using gelatin was evaluated during storage at 10°C. Pineapple fruits were pre-cooled overnight at 10°C prior to cutting. Cut pineapple was coated with gelatin at concentrations of 0.5, 1.0 and 1.5%. Samples without coating were treated as control. All samples were packed in rigid polypropylene containers and stored for 8 days at 10°C. Samples were evaluated at 2 days interval for the physicochemical changes (colour, texture, pH, TTA and TSS) and microbiological changes (total plate count, total coliform and total yeast and mold). Overall results indicated fresh-cut pineapple remained good only for 6 days during storage at 10°C as fungal infestation was observed in all treatments with prolonged storage. No significant difference was observed in all physicochemical parameters between the treated and control samples. However, overall microbiological analysis showed a slight reduction of total bacteria counts (TBC) and total yeast and mold (TYM) in 0.5% gelatin and reduction of total coliform (TC) in 1.0% gelatin.

**Keywords:** /Pineapple/ /Edible Coating/ /Physicochemical Properties/ /Microbial Parameters/ /Shelf Life/

Latifah, M.N., et. al. 2013. Effect of packing system on the quality of fresh-cut pineapple stored at 2°C. Acta Hort. 1012: 1005 – 1012.

### Abstract

The effects of packing systems on the quality of fresh-cut pineapples cultivars 'MD2' and 'Josapine' were evaluated during storage at 2°C. For fresh-cut processing, the pineapples were mechanically sliced into semicircle shape and immersed in the treatment solutions (calcium chloride, citric acid and sodium chloride) for 1 min before mechanical drip drying for 2 min. Two packing systems were used for the study; round polypropylene container with seal on lid (T1 and T3) and shrink wrapping square polypropylene container with clip on lid (T2 and T4). Storage study was conducted at 2°C for 12 days. Surface colour (L and b values), total soluble solids (TSS), pH, total titratable acidity (TTA), gases in package (O<sub>2</sub>, CO<sub>2</sub> and ethylene), microbial counts and sensory evaluation were monitored during the evaluation days (1, 2, 5, 6, 7, 8, 9 and 12). No significant difference was observed on the changes in colour of fresh-cut pineapple stored at 2°C for 12 days. The L (lightness) values remained steady throughout the 12 days of storage as observed in both pineapple cultivars in packing systems (seal on and shrink wrapped). Steady TSS values (15-17°Brix) was observed in the fresh-cut 'Josapine' in both packing systems. An inconsistent trend was noted on TSS values of fresh-cut 'MD2' as observed in both packing treatments (T3 and T4) (12-16°Brix). A similar trend was also observed in pH values (3.3-3.5) of fresh-cut 'Josapine' (T1 and T2). Inconsistent TTA values were observed in both cultivars of all packing treatments (T1, T2, T3 and T4). No significant difference was found in the microbial counts (VRBA, PDA and PCA) of fresh-cut pineapple in different packing systems. Consistent low values (2-3 cfu/cm<sup>2</sup>) were observed in all samples throughout storage period. Higher score was given by sensory panelist on the colour of T1 and T2 due to intense yellow colour of fresh-cut 'Josapine'. Higher accumulation of CO<sub>2</sub> value was observed in the seal packing of 'Josapine' pineapple throughout the storage period. Significantly higher accumulation of C<sub>2</sub>H<sub>4</sub> was shown in the sealed pack fresh-cut 'Josapine' than that in 'MD2' as observed throughout the 9 days storage periods.

**Keywords:** /Pineapple/ /Physical and Chemical Changes/ /Gas Composition/

Martins, L.P., et. al. 2013. Postharvest quality of 'smooth cayenne' pineapple treated with 1-methylcyclopropene and cold shock. Acta Hort. 1012: 503 – 508.

### Abstract

Pineapple when submitted to low temperatures suffers physiological and biochemical changes that result in loss of quality. The internal browning (IB) is an important physiological disorder of pineapple when stored at low temperatures. The objective of this work was to evaluate the influence of 1-methylcyclopropene (1-MCP) and cold shock (CS) on the incidence of IB in 'Smooth Cayenne' pineapple, stored at 13 and 23°C. Pineapples were harvested at light green maturity stage and subjected to the following treatments: control (fruits without treatments); CS (fruits exposed to cold shock at 5°C/12 h); 1-MCP (fruits treated with 150 µl L<sup>-1</sup> 1-MCP/12 h); and 1-MCP + CS (fruits treated with 1-MCP and CS). Pineapples from each treatment were stored at 13±1 and 23±2°C for 20 days.

The quality of pineapples was evaluated based on fresh mass loss, fruit firmness, enzymatic activity, and browning index. The application of 1-MCP followed by CS, promoted significant reduction of the incidence of internal browning and loss of quality of 'Smooth Cayenne' pineapple during storage. The application of 1-MCP in 'SmoothCayenne' pineapple was effective in reducing the damage caused by exposing fruit to low temperature, thus keeping the quality of the fruits stored at both 13 and 23°C. This effect, however, was much evident in fruit kept under refrigeration.

**Keywords:** /Pineapple/ /Chilling Injury/ /Internal Browning/ /Polyphenol Oxidase/ /Sugar/

Paузiah, M., et. al. 2013. Physical properties and chemical compositions of 'maspine' **pineapple** at different stages of maturity. Acta Hort. 1012: 165 – 170.

#### **Abstract**

The relationship of maturity stages on physical properties and chemical compositions of 'Maspine' pineapple fruits were studied. The fruits were harvested weekly from 18-24 weeks after the plants were induced for flowering or after hormoning. The changes in physical characteristics and the chemical properties were monitored. The results showed that the increasing trend in fruit weight was similar to that of fruit length and diameter. The maximum fruit weight was at 23 weeks after flower induction. The flesh colour changed during fruit development, and turned to full yellow at 22 weeks after flower induction. The total soluble solids (TSS) content of fruits increased with maturity and reached the optimum levels (15.58°Brix) at 23 weeks after flower induction. The total titratable acidity (TTA) of fruit remained unchanged (0.35-0.45%) until 22 weeks after flower induction, after which these values dropped drastically. The TSS/TTA ratio increased slowly with maturity and markedly increased at 22 weeks after flower induction resulting in sweeter fruit with no sour taste. For 'Maspine' pineapple, the optimum harvest maturity is at 22 weeks after flower induction for optimum eating quality.

**Keywords:** /Pineapple/ /Harvesting/ /Optimum Maturity/ /Color/ /Sensory Evaluation/

Raiputta, J., S. Setha, and P. Suthiluk. 2013. Microbial reduction and quality of fresh-cut 'phulae' **pineapple** (*Ananas comosus*) treated with acidic electrolyzed water. Acta Hort. 1012: 1049 – 1056.

#### **Abstract**

Electrolyzed water (EW) is a promising alternative as a novel sanitizer and disinfectant due to its broad spectrum of microbial decontamination and environmentally friendly technology. In this study, the effects of acidic electrolyzed water (AEW) on microbial reduction and the quality of fresh-cut 'Phulae' pineapple (*Ananas comosus*) were investigated. Fresh-cut 'Phulae' pineapple was treated in AEW (66 mg/L, pH 2.36) for 1 and 2 min followed by washing with distilled water or 2% NaCl for 1 min. Sample treated in distilled water (DW) for 2 min followed by 2% NaCl for 1 min was used as a control. Washed sample was then packed into polypropylene bag and sealed. Total plate count (TPC), coliform, yeast and mold and the quality in terms of firmness, vitamin C content and sensory evaluation were determined during 14 days storage at 5°C, 95% RH. TPC was found in all treatments from 8 days storage while coliform and yeast and mold were not detected during the end of experiment. Fresh-cut sample treated in AEW for 2 min followed by 2% NaCl for 1 min obtained the lowest TPC of 6.79 log CFU/g at 14 days storage. In addition, firmness and vitamin C content in all treatments were significantly decreased during storage. Treated sample in AEW for 2 min followed by 2% NaCl for 1 min had the highest firmness of 9.11 N and vitamin C content of 7.40 mg/100 g fresh weight at 14 days storage. However, the acceptable storage life of fresh-cut 'Phulae' pineapple was only 10 days, limited by the overall acceptance score from the sensory evaluation. Therefore, the application of AEW could minimize the microbial growth and maintain the quality of fresh-cut 'Phulae' pineapple during storage at 5±1°C, 95% RH.

**Keywords:** /Pineapple/ /Electrolyzed Water/ /Fresh-Cut/ /Quality/ /Storage Life/ /Total Plate Count/

Setha, S., A. Kongsuwan and V. Srilaong. 2013. Reduced internal browning in **pineapple** fruit by 1-mcp pretreatment and the antioxidant response. Acta Hort. 1012: 573 – 580.

#### **Abstract**

The objective of this study was to determine the involvement of 1-MCP on reducing internal browning and antioxidant systems in 'Phulae' pineapple fruit under chilling stress. Phulae pineapple at 25% yellow peel stage and non-treated fruit were used as the control. Fruit were packed in corrugated boxes and stored at 10°C, 90-95% RH, for 30 days. Internal browning symptoms were first observed in the control treatment after 20 days of storage, while pretreatment with 200 nl L-1 of 1-MCP significantly reduced the percentage of internal browning in Phulae pineapple fruit. The changes of peel color and total soluble solid (TSS) was delayed by 1-MCP treatment. Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), superoxide dismutase (SOD), and ascorbate peroxidase (APX) increased during storage and their changes were not significantly affected by different concentrations of 1-MCP treatment. The activity of catalase (CAT) was higher in 200 nl L-1 of 1-MCP than other concentrations until 10 days of storage. Glutathione content was significantly higher in fruit pre-treated by 200 nl L-1 of 1-MCP than in fruit pretreated with other concentrations throughout storage. These results suggest that 200 nl L-1 of 1-MCP could increase chilling resistance in Phulae pineapple fruit by regulating glutathione metabolism.

**Keywords:** /Pineapple/ /1-MCP/ /Antioxidant/ /Chilling Injury/ /Internal Browning/

Syazwani, S., I. Nurliya and P. Ding. 2013. Storage quality of 'MD2' **pineapple** (*Ananas comosus* L.) fruits. Acta Hort. 1012: 897 - 902.

#### **Abstract**

Selected physical (texture, peel and flesh colour) and chemical (pH, titratable acidity (TA), soluble solids concentration (SSC) and ascorbic acid) characteristics of 'MD2' pineapple (*Ananas comosus* L.) fruits during storage were studied. The fruits were harvested at four different maturity stages according to the peel colour (stage 1 = mature green; stage 2 = colour break; stage 3 = 25% yellow peel; stage 4 = 50% yellow peel) and the fruits were stored at 10°C for 3 weeks. Peel and flesh color were measured by Minolta CR-300 Chroma Meter (Minolta Corp., Osaka, Japan). Flesh firmness was measured as penetration force using a texture analyzer Instron with Merlin Software. SSC were determined using juice extracted from flesh samples using a digital refractometer PAL-1 (Atago Co., Ltd., Tokyo, Japan) to obtain the %SSC. TA was measured using 5 ml juice that titrated with 0.1 mol/L NaOH and expressed as percentage of citric acid. The pH of the juice was measured using a glass electrode pH meter model Crison Micro pH 2000 (Barcelona, Spain). Ascorbic acid content determination was carried out using dye, 2,6-dichlorophenolindophenol titration method and expressed as mg/100 g. The experimental design was a completely randomized design with three replications. The obtained data were analyzed by using ANOVA. When F values showing significance ( $P \leq 0.05$ ), differences within each factor were determined by least significant differences using SAS. Significant differences ( $p < 0.05$ ) were found in peel and flesh colour, flesh firmness, SSC, TA, pH and ascorbic acid of 'MD2' pineapple fruit during storage. The results showed that postharvest storage at 10°C changed the 'MD2' pineapple fruit characteristics. The lightness of 'MD2' pineapple peel increased during storage showed that colour changed as ripening progressed. While the lightness of flesh decreased during storage indicated that colour changed from light yellow to deep yellow as ripening progressed. The flesh firmness of the fruits decreased during storage as the fruits ripened. Even though the soluble solids concentration of the 'MD2' pineapple fruits decreased during storage, fruits harvested at earlier stage showed higher soluble solids concentration than fruits harvested at later stage. The pH values declines slightly during storage at 10°C, while TA increased. Ascorbic acid content decreased significantly during storage.

**Keywords:** /Pineapple/ /Color/ /Firmness/ /Storage Quality/ /Titratable Acidity/

Uthairatanakji, A., et. al. 2013. Effect of gamma irradiation dose on postharvest quality and antioxidant activity of 'Trad Si Thong' **pineapple**. Acta Hort. 1012: 829 – 836.

## Abstract

Gamma irradiation has been used widely as a quarantine treatment. We have previously reported that maturity affects quality change in irradiated 'Trad Si Thong' pineapple. Therefore, the objective of this research was to investigate the effect of gamma ray dose on postharvest quality and disorders in 'Trad Si Thong' pineapple fruit harvested at mid-maturity (commercial stage). Fruits were soaked in 500 ppm prochloraz and then dried at 22°C. Fruits were packed in carton boxes and irradiated with gamma rays at doses 0 (control), 0.5 and 1.0 kGy, and then stored at 13°C for 18 days. Physical and biochemical parameters analyzed including disease incidence, titratable acidity, total soluble solids, pulp colour, internal browning, DPPH radical-scavenging activity, total phenolic contents. Gamma irradiation did not affect internal browning, hue angle of pulp, or disease incidence. Phenolic contents in irradiated fruits were higher than in control fruit. However, the dose of gamma ray significantly affected the total soluble solids/titratable acids ratio and the antioxidant activity.

**Keywords:** /Pineapple/ /DPPH Scavenging/ /Disease Incidence/ /Total Phenolics/ /Taste/

## PLUM

Gavidia, Alamanar, M.C. and L.A. Terry. 2013. Temporal changes in individual phenolics and sugars in imported nectarines subjected to simulated "real world" supply chain conditions. Acta Hort. 1012: 1291 – 1298.

## Abstract

Most previous research has not considered the effects of the 'real world supply' chain on quality attributes of ready-to-eat imported stone fruit. This work tackles this outstanding problem by simulating and assessing the effect of different storage regimes to reflect current practice in the real-world supply chain between Spain and the UK, considering ripening, transit, shelf life and home life. Two midseason nectarines, 'Nectaross' and 'Honey Royale', were selected. Individual sugars (sucrose, fructose and glucose) and individual phenolics were identified and quantified, in both skin and flesh tissue, using HPLC equipped with RID and DAD, respectively. The effect of storage practices, cultivar and sampling date on the level and abundance of these individual compounds was studied. A dramatic increase in fructose content was found in skin of those nectarines stored at 2°C for one week. Transit period from Spain to UK negatively affected sucrose and total sugar content in 'Honey Royal' mesocarp, whereas it positively affected individual phenolic content. Phenolic concentration, however, significantly decreased after 7 days of cold storage, reaching similar or lower values than at harvest. Higher antioxidant capacity was observed in 'Nectaross' nectarines.

**Keywords:** /Plum/ /Ready-to-Eat/ /Nectarine/

Guillen, F., et. al. 2013. A novel active packaging based on MAP and addition of essential oils maintains plum quality and enhances antioxidant properties. Acta Hort. 1012: 1283 -1290.

## Abstract

In this work the effect of modified atmosphere packaging (MAP) in combination with the addition of a mixture of 3 essential oils (eugenol, thymol, and carvacrol, 25 µl each) inside packages on maintaining 'Black Amber' plum quality parameters was assayed. Fruit were thermo-sealed in baskets with 2 distinct films (M and P) which differ in permeability. Fruit stored with macroperforated film served as control and lost their quality attributes very rapidly manifested by accelerated colour changes and softening. The use of MAP with essential oils retarded these changes. Generally, the efficacy was higher in the fruit packed with film M compared with film P as a result of the delay in the postharvest ripening process, which could be attributed to the effect of MAP on reducing ethylene production rate. In addition, total phenolics and anthocyanins showed a delay in the accumulation associated with the retardation in the ripening process. In the same way, total carotenoids were maintained at higher levels in plums with both films in comparison with control film. Antioxidant activity was

affected by MAP conditions too, showing a positive effect when essential oils were added to the package in this parameter and in the other bioactive compounds studied.

**Keywords:** /Plum/ /Antioxidant Activity/ /Modified Atmosphere/ /Polyphenols/ Fruit Quality/ /Storage/

Velardo, B.M., et. al. 2013. Influence of postharvest storage temperature on firmness and bioactive compounds of Japanese plums (*Prunus salicina* Lindl.). Acta Hort. 1012: 801 - 806.

#### **Abstract**

The aim of this work was to evaluate the effect of storage temperature on flesh firmness and bioactive compounds of six Japanese plum cultivars (two red, one yellow and three dark-purple). Flesh firmness, total phenolics, anthocyanin pigments, total carotenoid content and the total antioxidant activity were evaluated in all fruits at harvest and after storage at 0 or 5°C plus shelf-life. Fruits harvested at commercial maturity were stored at least 42 days at 0 or 5°C and this period increased depending on the storage potential of each cultivar. After storage, fruit was kept for 3-6 days at 20°C, according to the cultivar. Storage at 0°C maintained flesh firmness of all the studied plum cultivars in values “ready to buy”, except ‘Crimson Globe’ and ‘Golden Globe’, which were not suitable for prolonged storage. In contrast, all cultivars exhibited excessive pulp firmness loss during storage at 5°C. With regard to the bioactive compounds evolution during storage, total phenolics and carotenoid content correlated with cultivar. However, a significant improvement in total anthocyanins of red and dark-purple plum cultivars was observed in fruit stored at 5°C. Total antioxidant capacity was also significantly higher in fruit stored under these conditions. In conclusion, the cultivars ‘Black Diamond’, ‘Fortune’, ‘Larry Ann’ and ‘Angeleno’ had commercial firmness values at the end of the long cool storage at 0°C. Moreover, they reached functional values higher than those recorded in fruits at the harvest time. On the other hand, the long postharvest storage at 5°C reduced pulp firmness of the fruits and had a negative influence on their fresh consumption; however, the amount of bioactive compounds found in the fruit stored under these conditions (5°C) was significantly higher. For this reason, these fruit could be suitable to elaborate manufactured products with high functional value.

**Keywords:** /Plum/ /Phenolic/ /Anthocyanin/ /Carotenoids/ /Antioxidant Activity/

Wang, Y., et. al. 2013. Preharvest GA3 sprays reduced chilling injury and maintained quality of plums during storage. Acta Hort. 1012: 271 - 276.

#### **Abstract**

Chilling injury (CI) is the primary factor limiting postharvest life during storage and transport of plum fruits at low temperatures. CI is usually manifested as dull coloration or breakdown and browning of internal tissues, loss of firmness and increased susceptibility to decay. The effect of preharvest 100 ppm GA3 sprays at three stages of fruit development combined with postharvest modified atmosphere packaging (MAP), intermittent warming (IW) on CI and fruit quality of plums were studied. CI index and browning index (BI) of plums were decreased ( $p < 0.05$ ) by preharvest GA3 treatments at three stages (a week before fruit expanding stage, fruit expanding stage, a week after fruit expanding stage). The optimum treatment was spraying 3 times at all three stages. CI index and BI in this treatment were 36 and 49%, respectively compared with the control 49 days after postharvest MAP with PE film (0.04 mm) and IW (15 days interval between 0°C for 14 days and 20°C for 1 day) storage. Moreover, the treatments also effectively maintained the firmness and soluble solids content (SSC), delayed the decrease of titratable acidity (TA) and ascorbic acid (ASA) content of the fruit.

**Keywords:** /Plum/ /Preharvest Treatment/ /Modified Atmosphere Packaging/ /Chilling Injury/ /Quality/

#### **POMEGRANATES**

Kumar, A.K., et. al. 2013. Effect of modified atmosphere packaging on shelf life and quality of ‘bhagwa’ pomegranate in cold storage. Acta Hort. 1012: 963 – 970.

## Abstract

An experiment to investigate modified atmosphere packaging to improve shelf life and maintain quality of 'Bhagwa' pomegranate fruit was conducted using polypropylene (PP) bags of 12.5 micron (50 gauge), 25 micron (100 gauge) and 37.5 micron (150 gauge) and StePac, Xtend® modified atmosphere/modified humidity bags and control (without packaging in CFB boxes). The packed fruits were stored at 4±1°C. Pomegranate fruits were evaluated for changes in physiological loss in weight, colour, firmness, external appearance, moisture accumulation in bags, total soluble solids, titratable acidity, browning, spoilage and sensory attributes at every 30 days interval up to 120 days. The physical and chemical parameters of fruits packed in StePac, Xtend® modified atmosphere/ modified humidity bags were maintained up to 90 days. Shrinkage and decay was noticed in Xtend® bags after 90 days of cold storage. Following Xtend® modified atmosphere/modified humidity and cold storage at 4±1°C pomegranate fruits can be stored up to 90 days at 4±1°C, maintaining the quality of the fruit compared to control and polypropylene packaging material.

**Keywords:** /Pomegranate/ /Firmness/ /External Appearance/ /Browning/

Mirdehghan, S.H. and G. Vatanparast. 2013. Avoiding the paleness of pomegranate arils by preharvest application of salicylic acid and potassium sulfate. *Acta Hort.* 1012: 815 - 820.

## Abstract

The physiological disorder of aril paleness, thought to occur due to oxidative stress, in pomegranate threatens the popularity of this fruit. Based on the results of a preliminary experiment on pomegranate trees, a factorial experiment was designed consisting of salicylic acid (0, 0.3 and 0.6 mM) and potassium sulfate (0, 0.5 and 1%). The prepared concentrations of above mentioned treatments were foliar sprayed to the trees 9 and 13 weeks after full bloom. Results showed that these compounds could alleviate the aril paleness of fruit, manifested by higher chroma values of arils and peel of pomegranate and maintain the overall quality of fruit compared to the control. In addition, total phenolics and antioxidant activity increased in fruit of treated tree by potassium sulfate at harvest while the lowest values of these parameters were observed in the control. The result of measuring photosynthetic parameters and pigments showed that treated plants have higher Fv/Fm, pi and some pigment of plants compared to the control. Thus preharvest treatments with salicylic acid and potassium sulfate could be considered as suitable tools to avoid paleness of pomegranate arils with higher bioactive compounds and antioxidant activity as compared to control fruit.

**Keywords:** /Pomegranate/ /Anthocyanin/ /Antioxidant Activity/ /Phenolic Compounds/

Sepahvand, E., M. Ghasemnezhad, A. Salvador and O. Khademi. 2013. Impact of 1-MCP and hot water treatment on postharvest quality of pomegranate fruit. *Acta Hort.* 1012: 1217 – 1222.

## Abstract

Pomegranates are commonly stored in Iran at temperatures higher than 10°C and RH≈70%. At this storage condition, the fruit are affected by desiccation and loss of quality. In this experiment, the effect of Smartfresh™ (1-MCP) at 1 µl L<sup>-1</sup> with hot water treatment (HWT) at 50°C for 5 min and the combination of these two treatments (Smartfresh™+HWT) were studied in reducing the mentioned problems in 'Malas Saveh' pomegranate fruit. Untreated fruit was used as the control. The fruit were stored at 13°C for 45 days and thereafter, fruits were held further at 20°C for 7 days as a simulated shelf life. Fruit firmness, colour parameters and skin shriveling index were evaluated at the end of storage and after holding, but the fruit quality characteristics were determined only after holding at 20°C. Results showed that the fruit firmness of Smartfresh™ treated fruits was higher than that of other treatments after storage, but after holding, there were no significant differences in fruit firmness among the tested treatments. HWT treated fruit, in contrast with other treated fruit, had lower L\* value than the control fruit after storage and after holding. There were no significant differences in

a\* and b\* among the treatments in this trial. The skin shriveling index of Smartfresh™ treated fruits was significantly lower than that of other treatments after storage and after holding. The skin shriveling indexes of HWT and Smartfresh™+HWT treatments were lower than that of control after holding, while after storage, no significant differences in skin shriveling indexes were observed among them. Fruit treated with Smartfresh™ had highest titratable acidity and lowest total soluble solids compared to other treatments. Titratable acidity of control fruits was lower than that of HWT and Smartfresh™+HWT treatments, but there were no significant differences among the control, HWT and Smartfresh™+HWT treatments in total soluble solids. Smartfresh™ treated fruit had greatest aril moisture and medium juice colour among the tested treatments at this experiment. Overall, Smartfresh™ treatment was more effective than hot water and combination treatments in maintaining the postharvest quality of pomegranate fruit during storage and under holding.

**Keywords:** /Pomegranate/ /Hot Water Treatment/ /Postharvest Quality/ /Storage/

## RAMBUTAN

Aisyah, Siti, A., et. al. 2013. Simulation study to determine the effect of packaging on quality of rambutan (*Nephellium lappaceum* L.) for export market. Acta Hort. 1012: 1335 – 1340.

### Abstract

Rambutan (*Nephellium lappaceum* L.) is one of the popular tropical fruits in Malaysia. A simulation study was conducted to evaluate the effect of palletization on the quality of rambutan targeted for export to US markets. Fruits were packed directly in boxes, either in 1) corrugated fibre board (CFB) boxes without wrapping which served as control and 2) corrugated fibre board (CFB) boxes wrapped with shrink film as palletization packing treatment. Fruits were stored overnight at 10°C before transferring to 18°C for 2 days (assuming flight time + 8 hours storage and transit). Fruits were transferred to 10°C with a relative humidity set at 85-90% for two week storage period. Evaluations were carried out at day 0, 3, 6, 9, 12 and 15. The fruit quality was evaluated by determining the total soluble solids (TSS), total titratable acidity (TTA), pH, ascorbic acid content, and skin and flesh colour (L, hue and chroma). Results indicated that palletization did not significantly affect the TSS, TTA, pH, ascorbic acid content, skin and flesh of rambutan fruits. Palletization significantly ( $p < 0.05$ ) increased skin hue and reduced flesh hue indicating that palletization packing could maintain skin colour, reduce flesh browning and help in delaying spintern browning and drying of the skin as observed after 13 days storage at 10°C.

**Keywords:** /Rambutan/ /Palletization/ /Packing/ /Storage Life/ /Quality/

Latifah, M.N., et. al. 2013. Quality evaluation of rambutan fruits packed with frozen gel during storage at 10°C. Acta Hort. 1353 – 1360.

### Abstract

The quality changes of rambutan fruits packed in insulated box lined with frozen gel (1 kg) at different sides of the insulated box (bottom, top and opposite sides) were evaluated. Fruits packed without frozen gel were treated as the control samples. Storage was conducted at 10°C with relative humidity (RH) at 85-90%. Evaluation of samples was conducted for every 2 days interval for durations of 14 days storage. All fruits packed with frozen gel retained their freshness and showed minimal colour changes as compared to the control until day 12 of storage. Rambutan fruits packed with frozen gel also had lower weight loss (0.2-1.4%), whilst the weight loss of the control fruits increased with duration of storage (2.2-5.5%). The total soluble solids (TSS) of frozen gel packed fruits decreased on day 2 as compared to the control fruits. However, there was no significant difference between the fruits packed with different arrangement of frozen gel. On day 10, the TSS of the packed fruits increased (16.5-16.6°Brix) whilst a sudden decrease (16.4°Brix) was observed in the control fruits which had a higher weight loss (6%). The use of frozen gel in the packing had contributed to the high RH of the surrounding atmosphere inside the packing (95%) for 4 day as compared to the RH of the surrounding atmosphere of the control fruits (85%). Regardless of the packing system, all fruits had shown serious quality degradation from day 14 onwards.

**Keywords:** /Rambutan/ /Frozen Gel/ Quality/ /Shelf Life/ Bulk Packing/

## SAPOTA

Aifaa, Nor Hanis, Y., et al. 2013. Quality evaluation of six rambutan hybrids stored at 25 and 10°C. Acta Hort. 1012: 865 – 872.

### Abstract

The fruits of six hybrids selection of rambutan (*Nephelium lappaceum* L.) were characterized to identify those with marketing quality to promote their propagation, improvement and conservation in germplasm bank. Fruits were harvested from a MARDI's farm at Bukit Tangga Station, Kedah. Assessments for physical changes comprise weight, thickness of flesh and skin, breadth, length, and flat shape of fruits, length of spinterns, and colour of skin and flesh. Chemical analysis includes total soluble solids, pH and titratable acidity. Sensorial quality was conducted by fifty panelists who graded each selection for colour, shape, sweetness, acidity and overall acceptability. The shape of six selections were ovoid, and with the following characteristics (in ranges); fruit weight, 29.16 to 42.38 g; fruit length, 41.80 to 47.59 mm; fruit breadth, 34.28 to 42.35 mm; fruit flat shape, 30.96 to 38.63 mm; thickness of the skin, 2.16 to 3.63 mm; thickness of flesh, 6.04 to 8.78 mm; and length of spintern, 0.71 to 1.21 cm. The fruits had high contents of total soluble solids (16.63 to 20.17°Brix), vitamin C (21.94 to 26.47 mg/100 g), pH (4.45 to 5.28) and total titratable acidity ranging from 0.17 to 0.32%. The fruits from GB 44 and IE 20 selections had better attributes of fruit weight (32.50 and 42.38 g) as compared to the other hybrids. The GB 44 hybrid contained total soluble solids (20.07°Brix), desirable traits for export markets. The hybrid GB 44 was most preferred by panelists for its sweetness, less acidic, easier removal of testa seed and crunchier and firmer texture compared to the others. Different temperatures had significant influence on the rambutan quality. Rambutan fruits can be stored at 10°C for 10 days, whereas at ambient condition, the quality remained good for only 2 days.

**Keywords:** /Sapota/ /Quality Evaluation/ /Physical Changes/ /Chemical Changes/

Praveena, Bindu R., et al. 2013. Influence of low temperature on shelf life and quality of sapota (*Manilkara achras* (Mill.) Fosberg) fruits packed in polybags. Acta Hort. 1012: 873 - 880.

### Abstract

An experiment was set up to study the effect of packaging of sapota fruits in polythene bags with ventilation on the postharvest shelf life and quality under low temperature at the Horticultural College and Research Institute, Venkataramannagudem. Mature fruits of 'Kalipatti' were stored at 12±1°C (80- 85% RH) in LDPE bags with different gauges (100, 200, 300 gauges) and three different ventilations (0.8, 1.2, and 1.6%). The study revealed that fruits stored in polybags had a better quality and longer shelf life. The fruits stored in 200 gauge polybags with 1.2% ventilation recorded a maximum shelf life of 31.83 days and higher quality in terms of fruit firmness (2.1 kg/cm<sup>2</sup>), organoleptic score (9.93), TSS ( 20.11°Brix), ascorbic acid (22.34 mg/100 g), titratable acidity (0.23%), reducing sugars (8.21%) and total sugars (12.31%). Physiological loss of weight (PLW), rate of ripening, and fruit decay were maximum in control (1.05, 40.09, 55.0%). The longer shelf life and better quality of fruits in polybags was due to the reduced permeability of the polybags for oxygen and accumulation of carbon dioxide coupled with low temperature and the resultant retarded respiration rate, delayed onset of ripening and slowed the activity of enzymes that degrade the cell wall.

**Keywords:** /Sapota/ /LDPE bags/ /Storage/ Ventilation/ /Shelf Life/

## STARFRUIT

Rahman, Abd M. and B. Ahmad Hafiz. 2013. genetic improvement of fruit quality traits in **starfruit** (*Averrhoa carambola*) hybrids. Acta Hort. 1012: 259 – 264.

#### **Abstract**

Fruit quality performance of 12 selected F1 hybrid starfruits from a hybridisation programme were evaluated at MARDI Kluang Station, Johor, Malaysia. Four commercial and registered clones ('B10', 'B17', 'B11' and 'B2') that were used as parents were also planted as controls. Seven fruit quality traits were recorded and analysed. Results showed that six fruit quality traits, namely, fruit weight, fruit length, fruit width, wing width, wing length and total soluble solids content were highly significantly different among the treatments except for one parameter (number of seeds per fruit) that was only significant different. Trait number of seeds per fruit was also significantly different among treatments. However, there was no significant difference between replications. Results also showed no wide variation in the fruit quality traits in hybrids except for the number of seeds per fruit (CV - 38.04%) as starfruit is a cross-pollinated crop. Among the treatments, hybrid 1711-24 showed the highest TSS and medium fruit size as compared to the parents. Based on preliminary water content (juiciness) analysis, hybrid 1711-24 (88.7 g/100 g) had comparable juice content with parent 'B17' (84.6 g/100 g) which had the lowest juice content. Thus, hybrid 1711-24 has good eating quality as it is less juicy since starfruit contains too much water. Vitamin C content was highest in hybrid 1711-24 (32.2 mg/100 g) as compared to the parents. Overall, the hybrids showed significant improvement of fruit quality traits as compared to the parents. Hybrid 1711-24 has the potential to become a commercial clone as it has higher TSS and vitamin C content, less water content and medium in fruit size as compared to export clone 'B10'. This fruit size character is good for export market because it can increase the number of fruits per box in transportation.

**Keywords:** /Starfruit/ /Breeding/ /Total Soluble Solids/

#### **STONE FRUIT**

Miguel-Pintado, C., et. al. 2013. Forced-air precooling effect on quality of delayed cold stored **stone fruit**. Acta Hort. 1012: 491 - 496.

#### **Abstract**

A growing body of research has shown that delayed cold storage extends peach and nectarine market life, since it delays chilling injury development and simultaneously improves sensorial quality. However, delayed storage is often accompanied by side effects, mainly fruit softening. On the other hand, precooling of horticultural products immediately after harvest has long been recommended to maintain a high level of quality that ensures customer satisfaction as it arrests the deteriorative and senescence processes. This work was carried out to evaluate the effect of forced-air precooling after delayed storage on stone fruit quality and market life. 'Rich Lady' peach and 'Siglo' nectarine, harvested at commercial maturity, were stored for 24 h at 20°C (delayed storage), followed or not by forced-air precooling (2-3 m s<sup>-1</sup>) at 0°C for 1 h, and then stored at 0°C and 85-90% relative humidity for 7, 14 and 21 days. Flesh firmness, colour (L\*, C\*, h°), soluble solids content and titratable acidity were assessed at harvest and after cold storage plus 1 day and 2 days of shelf life for peach and nectarine, respectively. Results showed that forced-air precooling after delayed storage did not retard softening and had no significant effect on the above mentioned quality parameters. Therefore, forced-air precooling had no beneficial effect on delayed stored fruit quality and market life.

**Keywords:** /Stone Fruit/ /Preconditioning/ /Nectarine/ /Firmness/

#### **STRAWBERRY**

De George, T.S., et. al. 2013. Evaluation of packaging and edible coating on postharvest **strawberry**. Acta Hort. 1012: 533 – 538.

## Abstract

The strawberry (*Fragaria × ananassa*) fruit is considered a very delicate and highly perishable fruit. Some of the important problems of this culture are on the packaging, transportation and storage due to its fragility. The demand for new packaging and technologies that minimize contamination to the environment has increased considerably because of environmental sustainability. Biodegradable coating is one of the important tools for environmental sustainability. Some polysaccharides and derivatives have been used as edible coatings due to their gelling properties in the presence of polyvalent cations. The objective of this study was to evaluate the new design of the strawberry packaging as well as the association between the packaging and edible coatings on its postharvest preservation.

**Keywords:** /Strawberry/ /Postharvest/ /Packaging/ /Edible Coating/

Wan Mahfuzah, W.I., et. al. 2013. Evaluations for effectiveness of calcium chloride treatment on the postharvest quality of strawberry. Acta Hort. 1012: 515 - 520.

## Abstract

Effectiveness of calcium chloride (1, 2 and 3%) treatments on the postharvest quality of strawberry fruits was evaluated during storage at 10°C. Dipping time in calcium chloride solutions were fixed for 1 min. Undipped fruits were treated as a control. Fruit were dripped dry before packing by using clip on lid round polypropylene containers (50 mm in diameter). Evaluation of physical changes (weight loss, colour and firmness), chemical changes (total soluble solid (TSS) and pH) sensory evaluation and overall appearance were conducted on day 0, 3, 8 and 12 days of storage. Strawberry fruits treated with 1% calcium chloride exhibit lower weight loss (0.123%) as compared to fruits treated with 2% (0.17%) and 3% (0.5%) at the end of storage period. Fruits treated with 1% calcium chloride maintained the firmness with score 2 with deep red colour development was more obvious as compared to the other fruits (2 and 3% calcium treated and control fruits) as observed on day 8 and 12. No significant fungus infection was observed to the treated and the control fruits throughout the 12 days storage at 10°C. All fruits still can be eaten after 12 days storage with better taste acceptance was noted to the 1% treated fruits. No significant changes in the pH and TSS values throughout the 12 days storage period as noted both to the control and treated fruits.

**Keywords:** /Strawberry/ /Quality Changes/ /Storage Life/

## SWEET CHERRY

He, Long., et. al. 2013. Energy efficacy analysis of a mechanical shaker in sweet cherry harvesting. Biosystems Eng. 116: 309 – 315.

## Abstract

To obtain the baseline information for designing a high efficiency mechanical sweet cherry harvester, a series of dynamic and harvesting tests were conducted in orchards. In the dynamic test, a mechanical shaker was used to shake branches of target trees. Three trees were randomly selected for the study and each studied branch of the tested trees was divided into three response zones where one accelerometer was mounted on each zone to record the response to the input excitations. The kinetic energy induced by the input excitation in each response zone was tracked during the course of energy delivery. Results from these dynamic response tests showed that the kinetic energy delivered to an excited branch on average accounted for 60%, 77%, 92% and 95% of input excitation energy at shaking frequency of 6, 10, 14, and 18 Hz, respectively. Harvesting tests were also conducted using shaking frequencies of 14 and 18 Hz, and test trees were shaken using a sequence of four 5 s long intermittent excitations. On average, the shaker removed 67 ± 16% of the fruit during the first cycle of 18 Hz shaking, and 42 ± 16% with 14 Hz shaking. The shaker energy efficacy, defined as the percentage fruit removal per kilo-joule of input energy, was 6.9 ± 2.2% kJ<sup>-1</sup> and 7.4 ± 1.3% kJ<sup>-1</sup> during the first cycle of 14 and 18 Hz shaking, respectively. The

results indicated that the 18 Hz shaking frequency reached higher fruit removal efficiency when compared to the 14 Hz shaking frequency with similar energy efficacy.

**Keywords:** /Sweet Cherry/ /Mechanical Shaker/ /Harvesting/

## **SWEET ORANGE**

Ahmad, S., Z. Singh and Z. Iqbal. 2013. Effect of preharvest sprays of salicylic acid on the shelf life and quality of 'lane late' sweet orange (*Citrus sinensis* L.) cold storage. Acta Hort. 1012: 103 - 112.

### **Abstract**

The plants of 'Lane late' sweet oranges were sprayed ten days before fruit harvesting with salicylic acid (SA) at different concentrations (2, 4, 6, 8 mM). After harvest some fruits were analysed and other fruits were stored at 5°C for 31, 62 and 93 days to investigate the effects of SA on fruit rot, chilling injury and quality relating parameters i.e., fruit firmness as well as sugar and organic acid contents. The results showed that preharvest spray of SA at 8 mM was effective to reduce the fruit rot from 16.93 to 6.06%. This concentration was also very helpful to minimize the incidence of chilling injury. Textural properties relating to fruit firmness force of treated fruits were also significantly higher than those of control. SA also showed effectiveness to maintain the SSC%, TA%, individual sugars and organic acids in long term storage which indicate that SA has anti-senescent effect. It is concluded that citrus industry should use the preharvest spray of SA to minimize the postharvest/storage losses of oranges rather than fungicides.

**Keywords:** /Sweet Orange/ /Salicylic Acid/ /Shelf Life/ /Organic Acid/ /Chilling Injury/

## **TABLE GRAPE**

Defilippi, B.G., et. al. 2013. Expression of a 1-aminocyclopropane-1-carboxylic acid oxidase gene family in table grape cultivars. Acta Hort. 1012: 337 – 344.

### **Abstract**

During berry development, veraison is a key developmental stage in grapes as most of the compositional changes that determine quality are triggered in this stage. Recently, it was demonstrated that ethylene biosynthesis was up-regulated at veraison. In this work, we evaluated the expression of 1-aminocyclopropane-1-carboxylic acid (ACC) oxidase genes that catalyze the last step in ethylene biosynthesis during berry development. Experiments were performed using three cultivars of table grapes (*Vitis vinifera* L.) that were sampled weekly, from the early stages of fruit development until commercial maturity. In all cultivars ('Thompson Seedless', 'Crimson Seedless' and 'Red Globe'), *VvACO1* accumulated at higher levels, in comparison to *VvACO2* and *VvACO3*, and in all three cultivars the *VvACO1* transcripts accumulated around the veraison stage, at levels four to five-fold higher than at the harvest stage. *VvACO1* transcript peak at veraison was higher in 'Thompson' and 'Crimson Seedless' grapes and concomitant with the characteristic changes observed at veraison, especially in terms of the sugar accumulation rate. Therefore, further studies with a larger number of cultivars will confirm if *VvACO1* expression is a suitable measurement for identifying veraison in table grape.

**Keywords:** /Table Grape/ /ACC Oxidase/ /Quality/

Mirdehghan, S.H., S. Rahimi and M. Esmailizadeh. 2013. Improving the postharvest characteristics of table grape by preharvest application of polyamines. Acta Hort. 1012: 293 -298.

### **Abstract**

Although table grape is a non-climacteric fruit with low physiological activity, it is however prone to weight loss, softening and fungal infection during postharvest period. The whole vine especially fruits were sprayed with putrescine (put; 0, 1, 2 mM), spermidine (spd; 0, 1, 2 mM) at 40 and 20 days before harvest. Different fruit characteristics were analyzed after harvest and remaining fruits were stored at  $1.5\pm 1^\circ\text{C}$  and  $90\pm 5\%$  RH for 25 and 55 days. Different concentrations of polyamines significantly increased firmness of grapes at harvest. Firmness was also retained and decreased weight loss of fruit during storage. Table grape storability could be extended by put and spd treatments due to their significant effect on delaying the softening, water loss, fungal infection and senescence.

**Keywords:** /Table Grape/ /Putrescine/ /Spermidin/ /Microbial Activity/ /Polyamines/

## **WATERMELON**

Aguayo, E., et. al. 2013. Hot water calcium dips to improve quality of fresh-cut watermelon. Acta Hort. 1012: 1013 - 1020.

### **Abstract**

Fresh-cut watermelon is a relatively new product in Spain, with great consumer appeal. However, even under cold storage, deterioration occurs as juice leakage, loss of texture, colour, and sweetness, reducing the shelf-life of this commodity. The use of calcium chloride ( $\text{CaCl}_2$ ) dips using hot water helped to keep the quality of fresh-cut fruits. Cubes of watermelon were dipped into 1 or 0.5%  $\text{CaCl}_2$  for 2 min at 5 (CWD) or  $45^\circ\text{C}$  (HWD). As control, non-dipped watermelon cubes were used. After treatment, fresh-cut watermelon was packaged under modified atmosphere packaging up to 8 days at  $5^\circ\text{C}$ . As conclusion the use of 1% of  $\text{CaCl}_2$  applied in HWD or CWD helped to reduce the levels of  $\text{CO}_2$  and provided a better final overall quality. HWD, combined with 0.5 or 1% of  $\text{CaCl}_2$ , provided regular and lower levels of respiration rate, helping maintain firmness and the yeast growth. The combination of 1%  $\text{CaCl}_2$  in HWD provided the lowest psychrotrophic load and was a very effective treatment to maintain quality during 8 days storage at  $5^\circ\text{C}$ .

**Keywords:** /Watermelon/ /Firmness/ /Sensorial Parameters/

Ebadi, M., et. al. 2013. Fresh-cut quality of watermelon during storage at different temperatures. Acta Hort. 1012: 497 – 502.

### **Abstract**

Fresh-cut watermelons from accessions of Iranian indigenous fruits were analysed for changes in their marketability features and qualitative compounds during storage at different temperatures of 0-1, 4-5 and 12-13 $^\circ\text{C}$ . Harvested watermelons were divided into four quarters before storing. Fresh-cut quality parameters were recorded at weekly intervals on days 0, 7, 14 and 21. It was observed that storage temperature condition and cultivars significantly affected the quality of fresh-cut watermelons. Weight loss, total soluble solids (TSS), firmness of head, heart and pericarp, and total acidity (TA) represented more variation between accession and storage condition. Weight loss and TA increased throughout storage while firmness of head, heart and pericarp decreased in the samples. Temperature treatment on accession showed that sensory quality at  $4^\circ\text{C}$  was less than other treatments. Fresh weight loss and total acidity increased throughout storage while overall Iranian accessions revealed more stability and quality than the hybrid type and temperature. A temperature at 4-5 $^\circ\text{C}$  was recommended for storage of fresh-cut watermelon.

**Keywords:** /Watermelon/ /Firmness/ /Fresh Cut/ /Total Acidity/

Ebadi, M., F. Soltani and Y. Mostofi. 2013. Effect of temperature and accession type on lycopene stability and total phenolic compound of fresh-cut watermelon. Acta Hort. 1012: 947 – 954.

## Abstract

Enhancement of watermelon germplasm for marketing traits is one of the major objectives of breeding programs. The purpose hybrid and open-pollination types were harvested from the field and stored at different temperatures. Descriptive sensory analysis was used to evaluate lycopene, phenol, hue, aroma, lightness and color index at harvest day upon processing (0 day) and after days 7, 14 and 21 of storage at 0, 4, and 12°C. Lycopene, phenol, chroma and other attributes were affected by varying temperatures and type of accessions. The Iranian watermelon accession indicated less reduction in lycopene amount than 'Crimson Sweet' during storage. The temperature where all accessions showed more lycopene stability and least amount of total phenolic compound was 4°C. The result of this study demonstrated that cutting and storing of watermelon resulted in lycopene deterioration, however, accession type and genetic basis have a critical role to improve the fruit quality. It is necessary to study and use local accession for breeding work in the future. of this investigation was to evaluate the rate of lycopene stability and changes in total phenolic compound of different watermelon accessions in storage conditions. Five accessions of watermelon cultivars representing.

**Keywords:** /Watermelon/ /Low Temperature Storage/ /Sensory Analysis/

## VEGETABLES

### **BABY CORN**

Vani, Sudha, V., M.Rajaskhar and Y.N. Reddy. 2013. Shelf life and quality of **baby corn** (*Zea mays* L.) as affected by storage at low temperature in polybags. Acta Hort. 1012: 881 - 888.

## Abstract

Baby corn is a highly perishable produce because of its high respiration rate. An inexpensive way to extend shelf life is the use of modified atmospheric packaging (MAP) in combination with low temperature. An experiment was conducted to enhance the shelf life by storing baby corn at 3°C in low density polythene bags of 150, 200 and 300 gauges with different ventilations (0, 0.2, 0.4 and 0.6%) at the College of Agriculture, Hyderabad. Spoilage was delayed and shelf life was extended by 38 days over control and 8 days over the second best treatment when stored in unventilated 150 gauge polybags which had a maximum shelf life of 63 days. PLW was low, while TSS, reducing sugars, total sugars, proteins and ascorbic acid were retained with a superior organoleptic score. Highest PLW, low TSS, reducing sugars and shelf life were recorded in control. Spoilage was 100% in control after the 31<sup>st</sup> day while it was 43% in unventilated polybags even after the 63rd day. The longer shelf life and a better quality of cobs in polybags were due to the reduced permeability of the polybags for oxygen and accumulation of carbon dioxide coupled with low temperature and the resultant retarded respiration rate. However, spoilage was more and shelf life less when stored in 300 gauge polybags followed by 200 gauge polybags.

**Keywords:** /Babycorn/ /Shelf Life/ /Quality/

### **BABY SPINACH**

Cocetta, G. et. al. 2014. Effect of cutting on ascorbic acid oxidation and recycling in fresh-cut **baby spinach** (*Spinacia oleracea* L.) leaves. Postharvest Biol. & Technol. 88: 8 – 16.

## Abstract

Fresh-cut spinach during processing undergoes several mechanical procedures such as cutting, which may induce stress responses. These stresses may trigger the accumulation of harmful reactive oxygen species (ROS). Plants respond through a wide range of mechanisms and ascorbic acid (AsA) has an important role. The combined effect of cutting, temperature and storage time on AsA recycling route in spinach fresh-cut leaves was studied.

AsA, gene expression and activities of the enzymes involved in the AsA oxidation and recycling were considered. Spinach leaves were cut in six pieces and stored at 4°C or 20°C. AsA content and enzymes activities were measured over six days of storage, while gene expression analyses were performed in a time-point experiment within 24 h after cutting. Results showed that AsA decreased after cutting (from 19.41 mg/100 g FW to 15 mg/100 g FW) and generally was higher in samples stored at 4°C. After six days, AsA was 10 mg/100 g in control and 5 mg/100 g FW in cut leaves. The expression of genes and activities of the enzymes involved in the AsA oxidation and recycling route were, for some enzymes, in accordance with AsA levels. The APX (EC 1.11.1.11) activity after cutting increased up to 290 nmol AsA mg<sup>-1</sup>prot min<sup>-1</sup> compared to the control with 190 nmol AsA mg<sup>-1</sup>prot min<sup>-1</sup>. AsA reduction is firstly affected by temperature and aggravated by cutting procedures. AsA represents a valuable postharvest quality indicator of freshness in spinach leaves.

**Keywords:** /Baby Spinach/ /Fresh Cut/

## BEAN SPROUTS

Phornvillay, S., S.H. Ahmad and M.Y. Zazarini. 2013. Effect of 2,4-D and BAP on growth and chemical characteristics of **bean sprouts** (*Vigna mungo* L.). Acta Hort. 1012: 287 - 292.

### Abstract

Bean sprouts or “tauge” is a popular vegetable among the Malaysians. Sprouts are rich in nutrients, easily digested, but are perishable and have a short life cycle. Relatively, standard sprouts have long, thin hypocotyls and long roots. Some farmers use plant growth regulators, such as the 2,4-dichlorophenoxyacetic acid (2,4-D) and 6-benzylaminopurine (BAP), to increase the hypocotyl thickness and inhibit bean sprout growth. Calcium makes the sprouts crispy, healthy and fresh. Thus, the objective of this study was to determine the efficiency of 2,4-D and BAP in influencing the growth of bean sprouts. *Vigna mungo* (black gram) seeds were used in this study. The bean seeds were treated with 2,4-D and BAP at 5, 10, 15 and 20 mg L<sup>-1</sup>, and each with the addition of 100 mg L<sup>-1</sup> calcium. The bean sprouts were analyzed for soluble solids concentration (SSC), pH, titratable acidity and vitamin C. Physical characteristics, such as hypocotyl length, diameter and weight and root length, were determined. The experimental design was a randomized complete block design with a factorial arrangement of treatments. The results showed that seeds treated with 2,4-D and BAP produced significantly shorter sprout hypocotyl and roots length, thicker hypocotyls diameter and higher hypocotyls weight than sprouts from control (water treatment). Also, treated seeds produced sprouts with higher pH, vitamin C, SSC and titratable acidity compared to control. In conclusion, 2,4-D and BAP, produced desirable commercial characteristics of the bean sprouts.

**Keywords:** /Bean Sprouts/

## BITTERGOURD

Ng, Z.X., et. al. 2014. Proteomic analysis of heat treated **bitter gourd** (*Momordica charantia* L. var. Hong Kong Green) using 2D-DIGE. Food Chem. 148: 144 – 161.

### Abstract

This study aimed to investigate the changes in the proteome of bitter gourd prior to and after subjecting to boiling and microwaving. A comparative analysis of the proteome profiles of raw and thermally treated bitter gourds was performed using 2D-DIGE. The protein content and number of protein spots in raw sample was higher when compared to the cooked samples. Qualitative analysis revealed that 103 (boiled sample) and 110 (microwaved sample) protein spots were up regulated whereas 120 (boiled sample) and 107 (microwaved sample) protein spots were down regulated. Ten protein spots with the highest significant fold change in the cooked samples were involved in carbohydrate/energy metabolisms and stress responses. Small heat shock proteins, superoxide dismutase, quinone oxidoreductase, UDP-glucose pyrophosphorylase and phosphoglycerate kinase

play a role in heat-stress-mediated protection of bitter melon. This study suggests that appropriate heat treatment (cooking methods) can lead to induction of selected proteins in bitter melon.

**Keywords:** /Bittermelon/ /Proteomic Analysis/

## **BROCCOLI**

Duarte-Sierra, A. 2013. Effect of oxidase stresses on glucosinolates profile in **broccoli** florets during postharvest storage. Acta Hort. 1012: 361 - 368.

### **Abstract**

Stresses cause production of reactive oxygen species in plant bodies and high levels of stress can be harmful to plant tissues. When sub-acute doses of stresses are applied to postharvest crops, beneficial effects can occur through activation of protection mechanisms. In broccoli (*Brassica oleracea*), such mechanisms can be induction of glucosinolates and phenolic compounds, which are also beneficial to human health. The objective of this work was to examine sub-acute or hermetic doses as well as extreme doses of UV-B, ozone and hydrogen peroxide on the content of glucosinolates during postharvest storage. Broccoli florets were exposed to hermetic and high doses of UV-B (0, 1.5 and 7.5 kJ m<sup>-2</sup>); O<sub>3</sub> (5 ppm for 0, 60 and 720 min) and H<sub>2</sub>O<sub>2</sub> (0, 1.25 and 5 mM for 3 h). The profile of glucosinolates and hydroxy-cinnamic acids was determined for up to 14 days in broccoli florets stored at 4°C by LC-MS. The expression of glucosinolate pathway genes (p450 of the CYP79 family-A2, B3 and F1) and phenylpropanoids pathway genes (PAL, CS and F3H1) were also monitored. Titer of neoglucobrassicin in UV-B treated broccoli florets at 1.5 kJ m<sup>-2</sup> was the highest at the end of the 14 days of storage. However, up regulated expression of genes CYP79B3 and CoL were observed with the high UV-B dose of 7.5 kJ m<sup>-2</sup> throughout and at the beginning of the storage, respectively. Both O<sub>3</sub> and H<sub>2</sub>O<sub>2</sub> increased the titers of 4-methoxy-glucobrassicin and 4-hydroxyglucobrassicin; and the florets treated with high ozone dose (5 ppm for 720 min) exhibited an over expression of genes CYP79F1 and CYP79B3, at the beginning of the storage. Results showed a good correlation between gene expression of CYP79B3, and the titers of indole glucosinolates in treated broccoli florets, suggesting that the target of the applied stresses is likely to be the branch pathway of indole glucosinolates.

**Keywords:** /Broccoli/ /Storage/ /Postharvest/

Gamage, G.R., et. al. 2013. Effectiveness of UV-C irradiation on growth of post-inoculated *Listeria monocytogenes* on fresh-cut **broccoli**. Acta Hort. 1012: 1031 – 1036.

### **Abstract**

Ultraviolet (UV) light irradiation has demonstrated positive effects as a postharvest treatment in prolonging the storage life of fresh produce and as a nonthermal method of inactivation of pathogenic microorganisms. The objective of this research was to study the effectiveness of UV-C light irradiation as a postharvest treatment on the subsequent attachment and growth of human pathogens on fresh produce. Fresh-cut broccoli is highly perishable and susceptible to deterioration and contamination by pathogenic microorganisms after harvest. Fresh-cut broccoli branchlets were treated with UV-C doses of 2.5 and 5 kJ/m<sup>2</sup> and inoculated with *Listeria monocytogenes* at various times (0, 6 and 24 h) after treatment. Growth of the bacteria on UV-C treated surfaces of broccoli branchlets was evaluated by extracting and enumerating the microorganisms on day 3, 4, 6, and 8 after treatment. Results of the study show UV-C irradiation at a dose of 5 kJ/m<sup>2</sup> was able to restrict the growth of *L. monocytogenes* in the samples inoculated 24 h post treatment, with no significant differences (P=0.05) in colour and weight loss of the broccoli compared to the control treatments. These results imply UV-C treatment may be effective not just in controlling pre-existing pathogens but also reducing the risk of post-harvest contamination. Previous studies have suggested that mild stress produced by UV-C light irradiation stimulates the synthesis of defence related phytochemicals in broccoli (such as glucosinolates) which also offer a variety of health benefits. It is not yet clear whether this mechanism is also responsible for the restriction of *L. monocytogenes* attachment and growth after UV-C irradiation.

**Keywords:** /Broccoli/ /Fresh Cut/ /Irradiation/

Martinez-Hernandez, G.B., et. al. 2013. Extending the shelf life of the new bimi® **broccoli** by controlled atmosphere storage. Acta Hort. 1012: 925 – 932.

#### **Abstract**

The new Bimi® broccoli is a natural hybrid between kailan (*Brassica oleracea* Alboglabra group) and conventional broccoli (*B. oleracea* Italica group). This new *Brassica* has a tender stem (similar to asparagus) and a small floret. Its mild flavour (compared to conventional cultivars) makes this vegetable ideal for fresh-cut purposes, besides their nutritional benefits. However, Bimi® is very perishable, being yellowing, stem bent, off-odours and off-favours the main sensory quality parameters affecting its postharvest life. Controlled atmosphere storage (CA) has been described as a very effective technique to maintain broccoli quality. The aim of the present work was to study changes in the sensory quality, pH, titratable acidity (TA), soluble solids content (SSC), stem firmness and colour changes under 5 different CO<sub>2</sub> CA (5, 10, 15, 20 and 25 kPa CO<sub>2</sub> + with 2 kPa O<sub>2</sub> + balanced with N<sub>2</sub>) throughout 27 days at 2, 5 and 8°C. A control under air conditions was used. Better sensory scores were reached under 10 kPa CO<sub>2</sub>. However CA of 15 kPa CO<sub>2</sub> avoided stem bent during 27 days at 2 and 5°C. Samples stored at 8°C were excluded due to yellowing and the high stem bent observed. Low moisture loss (0.5-1%) was registered after 27 days for both storage temperatures. Stems showed a luminosity increase around 23% after 6 days, without differences at both temperatures. The initial pH (6.0) rose approximately 3.5% after 6 days at both temperatures, with no changes until the end of the storage. Initial TA values (0.18 g citric acid 100 ml<sup>-1</sup>) did not show changes during 19 days at both storage temperatures. However, after 27 days TA content increased between 14-40% for both storage temperatures, showing the higher the CO<sub>2</sub> concentrations the lower the TA increases. No stem firmness and SSC changes were found throughout storage at both temperatures. In conclusion, CA storage with 10-15 kPa CO<sub>2</sub> (+2 kPa O<sub>2</sub> balanced with N<sub>2</sub>) provides great benefits for keeping the quality of Bimi® broccoli during cold storage, reaching an acceptable sensory quality after 27 days of shelf life at 2 to 5°C.

**Keywords:** /Broccoli/ /Stem Firmness/ /Color/ /Yellowing/

#### **CAULIFLOWER**

Farahzety, A.B., M.K. Illias and H. Siti Aishah. 2013. Nutritional quality and yield of **cauliflower** (*Brassica oleracea* var. *botrytis*) as affected by fertilizer sources. Acta Hort. 1012: 265 - 270.

#### **Abstract**

The effects of fertilizer sources on the nutritional quality and yield of cauliflower grown under protective structure were determined. The fertilizers sources were from three different compost consisting of oil palm empty fruit bunches compost (EFBC), chrysanthemum residues compost (CRC) and soybean wastes compost (SWC) and two different vermicomposts namely green wastes vermicompost (GWV) and vegetable waste vermicompost (VWV) with inorganic fertilizer NPK (12:12:17) as a control treatment. The amount of fertilizer applied was calculated based on 180 kg h<sup>-1</sup> of nitrogen. Application of SWC and EFBC resulted into slightly higher nitrogen content in cauliflower curds. Phosphorus and potassium contents were not significantly different among the treatments. Whereas, magnesium and zinc were increased and slightly higher in organics compared to chemically fertilized plant with curds of EFBC having the highest values. The curds of VWV can be harvested 7 days earlier than plants fertilized with inorganic fertilizer although the yield was similar with EFBC and inorganic plants. Highest yield (12.75 t/ha) was obtained by the application of VWV although statistically no differences were observed with inorganic fertilizer plants and EFBC. Cauliflower ascorbic acid was also higher in VWV and EFBC.

**Keywords:** /Cauliflower/ /Quality/

Zhan, L., et. al. 2013. Light exposure reduced browning enzyme activity and accumulated total phenols in cauliflower heads during cool storage. *Postharvest Biol. & Technol.* 88: 17 – 20.

#### **Abstract**

Effects of continuous light exposure (24 mol m<sup>-2</sup>s<sup>-1</sup>) on browning enzyme activity and total phenol (TP) content in fresh cauliflower heads were investigated during 7 d storage at 7°C using darkness as the control. Results showed that light exposure inhibited polyphenol oxidase activity (PPO) by 26% and peroxidase (POD) by 16%, as well as lowering the browning index (BI) by 33%, compared to darkness, at the end of storage. Light exposure also induced 43%, 35%, and 20% increases in phenylalanine ammonia lyase (PAL) activity at 1, 3, and 5 d storage, respectively, thus accumulating 41% more de novo TP content than in darkness after 7 d storage. In addition, vitamin C content deteriorated during storage under both light and dark conditions, with light exposure preserving vitamin C content 30% more than in darkness. However, light exposure accelerated fresh weight loss, with the largest value of 1.8% at the end of storage.

**Keywords:** /Cauliflowers/ /Browning/ /Storage/

#### **GARLIC**

Zaulia, O., et. al. 2013. Influence of nanosilver packaging on quality retention of peeled garlic. *Acta Hort.* 1012: 1317 – 1322.

#### **Abstract**

The effect of nanosilver packaging on quality of peeled garlic stored at 2°C was determined. Five different types of packaging for this experiment were studied. They are polypropylene container containing 1% nanosilver with nanosilver cap (PPCN), polypropylene container containing 1% nanosilver with cap without nanosilver (PPN), polypropylene container and cap without nanosilver (PP), low density polyethylene coating with nanosilver (LDPE-N) and low density polyethylene without nanosilver as control for LDPE plastic bag (LDPE). Nanosilver significantly affected the quality of peeled garlic. PPCN was effective in maintaining firmness of peeled garlic. Nanosilver in PPCN enhanced the effectiveness of MAP by significantly reducing O<sub>2</sub> and significantly increasing CO<sub>2</sub> in the container. PPCN also significantly reduced cut surface browning and acidity (reduced TTA, increased pH) of peeled garlic. Among all the PP packaging studied, PPCN was the best packaging which could extend the shelf life and freshness of the peeled garlic for 4 weeks. Nanosilver accelerated rooting and cut surface browning which was significantly lower in PPN compared to PP. Nanosilver in PE bag significantly reduced the ethylene inside the packaging. However, nanosilver in LDPE bag reduced the ascorbic acid content of peeled garlic. Nanosilver in LDPE and PP had no significant effect on TSS and lightness. The best packaging to maintain hue and ascorbic acid content of peeled garlic was LDPE bag without nanosilver. Peeled garlic could be stored for 8 weeks in LDPE with and without nanosilver with less cut surface browning, rooting and sprouting problems as compared to PP.

**Keywords:** /Garlic/ /Sprouting/ /Packaging/ /Quality/

#### **LETTUCE**

Berna, Z., C.C. Webb and M.C. Erickson. 2013. Electronic nose and fast GC for detection of volatiles from *Escherichia coli* O157:H7, *Escherichia coli* and *Salmonella* in lettuce. *Acta Hort.* 1012: 1255 – 1262.

#### **Abstract**

Timely and accurate determination of the presence and nature of foodborne bacterial pathogens is very important in food safety. It is desirable to have methods that can quickly discriminate pathogens from non-pathogens whilst classifying correctly different isolates of the same pathogen. In this work we evaluated the potential of an electronic nose (DiagNose™) and a fast GC (zNose™) to detect and distinguish pathogens

(*Escherichia coli* O157:H7 and *Salmonella* spp.) from nonpathogens (*E. coli*) in lettuce. For the cross-species discrimination study, tryptic soy broth supplemented with an amino acid mixture plus D-sorbitol was used. For the within-species study, a similar medium was used and three isolates were evaluated separately for each group of bacteria. All samples were incubated at 37°C for 8 hours. After incubation, sample headspace was analyzed with: (1) DiagNose™ a metal oxide sensor-based electronic nose (5 min analysis time) and (2) zNose™ a fast-GC with a 1 m long DB-5 column and a surface acoustic wave sensor (30 s analysis time). Principal component analysis showed that E-nose could discriminate pathogenic *Salmonella* from *E. coli* O157:H7 but failed to discriminate *Salmonella* from non-pathogenic *E. coli*. Fast GC could discriminate pathogenic *E. coli* O157:H7, non-pathogenic *E. coli*, *Salmonella* and a cocktail of all three bacteria from each other. Also E-nose discriminated each of the pathogenic *E. coli* O157:H7 strains from control but could not distinguish the pathogenic strains from each other. Similarly, fast GC was able to distinguish each of the non-pathogenic *E. coli* strains from control. Neither instrument could discriminate any *Salmonella* isolate from the control.

**Keywords:** /Lettuce/ /Pathogens/ /Escherichia coli/

Fairuz, Siti Y., et. al. 2013. Screening of *Escherichia coli* O157:H7 from hydroponic and organic 'butterhead' **lettuce** after aqueous ozone treatment and its effect on postharvest quality. Acta Hort. 1012: 745 - 754.

### Abstract

*Escherichia coli* O157:H7 is a gram negative bacterium and can cause a bloody diarrhea due to toxins secreted when it infects human intestinal tracts. The effectiveness of aqueous ozone on *E. coli* O157:H7 was studied for improvement in produce shelf life and food safety. Hydroponic 'Butterhead' lettuce was grown under a rain shelter and organic lettuce were grown in an organic-field plot at Taman Pertanian Universiti (TPU), UPM. After 41 days after transplant, both of the hydroponic and organic lettuce heads were harvested and immediately transported to the Postharvest Laboratory, UPM for analysis. The effects of ozone on hydroponic and organic 'Butterhead' lettuce were evaluated by varying aqueous ozone concentrations applied as a potential food sanitizer especially for lettuce which is normally consumed raw. The produce quality was assessed by comparing the changes in weight loss, firmness and chlorophyll content after treatment with aqueous ozone at 0, 3 and 5 mg L<sup>-1</sup> and stored at 10°C for 12 days. The analysis was conducted on day 0, 4, 8 and 12 of storage. The number of *E. coli* O157:H7 in organic lettuce was found to be higher than hydroponic lettuce. The aqueous ozone treatments were effective in reducing the *E. coli* O157:H7 contamination on the day of treatment applied but the effectiveness decreased as the storage period progressed. The aqueous ozone at 5 mg L<sup>-1</sup> treatment resulted in the highest reduction of *E. coli* O157:H7 but the quality characteristics were negatively affected. The aqueous ozone at 3 mg L<sup>-1</sup> was found to be the potential concentration in reducing *E. coli* O157:H7 without compromising the quality.

**Keywords:** /Lettuce/ /Quality/ /Food Safety/

Golding, J.B., et. al. 2013. Efficacy of no treatment to inhibit browning on fresh cut **lettuce** types. Acta Hort. 1012: 933 - 938.

### Abstract

Browning of the cut surfaces of minimally processed fruit and vegetables, including on pre-cut slices of lettuce (*Lactuca sativa* L.), is a limiting quality factor during storage and marketing. 'Iceberg' lettuce slices were fumigated with nitric oxide (NO) gas at concentrations between 5 and 1000 µl L<sup>-1</sup> in air at 20°C for 1 to 4 h or dipped in an aqueous solution of the NO-donor compound, 2,2'-(hydroxynitrosohydrazino)-bis-ethanamine (diethylene triamine-nitric oxide; DETANO) at concentrations between 10 and 1000 mg L<sup>-1</sup> for 15 s to 60 min, followed by storage at 0°C in air. The most effective treatments were fumigation with 500 µl L<sup>-1</sup> NO for 1 h, and dipping in 500 mg L<sup>-1</sup> DETANO for 5 min. The ability of NO to inhibit the development of browning of different types of lettuces was further investigated on the cut surfaces of four fresh-cut lettuce types ('Green Oak', 'Green Coral', 'Baby Cos', and 'Butter') during storage at 5°C. The NO was applied to lettuce strips (i) by fumigation with NO gas for 2 h, (ii) by dipping in DETANO solution dissolved in 0.01 M phosphate buffer pH 6.5, or (iii) by dipping in

an aqueous solution of the NO-donor compound, sodium nitroprusside (SNP). Treatment with NO gas, DETANO, or SNP inhibited the development of browning and extended the postharvest life of all four lettuce types. The optimum treatments were dipping in 500 mg L<sup>-1</sup> DETANO or SNP, which resulted in an approximately 60% increase in postharvest life over untreated lettuce slices.

**Keywords:** /Lettuce/ /Browning/ /Postharvest Life/

Ibrahim. R. and W.A.M. Zuki. 2013. the physico-chemical properties of lettuce (*Lactuca sativa* 'grand rapid') grown under different planting methods. Acta Hort. 1012: 201 – 206.

#### **Abstract**

A study was conducted to investigate the effect of different planting methods on the postharvest quality of lettuce (*Lactuca sativa* 'Grand Rapid'). The lettuce plants were planted by using three different methods which were hydroponic, aquaponic and soil (conventional) planting. The growing period takes about 6 to 8 weeks before the lettuce can be harvested. The yield (weight/plant) and physicochemical parameters of texture, colour, chlorophyll and carotenoid contents, moisture, ash and fibre contents of the lettuce samples were determined and analyses were done on the day of harvest. Sensory evaluation was also carried out for the acceptability of lettuce from different planting methods. The results showed that lettuce from hydroponic planting method had higher and better postharvest quality compared to that from soil and aquaponic planting methods. The crispness values of lettuce were also higher in hydroponic planting method. Lettuce from soil planting method had higher moisture and ash contents whilst lettuce from aquaponic was rich in fibre. However, there was no significant difference ( $p>0.05$ ) among all the planting methods for color, chlorophyll and carotenoid contents. Sensory evaluation conducted showed that the hydroponic lettuce had good scores in all the attributes of appearance, taste, texture, odour and overall acceptability. No significant difference ( $p>0.05$ ) was obtained between lettuce from soil and aquaponic planting methods for sensory evaluation. Therefore, hydroponic was found to be the best planting method to obtain higher yield and better quality lettuce. Lettuce grown under the aquaponic planting method also has the advantage of two commodities harvestable at the same time which are lettuce and fish.

Karaca, H., and Y. Sedat Velioglu. 2014. Effects of ozone treatments on microbial quality and some chemical properties of lettuce, spinach, and parsley. Postharvest Biol. & Technol. 88: 46 – 53.

#### **Abstract**

The effects of distilled, ozonated (12 mg L<sup>-1</sup>) and chlorinated (100 mg L<sup>-1</sup>) water treatments on inactivation of *Escherichia coli* and *Listeria innocua* inoculated on lettuce, spinach, and parsley and on some chemical characteristics (chlorophyll a, chlorophyll b, ascorbic acid, and total phenolic contents and antioxidant activity) of these vegetables were investigated. Chlorine and ozone washes resulted in average log reductions ( $\pm$  standard error) of  $2.9 \pm 0.1$  and  $2.0 \pm 0.3$  for *E. coli* in the vegetables tested, respectively, while the efficiency of ozone ( $2.2 \pm 0.1$  log) was very close to that of chlorine ( $2.3 \pm 0.1$  log) on *L. innocua*. Aqueous ozone did not cause any detrimental effects on the chemical characteristics of the vegetables. The effect of gaseous ozone treatment (950 L L<sup>-1</sup>, 20 min) on microbial inactivation and the chemical characteristics of parsley were also determined. This treatment resulted in 1.0–1.5 log reductions in the numbers of both microorganisms but caused significant losses in important bioactive compounds of parsley. Ascorbic acid and total phenolic contents and antioxidant activity in ozone-treated samples were 40.1, 14.4, and 41.0%, respectively, less than the control samples.

**Keywords:** /Lettuce/ /Spinach/ /Parsley/ /Microbial Quality/

Yang, Z.F. Y.H. Zheng and S. F. Cao. 2013. Influence of harvest maturity on fruit quality, color development and phenylalanine ammonia-lyase (PAL) activities in chinese bayberry during storage. Acta Hort. 1012: 171 - 176.

#### **Abstract**

The effects of harvest maturity on fruit colour and quality in Chinese bayberry (*Myrica rubra* Sieb. and Zucc.) were investigated. Bayberry fruit was harvested at four maturity stages according to the fruit color: unripe, color turning, mature and ripe, and stored at 20°C for 48 h. Changes in fruit quality, color, anthocyanin and PAL activity were determined every 6 h during storage. The results indicated that unripe, and color turning bayberry fruit became much redder during storage with the increasing in total anthocyanin content and phenylalanine ammonia-lyase activity. The decrease of fruit firmness and total titratable acidity content was found in each maturity stage. Our results suggested that the optimum harvest stage for Chinese bayberry is at full ripeness. Unripe bayberries could not undergo sufficient changes in color and quality that suitable for fresh consumption, although they became red during storage. This study provides important information on the postharvest response of Chinese bayberry.

**Keywords:** /Lettuce/ /Fruit Quality/ /Color/ /Harvest/

## MUSHROOM

Syafini, Nur, G., et. al. 2013. Quality maintenance of grey oyster **mushroom** (*Pleurotus ostreatus*) by nanosilver packaging and ethylene absorbers. Acta Hort. 1012: 1341 – 1346.

### Abstract

Grey oyster mushroom (*Pleurotus ostreatus*) is widely cultivated and consumed as food in Malaysia. Mushrooms continue to respire after harvest and they have a relatively high respiration rate compared to other fresh produce. It is necessary that they are either marketed soon after harvesting or preserved with special care such as in cold storage or other controlled environment storage. Therefore, the present study aims to assess the effect of ethylene absorber and nanosilver packaging on quality of grey oyster mushroom. Grey oyster mushroom was harvested at 5 days after emerging with the cap diameter 75-80 mm. The quality of grey oyster mushroom was evaluated after packing in 3 different packages i.e., (1) CFB boxes lined with 0.04 mm LDPE as a control, (2) CFB boxes lined with 0.04 mm LDPE with added six sachets of ethylene absorber, and (3) CFB boxes lined with 0.04 mm LDPE containing 1% nanosilver. In all the packaging, water absorbers were added to absorb moisture during storage. Mushroom was stored at 2°C and evaluation was carried out at 0, 5, 8,12, 15, 19 and 22 days of storage. Postharvest quality evaluation included physical (visual appearance, weight loss, colour of cap and gill; L, hue, chroma), chemical (pH, TSS, TTA, ascorbic acid) and gases (O<sub>2</sub>, CO<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>). Ethylene absorber did not result in significant changes in most of mushrooms quality parameters evaluated (TSS, ascorbic acid, O<sub>2</sub>, CO<sub>2</sub>, colour of cap and gill; L, hue, chroma). However, ethylene absorber significantly (p<0.05) increased acidity of grey oyster mushroom (reduction of pH and increased of TTA). Nanosilver packaging did not affect the variables studied except increasing chroma of gill. Visually, mushroom packed in nanosilver packaging was yellowing rapidly and the surface looked dry compared to other packaging. Grey oyster mushroom can be stored until 22 days at 2°C packed in 0.04 mm LDPE with added ethylene absorber compared to 19 days in nanosilver packages and 12 days for control.

**Keywords:** /Mushroom/ /Modified Atmosphere Packaging (MAP)/ /Storage Life/

## OKRA

Boonyaritthongchai, P., et. al. 2013. Effect of methyl jasmonate on reducing chilling injury symptom and maintaining postharvest quality of **okra** (*Hibiscus esculentus* L.). Acta Hort. 1012: 1119 – 1124.

### Abstract

Effect of methyl jasmonate (MeJA) at 10<sup>-2</sup> M concentrations on physiological and biochemical changes in okra kept at 4°C was investigated. We found that weight loss in okra treated with 10<sup>-2</sup> M MeJA was lower than untreated okra (control). The 10<sup>-2</sup> M MeJA treated okra showed slight changes of peel color in L, a, and Hue when compared with control treatment. Moreover, percentage of electrolyte leakage was also lower than untreated

okra. Chilling injury (CI) score was determined by observing the chilling injury symptoms of okra to evaluate damage score. The results showed that MeJA untreated okra revealed 5% of CI symptoms at 4 days. Meanwhile, 10-2 M MeJA treated okra showed 5% of CI symptom at 6 days of storage. Activity of lipoxygenase (LOX) was determined. The LOX enzyme is involved in senescence of membrane permeability and cell death. Okra treated with MeJA had lower LOX activity and malondialdehyde contents (MDA) than okra not treated with MeJA.

**Keywords:** /Okra/ /Methyl Jasmonate/ /Chilling Injury/ /Postharvest/ /Quality/

## ONION

Eshel, D., et. al. 2013. Fast curing: A method to improve postharvest quality of onions in hot climate harvest. *Postharvest Biol. & Technol.* 88: 34 - 39.

### Abstract

Most of the onions (*Allium cepa* cv. Orlando) grown in southern Israel are treated with maleic hydrazide before storage, and are cold-stored for up to 8 months with minimal losses to rots or sprouting. Never-the less, in most cases the complete dry outer skin (tunic) cracks and loosens, and tends to fall off during storage. To improve onion postharvest quality, bulbs were harvested at 80–100% green leaf drop (top-down), leaving about 10 cm of neck above the bulb. The early harvest reduced skin cracks in 93% of the bulbs, resulting in a sturdy tunic beneath the muddy outer skin. We applied fast curing (FC) at 30°C and 98% RH for up to 9 days postharvest: the onion neck became 52% narrower after 6 days, similar to the effect of 5 months of cold storage. FC also changed the color of the treated onion bulbs' outer skin to a darker reddish brown. FC of onions harvested with a long neck and stored for 290 days reduced weight loss and rot by 30% and 80%, respectively, as compared to non-FC onions. The better onion quality induced by FC was accompanied by an increased number of onion skin layers (from an average of 1.8 to 4) and a higher force needed to tear the tunic (average 4.8 N as compared to 3.5 N in the control). FC compressed the effects of 5 months of cold storage into a few days, since most of the bulb neck and tunic changes measured during FC occurred only after long cold storage without FC. Although emission of the lachrymatory factor was not affected by FC, it markedly increased after 5 months of storage. Histological observation showed that FC keeps the onion tunic and inner fleshy scales intact and ensures postharvest quality, even after 8 months of cold storage. The high temperature used for FC can be reached in hot-climate storage areas with minimal energy investment.

**Keywords:** /Onion/ /Postharvest Quality/

Mesta, R.K. and L. Kukanur. 2013. Management of postharvest smudge infections in onion through fungicides. *Acta Hort.* 1012: 627 - 632.

### Abstract

Onion is one of the important vegetable crops of India. In Karnataka state, onion farmers are facing severe postharvest losses due to infection of *Colletotrichum circinans*. The bulbs get infected in field and start rotting when carried to the storage units for drying. Since the infection is from field fungus which infects just prior to harvest and aggravate disease during storage, an experiment was conducted at the Horticulture Research Station Devihosur, Haveri, India, to minimize the losses in onion due to pre- and postharvest smudge by practicing fungicidal spray in the field before harvest. Seven different fungicides were tried to manage the disease. The results revealed that spraying of hexaconazole (0.1%), difenconazole (0.1%) and kresoxim methyl (0.1%) have given best control of the disease in field as well as in storage. Normally onions are given fungicidal sprays at 30 and 60 days after sowing. However, in the present study it was found that spraying fungicides at 40, 60 and 80 days after sowing were found effective. As onion is normally harvested after 90 days of sowing, spraying of fungicides especially at 80 days after sowing found to minimise infection carried to storage which intern recorded significantly least smudge in storage.

Keywords: /Onion/ /Disease/ /Fungicides/ /Storage/

Zaulia, O., et. al. 2013. Active modified atmosphere packaging using ZP ageless to control cut surface browning of peeled **onion**. Acta Hort. 1012: 979 – 986.

#### **Abstract**

Packed peeled onion is gaining popularity in Malaysian supermarkets and hypermarkets. The product can be introduced for food retail stores and food services such as restaurants, hotels, food institutions and food industries. The problems of peeled onion during storage include growth of roots, sprouts, fungal infection, surface drying and browning, unpleasant and strong smell and discolouration. This study was carried out to investigate the combined effect of water and oxygen absorber on the quality and shelf life of peeled onion in bulk packaging. Peeled onion packed in corrugated fiber board (CFB) boxes lined with low density polyethylene (LDPE, 0.04 mm thickness) containing water absorber (SupasorbTM) alone served as the control, and in combination with oxygen absorber (ZP Ageless 100TM) as treatment. Packed peeled onions were stored at 2°C and quality evaluations were carried out at weekly intervals for 8 weeks. It was shown that the oxygen absorber increased discolouration, texture loss and CO<sub>2</sub> production of peeled onion during storage. The oxygen absorber caused an increase in ethylene production at the end of storage (week 7). The total titratable acidity (TTA) was reduced by O<sub>2</sub> absorber after 3-4 weeks of storage. There were no significant differences on the effect of O<sub>2</sub> absorber on O<sub>2</sub> concentration in packages, pH, lightness (*L*), total soluble solids (TSS) and microbial counts. The oxygen absorber in modified atmosphere packages of the peeled onion has the advantages of delaying rooting and sprouting, reduction of yellowing on the cut surface and maintaining the ascorbic acid content during 8 weeks storage at 2°C.

Keywords: /Onion/ /Modified Atmosphere Packaging/ /Packaging/

#### **RADISH**

Xiao, Z., et. al. 2014. Postharvest quality and shelf life of **radish** microgreens as impacted by storage temperature, packaging film, and chlorine wash treatment. Food Sci and Tech. 55: 551 – 558.

#### **Abstract**

Microgreens are new and emerging products, which are young seedlings of vegetables and herbs. A recent study showed that microgreens contain higher nutrients compared to their mature counterparts. However, they typically have a short shelf life (1e2 days) at ambient temperature. The objective of this study was to optimize postharvest handling conditions to reduce the quality loss and extend the shelf life of daikon radish (*Raphanus sativus* L. var. *longipinnatus*) microgreens. Storage temperature, packaging film, and wash treatment were investigated. Changes in headspace composition, quality index, chlorophyll concentration, tissue electrolyte leakage, and aerobic mesophilic bacteria (AMB) and yeast & mold (Y&M) counts were monitored periodically during storage. Results indicated that (1) storage temperature significantly ( $P < 0.05$ ) affected package atmosphere, product quality and shelf life. One degree Celsius was the optimal temperature for storage of radish microgreens with no chilling injury observed; (2) film oxygen transmission rate (OTR) significantly ( $P < 0.05$ ) affected O<sub>2</sub> and CO<sub>2</sub> composition, but OTR did not significantly affect quality attributes during 28 days of storage at 1 °C; (3) Chlorine wash treatment (100 mg/L) significantly reduced initial microbial populations by 0.5 log cfu g<sup>-1</sup>, including AMB and Y& M. However, microbial populations rebounded after day 7.

Keywords: /Radish/ /Postharvest Quality/ /Shelf Life/ /Storage/ /Packaging/

#### **SHALLOT**

Azizah, Noor A., et. al. 2013. Volatile compound content of **shallot** (*Allium ascalonium*) puree in modified atmosphere bulk packaging during storage. Acta Hort. 1012: 1329 – 1334.

## Abstract

The changes in volatile compound content of modified atmospheric (10% CO<sub>2</sub>) bulk packaging shallot (*Allium ascalonium*) puree were studied. Freshly prepared shallot puree was packed in unprinted pouches 45×35 cm made from Ony/LLDPE of 0.07 mm thickness as a primary packaging material. The packed samples were then put into secondary packaging by using telescopic carton box, flute B type of size 59×38×11.9 cm<sup>3</sup>. Both control and treated samples were stored at 5±1°C, 85-90% relative humidity for 3 months. Observation was made every two weeks interval to determine the changes of volatile compound content. Sulphur group was found as major compounds of shallot puree, while identified compounds were sulphide, disulphide, trisulphide and tetrasulphide. Results showed that a total of 15 compounds were presented in shallot puree throughout of storage period. However, the compound of sulphide, propenyl 1-propenyl was not detected in the control sample after week 4 of storage. Modified atmospheric bulk packaging containing 10% CO<sub>2</sub> in Ony/LLDPE provided better storage conditions for preserving the volatile compound of shallot puree for up to 12 weeks at 5±1°C.

**Keywords:** /Shallot/ /Low Temperature/ /Storage/ /Quality/

## TOMATO

Hatami, M., S. Kalantari and M. Delshad. 2013. Responses of different maturity stages of **tomato** fruit to different storage conditions. Acta Hort. 1012: 857 – 864.

## Abstract

In tomato as a climacteric fruit, fruit ripening can be completed after harvest. Provided that appropriate storage condition for a given harvesting stage is implemented, fruits are endowed with proper quality for the market. In order to study the effects of maturity stage on fruit storage life, tomato fruits were harvested at three ripening stages. They were stored at three storage temperature conditions including 5, 13°C, and a simulated condition (SC) of the interval between harvest and consumption by the consumer. Fruit color, lycopene, firmness, titratable acidity (TA), total soluble solids (TSS), ascorbic acid, weight loss, and chilling injury (CI) were measured and evaluated during the experiment. Results showed that at the end of the storage at 13°C, mature green fruits had relatively similar values of color, lycopene content, TA, TSS, and firmness compared to the red ones; however, ascorbic acid did not accord. While storage of different maturity stages of tomatoes at 13°C developed normal ripening, storage at 5°C and SC disturbed the normal ripening process.

**Keywords:** /Tomato/ /Color/ /Firmness/ /Chilling Injury/ /Ripening/

Ibrahim, R. S.A. Rhani and A. Buhri. 2012. reduction of chilling injury in **tomato** (*solanum lycopersicum*) using different postharvest (pre-storage) treatments. Acta Hort. 1012: 473 – 478.

## Abstract

Chilling injury is a serious disorder that can be observed in plant tissues especially those of tropical and subtropical origin. One of the most susceptible produce to chilling injury is tomato which resulted in the irregular ripening of the peel from the exposure to temperature lower than 10°C. However, the critical temperature at which chilling injury symptoms are manifested varies among different cultivars and commodities. Chilling injury causes the release of metabolites such as amino acids and sugar, and minerals from cells and together with the degradation of cell structure. This study was carried out to investigate the effect of different postharvest (pre-storage) treatments in the reduction of chilling injury in tomatoes (*Solanum lycopersicum*). The treatments involved were hot water treatment, anoxic treatment, forced air cooling treatment and fruits without any treatment served as control. Control and treated tomatoes were stored at 9±1°C; RH 85-90% for 30 days. The physico-chemical analyses and the manifestation of chilling injury were observed at 3 days intervals up to 12 days and continued with 6 day intervals until day 30. The chilling injury score, color L a b values, lipid peroxidation, total soluble solid (TSS), titratable acidity (TA), and ascorbic acid value were increased and firmness decreased over the

storage. The chilling injury symptoms started to occur on day 18 for control and hot water treatment and day 24 for anoxic treatment. Therefore, among all the treatments, the best treatment which can prolong the shelf life and reduce the manifestation of chilling injury in tomatoes was observed to be forced air cooling treatment where other treatments showed the chilling injury symptoms of uneven ripening that cannot be accepted during storage at  $9\pm 1^{\circ}\text{C}$ .

**Keywords:** /Tomato/ /Chilling Injury/ /Postharvest/

Leungwilai, K. and Beckles, D.M. 2013. Effect of low temperature storage on fruit physiology and carbohydrate accumulation in **tomato** ripening-inhibited mutants. J. Stored Products & Postharvest Res. 4: 35 – 43.

#### **Abstract**

Chilling-sensitive fruits often produce a burst of ethylene when reconditioned at ambient temperature after cold storage. This has led some researchers to propose that chilling injury (CI) may be induced by post-chilling ethylene production. To test this hypothesis, we examined two tomato (*Solanum lycopersicon* L.) mutants, *non-ripening* (*nor*) and *ripening-inhibitor* (*rin*), that do not produce climacteric ethylene, after they were subjected to cold-storage and reconditioning. The response of the mutants differed, and was not as extreme as the parent line cv. Ailsa Craig, but both showed symptoms of chilling stress. Therefore while ethylene production may influence chilling injury, it is not essential for initiating this process in tomato cv. Ailsa Craig.

**Keywords:** /Tomato/ /Fruit Physiology/ /Ripening/ /Low Temperature/

Na-Na Ma, Nana, et.al. 2013. The multiple stress-responsive transcription factor *SINAC1* improves the chilling tolerance of **tomato**. *Physiologia Plantarum*. 149: 474 – 486.

#### **Abstract**

NAC (NAM-ATAF1, 2-CUC2) family members play important roles in various environmental responses. Here, we cloned a full-length NAC gene (954 bp) from *Solanum lycopersicum* (SINAC1). This gene belonged to ATAF subfamily which included ATAF1 and ATAF2 of *Arabidopsis thaliana*. SINAC1 expression was induced by chilling stress ( $4^{\circ}\text{C}$ ), heat stress ( $40^{\circ}\text{C}$ ), high salinity, osmotic stress and mechanical wounding. SINAC1 transcripts were enhanced after application of abscisic acid, methyl jasmonate, salicylic acid, gibberellin, ethylene, methyl viologen and hydrogen peroxide. The seedlings of transgenic plants overexpressing SINAC1 grew more leaves but were shorter than wild-type (WT) plants. SINAC1 overexpression increased the chilling tolerance of tomato plants by maintaining the higher maximal photochemical efficiency of photosystem II and oxygen-evolving activities. Compared with WT plants, transgenic plants showed higher superoxide dismutase (EC 1.15.1.1) and catalase (EC 1.11.1.6) activities, which reduced levels of  $\text{H}_2\text{O}_2$  and superoxide anion radicals and promoted lower ion leakage and malondialdehyde content. The expression level of SICBF1 in transgenic plants was also higher than that in WT plants under both normal conditions and chilling stress; this increased expression may be the main factor influencing the high chilling tolerance of transgenic plants. The results suggest that SINAC1 plays important roles in diversiform plant-stress responses and diverse signaling pathways.

**Keywords:** /Tomato/ /Chilling Injury/

Mustafa, M.A., A. Ali and S. Manickman. 2013. Application of a chitosan based nanoparticle formulation as an edible coating for **tomatoes** (*Solanum lycopersicum* L.). *Acta Hort*. 1012: 445 – 452.

#### **Abstract**

The efficacy of chitosan edible coatings in maintaining postharvest quality has been well demonstrated. Further enhancement may be possible by a novel chitosan based nanoparticle formulation capable of allowing better delivery of the chitosan particles into intact fruit tissues due to reduced droplet size. Three nanoparticle

formulations of 1% chitosan with different droplet sizes (800, 600 and 400 nm) were prepared by subjection to ultrasonic waves, and applied as an edible coating on tomatoes. The fruits were stored at 15±2°C and 70-80% relative humidity (RH) for 20 days, during which different quality parameters of the fruits were assessed as an indication of the progression of ripening. The indicators of tomato ripening, which include loss of firmness and chlorophyll content as well as increase in soluble solids content and colour evolution from green to red were all found to be delayed in the chitosan treated fruits in comparison to the control ( $p < 0.05$ ). However, weight loss was relatively higher in the treated fruits in comparison to the control. Meanwhile, the 800, 600 and 400 nm treatments were at par ( $p > 0.05$ ). The results demonstrate the potential of this coating for maintaining postharvest quality of fresh fruits like tomato except for weight loss.

**Keywords:** /Tomato/ /Fresh fruits/ /Nanotechnology/ /Postharvest Quality/ /Shelf life/

Naram, L., et. al. 2013. Activity of cell wall softening enzymes and its relation to fruit firmness during chemically regulated ripening tomato (*Solanum lycopersicum* L.). Acta Hort. 1012: 521 - 526.

#### **Abstract**

Studies were conducted to find out the influence of six postharvest chemical treatments (CaCl<sub>2</sub> at 1 and 2%; GA3 at 75 and 150 ppm; spermine at 100 and 200 ppm; ethanol 2 and 4 ml kg<sup>-1</sup> fruit; menadione at 100 and 200 ppm; ethrel at 250 and 500 ppm) on the enzyme activity, fruit firmness and shelf life of tomato cultivar 'PKM-1'. Fruits at breaker stage after chemical treatments were studied for their postharvest ripening behaviour at ambient temperatures in open ventilated plastic trays. The activity of cell wall softening enzymes viz., polygalacturonase (PG) and pectin methyl esterase (PME) increased gradually during storage reaching its peak by the ninth day after storage followed by a decline towards the end of storage while the fruit firmness gradually decreased during storage. Though the pattern of changes observed was similar for all the treatments including untreated control, the enzyme activity was relatively low and the rate of decrease in fruit firmness was much lower in treated fruits than those untreated. Among the chemical treatments, spermine and ethanol were found to be more effective in delaying softening by inhibiting the activity of both the enzymes during ripening and the shelf life of tomato could be extended by 10-12 days over the untreated control with the postharvest application of these two chemicals.

**Keywords:** /Tomato/ / Postharvest/ /Firmness/ /Shelf Life/

Pezzarossa, B., et. al. 2013. Effects of selenium enrichment of tomato plants on ripe fruit metabolism and composition. Acta Hort. 1012: 247 – 252.

#### **Abstract**

The effects of selenium (Se) addition on production and quality traits of *Solanum lycopersicon* 'Red Bunch' were investigated. Se was added as sodium selenate at the rate of 0, 0.5 and 1 mg Se L<sup>-1</sup> to the nutrient solution. Se was absorbed by roots and accumulated in leaves and fruits, and at the tested concentrations, it did not affect yield. Se concentration followed a gradient, decreasing from the basal to the apical part of the plant. At red ripe stage, the fruits on the lower trusses accumulated higher amount of Se than the fruits of the higher trusses. β-carotene and lutein significantly decreased only at 1.0 mg Se L<sup>-1</sup>. Lycopene increased either in 0.5 and, less markedly, 1.0 mg Se L<sup>-1</sup>-treated fruits where a pronounced increase in quercetin was also observed.

**Keywords:** /Tomato/ /Ripening/

Rajesakhar, M., Y.N. Reddy and V. Sudha Vani. 2013. Changes in physico-chemical characters, ethylene and polyamines during antioxidant regulated ripening of tomato fruits. Acta Hort. 1012: 353 – 360.

#### **Abstract**

A study was initiated at the College of Agriculture, Hyderabad, India, to investigate the relationship between ethylene and polyamine production and shelf life of ripening tomato fruits treated with antioxidants, sodium benzoate (SB) and ascorbic acid (AA) and data were recorded during storage at ambient conditions. Physiological loss in weight and rate of ethylene production were highest in untreated control fruits (6.63% and 17.18 nl g<sup>-1</sup> h<sup>-1</sup>) and lowest in SB 1000 ppm (3.30% and 8.60 nl g<sup>-1</sup> h<sup>-1</sup>). Colour development in fruits was rapid in control and slow in SB 1000 ppm. Shelf life was highest in SB 1000 ppm treated fruits (28 days) and lowest in control (15 days). Polyamine content was highest in SB 1000 ppm (5.81 μM/g) and lowest in control (4.76 μM/g). Titratable acidity was high in fruits treated with SB 1000 ppm (0.53 g/100 ml) and lowest in control (0.44 g/100 ml). Reducing sugars were high in AA 1000 ppm (4.67%) and lowest in control (3.51%). Shelf life had a significant negative correlation with PLW, colour development and ethylene production; and polyamine content with ethylene production. Rate of ethylene production was low initially but peaked on 9th day, while polyamine content peaked by 6th day and decreased gradually until 12th day corresponding to the increase in ethylene production. The results confirmed that both ethylene and polyamines share a common precursor and the antioxidant treatments have blocked ethylene production by their free radical scavenging property facilitating production of polyamines from SAM instead of ethylene during initial period of storage.

**Keywords:** /Tomato/ /Ethylene/ /Antioxidants/ /Ripening/ /Shelf life/

Razali, M., et. al. 2013. Effectiveness of nanosilver packaging related to health awareness of tomato (*Lycopersicon esculentum* 'Leckat 139') grown organically. Acta Hort. 1012: 1323 – 1328.

#### **Abstract**

The effectiveness of nanosilver packaging materials compared with other packaging materials in maintaining the antioxidant activity of tomato cultivar 'Leckat 139' was studied. The experiment was carried out by packing the tomatoes at colour index 4 (red colour) using perforated 0.04mm LDPE sealed (A), perforated nanosilver LDPE sealed (B), nanosilver cling wrap (C), and commercial cling wrap in polystyrene tray (control; D). Changes in antioxidant activity, ascorbic acid content and total phenolic content were observed during storage at 5°C for 5 weeks. After 5 weeks storage, antioxidant activity of tomatoes was not significantly ( $p>0.05$ ) different in nanosilver packaging as compared to other packages. Tomato packed with perforated 0.04 mm LDPE sealed had highest antioxidant activity (40.64% of inhibition) compared to nanosilver (40.14% of inhibition) and control (37.93% of inhibition) during storage. The vitamin C content of 'Leckat' tomato was not significantly ( $p>0.05$ ) different between packages during storage. Result shows that tomato packed with perforated 0.04 mm LDPE sealed were significantly ( $p<0.05$ ) higher in antioxidant activity, total phenolic and ascorbic acid content during storage period compared to other packages during storage.

**Keywords:** /Tomato/ /Organic Vegetable/ /Storage Life/ /Packaging/

Jinhua Zuoa, Jinhua, 2013. RNAome parsing yields insights into tomato fruit ripening control. Physologia Plantarum. 149: 540 - 553.

#### **Abstract**

Small RNAs have emerged as critical regulators in the expression and function of eukaryotic genomes at the post-transcriptional level. To elucidate the functions of microRNA (miRNAs) and endogenous small-interfering RNAs (siRNAs) in tomato fruit ripening process, the deep sequencing and bioinformatics methods were combined to parse the small RNAs landscape in three fruit-ripening stages (mature green, breaker and red-ripe) on a whole genome. Two species-specific miRNAs and two members of TAS3 family were identified, 590 putative phased small RNAs and 125 cis-natural antisense (natsiRNAs) were also found in our results which enriched the tomato small RNAs repository and all of them showed differential expression patterns during fruit ripening. A large amount of the targets of the small RNAs were predicted to be involved in fruit ripening and ethylene pathway. Furthermore, the promoters of the conserved and novel miRNAs were found to contain the conserved motifs of TATA-box and

CT microsatellites which were also found in Arabidopsis and rice, and several species-specific motifs were found in parallel.

**Keywords:** /Tomato/ /Ripening/

## **HERBS AND SPICES**

### **CHILLI**

Mesta, R.K., et. al. 2013. Postharvest management of fruit rot of **chilli** using solar tunnel dryer. Acta Hort. 1012: 755 – 758.

#### **Abstract**

Fruit rot of chilli caused by *Colletotrichum capsici* is one of the important postharvest disease in red chilli. The disease is favoured by high moisture content in chillies and slow drying process especially by traditional method of drying resulting in deterioration and loss of quality of the chilli beside aflatoxin contamination. An effort has been done by Horticulture Research Station, Haveri (Devihosur), India to manage the disease by drying freshly harvested red chillies using a solar tunnel dryer (STD). The results indicated that drying of chillies in STD more than 24 h resulted in rapid removal of moisture, and drying for more than 96 h in STD brought moisture content to below 10%. Fruit rot incidence was significantly less when dried in STD for more than 24 h as compared to open sun, shade and heap drying. With respect to colour, drying in STD for 24 h resulted in good retention of colour. Drying chillies for more than 24 h, and other methods of drying recorded less colour index.

**Keywords:** /Chilli/ /Solar Dryer/ /Postharvest/ /Diseases/ /Fruit Rot/

### **LEMONGRASS**

Tajidin, N.E., S.H. Ahmad and A.B. Rosenani. 2013. Physico-Chemical quality characteristics of lemongrass as affected by maturity stage at harvest, packaging materials and storage durations. Acta Hort. 1012: 889 - 896.

#### **Abstract**

This study was conducted to determine the effects of different maturity stages, packaging materials and storage durations on physico-chemical quality characteristics of lemongrass. Lemongrass was planted at the Universiti Agricultural Park, Universiti Putra Malaysia, Serdang, Selangor using a randomized complete block design with four replications. Harvesting was done at 5.5, 6.5, and 7.5 months after planting. The physico-chemical characteristics of the lemongrass evaluated firmness, chlorophyll, anthocyanin, ascorbic acid, and total phenolic contents. Measurements were made at 0, 5, 10 and 15 days after storage (10°C, 68% RH). Results indicated that there were no interaction effects between the treatments on firmness and ascorbic acid contents. Firmness increased as maturity stage advances from 5.5 to 7.5 months after planting, but decreased as storage duration was increased. Ascorbic acid content decreased with increase in maturity stages and storage duration. During storage, data obtained show that firmness and ascorbic acid content were not affected by the use of the clear and black polyethylene (PE) packaging materials (bag). Chlorophyll content of lemongrass harvested at 5.5, 6.5 and 7.5 months after planting tends to decrease during storage. In contrast, the anthocyanin content increased when the storage duration was increased, but it was lower in lemongrass pseudostems that were packed in black PE bag than those packed in clear PE bag. There was a significant interaction effect between maturity stage at harvest and storage duration of lemongrass on total phenolic content of lemongrass pseudostems. By the end of the storage duration, lemongrass harvested at 7.5 months after planting contained the highest total phenolic content compared to those harvested at 5.5 and 6.5 months after planting. Thus, lemongrass should be harvested between 6.5 to 7.5 months after planting to obtain optimum postharvest quality characteristics.

**Keywords:** /Lemongrass/ /Firmness/ /Polyethylene Bag/

## MISAI KUCING

Rosalizan, M.S., et. al. 2013. The effect of intermittent cooling during drying on phytochemical content of Misai Kucing (*Orthosiphon stamineus*). Acta Hort. 1012: 1235 -1240

### Abstract

Misai kucing (*Orthosiphon stamineus*) is one of the priority herbs under the Entry Point Projects (EPP) of the National Key Economic Areas (NKEAs) which has been identified by Ministry of Agriculture (MOA), Malaysia. Most herbs including misai kucing are always consumed in dried form, so drying is the most important process in herbal preparation. Efficient drying technique needs to be established in order to produce herbal products of a premium quality for maximum health benefits. Improper drying will cause reduction in product quality especially the content of bioactive compounds. Continuous drying is the most common method used by herbs producers in Malaysia and its effect on phytochemical content is well documented. However, there is a need to explore other drying technique such as adopting intermittent cooling process during drying for highest retention of phytochemicals in herbs. Stopping the drying process temporarily and putting the material under ambient condition is called intermittent cooling or ambient resting. So, this paper discusses the possibility to adopt intermittent cooling during drying of misai kucing. The effect of intermittent cooling time during drying on phytochemicals retention in misai kucing was investigated using a cabinet dryer. Intermittent cooling of 2 h during drying showed better retention of phytochemical contents in misai kucing as compared with continuous drying. The drying time and drying rate were not significantly affected by intermittent cooling treatment. Intermittent cooling for 2 h showed better retention of total flavonoid and rosmarinic acid contents. The level of rosmarinic acid which is the marker compound of misai kucing remained high after 2 h treatment.

**Keywords:** /Misai Kucing/ /Intermittent Cooling/Photochemical/

## SWEET PEPPER

Mohammad, S. and G. Fardin. 2013. Effect of acetyl salicylic acid on quality and chilling resistance of sweet pepper (*Capsicum annuum* L.) at different storage temperatures. Acta Hort. 1012: 559 – 568.

### Abstract

The effects of pre-storage treatments of acetyl salicylic acid (ASA) in three concentrations (0, 0.5 and 1 mM) on chilling resistance, proline content and qualitative parameters of sweet pepper fruits, packaged in plastic (polythene) bags and stored at 2 or 10°C, were evaluated at 0, 8 and 21 days of storage period. The chilling resistance indices such as proline content, electrolyte leakage (EL) and chilling index (CI) and qualitative parameters were elucidated in the fruits of experimental sets and they were compared with that of a control set. Fruits treated with ASA and stored at 2°C showed a significant ( $p < 0.05$ ) delay in changes of weight, total soluble solids (TSS), pH, titratable acidity (TA) and proline content compared to untreated control fruits. Chilling symptoms were more obvious in fruits that were stored in higher temperature with longer storage time as indicated by CI. ASA treatments led to accumulation of proline during storage. Thus, it may be concluded that the ASA treatments (especially in 0.5 mM concentration) may ameliorate chilling injury, enhancing the keeping quality while retaining the nutritional quality of sweet peppers more than that of control fruits in chilling conditions.

**Keywords:** /Sweet Pepper/ /Quality/ /Storage/

## **ORNAMENTALS**

### **ACACIA HOLOSERICEA**

N.M. Che Husin, et. al. 2013. Gel occlusion in the xylem vessels of cut *acacia holosericea* foliage. Acta Hort. 1012: 369 – 374.

#### **Abstract**

The short commercial vase life of cut *Acacia holosericea* foliage is potentially the result of physiologically-mediated xylem vessel occlusion. Xylem-occluding gels are considered to be a defence and wound healing mechanism. In ~45 cm-long cut *A. holosericea* foliage stems, occluding gel secretions were observed in xylem vessel lumens at the cut end and for up to 35 cm distally from the cut end. The gels were deposited soon after the stems were detached (mechanically wounded) and they apparently matured over time. Early gels were transparent and colourless in reaction with phloroglucinol-HCl (P-HCl). The staining of late gels with P-HCl was typically pink to cherry red, amber and yellow, or light brown to dark brown. The deposition of gels evidently reduced the xylem hydraulic conductance (*Kh*) of cut *A. holosericea* foliage stems.

**Keywords:** /Acacia Holosericea/ /Foliage/

### **CARNATION**

Chaman, Hamed Ss., et.al. 2013. Postharvest longevity and quality of cut *carnations*, 'Pax' and 'Tabor', as affected by silver nanoparticles. Acta Hort. 1012: 527 – 532.

#### **Abstract**

Carnation (*Dianthus caryophyllus* L.) is one of the most important cut flowers around the world. In cut-flower production, improvement of postharvest longevity and quality besides minimizing wastes are considered as strategic objectives. These kinds of flowers are sensitive to microbial contamination in vase solution, which led to shortened vase life as a result of blocking stem vessels on the cut surfaces. Silver nanoparticles (SNP) are novel antimicrobial agents in extending postharvest longevity of cut flowers. Antimicrobial effects of SNP are due to structural changes in bacterial cell membrane and finally cell death. In this experiment, the effects of four concentrations of SNP including 0 (control), 5, 10 and 20 µl L<sup>-1</sup> beside silver nitrate at 100 µl L<sup>-1</sup>, all with 4% sucrose in continuous solution were evaluated on extending postharvest longevity and quality of two cut carnations, 'Pax' and 'Tabor'. Electrolyte leakage (EL), chlorophyll (Chl) content, turbidity solution, relative fresh weight (RFW) and solution uptake were also the other traits assessed during this experiment. The results showed the use of continuous solution containing 5 µl L<sup>-1</sup> SNP could increase the vase life of cut carnations up to 8.7 and 5.8 days in 'Pax' and 'Tabor' cultivars, respectively. Also indicated that the concentration of 5 µl L<sup>-1</sup> SNP was not only effective in extending the longevity of the cut carnations but also preserving the quality of the flowers as well.

**Keywords:** /Carnation/ /Cut flower/ /Vase Life/

Fanhua Zhang, Fanhua, et.al. 2014. Low temperature phosphine fumigation for postharvest control of *Liriomyza huidobrensis* Blanchard (Diptera: Agromyzidae) on *carnation*. Postharvest Biol. & Technol. 88: 40 – 45.

Phosphine (PH<sub>3</sub>) fumigation with different concentrations and exposure durations at low temperature was studied to determine its effects on *Liriomyza huidobrensis* Blanchard (Diptera: Agromyzidae) on carnations, and on postharvest quality. Laboratory tests showed that tolerance of *L. huidobrensis* to phosphine fumigation at 5°C varied with different life stages. 1 d-old eggs and adults showed the highest susceptibility, and 3 d-old eggs was the most tolerant stage. In the fumigation tests of 3 d-old eggs with a range of phosphine concentrations from 0.46 to 2.73 mg L<sup>-1</sup> and exposure durations from 6 to 144 h at 5°C, 85.96–282.08 h fumigation durations were required to achieve 99% mortality with different phosphine concentrations. The expression of  $C0.77T = k$  was obtained, which

indicated that exposure duration other than phosphine concentration was the critical factor in the toxicity of phosphine against the 3 d-old egg of *L. huidobrensis*. Controlled atmosphere (CA) treatment with increased CO<sub>2</sub> and reduced O<sub>2</sub> had synergistic effects on phosphine toxicity. Phosphine fumigation could achieve 100% mortality for insects of *L. huidobrensis* on carnation, and had no significant adverse effects on vase life and damage indices of carnation at 1.92 mg L<sup>-1</sup> PH<sub>3</sub> and 8% CO<sub>2</sub> for 32 h, and at 3.44 mg L<sup>-1</sup> for 3 d at 5°C. All results suggested that phosphine fumigation at low temperature could be used as an alternative for postharvest control of *L. huidobrensis* on carnations.

**Keywords:** /Carnation/ /Vase life/ /Postharvest Control/

## CUCURMA ALISMATIFOLIA

Taheri, S., et. al. 2013. Effect of chronic gamma irradiation on vase life of *Curcuma alismatifolia* cultivars. Acta Hort. 1012: 547 – 550.

### Abstract

*Curcuma* (*Curcuma alismatifolia*) is a monocotyledonous perennial, a member of the ginger family (*Zingiberaceae*) originating from tropical and subtropical areas of northern Thailand and Cambodia. Because of their colorful, long-lasting and showy inflorescence, *Curcuma alismatifolia* cultivars have a great potential for use as a cut flower, potting plant and garden plant. The inflorescence comprises a number of pink coma bracts in the upper part and green coma bracts in the lower part, with small true flowers. Gamma irradiation is one of the most common procedures in plant mutagenesis. Chronic irradiation is an exposure to ionizing radiation over an extended period (hours, weeks, months) depending on their nature, sensitivity and research requirements. Effects of chronic gamma irradiation on vase life of harvested inflorescences of four *Curcuma alismatifolia* cultivars, namely 'Doi Tung 554', 'Chiang Mai Red', 'Sweet Pink' and 'Kimono Pink' was investigated at gamma green house (GGH) of the Malaysian Nuclear Agency (Nuclear Malaysia), Bangi, Malaysia. Five chronic radiation doses of 0, 6.25, 8.8, 14.6, 33, and 87.4 Gy at dose rates of 0.02, 0.03, 0.05, 0.11, 0.3 (Gy/h) respectively were applied. Both cut flowers and true flowers were damaged by irradiation. Irradiated inflorescences showed earlier browning in bract tips, smaller size of inflorescence and less true flowers. Vase life of irradiated flowers was reduced and the flowers wilted within 5-7 days after treatment. Untreated inflorescence had a vase life of 10-14 days.

**Keywords:** /Curcuma alismatifolia/ /Chronic Gamma Radiation/ /Vase Life/

## ONCIDIUM

Umikalsum, M.B., et. al. 2013. expression of ethylene receptor gene from *Oncidium* 'gower ramsey' during flower senescence. Acta Hort. 1012: 141 - 148.

### Abstract

The process of flower senescence is influenced by the plant hormone, ethylene. In *Arabidopsis*, ethylene perception is controlled by a family of five genes, including *ETHYLENE RESPONSE 1 (ETR1)*, *ETHYLENE RESPONSE SENSOR 1 (ERS1)*, *ETHYLENE RESPONSE 2 (ETR2)*, *ETHYLENE RESPONSE SENSOR 2 (ERS2)* and *ETHYLENE-INSENSITIVE 4 (EIN4)*. They fall into two subfamilies based on their sequence similarities. In flower, it has been reported that a similar set of genes is also involved. The changes in gene expression in ethylene signaling during senescence of orchid's flowers were studied. Total RNA was extracted from the self-pollinated *Oncidium* 'Gower Ramsey' flowers followed with reverse transcriptase-polymerase chain reaction (RT-PCR). Previously, an ethylene gene named *ER25*, was cloned, which encodes for a protein that has a missing region in the histidine kinase domain as compared to the sequence of ER protein for a similar orchid hybrid. In this study, the result demonstrated that the expression of the isolated gene was successfully detected by real-time RT-PCR at a very low

level in the tested flower tissues, as well as in roots. Results suggest that *ER25* may be involved in the development of different plant tissues.

**Keywords:** /Oncidium/ /Gene Expression/ /Dancing Lady/

## ORCHIDS

Azlin, Nur R., et. al. 2013. Potential use of 1-methylcyclopropene (1-mcp) treatment to reduce bud and flower abscission in *Mokara* orchids. Acta Hort. 1012: 589 - 592.

### Abstract

*Mokara* 'Oriental Red' and 'Chao Praya Pink' cut orchids were treated with or without 10 ppm 1-MCP for 4 h at 25°C. All samples were then exposed to 1 ppm ethylene for 16 h and placed in sugar solution at 25°C. In *Mokara* 'Oriental Red' cut orchids, 20-80% of the floral buds and 0-20% of the open flowers abscised within 1 week. However, in 1-MCP-treated samples, all floral buds and all open flowers were maintained during vase life in the first week, and abscised within 2 weeks of treatment. In *Mokara* 'Chao Praya pink', the 1-MCP pre-treatment also extended the vase life from 14 days in control to 21 days in treated samples. 1-MCP treatment also reduced ACC oxidase activity in 'Chao Praya Pink' cut orchid. *Mokara* 'Oriental Red' and *Mokara* 'Chao Praya Pink' cut orchids appear to respond well to 1-MCP pre-treatment, but further studies are required to confirm that effect.

**Keywords:** /Orchids/ /ACC Oxidase Activity/ /Ethylene Production/ /Vase Life/

Rahman, M.M., et. al. 2013. Leaf extracts of *Jatropha curcas*, *Psidium guajava* and *Andrographis paniculata* control microbial population in the vase solution of cut 'mokara red' orchid flower. Acta Hort. 1012: 593 - 598.

### Abstract

Contamination by microbes in the vase solution causes petal wilting and discoloration of cut flowers, thus reducing vase life. Cut 'Mokara Red' orchid flower was used to determine the effect of leaf extracts from *Jatropha curcas* (J), *Psidium guajava* (P), and *Andrographis paniculata* (A) on microbial populations in the vase solution. Freshly cut 'Mokara Red' orchid flowers were placed in vase solutions containing leaf extracts (0, 5, 10, and 15 mg/L) + 2% sucrose (S) + 3% citric acid (C). Their effects were compared with a standard solution (STD) of 125 mg/L 8-hydroxyquinoline citrate+S+C as a positive control. Tap water (TW) was used as a negative control. The experiment was a completely randomized design with five replications. The effects of the treatments on vase life and quality of the cut flower were measured. The results indicated that flower in the vase solution containing paired combination of JASC and JPSC leaf extracts had 13-17% higher water uptake, during 10 days of treatment, compared to flower in the STD vase solution. Flower with high water uptake was associated with an extended vase life. Fungi and bacteria were not found in the paired combination of JASC and JPSC leaf extracts treated vase solution, respectively. Flower in the JPSC leaf extracts treated vase solution retained better petal colour 3 days longer than the other flower. Thus, leaf extracts of *J. curcas* in combination with *P. guajava* has the potential to minimize microbial populations in a cut flower preservative solution and extend the vase life of the flower.

**Keywords:** /Orchids/ /Mokara/ /Petal Colour/ /Vase Life

## ROSE

Ashtari, M., E. Hadavi and J. Hekmati. 2013. Application of various levels of malic acid and salicylic acid as pulse treatment on durability of 'utopia' cut rose. Acta Hort. 1012: 413 -418.

### Abstract

Short vase-life of cut flowers after harvest leads to problems in transportation and marketing during long distances. Several efforts have been made in increasing the vase-life of cut roses using salicylic acid. In this test, four levels of malic acid (0, 2, 4, and 6 mM) and three levels of salicylic acid (0, 1 and 1.5 mM) were used in a full randomized factorial test on 108 cut roses as pulse treatment. The test was replicated twice with three roses in each repetition. Traits investigated in this test included flower vase life, malondialdehyde (MDA) content, total chlorophyll, fresh weight, flower diameter and quality. Results indicated that both salicylic acid and malic acid had increased flower vase-life and decreased the MDA content, while malic acid had decreased fresh weight loss and increased flower diameter. The vase-life of the flowers was longer in treatment containing 6 mM of malic acid and 1.5 mM salicylic acid. Direct relation was observed between flower vase-life and increased of fresh weight. The treatments have the potential for commercial use in increasing the vase-life of cut roses besides being environmentally friendly.

**Keywords:** /Rose/ /Cut Flowers/ /Organic Acid/ /Vase Life/

Farhad, F., H. Ebrahim and H. Jamshid. 2013. Glutamin and malic acid increased the vase life of cut rose flowers ('avalanch'). Acta Hort. 1012: 461 - 466.

#### **Abstract**

Rose is one of the worlds and Iran's most popular flower or cut flowers. The study was aimed to increase vase life of cut rose flowers. The experimental factors were malic acid (0, 1.5 and 3 mM), succinic acid (0, 1.5 and 3 mM) and glutamin (0 and 5 mM). The treatments were compared with one external control treatment (200 mg L<sup>-1</sup> HQS). The effects of treatments and their interaction on the total chlorophyll content, membrane stability and malondialdehyde content, vase-life, solution uptake, wet weight and flower diameter of cut flowers of rose was observed. The results indicate that experimental factors significantly affected flower parameters. Maximum flower vase life was recorded in M3S0G5 (malic acid 3 mM+ succinic acid 0 mM + glutamine 5 mM) with average vase life of 15 days.

**Keywords:** /Rose/ /Cut Flower/ /Preservative Solution/ /Malic Acid/

Hashemabadi, D. et. al. 2013. Evaluation of silver nano particles (SNP) and boric acid on longevity and quality of cut rose 'yellow island'. Acta Hort. 1012: 391 - 398.

#### **Abstract**

Effect of pulse treatment of silver nano particles (SNP) (0, 5, 10, and 15 mg/L) and boric acid (0, 100, 200 and 300 mg/L) were evaluated in a factorial experiment based on RBD in 3 replications. In this study, vase life, ethylene production, chlorophyll index, amount of  $\beta$ -carotene in petals and number of bacterial colonies in stem end were measured. Effect of boric acid, nano-silver and interaction effect of them on vase life, ethylene production and amount of  $\beta$ -carotene in petals were significant ( $p \leq 0.01$ ). Nano-silver had significant effect on the number of bacterial colonies in stem end ( $p \leq 0.01$ ), but had no significant effect on chlorophyll index. The most vase life was observed in 100 mg/L boric acid (9.69 days), the least ethylene production (0.59 nl/L/h/g) was obtained in 100 mg/L boric acid and 5 mg/L nanosilver, while ethylene production in the control plants was 2.42 nl/L/h/g. All concentrations of SNP decreased microbial load of stem end compared to the control flowers. Boric acid diminished the amount of  $\beta$ -carotene in petals but SNP had positive effect on this trait.

**Keywords:** /Rose/ /Vase Life/ /Ethylene Production/ /Nano-silver/

Jowkar, .M., et. al. 2013. Evaluation of aluminum sulfate as vase solution biocide on postharvest microbial and physiological properties of 'cherry brandy' rose. Acta Hort. 1012: 615 - 626.

#### **Abstract**

The major cause of vase life reduction in cut flowers is water relation interruption which is mostly due to vase solution microbial proliferation and consequently vascular occlusion resulting in solution uptake reduction. In order to control microbial proliferation biocides are usually integrated in vase solution preservatives. Beside microbial proliferation control, biocides could affect cut flowers' quality and physiology in various aspects. In order to find an easy to use, non-toxic and inexpensive compound for large scale application, cut 'Cherry Brandy' roses were treated with aluminum sulfate (100, 200 and 300 mg L<sup>-1</sup>) and sterilized distilled water (control). Effects of aluminum sulfate application as vase solution biocide and its impact on vase life, water relation, vase solution microbial kind and population beside different physiological parameters such as chlorophyll degradation, chlorophyll fluorescence and membrane permeability were investigated. Results indicated that aluminum sulfate treatment significantly increased vase life and improved postharvest visual quality of this cultivar by retaining leaf freshness even at the end of vase life. Controversially solution uptake was reduced at most stages of vase life by aluminum sulfate application; while fresh weight was best retained by this compound especially during the second week of vase life. This compound significantly controlled microbial proliferation resulting in zero contamination until day 4. After which a few isolates of *Bacillus subtilis*, *Bacillus polymyxa*, *Pectobacterium* sp. *Coccus* and *Fusarium solani* were found. Membrane permeability was best maintained by 300 mg L<sup>-1</sup> aluminum sulfate treatment. Besides that, aluminum sulfate increased leaf chlorophyll content while it resulted in chlorophyll fluorescence reduction during vase life.

**Keywords:** /Rose/ /Postharvest/

## **TORCH GINGER**

Choon. S.Y. and P. Ding. 2013. Sucrose affects postharvest characteristics of torch ginger (*Etilingera elatior*) inflorescence. Acta Hort. 1012: 581 – 588.

### **Abstract**

Torch ginger (*Etilingera elatior*) is a native plant in Malaysia commonly used for culinary purposes. The use of torch ginger inflorescence as cut flower is new in Malaysia. Therefore, the effects of sucrose on the postharvest characteristics of cut torch ginger inflorescence were evaluated in this study. Sucrose at different concentrations (5, 10, 15 and 20%) was used as vase solution and distilled water as control treatment. Postharvest characteristics including vase solution uptake rate, fresh weight of cut stems and bud diameter were determined. The supplementation of sucrose at different concentrations in vase solution significantly increased the vase solution uptake, fresh weight and bud diameter compared to control treatment. Increased vase solution uptake, fresh weight and bud diameter were shown from day 0 to day 2 in all vase solutions. However, significant reduction was shown on day 4 and decrease thereafter until the end of vase life. Fresh weight was positively correlated with vase solution uptake and bud diameter. Therefore, low vase solution uptake could be a possible cause of the reduction in fresh weight and bud diameter resulting in loss of vase life. The bracts started to dry and browning appeared when fresh weight decreased while reduction of bud diameter caused the bulb to fail to open. Supplementation of sucrose in vase solution reduced bracts browning. However, the result was not satisfactory due to the low vase solution uptake. Low vase solution uptake caused insufficient energy resource for the continuous growth and development of cut inflorescence. Further research will be conducted to determine the causes of low vase solution uptake and the use of other postharvest treatment, to improve the postharvest quality and extend the vase life of cut torch ginger inflorescence.

**Keywords:** /Torch Ginger/ /Cut Flowers/ /Postharvest Physiology/ /Vase Life/

## **TUBERS & ROOTCROPS**

### **SWEET POTATO**

Amoah, R. and L.A. Terry. 2013. Biochemical and physiological changes in stored **sweet potatoes** as mediated by 1-methylcyclopropene (1-MCP). Acta Hort. 1012: 345 - 352.

#### **Abstract**

Many countries in Africa are currently promoting the consumption of sweet potato (*Ipomoea batatas* (L.) Lam.) as a public health tool for improved child and maternal nutrition. The difficulties in long-term storage of sweet potato roots, however, pose a major challenge in its role as a food security crop. This study investigated the effects of 1-methylcyclopropene (1-MCP) as a potential treatment to prolong the postharvest life of sweet potato since the ethylene inhibitor and indeed ethylene have been shown to affect other non-climacteric crops which also produce very low ethylene levels. Two sweet potato cultivars, organic 'Covington' and Portuguese-derived 'Covington' were treated with 1-MCP (1.0 µl L<sup>-1</sup>) for 24 h and stored at 15°C. At periodic intervals, samples were randomly collected from storage and the decay, saleable weight, dry matter, sprouting and respiration evaluated. The spatial variations of non-structural sugars (maltose, fructose, glucose, sucrose) and individual phenolics (chlorogenic acid, iso-chlorogenic acids, caffeic acid, coumaric acid and ferulic acid) in the organic 'Covington' were assessed at the proximal (stem end), middle, and distal (root end) segments for both skin and flesh tissues using high performance liquid chromatography. 1-MCP treatment significantly reduced weight loss and decay development in both cultivars. Phenolic compounds and dry matter were more abundant in the skin than flesh for all segments with the proximal sections accumulating higher amounts with time. The proximal dominance in phenolics accumulation was significantly more pronounced in the 1-MCP-treated roots. No sprouting was recorded in both cultivars for treated and control roots. The implications of the use of 1-MCP on sweet potato and the accompanying physiological and biochemical changes are discussed.

**Keywords:** /Sweet Potato/ /Respiration/ /Decay/ /Weight Loss/

### **TARO**

Chang, M., et. al. 2013. Effects of heat treatment on the quality of fresh-cut **taro**. Acta Hort. 1012: 939 – 946.

#### **Abstract**

It is known that heat treatment may have positive effects on fruits and vegetables quality such as extending storability and marketing by inhibition of browning. However, little is known about the effects of heat treatment on the quality of fresh-cut taro. This study investigated the changes in quality of fresh-cut taro after being treated with hot water. Taro was cultivated in horticultural farms of DukSung Women's University in Seoul, Korea. After harvesting, the taro was washed, peeled and dipped for 1 min in water at 55°C. After air-drying at room temperature, the samples were packaged with polyethylene (PE) films and vacuum (V). And then they were stored at 4°C for 12 days. Changes in the weight loss rate, color, microorganisms and appearance were measured. In general, the weight loss rate increased slightly in hot water treated taro. Application of heat treatment at 55°C hot water delayed browning of taro. The L value of taro treated with hot water was higher than those of others and the color differences value (ΔE) was lower than those without hot water treatment. Taro treated with hot water at 55°C showed the best organoleptic quality and appearance. The use of 55°C hot water treatment improved the quality of fresh-cut taro including inhibition of browning and extension of shelf life.

**Keywords:** /Taro/ /Fresh Cut/ /Heat Treatment/ /Browning/