

SELECTIVE DISSEMINATION OF INFORMATION
As of December 2020

APPLE

Khanal, B. P., Mekonnen, S. B., & Knoche, M. (2020). Shading affects fracture force and fracture strain of apple fruit skins. *Scientia Horticulturae*, 274, 109651. doi: 10.1016/j.scienta.2020.109651

Abstract

Simple observation shows that naturally shaded apple fruit are more prone to russeting than sun-exposed fruit. The formation of microcracks in the fruit skin is the first visible sign of russeting. Our objective was to establish the effects of different levels of shading on the mechanical properties of apple (*Malus × domestica* Borkh.) fruit skins. Exposure of developing 'Idared' apples to visible and UV light was varied by shade-bagging and by sampling fruit from naturally shaded and exposed positions in the canopy. Fruit exposure to UV light was also varied using UV-absorbing film. Epidermal skin segments were excised, the cuticular membranes were isolated enzymatically and both were subjected to uniaxial tensile testing. Partial shading or blocking of UV light decreased the frequency of fruit having a red surface and also reduced the intensity of the red coloration, as indexed by increases in hue angle. The stiffness of epidermal skin segments was not affected by partial shading but fracture force and fracture strain were decreased. Blockage of UV slightly increased stiffness and decreased fracture force and fracture strain. The stiffness, fracture force and fracture strain of isolated cuticle samples were all markedly less than of epidermal skin segments. This indicates that, regardless of light treatment (visible and/or UV), it is the cellular layers of the skin, not the cuticle, that represent the load-bearing structure. There were no effects of shading or of UV blockage on cell size, cell shape or cell aspect ratio of either epidermal or hypodermal cells, or on sizes of parenchyma cells. There were also no detectable effects of shading or of UV blockage on thickness or wax content of the cuticle. We conclude that the effect of shading (visible and UV light) on the mechanical properties of the apple fruit skin was small, but was nevertheless consistent with an increase in the russet susceptibility of shaded fruit.

Keywords: *Malus × domestica* /Skin/ /Light/ /Mechanical properties/ /Fracture strain/ /Fracture force/ /Stiffness/

Tomala, K., Grzęda, M., Guzek, D., Głąbska, D., & Gutkowska, K. (2020). The effects of preharvest 1-methylcyclopropene (1-MCP) treatment on the fruit quality parameters of cold-stored 'szampion' cultivar apples. *Agriculture (Switzerland)*, 10(3). doi: 10.3390/agriculture10030080

Abstract

Postharvest treatment by 1-methylcyclopropene (1-MCP) for 'Szampion' cultivar apples inhibits ripening of climacteric fruit by blocking ethylene receptors, preventing ethylene from binding and eliciting its action. It is also possible to apply 1-MCP preharvest, which so far has not been studied for the 'Szampion' cultivar. The aim of this study was to assess the effects of preharvest

1-MCP treatment on the fruit quality parameters of cold-stored 'Szampion' cultivar apples in a Polish experiment. Two identical groups of apple trees (6 years, experimental orchard in Warsaw) were included, to obtain studied apples (preharvest 1-MCP treatment with Harvista™, 150 g/ha, 7 days before the optimum harvesting window, OHW) and control apples (1-MCP not applied). Apples for the studied group were harvested twice—on 28 September (OHW) and 24 October (delayed harvesting)—and for the control group once—on 28 September, as before 24 October the majority of apples fell from trees. Afterwards, apples were stored in an Ultra Low Oxygen chamber (1.2% CO₂, 1.2% O₂). Apples were assessed in the preharvest period (weekly, six measurements for the studied group, and five measurements for the control group) and postharvest period (monthly, three measurements separately for each harvest time for the studied group and control group). The following parameters were assessed: internal ethylene content (IEC), firmness, total soluble solids (TSS) content, starch index, Streif index, titratable acidity (TA), and color for blush. For the pre harvest period, statistically significant differences between the studied group and the control group were observed for IEC, the a* coordinate of color ($p < 0.05$; for apples treated with 1-MCP lower results), firmness, Streif index, TA ($p < 0.05$; higher results), and starch index ($p < 0.05$; no defined trend). For the postharvest period, statistically significant differences between the studied group and the control group were observed for apples harvested in the OHW for firmness ($p < 0.05$; for apples treated with 1-MCP higher results) and IEC ($p < 0.05$; no defined trend), while for delayed harvesting the differences were only minor. It may be concluded that preharvest 1-MCP application makes it possible not only to obtain better results for 'Szampion' cultivar apples' quality parameters, but also allows delayed harvesting without deterioration in quality.

Keywords: /1-methylcyclopropene/ /1-MCP/ /preharvest/ /'Szampion'/ /quality/ /ethylene production/ starch index/ /total soluble solids/ /titratable acidity/ /firmness/ /Streif index/ /color/

BAMBOO SHOOT

Qi, X., Ji, Z., Lin, C., Li, S., Liu, J., Kan, J., ... Qian, C. (2020). Nitric oxide alleviates lignification and softening of water bamboo (*Zizania latifolia*) shoots during postharvest storage. *Food Chemistry*, 332, 127416. doi: 10.1016/j.foodchem.2020.127416

Abstract

Water bamboo shoots quickly deteriorate after harvest as a result of rapid lignification and softening. Nitric oxide (NO) has been used to extend the postharvest life of several other vegetables. Here, we examined the effect of NO on the storage of water bamboo shoots at 4°C for 28 days. Without NO, fresh weight and firmness decreased quickly, while the cellulose and lignin contents increased sharply during storage. NO treatment delayed softening by maintaining the integrity of the cell wall and inhibiting the degradation of protopectin and the expressions of pectin methylesterase and polygalacturonase. NO treatment also delayed cellulose synthesis by increasing cellulase activity. NO treatment decreased the synthesis of lignin by inhibiting the activities of phenylalanine ammonia-lyase, cinnamyl alcohol dehydrogenase, laccase and peroxidase. These results indicate that NO treatment is effective at suppressing the softening and lignification of water bamboo shoots during postharvest storage.

Keywords: /Lignification/ /Nitric oxide/ /Pectin methylesterase/ /Phenylalanine ammonia-lyase/ /Softening/ /Water bamboo shoots, *Zizania latifolia*/

BASELLA RUBRA

Sravan Kumar, S., Singh Chauhan, A., & Giridhar, P. (2020). Nanoliposomal encapsulation mediated enhancement of betalain stability: Characterisation, storage stability and antioxidant activity of *Basella rubra* L. fruits for its applications in vegan gummy candies. *Food Chemistry*, 333, 127442. doi: 10.1016/j.foodchem.2020.127442

Abstract

Betalains are violet-red, natural food grade pigments with health benefits; however, their stability limits its use in industrial food processing. This can be overcome by placing the betalains in lecithin nanoliposomes (NLs), which causes a 76% improvement of betalain colour and stability. Extended sonication time (8 min) lowered the zeta potential (−47.5 to −40.8), and particle size (74.23 to 55.35 nm). Zeta potential, particle size, and polydispersity index of Betalain NLs (BNLs) didn't change significantly during storage (40 days). Degradation in the colour of BNLs was observed only at 121 °C (20 min) while the native juice degraded at 100 °C (20 min). BNLs were incorporated in gummy candies (GuCa) to improve its colour stability. The betalain retention, colour, texture, antioxidant activity, and shelf-life of the GuCa during storage (5 °C, 28 days) demonstrated the efficacy of BNLs to be explored as a natural colourant for the food industry.

Keywords: /*Basella rubra*/ /Betalains/ /Nanoliposomes/ /Zeta potentials/ /Gummy candies/

BELL PEPPER

Kong, X., Ge, W., Wei, B., Zhou, Q., Zhou, X., Zhao, Y., & Ji, S. (2020). Melatonin ameliorates chilling injury in green bell peppers during storage by regulating membrane lipid metabolism and antioxidant capacity. *Postharvest Biology and Technology*, 170, 111315. doi: 10.1016/j.postharvbio.2020.111315

Abstract

Melatonin is a kind of indoleamine that plays an important role against abiotic stress. In the current study, we investigated the effect of exogenous melatonin (100 µM) on bell pepper during storage at 4 °C for 20 d and afterward shelf at 20 °C for 3 d. Melatonin treatment reduced cell structure damage and lightened the increase in chilling injury incidence, membrane permeability, and malonaldehyde (MDA) content under cold stress. The membrane lipid content and the ratio of unsaturated to saturated fatty acids increased by reducing the enzymatic activity and transcripts of phospholipase D (PLD) and lipoxygenase (LOX). Besides, melatonin application also inhibited the transcription of *CaNAC1*, which is the direct targeted regulator of the *CaPLD* gene. In addition, peppers treated with melatonin had a higher proline content than untreated peppers. Moreover, melatonin triggered the antioxidation protection system in peppers to resist oxidative damage by up-regulating the transcription level of the *CaSOD*,

CaPOD, *CaCAT*, and *CaAPX* genes. Our results show that melatonin treatment may be a reliable method to relieve chilling injury in bell pepper fruit via the alleviation of cold-induced membrane lipid peroxidation and activating an antioxidant defense system.

Keywords: /Green bell pepper/ /Cold stress/ /Membrane lipid peroxidation/ /Melatonin/ /Antioxidation/

Padmanabhan, P., Cheema, A. S., Todd, J. F., Lim, L., Paliyath, G., & Pepper, B. (2020). Ripening responses , fruit quality and phospholipase D gene expression in bell peppers exposed to hexanal vapor. *Postharvest Biology and Technology*, 170, 111317. doi: 10.1016/j.postharvbio.2020.111317

Abstract

Phospholipase D (PLD) is a key enzyme involved in membrane lipid catabolism. Hexanal, a C6 volatile aldehyde is a strong PLD -inhibitor, and has been observed to enhance the shelf life and quality of horticultural produce. In the present study, the effect of hexanal vapor exposure on the postharvest quality and ripening response of bell pepper fruit was evaluated. Hexanal exposure for a minimum of 6 h was found to be essential to delay ripening in bell pepper fruit. Quantification of head space hexanal levels in the presence of pepper fruit revealed a gradual decrease in concentration, while it remained relatively steady close to the peak value in the absence of pepper fruit. Hexanal treated bell peppers subjected to 21 d of postharvest storage evolved higher levels of aroma volatiles than untreated peppers. Hexanal vapor treatment induced significant alterations in the transcript accumulation and expression of genes involved in the carotenoid biosynthetic pathway, antioxidant enzyme systems, and the LOX pathway in stored pepper fruit. Real time PCR analysis also confirmed the near-complete downregulation of expression of genes encoding PLD α , β , δ and ζ isoforms in hexanal vapor treated peppers. The results suggest that hexanal vapor treatment can beneficially influence the expression of genes in multiple biochemical pathways, which could ultimately result in enhancing the shelf life and quality of horticultural produce.

Keywords: /*Capsicum annuum*/ /Bell Pepper/ /Hexanal/ /Postharvest/ /Phospholipase D/ /Volatiles/

Taheri, A., Behnamian, M., Dezhsetan, S., & Karimirad, R. (2020). Shelf life extension of bell pepper by application of chitosan nanoparticles containing *Heracleum persicum* fruit essential oil. *Postharvest Biology and Technology*, 170, 111313. doi: 10.1016/j.postharvbio.2020.111313

Abstract

In the present research, the impregnated filter papers with *Heracleum persicum* essential oil (HPEO) and HPEO loaded chitosan nanoparticles (HPEO-CSNPs) were put into packages and the effect of HPEO fumigation and controlled release of HPEO from HPEO-CSNPs on color, firmness, weight loss, total phenolic and flavonoid as well as ascorbic acid contents were evaluated. In addition, the activity of superoxide dismutase (SOD), catalase (CAT), peroxidase

(POD) and polyphenol oxidase (PPO) measured during 30 d of storage at 9 ± 1 °C. The HPEO was encapsulated in chitosan nanoparticles by ionic gelation technique. The synthesized nanocapsules were characterized by high resolution transmission electron microscopy (HRTEM) and dynamic light scattering (DLS) technique was used for the particle size distribution assay. According to HRTEM, the average size of HPEO-CSNPs were between 40–80 nm. At the end of storage, the lowest changes in color, firmness and weight and the highest contents of phenolic compounds, flavonoids and ascorbic acid were observed in samples packed with HPEO-CSNPs. In addition, the highest activity of SOD, CAT and POD was obtained in bell peppers treated with HPEO-CSNPs at the day 24 of storage, while PPO activity increased throughout the storage period, but its activity in control samples was higher than other treatments. The treated fruits with HPEO-CSNPs indicated overall acceptability up to day 24 of storage, while the untreated samples lost their acceptability on day 18. Our results revealed antioxidant activity of the investigated oil and effectiveness of its encapsulation to extend sweet bell pepper fruit shelf life.

Keywords: /Antioxidant/ /Biopolymer/ /Persian hogweed/ /Sweet bell pepper/

BLUEBERRY

Yuan, F., Yan, J., Yan, X., Liu, H., & Pan, S. (2020). Comparative transcriptome analysis of genes involved in volatile compound synthesis in blueberries (*Vaccinium virgatum*) during postharvest storage. *Postharvest Biology and Technology* 170, 111327. doi: 10.1016/j.postharvbio.2020.111327

Abstract

Transcriptional regulation of aroma formation genes during postharvest storage remains poorly understood in the blueberry. In order to have a better understanding of the transcriptional regulation processes that occur in rabbiteye blueberry during storage and their effect on the volatile composition change, we performed volatile metabolite profiling and transcriptomic analysis. Our study reveals that during postharvest storage, 'Garden blue' blueberry volatile composition changed by regulating several secondary metabolic pathways, in particular, by stimulating the expression of pyruvate decarboxylase (PDC) genes, resulting in a high production of ethyl acetate. Postharvest storage also modulated some terpene synthase (TPS) genes associated with linalool production. The concentration of C6 aldehydes and alcohols decreased during the postharvest storage accompanied by lower lipoxygenase (LOX) gene expression. These findings illustrate the molecular and biochemical mechanisms that occur in blueberry during the postharvest storage period, especially with regard to volatile composition changes.

Keywords: /Rabbiteye blueberry/ /Volatile compounds/ /Transcriptome analysis/ /Postharvest storage/

BROCCOLI

Aghdam, M. S., Sayyari, M., & Luo, Z. (2020). Exogenous application of phyto­sulfokine α (PSK α) delays yellowing and preserves nutritional quality of broccoli florets during cold storage. *Food Chemistry*, 333, 127481. doi: 10.1016/j.foodchem.2020.127481

Abstract

In this study, we tested the exogenous application of phyto­sulfokine α (PSK α) for delaying the yellowing of broccoli florets during cold storage. Our results showed that the lower yellowing in broccoli florets treated with 150 nM PSK α was probably due to the higher endogenous accumulation of PSK α , leading to the endogenous accumulation of guanosine 3', 5'-cyclic monophosphate (cGMP). Besides, broccoli florets treated with 150 nM PSK α exhibited a higher accumulation of phenols and flavonoids by triggering gene expression and activities of phenylalanine ammonia-lyase (*PAL*) and chalcone synthase (*CHS*). Moreover, the higher expression of L-galactotano-1,4-lactone dehydrogenase (*GLDH*) gene and the lower expression of ascorbic acid oxidase (*AAO*) gene in broccoli florets treated with 150 nM PSK α may be the reasons for the higher accumulation of ascorbic acid. In conclusion, the exogenous application of PSK α is a promising strategy in delaying the yellowing and preserving the nutritional quality of broccoli florets during cold storage.

Keywords: /Cold storage/ /Florets yellowing/ /cGMP accumulation/ /Nutritional quality/ /Phyto­sulfokine α /

CITRUS

Restuccia, C., Lombardo, M., Scavo, A., Mauromicale, G., & Cirvilleri, G. (2020). Combined application of antagonistic *Wickerhamomyces anomalus* BS91 strain and *Cynara cardunculus* L. leaf extracts for the control of postharvest decay of citrus fruit. *Food Microbiology*, 92, 103583. doi: 10.1016/j.fm.2020.103583

Abstract

Combined use of biocontrol agents and plant extracts can be considered a viable and promising strategy for protecting plant tissues with different synergistic mechanisms of action that improve the antimicrobial activity of the mixtures. Treatments of citrus fruits with *Wickerhamomyces anomalus* BS91 have been previously reported as effective measures to reduce the incidence of green mold caused by *Penicillium digitatum*. On the opposite, the knowledge of the antifungal activity of cultivated cardoon (*Cynara cardunculus* L. var. *altilis* DC.) leaf extract, vegetable widespread in some Mediterranean areas, is still very limited. In this study, experimental trials were conducted to evaluate the effectiveness *in vitro* of leaf aqueous, methanolic and ethanolic extracts of *C. cardunculus* against seven fungal pathogens responsible for considerable food losses in the post harvest stage. In addition, biocontrol yeast *W. anomalus* BS91 and the three *C. cardunculus* extracts were tested *in vivo* both as a single treatment and in mixture, against *Penicillium digitatum* on 'Tarocco' oranges and 'Femminello' lemons. The combination of *W. anomalus* BS91 and leaf ethanolic extract reduced with the highest efficacy the incidence and severity of green mold on orange and lemon fruits with respect to the control, and was more

effective than treatment with antagonistic yeast or leaf extracts applied alone. Incidence and severity of citrus decay were more consistently reduced when mixtures were applied 24 h before the inoculation of the pathogen, thus suggesting the relevance of preventive treatments. The mixtures of antagonistic *W. anomalus* BS91 and ethanolic leaf extract were more effective in controlling green mold decay on oranges than on lemons. These results indicate that biocontrol agents and leaf extracts, used in appropriate combinations, can provide a stronger protection than when used singularly. However, compatibility between microbial antagonist and antimicrobial extract should be preliminary verified.

Keywords: /Biocontrol/ /Yeasts/ /*Cynara cardunculus*/ /Citrus/ /Green mold/ /Postharvest/

CUCUMBER

Aslam, W., Noor, R. S., Hussain, F., Ameen, M., Ullah, S., & Chen, H. (2020). Evaluating morphological growth, yield, and postharvest fruit quality of cucumber (*Cucumis sativus* L.) grafted on cucurbitaceous rootstocks. *Agriculture (Switzerland)*, 10(4). doi: 10.3390/agriculture10040101

Abstract

Grafting is a substitute technique to boost tolerance against abiotic stresses, which also diminish root syndromes from soil-borne pathogens and increase crop production. This piloted study evaluates the tongue grafting technique and investigates the influence of grafting hybrid cucumber (Kalam F₁) scion onto local cucurbitaceous and hybrid rootstocks on plant morphology, fruit yield, nutrients concentration in different plant organs, and postharvest fruit quality during three seasons of 2017 to 2019, consecutively. The research design was completely randomized (CRD), and the effects of grafted rootstocks were determined with comparison of percent plant survival, growth characteristics, fruit yield, and texture properties (during storage). The experimental results indicated that all rootstocks presented compatibility with hybrid cucumber (Kalam F₁) scion and showed significant comparable performance with hybrid rootstock during all seasons in terms of vegetative growth, yield, and storage except pumpkin (68% during the 1st, 74% during the 2nd, and 71% during the 3rd seasons). The plants with Bottle gourd (*Lagenaria siceraria*) rootstock showed the highest survival rate as compared to all other cucurbitaceous and hybrid rootstocks during three seasons: 94%, 98%, and 93%, respectively. Similarly, the other factors such as plant height (613, 622, and 615 cm), fruit weight (282, 281, and 277 g), fruit shape index (7.77, 8.18, and 8.25), Total soluble solids (TSS) (5.1%, 5.17%, and 4.96%), fruit dry matter (4.55%, 4.625, and 4.57%), fruit yield (4.37, 4.9, and 3.95 kg/plant), and disease resistance index (<3) during three seasons were comparable with all other cucurbitaceous and hybrid rootstocks. The lower survival rate of pumpkin rootstock made a significant poor performance with lower growth, yield, nutrients, and storage than all other cucurbitaceous rootstocks. Ridge and Bitter gourds showed improved results for vegetative growth, yield, fruit characteristics, nutritional values, and storage performance than that of hybrid cucumber rootstock. The fruit textural and physical properties were found significantly better at 10 °C than 25 °C for 10 days of storage without quality deterioration, while no impact was perceived on physical properties of the fruit. According to economic analysis, the grafted cucumber production system showed higher net return and benefit-cost ratio (BCR) in comparison with the real rooted hybrid cucumber production system, which was assumed to be

profitable practice.

Keywords: /hybrid cucumber/ /tongue grafting/ /vegetative and fruit characteristics/ /plant nutrient concentration/ /storage performance/ /textural physical properties/

FIGS

Byeon, S., & Lee, J. (2020). Fruit quality and major primary metabolites differ across production systems in cold-stored figs (*Ficus carica* L .). *Scientia Horticulturae*, 274, 109669. doi: 10.1016/j.scienta.2020.109669

Abstract

The greenhouse production system is becoming popular in fig cultivation as a means to extend the harvest window and season of fig fruit. The aim of this study was to evaluate the comparative effects of two production systems (open field vs. greenhouse) on the physiological and biochemical responses in terms of fruit quality attributes and the major primary metabolites in 'Masui Dauphine' fig fruit stored at 0.5 °C for up to 30 days. Weight loss increased with storage duration and was much greater for fruits grown in the greenhouse than those grown in the open field; fruit length and diameter at the peduncle-end region decreased with storage duration and were much shorter in the greenhouse fruit than in the open field fruit; fruit respiration rate was higher in the open field fruit than in the greenhouse fruit during cold storage. The colour variables gradually decreased in peel tissues regardless of the tissue region but were not consistent in the cortex tissues during cold storage; and the glucose and fructose levels increased with storage duration, regardless of the production system. The organic acid contents were not consistent during cold storage—citric acid content was higher but fumaric acid content was lower in the open field fruit than in the greenhouse fruit. Aspartic acid, arginine, γ -aminobutyric acid, methionine, tryptophan, phenylalanine, leucine, and lysine levels were higher in the open field fruits than in greenhouse fruits, and vice-versa for glutamic acid. The results of multivariate data analyses, including a normalised heatmap matrix system, principal component analysis loading plot, and correlation coefficient matrix, indicated that fruit quality attributes and major metabolites responded differently to production systems during cold storage. Overall, the results suggested that production systems could affect fig fruit quality and storability as well as the concentrations of certain major metabolites during cold storage.

Keywords: /Open field cultivation system/ /Greenhouse cultivation system/ /Fruit physiological attributes/ /Soluble carbohydrates/ /Organic acids/ /Free amino acids/

FRUITS AND VEGETABLES

Che, J., Chen, Y., Wu, Y., Li, L., & Tao, N. (2020). Metabolomics analysis reveals that myrcene stimulates the spore germination of *Penicillium digitatum* via the upregulation of central carbon and energy metabolism, 170, 111329. doi: 10.1016/j.postharvbio.2020.111329

Abstract

Tremendous economic losses in the citrus industry are caused by infestations of *Penicillium digitatum*. Previous research has shown that the terpene myrcene in citrus essential oils could stimulate the spore germination and mycelial growth of *P. digitatum*. However, the underlying mechanism is poorly known. Here, how myrcene induces the spore germination of *P. digitatum* was elucidated. The addition of myrcene significantly promoted the spore germination of *P. digitatum* and green mold in citrus fruit. As the incubation time increased, the intracellular and extracellular myrcene contents both significantly decreased in myrcene-treated samples, and no downstream products were detected through a Gas Chromatography-Mass Spectrometer. Metabolomics analysis revealed that the contents of metabolites involved in central carbon metabolism, such as glycolysis, pentose phosphate pathway, and citrate cycle, were significantly affected after the addition of myrcene. The adenosine triphosphate content and the intracellular energy charge were also drastically increased. Overall, our results suggest that the ability of myrcene to stimulate the spore germination of *P. digitatum* might be mediated by the upregulation of central carbon and energy metabolism.

Keywords: /Myrcene/ /*Penicillium digitatum*/ /Spore germination/ /Metabolomics analysis/ /Central carbon and energy metabolism/

Kathiravan, S., Sundaram, E., Paulraj, B. A., Johnson, P. M., Huang, S. T., Mani, V., & Vasantha, V. S. (2020). Simple and selective optical biosensor using Ultrasonicator synthesis of 5-((anthracen-9-yl methylene) amino)-2,3-dihydrophthalazine-1,4-dione for direct detection of ascorbic acid in vegetables and fruits. *Food Chemistry*, 332, 127150. doi: 10.1016/j.foodchem.2020.127150

Abstract

We report an optical biosensor using imine, 5-((anthracene-9-ylmethylene) amino)-2,3dihydrophthalazine) 1–4-dione (ADD) for direct detection of ascorbic acid (AA) via FRET quenched. The ADD was successfully prepared by using a simple ultra - sonication method, which was characterized by various spectroscopic techniques. The fluorescence intensity of the ADD probe was drastically quenched in presence of AA, and showed excellent selectivity towards the detection of AA in presence of possible biological active interferences. A wide linear range from 0.25 to 190 μM was achieved towards the detection of AA with a LOD of 10 nM. The occurrence of FRET mechanism is due to intermolecular hydrogen bonding between ADD and AA, which was confirmed by Density Functional Theory calculations. Moreover, the biosensor was successfully applied for the detection of AA in real samples such as fruits and vegetables to demonstrate the practicability. In addition, the developed biosensor could be a simple and economically cheap platform for the detection of AA in food samples.

Keywords: /Ultrasonication/ /Ascorbic acid/ /Imine/ /FRET mechanism/ /Optical biosensor/ /Density Functional Theory/ /Vegetables and Fruits/

Hassan, A. B., Al Maiman, S. A., Sir Elkhatim, K. A., Elbadr, N. A., Alsulaim, S., Osman, M. A., & Mohamed Ahmed, I. A. (2020). Effect of UV-C radiation treatment on microbial load and antioxidant capacity in hot pepper, fennel and coriander. *Lwt*, *134*, 109946. doi: 10.1016/j.lwt.2020.109946

Abstract

Ultraviolet (UV-C) radiation treatment effects on microbial load, total phenolic content, total flavonoids and antioxidant activities of three spices, hot pepper, fennel and coriander, were investigated. Spice samples were placed 15 cm from the UV-C source for 20, 40 and 60 min to provide doses of 3.5, 7.0 and 10.4 kJ m⁻² inside the package. UV-C treatments significantly ($P < 0.05$) reduced the microbial load and *Salmonella* and *E. coli* were eliminated in all samples. The total phenolic content and total flavonoids greatly increased with an increasing exposure of UV-C in all samples ($P < 0.05$). Moreover, the antioxidant activity of the spices was enhanced after the UV-C treatment. These results indicate that UV-C treatment can maintain the quality of dried spices and be applied as an effective preservative method in food industries.

Keywords: /UV-C/ /Spices/ /Antioxidants/ /Microbial load/

Quansah, J. K., Escalante, C. L., Kunadu, A. P. H., Saalia, F. K., & Chen, J. (2020). Pre- and post-harvest practices of urban leafy green vegetable farmers in Accra, Ghana and their association with microbial quality of vegetables produced. *Agriculture (Switzerland)*, *10*(1), 3–6. doi: 10.3390/agriculture10010018

Abstract

Vegetable farming is the most practiced urban agriculture in Ghana. A previous study of our laboratory revealed poor microbial quality of, and presence of *Salmonella* on, leafy green vegetables grown or sold in Accra, Ghana. The aims of this study were to determine agricultural practices of urban vegetable farmers and the association between agricultural practices and microbial safety of vegetables produced. A survey was conducted among 102 farmers from 12 farming areas who produced exotic and indigenous leafy greens in Accra, Ghana to identify their farming practices. It was observed that water from waste drains pumped into shallow wells was used for irrigation by 70% of the farmers. Incompletely composted manure was commonly used (99%) in farming. Vegetables were usually harvested using bare hands (96%) and knives (73%) and transported mainly in sacks (94%) to market centers under non-refrigerated conditions. Over 60% of the farmers disagreed that the use of polluted irrigation water can contaminate vegetables or make consumers sick. According to the seemingly unrelated regression model, farmers with no formal education and less food safety knowledge and had been planting on their current farmlands for several years were likely to produce vegetables with higher fecal coliform and *Enterococcus* sp. counts compared to other farmers. Vegetables cultivated by farmers who disagreed that the use of contaminated water can make consumers sick were associated with the production of vegetables with high fecal coliform and *Enterococcus* sp. counts. Education and improved agricultural and post-harvest handling practices should be encouraged among vegetable producers in the area to improve food safety.

Keywords: /leafy green vegetable/ /vegetable farming practice/ /vegetable safety/ /manure/ /irrigation/

Ruiz-Moyano, S., Hernández, A., Galvan, A. I., Córdoba, M. G., Casquete, R., Serradilla, M. J., & Martín, A. (2020). Selection and application of antifungal VOCs-producing yeasts as biocontrol agents of grey mould in fruits. *Food Microbiology*, 92, 103556. doi: 10.1016/j.fm.2020.103556

Abstract

Rotting caused by grey mould (*Botrytis cinerea*) is a concerning disease for numerous crops both pre- and postharvest stages. Application of antagonistic yeasts is a promising strategy for controlling grey mould incidence which could mitigate undesirable consequences of using synthetic fungicides. In this work, a screening for detection of yeasts isolated from figs producers of antifungal volatile organic compounds (VOCs) were performed by confrontation in double dishes systems. Eleven out of 34 yeasts confronted reduced *B. cinerea* growth parameters in vitro. This reduction was correlated ($p \leq 0.050$) with the production of 10 volatile compounds: two acids (acetic acid and octanoic acid), 7 esters (Ethyl propionate, n-Propyl acetate, Isobutyl acetate, 2-methylbutyl acetate, furfuryl acetate, phenylmethyl acetate, 2-phenylethyl acetate) and one ketone (Heptan-2-one). In bases on in vitro assay, *Hanseniaspora uvarum* 793 was applied to *in vivo* assays with strawberries and cherries. The reduction of incidence of *B. cinerea* in strawberries at 7 °C and 25 °C was 54.9 and 72.1% after 6 and 3 days, respectively. The reduction of incidence of *B. cinerea* in cherries at 7 °C and 25 °C was 48.9 and 45.6% after 5 and 4 days, respectively. These results showed that VOCs produced by *Hanseniaspora uvarum* 793 are effective in the control of incidence of *Botrytis cinerea* in fruits, being a potential alternative to chemical fungicide.

Keywords: /Botrytis cinerea/ /Postharvest/ /Antifungal volatile compounds/ /Strawberry/ /Cherry/

GRAPE

Sun, F., Zhu, L., Wang, X., Cheng, J., Cui, B., Liu, J., ... Fu, M. (2020). Sucrose transportation control mediates the fresh-keeping effects of burdock fructooligosaccharide in 'Crimson Seedless' grapes. *Food Chemistry*, 332 (June), 127437. doi: 10.1016/j.foodchem.2020.127437

Abstract

In 'Crimson Seedless' grapes, the appearance of senescence caused by abnormal dark red color, the loss of crisp taste caused by the decrease in firmness, and the fading of sweetness caused by the decrease in total soluble sugar (TSS) are the main problems affecting its edible qualities after storage. In the mesocarp, burdock fructooligosaccharide (BFO) restricted sucrose export; therefore, more carbohydrates were retained directly leading to higher TSS and sweetness, and cell osmotic pressure and firmness were retained indirectly. In the exocarp, BFO restricted sucrose import; therefore, the signal molecule sucrose was reduced and the senescence-related processes were inhibited. The downregulation of *SUC12* and *SUC27* by

BFO may play an important role in restricting sucrose transportation. The opposing effects exhibited by exogenous sucrose treatments compared to those of BFO further verified these mechanisms. Based on the above mechanisms, sucrose transportation mediates the fresh-keeping effects of BFO in 'Crimson Seedless' grapes.

Keywords: /Burdock fructooligosaccharide/ /Grape/ /Sucrose/ /Sucrose transporter/ /SUC12/ /SUC27/

HYSSOP

Ahmadi, H., Babalar, M., Sarcheshmeh, M. A. A., Morshedloo, M. R., & Shokrpour, M. (2020). Effects of exogenous application of citrulline on prolonged water stress damages in hyssop (*Hyssopus officinalis* L.): Antioxidant activity, biochemical indices, and essential oils profile. *Food Chemistry*, 333, 127433. doi: 10.1016/j.foodchem.2020.127433

Abstract

This study examined the effects of exogenous citrulline (control, 1 and 2 mM) and water availability (100%, 50% and 25% WA) on antioxidant attributes and essential oil constituents of *Hyssopus officinalis* L. in two successive harvests. Hyssop tolerantly responded to water deficiency by well-promoted antioxidant enzymes (i.e., superoxide dismutase, and catalase), strong DPPH-scavenging activity, and increasing polyphenols; however, the essential oil content was negatively reduced by water stress. External citrulline further increased the activity of antioxidant enzymes. Citrulline application at 2 mM under severe water stress could also improve essential oil (EO) content in the first and second harvests by about 15 and 30%, respectively. Furthermore, under severe drought, citrulline at 2 mM could obtain the highest yield of isopinocampone (47%) as the main component of EO. The results showed the high potential of this novel applied metabolite agent to be used in a well-fulfilled production of this medicinal plant.

Keywords: /*Hyssopus officinalis* L./ /Antioxidant activity/ /Compatible solutes/ /Isopinocampone/ /Foliar treatment/

LETTUCE

Fasciglione, G., Goñi, M. G., Yommi, A. ., Perez-Bravo, J. J., Ortueta, R., Scampini, A., Buffa, L., Andreu, A. ., & Creus, C. . (2020). Revaluation of waste from fishing industry through generation of chitosan coatings to improve quality and extend shelf-life of minimally processed lettuce. *Postharvest Biology and Technology*, 170, 111310 . Doi: 10.1016/j.postharvbio.2020.111310

Abstract

Chitosan is obtained at industrial scale through a process of alkaline deacetylation of chitin, the major waste of the shrimp industry. Its utilization could both diminish industrial environmental impact and add value to foods and other industrial products. In this study, an industrial chitosan

obtained in Argentina and a commercial chitosan were physicochemically characterized and evaluated as edible coating for biopreservation of minimally processed lettuce. Based on Nuclear Magnetic Resonance, X-ray diffraction and thermogravimetric and viscosimetric assays we conclude that both biopolymers have similar molecular weight and deacetylation degree. The chitosan coatings were applied by spraying to lettuce leaves that had been removed and cleaned after the harvest. Each sample composed by four whole leaves, packed into a low-density polyethylene bag, was stored at 4 °C for 15 d. Microbial quality, weight and color losses, antioxidant contents, stomatal closure and sensorial attributes were evaluated during storage. An initial reduction of 2 log in molds and yeast counts were obtained for both types of chitosan coatings. As a result, the counts remained below the limit value of 6 log for 12 d in the chitosan coatings, while in the control samples this limit was reached 6 d after storage. Total mesophilic bacteria counts were also reduced by both types of chitosan coatings, keeping counts under the threshold value of 7 log for 12 d while in control samples this value was exceeded at 9 d. Both chitosans increased chlorophyll content, total phenolic compounds and antioxidant activity in lettuce leaves during the storage. Besides, the leaf weight loss was minimized by both chitosan coatings, in accordance with a higher proportion of stomatal partial closure as seen by SEM. The overall visual quality was not affected by chitosan coatings. In conclusion, the industrial chitosan showed similar effects on stored minimally processed lettuce than the commercial chitosan adding value to a material that is currently considered a waste.

Keywords: /Shrimp waste revaluation/ /Bio-preservation/ /Antioxidant phytochemicals/ /Sensorial quality/

Kyere, E. O., Qiu, G. W., Md Zain, S. N., Palmer, J., Wargent, J. J., Fletcher, G. C., & Flint, S. (2020). A comparison of *Listeria monocytogenes* contamination in bagged and un-bagged lettuce in supermarkets. *LWT*, 134, 110022. doi: 10.1016/j.lwt.2020.110022

Abstract

The popularity of bagged salads sold in the market has increased due to their ease of transportation and convenience but there are food safety risks. In this study, we examined the prevalence of *Listeria monocytogenes* (*L. monocytogenes*) in 100 samples of ready-to-eat bagged and non-bagged lettuces sold in supermarkets in New Zealand. We found five samples tested positive for *L. monocytogenes* and two further bagged lettuce samples which tested positive for other *Listeria* species. None of the un-bagged lettuce samples were contaminated with *Listeria*. The results of this survey indicate a higher microbial risk associated with consumption of bagged salads. This underlines the need for the fresh produce industry to ensure efficient sanitization of their produce before bagging to reduce the risk of *Listeria* contamination.

Keywords: /Fresh produce/ /*Listeria monocytogenes*/ /Supermarkets/ /Relative humidity/

Townsend, A., Li, S., Mann, D. A., & Deng, X. (2020). A quasimetagenomics method for concerted detection and subtyping of *Salmonella enterica* and *E. coli* O157:H7 from romaine lettuce. *Food Microbiology*, 92, 103575. doi: 10.1016/j.fm.2020.103575

Abstract

Quasimetagenomics refers to the sequencing of a modified food microbiome to facilitate combined detection and subtyping of targeted pathogens in a single workflow. Through quasi metagenomic sequencing, pathogens are detected and subtypes in a shortened time frame compared to traditional culture enrichment and whole genome sequencing-based analyses. While this method was previously used to detect and subtype *Salmonella enterica* from chicken, iceberg lettuce, and black pepper, it has not been applied to investigate multiple pathogens in one workflow. A quasi metagenomic method to concertedly detect and subtype *Salmonella enterica* and *Escherichia coli* O157:H7 from artificially contaminated romaine lettuce in a single workflow was developed. All quasi metagenomic samples with initial target pathogen inoculum levels of ~1 CFU/g were detected and serotyped after co-enrichment of the two pathogens for 12 h. Single nucleotide polymorphism typing was achievable for some initial pathogen inoculum levels as low as ~0.1 CFU/g. Our results suggest that this method can be used for concerted detection and subtyping of multiple bacterial pathogens from romaine lettuce even at low contamination levels.

Keywords: /Quasi Metagenomics/ /Romaine lettuce/ /E. coli/ /Salmonella/ /Detection/ /Subtyping/

MANGO

Liguori, G., Gentile, C., Sortino, G., Inglese, P., & Farina, V. (2020). Food quality, sensory attributes and nutraceutical value of fresh “Osteen” mango fruit grown under mediterranean subtropical climate compared to imported fruit. *Agriculture (Switzerland)*, 10(4). doi: 10.3390/agriculture10040103

Abstract

Mango is a fruit with a very short shelf-life due to its rapid ripeness after harvest; it is high in B vitamins, contains some amounts of magnesium, calcium, zinc, and selenium and it is rich in soluble and insoluble fibers. In order to reach the European markets at proper marketable maturity, fruit from tropical countries are harvested at an early maturity stage. Although this harvesting practice improves mango postharvest life, fruit reaches the market with very low quality, especially in terms of taste. The present study was conducted to evaluate food quality, sensory attributes and nutraceutical value of “Osteen” fresh Mediterranean Italian mango fruit, and imported ones coming from tropical countries. Mango fruit imported from abroad were collected from 5 large-scale organized markets; fresh Italian mango fruit were harvested from a commercial orchard, at green- and mature-ripe stage. Imported and fresh Italian mango fruit were analyzed in terms of firmness, total soluble solids content, titratable acidity, flesh disorders, nutraceutical value, and sensory attributes. Mediterranean Italian mango fruit showed the best quality performances in terms of nutraceutical value and quality attributes. Sensorial analysis confirmed this behavior, these quality attributes were perceived by the trained panel that preferred fresh Mediterranean mango fruit.

Keywords: /Mangifera indica/ /Italian mango production/ /quality attributes/ /bioactive compounds/ /sensory analysis/

MUSHROOM

Catal, S., & Peksen, A. (2020). Physical , chemical and biological properties of spent mushroom substrates of different mushroom species. *Acta Horticulturae*, 1287, 353–360. doi: 10.17660/ActaHortic.2020.1287.45

Abstract

The production of different mushroom species in the world and Turkey, and the amount of spent mushroom substrate remaining after the mushroom production process increase year by year. Mushroom substrates released in large quantities are removed from the enterprises by burning, discarding, or incorporating into the soil in agricultural areas. These practices are not economical for the enterprises and cause some serious environmental pollution problems. However, the spent mushroom substrate is a material that could be included in the economy by reusing in many different fields. The composition of the spent mushroom substrate varies depending on produced mushroom species and also the materials used in compost preparation. Therefore, determining the properties of spent mushroom substrates is of great importance. In this study, some physical, chemical and biological properties of spent mushroom substrates obtained from the production of different mushroom species (*Agaricus bisporus*, *Ganoderma lucidum*, *Hericium erinaceus*, *Lentinula edodes* and *Pleurotus ostreatus*) cultivated in Turkey have been determined and compared with peat and standard media in terms of these properties. Statistically significant differences were determined among spent mushroom substrates and peat and standard media in terms of all examined properties. EC, organic matter, C, C:N rate, water holding capacity, microbial biomass carbon, arylsulphatase activity of spent mushroom substrate had been found significantly higher than that of peat and standard media. Results of EC, pH, C:N rate and phytotoxicity experiments revealed that fresh spent mushroom substrates taken just after the mushroom production process did not have matured compost properties.

Keywords: /spent mushroom compost/ /enzyme activity/ /organic matter/ /minerals/ /microbial biomass/

MICROGREEN

Rocchetti, G., Tomas, M., Zhang, L., Zengin, G., Lucini, L., & Capanoglu, E. (2020). Red beet (*Beta vulgaris*) and amaranth (*Amaranthus* sp.) microgreens: Effect of storage and *in vitro* gastrointestinal digestion on the untargeted metabolomic profile. *Food Chemistry*, 332, 127415. doi: 10.1016/j.foodchem.2020.127415

Abstract

This study aimed to investigate the combined effect of storage at 4 °C (10-days) and *in vitro* gastrointestinal digestion on the phytochemical profile of red beet (*Beta vulgaris*) and amaranth (*Amaranthus* sp.) microgreens. The untargeted profiling based on UHPLC-QTOF metabolomics allowed annotating 316 compounds, comprising mainly polyphenols and lipids. An impact of storage on the total phenolic content (TPC) was observed, with a maximum increase at 10-days

of storage for both red beet (+1.3-fold) and amaranth (+1.1-fold). On the other hand, *in vitro* digestion of both red beet and amaranth microgreens produced a significant increase in TPC (36–88%), CUPRAC (27–40%), DPPH (6–43%), and BC (41–57%) to reach the maximum at 10 days of storage. Tyrosinase inhibitory potential also decreased following digestion. The combination of biochemical changes occurring in microgreen immature plants (likely in response to the harvest stress) with changes during digestion, determined the actual functional value of microgreens.

Keywords: /Foodomics/ /Polyphenols/ /Betalains/ /Lipids/ /UHPLC-QTOF/ /*In vitro* digestion/

PEPPER

Lee, J. G., Yi, G., Choi, J. H., & Lee, E. J. (2020). Analyses of targeted/untargeted metabolites and reactive oxygen species of pepper fruits provide insights into seed browning induced by chilling. *Food Chemistry*, 332, 127406. doi: 10.1016/j.foodchem.2020.127406

Abstract

Hot peppers are sensitive to low temperature, and seed browning significantly reduces the fruit quality. This study aims to clarify the mechanisms of seed browning in terms of metabolite changes. Metabolites were analysed during a 30-day-storage period at 2 °C and 10 °C. Gamma-aminobutyric acid, tyrosine, phenylalanine, and isoleucine concentrations were significantly higher at 2 °C storage than at 10 °C. Reactive oxygen species (ROS) generation was associated with seed browning. Transcription of jasmonic acid synthesis and ROS scavenging genes were higher in hot peppers stored at 2 °C than those stored at 10 °C. This study elucidated the mechanisms underlying seed browning and chill damage in hot peppers during storage at low temperatures and our findings may help improve hot peppers' quality following harvesting.

Keywords: /Hot pepper/ /Chilling injury/ /Seed browning/ /Reactive oxygen species/ /Jasmonic acid/

ORANGE

Ma, X., Li, N., Guo, J., Yang, L., Hao, C., Li, Y., Gentile, A., Lu, X., Ma, X., Deng, Z., Long, G., & Sheng, L. (2020). Involvement of CsPH8 in citrate accumulation directly related to fruit storage performance of 'Bingtang' sweet orange mutants. *Postharvest Biology and Technology*, 170. Doi: 10.1016/j.postharvbio.2020.111316

Abstract

Loss of organic acids during postharvest storage is one of the major factors that negatively affect the quality and storage performance of citrus fruit. 'Qianyang Bingtang' navel orange (QY-BTNO) and 'Jinxu Bingtang' sweet orange (JX-BTO) are bud mutants of common 'Bingtang' sweet orange (CK-BTO) (*Citrus sinensis* Osbeck), and are respectively characterized

by the trait of higher and lower accumulations of organic acids in fruit juice sacs, which is maintained throughout the storage period. Here, gene expression analysis on citrate metabolism showed that the high citrate accumulation in QY-BTNO could be attributed to the high expression of the p-type proton pump gene (*PH8*), and might be partially due to the low activity of citrate degradation pathway as indicated by the low expression of aconitase (*ACO*) and glutamate dehydrogenase (*GAD*). QY-BTNO had significantly lower fruit disease incidence than JX-BTO. Besides, the content of energy source ATP and the activity of peroxidase (POD) were observably different between QY-BTNO and JX-BTO.

Keywords: /citrate/ /fruit disease incidence/ /gene expression/ /ATP/ /citrus bud mutant/ /postharvest/

PEACH

Sortino, G., Saletta, F., Puccio, S., Scuderi, D., Allegra, A., Inglese, P., & Farina, V. (2020). Extending the shelf life of white peach fruit with 1-methylcyclopropene and aloe arborescens edible coating. *Agriculture (Switzerland)*, 10(5), 1–18. doi: 10.3390/agriculture10050151

Abstract

The maintenance of high-quality standards for prolonging the shelf life of fruit and preserving sensory and nutritional quality is a priority for horticultural products. The aim of this work is to test the effectiveness of a single treatment of edible coating based on *Aloe arborescens* (EC) and a combined treatment of 1-methylcyclopropene (1-MCP) and edible coating to prolong the shelf life of “Settembrina” white flesh peach fruit. White flesh peach fruit were harvested at the commercial ripening stage, treated with an edible coating (EC) or 1-MCP + EC or 1-MCP, and stored for 28 days at 1 °C. After 7, 14, 21, and 28 days, fruits were removed from cold storage, transferred at 20 °C and then analyzed immediately (cold out) and after 6 days (shelf life) to evaluate the combined effect of cold storage and room temperature. The fruits were tested for carotenoids content, phenolic content, reducing activity (ABTS). The physicochemical traits were measured in terms of the titratable acidity, total soluble content, weight loss, and vitamin C content. Moreover, their sensory profile was analyzed by a semi-trained panel. Fruit treated with EC and 1-MCP + EC kept their marketing values better than control after 14 days of storage and 6 days of simulated shelf life in terms of flesh firmness, total soluble solids and titratable acidity, as well as sensory parameters. After 21 days of storage, all treatments showed a deterioration of all the quality parameters. The single and combined application of Aloe-based coating (with 1-MCP) slowed down the maturation processes of the fruit, limited the weight loss, and preserved its organoleptic characteristics.

Keywords: /*Prunus persical*/ /edible coating/ /1-methylcyclopropene/ /*Aloe* spp/ /bio-compound content/ /post-harvest quality/ /consumer acceptability/

POMEGRANATE

Atay, M., Kara, M., Uysal, A., Soyulu, S., & Soyulu, E. M. (2020). In vitro antifungal activities of endophytic bacterial isolates against postharvest heart rot disease agent *Alternaria alternata* in pomegranate fruits. *Acta Horticulturae*, 1289, 309–314. doi: 10.17660/ActaHortic.2020.1289.44

Abstract

Pomegranate (*Punica granatum* L.) is one of the most commonly consumed fruits which suffers from postharvest decay giving rise to large economic losses. *Alternaria alternata* (Fr.) Keissl. is an important postharvest fungal pathogen causing loss of fruit during transportation and storage. Chemical applications are primarily made to control them. However, the recent trend is to convert toward safer and more friendly alternatives for the control of postharvest decays. In this study, we investigated the biological control of pomegranate postharvest heart rot disease agents using endophytic bacterial isolates obtained from healthy pomegranate fruits. A proteomic analysis through MALDI-TOF MS (matrix assisted laser desorption ionization time of flight mass spectrometry) was performed to identify these bacterial isolates. The antifungal activities of 12 putative endophytic bacterial isolates of *Bacillus pumilus*, *Bacillus subtilis* ssp. *subtilis*, *Bacillus amyloliquefaciens*, *Bacillus vallismortis*, *Bacillus mojavenis*, *Bacillus megaterium*, *Solibacillus silvestris*, *Erwinia herbicola*, *Corynebacterium glutamicum*, *Bacillus cereus*, *Pantoea dispersa* and *Bacillus endophyticus* were tested against *A. alternata* in dual culture assays. *Bacillus mojavenis* PEB39 was the most effective isolate against pathogenic fungi in vitro (80% inhibition of mycelial growth) followed by *Bacillus amyloliquefaciens* PEB46 (78.9%) *Bacillus vallismortis* PEB40 (76.7%) and *Bacillus subtilis* ssp. *subtilis* PEB43 (75.6%). Our findings suggest that as an alternative and promising biological control agent *B. mojavenis* can suppress postharvest diseases caused by *A. alternata* and may effectively control postharvest physiological changes caused by fungal pathogens.

Keywords: /pomegranate/ /postharvest/ /biological control/ /*Alternaria alternata*/

Testempasis, S., Puckett, R. D., Michailides, T. J., & Karaoglanidis, G. S. (2020). Genetic structure and fungicide resistance profile of *Botrytis* spp. populations causing postharvest gray mold of pomegranate fruit in Greece and California. *Postharvest Biology and Technology*, 170, 111319. Doi: 10.1016/j.postharvbio.2020.111319

Abstract

Gray mold is the main postharvest disease of pomegranate fruit worldwide caused by *Botrytis cinerea*. However, recent advances in phylogeny of *Botrytis* spp. revealed that *B. cinerea* is a complex species. In this study, in total 150 and 246 *Botrytis* spp. isolates were collected during 2015 and 2016 from Greek and Californian pomegranate packinghouses, respectively, and used to investigate the disease etiology, the fungal population structure and the fungicide resistance profile of the isolates. Identification of causal agents showed that, both in Greece and California, gray mold of pomegranate is caused by a complex of *Botrytis* species/groups that includes *B. cinerea*, *B. pseudocinerea* and *Botrytis* group S. *B. cinerea* sensu stricto was the predominant species associated with the disease, although *B. pseudocinerea* was also

identified at relatively high frequencies. *B. pseudocinerea* is reported for first time as an agent of the disease on pomegranates. The population structure was investigated using as marker the presence of two transposable elements (TEs, Boty and Flipper). Results showed that boty and transposa isolates (both TEs present) were predominant in the *B. cinerea* subpopulations in Greece and California, respectively, while vacuma (both TEs absent) and boty isolates were found to be predominant in the *B. pseudocinerea* subpopulations. Measurements of fungicide sensitivity revealed the complete absence of fungicide resistance in the fungal population originating from Greece, while in the Californian subpopulations high frequencies of fungicide resistance were observed in *B. cinerea* sensu stricto isolates but not in *B. pseudocinerea* and *B. cinerea* group S. The higher frequencies of resistance were observed for QoIs, SDHIs and benzimidazoles. In summary, this study provided a description of the structure of *Botrytis* species complex on pomegranate fruit in 2 different geographic regions of the world and on their fungicide resistance status that will be useful for a better adaptation of the disease control strategies and a better understanding of the risk for fungicide resistance development.

Keywords: /*Botrytis cinerea*/ /*Botrytis pseudocinerea*/ /*Punica granatum*/ /Postharvest rots/ /Succinate dehydrogenase inhibitors/ /Transposable elements/

POTATO

Abdel-Gaied, T. G., Mikhail, M. S., Abdel-Alim, A. I., Seif El-Nasr, H. I., & El-Khair, H. A. (2020). Field application of bio-control agents and aqueous plant extracts for controlling bacterial soft rot and enhancement yield quality of *Solanum tuberosum* L. cv. Diamond. *Bulletin of the National Research Centre*, 44(1). doi: 10.1186/s42269-020-00338-4

Abstract

Application of chemical bactericides, for controlling soft rot bacteria, causes environmental pollution and toxic hazards to humans. In addition, it is ineffective, expensive, and limited. Therefore, application of bio-control agents, plant extracts, or safe chemicals may play an important role as safe alternative approaches for controlling phyto-pathogenic bacteria. This work is aimed to apply bio-control agents (*Bacillus subtilis*, *Bacillus pumilus*, *Trichoderma harzianum*, and *Trichoderma virens*), aqueous plant extracts (lantana flowers and leaves, lemongrass leaves, and olive cake), and citric acid as pre-sowing treatment for controlling bacterial soft rot pathogen and study their ability for improving yield and quality of potato tubers in field and storage. All treatments were applied as soil treatment and/or foliar spray, except citric acid applied as foliar spray only. The cultural filtrates of bio-control agents of *B. subtilis*, *B. pumilus*, *T. harzianum*, and *T. virens*; aqueous plant extracts of lantana, lemongrass, and olive cake; and citric acid could protect daughter potato tubers against bacterial soft rot disease in field application, except lemongrass (as soil treatment). The bio-control agents highly increased the activities of peroxidase, polyphenol oxidase, and chitinase enzymes, than other treatments. The biocontrol agents also improved the shoot parameters, viz, shoot length, number of shoots/pit, and number of leaves/ pit and yield parameters, viz, tuber weight/pit, tubers number/pit, and total tubers weight/pit, compared to citric acid and plant extracts, respectively. The treatments as foliar spray have good results for protecting the potato tubers through storage, than soil treatment. The treatments highly enhanced the stored potato tubers quality, viz, dry matter, reducing sugars, total carbohydrates, specific gravity, and starch content. The

tested treatments could protect the potato tubers in the field and/or storage against soften development. The treatments could improve the plant growth and yield parameters in the field as well as enhance the stored potato tubers quality and increase the stored time. It is clear that the treatments can be applied as pre sowing treatment for controlling *Erwinia* soft rot bacteria.

Keywords: /Field application/ /Bacteria soft rot/ /Pre-sowing treatments/ /Storage/ /Safe treatments/

Ru, X., Tao, N., Feng, Y., Li, Q., Wang, Q., & Ru, X. (2020). A novel anti-browning agent 3-mercapto-2-butanol for inhibition of fresh-cut potato browning. *Postharvest Biology and Technology*, 170, 111324. doi: 10.1016/j.postharvbio.2020.111324

Abstract

Enzymatic browning is one of the essential issues affecting the quality of fresh-cut produce. In this study, we identified a novel, safe, and effective anti-browning agent, 3-mercapto-2-butanol, which can prevent fresh-cut potatoes from browning for 5 d under the concentration of 25 $\mu\text{L L}^{-1}$ at 5 °C. The inhibitory effect of 3-mercapto-2-butanol was close to sodium bisulfite. 3-Mercapto-2-butanol was further identified as a competitive inhibitor which directly inhibited the activity of polyphenol oxidase (PPO) by enzyme kinetic analysis, and the expression levels of PPO-related genes (*POT32* and *POT33*) were decreased after 3-mercapto-2-butanol treatment. Besides, the concentration of enzymatic browning substrate tyrosine (Tyr) in the potato chips was found significantly higher in the 3-mercapto-2-butanol treatment group than in the control group. We speculated that 3-mercapto-2-butanol could reduce the consumption of Tyr by inhibiting the activity of PPO. Our finding not only provided a novel and safe anti-browning agent candidate (3-mercapto-2-butanol) to efficiently solve the browning issue for fresh-cut food products, but also preliminarily revealed its mechanism in browning inhibition.

Keywords: /3-Mercapto-2-butanol/ /Anti-browning agent/ /PPO/ /Fresh-cut potato/ /Gene expression/

Sharaby, A. M. F., Gesraha, M. A., & Fallatah, S. A. B. (2020). Botanical extracts against the potato tuber moth, *Phthorimaea operculella* (Zeller 1873) (Lepidoptera: Gelechiidae), during storage conditions. *Egyptian Journal of Biological Pest Control*, 30(1), 1–7. doi: 10.1186/s41938-020-00294-1

Abstract

The potato tuber moth (PTM), *Phthorimaea operculella* (Zeller 1873) (Lepidoptera: Gelechiidae), is a destructive pest of stored potatoes and potato crop. Biopesticides are certain types of pesticides derived from animals, plants, and bacteria. Botanicals are especially efficient in the form of antifeedant, repellent, protectants, and growth-disrupting hormones. They are also sources of secondary metabolites that are safer than synthetic insecticides. Present research was conducted to evaluate some botanical extracts as natural local alternatives against PTM under storage conditions. Twelve different 80% ethanolic plant extracts were tested on PTM during storage conditions ($30 \pm 2^\circ\text{C}$ and $70 \pm 5\% \text{RH}$) at a light regime of the day 10-h light and

14-h dark. Biological parameters of the pest, evidence of the potato tubers damage, and continuation of protection to the tubers were recorded. Extracts of mint, zygotyllum, coriander, arnoglasse, harmel, and solanum indicated a total inhibition of egg deposition at 2.5% concentration; also, they provided high protections to the potato tubers from the PTM infestation for about 3 months and without observations' effect on tubers germination. Senna, colocynth, and basil reduced the number of deposited egg/female. Jasmine, geranium, and chamomile recorded a low potential on egg deposition. Basil showed the highest potency in decreasing development of larvae that hatched from eggs, therefore, reduced the number of next adult offspring (F1) and followed by jasmine and geranium. Variable levels of extracts' protection can be arranged according to their damage evidence as follows: basil > colocynth > jasmine > geranium > senna > chamomile.

Keywords: /Phthorimaea operculella/ /Botanical extracts/ /Storage conditions/ /Potential/

RASPBERRY

Chen, Y., Wang, Y., Xu, L., Jia, Y., Xue, Z., Zhang, M., ... Chen, H. (2020). Ultrasound-assisted modified pectin from unripe fruit pomace of raspberry (*Rubus chingii* Hu): Structural characterization and antioxidant activities. *Lwt*, 134, 110007. doi: 10.1016/j.lwt.2020.110007

Abstract

With the aim of making full use of the resource of *Rubus Chingii* Hu, this work comparatively investigated the structural characterization and antioxidant activities of pectin (RP) from unripe fruit pomaces of *Rubus chingii* Hu and ultrasonic-modified pectin (URP) from unripe fruit pomaces of *Rubus Chingii* Hu. Compared with the original RP, ultrasound treated RP (URP) significantly changed the chemical composition. The scanning electron microscopy (SEM) results suggested that the conformation of RP was filiform, smooth and slim and a large number of spherical pectins were produced by ultrasonic modification. Both RP and URP exhibited the potential antioxidant activity and α -glucosidase inhibitory activity. Moreover, RP and URP effectively attenuated the oxidative damage induced by H₂O₂ and reduced intracellular reactive oxygen species (ROS) levels in human hepatic L02 cells and URP showed higher activity than RP. These results suggested that the unripe fruit pomace of *Rubus chingii* Hu could be used as a potential resource to obtain the antioxidant pectin and the ultrasound-assisted modification could significantly change the physical structure of pectin and effectively improve its antioxidant activities.

Keywords: /Pectin from *Rubus Chingii* Hu/ /Ultrasonic modification/ /Structural characterization/ /Antioxidant activities/

SPINACH

Mu, Y., Feng, Y., Wei, L., Li, C., Cai, G., & Zhu, T. (2020). Combined effects of ultrasound and aqueous chlorine dioxide treatments on nitrate content during storage and postharvest storage quality of spinach (*Spinacia oleracea* L.). *Food Chemistry*, 333, 127500. doi: 10.1016/j.foodchem.2020.127500

Abstract

The objectives of this study were to optimize the condition of ultrasonic treatment combined with aqueous chlorine dioxide (ClO₂) on nitrate content of spinach by response surface methodology (RSM), and determine the effectiveness of ultrasound (US) and ClO₂ alone and in combination, on spinach postharvest quality during 7 days' storage period. The optimal treatment parameters obtained were ultrasonic power (300 W), ClO₂ concentration (50 ppm), treatment time (4 min). The combined treatments significantly reduced the nitrate content and maintained better storage quality in terms of total soluble solids (TSS) and ascorbic acid content compared with the individual treatment or untreated. For Chlorophyll content, the combined treatment was significantly higher than the control and ClO₂ treatment, but lower than ultrasonic treatment. The results demonstrated that US combined with ClO₂ are promising alternatives for the reduction of nitrate content, as well as preserving the quality of stored leafy vegetables.

Keywords: /Ultrasound/ /Aqueous chlorine dioxide/ /Combined treatment/ /Nitrate/ /Storage quality/ /Spinach (*Spinacia oleracea* L.)/

TOMATOES

Ilić, Z. S., Koukounaras, A., Milenković, L., Kevrešan, Ž., Bajić, A., Šunić, L., ... Mastilović, J. (2020). Grafting and shading—the influence on postharvest tomato quality. *Agriculture (Switzerland)*, 10(5). doi: 10.3390/agriculture10050181

Abstract

Interaction of grafting and shading on tomato physical properties and chemical composition after 15 days of storage at 10 °C and 90% relative humidity was investigated in ungrafted and grafted tomato cultivars 'Optima F₁' and 'Big beef F₁' grown under shading nets (red and pearl net) and non shaded conditions. For grafted plants 'Maxifort' rootstock was used. The effects of two weeks of storage was statistically significant when taking into account the effects of grafting, shading and variety for all tomato fruit composition parameters, except total phenols. A principal component analysis demonstrated that the changes in tomato fruit traits during the studied storage period were the main source of differentiation in tomato fruit quality. Beside a slight loss of firmness, tomato fruits were generally expected to have lower lycopene, sugar, malic and citric acid contents, higher succinic acid content, more elastic fruit skin and higher ascorbic acid content. Additionally, after storage, fruits from grafted plants had lower total phenol, higher ascorbic acid and higher succinic acid contents compared to fruits from ungrafted plants. Storage diminishes the differences in quality achieved through convenient grafting and shading combinations.

Keywords: /*Solanum lycopersicum* L./ /grafting/ /shading/ /storage/ /quality/

Kabir, M. S. N., Ali, M., Lee, W. H., Cho, S. I., & Chung, S. O. (2020). Physicochemical quality changes in tomatoes during delayed cooling and storage in a controlled chamber. *Agriculture (Switzerland)*, 10(6), 1–12. doi: 10.3390/agriculture10060196

Abstract

The exposure of tomato fruits to unfavorable environments during the postharvest could result in severe losses along the supply chain. In this research, four tomato cultivars were stored in a controlled chamber under three levels of postharvest conditions to investigate the effects of delayed cooling on selected physicochemical quality parameters of the tomatoes. The tomato cultivars were subjected to three postharvest treatments: Immediate storage (IS) at harvest day; delayed storage (DS), leaving tomatoes without cover for one day; and under cover (DSC), separately in a greenhouse, and then stored in a controlled chamber at a temperature of 10 ± 1 °C and relative humidity of $90\% \pm 3\%$. Fresh weight, firmness, total soluble solids (TSS), and hue angle (h°) were examined over 15 days, every 5 days. Among the tomato cultivars, Cherry (7160), treated under DS showed the highest weight loss (13.01%) and firmness loss (42.14%) after 15 days of storage. Dabol (large) tomatoes treated with DS showed higher changes in TSS ($^{\circ}\text{Bx}$) values (4.79 to 5.76). Low changes in hue angle values were found in IS-treated Cherry (7160) tomatoes at the end of the storage period. Overall quality changes were slower for all tomato cultivars treated with IS than with other treatments throughout the storage period. This study indicated the importance of reducing cooling delays to maintain the quality during the postharvest and prolong storage of harvested tomatoes.

Keywords: /postharvest handling/ /cooling delay/ /quality parameter/ /storage/ /tomato/

Loayza, F. E., Brecht, J. K., Simonne, A. H., Plotto, A., Baldwin, E. A., Bai, J., & Lon-kan, E. (2020). Synergy between hot water treatment and high temperature ethylene treatment in promoting antioxidants in mature-green tomatoes. *Postharvest Biology and Technology*, 170, 111314. 10.1016/j.postharvbio.2020.111314

Abstract

Controlled postharvest stresses were used to induce the synthesis of antioxidants in tomato fruit. In this study, a hot-water (HW) treatment of 52 °C for 5 min promoted higher total oxygen radical absorbance capacity (ORAC) compared to fruit immersed in 25 °C water for 5 min. Whereas, ethylene treatment at high temperature, particularly at 35 °C for 24, 48 or 72 h, induced higher content of total phenolics and ferric reducing ability of plasma (FRAP) than fruit treated with ethylene at 20 or 30 °C. In combination, there was synergy between the treatments, and this was most notable by the increase of total phenolics in HW-treated tomatoes exposed to ethylene at 35 °C for 24, 48 or 72 h. There was also a significant increase of total ORAC in HW-treated fruit exposed to ethylene at 30 °C for 72 h or 35 °C for 24, 48 or 72 h. This increase in antioxidant capacity was observed in the hydrophilic fraction of HW-treated fruit exposed to ethylene at 30 °C for 72 h or 35 °C for 24 or 48 h and in the lipophilic fraction of HW-treated tomatoes exposed to ethylene at 35 °C for 24, 48 or 72 h. Moreover, The HW-treatment especially maintained the level of total carotenoids and ascorbic acid when exposed to ethylene at 30 °C for 72 h or 35 °C for 48 or 72 h. Nevertheless, the high temperature ethylene treatment

reduced the a^* value of tomato peel regardless of the application of HW treatment. In conclusion, application of a HW treatment of 52 °C for 5 min followed by exposure to ethylene at 35 °C for 48 h was most effective in synergistically improving the antioxidant capacity and composition of tomatoes without severely impairing color development.

Keywords: /Postharvest stress/ /Phenolic/ /Carotenoid/ /ORAC/ /FRAP/ /*Solanum lycopersicum*/

Wang, H., Sun, S., Zhou, Z., Qiu, Z., & Cui, X. (2020). Rapid analysis of anthocyanin and its structural modifications in fresh tomato fruit. *Food Chemistry*, 333, 127439. doi: 10.1016/j.foodchem.2020.127439

Abstract

Anthocyanin is derived from a flavylum cation structure, and it promotes health in humans and functions in plants as protection against environmental stress. The rapid analysis of anthocyanin structure and content is a critical challenge for improving fruit quality. In this study, the tomato cultivar Indigo Rose, which is a popular purple cultivated tomato used for breeding, was taken as an example for anthocyanin analysis. A rapid analysis method was developed to minimize anthocyanin loss from the fresh fruit. Four new anthocyanins were discovered in the tomato, and the structures of a total of 12 anthocyanins were determined. Among these, petunidin-3-(*trans-p*-coumaroyl)-rutinoside-5-glucoside and malvidin-3-(*trans-p*-coumaroyl)-rutinoside-5-glucoside were the main anthocyanins in Indigo Rose. The structural modifications of these anthocyanins were mainly glycosylation and acylation, and there were also hydroxylation and methylation. Our findings provide new insight into the biosynthesis pathway in tomato fruit.

Keywords: /Anthocyanin/ /Structure/ /Modification/ /Liquid chromatography/ /Mass/

WATERMELON

Zaaroor-Presman, M., Alkalai-Tuvia, S., Chalupowicz, D., Beniches, M., Gamliel, A., & Fallik, E. (2020). Watermelon Rootstock/Scion Relationships and the Effects of Fruit-Thinning and Stem-Pruning on Yield and Postharvest Fruit Quality. *Agriculture*, 10(9), 366. doi: 10.3390/agriculture10090366

Abstract

This study examined the effects of stem-pruning and fruit-thinning on the yield of marketable watermelon fruit (>5 kg) and watermelon quality after four days of postharvest storage at 22 °C (marketing simulation). We examined the fruits from non-grafted and grafted plants (TZ and Nurit rootstocks) for two consecutive years. Grafting increased the number of marketable fruit per m². The weight of the average marketable fruit was increased by pruning, but was not affected by thinning or by the choice of rootstock. The level of total soluble solids was higher among fruits from Nurit rootstock. Flesh texture was improved by grafting, but was not affected by thinning or pruning. Thinning improved the taste of the fruit significantly better than stem-pruning did. Grafting (both rootstocks) was associated with crispier fruits. The fruits from

Nurit-grafted plants tasted best. The combination of grafting + fruit-thinning increased the fruit lycopene content. The highest levels of vitamin C were found among the fruit from Nurit-grafted plants and the pruned + Nurit-grafted plants, in particular. Overall, fruit quality was affected mainly by grafting onto Nurit rootstock in combination with fruit-thinning and less by stem-pruning. However, not all internal and nutritional quality parameters were significantly affected by the grafting + fruit-thinning treatment.

Keywords: /Citrullus lanatus/ /Cucurbita maxima × Cucurbita moschata/ /fruit quality/
/postharvest/