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ALLIUM MONGOLICUM REGEL

Bu, H., Hu, Y., & Dong, T. (2022). Changes in postharvest physiology, biochemistry, sensory properties and microbiological population of Allium mongolicum Regel regulated by adjusting the modified atmosphere inside the package during storage. *Journal of Food Processing & Preservation*, *46*(1), 1–14. https://doi.org/10.1111/jfpp.16128

Abstract

Allium mongolicum Regel is a high-quality plant resource but highly perishable with a short shelf life of 1–2 days. Changes in postharvest quality and microbiological population on A. mongolicum regulated by poly (butylene adipate-co-terephthalate)/poly (butylene succinate), poly (butylene adipate-co-terephthalate)/polycaprolactone, poly (butylene adipate-co-terephthalate)/poly (L-lactide) and poly (butylene adipate-co-terephthalate)/polypropylene MAP were investigated during near-freezing storage. The results showed all four MAPs could reduce the respiration rate, water loss, decay rate and malondialdehyde content significantly and maintain the morphology, color and typical flavor of A. mongolicum effectively which also had high level acceptable commercial score as well as ascorbic acid and chlorophyll contents. However, the preservation effect packed with poly (butylene adipate-co-terephthalate)/polypropylene was significantly better than the other three films in which it could establish an optimal atmospheric condition with O2 concentration of 0.34%–0.53% and CO2 concentration of 4.53%–6.13% and the A. mongolicum had the highest level of postharvest quality, the lowest level of physiological metabolism and surface microorganisms, and its shelf life could reach 18 days. Practical applications: Allium mongolicum Regel has delicious taste, high nutritional value, and bioactive ingredients good for human health but with short shelf life which is a great challenge to the storage and sales. Therefore, maintaining postharvest quality and extending shelf life are significant to the industry development for A. mongolicum. However, studies on its preservation are not available. Modified atmosphere packaging is a cheap, safe and effective method to keep produce fresh. In this study, the shelf life of A. mongolicum was extended significantly in the treatment of poly (butylene adipate-co-terephthalate)/polypropylene MAP. It provided an effective solution for the storage problem and had great potential in industry for A. mongolicum. Furthermore, it provided a theoretical basis for the storage and industry development by studying the correlations of the O2, CO2 and water vapor transmission rate of package film, O2, CO2 concentration in package and postharvest physiology and quality of A. mongolicum during storage.

Keywords: /Controlled Atmosphere Packaging/ /Allium/ /Packaging Film/ /Physiology/ /Biochemistry/ /Respiration In Plants/ /Vitamin C/ /Flavor/

APPLE

Hamilton, A., Ruiz-Llacsahuanga, B., Mendoza, M., Mattheis, J., Hanrahan, I., & Critzer, F. J. (2022). Persistence of Listeria innocua on Fresh Apples during Long-Term Controlled Atmosphere Cold Storage with Postharvest Fungal Decay. *Journal of Food Protection*, *85*(1), 133–141. https://doi.org/10.4315/JFP-21-232

Abstract

Recent apple-related recall and outbreak events have exposed a need for better food safety controls along the supply chain. Following harvest, apples can be stored under a controlled atmosphere for up to 1 year after harvest before packing and distribution, making the crop susceptible to many opportunities for contamination that increase the quantity of postharvest losses. Botrytis cinerea and Penicillium expansum cause significant rot-associated losses to the apple industry. These fungi can colonize and destroy apple

tissue as storage duration increases, which may also impact the growth of saprophytic foodborne pathogens like Listeria monocytogenes. Thus, the objective of this study was to observe population changes of Listeria innocua as a surrogate for L. monocytogenes on apples inoculated with B. cinerea or P. expansum under long-term controlled atmosphere cold storage conditions to identify the effect of postharvest mold growth on growth patterns of a microorganism relevant to food safety. 'Gala' and 'WA 38' apples (n = 1,080) were harvested, treated with pyrimethanil, and inoculated with L. innocua only or with L. innocua and one of the mold species on wounded and unwounded portions of the apple equator. Apples were treated with 1-methylcyclopropene and stored at a controlled atmosphere (2 kPa O2, 1 kPa CO2, 1°C) for 1 week and 1, 3, 6, 9, and 11 months before enumeration. After 3 months, L. innocua consistently fell below the limit of detection (2.35 Log CFU/g), and samples were enriched following a modified Bacteriological Analytical Manual method with PCR confirmation. Listeria persistence was dependent on the storage duration and type of fungal contamination ($P \leq 0.05$). Surface wounding may impact these trends, depending on the apple variety. Prevalence of L. innocua was greater in Gala apples. Future studies should more closely examine the interactions on the fruit surface that occur during the seemingly critical time frame of 3 to 6 months in storage.

Keywords: /Botrytis/ /Listeria/ /Penicillium/ /Apples/ /Storage/

Li, L., Huang, W., Wang, Z., Liu, S., He, X., & Fan, S. (2022). Calibration transfer between developed portable Vis/NIR devices for detection of soluble solids contents in apple. *Postharvest Biology and Technology,* 183, 111720. https://doi.org/10.1016/j.postharvbio.2021.111720.

Abstract

Calibration transfer is an important step for practical applications of Visible and Near-infrared (Vis/NIR) instruments, making the developed model transferable and avoiding recalibration. A calibration transfer method between two developed portable Vis/NIR devices (master and slave devices) for predicting soluble solids content (SSC) of apples was investigated in this study. The partial least squares (PLS) calibration models based on the spectra of the master and the slave devices in the range of 550–930 nm yielded high prediction performance, with the correlation coefficient (R_p) and the root mean square error of the prediction set (RMSEP) of 0.918, 0.552 % and 0.881, 0.666 %, respectively. However, the direct use of the PLS model built by the master instrument to the slave instrument was impracticable. A Hg (Ar) lamp was used to correct the spectral dimension for the two devices, followed by the transfer performance comparison of three methods including piecewise direct standardization (PDS), spectral space transformation (SST), and calibration model transformation based on canonical correlation analysis (CTCCA). The prediction results indicated that PDS yielded better performance when the window size was 3 and the number of the transfer samples was 25, with R_p and RMSEP of 0.874 and 0.713 %, respectively. Lower spectral angle and higher spectral correlation coefficient also illustrated that PDS had a preferable performance compared with SST and CTCCA.After PDS and slope/bias (S/B), the SSC was successfully predicted, achieving high accuracy of R_p = 0.926 and RMSEP = 0.778 %. The above results illustrated that the proposed algorithm was a promising calibration transfer method from the master device to the slave device, and could effectively compensate for the differences of spectral response between the developed Vis/NIR devices and different batches of samples.

Keywords: /Calibration model transfer/ /Piecewise direct standardization/ /Cubic spline interpolation/ /Apple/ /Soluble solids content/ /Vis/NIR/

AVOCADO

Mishara, P., Paillart, M., Meesters, L., Woltering, E., Chauhan, A.(2022). Avocado dehydration negatively affects the performance of visible and near-infrared spectroscopy models for dry matter prediction. *Postharvest Biology and Technology,* 183, 111739. https://doi.org/10.1016/j.postharvbio.2021.111739.

Abstract

This study aims to test the hypothesis that skin dehydration can cause the development of cork-like layers in the avocado fruit skin which may negatively affect Vis-NIR spectroscopy. To test this, dehydration treatment was applied on avocado fruit by storing them at low relative humidity (RH) during ripening treatment. Furthermore, to demonstrate that the hypothesis was not only valid for a single instrument and in general valid for any type of Vis-NIR instrument the avocados were also measured with two different spectrometers i.e., lab-based, and hand-held. Since the two instruments have two different measurement geometries i.e., diffuse reflection and interaction, the study also tests which geometry was best for the measurement of DMC in dehydrated avocados. The results showed that the dehydration of avocado fruit negatively affects the performance of Vis-NIR calibrations compared to the non-dehydrated fruit. The root mean squared error of cross-validation ($RMSE_{cv}$) on internal test sets for dehydrated and non-dehydrated fruit were up to 1.49 % dw/fw and 1.02 % dw/fw, respectively. The hypothesis was true for both lab-based and hand-held instruments, and the root mean squared error of prediction on the internal test set was up to 28 % higher for dehydrated fruits. The performance of interaction measurement mode was better ($RMSE_{cv}$ = 0.98 % dw/fw) than the diffuse reflection mode ($RMSE_{cv}$ = 1.21 % dw/fw) for non-dehydrated fruit, however, both modes achieved similar performance ($RMSE_{cv}$ = ~1.42 % dw/fw) for dehydrated fruit. The poorer performance of Vis-NIR models on dehydrated avocado fruit can be accepted as a limitation of Vis-NIR spectroscopy for avocado fruit analysis.

Keywords: /Chemometrics/ /Multivariate/ /Fruit storage/ /Quality/

BAMBOO SHOOT

Hou, D., Lu, H., Zhao, Z., Pei, J., Yang, H., Wu, A., Yu, X., & Lin, X. (2022). Integrative transcriptomic and metabolomic data provide insights into gene networks associated with lignification in postharvest Lei bamboo shoots under low temperature. *Food Chemistry*, *368*, 130822. https://doi.org/10.1016/j.foodchem.2021.130822

Abstract

Lei bamboo (Phyllostachys violascens) shoots are delicious food in Asia. Here, the molecular basis of lignification in postharvest Lei bamboo shoots under low temperature (LT) is revealed by transcriptomic and metabolomics analyses for the first time. We identified substantial accumulations of jasmonates (JAs) and major lignin biosynthesis precursors (coumarin, trans-4-coumaric acid, trans-ferulic acid and L-phenylalanine). Transcriptome analysis indicated that some regulatory genes were significantly differentially expressed, and the expression patterns of them were highly consistent with the changes in the key lignin precursors or JA profiles. Co-expression analysis showed that the LT responsive genes PvCRPK-4/-5, PvICE2-1/2, PvDREB2B might form a network module with the lignin (PvC3H-2/3, PvC4H-2/4, PvCAD-1/2/3/4, etc.) or JA biosynthesis genes (PvOPR2, PvJAZ-4 and PvPEX5, etc.), indicating a LT-lignification or LT-JA-lignification regulatory pathway in Lei bamboo shoots. Above all, our findings provide new insight into the LT-associated lignification in postharvest bamboo shoots.

Keywords: /Jasmonate/ /Lignification/ /Low temperature/ /Phyllostachys violascens shoots/

BANANA

Kulkarni, S. A., Sellamuthu, P. S., Nagarajan, S. K., Madhavan, T., & Sadiku, E. R. (2022). Antifungal activity of wild bergamot (Monarda fistulosa) essential oil against postharvest fungal pathogens of banana fruits. *South African Journal of Botany*, *144*, 166–174. https://doi.org/10.1016/j.sajb.2021.08.019

Abstract

Wild bergamot (Monarda fistulosa) essential oil vapours could effectively suppress the in vitro growth of Colletotrichum musae and Lasiodiplodia theobromae at 4 μL per Petriplate. Molecular docking studies suggested that thymol, carvacrol and cinnamyl carbanilate were the components responsible for the antifungal activity. The values of the molecular descriptors obtained through conceptual DFT study also suggested that thymol, carvacrol and cinnamyl carbanilate were highly active components. Postharvest treatment of banana fruits using wild bergamot essential oil could extend the life of the fruits through sustainable means. This study aimed to examine the antifungal activity of wild bergamot (Monarda fistulosa) essential oil on Colletotrichum musae and Lasiodiplodia theobromae , the causative organisms of anthracnose and crown-rot diseases of banana fruits, respectively. Chitin synthase is a promising target for antifungal compounds, since it is involved in synthesizing chitin, which forms a major proportion of the fungal cell wall. Disc volatilisation method was employed to assess the in vitro antifungal activity of the oil. The vapours of this essential oil at 4 μL per Petriplate exhibited 100% growth inhibition of both the fungal pathogens, and at 66.66 μLL−1 , it significantly ($P < 0.05$) reduced the incidence and severity of anthracnose and crown-rot diseases in artificially wounded and infected fruits. The chemical composition of wild bergamot essential oil was determined by GC-MS technique and the components of the essential oil were docked against chitin synthase to determine the components responsible for antifungal activity. Chitin synthase was modeled by de novo approach due to non-availability of the 3D structure. The in silico techniques such as molecular docking and conceptual DFT revealed that the major components of the essential oil namely thymol, carvacrol and cinnamyl carbanilate manifested the best antifungal activity. This illustrates effective inhibition of the major postharvest diseases of bananas by wild bergamot essential oil.

Keywords: /Chitin synthase/ /Conceptual DFT/ /Disc volatilisation/ /GC-MS/ /Molecular docking/

Zhou, Z., Yang, Y., Shan, W., Zhang, H., Wei, W. Kuang, J., Chen, J., Lu, W. (2022). Ethylene attenuates chilling injury of banana fruit via the MabHLH060/183 module in controlling phosphatidic acid formation genes, Postharvest Biology and Technology, 183,111724. https://doi.org/10.1016/j.postharvbio.2021.111724

Abstract

Chilling injury (CI) of bananas represents a serious problem constraining postharvest preservation in the industry. Application of ethylene was found to efficiently attenuate CI of banana, however, the mechanism of which remains to be investigated. Here, we found that application of ethrel could ameliorate the CI of banana, as evidenced by lower CI index, electrolytic leakage and malondialdehyde content. Meanwhile, expression of phosphatidic acid (PA) formation genes *MaPLDδ1*, *MaPLDδ5* and *MaDGK2*, as well as two transcriptional regulators *MabHLH060* and *MabHLH183* was significantly increased with the progression of CI, but decreased under ethrel treatment. MabHLH060 and MabHLH183 were shown to be located in the nucleus and have transactivation ability. Importantly, these two transcriptional regulators MabHLH060/183 recognized the E-box elements in the promoters of *MaPLDδ1*, *MaPLDδ5* and *MaDGK2*, and promoted their transcription. Together, these findings suggest that ethylene-alleviated CI of banana may involve the MabHLH060/183 module in modulating the expression of PA formation genes.

Keywords: /Banana fruit/ /bHLH/ /Chilling injury/ /Membrane lipid metabolism/ /Transcriptional regulation/

BELL PEPPER

Kasampalis, D. S., Tsouvaltzis, P., Ntouros, K., Gertsis, A., Gitas, I., Moshou, D., & Siomos, A. S. (2022). Nutritional composition changes in bell pepper as affected by the ripening stage of fruits at harvest or postharvest storage and assessed non-destructively. *Journal of the Science of Food & Agriculture*, *102*(1), 445–454. https://doi.org/10.1002/jsfa.11375

Abstract

Nutritional quality in bell pepper is related to the ripening stage of the fruit at harvest and postharvest storage. Its determination requires time-consuming, tissue-destructive, analytical laboratory techniques. The objective of this study was to investigate the effect of ripening stage and of postharvest storage period on fruit nutritional quality, and whether it is feasible to develop reliable models for assessing the nutritional components in peppers using non-destructive methods. The dry matter, soluble solids, ascorbic acid, phenolics, chlorophylls, carotenoids and the total antioxidant capacity were determined in bell pepper fruits at six ripening stages, from green to full red, during storage at 10 °C for 8 days. Color, chlorophyll fluorescence, visible/near infrared (Vis/NIR) spectroscopy, red-green-blue (R-G-B) and red-green-near infrared (R-G-NIR) digital imaging were tested for assessing the nutritional quality of peppers. RESULTS: The nutritional composition was mainly affected by the ripening stage of bell pepper fruits at harvest and only to a small degree by the storage period. Indeed, the more advanced ripening stage of fruit at harvest resulted in superior nutritional quality. Most of the non-destructive techniques reliably predicted the internal quality of the fruit. The genetic algorithm (GA), the variable importance in projection (VIP) scores, and the variable inflation factor (VIF) tests identified nine distinct regions and four specific wavelengths on the whole visible/NIR electromagnetic spectrum that exhibited the most significant effect in the assessment of the nutritional components. CONCLUSION: It is possible to predict individual nutritional components in bell pepper fruit reliably and non-destructively, and irrespective of the ripening stage of fruits at harvest.

Keywords: Chemometrics/ /Multivariate regression/ /Non-destructive/ /PLS/ /Postharvest storage life/ /Spectroscopy/

BLUEBERRY

Giongo, L., Ajelli, M., Pottorff, M., Perkins-Veazie, P., Iorizzo, M. (2022). Comparative multi-parameters approach to dissect texture subcomponents of highbush blueberry cultivars at harvest and postharvest. *Postharvest Biology and Technology, 183*, 111696. https://doi.org/10.1016/j.postharvbio.2021.111696

Abstract

Fruit texture and firmness are important cues of blueberry quality for the fresh market. These attributes contribute to consumer acceptance, resistance to bruising during harvesting and transportation, and shelf-life. Thus, fruit firmness and texture are major priorities for blueberry breeders, producers and distributors. In this study, the discriminative power of texture analysis was examined using penetration tests with different probes and double compression for texture profile analysis (TPA). Mechanical parameters taken from the force deformation curves used to dissect texture subcomponents in blueberries that are associated with specific tissue layers. Principal component analysis (PCA) allows to filter and identify mechanical parameters that significantly discern the most variation amongst 24 blueberry genotypes and showed that texture in this crop is multi-trait and cultivar-dependent. Texture analysis was used also on blueberries stored over six weeks to identify mechanical parameters that could be used as predictors for long shelf life. Additionally, the mechanical parameters were correlated with dynamometer data to determine the utility and accuracy of a simple handheld device to measure fruit firmness in blueberries. This study provides a framework for the identification and characterization of the subcomponents of texture in highbush blueberry.

Keywords: /Blueberry/ /Fruit quality/ /Postharvest/ /Shelf life storage/ /Texture/ /Texture analysis/ /Texture profile analysis/ /*Vaccinium/*

BROCCOLI

Ahlawat, Y., Li,S., Timilsena, P., Pliakoni, E., Brecht, J., & Liu, T.Identification of senescence-associated genes in broccoli (Brassica oleracea) following harvest. Postharvest Biology and Technology, 183, 111729. https://doi.org/10.1016/j.postharvbio.2021.111729

Abstract

We used genomic tools to understand senescence and molecular signaling events in harvested broccoli florets stored at 25 or 4 °C to test the hypothesis that genetic markers can be used to identify the stage of senescence or physiological age of plant tissue. The RNA-sequencing approach provided key insights into the gradual changes in transcriptome during postharvest storage in broccoli. We found that 4279 and 4143 transcripts were differentially expressed after 3 and 5 days of storage at the two storage temperatures, respectively. We then performed genome-wide comparisons at 25 and 4 °C and illustrated the temporal and spatial-specific genes in stored broccoli. By using quantitative Real-Time PCR and transient tobacco assay, we validated our RNA-sequencing experiment. We further performed comparative analysis of *Arabidopsis* and broccoli to disclose conserved senescence genes. Concurrently, we found that 43 genes were senescence-specific genes that are common senescence-associated genes (SAGs) regardless of tissue-specific expression. Interestingly, we observed 73 transcription factors (TFs) within this group that might form a core transcriptional regulatory circuitry to control the onset and progression of senescence. Moreover, we also identified new molecular players involved in postharvest senescence including brassinosteroids (BR) perception genes, *BIK1* (*Brassinosteroid-Interacting Kinase1*), *BRL1* (*BRI1-like 1*), *BIR1* (*BAK1-Inteacting Receptor-Like Kinase 1*), stomatal patterning gene *SPCH*, and circadian clock genes CCA1. Those genes could serve as 'freshness-indicators' for the stage of senescence or relative freshness of the product. This report identified the SAGs that are essential for tissue-specific senescence and provided fundamental insights into signaling events during postharvest senescence in *Brassica* plants.

Keywords: /Chlorophyll/ /Physiological age/ /RNA sequencing/ /Real-Time PCR/ /Senescence-associated genes/ /SAGs/ /Transcriptome profiling/

Reyes Jara, A. M., Gómez Lobato, M. E., Civello, P. M., & Martínez, G. A. (2022). Phenylalanine ammonia lyase is more relevant than Chalcone synthase and Chalcone isomerase in the biosynthesis of flavonoids during postharvest senescence of broccoli. *Journal of Food Biochemistry*. https://doi.org/10.1111/jfbc.14054

Abstract

Practical applications Broccoli contains a high content of nutraceutical compounds, such as glucosinolates and flavonoids. In this work, the effect of different treatments that modulate postharvest senescence of broccoli was evaluated and flavonoid metabolism during postharvest storage was analyzed at 20°C. A decrease in hue angle (HUE°) and chlorophylls and an increase in flavonoid content were detected during senescence. It observed that most of the treatments that delayed senescence also decreased flavonoid content, except visible light and UV-C treatments. In all cases, a direct correlation between those treatments that increased flavonoid biosynthesis and <italic>BoPAL</italic> gene expression was detected. This response was not detected in the expression of the other two flavonoid synthesis relevant genes <italic>BoCHS</italic> and <italic>BoCHI</italic>, suggesting that <italic>BoPAL</italic> has a greater influence on the regulation of the via, during broccoli senescence.Broccoli is a vegetable with valuable nutritional properties. Because it is in full development at the time of harvest, it has a short shelf life. In this work, it is shown that visible light and UV-C

treatments not only delayed the senescence of broccoli, but also increased flavonoid content. Our results suggest that the most important enzyme in the phenylpropanoid biosynthesis pathway during broccoli postharvest is phenylalanine ammonia lyase, and that this may be a key point in regulating the biosynthesis of these nutritionally valuable compounds.

Keywords: /Broccoli/ /Postharvest storage/ /Shelf life/

CHAENOMELES JAPONICA

Juhnevica, R. K., Radenkovs, V., & Krasnova, I. (2022). The impact of 1‐MCP treatment and controlled atmosphere storage on the postharvest performance of four (Chaenomeles japonica (Thunb.) Lindl. ex Spach) fruit cultivars. *Journal of Food Processing & Preservation*, *46*(1), 1–13. https://doi.org/10.1111/jfpp.16193

Abstract

Japanese quince (JQ) shows climacteric behavior that respiration takes place during ripening. Phytochemical processes during fruit storage cause changes in quality; thus, relevant storage conditions are to be identified to sustain fruit quality over the storage time. The present work aimed to evaluate the effect of 1‐MCP treatment and controlled atmosphere (CA) storage on the quality of JQ fruit. Two experiments during the 2017 and 2018 seasons were carried out with four JQ cultivars. Better maintenance of fresh weight was observed in the case of CA storage, although the degree of effectiveness was cultivar and growing season dependent. The best preservation of JQ fruit phytochemicals, for example, total phenolics, proanthocyanidins, and vitamin C has been reached when the CA system was employed. In turn, no clear effect of either CA or 1‐MCP on fruit soluble solids and total acid content was observed for JQ fruit after long‐term storage. Practical application: In recent years, there have been many studies centered on the evaluation of the chemical composition of Japanese quince (JQ) fruits revealing that these fruits are a good source of valuable compounds for the food and pharmaceutical industries. Currently, the fruit of JQ are processed for many food products, thus leading to the intensive diversification of planting areas. It is expected that the market share of JQ will increase double or triple in the future. To ensure the quality of JQ during storage, proper storage technology needs to be identified. Acquired data in this study are of potential interest to growers and industries dealing with JQ fruit processing and storage.

Keywords: /Fruit/ /Fruit processing/ /Cultivars/ /Fruit storage/ /Preservation of fruit/

FRUITS AND VEGETABLES

Aguirre-Güitrón, L., Calderón-Santoyo, M., Lagarón, J. M., Prieto, C., & Ragazzo-Sánchez, J. A. (2022). Formulation of the biological control yeast Meyerozyma caribbica by electrospraying process: effect on postharvest control of anthracnose in mango (Mangifera indica L.) and papaya (Carica papaya L.). *Journal of the Science of Food and Agriculture*, *102*(2), 696–706. https://doi.org/10.1002/jsfa.11400

Abstract

Microorganism for biological control of fruit diseases is an eco-friendly alternative to the use of chemical fungicides. This is the first study evaluating the electrospraying process to encapsulate the biocontrol yeast Meyerozyma caribbica. The effect of encapsulating material [Wey protein concentrate (WPC), Fibersol® and Trehalose], its concentration and storage temperature on the cell viability of M. caribbica, and in vitro and in vivo control of Colletotrichum gloeosporioides was evaluated. The processing with commercial resistant maltodextrin (Fibersol®) 30% (w/v) as encapsulating material showed the highest initial cell viability (95.97 ± 1.01%). The storage at 4 ± 1 °C showed lower losses of viability compared to 25 ± 1 °C. Finally, the encapsulated yeast with Fibersol 30% w/v showed inhibitory activity against

anthracnose in the in vitro and in vivo tests, similar to yeast fresh cells. Electrospraying was a highly efficient process due to the high cell viability, and consequently, a low quantity of capsules is required for the postharvest treatment of fruits. Additionally, the yeast retained its antagonistic power during storage.

Keywords: /Colletotrichum gloeosporioides/ /Antifungal activity/ /Biocontrol/ /Electrohydrodynamic process/ /Encapsulating/

Chopra, S., Muller, N., Dhingra, D., Mani, I., Kaushik, T., Kumar, A., & Beaudry, R. (2022). A mathematical description of evaporative cooling potential for perishables storage in India. *Postharvest Biology and Technology, 183*, 111727. https://doi.org/10.1016/j.postharvbio.2021.111727

Abstract

Post-harvest losses of fruit and vegetables in India, estimated to be around 30 %, can cause major economic disaster for smallholder farmers. A significant part of these losses occur due to lack of appropriate cold storage facilities, high temperatures, and low RH of ambient air especially during summer months. The high capital required and lack of uninterrupted power supply makes it difficult for farmers to build cold stores and existing cold storages are not distributed equitably and do not have sufficient capacity to serve India's 100 million smallholder farmers. One cooling option is the relatively inexpensive evaporatively cooled (EC) storage, which was designed to enable farmers to avert distress sale and get a fair price for produce. An EC storage, termed the Pusa EC room, was built using novel construction materials including fabric walls and insulative blocks and evaluated year-round over a period of 5 years (2017–2021) using respiratory and senescence responses of amaranth (*Amaranthus* spp.) to storage temperatures. Wetting of the fabric walls yielded cooling of the structure interior during the daytime, but not at nighttime. As a result of lowered temperatures, storage life was predicted to be nearly doubled relative to storage at ambient temperatures during the warm and dry spring and summer weeks, however it was not improved appreciably when the ambient temperature declined and RH increased during late summer, fall, and winter. The estimated daily reduction in respired CO_2 for the leafy amaranth, used here as a model plant, was governed by a simple mathematical expression using wet bulb depression of temperature relative to ambient. The predictive equation can be applied to any plant material for which the metabolic response to temperature is defined and permits convenient estimation of the benefits of evaporative cooling, potentially anywhere on the globe. This relationship was used for predicting storage-life improvement for many cities of major climate zones in India using data retrieved from the website https://en.climate-data.org. EC room benefits were projected to be highest for warmer, drier climates, as would be expected; however, regional climate classifications were not always found to be a good guide for siting EC rooms due to local and microclimate variability.

Keywords: /Storability/ /Smallholder/ /Farmer/ /Climate/ /Nylon/ /Storage-life/

Kasampalis, D. S., Tsouvaltzis, P., Ntouros, K., Gertsis, A., Gitas, I., Moshou, D., & Siomos, A. S. (2022). Nutritional composition changes in bell pepper as affected by the ripening stage of fruits at harvest or postharvest storage and assessed non-destructively. *Journal of the Science of Food and Agriculture*, *102*(1), 445–454. https://doi.org/10.1002/jsfa.11375

Abstract

Nutritional quality in bell pepper is related to the ripening stage of the fruit at harvest and postharvest storage. Its determination requires time-consuming, tissue-destructive, analytical laboratory techniques. The objective of this study was to investigate the effect of ripening stage and of postharvest storage period on fruit nutritional quality, and whether it is feasible to develop reliable models for assessing the nutritional components in peppers using non-destructive methods. The dry matter, soluble solids, ascorbic acid, phenolics, chlorophylls, carotenoids and the total antioxidant capacity were determined in bell pepper fruits at six ripening stages, from green to full red, during storage at 10 °C for 8 days. Color,

chlorophyll fluorescence, visible/near infrared (Vis/NIR) spectroscopy, red-green-blue (R-G-B) and red-green-near infrared (R-G-NIR) digital imaging were tested for assessing the nutritional quality of peppers. The nutritional composition was mainly affected by the ripening stage of bell pepper fruits at harvest and only to a small degree by the storage period. Indeed, the more advanced ripening stage of fruit at harvest resulted in superior nutritional quality. Most of the non-destructive techniques reliably predicted the internal quality of the fruit. The genetic algorithm (GA), the variable importance in projection (VIP) scores, and the variable inflation factor (VIF) tests identified nine distinct regions and four specific wavelengths on the whole visible/NIR electromagnetic spectrum that exhibited the most significant effect in the assessment of the nutritional components.It is possible to predict individual nutritional components in bell pepper fruit reliably and non-destructively, and irrespective of the ripening stage of fruits at harvest.
Keywords: /PLS/ /Chemometrics/ /Multivariate regression/ /Non-destructive/ /Postharvest storage life/ /Spectroscopy/

Navarro, B. L., Edwards Molina, J. P., & Nogueira Júnior, A. F. (2022). Penetration by Botryosphaeriaceae species in avocado, guava and persimmon fruit during postharvest. *Journal of Phytopathology*, *170*(1), 57–68. https://doi.org/10.1111/jph.13055

Abstract

Botryosphaeriaceae species have a wide host range and a worldwide distribution. These fungal species can colonize several plant organs, such as the trunk, leaves and fruit. Some Botryosphaeriaceae species cause important diseases on persimmon, avocado and guava fruit. However, there is a lack of information regarding the mechanisms of penetration by Botryosphaeriaceae species on these tropical and subtropical fruits. This study aimed to better understand the mechanisms involved in fungal penetration, host specificity and aggressiveness of Botryosphaeria dothidea, Lasiodiplodia pseudotheobromae and Neofusicoccum parvum on avocado (Persea americana), guava (Psidium guajava) and persimmon (Diospyros kaki) fruit. Scanning electron microscopy (SEM) image analysis showed that in avocado fruit, the three studied Botryosphaeriaceae species penetrated through lenticels. In guava fruit, penetration through stomata was verified for Botryosphaeria dothidea and Neofusicoccum parvum. In persimmon fruit, an appressoria-like structure was observed for B. dothidea, which suggests direct penetration. Disease incidence in wounded fruit was 24% higher than in non-wounded fruit. L. pseudo theobromae and N. parvum showed differences in aggressiveness in guava fruit. The longest incubation period was observed for N. parvum inoculated on guava, with an average of 4.5 days, and the shortest incubation period was verified for B. dothidea inoculated on avocado, with an average of 2.8 days. The area under the disease progress curve (AUDPC) did not differ between Botryosphaeriaceae species on avocado, whereas on guava and persimmon fruit, the AUDPC was lower for B. dothidea. The information regarding penetration mechanisms and aggressiveness is important to improve postharvest disease control strategies.

Keywords: /Botryosphaeria dothidea/ /Diospyros kaki/ /Lasiodiplodia pseudotheobromae/ /Neofusicoccum parvum/ /Persea americana/ /Postharvest diseases/ /Psidium guajava/ /Scanning electron microscopy/

Shoji, K., Schudel, S., Onwude, D., Shrivastava, C., & Defraeye, T. (2022). Mapping the postharvest life of imported fruits from packhouse to retail stores using physics-based digital twins. *Resources, Conservation & Recycling*, *176*,105914. https://doi.org/10.1016/j.resconrec.2021.105914

Abstract

Controlling the hygrothermal conditions around fresh fruit and vegetables is vital for their preservation. Therefore, cold chain stakeholders often measure temperature along the supply chain of fresh produce. However, the temperature is typically monitored only in one segment of the entire cold chain, namely from the supplier until the distribution center. Besides, such measured data are rarely used for decision-making because they are not translated into the impact on the quality of the products. We provide a solution by extending the monitoring until the retail stores and upcycling these thermal data into actionable metrics.

To do so, we use physics-based digital twins, namely virtual representations of the food products. This study focuses on 331 cold chain shipments of cucumber, eggplant, strawberry, and raspberry imported from Spain to Switzerland. We followed these fruits through pre-cooling, thermally stable conditions at the distribution center, and the temperature ramp-up phase before arriving at the retail store. The temperature performance of each carrier and flow analysis of the shipment enabled us to map the complex logistic system better. The digital twins detected that the fruits lost 43 - 85% of their quality before being displayed at the retail store. This quality loss remains invisible to the retailer. Additionally, we found a strong correlation between fruit quality and shipment duration (i.e., for cucumber $r = -0.95$ ($P < 0.001$)), which emphasizes the importance of shortening the shipment to prolong the freshness of the fruit. The digital twins have shown a large potential to help further maximize shelf life and uniform product quality.

Keywords: /Cold chain/ /Food loss/ /Plant-based food/ /Shelf life/ /Supply chain optimization/ /Time-temperature monitoring/

GOJI

Wang, J., Wei, L., Yan, L., Zheng, H., Liu, C., & Zheng, L. (2022). Effects of postharvest cysteine treatment on sensory quality and contents of bioactive compounds in goji fruit. *Food Chemistry*, *366*, 130546. https://doi.org/10.1016/j.foodchem.2021.130546

Abstract

Effects of cysteine (Cys) treatments (0, 0.01%, 0.05% and 0.10%) on sensory quality and bioactive compounds in goji fruit stored at 4 °C and 90% RH for 10 d were investigated. Results indicated that 0.05% Cys treatment significantly reduced decay ratio and weight loss, and maintained total soluble solid content in goji fruit. Furthermore, 0.05% Cys treatment increased the contents of total phenolic, ascorbic acid and total glutathione, and the ratio of glutathione/oxidized glutathione, resulting in the higher antioxidant capacity. Determination of five free amino acids showed that 0.05% Cys treatment increased the Pro and Tau contents, while having no significant effect on the Cys, Glu and GABA contents. The increase in Tau content might be due to the up-regulation of two key genes involved in the Tau synthesis including CDO and CSAD. These findings suggested that Cys treatment could improve the storage quality in goji fruit.

Keywords: /Bioactive compounds/ /Cysteine/ /Goji/ /Quality/ /Taurine/

GRAPE

Piombino, P., Genovese, A., Rustioni, L., Moio, L., Failla, O., Bellincontro, A., & Mencarelli, F. (2022). Free and glycosylated green leaf volatiles, lipoxygenase and alcohol dehydrogenase in defoliated Nebbiolo grapes during postharvest dehydration. *Australian Journal of Grape & Wine Research*, *28*(1), 107–118. https://doi.org/10.1111/ajgw.12521

Abstract

Nebbiolo grapes are used to produce Sfursat wine, following partial dehydration. This research aimed to clarify the influence of fruit exposure to light and postharvest water loss on the concentration of green leaf volatiles (GLVs) and lipoxygenase (LOX) and alcohol dehydrogenase (ADH) activity of grapes. Methods and Results: Nebbiolo grapes from Control vines (no defoliation) (ND) and from vines defoliated at fruitset (DFS) or defoliated post-veraison (DPV) were harvested at about 23°Brix and dehydrated at 10 and 20°C, 60% RH and air flow of 1.5 m/s. Berries were sampled at 10 and 20% mass loss (ML). Significant differences in crop yield, bunch mass and berry mass were observed. As expected, the higher the dehydration temperature, the faster the dehydration process: 20% ML at 20°C occurred between 18 and 25 days, the shortest time corresponding to ND and the longest to DFS; at 10°C, the dehydration lasted between 27 and 32 days. At 10°C, the ADH activity was almost double that at 20°C, and in DFS was

much higher than in other samples. At harvest, LOX did not show any difference among the samples, while at 10°C and 10% ML, the enzyme activity increased significantly and then declined at 20% ML, especially in defoliated samples. At harvest, the total free GLVs associated with the metabolism of lipid oxidation were 9434, 7212 and 11 656 μg/kg dry weight (DW) in ND, DFS and DPV samples, respectively; the total bound GLVs lipid-derived were 7599, 18 486 and 15 409 μg/kg DW in ND, DFS and DPV samples, respectively. During dehydration at 10°C, the ML induced ADH + LOX activity, especially in defoliated samples, but the bound GLVs, produced by defoliation, greatly decreased. Conclusions: Defoliation affected the response of Nebbiolo grapes to dehydration temperature: postharvest cold stress (10°C) and ML induced glycosylation of GLVs, alcohol formation (via ADH) and membrane oxidation (via LOX); a further stress effect was observed with leaf removal, regardless of the time of application. Significance of the Study: The timing of defoliation and postharvest dehydration temperature are significant factors to mitigate the postharvest stress response of Nebbiolo grapes.

Keywords: /Alcohol dehydrogenase (ADH)/ /Defoliation/ /Dehydration/ /Glycosylated green leaf volatiles (GLVs)/ /Grape/ /Lipoxygenase (LOX)/

Xu, D., Qiao, F., Xi, P., Lin, Z., Jiang, Z., Romanazzi, G., & Gao, L. (2022). Efficacy of pterostilbene suppression of postharvest gray mold in table grapes and potential mechanisms. *Postharvest Biology and Technology, 183*, 111745. https://doi.org/10.1016/j.postharvbio.2021.111745

Abstract

Botrytis cinerea is an economically devastating necrotrophic fungus that is responsible for gray mold infection of table grapes. Fungicide application remains the most common approach in its control. However, in consideration of food and environmental safety, safe and eco-friendly alternatives are desirable to manage gray mold. Pterostilbene is a natural antimicrobial metabolite that inhibits growth of several phytopathogenic fungi. Moreover, pterostilbene has been widely used as a food additive on the basis of its safety and oxidation properties. However, the specific inhibitory effects of pterostilbene for pathogen control of postharvest fruit and its precise mechanism of action remain to be defined. Here, 0.25 g L^{-1} pterostilbene could suppress the development of gray mold in table grapes. Fluorescent staining indicated that pterostilbene-mediated disease suppression is mediated through loss of plasma membrane integrity. Electron microscopy revealed that pterostilbene inhibits *B. cinerea* by altering the morphology of the hyphae and conidiophores, with destruction of the plasma membrane and organelles. Furthermore, quantitative real-time PCR highlighted pterostilbene-mediated gene modulation and overexpression of genes associated with laccase production and cellular damage on *B. cinerea*, together with increased laccase activity. These data better define the mechanisms through which pterostilbene inhibits *B. cinerea* growth, thus making pterostilbene an attractive candidate in postharvest fruit disease management strategies.

Keywords: /Gray mold/ /Laccase/ /Membrane integrity/ /Pterostilbene/ /Suppression/

Zhu, M., Liu, Z., Zeng, Y., & Yu, J. (2022). Nordihydroguaiaretic acid reduces postharvest berry abscission in grapes. *Postharvest Biology and Technology, 183,* 111748. https://doi.org/10.1016/j.postharvbio.2021.111748

Abstract

The problem of berry abscission often occurs during the postharvest storage and transport of table grapes; this seriously affects the commodity value and brings major losses to growers and sellers. The objective of this study was to investigate the effects of nordihydroguaiaretic acid (NDGA, which can reduce ABA synthesis by down-regulating the expression level of *VvNCED1*), on berry abscission during storage. After NDGA treatment, the decline of berry detachment force was delayed, and the percentage of berry abscission was reduced. The expression levels of *VvNCED1* and *VvACO1* in fruit and rachis

were down-regulated, and the synthesis of abscisic acid (ABA) and ethylene in fruit and rachis were decreased by NDGA treatment. The activity of pectinesterase, polygalacturonase and cellulase, the malondialdehyde content and relative conductivity were lower than in the control. NDGA treatment also delayed the decline of total soluble solids, titratable acids, vitamin C and weight loss. Our results will help researchers to characterize the mechanism responsible for berry abscission during storage and transportation.

Keywords: /Grape/ /Abscission zone/ /Berry abscission/ /NDGA/ /ABA/

GUAVA

Domínguez, E. M. E., Fuentes, R. A., Arreola, G. A., Jaime, O. T. de J., Morales, O. M. A., Hernández, M. J. M. E., Hernández, C. M. del C., Cruz, R. R. I., Romero, C. T., Tirado, G. J. M., & Cruz, S. A. (2022). Edible coating based on banana starch and chitosan for postharvest conservation of guava. *Journal of Food Processing & Preservation*, *46*(1), 16154. https://doi.org/10.1111/jfpp.16154

Abstract

Fresh fruit is one of the fastest-growing segments of the agro-industry. The growing trend has sparked interest in sustainable and eco-friendly alternatives to preserve fruits' sensory properties, quality, and shelf life. Potential solutions are edible coatings from renewable sources. This paper reports on the evaluation of an edible coating (EC) based on male banana starch (Musa paradisiaca L.) and chitosan on the shelf life and postharvest preservation of guava (Psidium guajava L.) under specific storage conditions (25°C/50% RH). Also, it characterized male banana starch (MBstarch) and evaluated the MBstarch–chitosan film (functional, mechanical, and barrier properties) before applying it to the guava, which was stored at 25°C for 10 days (50% RH). The effect of EC on the postharvest quality of the fruit was evaluated via physicochemical parameters (weight loss, acidity, pH, firmness, and total soluble solids). In conclusion, the MBstarch–chitosan EC to be a suitable preservation alternative for fruit due to its barrier properties. Specifically, it was determined that MBstarch–chitosan EC delays the increase of pH, titratable acidity, and total soluble solids. Moreover, it was efficient in maintaining weight and firmness, improving appearance, and extending the shelf life of fruit by up to 10 days. Novelty impact statement: Starch isolated from male bananas, a nonconventional source, can be an alternative for manufacturing EC with favorable mechanical and barrier properties. MBstarch/Chitosan EC promotes the postharvest quality (physicochemical parameters) and extends the shelf life of guava by up to 10 days. This EC (MBstarch/Chitosan) can be considered a sustainable ecological postharvest preservation alternative for the guava fruit.

Keywords: /Guava/ /Edible coatings/ /Bananas/ /Plantain banana/ /Chitosan/ /Starch/ /Preservation of Fruits/

JASMINE

Zhou, C., Zhu, C., Tian, C., Xu, K., Huang, L., Shi, B., Lai, Z., Lin, Y., Guo, Y. (2021). Integrated volatile metabolome, multi-flux full-length sequencing, and transcriptome analyses provide insights into the aroma formation of postharvest jasmine (Jasminum sambac) during flowering. Postharvest Biology and Technology, 183, 111726. https://doi.org/10.1016/j.postharvbio.2021.111726

Abstract

Jasmine [*Jasminum sambac* (L.) Aiton] flowers usually bloom and release their fragrance at night. However, the underlying regulatory mechanisms of aroma formation during flowering in postharvest jasmine are still poorly understood. Here, we profiled the volatile metabolome, multi-flux full-length

sequencing, and transcriptome analysis to investigate volatile biosynthesis and global transcriptomic changes in postharvest flowering jasmine. A total of 102 volatiles were identified. Of these, 16 volatiles were considered key odorants of jasmine flowers. Linalool, α-farnesene, d-nerolidol, geraniol, α-cadinol, benzyl alcohol, benzaldehyde, benzyl acetate, benzyl benzoate, 3-hexen-1-ol benzoate, and (*Z*)-3-hexen-1-ol acetate play decisive roles in the typical jasmine fragrance, while benzeneacetaldehyde, benzoic acid, methyl anthranilate, methyl 2-(methylamino) benzoate, and (*E*)-2-hexenal modify the aroma of jasmine. Meanwhile, we built the first reference full-length transcriptome of postharvest jasmine flowers, which had 366,081 non-redundant isoforms. Among them, 280,326 (76.57 %) were annotated with at least one hit in the NT, NR, Swissprot, KEGG, KOG, Pfam, and GO databases. Combined with second-generation transcriptome analysis, we identified 52 differentially expressed transcripts (DETs) involved in terpenoid metabolic pathways and 28 DETs involved in phenylpropanoid/benzenoid metabolic pathway, and 31 β-glucosidase transcripts may be related to aroma formation of postharvest jasmine during flowering. In addition, the expression of 42 heat shock protein (HSP) transcripts was positively correlated with the content of 11 key odorants, as revealed by weighted gene co-expression network analysis (WGCNA). The present results advance the knowledge of the regulatory mechanism of aroma formation in postharvest jasmine during flowering and provide an abundant genetic resource for further studies on gene discovery in jasmine.

Keywords: /*Jasminum sambac/* /Aroma formation/ /Volatiles metabolome/ /Full-length transcriptome/ /Second-generation transcriptome/

LEMON

Soto-Muñoz, L., Martínez-Blay, V., Pérez-Gago, M. B., Fernández-Catalán, A., Argente-Sanchis, M., & Palou, L. (2022). Starch-based antifungal edible coatings to control sour rot caused by Geotrichum citri-aurantii and maintain postharvest quality of "Fino" lemon. *Journal of the Science of Food and Agriculture*, *102*(2), 794–800. https://doi.org/10.1002/jsfa.11414

Abstract

Two edible coating (EC) emulsions based on potato starch (F6 and F10) alone or formulated with sodium benzoate (SB, 2% w/w) (F6/SB and F10/SB) were evaluated to maintain postharvest quality of cold-stored 'Fino' lemons and control sour rot on lemons artificially inoculated with Geotrichum citri-aurantii. Previous research showed the potential of these ECs to improve the storability of 'Orri' mandarins and reduce citrus green and blue molds caused by Penicillium digitatum and Penicillium italicum, respectively. The coatings F6/SB and F10/SB significantly reduced sour rot incidence and severity compared to uncoated control samples on lemons incubated at 28 °C for 4 and 7 days. The F6/SB coating reduced weight loss and gas exchange compared to uncoated fruit after 2 and 4 weeks of storage at 12 °C plus a shelf life of 1 week at 20 °C, without adversely affecting the lemon physicochemical quality.Overall, the F6/SB coating formulation, composed of pregelatinized potato starch, glyceryl monostearate, glycerol, emulsifiers and SB, with a total solid content of 5.5%, showed the best results in reducing citrus sour rot and maintaining the postharvest quality of cold-stored 'Fino' lemons. Therefore, it showed potential as a new cost-effective postharvest treatment suitable to be included in integrated disease management programs for citrus international markets with zero tolerance to chemical residues.

Keywords: /Citrus limon/ /GRAS salts/ /food additives/ /postharvest quality/ /Sour rot control/

MANGO

Jiang, Z., Li, R., Tang, Y., Cheng, Z., Qian, M., Li, W., & Shao, Y. (2022). Transcriptome Analysis Reveals the Inducing Effect of Bacillus siamensis on Disease Resistance in Postharvest Mango Fruit. *Foods (Basel, Switzerland)*, *11*(1). https://doi.org/10.3390/foods11010107

Abstract

Postharvest anthracnose, caused by the fungus *Colletotrichum gloeosporioides* , is one of the most important postharvest diseases of mangoes worldwide. *Bacillus siamensis* (*B. siamensis*), as a biocontrol bacteria, has significant effects on inhibiting disease and improving the quality of fruits and vegetables. In this study, pre-storage application of *B. siamensis* significantly induced disease resistance and decreased disease index (DI) of stored mango fruit. To investigate the induction mechanisms of *B. siamensis* , comparative transcriptome analysis of mango fruit samples during the storage were established. In total, 234,808 unique transcripts were assembled and 56,704 differentially expressed genes (DEGs) were identified by comparative transcriptome analysis. Gene ontology (GO) enrichment and Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway analysis of DEGs showed that most of the DEGs involved in plant-pathogen interaction, plant hormone signal transduction, and biosynthesis of resistant substances were enriched. Fourteen DEGs related to disease-resistance were validated by qRT-PCR, which well corresponded to the FPKM value obtained from the transcriptome data. These results indicate that *B. siamensis* treatment may act to induce disease resistance of mango fruit by affecting multiple pathways. These findings not only reveal the transcriptional regulatory mechanisms that govern postharvest disease, but also develop a biological strategy to maintain quality of post-harvest mango fruit.

Keywords: /Bacillus siamensis/ /Disease resistance/ /Gene expression/ /Mango fruit/ /Transcriptome analysis/

Vilvert, J. C., de Freitas, S. T., Ferreira, M. A. R., Leite, R. H. de L., dos Santos, F. K. G., Costa, C. dos S. R., & Aroucha, E. M. M. (2022). Chitosan and graphene oxide-based biodegradable bags: An eco-friendly and effective packaging alternative to maintain postharvest quality of “Palmer” mango. *LWT - Food Science & Technology*, *154*, 112741. https://doi.org/10.1016/j.lwt.2021.112741

Abstract

Mango is a highly appreciated tropical fruit with high respiration rate and ethylene production, which makes it highly perishable after harvest. The objective of this study was to evaluate the effect of chitosan and graphene oxide-based biodegradable bags on the postharvest quality of 'Palmer' mangoes during cold storage. The fruit were harvested at the recommended maturity stage and were stored for 56 days at 12 °C without bagging (control), as well as in a chitosan-based bag, chitosan-based bag with graphene oxide, and polyethylene-based bag. According to the results, the bags evaluated in our study delayed mango ripening, maintaining external appearance, skin and flesh colors, firmness, soluble solids (SS), titratable acidity (TA), SS/TA ratio, β-carotene and chlorophyll contents in the fruit. In addition, bagging the fruit reduced weight loss, respiration rate and anthracnose (Colletotrichum gloeosporioides) incidence and severity during storage. Our results suggest that chitosan-based biodegradable bags are an ecological and effective alternative to maintain postharvest quality of 'Palmer' mango during cold storage. Chitosan-based biodegradable bags were prepared and characterized. Water resistance of chitosan-based bags was improved by graphene oxide. Bags were effective in delaying ripening and preserving the quality of mangoes. The bags preserved appearance and reduced disease incidence of fruits.

Keywords: /Biopolymer/ /Mangifera indica/ /Modified atmosphere packaging/ /Nanoparticles/ /Postharvest/

MUSHROOM

Wang, Wen-jun, Li, Yao, Li, Fu-hua, Zeng, Kai-fang, and Ming, Jian. (2022). Polypropylene crisper and 1-MCP delay the softening, lignification and transcription levels of related enzyme genes of golden needle mushrooms (Flammulina velutipes). Journal of Integrative Agriculture, 21 (1), 249-260. https://doi.org/10.1016/S2095-3119(21)63764-4

Abstract

The fresh postharvest golden needle mushroom (Flammulina velutipes) sporocarp has a high moisture content and crisp texture, but it still has high physiological activity and respiration, leading to senescence and quality deterioration. Treatments with 1-methylcyclopropene (1-MCP) and polypropylene (PP) crispers were used to study the changes of lignification and softening of F. velutipes during storage. The main findings were as follows: the crisper packaging could effectively prolong the storage time of F. velutipes; either the 1-MCP treatment, crisper packaging or the combination of the two treatments could significantly inhibit the accumulation of lignin and the decreases in the contents of cellulose and pectin, and had certain inhibitory effects on the activities of enzymes involved in lignification and softening including phenylalanine ammonia-lyase (PAL), cinnamyl alcohol dehydrogenase (CAD), cellulase (Cx), pectin methylesterase (PME) and polygalacturonase (PG). Among them, the inhibitory effect of the crisper packaging was higher than the 1-MCP treatment, while the combination of the two treatments was the best. The results of transmission electron microscopy (TEM) and scanning electron microscopy (SEM) showed that the crisper packaging in combination with the 1-MCP treatment could effectively maintain the integrity and stability of the F. velutipes cellular structure and inhibit the emergence of plasmolysis to prevent cell membrane rupture. The transcription levels showed that the crisper packaging and the combination of the 1-MCP treatment and crisper packing could effectively affect the expression of genes for enzymes related to lignification and softening of F. velutipes. In conclusion, 1-MCP and PP crispers could delay the lignification and softening of F. velutipes during storage.

Keywords: /Flammulina velutipes polypropylene crisper/ /1-MCP softening and lignification transcription levels

Zhu, B., Liu, Y., Qin, Y., Chen, H., & Zhou, L. (2022). Release of clove essential oil loaded by mesoporous nano‐silica in polylactic acid‐based food packaging on postharvest preservation of white button mushroom. *International Journal of Food Science & Technology*, *57*(1), 457–465. https://doi.org/10.1111/ijfs.15440

Abstract

This work prepared a controlled release food packaging film by solvent volatilization using polylactic acid (PLA) and mesoporous silica nanoparticles (MSNs) loaded with clove essential oil (CEO). White button mushrooms were packaged with PLA and CEO‐loaded MSN PLA composite films to investigate postharvest qualities. The result indicated that PMC‐3 film improves the postharvest qualities of Agaricus bisporus, as reflected by lower weight loss (7.03%), higher total phenolics (2.29 g/kg), and ascorbic acid (27.1 mg/kg) compared with A. bisporus packaged with PLA film. In addition, PMC‐1, PMC‐2, and PMC‐3 treatment significantly improved the antioxidant system of A. bisporus, which inhibited the activity of polyphenol oxidase and peroxidase, as well as control the release of clove essential oil during the storage period. These findings suggest that PMC film is a promising method in postharvest preservation of A. bisporus.

Keywords: /Clove essential oil/ /Food packaging/ /Mesoporous silica nanoparticle/ /White button mushrooms/

ORANGE

Ma, Q., Lin, X., Zhan, M., Chen, Z., Wang, H., Yao, F., & Chen, J. (2022). Effect of an exogenous strigolactone GR24 on the antioxidant capacity and quality deterioration in postharvest sweet orange fruit stored at ambient temperature. *International Journal of Food Science & Technology*, *57*(1), 619–630. https://doi.org/10.1111/ijfs.15415

Abstract

Summary: Quality deterioration and senescence are the main causes of loss of fruit postharvest. Here, the effects of 200 μmol L−1 strigolactone GR24 on the physicochemical characters, organoleptic quality, and antioxidant capacity of postharvest orange fruit were studied. GR24 increased fruit firmness (9.2%), citrus color index (22.34%), titratable acidity (11.7%), total soluble solid (13.13%), and soluble sugar content (8.17%) irrespective of the rates of weight loss (1.22%) and respiration (24.13%), indicating an improvement in organoleptic quality. GR24 also decreased the accumulation of hydrogen peroxide (30.08%) and malondialdehyde (27.59%), but increased the levels of antioxidants (ascorbate, glutathione, and total phenol) and enzyme activities (catalase, ascorbate peroxidase, and glutathione reductase), indicating an enhancement in antioxidant capacity. Moreover, GR24 delayed the fruit senescence process by stimulating the boost of the antioxidant system during 0–63 days and delaying the quality deterioration at 77–91 days.

Keywords: /Antioxidant capacity/ /Fruit quality/ /Orange/ /Postharvest senescence/ /Strigolactone GR24/

Zhang, Jun, Hang, Zhang, Jing-yi, Shan, You-xia, Guo, Can, He, Lian, Zhan, Lin-yan, Ling, Wei, Liang, Yan, Zhong, Ba-lian (2022). Effect of harvest time on the chemical composition and antioxidant capacity of Gannan navel orange (Citrus sinensis L. Osbeck 'Newhall' juice. *Journal of Integrative Agriculture,* 21(1), 261-272. https://doi.org/10.1016/S2095-3119(20)63395-0

Abstract

The present study investigates the chemical composition and antioxidant capacity of juice from the Gannan navel orange, which is harvested at one- to two-week intervals during the ripening period. The total soluble solid (TSS), total polyphenol content (TPC), total flavonoid content (TFC), sucrose and hesperidin contents gradually increase with the ripening of the fruit, followed by slight declines at the late maturity stage. Contrary to these observations, the contents of titratable acid (TA), vitamin C (Vc), and limonin trend downward throughout the ripening period. However, the contents of fructose, glucose, and narirutin fluctuate throughout the harvest time. Three in vitro antioxidant assays consistently indicate that the harvest time exerts no significant influence (P>0.01) on the antioxidant capacity. Furthermore, principal component analysis (PCA) and Pearson's correlation test are performed to provide an overview of the complete dataset. This study provides valuable information for evaluating the fruit quality and determining when to harvest the fruit in order to meet the preferences of consumers. Meanwhile, our observations suggest that the fruits subjected to juice processing should be harvested at the late maturity stage to alleviate the "delayed bitterness" problem without compromising the antioxidant capacity and the flavonoid content in the juice

Keywords: /Navel orange/ /Antioxidant/ /Harvest time/ /Chemical composition/

PASSION FRUIT

Diniz, A. A., Cavalcante, L. F., de Oliveira Filho, A. S. B., da Silva Dias, N., Dantas, T. A. G., Campos, V. B., do Nascimento, J. A. M., & Dantas, S. A. G. (2022). Postharvest quality of yellow passion fruit produced in soil with bovine biofertilizer and nitrogen. *Environmental Science and Pollution Research International, 2022*. https://doi.org/10.1007/s11356-021-18452-9

Abstract

The use of soil conditioners as bovine biofertilizer associated with mineral fertilization affect the physical and physicochemical quality of passion fruit. For fruit growth, post-harvest quality is crucial for production chain development, as it is the characteristic most used by the fresh consumption market for this fruit. In this sense, an experiment was carried out to investigate the effects of doses of bovine biofertilizer in the soil with and without nitrogen fertilization in the cultivation of yellow passion fruit. A randomized block

design was adopted, with three replications in a 5×2 factorial scheme, referring to five doses of liquid bovine biofertilizer (B) diluted in water (A): 0% - control (0B + 4A); 25% (1B + 3A); 50% (2B + 2A); 75% (3B + 1A); and 100% (4B + 0A) with and without nitrogen fertilization applied to the soil. Urea was the nitrogen source used in this study. A total of 10 g plant $^{-1}$ of N was applied monthly at 30 and 60 days after transplanting, and after that age, 20 g plant $^{-1}$ was applied until the end of harvest. During the final phase of production and ripening, twelve fruits were harvested from each treatment in physiological maturation for physical and physicochemical characterization. The following analyses were performed: longitudinal diameter, transversal diameter, number of seeds per fruit, peel firmness, pulp yield, fruit peel percentage, pulp pH, soluble solids content; titratable acidity and soluble solids content/titratable acidity ratio. Data underwent analysis of variance by the F test means for nitrogen were compared by Tukey's test and means for bovine biofertilizer, by regression. Nitrogen enhances the positive effect of bovine biofertilizer on the postharvest quality of yellow passion fruit. The association of biofertilizer and nitrogen improves fruit quality in comparison to plants without these inputs, except for pulp yield and fruit peel percentage, which suffered isolated effects from the factors. High doses of biofertilizer, above 75 and 100%, reduce soluble solids content and increase titratable acidity. The bovine biofertilizer has promising effects, but it does not replace nitrogen fertilization on the postharvest quality of yellow passion fruit.

Keywords: /Fruit quality/ /Nitrogen fertilization/ /Organic inputs/ /Passiflora edulis Sims/ /Soil conditioners/ /Urea/

PEACH

Batool, R., Kazmi, S. A. R., Khurshid, S., Saeed, M., Ali, S., Adnan, A., Altaf, F., Hameed, A., Batool, F., & Fatima, N. (2022). Postharvest shelf life enhancement of peach fruit treated with glucose oxidase immobilized on ZnO nanoparticles. *Food Chemistry*, *366*, 130591. https://doi.org/10.1016/j.foodchem.2021.130591

Abstract

For the shelf life extension of fruits, we envisioned a novel antimicrobial approach that is based on the production of a thin layer of hydrogen peroxide at the surface of food by utilizing the bioactivity of glucose oxidase (GOx). The enzyme, purified from Aspergillus Niger, was immobilized on zinc oxide nanoparticles and then suspended in a buffer to prepare a spraying solution of GOx/ZnONPs. Post-immobilization analyses indicated that immobilized enzymes showed higher activity as compared to the free enzyme. The GOx/ZnONPs spray was applied for post harvest treatment of peaches. The control and treatment groups were stored at ambient conditions for fifteen days and standard quality parameters were analyzed. In contrast to the control group, the GOx/ZnONPs spray treatment was remarkably effective in maintaining the physiological appearance of fruits even more than 12 days and showed a significant reduction in the decrease of weight, firmness, TSS, and DPPH free radical scavenging activity of fruits. Thus GOx/ZnONPs is an excellent platform to extend the postharvest shelf life of peaches.

Keywords: /Food chemistry/ /Fruit shelf life/ /Glucose oxidase/ /Immobilization/ /ZnO nanoparticles/

Zhang, Y., Ling, J., Zhou, H., Tian, M., Huang, W., Luo, S., Hu, H., & Li, P. (2021). 1-Methylcyclopropene counteracts ethylene inhibition of anthocyanin accumulation in peach skin after harvest. Postharvest Biology and Technology, 183, 111737 https://doi.org/10.1016/j.postharvbio.2021.111737.

Abstract

Anthocyanin biosynthesis is induced by ethylene in most fruit species. However, the hormone function in peach skin red coloration remained unclear. We investigated the effect of ethylene and ethylene action inhibitors (1-methylcyclopropene, 1-MCP) on color development and anthocyanin content in postharvest peaches as well as the mechanism behind this. The results showed that ethylene decreased total

anthocyanin and cyanidin-3-glucoside accumulation and thus prevented the red coloration of fruit skin, whereas 1-MCP treatment had an opposite effect. The activity of all enzymes associated with anthocyanin biosynthesis (except 4CL), and expressions of their coding genes as well as the related transcription factors (TFs) were also affected oppositely by 1-MCP and ethylene. In addition, the activity of ANS and UFGT was positively correlated with total anthocyanin and cyanidin-3-glucoside content. The result implied that ethylene blocked anthocyanin biosynthesis by regulating the expression of upstream TFs, thus hampering the anthocyanin biosynthesis pathway. This is the first evidence pertinent to the inhibition of ethylene to the skin red coloration in postharvest peach. It also provides a technology (1-MCP application) to improve postharvest fruit coloration and quality.

Keywords: /1-Methylcyclopropene/ /Ethylene/ /Anthocyanin/ /Biosynthetic pathway/ /Gene expression/

PONKAN MANDARIN

Cai, N., Wan, C., Chen, J., & Chen, C. (2022). Evaluation of postharvest storability of Ponkan mandarins stored at different temperatures. *Folia Horticulturae*, 1-11. https://doi.org/10.2478/fhort-2021-0027

Abstract

The effects of storage temperature on postharvest storability, quality attributes and antioxidant enzyme activities of harvested Ponkan mandarins were investigated. Fresh fruits were randomly divided into four groups and stored at different temperatures [5 ± 1 °C (S5), 10 ± 1 °C (S10), 15 ± 1 °C (S15), and 20 ± 1 °C (S20 or control)] for 120 days. The results indicated that, compared with the control fruit, low-temperature storage at 10 °C significantly delayed the increase in fruit decay rate, weight loss, citrus colour index, respiration intensity, relative electrical conductivity, the accumulation of hydrogen peroxide and malondialdehyde, retarded the decline in L* value, retained high contents of total soluble solid, titratable acid, vitamin C, total phenol and total flavonoid, as well as higher activities of antioxidant enzymes – superoxide dismutase, catalase, peroxidase and ascorbate peroxidase. The principal component analysis results showed that low-temperature storage significantly maintained the postharvest quality of Ponkan mandarins, with fruit stored at 10 °C having no significant difference from the fruit stored at 5 °C, but markedly higher than those fruit stored at 15 °C. The comprehensive result of single-factor analysis and PCA showed that 10 °C could be used as the optimum storage temperature for improving the postharvest storability of Ponkan mandarins.

Keywords: /Antioxidant enzymes/ /Citrus reticulata Blanco/ /Fruit senescence/ /Principal component/ /Analysis/ /Storability/

POSTHARVEST DISEASE

de Siqueira, K. A., Liotti, R. G., Januário, A. H., Vieira, L. C. C., de Araújo Boleti, A. P., dos Santos, E. L., & Soares, M. A. (2022). Isolation of 4-chlorocinnamic acid from *Streptomyces griseocarneus* R132, and its inhibition activity against sweet pepper postharvest anthracnose. *Biocontrol Science & Technology*, 1–6. https://doi.org/10.1080/09583157.2021.2023830

Abstract

Streptomyces griseocarneus R132 is an actinobacterium capable of controlling fungi in sweet peppers. The crude *S. griseocarneus* R132 methanol extract was fractionated in a polystyrene-divinylbenzene column eluted with 20–100% acetone gradient. Compound 1 isolated from the 60% fraction was identified as 4-chlorocinnamic acid. This fraction and 4-chlorocinnamic acid inhibited *Colletotrichum gloeosporioides* growth by 28% and 65%, respectively, and reduced the diameter of lesions caused by the phytopathogen in *Capsicum annuum* L. fruits by 33.19% and 31.92%, respectively. The isolated 4-chlorocinnamic acid was not toxic to MRC-5 fibroblasts.

Keywords: /4-Chlorocinnamic acid/ /Antifungal activity/ /Colletotrichum gloeosporioides/

Duanis, A. D., Galsurker, O., Davydov, O., Maurer, D., Feygenberg, O., Sagi, M., Poverenov, E., Fluhr, R., & Alkan, N. (2022). Double-stranded RNA targeting fungal ergosterol biosynthesis pathway controls Botrytis cinerea and postharvest grey mould. *Plant Biotechnology Journal*, *20*(1), 226–237. https://doi.org/10.1111/pbi.13708

Abstract

Pathogenic fungi cause major postharvest losses. During storage and ripening, fruit becomes highly susceptible to fungi that cause postharvest disease. Fungicides are effective treatments to limit disease. However, due to increased public concern for their possible side effects, there is a need to develop new strategies to control postharvest fungal pathogens. Botrytis cinerea, a common postharvest pathogen, was shown to uptake small double-stranded RNA (dsRNA) molecules from the host plant. Such dsRNA can regulate gene expression through the RNA interference system. This work aimed to develop a synthetic dsRNA simultaneously targeting three essential transcripts active in the fungal ergosterol biosynthesis pathway (dsRNA-ERG). Our results show initial uptake of dsRNA in the emergence zone of the germination tube that spreads throughout the fungus and results in down-regulation of all three targeted transcripts. Application of dsRNA-ERG decreased B. cinerea germination and growth in in vitro conditions and various fruits, leading to reduced grey-mould decay. The inhibition of growth or decay was reversed by the addition of ergosterol. While dual treatment with dsRNA-ERG and ergosterol-inhibitor fungicide reduced by 100-fold the required amount of fungicide to achieve the same protection rate. The application of dsRNA-ERG induced systemic protection as shown by decreased decay development at inoculation points distant from the treatment point in tomato and pepper fruits. Overall, this study suggests that dsRNA-ERG can effectively control B. cinerea growth and grey-mould development suggesting its efficacy as a future method for postharvest control of fungal pathogens.

Keywords: /Botrytis cinerea/ /Double-stranded RNA/ /Ergosterol biosynthesis/ /Grey mould/ /Postharvest/

Harpaz, D., Duanis-Assaf, D., Alkan, N., & Eltzov, E. (2022). Detection of postharvest pathogenic fungi by RNA markers in high-throughput platform on streptavidin plate. P*ostharvest Biology and Technology, 183,* 111728. https://doi.org/10.1016/j.postharvbio.2021.111728.

Abstract

Postharvest pathogenic fungi cause rots and major losses in harvested crops worldwide. Therefore, advanced disease detection and decay prevention in crops are essential to minimize these rots. In this study, oligonucleotides-based detection was integrated into an adapted commercial well-plate reader to enable a high-throughput biosensor monitoring system for the detection of RNA-markers of quiescent fungi in harvested crops. The streptavidin commercial 96-well plates were functionalized with complementary strands to the target RNA-markers of quiescent fungal-pathogens *Alternaria alternata* and *Botrytis cinerea*. After exposure to the target sample, the target RNA sequence binds to the immobilized surface DNA strand. Then, a reporter DNA strand binds to the target RNA. The reporter DNA that is linked to the fluorophore Texas-Red produces a light signal, which is detected by the plate reader. Firstly, the assay functionality was optimized with the surface DNA strand and reporter DNA strand concentrations of 100 nM and 250 nM, respectively. Then, the specificity of the platform was examined against several non-specific target DNA markers from different pathogenic fungi. The light intensity signals were significantly higher by 3.6- and 4.9-fold as compared to the control in the markers of *Botrytis cinerea* and *Alternaria alternata*, respectively. The biosensor demonstrated highly sensitive detection for both *Botrytis cinerea* (LOD = 0.657 nM RNA), and *Alternaria alternata* (LOD = 0.533 nM RNA), which was validated with biological samples. The obtained valuable information from this platform allows the early detection of RNA-markers of quiescent pathogenic fungi in agricultural produce, which will provide a smart and data-based decision-making tool to reduce postharvest losses.

Keywords: /Postharvest loss/ /Optical biosensor/ /Patho

POTATO

Li, L., Chen, J., Li, Z., Li, H., Yang, S., Ren, B., Lu, Y., Zheng, S., Yu, L., Wang, X., & Lu, L. (2022). Proteomic analysis of garlic essential oil-treated potato reveals that StHSP26.5 as a vital gene involving in tuber sprouting. *Postharvest Biology and Technology,183,* 111725. https://doi.org/10.1016/j.postharvbio.2021.111725

Abstract

Potato (*Solanum tuberosum* L.) tubers are rich in starch, protein, vitamins, minerals and other nutrients. However, sprouting can produce solanine and reduce the commodity value during periods of storage. Some research has suggested that some essential oils from plants reduce tuber sprouting. Garlic essential oil (GEO) is reported to have antioxidant, anti-inflammatory, and antimicrobial properties. In this study, we first found that GEO reduced tuber sprouting, and the starch content, soluble sugar content and α-amylase activity were altered after 60 d of GEO treatment. Then, comparative proteomic analysis of tuber bud eyes revealed 140 and 180 differentially abundant proteins (DAPs) with increased and decreased levels of abundance respectively after 30 d of GEO treatment. Among them, StHSP26.5 protein abundance decreased after GEO treatment, however, as the storage time increased, the expression level of this gene increased. Further research suggested that overexpressing StHSP26.5 tobacco showed increased seed germination and POD activity after GEO treatment. Our results provide new insights into proteomic mechanisms in the sprouting process after GEO treatment and suggest the potential utility of *StHSP26.5* as a target gene in tuber molecular breeding programs.

Keywords: /Potato/ /Garlic essential oil/ /Sprouting/ /Proteomics/ /StHSP26.5/

Liu, J., Sun, Z., Zou, Y., Li, W., He, F., Huang, X., Lin, C., Cai, Q., Wisniewski, M., & Wu, X. (2022). Pre- and postharvest measures used to control decay and mycotoxigenic fungi in potato (Solanum tuberosum L.) during storage. *Critical Reviews in Food Science and Nutrition*, *62*(2), 415–428. https://doi.org/10.1080/10408398.2020.1818688

Abstract

Potato (*Solanum tuberosum* L.), a worldwide, staple food crop, is susceptible to postharvest rots caused by a variety of fungal pathogens, including *Fusarium* spp., *Alternaria* spp., *Phytophthora infestans* , *Helminthosporium solani* , *Rhizoctonia solani,* and *Colletotrichum coccodes* . Rots resulting from infections by these pathogens cause a significant reduction in potato quality and marketable yield. Importantly, some of these decay fungi also produce mycotoxins that represent a potential risk to human health. In the present review, an overview and discussion are provided on the epidemiology and pathogenesis of decay fungi, especially *Fusarium* spp., that include recent data derived from genomic and phylogenetic analyses. The biosynthesis and functional role of fungitoxic metabolites such as trichothecene mycotoxins and fusaric acid, produced in rotted potatoes are also reviewed. Advances in pre- and postharvest measures for rot management, especially eco-friendly methods including physical control, biological control, the use of natural compounds, and other agricultural management practices are also reviewed. Lastly, novel approaches to control potato dry rot such as the use of mycoviruses and CRISPR technology are highlighted.

Keywords: /Decay control/ /Food safety/ /postharvest rot/ /Potato/

Zhang, H., Liu, X., Nie, B., Song, B., Du, P., Liu, S., Li, L., & Zhao, Z. (2022). Nitrogen management can inhibit or induce the sprouting of potato tubers: Consequences of regulation tuberization. *Postharvest Biology and Technology, 183*, 111722. https://doi.org/10.1016/j.postharvbio.2021.111722

Abstract

Regulation of tuber dormancy and sprouting are pivotal for postharvest storage, sales, and seed breeding of potatoes (*Solanum tuberosum* L.). Nitrogen is an essential mineral nutrient required in potato production, which directly influences tuber development and quality. However, the effects of nitrogen on the post-harvest dormancy of potato tubers remain unclear, and their association with the initial tuber development are poorly understood. The aim of this study was to clarify the effects of nitrogen application rate on potato tuber dormancy and the associated physiological mechanisms. We obtained the tubers of different commercial potato cultivars (E shu3, Z shu5, and H shu3) at three nitrogen levels (0, 210, and 315 kg N ha^{-1}) through field experiment, and then stored the tubers at room temperature (25 ℃) in the dark for 0–16 weeks. The dormancy period and alkaloid accumulation of potato tubers were analyzed, and the quality of seed tubers was evaluated by examining eye sprouting and replanting. We also conducted a pot experiment to explore the differences in tuber and stolen development of one potato cultivar (H shu3) at the three nitrogen levels. The carbohydrate and phytohormone contents in the apical bud meristem of dormant tubers and the enlarged subapical region of stolons were measured. The results showed that a reduction in the nitrogen application rate extended the dormancy period of potato tubers by 3–6 weeks and thereby reduced the risk of alkaloid accumulation caused by tuber sprouting, which was favorable for potato storage and sales. From the perspective of seed potato breeding, nitrogen application markedly increased the number of sprouting eyes, resulting in more stems and higher tuber yield after replanting. Compared to the control, nitrogen application promoted the sprouting of eyes at the apical bud of potato tubers, improved associated α-amylase activity and sucrose content, and increased gibberellin 1 (GA 1) content by 6.0 times. Nitrogen application also facilitated stolon elongation and growth, increased associated GA 1 content by 2.2 times, and delayed the enlargement of the subapical region to form tubers by 6–15 d. Taken together, the results indicate that nitrogen management (increasing or reducing nitrogen application rate) can be used as an agricultural practice to regulate potato tuber dormancy and sprouting. The intrinsic link between regulation of tuber dormancy by nitrogen application rate and its effects on tuber development is attributable to the regulation of tuberization. This research provides abundant physiological information for tuber dormancy and development in potatoes.

Keywords: /Potato tuber/ /Nitrogen/ /Dormancy/ /Sprouting/ /Tuberization/ /Gibberellins/

STRAWBERRY

Petrasch, S., Mesquida-Pesci, S. D., Pincot, D. D. A., Feldmann, M. J., López, C. M., Famula, R., Hardigan, M. A., Cole, G. S., Knapp, S. J., & Blanco-Ulate, B. (2022). Genomic prediction of strawberry resistance to postharvest fruit decay caused by the fungal pathogen Botrytis cinerea. *G3: Genes | Genomes | Genetics*, *12*(1), 1–15. https://doi.org/10.1093/g3journal/jkab378

Abstract

Gray mold, a disease of strawberry (Fragaria x ananassa) caused by the ubiquitous necrotroph Botrytis cinerea, renders fruit unmarketable and causes economic losses in the postharvest supply chain. To explore the feasibility of selecting for increased resistance to gray mold, we undertook genetic and genomic prediction studies in strawberry populations segregating for fruit quality and shelf life traits hypothesized to pleiotropically affect susceptibility. As predicted, resistance to gray mold was heritable but quantitative and genetically complex. While every individual was susceptible, the speed of symptom progression and severity differed. Narrow-sense heritability ranged from 0.38 to 0.71 for lesion diameter (LD) and 0.39 to 0.44 for speed of emergence of external mycelium (EM). Even though significant additive genetic variation was observed for LD and EM, the phenotypic ranges were comparatively narrow and genome-wide analyses did not identify any large-effect loci. Genomic selection (GS) accuracy ranged

from 0.28 to 0.59 for LD and 0.37 to 0.47 for EM. Additive genetic correlations between fruit quality and gray mold resistance traits were consistent with prevailing hypotheses: LD decreased as titratable acidity increased, whereas EM increased as soluble solid content decreased and firmness increased. We concluded that phenotypic and GS could be effective for reducing LD and increasing EM, especially in long shelf life populations, but that a significant fraction of the genetic variation for resistance to gray mold was caused by the pleiotropic effects of fruit quality traits that differ among market and shelf life classes.

Keywords: /Botrytis cinerea/ /Breeding/ /Disease resistance/ /Fragaria x ananassa/ /Genome-wide association study/ /Hecrotroph/ /Whole-genome regression/

SUGAR BEET

Kleuker, G., & Hoffmann, C. (2022). Gunnar Kleuker, Christa M. Hoffmann. Causes of different tissue strength, changes during storage and effect on the storability of sugar beet genotypes. *Postharvest Biology and Technology,183, 111744.* https://doi.org/10.1016/j.postharvbio.2021.111744

Abstract

Genetic variation in the tissue strength of sugar beet (*Beta vulgaris* L.) roots has been found in recent studies. There are indications that tissue strength influences damage susceptibility and storability. The objective of this study was to analyse the impact of storage on tissue strength, to determine causes for differences in tissue strength and to find possible relations between tissue strength, damage susceptibility and storability of sugar beet genotypes. For this purpose, trials with six sugar beet genotypes were conducted in seven environments across Germany in 2018 and 2019, followed by a screening trial with 12 commercial genotypes at one location in 2020. Tissue strength changed during storage depending on the growing environment, but independently of the genotype; puncture resistance increased by 0.35 MPa. The genotypic tissue strength was mainly determined by the cell wall content (r^2 up to 0.97), less by the cell wall composition. For sugar beet genotypes, the relationship between tissue strength and storability could be explained by the fact that root tip breakage and subsequent storage losses tended to decrease with higher tissue strength, as shown by principal component analysis (PCA). Introducing tissue strength as a variety trait in breeding and official variety trials could thus contribute to reduced harvest and storage losses in the future.

Keywords: /Storage/ /Damage/ /Sugar beet/ /Mechanical property/

SWEET CHERRY FRUIT

Pan, L., Chen, X., Xu, W., Fan, S., Wan, T., Zhang, J., & Cai, Y. (2022). Methyl jasmonate induces postharvest disease resistance to decay caused by Alternaria alternata in sweet cherry fruit. Scientia Horticulturae, 292, 110624. https://doi.org/10.1016/j.scienta.2021.110624

Abstract

The concentration of 0.05 mmol/L MeJA was beneficial in controlling postharvest decay of sweet cherry fruits. MeJA induces the activities and gene expression of antioxidant and defense enzymes. MeJA induced relative expression of JA biosynthesis-related genes. MeJA treatment is a safe and effective method for sweet cherry fruit storage. This research investigated the effect and mechanism of methyl jasmonate (MeJA) for decay caused by Alternaria alternata in postharvest sweet cherries. The results revealed MeJA at lower concentrations (0–0.05 mmol/L) had little effect on the mycelial growth of A. alternata in vitro. Furthermore, in vivo studies in fruits, applying optimal concentration 0.05 mmol/L MeJA significantly reduced the degree of decay, enhanced the activities of antioxidant enzymes and disease resistance-related enzymes (catalase, peroxidase, superoxide dismutase, polyphenol oxidase,

phenylalanine ammonia lyase, chitinase, β-1,3-glucanase), with membrane lipid peroxidation considerably reduced. Moreover, this MeJA treatment up-regulated the expression of antioxidant enzyme genes (PavPOD, PavPPO, PavSOD, PavCAT) and key genes related to jasmonic acid (JA) biosynthesis and signal transduction pathways (PavLOX, PavAOS, PavOPR3, PavMYC2). These results suggest their regulation by MeJA and a mechanism for how it could induce sweet cherry's resistance to A. alternata , rather than its fungi toxicity effect on pathogens.

Keywords: /Alternaria alternata/ /Induced resistance/ /Methyl jasmonate/ /Sweet cherry fruit/

SWEET POTATO

Chen, H., Zhou, S., Li, X., & Yang, H. (2022). Exogenous progesterone alleviates chilling injury by upregulating IbAOX1 to mediate redox homeostasis and proline accumulation in postharvest sweetpotato tuberous root. *Postharvest Biology and Technology, 183*, 111738. https://doi.org/10.1016/j.postharvbio.2021.111738

Abstract

This study aimed to elucidate the role of progesterone (PROG) in mitigating chilling injury (CI) in sweetpotato tuberous root and its relation to alternative oxidase (AOX). The Roots were pretreated by immersing them in 100 mM PROG or PROG-salicylhydroxamic acid (SHAM). The results showed that PROG effectively enhanced the transcription level of *IbAOX1* and the activity of AOX, inhibited the formation of CI, and reduced membrane permeability, malonaldehyde levels, and the production of ROS compared with the control. PROG also enhanced the antioxidant protection system by maintaining higher activities of antioxidant enzymes and levels of ascorbic acid and total phenolics. PROG further induced the upregulation of Δ1-pyrroline-5-carboxylate synthetase and ornithine d-aminotransferase and the downregulation of proline dehydrogenase, which advanced the proline level. However, the above mentioned effects resulting from PROG treatment were weakened by SHAM. Therefore, PROG upregulated AOX to mediate the antioxidant system and proline accumulation, thereby alleviating CI in the tuberous root. The strategy of PROG treatment combined with cold storage can potentially be used for cold-induced rapid sweetening and enhancing the antioxidant capacity of freshly harvested tuberous roots.

Keywords: /Sweetpotato/ /Progesterone/ /Alternative oxidase/ genic fungi/ /*Botrytis cinerea/ /Alternaria alternata/ /*RNA markers//Chilling injury/ /Antioxidant defense/

Selokela, L. M., Laurie, S. M., & Sivakumar, D. (2022). Impact of different postharvest thermal processes on changes in antioxidant constituents, activity and nutritional compounds in sweet potato with varying flesh colour. *South African Journal of Botany*, *144*, 380–388. https://doi.org/10.1016/j.sajb.2021.09.009

Abstract

Cooking negatively affected the protocatechuic acid and vanillic acid content. Cooking increased the antioxidant power (FRAP activity) in all six cultivars. Solar drying (blanched) increased the β-carotene content in C5-1 and Bophelo. Novel information provided on the changes in phytonutritional components. Sweet potatoes are key to food security, nutrition and income generation in sub-Saharan Africa, and orange-fleshed sweet potato contributes towards pro-vitamin A intake. This study investigated the changes in phytonutritional components and antioxidant activity in six sweet potato cultivars with varying flesh colour in fresh form and during different postharvest thermal treatments; conventional cooking (boiled), drying in hot-air convection oven dryer (14 h at 60°C) as well as blanched and unblanched indirect solar drying (at 20-60°C for 48 h). Overall thermal processing enhanced the retention of total protein content, Zn, total phenols, epicatechin, protocatechuic acid, and 2-caffeoyl-L-tartaric acid in all six

cultivars compared to the fresh form. However, vanillic acid was not detected in most of the cultivars after cooking except in 'C5-1. Hot-air convection oven drying significantly increased the total phenolic content in all six cultivars compared to the fresh form and other drying methods, while hot-air oven dried 'Monate' contained the highest total phenols and protocatechuic acid. Similarly, hot-air oven dried 'C5-1' showed the highest epicatechin and vanillic acid content compared to the fresh form and other drying methods. Cooking increased the 2-caffeoyl-L-tartaric acid in all six cultivars, compared to the fresh form and the highest content was detected in cooked 'Bophelo'. Blanching and solar drying improved the β-carotene content in orange cultivars 'Beauregard', 'Bophelo' and 'C5-1', of which 'C5-1' showed the highest β-carotene content. Cooking increased the antioxidant power (FRAP activity) in all six cultivars and increased the protein content and Zn content in 'Ndou' and '199062.1' respectively. The study provided novel information on the changes in phytonutritional components of different sweet potato cultivars including the cream cultivars 'Monate' and 'Ndou' and orange cultivars 'Bophelo' and 'C5-1' bred locally in South Africa, using different processing methods.

Keywords: /β-carotene/ /Ipomoea batatas/ /Phenolic compounds/ //Postharvest processing/ /Sweetpotato/

TOMATO

Sossi, M. L., Valle, E. M., & Boggio, S. B. (2022). Reversible changes in galactolipid saturation level and head group composition are associated with tolerance to postharvest chilling in tomato fruit. *Journal of the Science of Food and Agriculture*, *102*(2), 531–539. https://doi.org/10.1002/jsfa.11381

Abstract

Chilling injury (CI) is a physiological disorder that results in a limitation for cold storage (CS) of many fruits and vegetables. The low temperature-induced changes in the properties and composition of cell membranes are involved in the response to chilling temperature and in the mechanism of CI and tolerance. We compared the changes in the lipid composition by gas chromatography-mass spectrometry before, immediately after CS, as well as during a 3-day subsequent period, of tomato fruits with different chilling-sensitivity: Micro-Tom (tolerant) and Minitomato (susceptible). The changes in linolenic acid content, double bond index and digalactosyldiacylglycerol/monogalactosyldiacylglycerol ratio (DGDG/MGDG) showed membrane fluidity adjustment, depending on the temperature. By a database search, we identified 18 membrane-bound fatty acid desaturase (FAD) genes and five DGDG synthases (DGD) genes that are phylogenetically clustered into four and two subfamilies, respectively. The FAD and DGD genes were differentially expressed in response to CS, as determined by quantitative reverse transcriptase-polymerase chain reaction analysis. The data strongly suggest that reversion of CS-induced changes during the recovery period is important for the proper function of the membrane and tolerance to postharvest CI in tomato fruit.

Keywords: /DGD synthases/ /FADs/ /Micro-Tom/ /Chilling injury/ /Membrane lipids/