



## What's Key in this Issue

[Upcoming Workshops](#)

[Our Website & Social Media](#)

[Research Highlights](#)

[Postharvest Opportunities](#)

[Postharvest Calendar](#)

[Ask the Produce Docs](#)

## Director's Note

As we enter the month of September, the fall season begins in the United States. Late summer and fall is a time when many fruit are harvested for long-term storage, including apples and pears. What should growers and storage operators have in mind as they approach the harvest and storage season?

Produce intended for long-term storage requires special care to maximize storage life and post-storage quality. The first consideration is harvest maturity. Depending on the fruit, harvest maturity can be based on firmness, ethylene production, skin color, starch content and/or soluble solids content (often called Brix). The exact parameters for best harvest maturity depend on the type of fruit and the specific variety, as well as the intended length of storage and storage conditions. Careful handling to avoid bruises and cuts is also important to maintaining quality during storage.

Apples and pears are stored the longest and are the fruit most commonly stored under controlled atmosphere (CA) conditions (reduced oxygen and elevated carbon dioxide). Storage at the lowest safe temperature has long been recommended to maintain fruit quality, with the addition of CA to further extend storage life; however, the introduction of 1-methylcyclopropene (1-MCP) has modified these recommendations, at least for apples. Apples treated with 1-MCP can successfully be stored in cold air for moderate lengths of time or stored at slightly warmer temperatures. Use of slightly warmer temperatures during storage saves energy and can reduce some low temperature disorders. Use of 1-MCP for pears is more complicated because they need to eventually soften.

You can always check the [Produce Facts Sheets](#) on our website for a short summary of recommended practices for harvesting and handling various produce items. Additional information can be found in the many [publications on our website](#).

Beth



*Interim Director,  
Beth Mitcham*



*Associate Director,  
Irwin Donis-Gonzalez*



## Emerging Technologies: Addressing Grand Challenges in the Produce Industry

January 18-20, 2022

The UC Postharvest Technology Center, and The Department of Biological & Agricultural Engineering, in collaboration with the World Food Center at UC Davis, are hosting a workshop as part of the UC Davis World Food Center's Aligning the Food System Workshop Series that will bring together academics, extension experts, and industry representatives to discuss and propose solutions to challenges (labor shortages, sustainability needs, consumer demands) facing the produce industry. The purpose is to identify critical needs to address these challenges, and lay out future directions in produce-handling technology.

The event will focus primarily on emerging technological solutions, and research and development activities that have the potential to revolutionize the way fresh produce is harvested, handled, stored, transported and distributed from farm to table. The aim is to create a produce supply chain that is prepared to ensure the integrity, safety and nutritional quality consumers desire in the modern age.

The workshop will be divided into several modules following a hybrid model, including keynote speeches, interactive activities and demonstrations. Selected research academics and industry representatives will highlight cutting-edge information on current produce trends, key challenges, and potential technological solutions. In addition, a round table discussion for each module will be moderated by an extension expert that will enable a dialogue with the selected experts, with the goal of conceptualizing technological solutions to identified challenges. **This workshop will be offered in person on the UC Davis campus and virtually.**



## Upcoming UC Postharvest Technology Center Educational Opportunities

[Produce Professional Certificate Program](#) :: Ongoing

[Aligning the Food System Workshop: Emerging technologies to address grand challenges in the produce industry](#) :: January 18-20, 2022

[Fruit Ripening & Ethylene Management Workshop](#) :: April 5-7, 2022

[Postharvest Technology of Horticultural Crops Short Course](#) :: June 13-24, 2022

## Our Website & Social Media

### New Publications on our Website

Lucía Félix-Palomares and Irwin R. Donis-González. 2021. [Optimization and Validation of Rancimat Operational Parameters to Determine Walnut Oil Oxidative Stability](#). *Processes* 2021, 9, 651

*The potential of walnut kernels to oxidize and become rancid, greatly reducing their marketability, can be measured by an accelerated oxidation method or aging test. A Rancimat machine can be used to predict the storage life of walnut samples by exposing an oil sample extracted from the walnuts to a constant high temperature and airflow to guarantee a sufficient supply of oxygen to rapidly induce lipid oxidation. The authors used a response surface methodology statistical technique, in combination with a Box-Behnken experimental design, to optimize and validate Rancimat operational parameters (sample weight, temperature, airflow), and established a standard for future walnut oil assessments.*

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## Research Highlights

Liu, J., Z. Jiang, Y. Qi, Y. Liu, Y. Ding, Z. Tian, and X. Ren. 2021. [MdCAX affects the development of the 'Honeycrisp' bitter pit by influencing abnormal Ca distribution](#). *Postharvest Biology and Technology* 171:111341.

*Bitter pit is a calcium deficiency disorder in apple fruit and has not been fully characterized. The Ca<sup>2+</sup>/H<sup>+</sup> exchanger (CAX) is a kind of Ca<sup>2+</sup> transport protein that have been linked to calcium deficiency in tomato fruit (blossom-end rot). In this study, the authors analyzed mineral content in different parts of the fruit, the expression levels of genes related to Ca transport and the functional roles of MdCAXs. The results showed lower water-soluble Ca content and significantly higher ratios of water-soluble P/Ca and (K + Mg)/Ca in the calyx-end flesh of bitter pit and normal fruit than in the peduncle-end. The expression level of MdCAX11 increased as the severity of bitter pit increased, and the expression profile was negatively correlated with water-soluble Ca content. Yeast growth assays showed that both MdCAX11 and MdCAX5 have the function of transporting Ca into vacuoles. Subcellular localization analysis showed that MdCAX11-GFP and MdCAX5-GFP were colocalized on the vacuole membrane with a tonoplast marker. Taken together, the results of this study indicate that high expression levels of MdCAX11 and MdCAX5 may cause an influx of Ca from the cytosol into vacuoles, which may be related to the occurrence of bitter pit.*

Tang, J., H. Chen, H. Lin, Y.-C. Hung, H. Xie, Y. Chen. 2021. [Acidic electrolyzed water treatment delayed fruit disease development of harvested longans through inducing the disease resistance and maintaining the ROS metabolism systems](#). *Postharvest Biology and Technology* 171:111349.

*Electrolyzed oxidizing (EO) water, an effective disinfectant is produced by the electrolysis of dilute sodium chloride or hydrochloric acid solution. Recent studies have pointed to an antimicrobial effect of EO water on produce. These authors tested the effects of a 10-minute dip in acidic EO water compared with distilled water on longan fruit quality. Their results showed a slight but significant reduction in the rate of decay development along with an increase in activity of disease-resistance enzymes (phenylalanine ammonia lyase, chitinase and  $\beta$ -1,3-glucanase). They also observed increased capacity to scavenge reactive oxygen species, which resulted in reduced membrane damage in the treated fruit.*

## Postharvest Opportunities



### Postharvest Research Fellow

Cranford University is currently recruiting a postharvest research fellow in the [Plant Science Laboratory](#) at Cranfield for a UK EPSRC project 'Zero Emission Cold-Chain ([ZECC](#); [EP/V042548/1](#)) - Building the Road to Sustainable Cold-Chain Systems for Food Resilience'. Candidate will be responsible for the data collection, analysis and interpretation of results in collaboration with all project partners: University of Birmingham, Heriot-Watt University and London South Bank University. Innovative thinking is key in this project. Click [here](#) for more information and to apply.



### Product Applications Associate II

Mori is seeking a highly motivated, resourceful, and proactive Product Applications Associate to contribute to the growing Salinas team. The candidate will have the following responsibilities, and more

- Collaborate with teammates based in Salinas, CA and Boston, MA to conduct in-field experiments and pilots
- Execute in-field experiments and pilots, including overseeing data collection and analysis
- Identify and implement improvements to methods



### Food Safety/Chemistry Fellow

The Office of Regulatory Science (ORS) of the U.S. Food and Drug Administration's Center for Food Safety and Applied Nutrition is seeking an outstanding chemist with analytical or bioanalytical expertise to participate in our food safety/food defense research program. An opening for a food safety/chemistry fellow is available in the Bioanalytical Methods Branch. The position will involve the development and validation of methods for the quantification of unapproved compounds, plant toxins, and botanical constituents in dietary supplements using mass spectrometry (MS)-based techniques (i.e. LC-MS and/or GC-MS). A Bachelor or

Master's degree in Chemistry or related fields, with a strong background and interest in instrumental analysis, is required. Training or experience in trace quantitative analysis using validated analytical methods for complex sample matrices is highly desirable.

Interested candidates should submit a curriculum vitae, a list of references and a cover letter that includes a short statement of experience and research interests via email to: Christine Parker, Chief, Bioanalytical Methods Branch ([Christine.Parker@fda.hhs.gov](mailto:Christine.Parker@fda.hhs.gov)). Please use "Research Fellow 2021" in the subject line.



### Postdoctoral Research Fellow

The Office of Regulatory Science (ORS) of the U.S. Food and Drug Administration's Center for Food Safety and Applied Nutrition is seeking an outstanding analytical or bioanalytical chemist with mass spectrometry expertise to participate in our food safety/food defense research program. An opening for a postdoctoral research fellow is available in the Bioanalytical Methods Branch. The position will involve the development and validation of methods for the quantification of unapproved compounds, plant toxins, and botanical constituents in dietary supplements using mass spectrometry (MS)-based techniques (i.e. LC-MS and/or GC-MS). A Ph.D. degree in Analytical Chemistry, Bioanalytical Chemistry or related fields, with a strong background and interest in MS instrumental analysis, is required. Candidates should be experienced with the latest liquid chromatographic and mass spectrometric techniques and application of those techniques to quantitative analysis. Training or experience in analytical method development for complex matrices such as food, cosmetics or environmental analysis is also highly desirable.

Interested candidates should submit a curriculum vitae, a list of references and a cover letter that includes a short statement of experience and research interests via email to: Christine Parker, Chief, Bioanalytical Methods Branch ([Christine.Parker@fda.hhs.gov](mailto:Christine.Parker@fda.hhs.gov)). Please use "PostDoc 2021" in the subject line.

## Postharvest Calendar

- January 18-20, 2022. [Aligning the Food System - Emerging technologies to address grand challenges in the produce industry](#). UC Postharvest Technology Center. Davis, CA
- April 5-7, 2022. [Fruit Ripening & Ethylene Management Workshop](#), UC Postharvest Technology Center, Davis, CA
- June 13-24, 2022. [Postharvest Technology of Horticultural Crops Short Course](#). UC Postharvest Technology Center, Davis, CA
- August 14-20, 2022. [International Horticulture Congress](#). Angers, France
- November 11-15, 2024. [Postharvest 2024](#), ISHS International Postharvest Symposium, Rotorua, New Zealand

## Ask the Produce Docs



Q. On Blueberries, we see that harvesting them at beginning of season gives a product that can better endure both storage and transport, whilst harvesting towards end of season the blueberries get weaker. Is there any "adaptable" transport/storage guideline to preserve the quality of this product? Such a pity that some blueberries go to waste even when having good storage/transport practices

A. Great question. I would expect (without knowing your growing conditions) that the higher temperatures later in the growing season affect firmness. I also expect that the same conditions are causing the product quality to deteriorate quickly after harvest. Ideas on how to mitigate this issue could be reducing the harvest to cool time, and harvesting during the cooler hours of the day.

Angelos Deltsidis

**Archived Items.** Link to a data store of all our previous ["Ask the Produce Docs"](#) questions, or link to [archived copies](#) of our e-newsletter as PDF documents.

**Frequency of Distribution.** This publication is produced regularly, or as special issues by the UC Postharvest Technology Center.

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**Editorial Review.** Beth Mitcham

**Writing and Coordinating Publisher.** Pam Devine, Beth Mitcham, Angelos Deltsidis

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*Our answers to "Ask the Produce Docs" questions represent the best understanding of the current state of knowledge at the time of the latest update, and does not represent an exhaustive review of all research results. Answers are for guidance only, recommendations may vary from those listed because of, but not limited to, geographical differences, cultivar differences, maturity at harvest or ripeness, growing conditions, grade and quality at harvest, temperature management practices after harvest, and use of special treatments. The UC Postharvest Technology Center and individuals answering the questions are not responsible for any losses, injury to you, any other person or any property. Further, users agree to release the UC Postharvest Technology Center and individuals answering the questions from any and all claims and liability related to use of any content.*



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