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Director's Note

After an extended pause in communicating with our followers by this E-News, I wanted to finally take the opportunity to share a few thoughts but especially welcome Professor Florence Zakharov as the new faculty Director of the UC Postharvest Technology Center. Her research program focuses on flavor and aroma biology of fruit and vegetable crops; molecular and biochemical aspects of aroma volatile formation and regulation during fruit development and after harvest. Florence has been a contributing instructor in the PTC workshops and flagship summer Short Course over several years. The evaluations of her presentations are always highly rated for content and delivery. For the last few years, she has been a Co-Leader of the Fruit Ripening and Ethylene Management Workshop offered each spring with PTC faculty member Mary Lu Arpaia of UC Riverside. While Florence does not have an academic appointment, which includes formal extension, and outreach responsibilities, she is part of the UC Davis College of Agriculture and Environmental Sciences (CAES) Agricultural Experiment Station, within the Plant Sciences Department. In true extension fashion, she recently stepped up at my request to fill in the leadoff lecture for our Fresh Cut Quality and Safety Workshop on Fresh-Cut Products Biology when perennial instructor Dr. Mikal Saltveit was suddenly unavailable.



In making my recommendation for my successor in this role to the Plant Sciences Chair, Professor Gail Taylor, I felt strongly that the future success and sustainability of the 40 years of effective program content and delivery at the PTC required an inclusive leadership emphasizing and integrating modern biology and technological advancements with quality management systems. With the reduction in active cooperative extension faculty within the PTC, and loss of these applied postharvest research and extension positions to other CAES priorities, it seemed the best strategy will be to re-focus on the Center's founding fundamentals, optimal postharvest management systems for consumer experience in sensorial and nutritional value. Florence's research and teaching program fit this profile well, emphasizing both the fundamental and practical aspects of overall sensory and flavor attributes of produce with an emphasis on flavor volatiles. Produce safety will continue to be a component of the PTC programs as technical advancements in preventive programs, from farm to fork, must be integrated into quality management systems to satisfy market demands and regulatory compliance.

Florence has received strong statements of support from our extension faculty colleagues for her willingness to take on this vital role in continuing the trajectory I started in reaching out and strengthening existing relationships and building new partnerships in postharvest science and technology.

As for my role, in case you missed it, I have retired from UC Davis, now with an Emeritus extension faculty appointment, and transitioned on October 1st to my new position as VP Produce Safety with the Produce Marketing Association. I continue to be heavily involved in the Center for Produce Safety and a number of produce safety alliances, panels, and advisory boards seeking to assist with FSMA implementation and compliance. I remain located in Davis and PMA is supportive of my continuing association with the L.K. Mann Postharvest Laboratory and the Postharvest Center. In persuading Florence to take on this very novel role, I made a commitment to her and our Chair to stay connected and assist, as requested, to build networks and provide support to not just sustain but also build the Center's relevance, resources, and impact. Part of that commitment has been to assist junior faculty in seeking support funding and access to grant opportunities. If senior faculty stick around too long applying for competitive grants, regardless of capacity for continuing research contributions, we run the risk of limiting the rate of professional participation and progress of the new generation of researchers and extension specialists.

I was going to share some snippets of the multitude of Center and produce safety and outbreak response activities that have dominated my professional life for the past six months, but this has little value at this point and, seriously, looking forward is what matters. So I hope to stay connected to the PTC and my ucfoodsafety.edu colleagues and look for my future advanced workshops and webinar programs in preharvest to postharvest produce safety to support the global industry and fresh produce supply-chain.

Please Give to the Postharvest Endowment

We share postharvest information to anyone who visits our website. The Center receives minimal institutional support and operates predominantly on extension programming, external funding and private contributions. So a big thanks to all the contributors to our Endowment! To date, we have been able to continue offering and improving the valuable resources found at our website. We established our endowment fund in 1989 as a main renewable revenue source to support extension and applied research activities related to fresh produce. There are three main funds associated with the endowment:

- **Postharvest Student Support.** Your gift provides access to students who would not otherwise afford to attend UC Davis, and contribute to their professional development.
- **Postharvest Program Endowment.** These funds are the main support for the maintenance and improvement of the center website that almost 30,000 users a month access from all reaches of the world.
- **Postharvest Technology Center.** Giving to this fund will strategically support the highest priority activities. Our current priority is to leverage these funds for preliminary research to we can use in application to federal and foundation grant programs and to expand our resources for distance-learning and global outreach.

Thank you in advance for your tax-deductible donation! We greatly appreciate your support and will use it to help us carry on the mission of reducing postharvest losses and improving the quality and safety of produce around the world. You can [donate online here](#) or call the Postharvest Technology Center at 530-752-6941 to talk to us in person.



GIVE NOW

Postharvest Education at UC Davis

Here at the UC Postharvest Technology Center, we have had a busy summer with two of our most popular classes wrapping up at the end of September.

We held our 40th annual Postharvest Technology of Horticultural Crops Short Course and had an impressive enrollment, with attendees coming from all over the world. Participants learned about the biology and current technologies being used for handling fresh fruits and vegetables. Topics included everything from harvesting, packing, cooling, transportation, storage and safety to facilities, equipment, ethylene treatments, modified atmospheres and more. A smaller group of attendees were able to attend the second week field tour, to see what they had just learned in the classroom in action.

Our Fresh-cut Products Workshop had a rush of enrollments at the end, and we ended up with over 75 attendees. With a diverse group, representing food scientists, food engineers, quality assurance personnel, restaurant and institutional food industries the class was lively and prompted a lot of interaction. Attendees learned about fresh-cut biology, temperature management, cell integrity, flavor and aroma biology, plastic film technologies, water safety, sanitary plant design and programs, and fresh-cut process lines. We also had a section on commodity overviews which included topics such as discussion of raw material quality, maturity indices, variety and production factors affecting raw material quality, preparation procedures and treatments, quality indices and defects of the fresh-cut product, benefits of atmospheres and other treatments in relation to temperature control, expected shelf-life, and new developments/research needs. We closed the three-day workshop with, first, a demonstration of the impact of temperature and packaging on quality of fresh-cut products where attendees walked around to different stations observing and noting the significant differences in quality. The remainder of the last day was spent on safety, microbiology, recalls and emerging consumer preferences.

If you missed the Fresh-cut workshop, it will be offered in September 2019. Click on the links below to enroll in the Fruit Ripening Workshop or Annual Postharvest Technology Short Course.

Registration is Open for April Fruit Ripening & Ethylene Management Workshop!



This popular workshop focuses on how to increase profits by reducing losses at the receiving end, and delivering ready-to-eat, delicious fruits and fruit-vegetables to the consumer. Topics will include ripening facilities and equipment, maturity and quality relationships, biology of ethylene production, sensory quality, temperature management, retail, psychological disorders and other losses and much more including sensory, quality and environmental demonstrations. Please visit the [website](#) for more information and to enroll.

[Enroll Here!](#)

Registration is Open for June Postharvest Technology Short Course!

This course is a two-week intensive study of the biology and current technologies used for handling fruits, nuts, vegetables and ornamentals in California. It is designed for research and extension workers, quality control personnel in the produce industry, and business, government or academic professionals interested in current advances in the postharvest technology of horticultural crops. The [website](#) has more information and the opportunity to enroll.

[Enroll Here!](#)

Featured Postharvest Bookstore Item

Sale! Receive 20% off any of our Transportation Series Publications

Marine Container Transport of Chilled Perishable Produce

An indispensable guide for shippers, transport company personnel, inspectors, surveyors, insurers and receiving company employees. Inside you will find comprehensive information on how to select the proper boxes for shipment, plan a load, select the correct temperature for loading, keep containers under optimum operating conditions, and monitor and record temperatures during transit. This booklet includes two 22x34 inch color posters, one in English and one in Spanish that summarize the major steps for successful loading.

Refrigerated Trailer Transport of Chilled Perishable Produce

This publication is a guide to the proper use of refrigerated highway trailers for shipping perishable products. The publication focuses on fresh fruit and vegetables but also contains information on the transport of meat, dairy and frozen items.

Air Transport of Perishable Products

This publication includes comprehensive information on protecting the product from the temperature extremes that are common in air freight, selecting the proper boxes for shipment, how to plan a load, product compatibility, loading air freight containers, and how to monitor and record temperatures during transit. The publication also describes the advantages and disadvantages of air freight and describes the services provided by freight forwarders. Use sale code TS20 to apply your discount. And, as always, if you order the whole series, you are automatically given a 25% discount.

For a complete listing of all our publications, see our bookstore.



On Our Website

Stay up-to-date with the Postharvest Technology Center by joining our [LinkedIn Group](#).



New Publications on our Website

Irwin R. Donis-Gonzalez, Daniel E. Guyer, Ismail Kavdir, Dena Shahriari, Anthony Pease, 2015. [Development and applicability of an agarose-based tart cherry phantom for computer tomography imaging](#), Food Measure (2015) 9:290–298 DOI 10.1007/s11694-015-9234-7

K. Albornoz and M.I. Cantwell, 2016. [Fresh-cut kale quality and shelf-life in relation to leaf maturity and storage temperature](#). Acta Hort. 1141. ISHS 2016. DOI 10.17660/ActaHortic.2016.1141.11 Proc. III Int. Conf. on Fresh-Cut Produce: Maintaining Quality and Safety

Elisabetta Lambertini, Javad Barouei, Donald W. Schaffner, Michelle D. Danyluk, Linda J. Harris 2017. [Modeling the risk of salmonellosis from consumption of pistachios produced and consumed in the United States](#), Food Microbiology 67 (2017) 85e96

Postharvest Opportunities



[BARD - US Israel Binational Agricultural Research & Development Fund](#) has just announced funding opportunities for 2019. Programs include:

Postdoctoral Fellowships January 15, 2019

Graduate Student Fellowships – January 15, 2019

Senior Research Fellows – January 15, 2019

Workshops – January 15, 2019

Located in Menlo Park, CA, the Produce Quality Specialist will primarily be focused on research and development for a produce quality control system. Your job will be to research produce types, defining quality attributes, ripeness and degradations markers, and lifecycle models. You will work closely with the computer science and vision systems engineering team to develop the models. Once the product is released, you will monitor product quality and customer feedback in order to further improve and optimize the quality analysis and modeling system.

Contact Jason Kalus at jasonkalus@fulfil.ai for more information.

Postharvest Calendar

- April 2-3, 2019. Fruit Ripening & Ethylene Management. Davis, CA
- June 17-28, 2019. Postharvest Technology of Horticultural Crops Short Course. Davis, CA
- September 17-19, 2019. Fresh-cut Products. Davis, CA
- November 9-13, 2020. 9th ISHS International Postharvest Symposium. Rotorua, New Zealand

Ask the Produce Docs



Classic early symptoms of *Alternaria* Head Rot on broccoli from our question submitter.

Q. We are grower shippers down in NZ and are having issues with Broccoli quality, namely the rapid development of head rots post harvest.

I am hoping that you might be able to give me some advice on this or at least point me in the right direction. (R.M.)

A. Well, I could take an educated guess, but it is more likely characterized as a wild guess at this point. Any responsible recommendation for a starting point would benefit from some additional information about the disorder you are experiencing, including variety, crop management and production conditions, rates and timing of nitrogen application (high rates of N-NO₃ tend to increase susceptibility), mode of irrigation, weather events close to harvest, and harvest and postharvest handling practices. Rapidly developing head rot is commonly bacterial decay but could be other pathogens or causes.

Bacterial soft rot, aka Head Rot, may be caused by several aggressive or opportunistic plant pathogens including *Pectobacterium carotovorum* subsp. *carotovorum*, *Pseudomonas fluorescens*, *Pseudomonas marginalis*, and *Pseudomonas syringae* pv. *syringae*, *Pseudomonas viridiflava*, and *Dickeya dadantii*.

Depending on conditions and bacterial type, infections may be direct through natural openings or dependent on some form or source of wounding. In general, if decay is observed after holding at common refrigeration temperatures, one might suspect a *Pseudomonas* sp. The most aggressive of these decay pathogens produce strong biosurfactants, which greatly reduce water surface tension on the epicuticular wax of broccoli beads and allow infection of non-wounded tissue. Broccoli varieties with a more domed shape tend to be less susceptible to direct infection in the field. More than a decade ago, we characterized the role of a key biosurfactant produced by *P. fluorescens* in rapid decay of broccoli, cauliflower, and fresh-cut celery. Natural infection and localized rot of both broccoli and cauliflower heads was observed with prolonged surface wetness but rough handling at harvest greatly increased the frequency and severity. These bacteria are commonly recovered from asymptomatic broccoli and, if the observed head rot is not prevalent in the field, then minimizing abrasion, crushing, or bruising during harvest and postharvest handling would be one place to start.

Alternatively, the general term 'head rot' may be applied to fungal infections, commonly *Alternaria brassicae* and *Alternaria brassicola*, which may be referred to as pin rot which is not become as macerated and odiferous as with bacterial decay.

Until the primary causal agent(s) and predisposing factors are determined, suggestion of potential control options is not possible.

Follow-up:

The cause of the product rejections was determined to be *Alternaria* head rot/pin rot by a qualified lab. Control of this field and postharvest disease is challenging but involves a systems approach including;

- Purchasing pathogen-free or very low prevalence seed, as both species can be seedborne
- If growing or receiving transplants, careful seed selection and sanitation practices in the greenhouse is essential
- As practical, avoid overlap between seasonal crops during rainy periods as windborne conidia (spores) are readily transferred from crop residues to a maturing crop
- As practical, periods of field rotation with non-cruciferous crops will help minimize carry-over and build-up of inoculum
- Varieties with some degree of tolerance under seasonal periods highly conducive to field infection are available and may be an option depending on market preferences
- Registered fungicides for *Alternaria* head rot control are available, but what I hear is that efficacy when the disease is a significant problem is very erratic. Always refer to local expertise and follow all label instructions and requirements
- Careful harvest to avoid obvious infected heads, especially when dark-green to black conidia are present, combined with good and regularly scheduled sanitation of harvest totes and contact surfaces will help reduce postharvest infection potential.
- Postharvest spraying with chlorinated water or other registered sanitizers is unlikely to control the disorder when weather conditions are favorable for spread and promoting a level of economically relevant field-infection. Once germination and active penetration of the broccoli heads has occurred these surface treatments will not be effective. If significant conidia have been deposited on the floret surface, I am not aware that spray-washing would be effective in removal and residual water may promote conidia germination.

Trevor Suslow

Postharvest Questions. If you have a postharvest question you'd like answered, please send it to postharvest@ucdavis.edu, and we'll see if one of our specialists can help.

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

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