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Director's Update



"Farming looks mighty easy when your plow is a pencil, and you're a thousand miles from the corn field." Dwight D. Eisenhower, Sept. 11, 1956

We've seen this quote popping up a lot recently in regards to the frustrations that naturally and inevitably seem to arise when federal policy and trade decisions or new regulations impact farm enterprises across regions, commodity groups, scale of operation, or marketing-style. To paraphrase and modernize this quote from our 34th President, *Crop management challenges seem straightforward when Googling information on a computer in a cubicle in a monolithic building far removed from furrow, vineyard, or orchard.*

One of these current sweeping issues of concern revolves around the Agricultural Water definitions and provisions of Food Safety Modernization Act (FSMA) Produce Safety Final Rule (PSR).

Agricultural water is defined in part as "*water (that is) intended to, or is likely to, contact covered produce or food contact surfaces*" and covered produce is defined in part as "*the harvestable or harvested part of the crop*" (§ 112.3(c)). Just to ensure the proper context is provided: The *Agricultural Water* (ag-water) quality requirements detailed in the [FSMA PSR \(Key Requirements\)](#) only apply to farms covered by the rule that are using water that **directly contacts the edible portion of the crop during growing activities, or during and after harvest activities.**

I have been involved in numerous grower meetings and training sessions directly related to the PSR and initial confusion, and frustration about the specific compliance expectations remain a hot-button topic in the fresh produce farming community. This is dramatically true for those farms where surface water sources are the main or only option for crop irrigation, frost-protection, micro-climate management, and other diverse purposes that meet the above FDA definition for covered produce. However, in reality, the current situation is vastly improved over the initial proposed water quality metrics. FDA held multiple listening sessions and many aspects of the final ruling are far less onerous than originally proposed. In addition, FDA is hard at work integrating industry, state agency, and academic feedback into guidance to better explain measures to ensure grower compliance and better position the allowed options for meeting expectations.

My purpose in this column is not to explain the details of the required on-farm ag-water quality profile baseline establishment or the substantial barriers to meeting the testing criteria in many production regions. There are many resources available to help with understanding where things stand today, in grower-friendly language, such as an explanatory document from the Produce Safety Alliance [[FSMA Produce Safety Rule Water Requirements: Insights to Get You Organized!](#)] Rather, I would like to highlight an opportunity I have been sharing with crop management consultants every chance I get for many years, since the emergence of Good Agricultural Practices audit programs, related to expanding their value-added services to growers of row, vine and tree-crops. As far as I am aware, crop and pest management service providers have taken very limited and tentative opportunities to offer services in food safety compliance

programs. Some key fee-for-service or value-added service add-ons, at least in my opinion, would relate to PSR ag water compliance provisions including observational scouting, mapping, sampling, chain-of-custody transport of samples, documentation, and other data reporting and record-keeping requirements. For many growers, already juggling many regulatory requirements from an increasing alphabet soup of local, state, federal, and international trade agencies, the current ag-water compliance requirements, details of calculating Geometric Means, Statistical Threshold Value, and post-irrigation Die-off allowance, and keeping up with evolving Guidance and standards of optional equivalency programs loom on the horizon of impending compliance dates (realistically for PSR ag-water not until January 2020 for larger operations and January 2022 for very small operations). If you have no idea what I am talking about here, these are all explained in the Produce Safety Alliance link provided above.

My main point here is that many of these functions could fit into services provided by crop and pest management specialists who spend time in vineyards, orchards, and groves sampling, collecting, observing, and walking the farm. These services could replace or supplement and, potentially, greatly reduce incremental costs to growers over the cost of sampling by the service micro-testing lab. This is especially true in more remote areas far from urban or major produce production centers. Perhaps a more important value would be ensuring an organized and standardized system for water quality compliance for farm operations not in a position to have dedicated food safety staff. In addition to ag-water, crop consultants could be in a good position to offer add-on services in observational documentation of domesticated animal and wildlife activity and intrusion into production areas. This is another key challenge under the PSR and consultants could play a major role in innovating effective measures to minimize intrusion.

In general, it is my hope that we see far more engagement among the certified professional crop consultants in food safety management across industry and federal standards in 2017. At least it seems a missed business opportunity to me. An excerpt from my presentation prepared for the National Alliance of Independent Crop Consultants Convention January 2017- St. Louis is available to view [here](#).

Postharvest Education at UC Davis



First Flurry of Enrollments for Upcoming Workshops

February is off to a great start with quite a few new enrollment for both our annual Fruit Ripening Workshop and Postharvest Technology Short Course. Enrollments generally trickle in, but we are excited to see such robust interest in our programs. Don't miss out! Be sure to register as early as possible to secure your space.

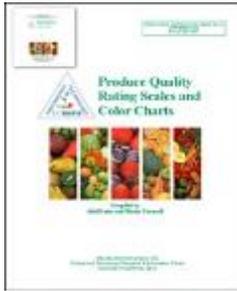
Fruit Ripening & Ethylene Management Workshop – April 18-19, 2017

We encourage anyone interested to enroll soon for the 23rd annual Fruit Ripening & Retail Handling workshop. The workshop will be held April 18-19, 2017 at the Conference Center on the UC Davis campus. This workshop is intended for shippers, fruit handlers (wholesale and retail), and produce managers who are involved in the handling and ripening of fruits and fruit-vegetables. The workshop is coordinated by Drs. Mary Lu Arpaia and Florence Zakharov, and will focus on managing the effects of ethylene, reducing losses at the receiving end, and delivering ready-to-eat, delicious fruits and fruit-vegetables to the consumer. Registration for this 2-day workshop is priced at \$885 and includes all instruction, instructional materials, morning and afternoon coffee, and two lunches. Space is limited. To register, or for more information, see the [webpage](#) or contact [Ms. Penny Stockdale](#).

Postharvest Technology of Horticultural Crops Short Course June 19-20 (two day) 19-23 (week one) and June 26-30 (optional tour), 2017

New this year! We are offering a limited number of seats in a 2-day Postharvest Fundamentals and Commodity Profiles portion of the short course. This world-renown course is an intensive 2-day or 1 or 2-week study of the biology and current technologies used for handling fruits, nuts, vegetables and ornamental crops in California. The first week includes the already-mentioned fundamentals and commodity profiles plus lectures and hands-on demonstrations, and the optional 2nd week is a field tour that will visit a broad spectrum of postharvest operations in California's great central valley and coastal regions. For more information or to enroll, visit the [webpage](#), or contact [Ms. Penny Stockdale](#).

Featured Postharvest Bookstore Item



Receive 25% off this month's featured publication: **Produce Quality Rating Scales and Color Charts**

Through the end of February, we're offering a 25% discount on [Produce Quality Rating Scales and Color Charts](#) Binder or CD. The objective of this manual is to compile the rating scales (scoring systems) and color charts for maturity, ripeness, and quality of fruits, nuts, and vegetables for the benefit of those interested in produce quality evaluation. To order a copy, please use our [online order form](#) and note "ProduceQuality25" to receive your discount.

For a complete listing of all our publications see our [bookstore](#).

Postharvest Specialists' Updates & Other News



Jim Thompson and Michael Reid Develop DryCard™

Molds that contaminate dry foods, especially ground nuts and maize cause significant postharvest losses in the developing world. Mold contamination results in poor flavor, loss of dry matter, and most importantly, is a health hazard. Aflatoxin, produced by several fungi, contaminates up to one quarter of the world's food crops and is a particular problem in sub-Saharan Africa and Asia. It causes acute poisoning, liver cancer and is associated with stunting and suppression of the immune system. It is estimated to cause about 100,000 cases of liver cancer per year and a world-wide loss of 1-2 million daily adjusted life years per year.

Fungal contamination can occur before harvest, but much of it occurs during drying and storage. Mold development can be stopped by ensuring that food and feed is adequately dried. Electronic moisture meters are commercially available but cost hundreds to thousands of dollars.

Jim Thompson and Michael Reid have developed a simple, low-cost method of determining whether foods are dry enough to prevent mold growth in dry foods. The device is called DryCard™ and is based on the concept that relative humidity of air around a product reflects the moisture content of the product. (This is called equilibrium relative humidity.) Molds will not grow if the relative humidity of the air around a product is lower than 65%. The convenient aspect of this concept is that it is not necessary to measure product moisture, but only the relative humidity in air around a food item.

The DryCard™ estimates relative humidity with a commercially available paper strip that changes color as air humidity changes. A blue or grey color indicates humidity is below the threshold that will allow mold growth. A pink color indicates that the product is not adequately dried and mold can develop. The materials used to make each DryCard™ cost less than 10 cents and the card can be reused many times.

Projects to introduce the DryCard™ are being planned in Zambia, Tanzania and Kenya. If you are interested in participating in the DryCard™ project, please contact Michael Reid msreaid@ucdavis.edu or Jim Thompson jfthompson@ucdavis.edu.



Trevor Suslow

Trevor Suslow traveled to speak at the National Alliance of Independent Crop Consultants (NAICC) Annual Convention in St. Louis mentioned in Director's Note above. From there, he traveled straight on to Florida to participate in the **Pilot Test of the On-Farm Readiness Review Tool** with University of FL, Michigan State University, Rutgers University, Cornell University/Produce Safety Alliance extension colleagues, National Association of State Departments of Agriculture, and US FDA. The tool, being spearheaded by the Southeast and Northeast Regional FSMA Training Centers, was tested in multiple farm and packing locations for large and small operations in Florida. They have done a very good job and with some additional tweaking identified during this three-day exercise, and some additional 'farm-truthing' in other regions. It should be ready for release as an inspection guide and a self-assessment tool for growers. Not surprisingly, water and biological soil amendments were key topics during the exercise.

Monitoring compost 3T's (time: temperature: turnings) and preventing run-off from contacting water sources and crops were topics for review.





Next, Trevor, along with Jim Gorny and Johnna Hepner from the Produce Marketing Association did grower and shipper trainings including their PMA Food Safety for Local Growers program with Sysco and FreshPoint as co-hosts in Turlock, CA and a Produce Safety Alliance FSMA Produce Rule training in Selma, CA for the CA Fruit Association. Jim and Trevor also conducted a FSPCA Preventive Controls training for a very lively group in Colorado hosted by Western Growers and the Colorado Fruit and Vegetable Growers Association.

In between travels, Trevor hosted a **Lunch & Learn Webinar** for Western Growers Association when they lost their scheduled presenter. The topic was Produce Testing: Current state, benefits and challenges and a slightly shortened PDF version is posted [here](#).

Resource Spotlight

Investigation of Mexico's farm operations reveals need for ethical sourcing framework

By Heidi Meier

A major focus of food safety training under industry market-access programs and the FSMA Produce and Preventive Controls rules involves worker hygiene, personal health and cleanliness, food safety awareness, and compliance-supportive training. Prerequisite to implementation and achieving these expectations includes factors relating to living and working standards as well as applicable child labor laws.

An 18-month investigation conducted by reporter Richard Marosi and photojournalist Don Bartletti of The LA Times took an exclusive look at daily routines and hardships of Mexican farm laborers and clear documentation of unethical treatment.

In 2013, The Packer dubbed Mexico as "[by far the most important supplier of fresh produce to the US.](#)" While food quality and safety regulations have been closely monitored by US food safety inspectors, fair and legal management of Mexican farm laborers has been overlooked or inconsistently corrected. Mexico's farm labor is predominantly composed of indigenous, financially disadvantaged workers willing to complete manually taxing jobs for meager pay. "Farm bosses" bus these workers from their rural communities, promising a reliable source of food and shelter, a livable wage, and sometimes even organized childcare during their time working as farm laborers.

In most cases, their reality is abundantly different from promised. Marosi and Bartletti's inside observations uncovered widespread instances of wage withholding, squalor living conditions, physical abuse, illegal confinement of workers in farm camps, and even child and under-aged labor.



Farm authorities defend and enforce their criminal operation, citing illegitimate contractual agreements that often ignore federal labor laws meant to protect and empower disenfranchised workers, and claiming wage withholding keeps laborers focused, productive, and unable to spend discretionally and engage in mischief or debauchery.

US produce sourcing coordinators claim ignorance to the abusive conditions, asserting that inspections are supervised routinely, and interventions and improvements are made when necessary. But The LA Times' investigation proves the contrary. Laborers explained that food safety inspectors have visited some of these farms, but fail to report or reprimand those responsible for the illegal operations and give produce quality and handling more careful attention than the sordid work environments.

In direct response to The LA Times' investigative findings, US retailers have allocated resources to ensure worker fairness, understanding the urgency of alleviating worker abuse and the importance of honestly advertising commodities as ethically produced and supplied.

To incorporate workers in farm planning and management processes, the [Equitable Food Initiative](#) (EFI) developed a [certification program](#) aimed at improving safety and sustainability industrywide. The EFI's unique and multifaceted approach "confronts food-borne threats, creates value and improves working conditions and corporate culture at the same time."

Continuing to work towards a balanced system, the Produce Marketing Association (PMA) broadcasted a need for ethical supply chain practices by introducing an [Ethical Charter](#) to “establish an industry framework to reach and/or confirm an environment where fruits, vegetables and flowers are grown and sourced responsibly.” The Ethical Charter reminds sourcing specialists that a significant amount of leverage lies with buyers, as they can choose to source elsewhere if basic thresholds of food safety and worker welfare are not met. Until February 20, 2017, the [PMA is welcoming open dialogue](#) among concerned and interested professionals to develop a standard of practices that promote worker dignity, safety and fairness. More information about the Ethical Charter can be found [here](#), and feedback can be directed to jointlaborcommittee@pma.com.

Striking photos and detailed accounts of The LA Times investigation can be found [here](#), [here](#), and [here](#).



On Our Website

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



New Publications on our Website

Yurong Ma, Mengnan Yang, Jingjing Wan, Cai-Zhong Jiang, and Qingguo Wang 2017. [Application of Exogenous Ethylene Inhibits Postharvest Peel Browning of ‘Huangguan’ Pear](#). *Frontiers in Plant Science* January 2017, Volume 7, Article 2029.

Chukwan Techakanon, Thomas M. Gradziel, Lu Zhang, and Diane M. Barrett, 2016. [The Impact of Maturity Stage on Cell Membrane Integrity and Enzymatic Browning Reactions in High Pressure Processed Peaches \(*Prunus persica*\)](#). *J. Agric. Food Chem.* 2016, 64, 7216–7224.

Pedro Novillo, Alejandra Salvador, Carlos Crisosto, Cristina Besada, 2016. [Influence of persimmon astringency type on physio-chemical changes from the green stage to commercial harvest](#). *Scientia Horticulturae* 206 (2016) 7–14

Postharvest Announcements



First All-Africa Postharvest Congress

This Congress, held in Nairobi, Kenya, March 28-31, will bring together diverse stakeholders in the food supply chain from farmers to traders to policy makers and entrepreneurs with the theme of “Reducing food losses and waste: Sustainable solutions for Africa.” The Congress Organizers are extending an invitation to paper presenters, exhibitors, sponsors and registrants. February 28 is the early registration deadline.

Postharvest Technology Challenge

This challenge hopes to connect entrepreneurs and investors to identify emerging postharvest solutions. Entries are limited to two pages and Feb. 17 is the deadline for submission entries. Click [here](#) for more information on the challenge

To learn more about the Congress and to register, please click [here](#).

Postharvest Calendar

- February 7, 2017. [FRUTIC Symposium](#). Berlin Germany
- February 8-10, 2017. [Fruit Logistica](#). Berlin, Germany
- March 28-31, 2017. [1st All Africa Postharvest Congress & Exhibition](#). Nairobi, Kenya
- April 18-19, 2017. [Fruit Ripening & Ethylene Management](#). UC Davis Campus
- June 19-30, 2017. [Postharvest Technology of Horticultural Crops Short Course](#). UC Davis Campus and Central CA
- July 2-6, 2017. [IX International Peach Symposium](#). București, Romania.
- July 18-20, 2017. [IX Congreso Iberoamericano de Tecnología Postcosecha y Agroexportaciones](#). UC Davis campus
- September 26-28, 2017. [Fresh-cut Products: Maintaining Quality & Safety Workshop](#). UC Davis Campus
- October 17-20, 2017. [International Postharvest Unlimited Conference \(ISHS\)](#). Madrid, Spain



Q. We grow roses, and we are having serious problems with Botrytis developing after just 4 days in a vase. Could you recommend a postharvest treatment solution that would be effective? We are currently using Teldor®. (S.M.)

A. Botrytis is the most serious postharvest fungal problem in roses, and it appears you are running into a problem of a strain of Botrytis that is resistant to the Fenhexamid (Teldor®) fungicide.

The disease spreads by spores that are formed in the greenhouse on diseased material, often dead or dying prunings and other plant residue, so perhaps the most important control measure is good sanitation in the greenhouse. Don't leave any plant materials on the ground in the greenhouse, and immediately remove any infected stems or buds. A greenhouse fungicide regime that rotates among effective chemicals is also an important strategy. Postharvest dips are commonly used. If Teldor® is no longer effective, perhaps you should try a different fungicide? A couple of years ago we wrote a paper on the [use of low concentrations of sodium hypochlorite](#) which was very effective as a postharvest dip in preventing development of Botrytis in roses. I'd certainly test that as well. There is zero chance of the fungus developing resistance to sodium hypochlorite.

Michael Reid

Q. (Short version) We specialize in retailing organic produce and sometimes have trouble receiving Ataulfo mango with good shelf-life. Here's a recent photo. How do we work with our shippers to minimize this loss?

A. Shivel from water loss can be a problem. It is not possible to do a root-cause assessment from a photo as water loss may involve a single key factor or several sequential or cumulative sub-optimal postharvest handling events. For example, severe water loss may result from extended forced-air cooling and lack of room humidification in storage. There are some other indicators of opportunities for improved postharvest treatment and handling practices in the image as well. Your best bet is to get the [Mango Postharvest Best Management Practices Manual](#) produced by the University of Florida with support from the National Mango Board. Beth Mitcham and Mary Lou Arpaia were among the UC Postharvest Technology Center Specialists who contributed. It is a rich source of practical information on quality and safety of mangoes. A great place to learn about mango ripening and postharvest management is in the upcoming 23rd annual Fruit Ripening & Retail Handling workshop. The workshop will be held April 18-19, 2017.

Trevor Suslow



End Notes and Disclaimers

Postharvest Questions. If you have a perplexing 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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