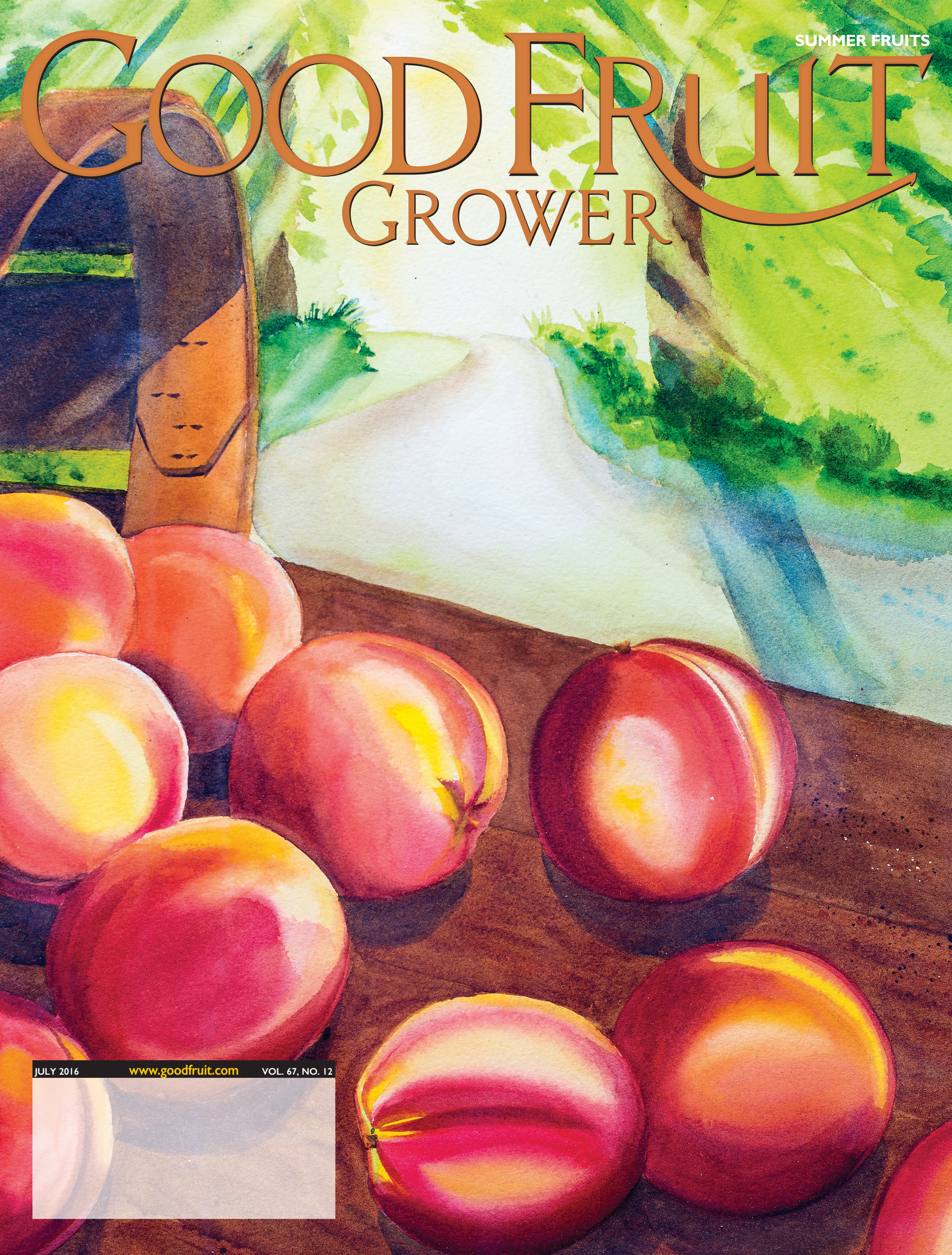


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James Claar Whitelatch owns RC Farms and Claar Cellars. See his interview on page 38.

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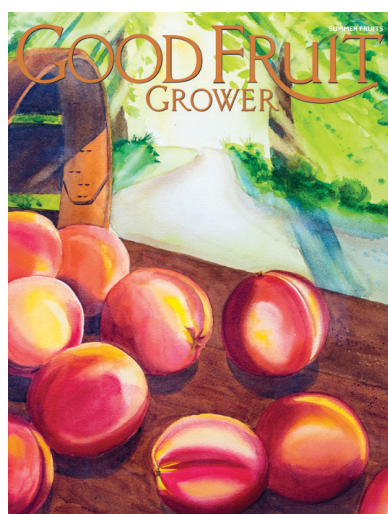
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## FIRST BITE

Shannon Dininny, Senior Editor

# How FSMA impacts you

**F**ood safety.

Perhaps no two words have frustrated U.S. fruit growers more — growers who believe their products are already safe and healthy for consumers.

But with passage of the Food Safety Modernization Act, growers and packers nationally are scrambling to meet new regulations that impose higher standards and more record keeping on everything from water sampling in the orchard to sanitary practices in the packing house. These new requirements can be confusing for some people — and daunting for many — particularly when some rules have yet to even be finalized.

*These new requirements can be confusing for some people — and daunting for many — particularly when some rules have yet to even be finalized.*

This isn't news. What is news today, and in the months to come, are the research efforts underway to address questions and concerns about how best to meet these new standards.

*Good Fruit Grower* recognizes the vital importance of this research to you, and just as we bring you the latest news about spray recommendations and trellis angles, we also will keep you up to date on food safety research in the months ahead.

In this issue, you'll find tips for taking a proper water sample in the field from researchers at the Western Center for Food Safety. You'll also find a package of stories by our regular freelance writer in Michigan, Leslie Mertz, about whole genome sequencing, the high-tech wizardry that enables regulators to track a pathogen to its source during an outbreak. It's the nudge to remind you why you should care, because that source, however unlikely, could be your orchard or packing house. And even if it isn't, your market is still likely to be affected.

Which means everyone is in this together, right?

Therein lies the point. Some of you have already found ways to manageably implement many of these requirements; others are still playing catch-up. But the rules apply to everyone, and in the event of illnesses tied to fruit, the ramifications affect everyone.

So, to those of you who are ahead of the curve, share your stories with us. Help your neighbors, because if there's one arena where competition shouldn't matter, it's food safety.

To everyone aiming to learn more: Ask questions. Sign up for industry workshops. And stay tuned. We'll have more on food safety in *Good Fruit Grower* in the months ahead. It's all part of our mission of service to the grower community. ●

*Shannon Dininny is senior editor of Good Fruit Grower. You can reach her at Shannon@goodfruit.com*

## Correction

A story in the June issue incorrectly reported that grower Steve Wood of Lebanon, New Hampshire, uses Malling 9 rootstocks to grow cider varieties. Instead, he said his current cider workhorses are EMLA.111 and B.9, followed by EMLA.106 and EMLA.26. He's trying B.118 for the first time next year. *Good Fruit Grower* regrets the error.



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## Northwest Horticultural Council president to retire

Christian Schlect, president of the Northwest Horticultural Council, has set a retirement date of March 31, 2017, after more than 35 years with the industry group.

Schlect worked as a deputy prosecuting attorney in Yakima County before joining the Hort Council in 1980, when he replaced Ernie Falk as president.

Mark Powers, executive vice president of the Hort Council, is slated to fill Schlect's position upon his retirement.



Christian Schlect

## Washington Apple Commission names officers for 2016-2017

The Washington Apple Commission has elected a slate of officers for the 2016-2017 season.

Dave Robison, a member of the Chelan Fruit Cooperative, will serve as chairman, with Cass Gebbers, president and CEO of Gebbers Farms, vice chairman, according to a news release from the commission

released following a commission board meeting May 19.

Todd Fryhover was re-elected as president and secretary of the organization, which is the international marketing arm of the state's apple industry. Robin Mooney will be vice president and treasurer.

The industry expects to spend \$7.7 million on exporting apples during the upcoming season, based on an early crop estimate of 135 million boxes.

## Pear groups name officers, set assessments for season

The Fresh Pear Committee has approved a 44.9 cents per box assessment for the administration of the federal marketing order for fresh pears from Washington and Oregon for the 2016-2017 season — the same rate as last season. Of that assessment, 38.5 cents will go to promotion, 3.1 cents to research and 3.3 cents to administrative expenses.

The committee also will keep the same slate of officers for the 2016-2017 season: Jordan Matson, chairman; Ron Meyer, first vice chairman; Don Gibson, second vice chairman; and Matt McDevitt, secretary-treasurer. Gibson will remain the Fresh Pear Committee's appointed representative to the Northwest Horticultural Council's science advisory committee, a position he has held for 20 years.

For the fifth straight year, the assessment charged to growers for the federal marketing order for processed pears will remain at \$7 per ton, as unanimously approved by the Processed Pear Committee board of directors.

Of that, \$5.50 will go to generic promotion, \$1 to the Washington Tree Fruit Research Commission and 50 cents to administrative and operational costs.

The group also kept its current board officers for the 2016-2017 season. Dan Kenoyer will remain as chairman, Andrew Sundquist as first vice chairman, Ron Ball as second vice chairman, and Rob Peterson, secretary treasurer.

## Rayapati fills role at Clean Plant Center

Naidu Rayapati, an associate professor of plant pathology at Washington State University's Irrigated Agriculture Research and Extension Center, has been appointed the interim director of Clean Plant Center Northwest.

Rayapati has been at WSU since 2004. His research focuses on virus diseases of horticultural, vegetable and food crops, with a particular focus on grapevines.

Rayapati fills a position left open since the retirement of Ken Eastwell in January.

The university is continuing its search for a permanent director, with interviews planned this summer.



Naidu Rayapati

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## IFTA hires new leader

**M**att Grayson has been hired as the new executive director of the International Fruit Tree Association.

Grayson comes to IFTA following a second stint at AMR Management Services, an association and event management company that has done work for IFTA. He replaces Rick Dungey, who retired in the spring. Grayson is based in Lexington, Kentucky.

AMR conducted the executive search for IFTA, and Nick Ruffin, AMR's president and chief operations officer, served as interim executive director during the search.

Born and raised in Kentucky, Grayson attended the University of Kentucky for both undergraduate and graduate school, ultimately earning a master's degree in public administration. He has been involved in association work for about 20 years, doing everything from policy work to international outreach and development.

"He's got a long history in association management, and he's diverse in that he's been doing quite a bit of international work — not related to agriculture, but his international experience made him extremely qualified to lead an international group — and his experience seemed like a very good fit," said IFTA President Tim Welsh of Columbia Fruit Packers in Wenatchee, Washington.

IFTA serves as a source of education and knowledge for the tree fruit industry, Grayson said, and though he comes to IFTA as a novice in the fruit tree industry, he said he's eager to learn and serve IFTA's members.

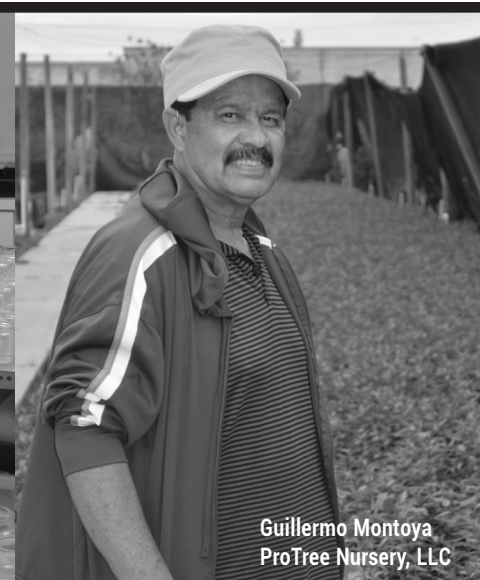
"With every association, you try to think of how best to serve the members — who are the old pros in the industry and also look at the people coming in — and how to best to reach them," Grayson said. "They're in a really interesting position of being very authoritative on the subject matter while still trying to relate and broaden their educational objectives and relationships."



**Matt Grayson**



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# Reinventing the string thinner

**California cling peach grower modifies Darwin for nonplanar orchards.**

*by Ross Courtney*

A traditional Darwin string thinner works just fine on fruit trees trellised or hedged in flat, flowering walls. But the trees supplying California's canned peach industry don't always grow that way, and few growers can afford to up and replant their entire orchard at once.

So, Frank Bavaro, a mechanically handy cling peach grower in the Central Valley, rebuilt a Darwin instead.

Using the Darwin's hydraulic motors and orbital spinning shafts, Bavaro made two modifications: He mounted the thinners horizontally on a high post to break up the clusters on the tops of trees, and mounted one vertically onto a pivoting arm that allows a worker to swing the strings in and out of the canopy to follow the contours of the branches. He considers the modifications easy and cheap.







PHOTOS BY TJ MULLINAX

Isaac Bernardino operates a custom-built overhead blossom thinner in a cling peach block at Bavaro Ranches in Escalon, California. The device, invented by Frank Bavaro (shown in his orchard below left) uses the flailing whips from a Darwin string thinner, attached to a steel armature, to better access blossoms in a traditional vase style orchard.

*“What I would really like is for people to look at this thing. Try it. It’s a no-brainer.”*

—Frank Bavaro

“Literally, for \$1,000, and a guy’s got one,” said Bavaro, known by family members and friends for converting an old airplane prop into a ceiling fan, a giant mill saw blade into a patio furnace and an old grain mill into an entertainment center.

Last year, Bavaro ran his own trials on 7.5 acres of his own Ross variety trees and found that the thinner reduced his labor needs and increased fruit size. He built three more of his homemade thinners, towed behind a conventional tractor, and used them this year on 125


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acres — about 75 percent of his canned peach farm on the banks of the Stanislaus River in Escalon.

Sure enough, he said, he got more of his orchard thinned and larger fruit for a fraction of the cost, he said. Now, he wants other growers to come and steal the idea he believes will work on fresh market peaches as well as canners. He has no ambition to patent or trademark it.

“What I would really like is for people to look at this thing,” he said. “Try it. It’s a no-brainer.”

### Trimming labor costs

Industry education was the idea in the first place, said Rich Hudgins, president and CEO of the California Canning Peach Association. “That was our desire from Day One,” he said.

In 2008, the Sacramento-based association teamed up with California’s peach canning companies to set aside industry funds for mechanization research to cope with a dwindling labor pool and rising labor costs. The groups raised \$1.1 million in the three-year funding period.

Together, they purchased two Darwin string thinners — at roughly \$10,000 each — and ran trials with a local farm adviser and growers in and around Yuba City and Modesto. Orchardists lost interest after struggling to maneuver the spinners in and out of the vase-shaped tree canopies, so the machines were not used as much as they had hoped.

Hudgins agreed to let Bavaro take a stab at modifying one of the Darwins to work better in the existing orchards.

“We’re all for this,” Hudgins said. “We’re pleased we’ve got somebody out there with a little different twist on the Darwin.”



Adrian Rey operates the modified thinner on a pivoting arm, which makes it easier to swing the strings and follow the contours of the canopy.

Hudgins expects more growers will adopt his method, or something similar, hoping for some labor-expense relief after the California State Legislature passed a law that will gradually increase the state’s minimum wage to \$15 per hour by 2022.

“It makes it all the more the imperative that we find a way to reduce our reliance on hand labor,” Hudgins said.

The state’s industry has funded other experiments

with vacuum harvesters, drum shakers, handheld string thinners and experimental plantings. Currently, the state harvests about 10 percent of its cling peaches mechanically.

The organization represents about 400 growers, roughly 80 percent of the state’s cling peach industry. The group negotiates prices with the canners on behalf of the growers. Currently, the negotiated price is \$490



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## Thinning trials

Frank Bavaro, a cling peach grower in Escalon, California, modified a Darwin string thinner to feature a pivoting arm that allows movement in and out along the contours of the orchard canopy.

He ran his own trials in 2015, comparing string thinner use at bloom four different ways, as well as traditional hand thinning at pit hardening, on a total of 500 14-year-old Ross variety V-shaped trees planted in 16-foot rows with 8-foot spacing. Each trial was 1.5 acres.

He chose Trial No. 3 to repeat commercially on about 125 acres this year and is having similar, if not better, results, he said.

—**Trial 1:** String thinning the sides and tops of trees and no hand thinning

Cost per acre: \$140

Production per acre: 33.6 tons for canning, 7.3 tons for juice. (Canners pay a flat, negotiated price of \$490 per ton of fruit that meets the minimum size of 2 3/8 inches diameter.)

—**Trial 2:** String thinning and hand thinning with no ladders

Cost per acre: \$230

Production per acre: 30.6 tons for canning, 6 tons for juice.

—**Trial 3:** String thinning and hand thinning with a rubber-tipped pole but no ladders

Cost per acre: \$293

Production per acre: 33.3 tons, all for canning.

—**Trial 4:** String thinning and hand-thinning with ladders

Cost per acre: \$760

Production per acre: 31 tons, all for canning.

—**Trial 5:** Conventional hand thinning after pit-hardening in May with ladders and no string thinning

Cost per acre: \$810

Production per acre: 29.3 tons, all for canning.

*Note: Fruit that had been string-thinned at bloom sized between 36 and 38 millimeters by pit-hardening in May, compared with 32 to 34 millimeter-sized fruit without string thinning.*

per ton. About 30 to 40 percent of the state's cling peaches are marketed to the food service industry, which includes schools, cafeterias, prisons, hospitals and senior nutrition programs.

### Bavaro's savings

In the past, Bavaro typically hired 25 employees for 30 days just to thin fruit by hand, using ladders, at a cost of \$900 to \$1,200 per acre.

This year, using his new invention on mostly V-shaped trees, Bavaro cut that to nine workers. Meanwhile, his fruit came out with better quality and size and required less postbloom hand thinning because it allowed for eyeball decisions from his employees about how aggressively to knock away blossoms, he said. Overall, he spent between \$325 and \$425 per acre.

Bavaro has plans for the future, too.

Next year, he plans to fit two swinging arms onto both sides of the thinner, each operated from a platform towed behind the tractor. That will allow a worker on each side of the alley to thin simultaneously without making them walk, alleviating a safety concern. He also is tinkering with a way to get a string thinner into the center of the tree, a hurdle he has yet to leap.

Like other peach growers, Bavaro is planting new blocks that he will train for shape uniformity from the beginning to make way for mechanization, such as a more traditional string thinner and maybe mechanical harvesting someday.

He has to, he said, if he wants to stay in the peach business — which he does. Workers are only going to get more scarce and expensive.

"You got to face the reality of it," he said. ●



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# Generations to

### California growers lay out future of family farm with succession plan.

by Ross Courtney

When Gene Bays farmed as a younger man, he hung ledgers on a nail in his shop, took his checkbook to an accountant once a year and let the division of ownership remain a mystery to those outside his family.

"Nobody knew how we cut the pie," said Bays, the 89-year-old president of Bays Ranches of Patterson, California, one of the largest canned apricot growers in the state.

That is not good enough today. Family orchard businesses both large and small are being advised in conference after conference to spend time on succession planning.

The Bays, who sell fruit to processors such as Del Monte Foods, Seneca Foods and Tree Top have just finished their plan.

It was tough, they said, assigning monetary value and legal definitions to what had always just felt like family property and routine chores, not to mention discussing how things would change if — and when — a loved one died.

But all the stress proved smaller than they feared, they said.

"Once you got the conversation open and going and start the process, it goes easier," said Ken Bays, 56, the vice president. His son Daniel, 29, is the secretary.

Day-to-day operational decisions they make informally, small ones on their own, large ones together. Daniel does most of the fertilizer and tractor work, Ken handles water and cost accounting, while Gene handles most of the bills and "go-fer" duties. They make a plan of attack for each day.

"We have a corporate meeting every morning," Gene said with a laugh. "McDonald's. We have our special table."

But after decades of farming, the trio legally incorporated as Bays Ranch, separating the farming operation from the family's land ownership, renting property from whichever family member owns it and stipulating on paper who gets what, when.

Succession planning is a hot topic in the fruit industry. Speakers at most



*"We have a corporate meeting every morning. McDonald's. We have our special table."*

—Gene Bays

meetings and workshops discuss it, while multigeneration farming families create boards of directors and sometimes hire CEOs from outside the family.

Today's farm demographics demand planning. The average age of the American farmer is 57 years; 80 percent of farmers plan to transfer assets to the next generation but only 29 percent have identified a successor, said Karen Bishop, of Ebey Road Farm in Coupeville, Washington, and manager of the Whidbey Island Conservation District. She cited AgriLegacy, a Tipton, Missouri, nonprofit dedicated to family farm preservation, as her source for the statistics.

"Without succession plans and the transfer of knowledge beginning early, the chance of a farm remaining an economically viable and productive entity is dramatically reduced," said Bishop, who has made presentations about transition planning for farm conferences, in an email to *Good Fruit Grower*.

Among other suggestions, Bishop, part of a family with six generations on the same farmland, recommends families not only make a plan but continue to update it as people age and change. She urges large families with conflicting ideas to consider splitting the farm into smaller companies.

"We just recently went through this, and it was the best thing we ever did," she said. "I have recently worked with a family who owns several hundred acres here on Whidbey (Island) that is owned by 60 family members, all who have equal decision-making responsibilities. It is not working well."



"If something happens to any of us, things continue to go on," said Ken Bays.



# follow



PHOTOS BY TJ MULLINAX/GOOD FRUIT GROWER

Three generations of the Bays family in a shop at Bays Ranches in Patterson, California: Daniel Bays, far left, his grandfather, Gene, center, and father, Ken. The trio recently completed a legal succession plan to determine how the family farm will be operated and owned for future generations, a move recommended for most family orchard businesses.

## A sense of security

Regardless of the details, a written, legal framework with exit clauses and buyout procedures gives the Bays family a sense of security that the farm will continue.

"If something happens to any of us, things continue to go on," Ken said.

The plan also allows the older generations to set aside a nest egg for all their children, whether they work on the farm or not, while being fair to those who do.

For example, Daniel has three sisters and several cousins. All grew up working summers on the farm to varying degrees. Daniel is the only one doing so full time

now. A written succession plan, drafted with the help of a lawyer and accountant, helped the family place a numeric value on the difference between those levels of involvement.

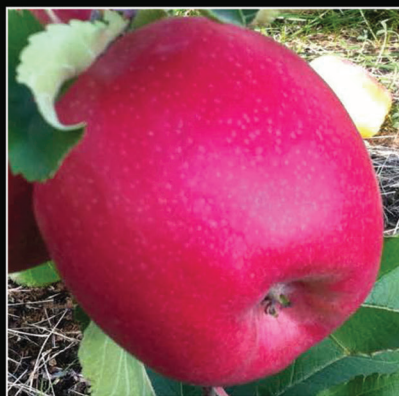
In fact, the family started the discussions in earnest after Daniel earned his degree in 2011 from California Polytechnic State University and returned to the farm.

"I came back and had nothing to offer other than labor," he said.

The hardest part was convincing everybody in the family to speak their true thoughts and feelings, "not try to be just Mr. Nice Guy," Ken said. ●

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# Marketing challenges in the Mid-Atlantic

**Eastern growers compete with new peach and nectarine varieties.**

*by Dave Weinstock*

**P**each growers and shippers in the Northeast who market to large retailers are seeing increasing competition from shippers in California, Georgia, South Carolina and even countries in the Southern Hemisphere. In the Middle Atlantic states, particularly, they have responded by continuing to change their stone fruit offerings to capture more shelf space in the produce section.

Though Mid-Atlantic peach production volume is less than that of the Southeast, the region has a number of attributes that make it a solid peach-growing location: good, well-drained sandy loam soils, a temperate climate and timely rainfall throughout the growing season — as well as proximity to major population centers.

Traditionally, the market has hung its hat on yellow-fleshed peaches, said Jerry Frecon, a Rutgers University emeritus professor and horticultural consultant to Adams County Nursery of Aspers, Pennsylvania. “We can pick them from June 20 through Sept. 15 but, unfortunately, have difficulty moving fruit and getting prices to cover the costs of production and marketing.”



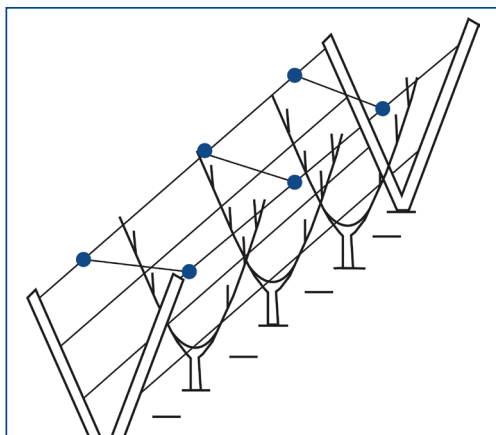
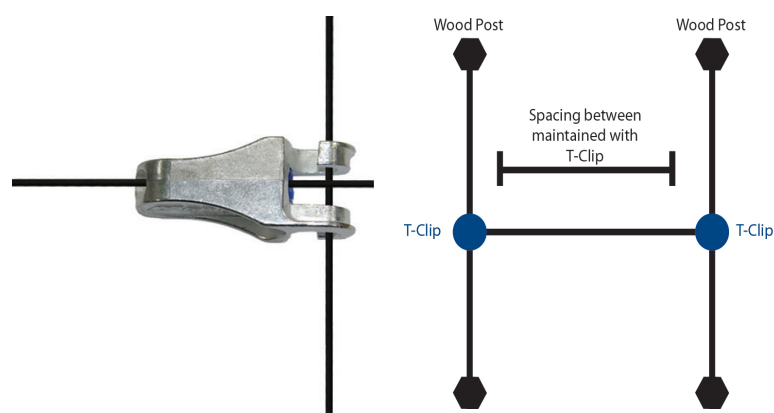
COURTESY JERRY FRECON

Developed at Rutgers University, the SilverGem nectarine is 80 percent red with a cream-colored background. It offers good resistance to bacterial spot and handles low temperatures, a big plus for Eastern growers who have dealt with two very cold winters and below-freezing spring temperatures in the past three seasons.

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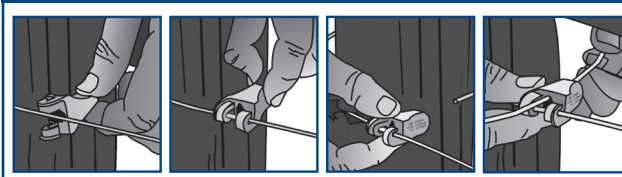


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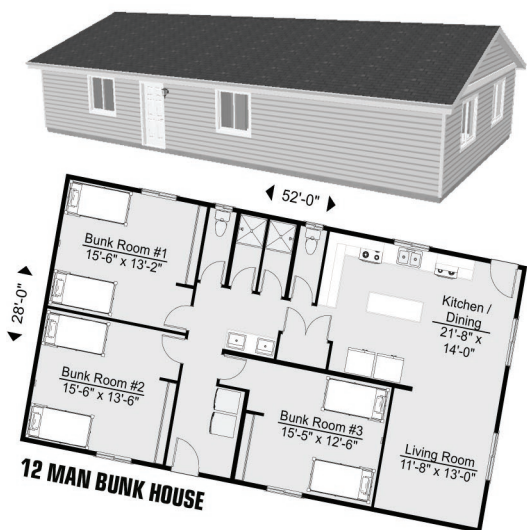
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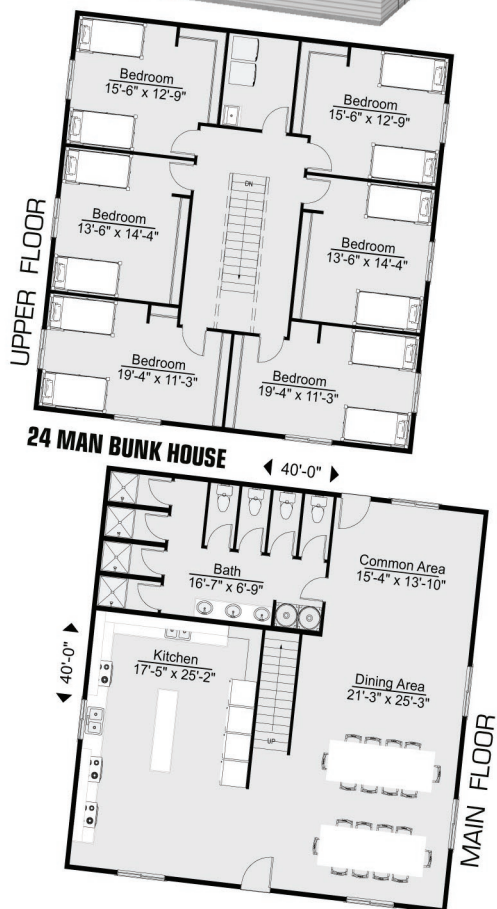
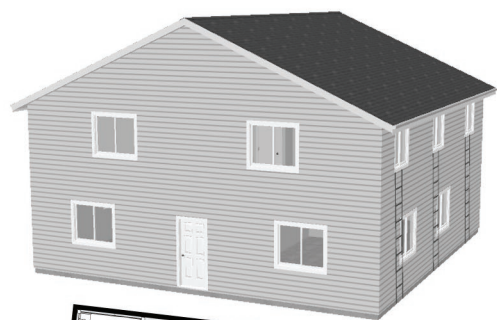


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Consumer demand for white peaches, low-acid varieties and various kinds of nectarines have upped the pressure on Mid-Atlantic growers and breeders to deliver new, novel fruit with great regularity. It's all about providing a steady supply of new types and varieties to keep up with diverse and changing consumer tastes.

### New peaches

Frecon said there are plenty of new peaches and nectarines being developed. Many in the Mid-Atlantic states are coming from Rutgers University's Tree Fruit Breeding Program, under the direction of plant biology and pathology professor Joseph Goffreda, at Cream Ridge, New Jersey.

Among the new varieties under advanced testing are five highly attractive, red-skinned, yellow-fleshed peaches — ripening in very early midseason, midseason and late season; a new, white-fleshed, red-skinned nectarine; an early, red-skinned, yellow-fleshed nectarine; a flat, yellow-fleshed, yellow-skinned nectarine; and a flat, yellow-fleshed nectarine.

The red-skinned peach's value lies in the way it presents itself in the market. "It has a bright, red skin that is more attractive than other peach varieties. Color must be right, complete or have a balance of a bright orange and yellow under-color," he said.

Flat peaches, mostly the "doughnut varieties," are hot sellers. Just about every farm market in the Northeast sells flat peaches — most often, the first flat peach variety, Saturn (NJ F-2). Supermarkets, too, will give shelf space to them.

There are two reasons. First, there is the novel shape, which is easily distinguished from other varieties and types of peaches, thus attracting the supermarket shelf space peaches would normally not get.

Second, their sugar is high. "They have an exquisite flavor, which people remember and associate with the shape," said Frecon.

They have a downside. Packinghouse equipment is

built to size round peaches. Flat peaches don't roll over the rollers very well and frequently get damaged.

The Saturn also comes with its own management problems. "You have to be very careful when you pick it to twist it just right or the skin tears. The fruit also has a scar on the distal end of the peach," he said. "We are evaluating varieties, similar to Saturn's exquisite taste, that do not tear, are firmer, freestone and only have small scars."

Marketers are in a bit of a quandary with low-acid peaches. While they don't appear to be different, they taste different. It seems growers prefer to grow and sell traditionally flavored peaches but many consumers like those peaches with less than 5 percent acid.

They associate many of the low-acid peaches with white flesh, but more and more varieties feature low acid and have yellow flesh. Low-acid peaches have a milder taste and appeal to younger and Asian consumers, though others say white-fleshed, low-acid peaches are too mild.

### Nectarines

The low temperatures of the past few winters and springs have been hard on white-fleshed nectarines. Yet hope springs eternal: the most recently introduced white-fleshed nectarine variety by Rutgers is called SilverGem (NJN 100). Unlike varieties developed in California and grown by Mid-Atlantic growers, it has better flavor and is more tolerant to bacterial spot and low temperatures.

SilverGem is a medium-sized fruit ripening two weeks ahead of Redhavens. What it brings to the table is flavor and lots of it. "It's the best flavor of all of the white-fleshed varieties," said Frecon.

Yet some of the varieties yet-to-come promise improvements. There are more than a few advanced selections producing large-sized fruit; some have cream-colored flesh, while others have red in the flesh.

"In the future, we may see peaches and nectarines that are fully red-fleshed with exquisite flavor, better than the ones we have now," he said.

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COURTESY JERRY FRECON

This test variety ripens in the early midseason and is one of the new, red-skinned, yellow-fleshed peaches developed by Rutgers University's fruit breeding program in Cream Ridge, New Jersey.

#### Tough hurdles

While supermarkets are interested in new varieties, they also want fruit throughout the season, he said. "We still have gaps in many fruit types; we don't have it all covered."

That's true, says Boyertown, Pennsylvania, fruit grower Ben Keim of Keim Orchard. The early season finds Eastern peach growers selling semi-cling peaches to retailers and farm markets.

"We don't start wholesaling until the last week of July. By that time, consumers are looking for freestone fruit," he said.

That's because California growers begin shipping semi-free and semi-cling peaches into the Mid-Atlantic markets. Keim said he'd like to have some early-season varieties to compete with the California produce, especially a freestone variety.

In the meantime, the New Jersey Peach Promotion Council, for which Frecon is a consultant, is pursuing a strategy of familiarizing consumers with peach varieties in their seasons. "If peaches were identified by variety, we can get more shelf space," said Frecon.

However, this is a much tougher marketing problem than it seems.

Experience shows supermarkets are not prone to devote extra space to peaches when they have several varieties on hand with different names but similar characteristics. For example, in late July and early August, they'll have Redhavens, JonBoys and Redstars for sale at the same time and give them the same shelf space because they look alike and can be mixed together.

Not surprisingly, tradition is another obstacle. The problem with Northeastern peaches — unlike apples — is that they enter the market and are sold for about 10 to 12 weeks throughout the summer, after which growers and supermarkets move on to the next fruit type.

So what's the incentive for supermarkets to sell peaches by varietal names? Not much, considering the fierce competition from other regions and other varieties of fruits and vegetables.

So, what's going to move supermarkets in the direction the promotion council wants them to go? "We need fruit with profoundly different colors, shapes and flavors," Frecon said.

One possibility is so-called "neat peaches" or peaches that can be snacked on without the juice squirting all over clothing. "Some people will not eat peaches as a snack because they are too juicy and messy," he said. ●

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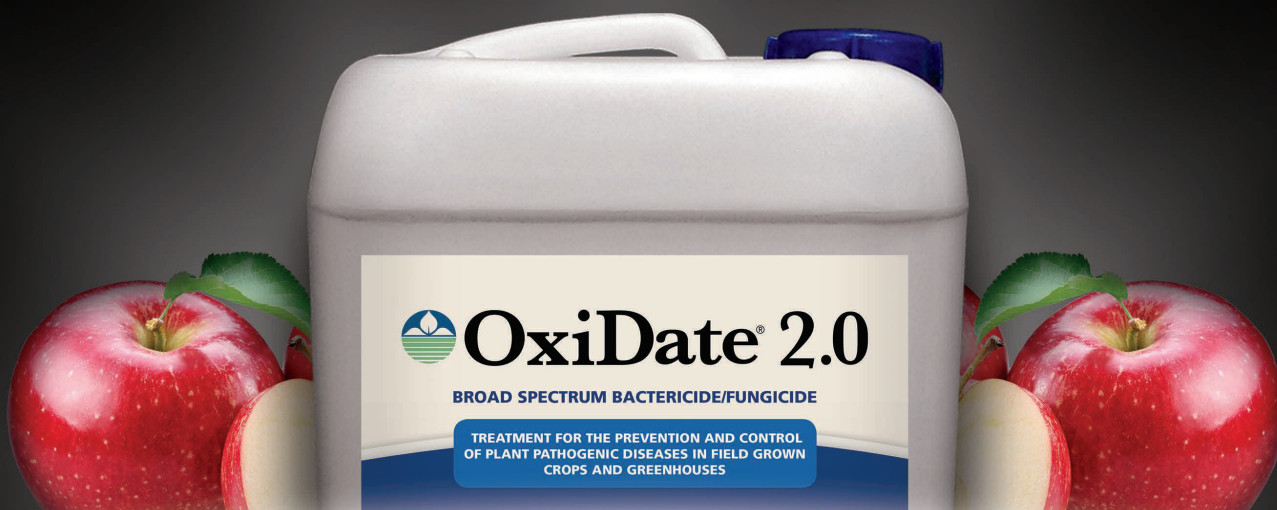
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# Managing mummy berry

## Researchers aim to improve control for blueberry disease.

by Shannon Dininny

**M**ummy berry is a disease that suits its name, turning plump blueberries into white, wrinkled berries that fall to the ground and serve as a winter home for the causal pathogen.

In early spring, those mummy berries develop into small mushrooms, called apothecia, which release spores to be spread by wind to infect healthy plants.

It's one of the most significant diseases of highbush blueberries in the Northwest. There are management options available for both conventional and organic growers, but they have been unable to consistently control the disease. In Oregon, commercial losses can range from 33 percent to 85 percent, with organic losses routinely reaching near 100 percent of the crop.

Researchers are working to help blueberry growers forecast for and better recognize the signs and symptoms of mummy berry. Those efforts include a particularly novel idea that, if successful, could carry over to help growers recognize other pests and diseases.

### Knowing when to spray

Understanding the cycle of the disease is key, researchers say.

Mummy berry has two stages of infection. Primary



COURTESY JAY PSCHIEDT

Researchers are working to help blueberry growers forecast for and better recognize the signs and symptoms of mummy berry, as seen in top photo. Here, infected green berries show no symptoms unless they are cut open. The fungus begins to fill the carpels of the infected berry on the left while seeds form in the healthy berry on the right.

infections occur when spores infect emerging leaf and flower buds in the spring. These “strikes” first appear as dark brown discoloration of leaves. Secondary infections occur when spores infect the flowers and fruit from within, which causes the wrinkled, pumpkin-shaped berries that give the disease its name.

Researchers at Washington State University are targeting the first phase of infection in hopes that by improving the timing of fungicide applications, growers can better control subsequent disease development in the field.

“Right now, growers are starting applications around bud break, and then continuing on a calendar schedule,” said Dalphy Harteveld, a postdoctoral research associate at WSU’s Northwestern Washington Research and Extension Center in Mount Vernon, Washington. “We’d like to refine that process, to use fungicides only when they’re needed and actually reduce the amount of fungicide that’s used to control the disease.”

Specifically, Harteveld is working to develop a model that identifies the weather factors that control spore release. With two years of data already gathered, Harteveld plans to collect data again this year to build the model and begin testing it next year.

“In the mummy berry cycle, there are specific susceptible phases when flower clusters and leaf clusters get infected. Initially, I thought that would be about the same time for each, but that’s not the case,” she said. “The timing of the development of these two features may actually affect whether disease develops in those plants.”

There’s a window of time in which the mushrooms produce the spores — about 10 days, maybe two weeks if the conditions are right. But the mushrooms don’t all come up at the same time, so over the spring, growers could have a month or five weeks that spores are coming up and being dispersed.

However, fewer spores are dispersed at the beginning and end of that window, and because different blueberry



cultivars develop at different rates, some varieties might not require such intense disease control as others, said Tobin Peever, associate professor of plant pathology at WSU's Pullman and Mount Vernon campuses.

"The timing of infection is related to bud break, or when vegetative and floral shoots appear, and this varies significantly by cultivar and location," Peever said. "Because there are large differences in when they first break their buds, growers are going to be able to time their sprays accordingly in a customized way."

Once the factors tied to spore release are confirmed, Hartevelde aims to build a calculator that growers could use to determine when they can expect spores to be released in their area.

In the meantime, she's been producing weekly mummy berry updates for four cultivars widely planted in two counties in western Washington, which are posted on WSU's website at <http://bit.ly/25I4kEZ>.

### Spotting 'shrooms

Scouting for the apothecia that emerge under blueberry plants could provide growers time-sensitive information about how best to manage the fungus. However, the mushrooms are small and blend in easily with the ground, making them difficult to find.

Enter the 3-D printed model of a mushroom.

Jay Pscheidt, professor and Extension plant pathology specialist at Oregon State University, is working to develop an actual-size and color model of the mushroom to help growers identify it in the field.

At only about 1/4-inch wide and a shade of brown that matches the soil, the mushrooms are difficult to spot for the untrained eye, Pscheidt said.

The mummified berries fall off the bush the previous year, often staying in place and emerging as mushrooms in the spring. If there's a raised berm or hill, they may roll a bit, or they could be covered with leaf material or debris, but the mushrooms work their way out without too much trouble, he said.

"The goal is to educate growers on what it looks like, what to look for, and to get them a little more keyed into what's going on so they can tighten up their control tactics," he said.

Pscheidt worked with OSU's Department of Archaeology to quickly scan into the computer real mushrooms from different positions before they began to dehydrate and lose color. From those scans, a model of the mushroom was born and printed on a 3-D printer.

Pscheidt handed out the first samples to field representatives and county agents for evaluation. Though the color washed out when it got wet and the printed material wasn't as strong as he would like, Pscheidt said the model shows promise. He's looking into a different service that could print them on stronger, more durable materials for long-term use.

"We track when these mushrooms come out and how long they stay out. In some years, it's as short as eight days, and in other years, it's as long as four weeks," he said. "It's variable over the years, and that's what makes it very hard to get after."

Ultimately, if the 3-D model proves successful, Pscheidt said he sees potential for the technology to be applied in other areas, namely, identifying brown marmorated stink bug.

"BMSB — there is an identification that might lend itself to 3-D printing," he said. ●



COURTESY JAY PSCHIEDT

The mushroom that releases the spores that infect blueberries with mummy berry disease is seen at center. A 3-D printed version of the mushroom, created by Jay Pscheidt of Oregon State University, is on the right. The 3-D version with wear and tear is seen on the left. Pscheidt is working to develop a sturdier version.

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# Simple steps

**Researchers are educating packing house operators and growers about proper water sampling methods in orchards and vineyards.**

*by Shannon Dininny*

*photos by TJ Mullinax*

**A**s the fruit industry gears up to begin complying with new food safety regulations, many are finding them to be unclear and intimidating, with plenty of unanswered questions.

Growers and packers have been working for months to determine which of the two rules — the Produce Safety Rule and the Preventive Controls for Human Food Rule — apply to their operations under the Food Safety Modernization Act (FSMA). And researchers are working to train growers and packers about how to meet the biggest requirements of each.

For growers, that requirement is water quality sampling, and the researchers' message is simple: Where you sample matters. When you sample matters. How you sample matters. How you test matters.

"We want to clarify some of the things in the rule that are vague, but also demystify it and empower growers with information — let them know it doesn't have to be as scary as it seems and a lot of things they can do themselves," said Melissa Partyka. She is a research ecologist with the Western Center for Food Safety at the University of California-Davis, a Food and Drug Administration Center of Excellence established to conduct research, outreach and educational programs to enhance implementation of FSMA.

Most growers fall under the Produce Safety Rule, which establishes standards for the growing, harvesting, packing and holding of produce. The rule requires growers to test their agricultural water and take certain actions should microbial tests come back above a set threshold close to harvest.



Ronald Bond of the University of California-Davis, shows a proper method for obtaining an accurate water sample during an irrigation water testing workshop in Selah, Washington, in May. Bond said samples should not be taken by skimming the surface or sides of an irrigation canal. Instead, dip the container mouth down into the water and sweep in a half-moon arc to obtain a representative sample.



# for sampling

The biggest misconception about water sampling under the rule is that it's intended to ensure food safety, Partyka said. It's not. FSMA compliance for this agricultural rule is meant to ensure growers determine and understand the variability of their water quality, which requires monitoring.

Things are messy in the outdoors, Partyka said, and there's plenty of variability to be found in an orchard or vineyard and near your water source. If it's raining hard in the mountains or upstream, there could be high runoff and higher turbidity in surface water. At certain times of year, animals are more active, resulting in greater potential for contaminants. A neighbor could be pulling out an orchard, driving wildlife closer to your property or water source or creating runoff.

The water quality requirements under the rule require

## FSMA: The two rules

Growers are covered by the Produce Safety Rule, which lays out standards for the growing, harvesting, packing and holding of produce. Some fresh fruit packers might fall under the Produce Safety Rule if most of the fruit they pack comes from company-owned orchards, though the location of the orchards is also a factor. However, if most of the fruit comes from outside growers, the packer will likely fall under the Preventive Controls for Human Food Rule instead. Packers who handle fruit from their own orchards and from other growers will need

to determine which rule applies to them. This also applies to storage facilities.

Very small growers — those with less than \$250,000 in annual produce sales — will have four years from Jan. 26, 2016 to comply with most provisions in the rule.

Growers with \$250,000 to \$500,000 in sales will have three years to comply, and all others will have two years.

However, growers will be given an additional two years to meet the water quality standards because of concerns about the difficulty that growers may have in meeting these new requirements.





During the workshop, Melissa Partyka of the University of California-Davis pointed out several environmental factors that can impact water quality, such as runoff, changes in canal banks, nearby animals and, as seen in the background, alterations to neighboring orchards and land.

growers to monitor irrigation water for the presence of generic *Escherichia coli* (*E. coli*), which indicates the presence of fecal contamination, if it could come into contact with the harvestable portion of a crop. It doesn't matter if that water is being applied through sprinkler irrigation, overhead cooling or other means.

Growers who use drip or micro jet irrigation may think they are exempt, Partyka said, but if they use irrigation water in their pesticide sprayers, then the water could come into contact with the crop and monitoring is required.

(For tips on how to properly take a water sample, see "Water sampling 101" on next page.)

#### Understanding the rule

The Produce Safety Rule requires untreated surface water that could come into contact with produce to undergo a minimum of 20 samples, collected as close as feasible to harvest, over the course of two to four years. The initial findings are used to calculate a geometric mean (GM) and statistical threshold (STV), which together create the microbial water quality profile for that source.

A single positive sample can't be seen as a "hit" — a word researchers would like to remove from the lexicon, said Ronald Bond, water quality researcher at WCFS.

In TMDL (total maximum daily load) water sampling for environmental purposes, a "hit" requires continued testing until the problem is cleared up, he said. In this case, growers will take 20 samples over the sampling period. Each year thereafter, five more samples will be added and the oldest five will be dropped, creating a rolling geometric mean.

For untreated ground water that is directly applied to growing produce, growers are required to do an initial survey using a minimum of four samples, with a minimum of one new sample each year thereafter.

One sample with high levels doesn't necessarily mean a grower has a water quality problem, Partyka said. The

*"We want to clarify some of the things in the rule that are vague, but also demystify it and empower growers with information — let them know it doesn't have to be as scary as it seems."*

—Melissa Partyka

series of samples are needed to understand the variability of the water quality, and not everyone's variability is going to be the same.

"Variability at the start of the season is likely to be different by the end of the season, and you need to understand what makes your system unique," she said.

#### Understanding the math

Partyka and Bond, joined by researcher Jennifer Chase of WCFS, conducted a training seminar for irrigation district personnel and packing house food safety compliance officers at several sites in Washington in May. The hope is that those who have been trained will help to initially spread the word and offer guidance to growers. More training seminars are planned for growers in the coming months.

However, a key point the researchers made during the training was that a late rule change by the U.S. Food and Drug Administration could affect the method or laboratory a grower might choose to analyze samples.

Most probable number (MPN) and colony-forming units (CFU) are both estimates of fecal indicator bacteria

concentration and are common measures of water quality in aquatic environments. CFU is a count of bacterial colonies grown on a petri dish, while MPN is based on a statistical estimation.

MPN methods for indicators have yet to be adequately vetted scientifically for epidemiological use, or for human contact, Bond said, and the FDA has ruled it is not acceptable for use under FSMA. That means growers must ensure that they use — or that the laboratory they hire to analyze their sample — uses a CFU analysis instead of an MPN analysis. Specifically, the FDA has stated that EPA Method 1603 is the only currently acceptable method for analyzing your samples. Any other method requires scientific verification.

Under the Produce Safety Rule, the geometric mean of a grower's samples must be 126 CFU or less of generic *E. coli* per 100 milliliters of water (2.1 log<sub>10</sub> *E. coli*). The statistical threshold of samples is 410 CFU or less of generic *E. coli* in 100 milliliters of water (2.6 log<sub>10</sub> *E. coli*).

Several tools have been developed to make it easier to calculate the geometric mean and statistical threshold to determine if water meets standards for unrestricted application before harvest. UC-Davis (WCFS) has created Excel tools both for those using untreated surface water or untreated ground water. In addition, the University of Arizona Cooperative Extension has developed an online calculator and ag water app to aid growers.

Visit the Western Center for Food Safety online for links to those sites at [wcfs.ucdavis.edu](http://wcfs.ucdavis.edu). ●

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PHOTOS BY TJ MULLINAX/GOOD FRUIT GROWER

Jennifer Chase of the University of California-Davis recommends holding containers away from equipment to prevent contaminants from entering.

## Water sampling 101

In a recent interview with *Good Fruit Grower*, UC-Davis researchers Melissa Partyka, Ronald Bond and Jennifer Chase offered tips to growers for taking a water sample.

—Do your homework. Walk the area upstream of your diversion point if you're drawing surface water from an irrigation canal or stream, or walk around the reservoir on your property if it serves as your water source. Are there a lot of animals in the area that could contribute to high bacteria levels? Is there runoff, and if so, where? Has the area changed since the last time you walked it? Take notes.

—Be mindful of neighbors. Are they removing an orchard that could drive wildlife to your property or to your upstream water source? When they irrigate, are they discharging upstream of your water source? If so, it would be good to note when that happens, and avoid sampling then. Again, take notes.

—Secure a sampling site. Find a spot to sample your source water that is easy to access, free of weeds or debris and requires the least effort (a 30-foot walk from the car rather than, say, a 2-mile hike.) If sampling from a canal, select a site with relatively calm, moving water; avoid stagnant water. Also avoid sites and times with high turbidity, unless the water is always turbid. If you are sampling piped water, find a convenient spot with a spigot or other hand valve that can be managed at the sampling site, and avoid garden hoses that are full of stagnant water and promote biofilm growth.

—Practice. Make reconnaissance trips to your sampling site and practice sampling at your site to develop good habits.

—Be prepared. Make sure you have everything you need: clean gloves, unused containers or containers that have been sanitized in an autoclave, alcohol pads, cooler of ice (not dry ice), paper and pen to make notes. Label your containers ahead of time with the location, date and time of the samples.

—Glove up only when you are ready to begin taking samples, not before leaving the office. Gloves mean you're ready to start.

—Remove container cap without contaminating the cap or the inside of the container. (Translation: Do not put your fingers inside the cap or container). Secure the cap in a safe place.

—If you are collecting your sample from a surface water source: Facing upstream, collect water with the bottle pointing down, swiping down through the water and up again in a half-moon arc. Do not skim the surface of the water, and do not disturb upstream sediment or the bottom or sides of the water source.

—For piped water samples, open the water and



Chase shows the proper level of air space that should remain in a testing container when sampling water. The inside of sampling containers must not come in contact with possible contaminants, such as equipment or foliage. Also, don't touch the inside of the bottle or cap.

flush the sample point for two to five minutes. Turn off water and disinfect sampling point with alcohol swab. Turn on water to reflush for a few seconds and fill container without touching the source point.

—Don't overfill; leave a little head space in the container for lab staff to shake the water sample.

—Recap bottle and place in your cooler.

—Document, document, document. Record notes clearly about your samples and anything unusual you noticed at the site.

With that, you're ready to send your samples to the lab for analysis. Remember, the researchers note, regulators are not asking you to fix your water quality. Rather, they are asking you to recognize if there's an issue with your water quality and to be able to show that you're taking steps to make allowances for high bacteria counts if your water comes in contact with your crop. —S. Dininny

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# Tracking pathogens

Kathleen Glass, distinguished scientist and associate director of the Food Research Institute at the University of Wisconsin-Madison, says whole genome sequencing provides a much more detailed picture of an organism's DNA, making it far less likely that the source of a bacteria will be misidentified.



## Whole genome sequencing tracks pathogens, perhaps to your door.

by Leslie Mertz

**W**hole genome sequencing has gone a long way toward helping scientists track foodborne illness back to the source. That's good for consumers who want assurances that food they eat is safe. At the same time, however, it's causing increasing concern for growers who realize that the technique could potentially implicate a region or any orchard or vineyard, including their own.

Fruit growers have become especially anxious in light of three things:

—The 2014 illness outbreak that was linked to apples.

—The recent use of whole genome sequencing to track not only current disease outbreaks, but also past sporadic clinical cases to their sources as a means of identifying responsibility for low-level but chronic contamination.

—The use of evidence gained from whole genome sequencing to initiate criminal investigations against those connected with illness-causing foods.

### Caramel apples

A 2014 listeriosis outbreak tied tainted caramel apples to 34 hospitalizations and three deaths. Listeriosis is caused by infection with the pathogenic bacterium *Listeria monocytogenes*. This marked one of the first times that whole genome sequencing had been used to pursue a foodborne-illness outbreak to its origin. It led to a voluntary recall of Gala and Granny Smith apples, and it showed growers and packers that dangerous illnesses can take root in all kinds of fresh produce, including tree fruit.

The question of who was to blame led to some tense moments, particularly since *Listeria* is a microorganism that exists just about anywhere in the great outdoors, said Kathleen Glass, distinguished scientist and associate director of the Food Research Institute at the University of Wisconsin–Madison. “Apple trees grow out in the open. An orchard is not a sterile environment, so you are going to have *Listeria* show up every once in a while.”

There is no evidence to determine whether apples may have initially been exposed to the bacterium in the orchard, but ample evidence that the specific *L. monocytogenes* causing illness and death was present in the packing facility. As a result, the responsibility for the caramel-apple outbreak fell mainly on the packers, she said.

“Ultimately, it was the packer who got into trouble because they didn’t have the next level of cleaning and sanitation that they should have had,” Glass said. The manufacturers also shared the problem. She explained, “When it came to the manufacturers who made the caramel apples out of the contaminated apples, at least one used another sanitation step and assumed it worked, but nobody had a validated sanitation step.”

Validation is key, Glass noted. “This is where we’re really behind the beam. Many packers and processors are doing things they think will be good, but they don’t really have proof that they are.”

Growers may not have been singled out as contributing to this particular outbreak, but Glass said they should nevertheless be cognizant of *Listeria* and ways they can mitigate it. “This is an instance where apples, and produce in general, is just a really difficult type of food product, because we don’t have a magic bullet yet to eliminate *Listeria*. All you can do is try to reduce the level of contaminants that are there.” (See “Protect your customers, protect your orchard” on page 29.)

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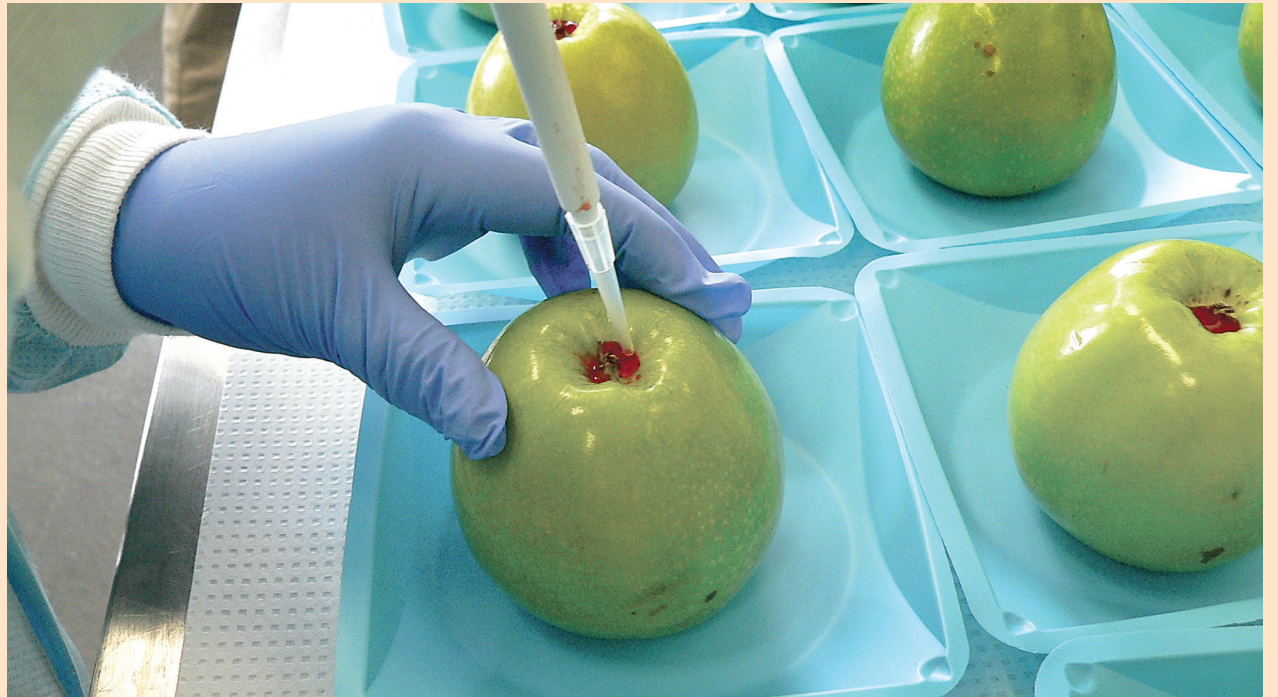
Besides using whole genome sequencing to track current illness, the U.S. Food and Drug Administration (FDA) has begun using the technique to revisit long-past instances of illness so it can find their source, much as police cold-case squads reinvestigate old crimes to find the culprit.

"A lot of what's going on in triggering what seems like the weekly product recalls nowadays is the FDA's, or state public health labs, conducting market-basket surveillance testing," said Trevor Suslow, extension research specialist in the Department of Plant Sciences at the University of California.

In other words, he explained, regulators are collecting bacterial samples from various foods and food-related locations during their standard or commodity-targeted inspections, and subjecting those positive samples to whole genome sequencing. When the FDA finds pathogens from those routine inspections or assignments, it is comparing them against the database of illnesses kept by the Centers for Disease Control and Prevention (CDC), and looking for connections between the two.

"We're talking about going back and looking at past cases, finding indistinguishable isolates associated with your apples or cherries or whatever, and then holding you responsible for those illnesses," he said. "That's really how the FDA is using whole genome sequencing — as both a current and as a retrospective assessment of food-safety risks to determine responsibility."

Although Suslow said the FDA seems confident that whole genome sequencing is an accurate tool for tracing illnesses, he is not so sure. "We're starting in my lab to develop data based on environmental testing, and it's suggesting that such results may not be as ironclad as some might think," he said, noting that his research group has been conducting this study specifically in tree fruit orchards for about two years. "We're now getting the first wave of isolates characterized by whole genome sequencing, in addition to other techniques,



## What is whole genome sequencing?

Over the past year or so, whole genome sequencing has gotten a lot of attention as a means of pinpointing where an illness outbreak started, but what exactly is it and how does it work?

Whole genome sequencing is a tool to determine an organism's full complement of genetic material, or the entire DNA sequence, in one fell swoop. An organism's DNA sequence is made up of building blocks, called nucleotides, that serve as the blueprint for that particular organism, whether it is a bacterium

like *Listeria* or a human being. The more closely two organisms are related to one another, the more similar their DNA. Therefore, whole genome sequencing can be used to provide evidence in paternity suits, or to determine whether the bacteria causing a person's foodborne illness is possibly the descendent of the bacteria found on machinery involved in making that food, or on the fresh fruit from an orchard.

Before whole genome sequencing was developed, scientists used other methods to tell organisms apart, but whole genome sequencing provides a much more



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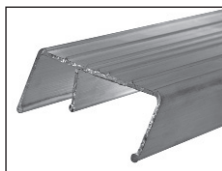
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PHOTOS COURTESY OF KATHLEEN GLASS.

A member of Glass's research group inoculates an apple with *Listeria*. The fruit is then used to make caramel apples, at which time they are tested for the bacteria. This provides insight into the potential for caramel apples to cause illness among consumers.

detailed picture, said Kathleen Glass, distinguished scientist and associate director of the Food Research Institute at the University of Wisconsin-Madison. The process of whole genome sequencing involves breaking the DNA into snippets, simultaneously deciphering the string of nucleotides within each snippet, and then putting the information from

all of the snippets in the right order to generate the entire DNA sequence end to end. "Whole genome sequencing is very precise, which makes it far less likely that we would misidentify what the original source of a bacteria is than if we used one of the older methods," Glass said.

Although whole genome sequencing has been around for at least a decade, it has only become a tool for pathogen tracking within the past year, she said. "The reason it's being used so much now is because the technology has gotten to be considerably more cost-effective. To do a sequence 10 years ago, it would have cost \$50,000, but now it's \$1,000 or less."

Often the cost today may fall below \$600, noted Trevor Suslow, extension research specialist in the Department of Plant Sciences at the University of California. He added that investigative analyses done by Centers for Disease Control and Prevention, the U.S. Food and Drug Administration and state labs also include other techniques that don't require full genome sequencing and are even less expensive.

Whole genome sequencing is just one part of the arsenal used to identify the source of a pathogen. Investigators still rely on good, old-fashioned detective work and careful epidemiology to narrow the field of suspect foods and possible infection sites and, once that's done, bring in whole genome sequencing to seal the case, Glass said.

That's exactly what happened with the 2015 Blue Bell ice cream listeriosis outbreak, she noted. Investigators questioned patients and their families, looked for commonalities, and ice cream came to the top of the list. "The only way they definitively tracked it down, though, was through whole genome sequencing: When they went back to the plants, they found *Listeria*, and matched it (to the patient samples). There was no doubt that was the source. Whole genome sequencing was the smoking gun."

—L. Mertz

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and we're finding that there are isolates that appear to be indistinguishable, yet were collected from regions 100-plus miles apart. So therefore, just because you find a matched whole genome sequencing isolate in one place, that doesn't necessarily mean it could *only* have come from one farm or one packing facility."

In the meantime, whole genome sequencing will continue to be a tool of choice in determining the origin of illness outbreaks, according to Shawn Stevens, a global food-safety attorney and founder of Food Industry Counsel LLC. "As time moves on, we may learn more, but I think the science is good enough to allow the agencies to do what they are trying to do."

Glass agreed that whole genome sequencing is a high-quality assay, and its use will expand. "It will definitely result in smaller outbreaks in the future, but we're going to start seeing an increasing number of identified outbreaks," she said.

### Placing criminal blame

Besides looking back in time, the FDA has switched gears in its approach toward the identified sources of contamination, said Stevens, who wrote a white paper on the topic in February (available at [bit.ly/22toCA9](http://bit.ly/22toCA9)).

In the past, the FDA tracked foodborne pathogens mainly as a means of learning how they got into the food stream, so it could then determine how to prevent the same thing from happening again. Following a number of food recalls, however, Congress in 2011 passed the Food Safety Modernization Act, which put the emphasis on preventing contamination rather than on responding to it, Stevens said.



PHOTO COURTESY OF TREVOR SUSLOW

The U.S. Food and Drug Administration is using whole genome sequencing to not only look for the source of and responsibility for current disease outbreaks, but also for past outbreaks, according to Trevor Suslow, extension research specialist in the Department of Plant Sciences at the University of California.

"The Food Safety Modernization Act essentially told the FDA that it was now responsible for overhauling the safety of our food supply," he said. "As a result, the FDA shifted its policy, and that policy now is one of using criminal sanctions in any circumstance where human illness occurs as a result of contaminated food."

In fact, an Associated Press article in July 2015 quoted Attorney General Stuart Delery as stating, "We have made a priority holding individuals and companies responsible when they fail to live up to their obligations that they have to protect the safety of the food that all of us eat."

Stevens pointed to the 2015 Blue Bell ice cream recall as a good example of the altered FDA policy. In this case, 10 patients over a five-year span — the first in January 2010 and the last in January 2015 — were hospitalized with listeriosis and three died. In its investigation, the FDA took ice cream samples from retail locations and environmental samples at Blue Bell production facilities, and then was able to match those samples that tested positive for *Listeria* to patient samples from the CDC database, he said.

Then, the FDA and Department of Justice served grand jury subpoenas on the company seeking all sorts of documents and records relating to their food safety practices, Stevens said. "That's the pattern that I think will be repeated over and over again as we move forward."

With the FDA's change in focus and the advent of whole genome sequencing as a means to track foodborne illnesses to their origins, Stevens said anyone involved in the food industry, including growers, should take steps now to scrutinize their operations.

"It's a very dynamic time for everybody, and I know there's a lot of apprehension in the industry, but hopefully we can get the word out, keep everybody informed, and look for ways to better protect everyone," he said. ●

*Leslie Mertz, Ph.D., is a freelance writer based in Gaylord, Michigan.*

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## Protect your customers, protect your orchard

*Listeria* is a true environmental bacterium, not requiring an animal host, and occurs naturally in water, soil and leaf litter, so eliminating it from the growing environment is not realistic. Other pathogens, such as *E. coli* and *Salmonella*, may survive in these same environments, too, but they don't typically grow or persist for extended periods in the absence of reintroduction.

However, with all of these microorganisms, growers can take steps to limit the potential for contamination and to protect their orchards and vineyards from lawsuits or legal action if new investigative techniques, such as whole genome sequencing, implicate their fruit in an outbreak of illness.

"My advice to any grower would be to conduct a very thorough risk assessment from the field all the way through packing or whatever stage they release the product. Ask yourself where along the way contamination could be introduced,"

said Shawn Stevens, a global food-safety attorney and founder of Food Industry Counsel LLC.

Every operation is different, but most growers can do a few things to reduce potential sources of contamination. These include:

—Raise bins off the ground. Apples might come off the tree fairly clean, but if they are stored in a bin that's set on wet ground, contaminated mud, fecal matter, or decaying vegetation can get into the nooks and crannies of the bins, said Trevor Suslow, extension research specialist in the Department of Plant Sciences at the University of California. Contamination



COURTESY OF SHAWN STEVENS.

Shawn Stevens, a global food-safety attorney and founder of Food Industry Counsel LLC, said growers should have contractual agreements in place to help protect them from liability should an illness be traced back to their orchards.

can also spread during pre-packing drench system treatments and dump tank or immersion and flotation of fruit for packing systems, he said. Another option to consider: adding polymer film bin liners to prevent fruit from contacting bins.

—Scan your property for piles of decaying vegetation, which can harbor *Listeria* and other pathogens. Such piles should be kept away from water sources, and also from human and equipment traffic, which can pick up and spread bacteria to other parts of the orchard, Suslow said. Similarly, growers should look beyond their property border to adjacent operations. *Listeria* grows well in silage, for example, so if a grower has an animal-feeding operation next door and silage piles near the orchard, he or she might want to work with the neighbor to mitigate the contamination risk.

If you're not sure, ask. Growers who have questions about a potential risk should consider approaching a consultant for a professional assessment, Stevens said.

Check in with an attorney to make sure you have contractual agreements in place to help protect you from liability should an illness be traced back to the orchard. For instance, an agreement might disclaim any responsibility for the condition of the product and require your customers to put certain interventions in place, or simply state that beyond replacement costs, you cannot be held responsible for any damages associated with your fruit, Stevens said. He also encourages growers to think about recall insurance, which will defray some of the often-extensive expenses associated with a crop recall.

Although the intent of whole genome sequencing is obviously to protect consumers, Suslow said, the possibility that it can link an illness outbreak to an orchard or vineyard is nothing to ignore. "It's a scary proposition, and I can understand there's quite a lot of hesitancy to want to go in and do a deep seek-and-destroy, investigative, environmental-testing program to truly understand what your challenges are on your property or in your packing environment," he said. But, growers are better off knowing more about their operations than doing nothing because they're afraid of the answer. "Not knowing is how folks get caught in these big recalls, and that's what you want to avoid." —L. Mertz

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# Assessment analyzes risk for spread of apple maggot

**Pest, plant experts find transporting and composting urban organic food and yard waste poses threat.**

by Ross Courtney

A trio of pest consultants has concluded that transporting urban organic waste would likely spread the dreaded apple maggot to orchards in rural Washington and recommended heating yard and food scraps before hauling them to areas the pest hasn't already reached.

The consultants published their results in early May in a pest risk assessment, gauging the likelihood that the apple maggot would hitch a ride on compost feed stocks hauled from areas quarantined for the pest — primarily the Puget Sound region — to eastern Washington compost facilities.

Today, the 271-page, \$200,000 technical document, paid for by fruit industry assessments, provides a guidebook for state officials, recycling companies, cities and counties searching for a way to meet a growing demand to compost while still protecting Washington's most valuable agricultural commodity from one of its most feared pests.

The goal is to do both, to "co-exist," said Laurie Davies, manager of the Washington state Department of Ecology's Waste to Resources program, which regulates commercial scale composting.

"We don't want solid waste to stop moving because of apple maggot," she said. "If it doesn't move, we have a health issue."

## About the assessment

The assessment paints an alarming picture for the spread of apple maggot, or *Rhagoletis pomonella*, a pest common in feral orchards and backyard fruit trees in much of western Washington but quarantined since the 1980s to prevent it from reaching the eastern Washington counties that produce apples.

The apple maggot directly attacks fruit, turning the flesh brown and mushy and causing apples to drop early. It has never been found in commercial fruit in Washington, yet many international trading partners consider it a pest of concern.

The consultants from Colorado, Massachusetts and England concluded the risk of spreading the maggot through waste hauling is "likely to occur with low uncertainty" if compost companies do not treat it first.

They traced four hypothetical routes for the maggot, called pathway analyses, each through a different eastern Washington composter, and gauged different levels of risk. Every composter handles their feed stocks, sometimes called municipal green waste or MGW, in different ways.

Overall, the risk posed by *R. pomonella* moving on waste from the quarantine area is unacceptable, they determined.

Tree fruit industry officials praised the report's strong



COURTESY RYAN LEONG

The PacifiClean composting facility in Quincy, Washington, is shown operational in the spring of 2015. Concerns over the spread of the apple maggot have prompted state authorities to stop composting activity, at least temporarily.

## Determining the risk

On March 31, Washington Gov. Jay Inslee signed into law Senate Bill 6605, which requires local agencies and the state Department of Ecology to gauge — with the state's Department of Agriculture — the risk of spreading pests when making solid waste regulations. It took effect June 9. For more information, visit [1.usa.gov/1Y4p7jn](http://1.usa.gov/1Y4p7jn).

language for validating their concerns.

Their painstaking methodology left few stones unturned and little room for argument, said Mike Willett, manager of the Washington State Tree Fruit Research Commission. For example, consultants normally would run only one pathway analysis, he said.

"There was dispute about how much pest risk there was," said Jon DeVaney, president of the Yakima-based Washington State Tree Fruit Association, which represents growers and packers. The third-party document concludes that the risk is "higher than a lot of people suspected."

The state still has a long way to go before implementing any of the recommendations or allowing any more transfer of yard compost outside the quarantine. The state currently has imposed a moratorium on any such transfers.

The consultants, all well known in the pest control industry, suggested mechanically heating the compost

material to kill all life stages of the apple maggot before moving it across quarantine lines. Entomologists from the U.S. Department of Agriculture have shown that heating will work in small quantities but have not tested it on a broad commercial scale. (See "Dealing with apple maggot in yard waste" in the March 1, 2016 issue.)

State officials will lean on the assessment to develop protocols for ensuring the yard waste is treated, said Kirk Robinson, deputy director of the Washington State Department of Agriculture, the agency charged with preventing the spread of farm pests. They have no deadline in mind for that to happen, he said.

## History of green waste

Composting, though more common as urban areas have grown, is not new.

Over the past 20 years, the state Department of Ecology has been regulating the disposal of food scraps and yard clippings from cities through composting to divert it from landfills, where it may leach into groundwater and cause greenhouse gasses as it breaks down. The Ecology Department writes the regulations while county health districts issue permits.

For years, the city of Seattle had sent much of its waste to Cedar Grove, a company with facilities in Everett and Maple Valley, helping turn compost into a business enterprise. "It is a commodity and it's a big business," said Davies of the Ecology Department.

However, composters in Puget Sound are running out of room, prompting local governments to seek help from eastern Washington facilities, usually located farther from metropolitan centers and closer to farmers who purchase the finished compost as fertilizer.



## The consultants

The three consultants hired by the state Department of Agriculture to draft a risk assessment of the apple maggot spread posed by organic waste for composting all have high credentials in the international pest management community.

—Claire Sansford of York, England, a plant pathologist known for evaluating threats for the United Kingdom and the European Union. She has been an independent plant health consultant for three years. She previously worked 24 years for former government crop agencies in the United Kingdom, where she specialized in phytosanitary risks posed by plant waste. She was the primary author of the report.



Claire Sansford



Victor Mastro



James R. Reynolds

—Victor Mastro, a private consultant in Cotuit, Massachusetts. He previously served as entomologist and laboratory director for the U.S. Department of Agriculture's Animal and Plant Health Inspection Service, or APHIS.

—James R. Reynolds, owner of a plant health consultancy in Fort

Collins, Colorado. He previously worked as the Western Regional Director for APHIS's Plant Protection and Quarantine program.

Another consultant — Jaak Ryckeboer, an expert in hygienic safety of organic waste processing in Brussels, Belgium — reviewed the 271-page document.

In 2013, the city of Seattle contracted with PacifiClean Environmental of Spokane to transport and compost the city's green waste at a facility in Quincy, Washington. An alert fruit grower in the area read about the agreement in a local newspaper and told a state Agriculture Department official he was worried about apple maggot. That was the first the agency had heard of the issue.

Seattle's well-publicized composting mandate for all residents took effect Jan. 1, 2015. PacifiClean began accepting the city's waste that February. On Feb. 3, the Department of Agriculture declared emergency authority to issue special permits for compost facilities that haul waste across the quarantine boundary, but allowed PacifiClean to continue while it worked out the details of the permit. On June 30, 2015, the Agriculture Department issued a special permit for the PacifiClean plant, located about 6 miles south of Quincy.

Within a few days, inspectors found apple maggot larvae in apple waste in the PacifiClean processing line, according to Jim Marra, manager of the Agriculture Department's pest management program, and the agency suspended the permit on July 10. However, they still allowed the waste transfer if the company ground it before hauling. In August, inspectors continued to find apples they feared could provide apple maggot habitat in the waste stream in Quincy and finally put a halt to all the shipments on Aug. 18.

When all was said and done, PacifiClean processed more than 24,000 tons of Seattle waste during the seven months of operation.

Later, inspectors also found an adult apple maggot fly in a trap near Royal Organics, a Royal City compost company that in the past had accepted green waste from inside the quarantine but ceased when the Agriculture Department made the emergency rule. The fly did not necessarily come from Royal Organics, officials said. The agency's traps catch some adults outside the quarantine every year.

### PacifiClean's dilemma

The controversy has left PacifiClean in limbo.

The company now is gauging the economic sense of the heat treatments called for in the risk assessment, General Manager Ryan Leong said. "We're in the process of evaluating all that and trying to determine if that's feasible," he said.

For now, the company is unable to use the expansion made specifically for the Seattle contract that could have been worth more than \$3 million per year and processed a projected 65,000 tons of waste.

"A lot of money went into developing additional infrastructure," Leong said. He declined to reveal how much.

In the meantime, Cedar Grove has temporarily resumed taking Seattle's waste.

PacifiClean may have landed the biggest catch with the Seattle contract, but they were not fishing uncharted waters. Other eastern Washington companies, such as Royal Organics and Natural Selection Farms in Sunnyside, had been accepting waste from quarantine areas before the fruit industry realized it. Their respective counties permitted it under Ecology's regulations.

*"We don't want solid waste to stop moving because of apple maggot. If it doesn't move, we have a health issue."*

—Laurie Davies

Meanwhile, the state Department of Agriculture has allowed other facilities to continue. Barr Tech in Lincoln County currently accepts municipal green waste from the Spokane area, which is inside the quarantine. In fact, department officials are planning to redraw the quarantine boundaries to include Barr Tech's portion of Lincoln County, reasoning that the apple maggot already is in the area, which is not home to any commercial fruit orchards anyway.

Also, the department permits the Greater Wenatchee Landfill and Recycling Center to accept solid yard waste. Solid waste does not pose as big of a threat as organic waste, Marra said, as long as the city sending it separates solid waste from organics, such as food scraps, and the landfill covers and buries the solid waste right away. Douglas County also has active pest boards and advisors who understand apple maggot, Marra said.

Fruit industry officials don't want to completely stop the state from recycling, they said. "It's not that the fruit industry has any problem with composting, per se," said Willett of the research commission. But the new risk assessment calls for a long-term plan that prevents the spread of the apple maggot and treats everybody fairly.

"I believe that it argues for some level of standardization of processing," he said. ●

### ONLINE

The risk assessment is available on the Department of Agriculture website at [1.usa.gov/28grvZo](http://1.usa.gov/28grvZo)

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# Wine grape revelations

**Survey finds research program matches growers' needs, but more education efforts may be necessary.**

*by Shannon Dininny*

**T**he impact of viticultural practices on the composition of wine flavor ranked first in a survey of Washington wine grape growers, vintners and researchers to prioritize research efforts and money and gauge awareness of research efforts.

The survey by the Washington State Wine Commission found that a majority of wine grape growers and winemakers are aware of the commission's targeted research program, launched last fall. The survey garnered a record number of responses, 138, representing 12 of the 14 appellations in the state and wineries and vineyards of all sizes.

Respondents ranked six categories of research on a five-point scale: fermentation management, aroma and flavor compounds in wine, impact of viticultural practices on fruit and wine quality, grapevine viruses, other diseases and pests, and site selection and site management.

The highest ranked topic was the impact of viticultural practices — heat and light exposure, crop load, irrigation and nutrition — on wine flavor, with a score of 4.5 out of five. Tied for second in the survey were grapevine viruses and fermentation practices, including the

impact of yeast strains, wine spoilage and nutrient status on wine flavor, both with a score of four out of five.

Overall, the scores for the six categories ranged from 3.3 to 4.5.

"The survey shows that the program is gaining traction and off to a strong start," said Steve Warner, president of the Washington State Wine Commission.

## Targeting research

The survey is intended to aid the Wine Research Advisory Committee, which is a subcommittee of the Wine Commission, with setting viticulture and enology research priorities. The current list of priorities covers a broad swath of industry topics, broken into several categories, including:

—Fermentation management: includes phenolic measurement and management, sulfide avoidance and removal, botrytis and bunch rot management, process control and fermentation monitoring, among other things.

—Aroma and flavor compounds in wine: includes modification of grape derived flavor compounds, flavor active compounds derived from microbial metabolites, smoke taint analysis and removal.

—Impact of viticultural practices on composition and wine flavor: includes canopy management, improving water use efficiency, crop load estimation, berry shrivel.

—Diseases and pests: includes replanting, vector control, trunk canker diseases, powdery mildew and nematodes.

—Site selection and site management: predictive vineyard site models and predictive inversions models.

—Mechanization options for viticulture practices.

—Winery waste.

In the survey, respondents recommended nearly 200 topics for additional study; many touched on areas that have already been heavily researched.

While that shows the research program is on the right track, it also may indicate the need for more education efforts to ensure growers know about the research that's already being done to benefit the industry, research program manager Melissa Hansen said.

Rick Hamman, viticulturist for Hogue Ranches and chair of the commission's Research Advisory Committee, agreed. "I was kind of pleased that they did have some overlap to our current research





Wine grapes near Sunnyside, Washington.

TJ MULLINAX/GOOD FRUIT GROWER

*"We've done a lot of work on irrigation, and there's still lots to be done, because every site is different and how you manage is different, and there are a lot of variables at play — sprayer type, variety. There's a lot of unanswered questions, and that's why irrigation is a hot topic worldwide."*

—Rick Hamman

priorities; that really was good. We felt like we weren't missing the boat too much and we're covering things fairly well," he said.

A couple of key themes came out in the recommendations. One, water management, was unsurprising given the drought conditions Northwest growers endured last year.

"We've done a lot of work on irrigation, and there's still lots to be done, because every site is different and how you manage is different, and there are a lot of variables at play — sprayer type, variety. There's a lot of unanswered questions, and that's why irrigation is a hot topic worldwide," he said.

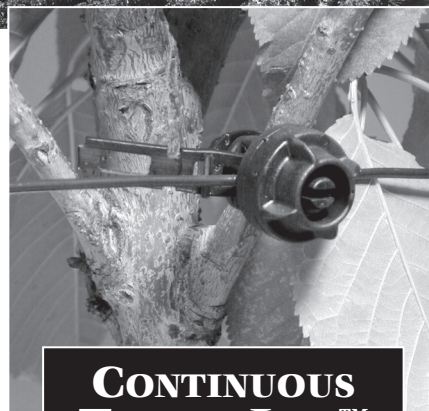
Survey respondents also expressed

interest in research into new technologies, from the use of drones and new, high-tech optical sorters to mechanization of pruning and harvest.

"There's been a lot of advancements in the field, but we want to keep close on this new technology and make sure we can help the research advance in that area," he said. "Winery waste issues also seem to be a little more of a topic that needs to be addressed, and that's something we did write down as part of an extra look."

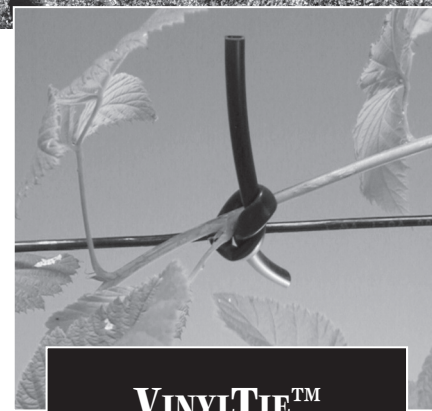
Those suggestions, along with all of the others, will be taken into consideration by the Wine Research Advisory Committee as it revises its research priorities this summer, Hamman said. ●

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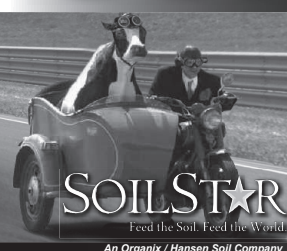
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## GOOD TO GO

For a complete listing of upcoming events, check the Calendar at [www.goodfruit.com](http://www.goodfruit.com)

### JULY

**July 19-21:** International Fruit Tree Association's New York Study Tour. Starts in Rochester, New York, [www.ifruittree.org](http://www.ifruittree.org).

**July 20:** Cornell Fruit Field Day, field stops and presentations on current research underway at Cornell in berries, hops, grapes and tree fruit, New York State Agricultural Experiment Station, Geneva, N.Y. 315-787-2341, [bit.ly/CornellFieldDay](http://bit.ly/CornellFieldDay)

### AUGUST

**August 26-28:** Festival of Fruit 2016 — The Year of Edible Landscaping, California Rare Fruit Growers, San Luis Obispo, California, [festivaloffruit.org](http://festivaloffruit.org).

### SEPTEMBER

**September 13-15:** Fresh-cut Produce: Maintaining Quality & Safety Workshop, Davis, California, UC Davis Campus, [postharvest.ucdavis.edu/Education/FreshCut](http://postharvest.ucdavis.edu/Education/FreshCut).

**September 14-16:** Macfrut 2016, Italian Fruit & Vegetable Trade Fair, Rimini Fiera, Italy, [macfrut.com](http://macfrut.com).



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## James Claar Whitelatch

grower / Pasco, Washington

age / 28

crops / Wine grapes

business / Owner of RC Farms and Claar Cellars

family background / James manages the wine grape crops on the family's estate in the White Bluffs region of central Washington. He works alongside his brother, John, and parents, Bob and Crista Whitelatch.

### How did you get your start?

“I have a lot of memories working with my dad, like when my brother and I would take naps in the cab of the swather when he was cutting alfalfa. Originally, I started around the time there was a big push with our apples to get GAP certified. So I started with collecting information to submit to the packing shed on nights and weekends. When we started looking into LIVE certification for the wine grapes ... I got more involved, spearheading those changes. Now it's a full-time job.

### What projects are you taking on?

“There's so much coming out in the industry right now. People are starting to use drones to more accurately gauge water stress and nutrient deficiencies. I'm just learning about new technologies that are coming to solve problems of overuse of pesticides, workforce problems, and what we can do to become mechanized. From prepruning, hedge trimming and doing what we can with tractors, technology is making the job easier, more cost-effective and better for the environment.

### Your opinion of replacing older Washington vines?

“Maybe it's just the rebellious teenage phase among Washington growers, or if we're just doing it because we can ... My father argues, “France has had vines for hundreds of years,” but I'm not sure they have the same soils and risks that we do.” From spacing to trellising, we're looking at replanting because of the potential of getting better quality with less expense.

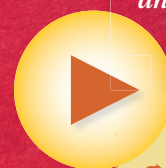
### Why are you a farmer?

“I have one of the most beautiful offices in the state of Washington: I've got 100 acres with a beautiful view of the Columbia River. Every day I feel like I've gotten something done and I've accomplished something. I joke that I'm an electrician, I'm a soil scientist, I'm a human resources manager — some days I'm knee deep in a hole fixing a water main line — you know it's not all glamorous. At the same time, I also see long-term goals as things continue to change based on what I've done. It's really fulfilling.

“We hope we can improve fruit quality using less water than before.”

by TJ Mullinax

More from this interview and other Young Growers at [goodfruit.com/yg](http://goodfruit.com/yg).



PLAY



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[www.c-onursery.com](http://www.c-onursery.com)



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