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Scott McDougall looks over the plantings at his company's new Legacy Orchard.

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TJ MULLINAX/GOOD FRUIT GROWER

On the cover

Workers harvest apples at a Stemilt Growers orchard near Quincy, Washington, using Automated Ag Systems platforms.

PHOTO BY
TJ MULLINAX,
GOOD FRUIT GROWER

Video: bit.ly/nightharvestGFG



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O. CASEY CORR/GOOD FRUIT GROWER

Prize winners in two drawings

Scott Jacky, left, manager of orchard operations for Valley Fruit in Wapato, Washington, won the Great Gator Give-A-Way contest co-sponsored by Wilbur-Ellis and *Good Fruit Grower*. Scott received his 2015 John Deere Gator TX 4X2 from Kyle Dillon, right, field technician with Wilbur-Ellis, and from Casey Corr, managing editor of *Good Fruit Grower*.

In another contest sponsored by *Good Fruit Grower*, Ismael Galeana of Othello, Washington, is the winner of a drawing for a new iPad.

Both drawings were held in December at the 111th Annual Meeting of the Washington State Tree Fruit Association in Yakima.

Congratulations to the winners!

New VP for Oregon Cherry Growers



Chantal Wright

Oregon Cherry Growers has named Chantal Wright as its new vice president of sales and business development. Wright will lead product development, business strategy and sales growth for the grower-owned cooperative.

"Chantal is a proven sales leader in the channels our cooperative serves and has a well-deserved reputation for building strong relationships," said Oregon Cherry Growers CEO and President Tim Ramsey. "Her emphasis on strategic selling and her ability to plan for growth make her an ideal leader for our sales and business development efforts at a time when we are poised for expansion."

Wright worked for the past seven years as director of vegetable sales for fruit and vegetable supplier RainSweet Inc. and, since 2012, concurrently managed regional sales for the industrial and foodservice divisions of frozen and specialty food company White Toque Inc. She previously

was a manager driving business development and overseeing regional sales managers for Norpac Food Sales LLC.

Founded in 1932, Oregon Cherry Growers comprises nearly 60 family farmers on 40,000 acres of land in the Willamette Valley and along the Columbia River Gorge. The cooperative is one of the largest producers and processors of sweet cherries in the world.

WSTFA renews officers

The Washington State Tree Fruit Association's slate of officers will remain the same in 2016.

Treasurer Jordan Matson of Matson Fruit Company in Selah and Secretary Sean Gilbert of Gilbert Orchards in Yakima were re-elected to an additional one-year term at the organization's quarterly board meeting Dec. 9 in Yakima.

Chairman José Ramirez of Stein-Manzana Orchards in Royal City and Vice-chair Jim Colbert of Chelan Fruit in Chelan are both in the middle of two-year terms.



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Firmer PEARS

More research ahead for compound to improve pear firmness.

by David Weinstock

A Washington State University horticulture researcher has found a new use for a familiar compound. Spraying pear trees with glycinebetain (GB) four weeks prior to picking allowed farmers to leave fruit on trees longer and to significantly improve its firmness when it came out of storage.

Dr. Amit Dhingra, a WSU horticulture department associate professor, had growers in Washington's Wenatchee Valley spray their pear trees with a compound normally used to control cracking in sweet cherries. Marketed as Bluestim, Greenstim and Verdera, it is an osmoregulator, used to control moisture loss in crops.

"What it really does," Dhingra said, "is prevent the degradation of chlorophyll."

Dhingra's quest began one day while he was standing in a Cashmere Valley orchard having a conversation with a grower. The grower asked if there was a way to keep pears greener.

After giving the question some thought, he remembered working with GB earlier in his career. Initially, he was unaware of its labeled use; after he found out, however, he quickly secured a patent for WSU for pre- and postharvest applications.

Dhingra's growers sprayed the compound onto trees at 2.5, 5 and 10 pounds per acre two weeks prior to harvest. Testing for fruit pressure and firmness at harvest, they saw no difference between treated and untreated d'Anjou and Bartlett pears.

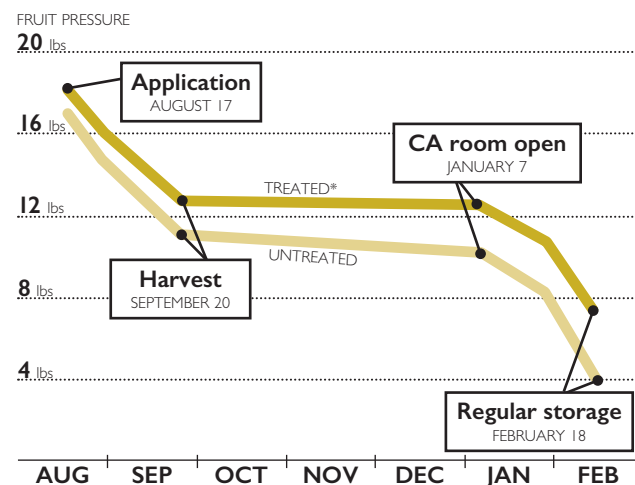
Improved freshness

But when he and his team opened the controlled-atmosphere (CA) storage rooms in January, they were confronted with "an amazing difference." Untreated pears showed a 34 percent decrease in firmness while treated pears showed only a 4 percent decrease. "In effect," he said, "ripening occurred under suspended animation. But when the fruit came out, it woke up."

Compound improves

A study found that d'Anjou pears sprayed with glycinebetain (GB) treated pears was initially lower on release from storage, it rose

Firmness



*D'Anjou pears treated with glycinebetain (GB) at 10 pounds per acre

SOURCE: WASHINGTON STATE UNIVERSITY

Once removed from storage, the treated pears were greener and firmer than the controls. The Brix level was 8° but rose to 12° within two weeks.

The added firmness translates to longer shelf life, he says. Based on fruit pressure, he estimated it can be extended by at least two weeks.

GB delivers other attributes consumers will find attractive, too. One is good color after storage. "We noticed blush in a lot of the control fruit, and this product showed it can help in eliminating it," Dhingra said. "This may be useful for Granny Smith and Golden Delicious apples."

David Sugar, now a retired Oregon State University-Medford fruit researcher, discovered another attribute.

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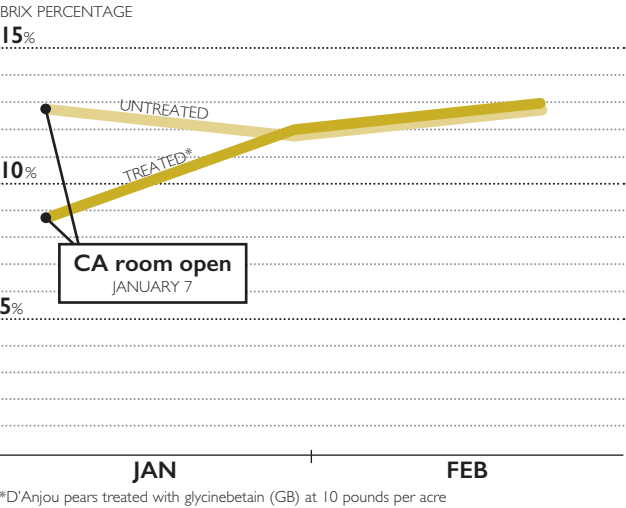
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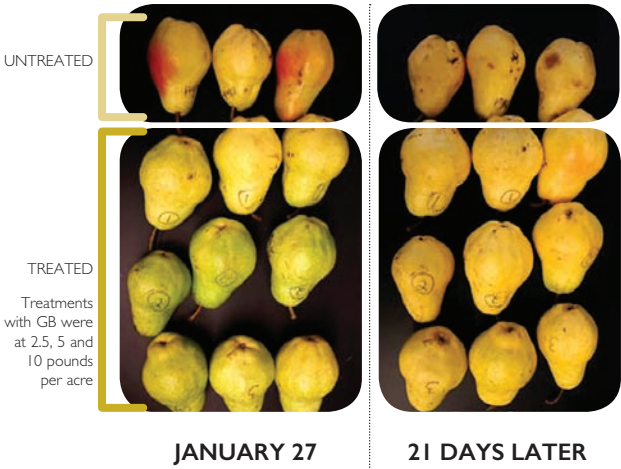
firmness, color for d'Anjou pears

before harvest were firmer and greener than untreated pears when they came out of storage. While the Brix level on the to match the level of untreated pears within a few weeks.

Postharvest Brix



Postharvest color



JARED JOHNSON/GOOD FRUIT GROWER ILLUSTRATION

GB eliminated internal browning after six months in storage at 0.5°C (33°F).

Sugar used Comice pears in his trial and duplicated Dhingra's fruit pressure results.

Delayed harvest

Another benefit GB brings to pear growers is delayed harvest. When sprayed prior to harvest, it extends the amount of time fruit can stay on trees.

How much time is an open question. Dhingra has anecdotal evidence of a grower who left his pears on his trees an extra two weeks after treating them with GB.

That result will be tested with more research, he said.

It's worth a look because added time on the tree means a longer picking season and the flexibility that brings, as well as heavier fruit.

The longer storage and shelf life means more time in front of consumers' eyes. Firmer fruit translates to less damage in packing and shipping.

Future research will likely look at what benefits come with postharvest applications as well as larger field trials to evaluate the product's effectiveness.

David Weinstock, Ph.D., is a freelance writer whose articles have appeared in Farming, Growing and other publications. ●

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Learning to fight *LISTERIA*

After years of experience in meat and dairy industries, food safety experts bring help to tree fruit industry.

by Shannon Dininny



SHANNON DININNY/GOOD FRUIT GROWER

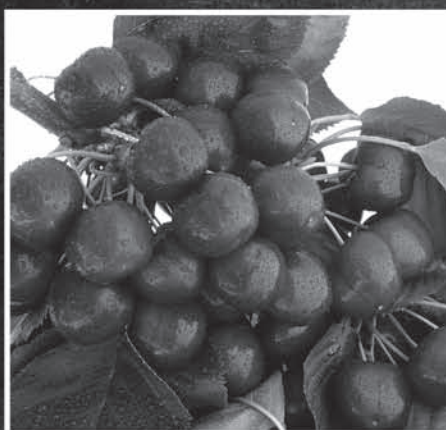
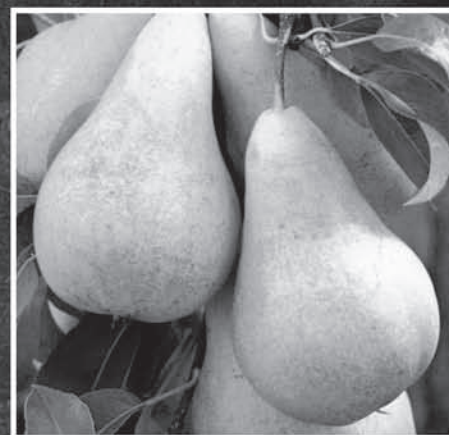
Rick Beecroft of Monson Fruit Company leads food safety scientist Kathleen Glass of the University of Wisconsin-Madison Food Research Institute on a tour of the packing house to better understand challenges faced by the tree fruit industry to meet new food safety regulations.

Kathleen Glass started working at the University of Wisconsin-Madison Food Research Institute 30 years ago, studying various microbes — primarily those turning up in the meat and dairy industries — and assisting with food safety investigations.

She added her first fruit case last year with a *Listeria monocytogenes* outbreak in caramel apples. Now, Glass and other researchers are working to better understand the needs of the tree fruit industry in order to help growers, packers and retailers meet new food safety regulations and ensure the safety of their products.

“The meat and dairy industries had problems 20 years ago. That’s really when we found our religion

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when it comes to food safety," Glass said. Fruit growers didn't have as much to worry about then, she said, but the new regulations will require additional precautions. "The learning curve will be much quicker than it was in other industries, just because they have the benefit of other industries' mistakes," she said.

Listeriosis

Each year, one in six people will be stricken with a food-borne illness, with Listeriosis being among the most serious. The *Listeria monocytogenes* pathogen sickens some 1,600 people each year and is one of the leading causes of death related to food-borne illness: Some 20 to 30 percent of those who contract the illness die, an estimated 260 people annually. Elderly people, those with compromised immune systems

was too low for minimum growth of the pathogen, which raised several questions. Is this the work of a superbug? Are conditions present to allow growth? Could damage to the apple contribute?

Preliminary studies suggest that damage to apples could encourage microbial growth, Glass said. In this case, puncturing the apple with a stick allowed *Listeria* to translocate to the core. In addition, deep depressions in apples may protect *Listeria* from hot caramel. Storage temperature also is an issue, with the apples stored at room temperature at retail, enabling *Listeria* growth.

Positive *Listeria* tests came back in several areas, including polishing brushes, drying brushes, a packing line drain, and the inside of an unpainted wooden bin at the packing house, said Kate Woods, vice president of the

"Listeria is an insidious bug, and you're going to have to keep looking where those niches are for concentrations. Find it and fix it."

—Kathleen Glass

and women who are pregnant are most susceptible.

A couple of consecutive outbreaks with ready-to-eat meat products led to significant changes in cleaning and sanitation in that industry, Glass said, as well as the addition of growth inhibitors to meat products so that *Listeria* can't grow during the normal shelf life. The changes sparked a 42 percent decrease in cases from 1996 to 2012.

The World Health Organization estimates an infectious dose of *Listeria* at about 10,000 cells or more. "Just a couple of *Listeria* in our food products probably is not going to make us sick. That means we need to focus on foods that support growth — perishable things you should refrigerate, those with the right amount of moisture and the right acidity level," Glass told growers and packers at December's Washington State Tree Fruit Association Annual Meeting in Yakima, Washington.

The case of the caramel apples

Investigators eventually tied the Jan. 6, 2015, *Listeria* outbreak to a specific supplier of Granny Smith and Gala apples in California, marking the first direct tie of fresh whole apples to a serious food safety outbreak.

But there were some novel things about the case, Glass said. Healthy children were getting sick from an unusual food source: caramel apples. The apples were sanitized, dipped in hot caramel, and the pH of the apples

Northwest Horticultural Council. This case, along with two other recalls of fresh whole apples in which no illnesses were reported, highlights the immediate need for hands-on training in packing houses and for additional research on industry best practices. The federal requirements will likely create the need for changes, she said, "but we will not have to start from scratch. It's adding to the things you already do."

What's known

Several things have been tried to control *Listeria*. However, none has been validated on a large scale, Glass said. Ultraviolet light might not be effective if there are stems or shadowing on the apple, or if the quality of the apple is low. Chlorinated water at low levels is not known to reduce *Listeria*, though higher concentrations will do more.

"A lot of things may have been used in a laboratory setting and you can get a certain amount of kill, but what happens in a laboratory can be so different because we have more control," she said. "*Listeria* is an insidious bug, and you're going to have to keep looking where those niches are for concentrations. Find it and fix it."

With that in mind, Glass and others toured packing houses, an orchard and an apple slicing facility following the annual meeting to get a better sense of the industry.

Claudia Coles, policy and external affairs advisor for the Washington State

Department of Agriculture's Food Safety and Consumer Services Division, used the tour as an opportunity to look for areas to target research funding. "If there are preventive steps that can control avenues of concern, we want to look at those, rather than have some go to extreme steps of changing out equipment when it might not be necessary," she said.

The group visited Monson Fruit Company in Selah, Washington. Glass joined the company's regulatory compliance manager, Rick Beecroft, in a discussion about specific areas of the apple packing line that could pose risks for *Listeria* contamination, including a belt that carries apples through the dryer. Glass recommended adding temperature sensors to the rollers to determine if the temperature is high enough — and the length of time long enough — to kill bacteria on the belt and on the product, as has been done at some other food processing companies.

If nothing else, she said, the area should be swabbed and tested in the morning and evening each day.

Beecroft liked the idea of adding a heat monitor. "We know this is a process that's a certain risk," he said. "That would be something that we may investigate further and pursue."

Glass said it's clear the industry is stepping up its efforts in the food safety arena and in environmental testing, which is the best way to determine if there's an area of concern. The problem is knowing if disinfectants are as effective as hoped. "We have to try things that have been done elsewhere and apply things in different ways," she said. "It's a tough, tough thing, because they don't have a great kill step. We don't have any magic at this point, and more research is needed."

That said, Glass added that the industry has made some phenomenal changes in terms of cleaning, sanitation, environmental testing and monitoring in the past 10 months. "We have to walk before we run, but we have to start somewhere, and the industry really is working hard," she said. "It's not the end." ●

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Postharvest

With display space for apples already crowded on retail shelves,

Shelf

Retail space is at a premium,
with growth in the number of
products and organics.

by Shannon Dininny

As growers produce larger crops comprising both mainstay and new varieties, marketers face greater challenges garnering retail shelf space.

Supermarkets are not miraculously getting bigger, and that space has to come from somewhere — either from new varieties, organics or competing products like citrus fruit, according to Steve Lutz, Columbia Marketing International's vice president of marketing. Produce space is governed by retailers' perceptions of consumer preference and what they think they can sell.

And the pressure is on the industry to remain competitive. As an example, Lutz said, look at Budweiser: Sales have fallen roughly 40 percent in the past 20 years — from 49.2 million barrels in 1988 to 17.2 million barrels in 2011 — thanks to the booming craft beer market.

"Go into a grocery store today and look at the beer display. It's now full of multiple brands," Lutz said during the 111th Annual Meeting of the Washington State Tree Fruit Association, held in December in Yakima, Washington. "The question is, 'How will I get it on the shelf, and how will I get it off the shelf once I've produced it?'"

Why worry?

The new orchards being planted each year mean there are a lot of young trees with new products and new varieties that will be bearing fruit and competing for space at the retail level, Lutz said. At the same time, consumption has been flat.

"The variety that we offer consumers offers us more opportunities to be successful with our products, but it puts demand on space," he said. "When we produce the next Cosmic Crisp, where are we going to put it?"

Apple, pear and cherry growers aren't the only growers producing new varieties, either. Variety is up everywhere — grapes, tomatoes, melons, all major commodities — as well as the growing organic sector.

The Costcos and Sam's Clubs of the world are unlikely to expand their produce footprint. Sam's Club averages seven varieties of apple, but "just try to get an eighth," Lutz said. "It is very, very difficult. They will say they have an expectation that your product will drive x number of sales per store, per week. If you can't do that, we don't want it."

Plus, as complexity increases in the marketplace, so



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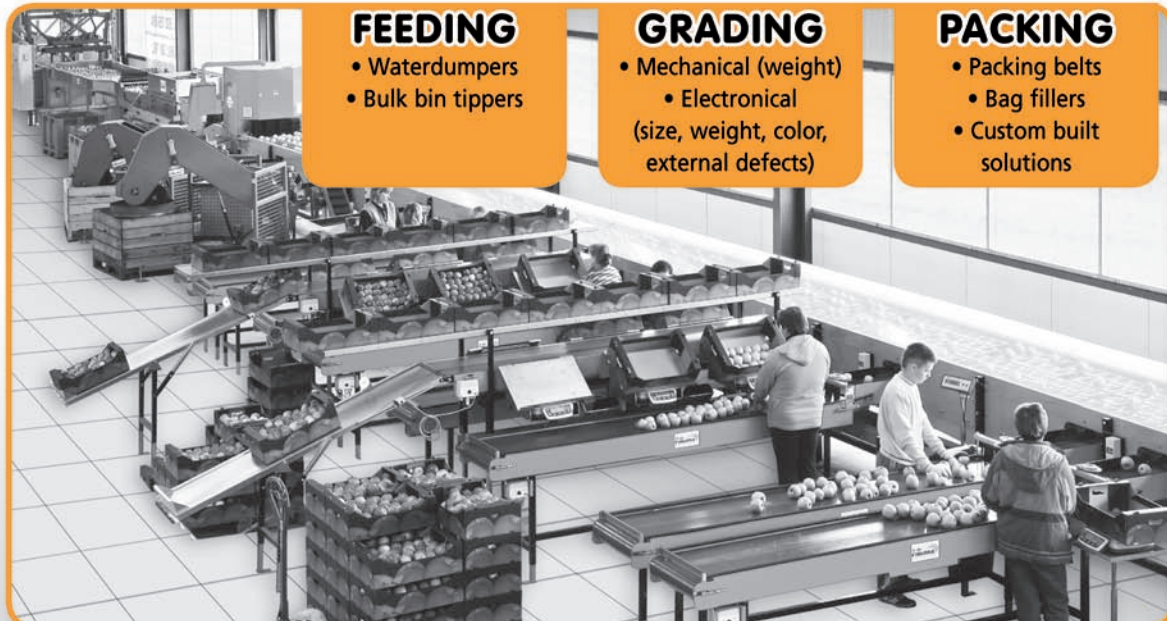
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will there be space for new varieties coming to market?

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do mistakes at the retail level, Lutz said. "It's easy for the retail companies that we rely on to get it wrong, to make mistakes and be less than optimal."

Driving retail

There's a relationship between what products pay to a supermarket and what space retailers are willing to offer that product, Lutz said. Apples have the largest footprint of space at retail, but because of that large footprint, the

dollars per square foot are among the lowest of all fruits, posing an even greater challenge to expand that space.

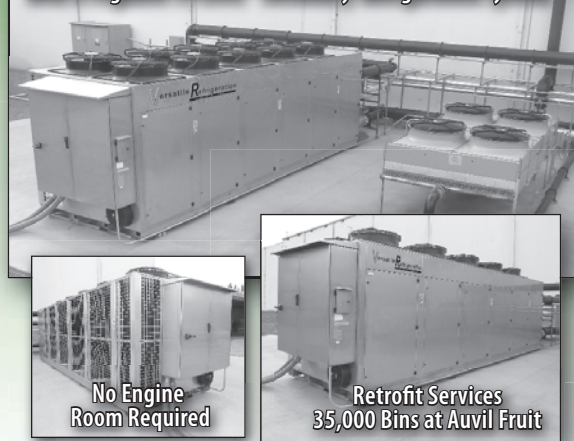
Retailers' approaches to sales factor in as well. During the marketing season for Washington's 2014 record apple crop of 140 million packed boxes, the top 15 supermarket chains sold more apples, but the bottom 15 chains not only lost dollars, they also lost volume, Lutz said.

Weaker-performing retailers tend to focus on a core low price and lack variety in their produce departments,

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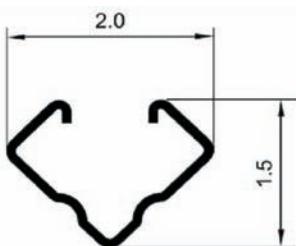
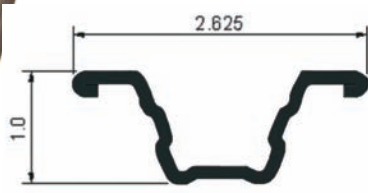
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TJ MULLINAX/GOOD FRUIT GROWER

Apples typically take up the largest display space in produce departments. However, the dollars per square foot for apples are among the lowest returns for all fruits, which is one reason retailers are reluctant to provide more space for new varieties.

with no new space or new items and no premium selections or upscale packages. Almost 80 percent of their sales and volume come from Red Delicious, Golden Delicious, Gala, Granny Smith and McIntosh, which means they're still "approaching the apple category like it's Budweiser," Lutz said.

Conversely, top-performing retailers are generating only about 45 percent of their revenue from those five varieties, making greater gains with newer varieties like Honeycrisp, Jazz, Envy, Ambrosia, Cripps Pink and Sweetango. Strong retailers allocate space to large volumes, with solid premium selections and packaging

"When we produce the next Cosmic Crisp, where are we going to put it?"

—Steve Lutz

options. They also leverage organics and organize flow in their departments to steer consumers to higher-value apples.

Lower-performing stores will put a familiar variety of apple for 49 cents per pound next to Honeycrisp at \$2.99 per pound. "What message is that sending to the consumer? Buy the cheap apples," he said. "It's a self-defeating strategy that is an absolute waste of space."

Marketers have opportunities in the retail market if they remember that packaging sells and displays matter, Lutz said. "There is a space race going on, but we have spectacular new products coming to market. You have to execute with marketing, and you have to execute with packaging." ●



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WATERING Concords

Testing soil moisture to determine water needs is better than applying a set amount on a weekly schedule.

by Shannon Dininny

Low water years pose additional challenges for Pacific Northwest Concord growers, who are already dealing with low prices. However, there are steps growers can take to ensure their vineyards remain healthy — even in a tight water year — at the most critical points during the season.

The first step is to know as much as possible about the vineyard's soil, according to Jason Stout, a post-doctoral research assistant at Washington State University's Irrigated Agriculture Research and Extension Center in Prosser. At the Washington State Grape

Society's annual meeting in November, Stout reminded growers that soil texture determines the field capacity and permanent wilting point in their vineyards — and the sweet spot for repeated irrigation throughout the season.

Field capacity (FC) is the total amount of water a soil can hold. Soil is typically at FC one to two days after a heavy rain or immediately after irrigation when no standing water is left on the soil surface. Any water added above the FC will not stay in the root zone, but will drain due to gravity. The permanent wilting point (PWP) is reached when water content is too low for the plant to remove water

from the soil, or the water is too tightly bound by the soil to be extracted by the plant, and the plant cannot recover from the deficit. The amount of water between FC and PWP is your plant-available water.

"You don't want to apply above the field capacity, because that's a waste. You lose that water," Stout said. "And you want to know your permanent wilting point and the range at which you need to reapply water, which is typically when you reach 50 percent of the plant-available water."

With Concords, unlike wine grapes, growers want to minimize stress levels as much as possible to maximize yields.



TJ MULLINAX/GOOD FRUIT GROWER

The key times in the growing season when water is most critical to grapevine development are in the spring, at bloom, during fruit set and during compound bud development.

Taking a measurement of the soil moisture content as a way to estimate water usage/availability is definitely better than applying a set amount of irrigation weekly, Stout said. Early in the season, growers on a set schedule may be overapplying, yet they may be underapplying water later in the season if it's a particularly hot year.

Stout examined soil moisture availability at different times in the growing season on a drip-irrigated Concord vineyard — at the three to four leaf stage in the spring, at veraison and after final irrigation.

In the spring, the soil was at or near FC throughout the primary rooting zone for Concord, he said. This was due to



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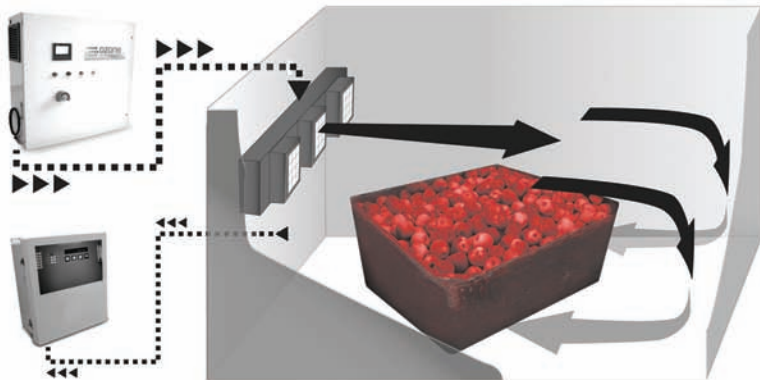
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overwinter precipitation and two to three early-season applications of irrigation. However, because the vineyard was drip irrigated, the moisture was contained within 100 centimeters on each side of the vine row.

From bloom to veraison, Stout applied 25 percent less water to the vineyard in one treatment than the control, resulting in a decrease in available water over that period, he said, but the soil refilled again before final irrigation.

Stout reminded growers that there are key times in the growing season when water is most critical to grapevine development, and all occur pre-veraison:

—In the spring for bud burst and canopy establishment.

—At bloom to ensure adequate pollination.

—During fruit set to determine the number of berries.

—During compound bud development to ensure next season's fruit production.

Also making that point: a 2011-2015 study highlighted by Dr. Markus Keller, WSU viticulturist. The study covered a large span of growing degree days — a cool year in 2011, an average year in 2012, above-average temperatures in 2013 and 2014 and a hot year in 2015. Seven drip irrigation regimes were tested at pre- and post-veraison points.

The study showed there was little or no difference to the vines when irrigation water was applied to replace 75, 100 or 150 percent of crop evapotranspiration. (Evapotranspiration is the process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants.) Only when water was reduced to about 50 percent evapotranspiration did the plant show

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"If you neglect to apply enough water at (pre-veraison), you cannot compensate later by applying more water post-veraison. Berries will remain small at that point."

—Markus Keller

significant water stress, Keller said. Overall, that level of deficit irrigation in juice grapes reduced yield by about 14 percent, but only if the stress occurred before veraison. "Applying less water from fruit set to the beginning of ripening is a key period of concern," Keller said. "It's less important to manage water post-veraison than we had thought. At that time Concord vines can tolerate a 50 percent reduction in water supply without suffering a loss in berry size, but it's extremely important to manage water during fruit set."

Keller said growers should not be afraid of drought conditions as long as they can manage big canopies with water supplies during the pre-veraison period. "If you neglect to apply enough water at that time, you cannot compensate later by applying more water post-veraison. Berries will remain small at that point."

However, Keller said, there was no effect on juice composition or cold hardiness during the changes from year to year. ●

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Remarkable MARQUETTE

The Minnesota variety could be nice addition for cooler-climate vineyards.

by Leslie Mertz

What started out as a whim nursery purchase has turned into a quality grape that could be a nice addition to cooler-climate Washington vineyards. At least that's what Paul Champoux is

finding.

He planted 600 Marquette plants on a half-acre at Champoux Vineyards in southern Washington's Horse Heaven Hills in 2011 and tasted his first wine from those grapes in 2014. Marquette shows promise.

"It has a lot of apple smell when we first crush it, but that's all gone by the time you get into the wine," he said. "And the wine? I can't put a name to what the exact fruit taste is, but it has a nice fruity flavor, a nice acidity in the middle, a nice color, soft, mellow tannins, and I think it's a great summer barbecue wine."



The Marquette's cold-hardiness and disease resistance have held

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"This is going to bring light to Marquette and whether it has a place here in Washington in specific sites. I think there's a spot for it."

—Paul Champoux

He described it as a medium-bodied but full wine with a beginning, middle and end. "I really like it."

In 2015, his half-acre yielded a harvest of about 2 tons, and he expects custom winemaker Charlie Hoppes from Fidelitas Wines to produce about 120 cases of wine from that crop.

Champoux decided to add the grape to the nine varieties already planted there, based on several things, not the least of which was the name.

"I went to Marquette High School in Yakima, Washington, so I thought, 'Wow, I've got to have some of that!'" he said.

He also liked the grape's reported cold hardiness, especially since he lost about 60 of his 190 cultivated acres to a severe cold snap in 2010. He said the Washington wine industry can average a major freeze about every fifth year, so he thought Marquette made sense.

Marquette could well be a good grape for Washington, agreed Dr. Thomas Henick-Kling, director of the viticulture and enology program at Washington State

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COURTESY OF PAUL CHAMPOUX

Paul Champoux thinks Marquette grapes, which he first planted in 2011, could be a good option for some Washington vineyards.

University. Before he joined WSU, he was part of a team at Cornell University that made research wines from Marquette, which was originally released from the University of Minnesota's breeding program in 2006.

"The prime goal was to produce a good quality wine grape that could withstand the cold winters of the Midwest," down to -40°F, Henick-Kling explained. "So if you look at sites here in Washington that would be highly susceptible to winter damage, then this variety would be a good option."

Although his vineyards haven't been hit with a deep freeze since 2010, Champoux is happy with the grape's performance so far. He did note, however, that Marquette does bud out early, so the grape should be either grown in a spring frost-free area or the vineyard should have frost measures in place, such as wind or heat machines. "You have to have something to protect that new green tissue," he said.

In addition to the cold hardiness, Henick-Kling is impressed with the grape's disease resistance. "It requires very few sprays to keep it free of fungal infection. That's a nice bonus for the grower," he said. Since Marquette is new to Washington, however, he noted that it will need a few more seasons to see how the resistance holds up over time.

Another plus for the grape is its naturally high acidity, even when it is fully flavor-ripe, said Henick-Kling. While the grape may struggle to completely ripen in cooler growing areas such as upstate New York, Washington's longer and warmer summers allow growers to let the grapes hang longer, he said.

At his vineyards, Champoux is working with the grape to develop the perfect acidity for wine balance and character.

Now that the 2015 harvest is past, he is busy planning a comparative tasting of eight different Marquette wines, including his own, another from Red Willow Vineyard in Washington, three from Minnesota, two from Vermont and one from Nebraska.

"There hasn't been a date set, but it will include about 20 of our industry researchers and industry kingpins that might be interested in a variety like this," he said. "I'm excited, because this is going to bring light to Marquette and whether it has a place here in Washington in specific sites. I think there's a spot for it."

Since the initial planting, it's been a bit of a wild ride, Champoux said. Once word got out about the grape and then the wine, schoolmates he hasn't seen since his 1968 graduation from Marquette High School have been contacting him about Marquette wine and memories. "The response has been unbelievable."

He added, "I'm just really pleased for sure. It's good wine, so what more can I ask for?" ●

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

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The new Legacy Orchard in East Wenatchee, Washington, has more than 500 plantable acres, making it McDougall and Sons' largest orchard.



New McDougall and Sons orchard honors the past and heralds the future.

story and photos by Geraldine Warner

When Scott McDougall, co-president of the Washington fruit growing and packing company McDougall and Sons, heard there was an 830-acre parcel of open land with water rights available near Wenatchee, he felt a blend of trepidation and excitement.

With orchard establishment costs at around \$50,000 per acre, the financial stakes are high. But Scott knew it was unlikely that a property of that size — with water rights and close to their packing house — would ever come up for sale again.

McDougall and Sons is a mid-sized family operation that needs to keep expanding in order to remain competitive in the industry today, he said. So he and brother Stuart, who jointly own the company, decided to seize the opportunity.

The property is a former dryland wheat farm tucked in a little-known area of East Wenatchee. No doubt because of its undulating ground and breathtaking views, there were plans at one time to develop it into a golf course.

"It's just a unique piece of ground," Scott said.

Scott and Stuart named it Legacy Orchard in memory of their father, Bob, who visited the property when they were purchasing it three years ago but died shortly after at age 87 and never saw it developed.

"He at least saw the land," Scott said. "He would love it. The new planting systems — he was intrigued by that and with how unique this property is with all the elevation change and the overall beauty."

The orchard's name also refers to what Scott and Stuart, who are fourth-generation orchardists, hope will be their legacy for the next generation. Stuart's son, Bryon, is company vice president and Scott's son, Tyler, recently joined the business.

About 570 acres on the new property are plantable, making it their largest orchard. The water is pumped from a well near the Columbia River, about 3 miles away, into three ponds at the orchard holding 1 million, 5 million, and

H-2A is expensive but

The Washington fruit grower-packer McDougall and Sons relies heavily on foreign guest workers to harvest its crops.

Hiring workers through the H-2A program required a big investment in housing and transportation, but it's ensured that the company has a reliable and well-trained workforce. McDougall said it's only because of the assurance of getting H-2A workers that the company has been able to invest in planting the new orchard.

McDougall and Sons takes pride in its housing camps.

by Geraldine Warner

Despite advertising for domestic workers, which is a condition of the H-2A program, locally hired people make up less than half a percent of the company's seasonal workforce.

McDougall and Sons has spent more than \$8 million to provide a total of 620 beds for H-2A workers at its orchards in Mattawa, Royal City, Quincy, Monitor, Bray's Landing and Bridgeport. That works out to roughly \$14,000 a bed. The company's new Legacy Orchard in East Wenatchee has beds for 98 workers, and there are plans to double that number.

"You have to keep pinching yourself," said Scott McDougall, co-president of the company. "This whole thing added a lot

of cost to our system and another layer of infrastructure to properly manage it."

They started out using three-bedroom manufactured homes with four bunks in each bedroom and a common eating area. However, as the price of manufactured homes increased and local builders were looking for more work during the recession, stick-built homes became the most affordable. Each camp has a full-time housing manager and daily cleaning is provided.

"We take a lot of pride in our camps in keeping them up and keeping them nice for people, and we expect them to pick up a little bit, too," McDougall said. "It's not just like a hotel."

During H-2A contract periods, workers must be paid at least the adverse effect wage rate, which was set by the U.S. Department of Labor at \$12.42 for Washington last season. However, McDougall's piece-rate workers average at least \$4 an hour more than that for picking apples and can earn \$20 to \$21 an hour for cherry picking. A Washington Supreme Court ruling this summer that piece-rate workers must be paid extra for rest breaks will add around \$700,000 to McDougall's annual payroll.

"We get frustrated with the perception on the outside that these people don't get paid well," McDougall said. "It's hard work, but there's the opportunity to make decent money."

McDougall and Sons has about 50 vans to shuttle the workers to places they need to go, including the grocery store once or twice a week. Groceries are the only thing the workers have to pay for during the contract.

Three contracts

McDougall and Sons used to hire H-2A workers under one contract starting with cherry harvest, but they weren't even able to get the pruning done with local labor. Now, the company has three H-2A contracts. The first workers arrived Feb. 1 to help with pruning and planting. The second batch arrived around June 1 to work on fruit thinning and cherry harvest. The last workers arrived in mid-August for apple harvest. All the contracts usually end Nov. 1, but this year the workers went home a week earlier because of the early harvest.

McDougall and Sons covers the costs for them to travel from Mexico to Washington by bus for the start of the contract and pays their airfare back home at the end.

This is the eighth year that the company has used the H-2A program. Between 80 and 90 percent of the workers return year after year, McDougall said.

"We're paying the price for this system, but we also feel like we have the most well-trained and effective workforce we could have." ●



The Legacy Orchard has housing

"Just going out and planting new varieties can escalate your position in the cemetery."

—Scott McDougall

15 million gallons of water ready to be used for frost control, irrigation and evaporative cooling.

Varieties

The elevation ranges from 1,400 to 2,140 feet, enabling them to plant varieties at different altitudes to spread out the harvest window. After installing seven miles of deer fence, they planted 230 acres in 2014 and another 90 acres last spring. Varieties include Ambrosia, Envy, Gala, Fuji and Honeycrisp. There are also 20 acres of cherries and cherry and apple rootstock trials (see "Race to the top" on page 28).

Over the next two or three years, the orchard will be completed with more Envy, Jazz and Cosmic Crisp (WA 38) plantings and possibly other managed varieties.

Scott said his initial plan was to plant the whole orchard over the course of three years, but Cosmic Crisp, the new Washington State University variety,



Scott McDougall chose a V-shaped system with trees 2 feet apart and 12 feet between rows for the Legacy Orchard.

essential



for 98 workers. McDougall is constructing more housing to double that number.



McDougall says that Legacy Orchard will have close to \$50,000 per acre invested by the time they get a crop from the trees in the third year.

won't be available for planting until 2017, and then only in limited quantities. McDougall and Sons has been assigned 20,000 of the first trees. Scott is excited about the variety, which will be restricted to Washington producers, and hopes there will be a cooperative effort among the state's marketers.

Steep V

All the apple plantings at Legacy are on a steep V system with trees 2 feet apart and 12 feet between rows, for a total of 1,815 trees per acre. At McDougall's other

ranches in the Columbia Basin, apples are on a vertical system on a 3-by-10-foot spacing (1,452 trees per acre). The wider row spacing at Legacy will lend itself better to mechanized equipment, including platforms, and eventually robotics. The plantings also should generate earlier and higher yields because of the greater number of trees. Scott is counting on consistent yields of 80 bins per acre of high-quality fruit.

It's not a formal training system. Large-diameter wood will be removed in winter to ensure that the canopy

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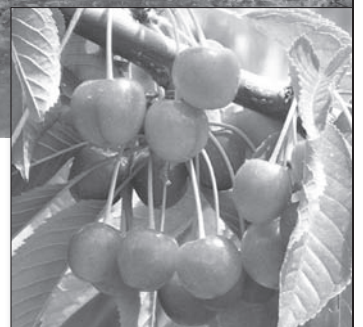
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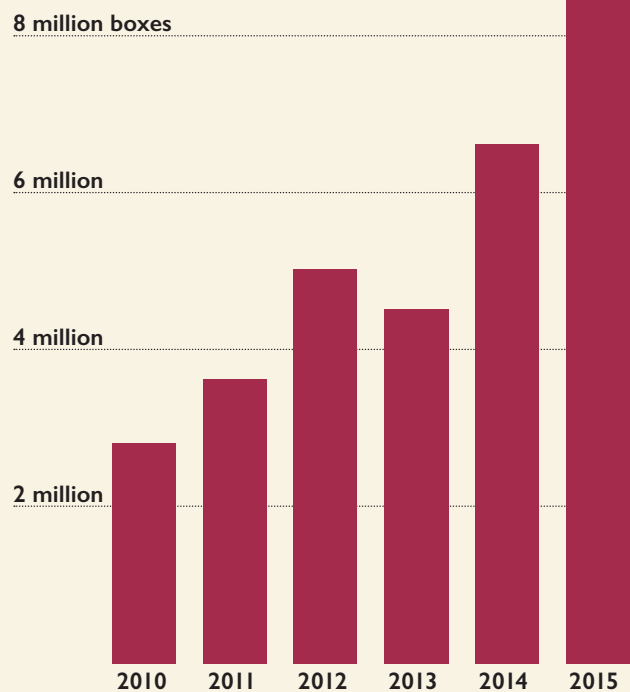
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Washington's growing Honeycrisp crop

Volume has tripled in the past five years.



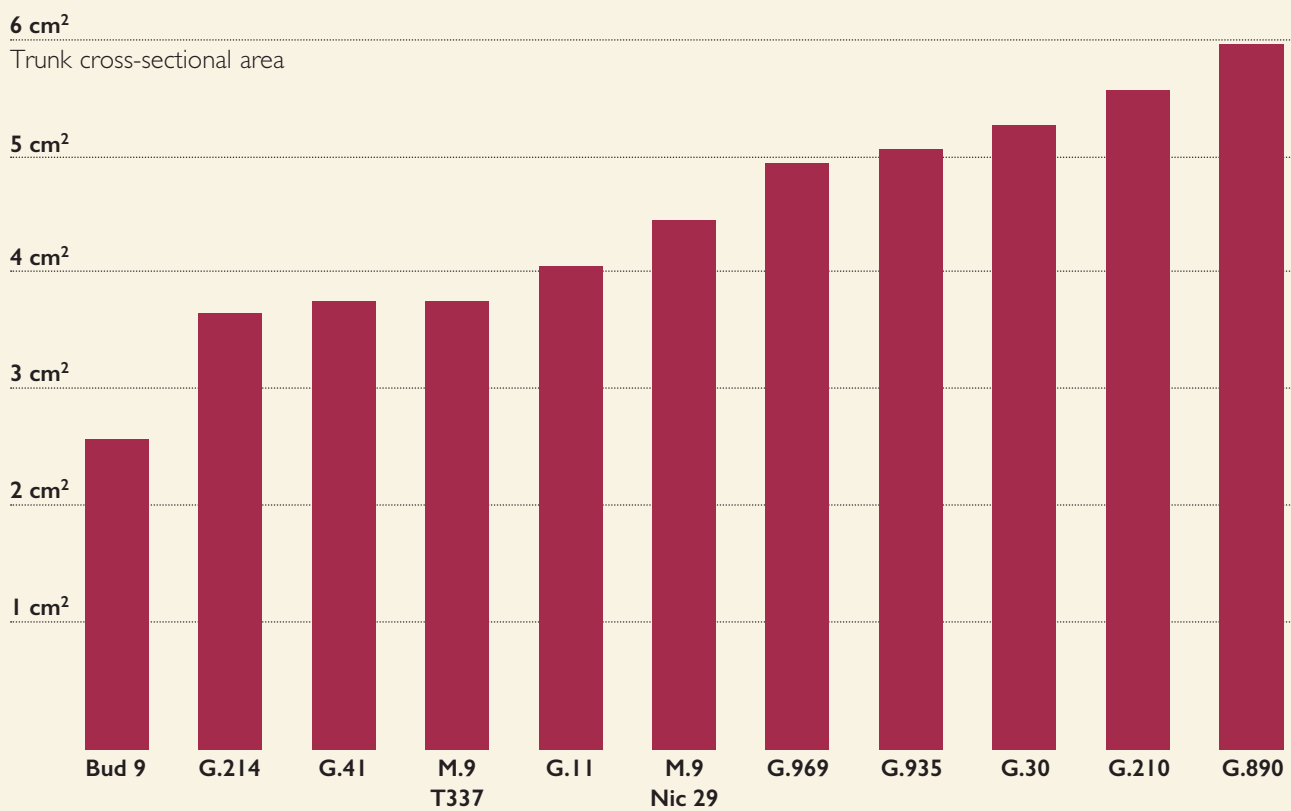
Honeycrisp was not tracked as a separate variety before 2010.

SOURCE: WASHINGTON STATE TREE FRUIT ASSOCIATION

JARED JOHNSON/
GOOD FRUIT GROWER

How Honeycrisp performs on different rootstocks

Relative growth of Honeycrisp trees after the first growing season in a rootstock trial in East Wenatchee.



SOURCE: WASHINGTON TREE FRUIT RESEARCH COMMISSION

JARED JOHNSON/GOOD FRUIT GROWER

Race to the top

As Honeycrisp production increases, growers feel the pressure to produce fruit sooner rather than later.

by Geraldine Warner

As the volume of Honeycrisp produced in Washington continues to increase, growers who are planting the variety want the trees to come into production as quickly as possible while the fruit still sells at high prices.

But if Honeycrisp trees are cropped too soon, they will stop growing and never fill the space, limiting future production. That's why McDougall and Sons won't crop the trees until the fourth leaf.

Washington's 2015 Honeycrisp crop is estimated at just under 9 million boxes, triple the volume five years ago.

At the company's new Legacy Orchard on virgin ground in East Wenatchee, McDougall planted Honeycrisp last spring on the relatively weak Malling 9 337 rootstock. The trees are two feet apart on a steep V-shaped system.

Scott McDougall, company co-president, said he chose M.9 337 because of the closeness of the planting and to avoid needing to use growth regulators to slow down vegetative growth.

After the first season's growth,

McDougall said he wished the trees had more vigor, though he knew he'd be happy with them once they'd grown to the top of the trellis.

Based on past Honeycrisp plantings, he's found that the weaker the rootstock, the less risk of bitter pit, to which the variety is particularly prone. However, at a McDougall orchard in Quincy, trees on Budagovsky 9 grew too slowly and dirt had to be mounded around the trunks to encourage scion rooting. When the trees did finally fill the space, though, the fruit had very little bitter pit and the fruit was about two box sizes smaller than on other rootstocks, which is desirable with the large-fruited Honeycrisp, he said.

Rootstock trial

At the Legacy Orchard, the company also planted a rootstock trial last spring in collaboration with Tom Auvil, research horticulturist with the Washington Tree Fruit Research Commission. Bud 9, M.9 337 and M.9 Nic 29 are being compared with Geneva 11, 30, 41, 210, 214, 890 and 989.



GERALDINE WARNER/GOOD FRUIT GROWER

Scott McDougall, right, discusses the growth of first-leaf Honeycrisp trees on the Geneva 890 rootstock during a tour of a rootstock trial at Legacy Orchard in East Wenatchee led by Tom Auvil, left.

Auvil and McDougall led a tour of the planting this fall. After the first season's growth, trees on Bud 9 were the smallest. Trees on G.11 were slightly bigger than those on M.9 337 and should be more productive, Auvil said. Trees on G.890 were the largest. G.890, one of the more vigorous Geneva rootstocks, is reported to be resistant to fire blight and woolly apple aphid and tolerant of replant disease.

Trees on G.890 grow very quickly, Auvil said. Though the rootstock might resemble Malling-Merton 106 in vigor, it is far more precocious. As soon as they are cropped, trees on G.890 should calm down immediately. In fact, it might be necessary to crop them in the third leaf to slow down the growth. The vigor might make the fruit susceptible to bitter pit, though it will take a couple of crops to find out, he added.

In the trial at Legacy, some of the bottom limbs on the G. 890 trees were 2 feet long after the first leaf. Auvil said they should be cut back to stubs about 4 to 6

inches long, otherwise they will detract from the tree's ability to grow vertically to the top wire of the trellis.

Virgin soil

McDougall noted that growers have been frustrated by the lack of availability of Geneva rootstocks for commercial plantings. Also, rootstock performance depends on the site and whether it's virgin soil or not. In a replant situation at Bray's Landing, G.890 was less vigorous, though the trees were still larger than those on M.9 337.

At Legacy, he could see the advantage of using G.890 for Honeycrisp. "As the volumes go up, the opportunity is going to be limited, so this might be the better system in the future.

"If I knew with 890 you could get it to the top in three years, crop it, shut it down, and it didn't have a lot of bitter pit, then it would be a race to the top and get that thing fruiting rather than what you see behind me," he added, indicating the slower growing planting on M.9 337. ●



Water is pumped from a well near the Columbia River 3 miles away through a 16-inch mainline into a 1 million-gallon reservoir and then up to the main 15 million-gallon pond (pictured) and another 5 million-gallon pond at a higher elevation.

is made up only of small, productive branches, and the trees will be hedged in summer.

High cost

With the increased tree density, updated trellis system, and the cost of the land, Scott figures they'll have close to \$50,000 per acre invested by the time they get a crop from the trees in the third year.

That's why he has no plans to plant more Gala or Fuji. With commodity varieties, it could be 11 to 12 years before the planting shows return on the investment. And that's not factoring in any potential crop loss due to frost or freeze, he noted. "If you went to your banker, I think they'd probably say 'You're crazy.' If you had that kind of money, you'd be better with a CD."

McDougall is one of three Washington packers licensed to pack the New Zealand varieties from ENZA, which include Jazz and Envy. Rainier Fruit Company in Yakima, Washington, has marketing rights for Jazz in North America and the Oppenheimer Group, based in Vancouver, British Columbia, is the exclusive marketer of Envy.

McDougall and Sons has been in ENZA's Washington program since day one. "A lot of companies weren't excited about that program because they could not have full control from packing to sales," Scott said, but his family was willing to accept that because of the quality of the varieties and good returns per acre.

"The club system, for us, is making this kind of investment look a little more attractive," he said. "All this works as long as we get paid for the fruit. But we don't have any guarantee from one year to the next that the retailer's going to pay us. It's a high-stakes game. It's always been risky in any kind of farming, but when you're putting this kind of money into these systems, it definitely can keep you up at night."

McDougall and Sons' flagship variety,

and Scott's personal favorite, is Ambrosia, a variety discovered in British Columbia. The company has owned the U.S. rights for the past decade.

A challenge to growing Ambrosia is its very short picking window — something that worries Scott as the variety becomes more widely available for planting after the patent expires. Applications of Harvista (1-methylcyclopropene) shortly before harvest can help slow maturity so it can be picked over a longer time.

Growers who don't have access to managed varieties have done well with Honeycrisp, but McDougall and Sons won't be planting any more of that either. Besides not being grower friendly, it's a challenge at the warehouse, averaging only 12 to 13 packs per bin — not much more than half the packout of some other varieties. Scott said that still pencils out when Honeycrisp is selling for \$50 or more a box, but he's also concerned that the increasing volumes of Honeycrisp produced in Washington will put pressure on prices.

Scott is testing other varieties, while recognizing there is limited retail shelf space. Any new apple will have to look and taste great, as well as be grower and packer friendly, he said.

"You really need to look at the full horticultural suitcase," he said, because otherwise, "Just going out and planting new varieties can escalate your position in the cemetery."

McDougall and Sons has been prepared to take the risks involved in expansion, not only to stay competitive but also to continue the integration with their sales company, Columbia Marketing International (in which they are partners), and to benefit the next generation, Scott said.

"To continue to grow has been a necessity because we know we have another generation coming, and the way this business has escalated, either you're in at a certain volume or you're out." ●

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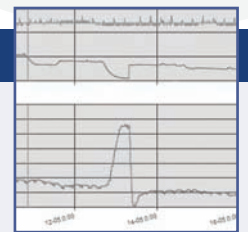


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Water PRIORITIES

Floating pumps. Recycling sewage for irrigation. Tens of millions of dollars in federal grants for water projects.

Irrigation districts in the western United States are taking extensive measures to provide fruit growers with more water during drought years. However, growers will foot a lot of the bill through higher rates.

Irrigation districts make expensive plans for pumps, recycling projects.

by Ross Courtney

California growers are bracing for their fifth straight drought year. In the Pacific Northwest, heavy snows in December eased drought concerns, but how much water growers will have for irrigation remains uncertain, following a year of record heat and low snowpack. The 2015 irrigation season saw irrigation districts with junior water rights curtailed to 47 percent of normal allotment.

Through mid-December, the Yakima River Basin's five mountain reservoirs in central Washington were half full, a little above average for that time of year. However, 66 percent of Washington was still in some level of drought, while about half of central Washington's fruit growing region was in an "extreme drought," according to the U.S. Department of Agriculture's Drought Monitor.

"It is way too early to panic or to celebrate," said Chad Stuart, the Yakima field office manager for the federal Bureau of Reclamation.

Planning ahead

Irrigation districts are trying to take action now.

The junior-rights Roza Irrigation District, based in Sunnyside, Washington, plans to participate in a permanent federal Bureau of Reclamation project to pump an extra 200,000-acre-feet of water from mountain reservoir Lake Kachess as part of the Yakima Basin Integrated Plan, a 30-year, \$4 billion effort to improve water management for both fish and irrigators. Irrigators in the Wenatchee River Watershed have a similar, if smaller, series of proposals.

Early cost estimates put the Lake Kachess idea at \$200 million, which would be shared by participating irrigation districts, said Scott Revell, Roza District manager.

Any increase would be on top of the rising costs irrigators already pay.

On Dec. 15, the Roza board of directors decided to increase 2016 assessment rates from \$134 per acre by \$48, a 36 percent jump.

Nearly all of that hike, \$43 of it, will be used to repay the district's drought fund, which spent \$1.8 million in 2015 on water leases, pump backs and other drought-related costs, plus \$1.35 million in design and permitting work for a proposed emergency floating pump on Lake Kachess that would have provided additional water this year.

The Roza board scrapped that emergency plan after cost estimates surged to \$77 million, but that doesn't mean irrigators are confident in the coming water supply.

"We're not convinced we're out of the woods yet for 2016," Revell said.

The Roza received only 47 percent of its full supply in 2015 and shut off water completely for three weeks in May.

Roza's 72,000 acres on the eastern side of the Yakima Valley are 80 percent "high-value" crops, such as tree fruit, grapes and hops.

The Washington Department of Ecology has awarded Roza a \$292,000 grant for an emergency drought well. The agency allowed its statewide drought declaration to expire at the end of 2015.

But, if necessary, the state is preparing to declare a drought emergency earlier this year than the May declaration of 2015, Maia Bellon, state Department of Ecology director, told growers at the Washington State Tree Fruit Association's Annual Meeting in December in Yakima. A drought emergency would free up some of the \$16 million emergency funds set aside for drought relief projects and fast-tracking emergency well permit applications. The state spent \$5.6 million of that in 2015.

Switching from tree fruit and grapes to annual crops would hurt the whole economy, not just growers, said Jon DeVaney, president of the Washington State Tree Fruit Association based in Yakima. Jobs would suffer and the overall value of agricultural production would drop because perennial crops require more labor and sell for higher prices, he said.

"It's important for our local economy because tree fruit is a high-value crop," he said.

The situation in California

In early December, California officials warned State Water Project customers they will get 10 percent of their full allotment if the irrigation season starts with current conditions, half what they received in 2015, according to a Dec. 1 news release from the state. The State Water Project delivers water to two-thirds of California's population through 29 urban and agricultural suppliers throughout the state.

As a result, irrigation districts there also are turning to extraordinary ideas.

The Del Puerto Water District in Stanislaus County has teamed up with the cities of Modesto and Turlock to pipe 30,600 acre-feet of recycled municipal wastewater under the San Joaquin River and into irrigation ditches for fruit and almond growers. The project, in the permitting process now, would start delivering water in 2018.

The proposed cost: \$100 million.

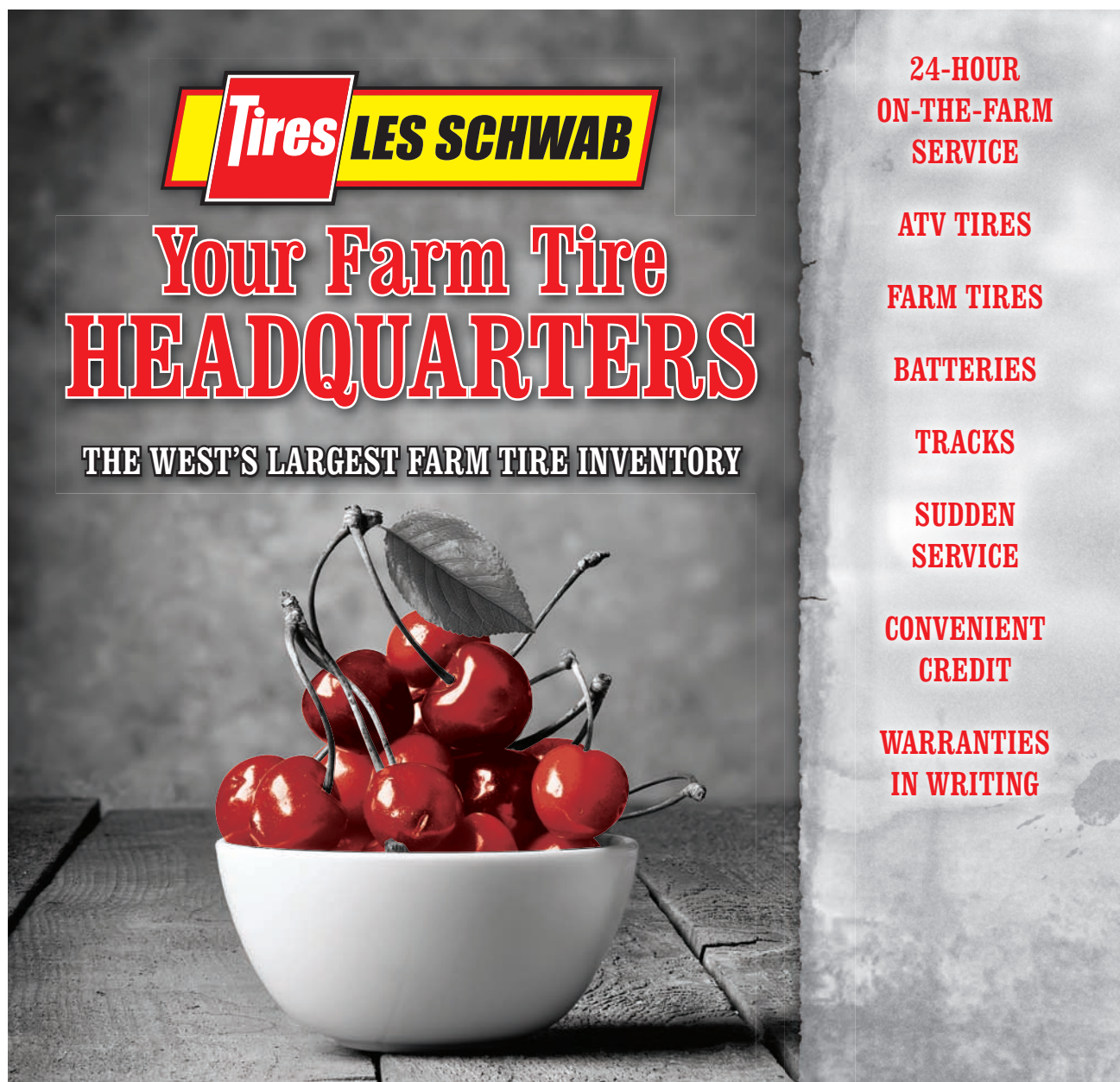
To pay for it, farmers would see their water rates increase by up to \$250 per acre-foot during the first 30 years, according to news coverage by the Modesto Bee. Growers in the junior-rights district received none of their federal rations from the Central Valley Project in 2014, instead paying up to \$1,000 per acre-foot on the open market.

Such a project would not fly in Washington because rerouting wastewater from cities for irrigation would divert water from the Yakima River and water users downstream, Revell said.

In fact, only coincidence allows Del Puerto to get away with it, said William Wong, project manager for the city of Modesto.

The city's wastewater permit effectively prevents discharging into the San Joaquin during the spring and summer anyway. Instead, the city used it to irrigate 2,500 acres of cattle feed land leased to a rancher.

"We ended up being lucky, and Del Puerto is even luckier," he said. ●



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GOOD TO KNOW

A research report by Kirti Rajagopalan
and Dr. Muhammad Barik

Changing climate impacts Northwest

Agriculture is a major player in the economy of the Columbia River Basin that spans several states in the Pacific Northwest and Canada, and the crop mix is diverse. Any changes in climate can have significant impacts on agricultural production through changes in crop growth patterns and water availability.

Elevated atmospheric carbon dioxide levels, increased temperatures and changes in precipitation patterns are among the factors affecting future agricultural production, and they could result in positive or negative consequences.

For example, increased temperatures can lead to a negative effect through accelerated plant development, earlier crop maturity and resulting lower yields. However, higher temperatures also increase the length of the available growing season and lead to a positive effect for some crops. Elevated atmospheric carbon dioxide levels can result in increased crop productivity and water use efficiency for certain kinds of crops. Earlier snowmelt, more precipitation falling as rain instead of snow, increased cold season precipitation and decreased summer season precipitation, all result in changes in irrigation demand as well as water availability, thereby impacting agricultural production.

The balance between these competing individual effects determines the overall net effect that is crop and region specific, and this net effect also has the potential to change over time.

A team of researchers led by Dr. Jennifer Adam, associate professor and associate director of the State of Washington Water Research Center (SWWRC) at Washington State University, examined the effects of climate change on future water supply as well as demand in the Columbia River Basin. In the 2030s, we expect to see a small increase in water supply of the order of 5 percent on an annual scale for the basin. However, there is an increase in cool-season water availability and a decrease in summer-season water availability, which is the season of highest agricultural water demands.

There are also differences by subregion. For example, the Yakima River Basin is an area that currently experiences water stress, and this stress is expected to be worse in the 2030s. On the

irrigation demand side, we also expect to see increases of about 5 percent on an annual scale, and there are differences by crop and region. Pastures and crops such as hay and alfalfa that can make use of a longer available growing season will see larger increases in irrigation demands. Perennials such as orchards will see small increases in irrigation demand. Even though the perennial crops are harvested earlier under elevated temperatures, they need to be irrigated throughout the growing season. Other annual crops will see decreases in irrigation demands because, under warmer temperatures, they can be planted earlier in the year when precipitation tends to be higher and they mature faster due to accelerated growth.

We should also note that in addition to these “average” effects, changes in the magnitude, frequency and timing of precipitation and temperature “extremes” also affect agriculture. In 2015, the region faced a snow drought (enough overall precipitation, but not enough snow), which affected water availability and hence agricultural production across a variety of crops. Based on climate projections, we expect to see these types of events occur more frequently and for longer durations in the future.

Changes in climate affect future agricultural production in multiple ways, and there are implications for water managers, agricultural producers and other decision makers in terms of developing long-term strategies for addressing those effects. A team of people from Washington State University, the University of Utah and Aspect Consulting are currently working with the Washington State Department of Ecology to extend previous work and create a water supply and demand forecast for 2035. The associated reports are expected to be available in November 2016, and outreach meetings will be held earlier in the year. We encourage everyone to engage in the process and provide feedback. ●

Kirti Rajagopalan is a research associate with the Center for Sustaining Agriculture and Natural Resources at Washington State University. Muhammad Barik, Ph.D., is a research associate and post-doctoral fellow with the Department of Civil and Environmental Engineering at Washington State University.



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ONLINE

This work was funded by the Washington State Department of Ecology and the reports generated through this work can be accessed online at bit.ly/1ms1a6Y

STRATEGIES for saving water

California peach growers could apply half as much water without affecting yields, research suggests.

by Vicky Boyd

Growers of early-season peach varieties in California's Central Valley may be able to conserve water without significantly affecting yields by cutting postharvest irrigation in half. An added benefit is that deficit irrigation lessens the amount of mid-season vegetative growth, reducing the amount of pruning and labor needed.

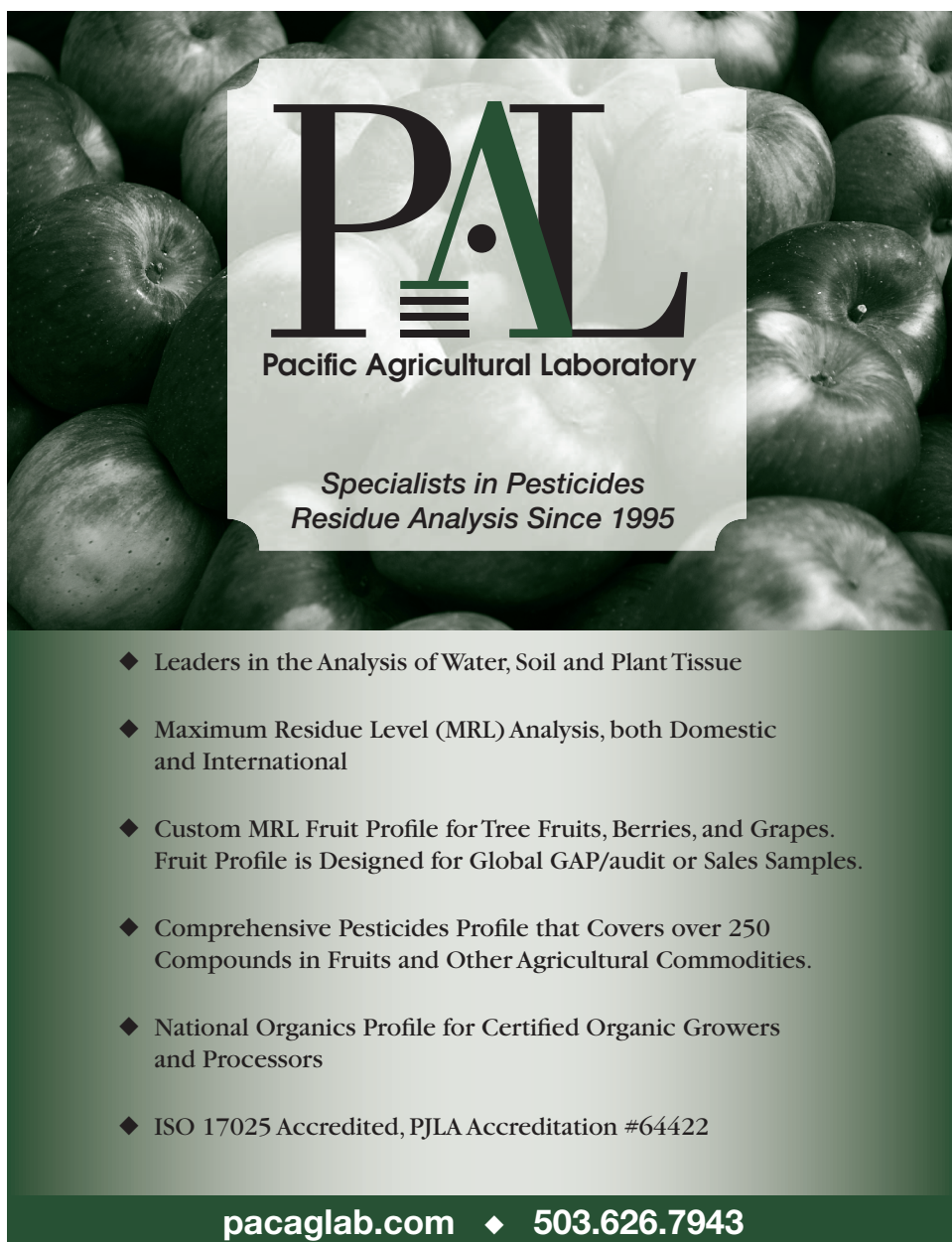
These are but a few of the results of a series of related stone fruit irrigation studies led by U.S. Department of Agriculture Agricultural Research Service scientists at the San Joaquin Valley Agricultural Sciences Center near Parlier. Although the work began nearly a decade ago, Drs. James Ayars and Dong Wang said the information they're gleaning about more efficient irrigation practices for stone fruit growers is especially relevant after four years of drought.


"Drought's a way of life in California," said Ayars, a research agricultural engineer. "Hopefully this will be a wake-up call, and people won't revert back to their old ways."

Early-season peach varieties are typically harvested in late May or early June, but about two-thirds of the irrigation is applied after harvest during the hottest part of the growing season. Ayars likened the water use to a bell curve, with harvest occurring at the beginning of the upward trend. His trials involved a four-acre block of Crimson Lady peaches, which mature typically in late May. The trial also involved three different types of irrigation: furrow, subsurface or buried drip, and microspray.

Although some older orchards still use furrow irrigation, he said most of the newer ones rely on microsprinklers or drip irrigation. One of the challenges with furrow irrigation is you have little control over the depth of the water applied.

"For the most part, you can't put on small amounts of water, and that's the advantage of drip or any pressurized system — you have good control on the depth of application," Ayars said. "You can still find furrow irrigation around here, but more and more people are moving to microsprays and microsprinklers or surface drip."



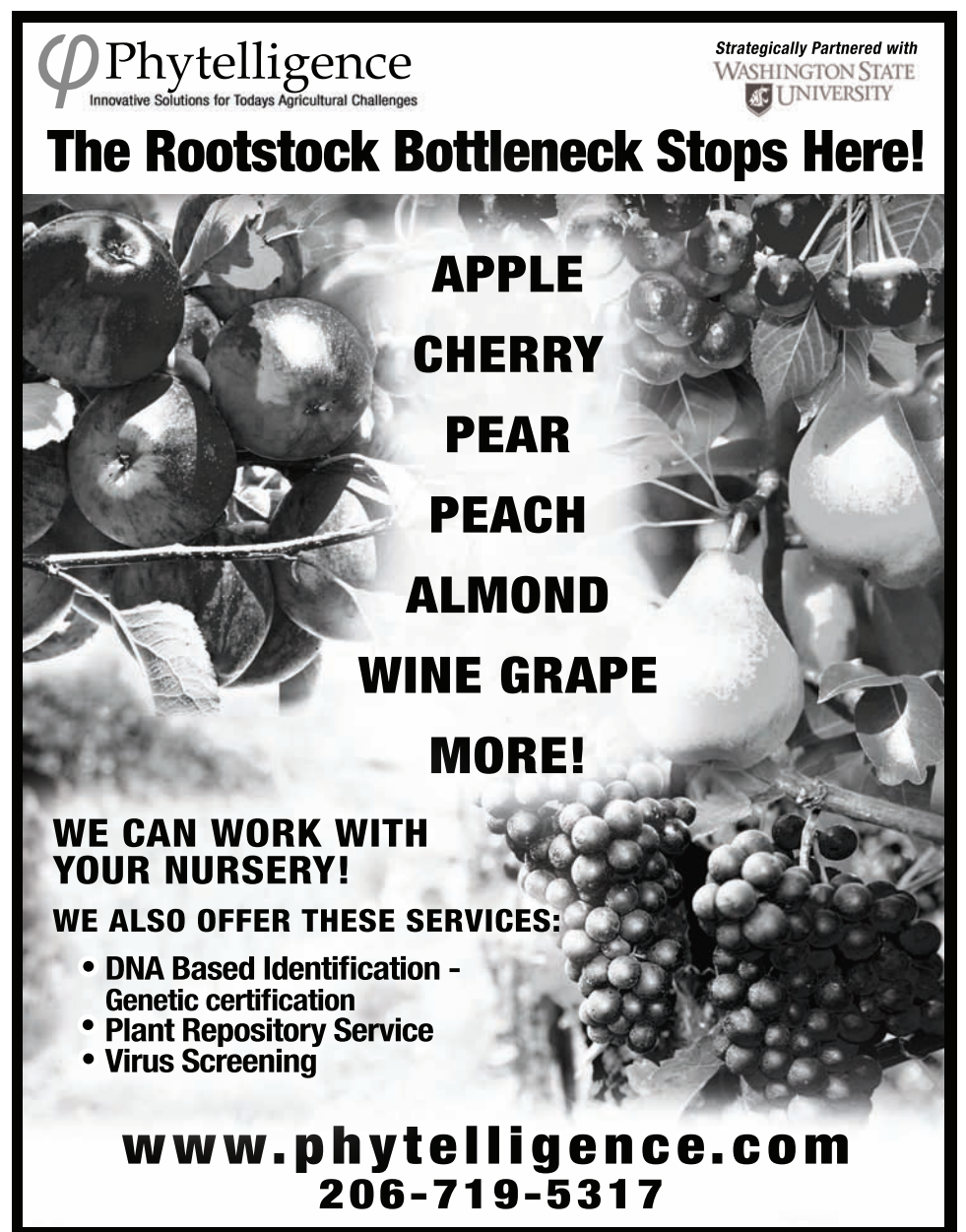


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PHOTO BY VICKY BOYD

Dong Wang, research leader with the San Joaquin Valley Agricultural Sciences Center's Water Management Unit, shows a data logger used to record information from soil moisture sensors placed at various depths.



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found that really excites us is that powdery mildew was significantly reduced in our orchards after we started using Pacific Gro's hydrolysate - even in highly susceptible varieties like Sweetheart.



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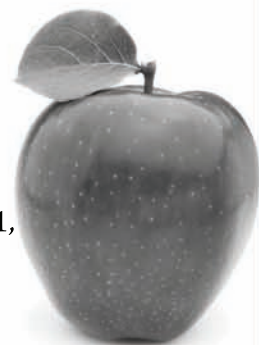


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Third-generation stone fruit grower Bill Chandler is one of those moving to microsprinklers when he plants new stone fruit orchards. A longtime supporter of research, the Selma producer has adopted regulated deficit irrigation in his wine grapes and almonds and year-round integrated pest management, among other practices.

But Chandler said he is cautious about reducing peach irrigation because of the potential for split pits and other fruit defects. Nevertheless, he remains interested in research that would help the industry better manage water.

“Drought’s a way of life in California. Hopefully this will be a wake-up call, and people won’t revert back to their old ways.”

—James Ayars

“It’s important because we’re worried about having enough water because of the drought,” he said. “So if we can be more efficient with the water and when we’re applying it on the trees, that would be beneficial.”

As part of Ayars’ trial, the trees received full irrigation, or 100 percent of the evapotranspiration (ET) rate, from March through May harvest. Then randomized blocks received 100, 50 or 25 percent ET following harvest until the end of the season. All blocks received the same commercial thinning, pruning and fertilizer treatments.

At the end of each harvest, researchers counted and removed defective fruit. They

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ASSOCIATE EDITOR

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PHOTO COURTESY AGRICULTURAL RESEARCH SERVICE

An infrared thermometer mounted on a pole measures peach tree canopy temperatures under regulated deficit irrigation. Canopies of stressed trees have a higher temperature than nonstressed trees.

then counted, weighed and mechanically sized the remainder of the crop.

Stress that occurs one summer can affect developing buds for the following year's crop. As a result, the researchers noted that trees that received only 25 percent ET had significantly reduced yields and quality the second year. The fruit also had more deformities.

Because of the negative impact 25 percent ET irrigation had on the crop, Ayars said he would not recommend that practice to growers.

But by cutting later-season irrigation in half, growers could see 50 percent savings in postharvest water use with no significant differences in yield or deformities compared to trees that received full ET.

Wang, research leader with the center's Water Management Unit, continued work in the same peach orchard to examine whether infrared sensors and thermal technology could be used to characterize plant water stress based on plant canopy temperature.

As temperatures rise, loss of water vapor through leaf pores — or stomata — cools the plant. When water loss from the leaves exceeds what the plant can take up from the soil through roots, the stomata shut down and the plant heats up. The temperature of the plant has been used previously as a measure of the stress in some field crops. Thermal technology and hand-held infrared sensors were used by cotton growers in the 1970s to monitor crop health.

Wang and ARS agricultural engineer Dr. Jim Gartung placed infrared temperature sensors above the tree canopy in the orchard.

In a well-irrigated orchard, tree temperatures can be about 2°C — about 35°F — lower than the ambient air temperature, Wang explained. But as trees become stressed, the difference may reverse, with canopy temperatures exceeding ambient air temperature by more than 4°C (about 39°F) under extreme conditions.

These trials compared thermal technology readings to soil moisture sensor data and midday stem water potential readings from a pressure chamber to determine how well the results correlated.

The researchers found canopy temperatures that were approximately 2°C warmer than the surrounding air correlated to about a 50 percent deficit irrigation while fruit size was not affected, Wang said.

In his latest research, Wang has begun working with a canning peach grower near Kingsburg to gain a better understanding of the water requirements of a tree's various growth stages.

The project differs from the work at Parlier because it involves a later-season canning peach variety. It also will examine how a grower's typical irrigation regime matches up against the tree's water requirements.

"One of the things I think is pretty common in California is most growers don't have water meters for surface irrigation," Wang said. Instead, many growers know the gallons-per-minute flow and run water for a set number of hours. Good water management requires an accurate measurement of applied water and that requires precise measurement of flow, he said. ●



John Klefleck of Royal City was the winning ticket holder for the WAEF benefit raffle prize: a 2016 Rears TTN Powerblast sprayer. John, at right, is pictured here with Mike Rear of Rears Manufacturing Company.



James Foreman of Wenatchee took home the silent auction prize, a Rears OMF756 orchard flail. James' winning bid boosts scholarship and grant programs: WAEF raised \$39,000 at the 2015 WSHA show.

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Blooms in the FALL?

Blooms on apple trees in September? That's what some growers in Michigan reported last fall — an oddity, but not a major cause for alarm, according to Michigan State University Extension fruit educator Mark Longstroth. Nonetheless, growers can curb the inappropriately timed apple blossoms.

Growers can curb ill-timed blooms caused by weather patterns.

by Leslie Mertz

Longstroth estimated that autumn apple blooming occurs about every four to five years in Michigan, and it also occasionally happens on plums, cherries and other trees. Scattered reports came primarily from apple growers in the southern part of the state last fall, although he did hear of fall bloom on cherry trees, too.

Fall blooms cut back on the following year's yield, Longstroth said, but it's probably not significant for a couple of reasons: First, only some buds on a tree will bloom early. Second, growers will thin fruit after this spring's bloom anyway.



Fall blooming removes these buds from the following season's apple harvest. Typically, however, it does not reduce overall yield much, if at all, according to Michigan State University Extension fruit educator Mark Longstroth. This fall apple bloom appeared at an actively growing shoot tip, a highly irregular location.

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PHOTOS BY BILL SHANE, MSU EXTENSION

This apple flower cluster bloomed in September in a Michigan orchard. Michigan State University Extension fruit educator Mark Longstroth explained that such clusters appear in the fall under certain weather conditions, but only if the bud hasn't developed its overwintering inhibition that would otherwise prevent blooming until spring.

"With apples, we normally want 75 percent of the flower spurs to bloom in the spring, but then we thin the fruit off 80 percent of those, so we end up with only about 10 percent of the fruit — the big-sized apples that we want to sell — at harvest," he said. In other words, although fall blooming does indeed take those buds out of the following year's apple production cycle, most growers will ultimately notice little if any difference in yield.

The fall blooming in Michigan can be traced to last year's weather pattern, he noted. Michigan had a very wet spring, which means that there was abundant water, so the trees grew rapidly but didn't have to grow a lot of roots. The wet conditions allowed the trees to sprout new white roots in the shallow surface soil rather than across a big root system to draw up water from deep in the ground. At the same time, the wet conditions allowed the tree to put out lots of leaves but with less of the waxy, outer cuticles that protect against water loss.

That water-rich June, however, was followed by a hot and dry July. "That just sucked all the water out of the trees, so they had to shut down for a little while until they could grow more roots," he said. Buds generally develop by late summer, after which they should develop an inhibition to blooming until they go through a winter chilling.

"What we think happened this past fall is that the drought stress caused the trees to stop growing, but when we got rain in September and the trees started growing again, some of the flower buds were far enough developed to have all of their flower parts, but weren't far enough

along to have developed the inhibition that would have kept them from blooming until they had gone through a winter," he said. "Those buds are the ones that bloomed in the fall."

While the fall-blooming buds are removed from apple production the following year, he doesn't believe the tree itself sustains any damage. "In the area of where the blossoms are, it would reduce winter hardiness, but you're never going to mature that fruit anyway, so it's not going to have a big impact on the overall winter hardiness of the tree," he said. "In fact, growers can have a much bigger negative impact on winter hardiness through their pruning activities in the fall, but that's a whole other article!"

Generally, fall blooming doesn't compromise the tree or the harvest much, but growers can still do something to help ensure that it doesn't happen to their trees in the future. "To reduce the likelihood of fall bloom, you should try to maintain good moisture content in the soil. Don't let the trees get drought-stressed in the midsummer if you can help it," Longstroth said. Whereas growers in the West typically use irrigation to maintain even soil moisture, those in Michigan often rely on Mother Nature, so they need to monitor rainfall and provide supplemental water if a midsummer drought sets in.

"I've been working in apples and other fruit trees since 1978, and in that time I've seen fall blooming a half-dozen times," he said. He doesn't think it's becoming more common or is related to climate change, but he is pretty sure he will hear from growers in a few years when September apple blossoms appear again. ●

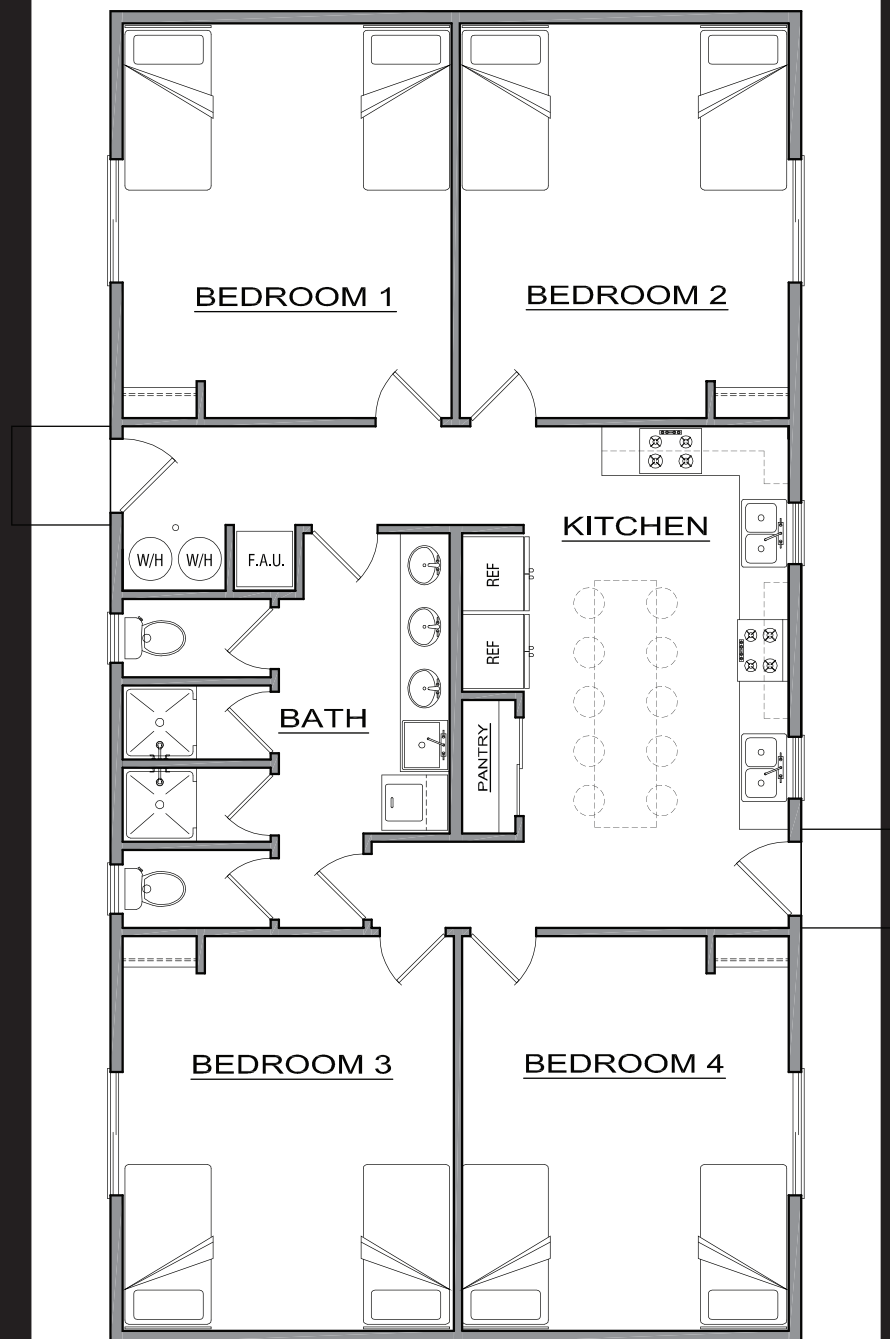
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For more on fall blooming, see Michigan State University Extension fruit educator Mark Longstroth's article on the subject at bit.ly/1RnnYBr



SAVING CHERRIES from the birds

TJ MULLINAX/GOOD FRUIT GROWER

Unfortunately for growers, cherries are often a favorite snack for birds. Researchers are using new findings to help limit damage.

New information provides help with bird management.

by Leslie Mertz

Cherry growers sometimes feel like they're growing fruit mainly for the birds, but there is new information that can help them make informed decisions about bird management, said Catherine Lindell at the Michigan State University Integrative Biology Department and Center for Global Change and Earth Observations. She presented the results of a variety of studies at the Great Lakes Fruit, Vegetable and Farm Market EXPO, held in December in Grand Rapids, Michigan.

The location of an orchard can make a big difference in the amount of bird damage sustained, she said. She and her research group considered cherry blocks that were surrounded by additional cherry orchards, by some other land cover, such as a forest or pasture, or by a mix of cherry orchards and other land covers. They analyzed bird damage over three years — 2012, 2013 and 2014 — and found that blocks that were isolated and did not have edges abutting other sweet cherries tended to have higher damage in all those years.

The findings suggest that because there is less alternative fruit in that immediate area, the birds key in on cherries, which leads to a higher-percent damage, she said.

Growers with early-ripening varieties would experience the same thing because, similarly, the birds would

have fewer alternative food sources, she added.

She also noted that orchard sites that have more resources for birds experience greater damage. For instance, she said, farms that supply cover from predators will support larger cherry-eating bird populations, as will farms with streamside vegetation suitable for roosting. Another possible resource is the presence of overhead wires for perching birds. "Although we haven't found a real clear pattern with wires in sweet cherries, we did find higher levels of bird damage in Honeycrisp apple blocks that were below wires compared to blocks that were without wires."

In addition, Lindell and her research group looked into different bird-management options. One was the hanging of dead birds or effigies to deter cherry-eating birds. Preliminary data show that the effigies appear to attract birds rather than repel them, she said. "We did not combine this with something like firing off a shotgun to (help the birds) associate these effigies with something bad, so there's still a possibility that by combining effigies with some other deterrent, their effectiveness might be improved."

They also looked into the addition of nest boxes to attract beneficial birds, particularly American kestrels (small falcons sometimes called sparrow hawks), which prey on nuisance birds and other animals such as



PHOTO BY CATHERINE LINDELL

Graduate student Megan Shave, right, led a monitoring effort from 2013-2015 to determine usage of nest boxes by American kestrels, small falcons that prey on nuisance birds and other animals and insects that can damage young trees and fruit. Here, Shave is examining a kestrel with the help of undergraduate student Emily Oja.



TJ MULLINAX/GOOD FRUIT GROWER

Kestrel nest boxes can provide “a nice, low-cost, low-maintenance contribution to integrated pest management,” says researcher Catherine Lindell. These were made at Dahle Cherry and Pear Orchards in Hood River, Oregon.

meadow voles and insects that can damage young trees and fruit. Through a monitoring effort of nest boxes in 2013-2015, led by graduate student Megan Shave, they found nearly 100 percent occupancy by kestrels. Using a 30-day nesting period, Lindell extrapolated that the kestrel pairs monitored would remove thousands of insects and numerous birds and mammals from the area.

Although nest boxes can be very successful, they will not solve entire pest problems, she said. Nonetheless, she added, “This looks like a nice, low-cost, low-maintenance contribution to integrated pest management.

“The bottom line is, assess the risk, decrease your resources and manage for detrimental birds, and increase your resources for beneficial predators.” ●

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A dip into the 300-page tome reveals that the first reports of cultivated pears came from ancient Assyria (now Syria) around the 18th century B.C. In the fifth and fourth centuries B.C., pears were cultivated in Greece, and the Peloponnese peninsula was once called Apia, meaning "pear land," because pear trees were so numerous there. Morgan discusses the development of new dessert and perry pear varieties and their cultivation and consumption in Europe through the ages.

The Defra National Fruit Collection at Brogdale in the United Kingdom now has more than 500 varieties of pears, drawn from across the world and spanning many centuries. The book includes a directory of pear varieties, based primarily on the Brogdale collection, which includes descriptions, tasting notes and historical, geographical and horticultural information.

The book is illustrated with watercolor paintings of 40 pear varieties by Elisabeth Dowle as well as many historical photos and drawings.

Go to www.thebookofpears.fruitforum.net for more information.



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GOOD TO GO

For a complete listing of upcoming events, check the Calendar at www.goodfruit.com

JANUARY

January 15: Cherry Institute, Yakima, Washington, www.wastatefruit.com. For information, call (509) 853-3504 or email cherryinstitute@wastatefruit.com.

January 18: Lake Chelan Horticultural Day, Chelan, Washington. For information, email tianna.dupont@wsu.edu.

January 18-20: Ohio Produce Growers & Marketers Association Congress, Sandusky, Ohio, www.opgma.org.

January 19: North Central Washington Stone Fruit Day, Wenatchee, Washington. For information, email tianna.dupont@wsu.edu.

January 19-21: Empire State Producers Expo, Syracuse, New York, nysvga.org/expo/information.

January 19-21: Indiana Horticultural Congress and Trade Show, Indianapolis, Indiana, www.inhortcongress.org.

January 20: North Central Washington Pear Day, Wenatchee, Washington. For information, email tianna.dupont@wsu.edu.

January 21: North Central Washington Apple Day, Wenatchee, Washington. For information, email tianna.dupont@wsu.edu.

January 26-28: Northwest Ag Show, Portland, Oregon, www.nwagshow.com. For information, call (503) 769-8940 or email agshow@wvi.com.

January 26-28: Unified Wine & Grape Symposium, Sacramento, California, www.unifiedsymposium.org.

January 27-28: Apple Horticulture and Postharvest Research Review, Confluence Technology Center, Wenatchee, Washington, www.treefruitresearch.com. For information call Kathy Coffey at (509) 665-8271 ext. 2 or email kathy@treefruitresearch.com.

January 28-29: Apple Crop Protection Research Review, Confluence Technology Center, Wenatchee, Washington, www.treefruitresearch.com. For information call Kathy Coffey at (509) 665-8271 ext. 2 or email kathy@treefruitresearch.com.

January 29-30: BC Fruit Growers Association Annual Convention, Kelowna, British Columbia, Canada, www.bcfga.com.

January 31-February 6: North America Farmers' Direct Marketing Association Annual Convention, Vancouver and Abbotsford, British Columbia, Canada, www.nafdma.com.

FEBRUARY

February 2-4: Mid-Atlantic Fruit & Vegetable Convention, Hershey, Pennsylvania, www.mafvc.org. For information, call (717) 694-3596 or email pvga@pvga.org.

February 2-5: CiderCon and U.S. Association of Cider Makers annual conference, Portland, Oregon, www.ciderconference.com.

February 3-5: Craft Beverages Unlimited Midwest, St. Charles, Missouri, www.midwestgrapeandwineconference.com.

February 4: Okanogan Horticultural Association Annual Meeting, Omak, Washington. For information, email tianna.dupont@wsu.edu.

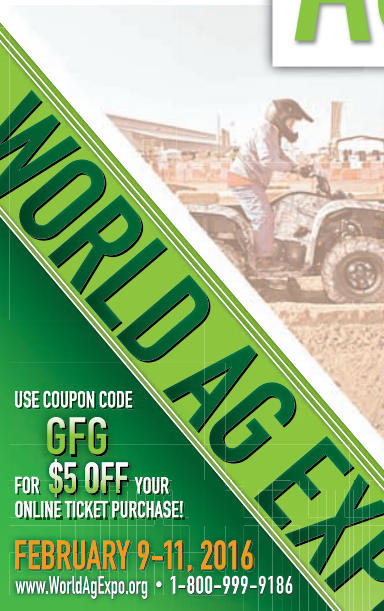
February 4: Technology Research Review, Washington Cattlemen's Association, Ellensburg, Washington, www.treefruitresearch.com. For information call Kathy Coffey at (509) 665-8271 ext. 2 or email kathy@treefruitresearch.com.

February 9-11: Washington Association of Wine Grape Growers Annual Meeting and Trade Show, Kennewick, Washington, www.wawgg.org.

February 9-11: World Ag Expo, Tulare, California, www.worldagexpo.com.



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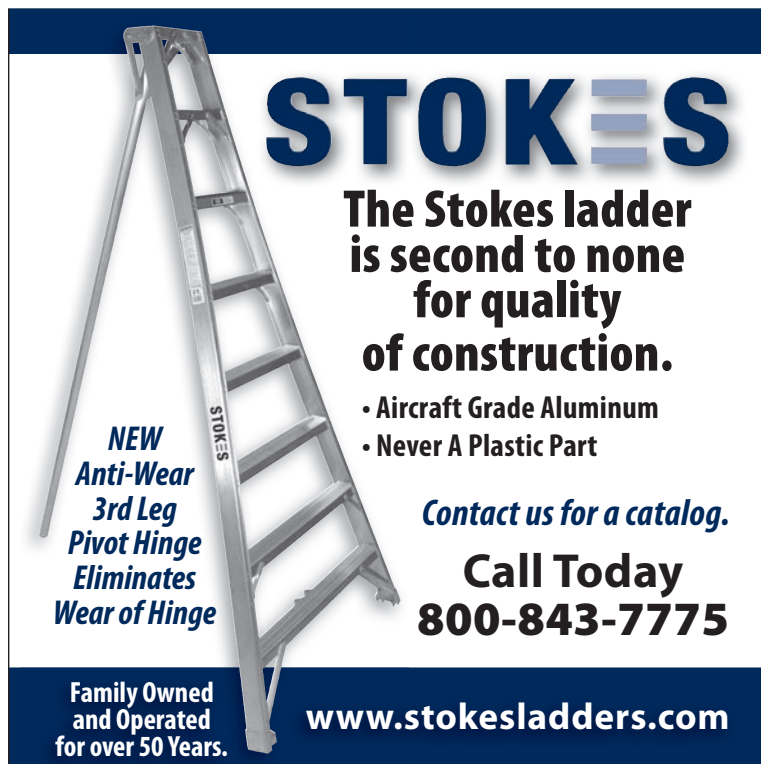
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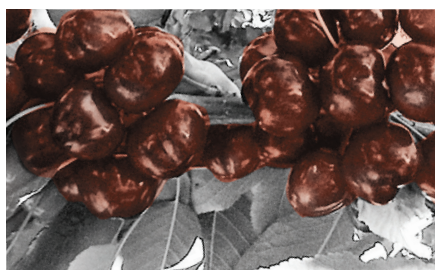
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age / 21

crops / Apples, peaches and pears

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family background / Sierra, a fifth-generation tree fruit grower, is one of three siblings and is the daughter of Dan and Connie Williams. The family farm, which is more than 100 years old, is on Colorado's western slope at an altitude above 6,000 feet.

What was your path to farming?

“My oldest memories on the farm are of picking apples with my great-grandfather. I've always had a love for growing fruit. Going into college, I thought about pursuing a career in exercise science and physical therapy, yet I missed being with my family and farming. So, I decided to learn about the business and help plan for its future.

What are your plans?

“There's a lot of change going on in the industry. Growing up, I wasn't all that involved with the farm as a child, never paying too close attention to the details. Now, I plan to use what I've learned from school and other resources that maybe my dad and grandfather wouldn't have known. I see potential in expanding the use of technology. I think our farm has a lot of opportunity for growth. It's exciting for me to be starting out learning the base-knowledge now — finding my niche in the company.

What are your goals?

“I'm learning how to take on projects like our GlobalGAP and Tilth certifications. I'm also learning how to document everything including regulations, organic farm management, audits and studying manuals. It's taken a lot of time.

Where do you see areas for growth?

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What are you doing to find your place in the company?

“I need to gain knowledge of what we can bring to the marketplace to have that competitive edge for the future, and go out and learn new things, like what new varieties are coming out, about shelf space in stores — anything I can bring to the table that will help the company be more successful.

“Fruit growing is always a gamble.”

by TJ Mullinax

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