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Examples of postharvest rot, above, and sunburn, below, on Red Delicious apples. Postharvest diseases caused by *Phacidiopycnis washingtonensis* and *Sphaeropsis pyriputrescens* can look similar to sunburn on the surface after a few months in RA storage. Find out more in "Getting to the rot of the problem," beginning on page 10.



PHOTO BY TJ MULLINAX/GOOD FRUIT GROWER

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Blossoms in a peach orchard near Buena, Washington.

PHOTO ILLUSTRATION
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U.S. SUBSCRIPTIONS: \$35.00 per year, 3 years \$75.00. CANADIAN SUBSCRIPTIONS: \$55.00 per year (U.S. funds, Canadian G.S.T. included: G.S.T. Registration #135100949). SUBSCRIPTIONS OUTSIDE U.S.A. & CANADA: \$100.00 per year (payment by credit card only). Single copies of current issues are \$5.00. To subscribe, call 1-800-487-9946.

Good Fruit Grower (ISSN 0046-6174) is published semimonthly January through May, and monthly June through December, by the Washington State Fruit Commission, 105 South 18th Street, Suite 205, Yakima, WA 98901-2149. Periodical postage paid at Yakima, WA, and additional offices. Publications Mail Agreement No. 1795279.

The publication of any advertisement is not to be construed as an endorsement by the Washington State Fruit Commission or Good Fruit Grower magazine of the product or service offered, unless it is specifically stated in the advertisement that there is such approval or endorsement.

POSTMASTER: Send address changes to Good Fruit Grower, 105 South 18th Street, Suite 217, Yakima, WA 98901-2177.

© 2016 by Good Fruit Grower Printed in U.S.A.

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Jim Doornink, left, presents Dennis Jones the crown of the 72nd Cherry King during the Cherry Institute meeting held in Yakima, Washington, in January. The Zillah grower was recognized for his passion for farming and contributions to the industry. Doornink was honored as the 71st Cherry King in 2015.

Cherry industry crowns 72nd Cherry King

Longtime grower Dennis Jones was crowned the 72nd Cherry King during the Cherry Institute meeting held in Yakima, Washington, in January. The Zillah grower was recognized for his passion for farming and contributions to the industry.

Jones and his brother, Will, are partners in a family farm that spans almost 500 acres, growing row crops and organic apples, pears and cherries. The farm includes more than 100 acres of organic Rainier, Early Robin, Bing, Chelan, Index, Benton, Regina, Attika, Lapins and Van cherries — and for at least one more year, the Royal Ann variety, also known as Royal Anne or Napoleon.

Jones has been a longtime member of the Cherry Institute board of directors and the Washington Cherry Marketing Committee. He also has served on the Washington Tree Fruit Research Commission's Cherry Research Review Committee. Outside of the tree fruit industry, Jones has served on the Toppenish Hospital board, the Bleyhl's board and, for more than 30 years, the Zillah School Board.

Jones was born in Yakima and began working on the family farm, started by his grandfather and father in 1946, by the time he was 7 years old. He attended Yakima Valley Community College, where he met his wife, Linda, and graduated from Central Washington State College. Jones joined the U.S. Army Reserve Corps in 1971 and moved to Spokane before deciding to move back to Zillah and the family farm. He became a partner in the family farm in 1974.

Jones and his wife have four children — all of whom attended Washington State University — and 12 grandchildren.

Apply for WAEF scholarships by March 1

The deadline for new applicants to submit scholarship applications to the Washington Apple Education Foundation (WAEF) is March 1.

WAEF is the foundation of the tree fruit industry, with a mission to impact lives through access to educational opportunities. The foundation will award about \$850,000 in new and renewing scholarships this spring.

Qualified applicants must have a tie to the tree fruit industry. Scholarships may be used by students to attend accredited trade or technical schools and two-year and four-year public and private colleges and universities.

All applications must be completed and submitted online. Application materials and information, as well as a list of scholarship tips, can be found at www.waef.org under the "scholarships" tab. Students are encouraged to contact WAEF at (509) 663-7713 with any questions.

The foundation currently assists 225 students. It expects to extend scholarship assistance to about 200 students for the 2016-2017 school year.



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Tim Smith cuts into a young Gala tree looking for fire blight damage during a Washington Tree Fruit Research Commission rootstock field day in Wapato, Washington.

Fire Blight CENTRAL

A research plot near Wapato, Washington, has become a test bed for fire blight.

by Shannon Dininny

Historically, the Konnowac Pass area near Wapato, Washington, has been known for Bartlett pear production for the canning industry.

Of course, pears are particularly susceptible to fire blight, and that history — combined with prime weather conditions last year — are triggering a test bed for the disease at a rootstock trial site owned by the Washington Tree Fruit Research Commission near the USDA entomology laboratory in Wapato.

A Gala replacement tree rootstock trial is underway there to better understand the replant disease tolerance in orchards with occasional tree losses. It turns out, this block of Gala also has acquired significant fire blight pressure due to the unique weather of 2015. Unfortunately, the block is mostly on Malling 9 rootstock, which is highly susceptible to fire blight. Nearly 10 percent of the M.9 trees planted in 2010 have had the rootstock die, as of September 2015.

Risk factors

Dr. Ken Johnson, plant pathologist at Oregon State University, reminded growers at the Washington State Tree Fruit Association Annual Meeting about risk factors for fire blight, including the vigor of the tree (a vigorous tree can spread the disease more quickly) and among some of the newer cultivars, such as Jazz and Cripps Pink.

But the biggest risk factor for fire blight is a tree's age — and Washington growers are planting a lot of young apple blocks. "It's just about impossible to keep it out once it starts cooking in a young block of trees," he said. "Programs need to be a little bit more intensive in young blocks. There's a lot invested there, and if you mess it up, you mess it up big."

A few things to remember:

Model thresholds for action should reflect the orchard's risk — whether there was fire blight in the orchard or in the neighborhood the previous year, the age of the block and the cultivar, among other things. Johnson recommends that growers lower their risk thresholds on the models if they have younger trees that are more susceptible, even if there was no fire blight in the area last year.

A fire blight infection can come late in the bloom period. While it may be difficult to find the pathogen at full bloom, it becomes more abundant as bloom progresses, and by petal fall, can be found easily.

Any interpretation of moisture depends on the orchard location and should be considered when determining risk level. Likelihood of dew and rain are both considerations, as are irrigation, both in the grower's orchard or from a neighbor's field. —*S. Dininny*



The circumstances are giving researchers there an unplanned opportunity to learn more about fire blight, and better understanding the disease is crucial to the industry. "Growers are spending \$50,000 an acre to plant a new orchard. We can't have any tree losses due to fire blight after planting new trees," said Tom Auvil, horticulturist with the Washington Tree Fruit Research Commission.

Ground zero for fire blight

Fire blight is caused by the bacterium *Erwinia amylovora*. The bacteria overwinter in cankers and can float in the air before coming to rest on flowers in the spring, colonizing the stigma prior to being washed into the base (floral cup or nectary) of the flower by dew or rain. The flower cluster becomes blighted, and bacteria enter the vascular system of the tree. Early season dieback of shoots starts from flower infections.

The bacteria move with water, wind and insects, and any event that wounds tissue — such as hail or wind — provides infection opportunities. The bacteria begin to multiply once temperatures are greater than 65°F. Growers should turn to fire blight models to determine their risk level once temperatures begin to get into the 70s.

The research plot near Wapato sits in a bowl of flat ground in an extended area where temperatures can warm quickly and with high potential for dew to appear well up in the tree. The area includes roughly 30 acres of pears, as well as 20 acres of apples, including a 2010 planting of 15 acres of Gala.

The first thing researchers noted last year: Roughly one in 10, or 10 percent, of the trees planted in 2010 defoliated, and on each of those trees, the rootstock died before dormancy. An earlier planting in 2006 didn't have anywhere near the amount of fire blight, Auvil said.

Gala has a unique feature where some spurs will bloom a few days after the one-year wood — a kind of double bloom that is similar to Bartlett pears, he said, which opens the susceptibility window for fire blight. Add in the high potential for dew and the inoculate load, and the area was ripe for bacteria to multiply rapidly.

Despite the region's historical susceptibility to fire blight, this is the first time the research block has really been clipped by it, Auvil said. "Whatever conditions occurred in 2015, we just had a little uptick in that delayed bloom, plus some bloom in August/September, then the weather triggered the blight infections."

Learning opportunities

In some seasons, trees bloom in August and September, dramatically increasing the risk of tree infection through flowers. M.9 and M.26



TJ MULLINAX/GOOD FRUIT GROWER

rootstocks do not need visual strikes of fire blight in the scion to acquire the disease below ground.

In the research block, trees from the 2010 planting on M9.337 rootstock were most likely to have died — in some cases, without a visual strike in the scion. A few planted in 2015 on Budavosky 9 experienced strikes but did not die. There were a few strikes in trees on Geneva rootstocks planted in 2004 and 2006 that have not spread into the tree as a whole. “I don’t want to say a Geneva tree will never die from fire blight, but unlike M.9, the percentage that you’ll lose will likely be insignificant,” he said. Many of the 2015 replacement trees on Geneva and the M.9 trees planted as comparisons for the Geneva rootstocks were stubbed back to 4 inches at planting, removing nearly all the bloom that would have created significant risk of blight infection.

Auvil said researchers will be working with the orchard operator at the Wapato block closely, advising to pull dead trees, prune strikes and manage cankers in the orchard. He advised growers with fire blight issues to do the same.

“If you have a relatively young, vigorous orchard with M.9 rootstock, you have to be very aggressive at getting the inoculum load down,” he said. That means pulling out trees with dead rootstock, monitoring the block from green tip through bloom looking at every rootstock union to check for a fire blight that may be oozing vast quantities of inoculum out of the union.

“As diligent as one can be to get it out of the field, it won’t cure the problem. It takes two, almost three years of seeing no strikes before you can breathe a sigh of relief on blight management,” he said. “It’s a relatively intense period of time.”

Tim Smith, regional WSU Extension educator, also noted that growers should take care when diagnosing their trees with disorders other than fire blight, such as collar rot, that can present similar symptoms. “People diagnose tree death as collar rot, but M.9 is actually pretty resistant

to collar rot,” he said. “I believe 99 percent is actually fire blight.”

Smith and Auvil also said the Wapato orchard will present an opportunity to learn more about the disease over time.

Aaron Clark, field manager for Price Cold Storage and Packing Co. in Yakima, said Price’s orchards located near the field plot didn’t experience significant fire blight last year, but it’s been an issue in the past — particularly in a couple of older Bartlett blocks. “You just don’t have Bartletts without having some blight once in a while. That’s like putting your boots on in the morning,” he said.

But he said the company has been diligent to stay on top of the disease, given that they have some young plantings, including 3-year-old Gala blocks that were planted from a sleeping eye. That includes examining the orchards regularly, aggressively cutting out cankers and treating for blight with a prophylactic approach whether they think they have an infection or not. Treatment methods include copper, the antibiotics streptomycin or terramycin and other products that help to retire blight.

“We just try to take a forward approach to covering, so that we’re applying some kind of blight protection every week. Otherwise, you get a weather system in that gives you a blight exposure, and invariably the weather is cruddy for a couple of days and you don’t get in there to do it,” he said. “And you’re too late.” ●

“It takes two, almost three years of seeing no strikes before you can breathe a sigh of relief on blight management.”

—Tom Auvil

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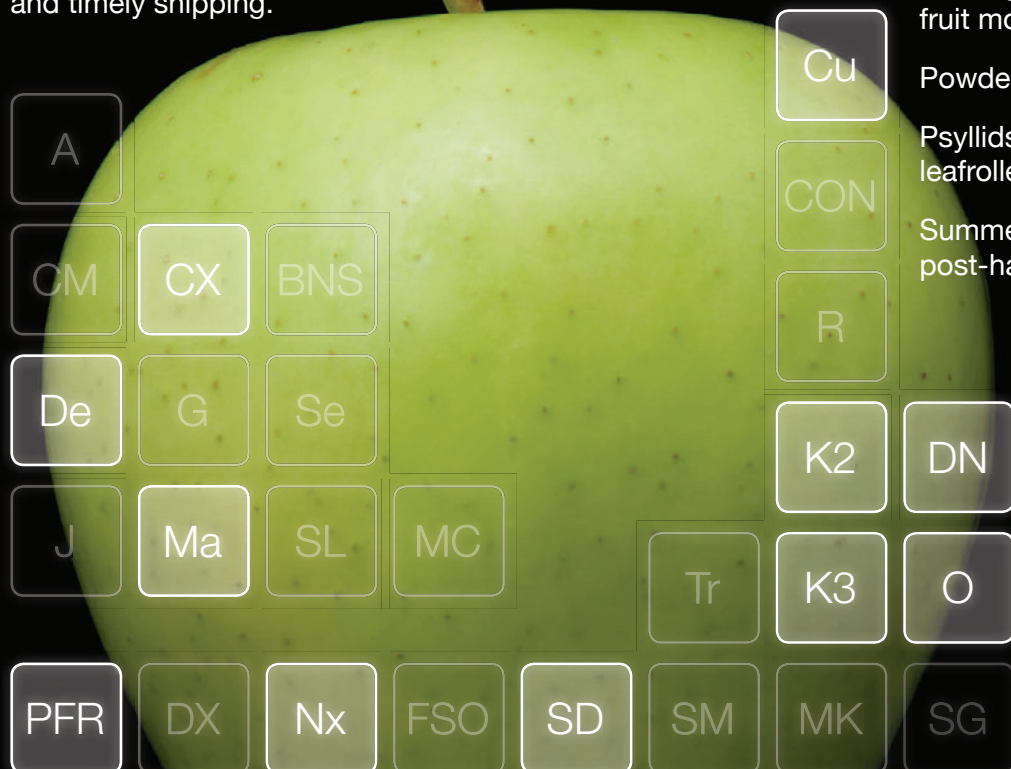
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PRODUCT REVIEW

Diseases

FIRE BLIGHT management

Mixing materials may bring growers closer to another "silver bullet" in fire blight management.

by Shannon Dininny

Researchers continue to examine the best methods to mitigate fire blight damage in an orchard, from pruning and treatment to regular surveys.

Resistance levels to streptomycin in the Pacific Northwest have receded a bit, but there still remains some resistance to the antibiotic in the region, Dr. Ken Johnson, Oregon State University plant pathologist, told growers at the Washington State Tree Fruit Association Annual Meeting in December. Certified organic production no longer allows the use of any antibiotic.

For conventional use, "we think it could be useful on a limited basis, maybe one application per year," he said. "It was the silver bullet back in the day, but we're getting closer to where we have silver bullets again by mixing materials."



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Fixed coppers can be used at dormancy to help prevent the disease. Johnson recommended growers implement an integrated control program.

For pears, Johnson said, growers should start with biological controls that target the stigmas, followed by a product mix to improve fire blight control in the floral cup. One suggestion: Apply a biological agent at early bloom, such as BlightBan (*Pseudomonas fluorescens* A506), Bloomtime Biological (*Pantoea agglomerans* E325) and Blossom-Protect (*Aureobasidium pullulans*), followed by an antibiotic mid-bloom (streptomycin, oxytetracycline or Kasumin).

Kasumin (kasugamycin) is the first antibiotic registered for crop use in 35 years and is in the same family as streptomycin. There is the potential for the bacteria to develop resistance to Kasumin, and Johnson advised against using it in combination with streptomycin. "You

have two resistance risks with strep and Kasumin, and you can do just as well with other mixes," he said.

For apples, an even better — though more costly — method is to apply lime sulfur during apple thinning, followed by the biological agent, then a combination of Kasumin and oxytetracycline (at 100 parts per million each).

"We did quite a bit of work with mixing Kasumin and found that

if we had a full rate of Kasumin and a half rate of oxytet, we just got outstanding control," Johnson said. "We were really impressed with that."

Johnson recommended growers producing conventionally grown fruit limit the use of streptomycin to once per season, perhaps after a hailstorm or when the fire blight model is exploding with extreme risk. When used, it should be applied at 100 ppm in combination with a full rate of oxytetracycline (200 ppm).

Johnson also recommended growers consider applying Actigard (acibenzolar-S-methyl), a plant defense inducer that mimics salicylic acid in the plant. "It doesn't give you high levels of control by itself, but it gives you a little better protection for a little longer period," he said. "An antibiotic may give you a three-day effective residual. With Actigard, you have lingering protection for about four more days."

Any of the above combinations can be mixed with Actigard at 2 ounces per 100 gallons.

Research studies have shown that oxytetracycline alone provides about 60 percent control of the disease, and one application of streptomycin improves that rate to 80 percent. The addition of two Actigard treatments improves the control obtained from antibiotics another 10 to 12 percent, he said.

"It's a price-conscious thing. It's a block-conscious thing. It might be useful in some blocks where you think you might be at very high risk," Johnson said.

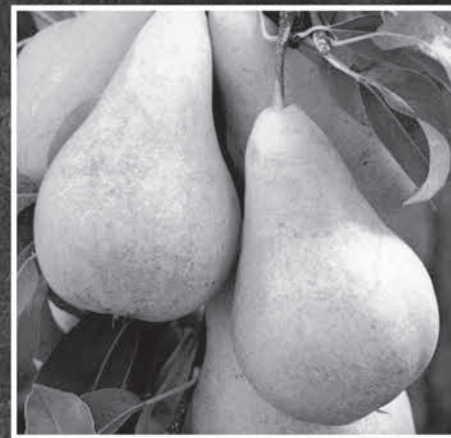
Cleanup

Actigard also is proving to be an effective "paint" during fire blight cleanup in the orchard to help prevent the spread of the disease through the tree, Johnson said. As growers prune and cut away blight, they should paint the cylinder of the tree below the cut for about 12-18 inches or, on a young tree, hit the central leader for about 3 feet.

"Where we paint Actigard, we get a lot less of the fire blight coming back on young trees. It's not perfect — the blight comes back — but we lose less trees as we clean up," he said.

Organic producers should check the approved list of materials annually to maintain their certification. ●

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Getting to the ROT OF THE PROBLEM

Researchers studying how best to prevent spread of disease from Manchurian crab apple pollinizers.

by Ross Courtney

Dr. Parama Sikdar and her assistant Emmi Klarer inspected thousands of Red Delicious apples one by one, huddling over a table in a Stemilt Growers warehouse stairwell in Wenatchee, Washington.

"It's warmer in here," Sikdar said, still bundled in a beanie and thick hoodie to ward off the chill from the cold storage just on the other side of the door. Besides,

the window light helped them spot evidence of rot, which they documented with a black Sharpie right on the fruits' skin.

Sikdar, a plant pathologist with the Washington State University Tree Fruit Research and Extension Center, is part of a team of Wenatchee researchers trying to help growers stave off three types of fungal diseases that prompted China to temporarily cease imports of U.S. apples in 2012. Meanwhile, other team members search for rot-resistant alternatives to the ubiquitous Manchurian crab apple pollinizers that also maybe won't pop so darn many tractor tires.

The group is in the second year of a five-year \$1.9 million U.S. Department of Agricultural Foreign Agricultural Service grant from the Technical Assistance for Specialty Crops program.

After one year of work, Sikdar and her colleagues have determined that a combination of aggressive Manchurian pruning and post-harvest fungicide treatments "significantly" reduce the incidence of two of those three fungal infections, speck rot (*Phacidiopycnis washingtonensis*) and sphaceloma rot (*Sphaeropsis pyri-putrescens*), in apples as they sit in cold storage. Now, Sikdar is measuring how much each technique — pruning and fungicide treatment — works individually.

In the meantime, she recommends growers prune Manchurians after twig dieback in a vertical shape to reduce overhanging limbs, avoid using overhead sprinklers as much as possible, remove the trimmings from the orchard to limit the spread of the disease and remove fruit mummies after harvest.

Manchurian connection

Manchurian crab apples and Snowdrift crab apples are the most common pollinizers in Washington's apple industry. Manchurians bloom early in the season, which is why growers began using them in the 1980s, along with Snowdrifts that bloom later.

In the past, growers have been hit-and-miss with pruning the spindly, unruly Manchurians, choosing to spend their money on the fruit trees instead. After all, more growth on pollinators just means more flowers for the bees.

Meanwhile, Manchurian branches are so hard and thorny they've been known to pop tractor tires. "They're just like having nails out in your orchard," said Denny Hayden, a Pasco area grower.

Hayden had always pruned his Manchurians, just to keep them from taking up too much space in his high-density blocks. He first tried using solid foam tires, but those made tractors hard to drive. He now instructs crews to haul away the prunings and burn them, an extra



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Dr. Parama Sikdar, left, inspects Red Delicious apples for evidence of rot in a cold storage facility in Wenatchee, Washington, with Emmi Klarer. Sikdar, a plant pathologist for the WSU Tree Fruit Research and Extension Center, is looking for evidence of rots from the postharvest diseases caused by *Phacidiopycnis washingtonensis* and *Sphaeropsis pyriputrescens*.

labor cost he would rather pay than continually fix flats.

But some growers didn't prune them at all. The unkempt condition led to dead and decaying branches that gave the opportunistic fungi a place to fester. The rots affect commercial cultivars of apple trees, too, but growers had always pruned those as part of their orchard management and kept the diseases at bay without even realizing it. In 2012 on shipments of U.S. apples, Chinese fruit inspectors found three rots — speck, sphaeropsis and a third kind called bull's-eye rot (*Neofabraea perennans*) — previously unseen in their country. They shut down imports for two years.

U.S. officials suspected some politics behind the move but began studies to set the record straight nonetheless, said Mike Willett, manager of the Washington State Tree Fruit Research Commission. Though they had conducted no trials, researchers in Washington already knew that pruning and postharvest fungicide reduce the incidence of speck and sphaeropsis, Willett said. The existing work, plus the new tests by Sikdar, helped convince China to reopen the market in November 2014.

Today, pruning is mandatory for growers planning to ship to China, Willett said. "They need to know if they're going to export fruit to China, they have to prune the crabs. It's not optional."

The risk is high. Speck and sphaeropsis rot have been known to cause orchard losses of up to 24 percent in isolated blocks. The pathogens spread by rain and irrigation water splashing from infected dead twigs and fruit mummies left to overwinter as pycnidia on those underpruned Manchurians.

Making matters worse, growers won't see the rot in the orchards. The symptoms don't show up until after at least 60 days in cold storage and usually not until 90 or more.

Through May this year, Sikdar will be comparing the incidence of speck and sphaeropsis rot on three categories of apples — those picked from orchards with pruned Manchurians and treated by fungicide, those from pruned orchards without fungicide and a control group of apples with neither method. So far, pruning is better than nothing but pruning plus fungicide works the best, she said.

In the future, Sikdar will study the biology of bull's-eye rot, another postharvest fungal infection, and possible

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"If they're going to export fruit to China, they have to prune the crabs. It's not optional."

—Mike Willett

control methods, continuing work already begun under the grant by Christian Aguilar, a WSU doctoral student in Wenatchee. Then, she will begin investigating how some of her research applies to pears, which have trouble with similar fungi.

A companion scientist, Dr. Stefano Musacchi, also at the Wenatchee center, is conducting trials to find a new pollinizer that growers may be able to use instead of Manchurians.

Sikdar and Klarer go through about 3,000 apples per month, harvested from test blocks in Yakima, Othello and Mallott. Sikdar keeps the fruit in Stemilt's research and development warehouse along the banks of the Columbia River.

They bundle up to open their storage unit and haul out a pallet of blue boxes, each filled with fruit, taking a few at a time to the warmer confines of the stairwell. Apple by apple, they search the stem and calyx for signs of the rots, which appear as brown, rubbery spots on the skin. *Sphaeropsis*, as an added indicator, supposedly smells like bandages, Sikdar said.

They take the infected apples back to the laboratory across town to verify the fungal strains by placing tissue samples on culture plates. The rest go back in storage until the next monthly inspection.

Over time, Sikdar has developed a keen eye for rot. But sometimes symptoms are hard to spot, she said, and even then may look like other defects, such as sunburn, leading Sikdar to speculate the diseases have been around for years undetected.

"It's a very tricky one, which is why it went missing for so long," Sikdar said. ●



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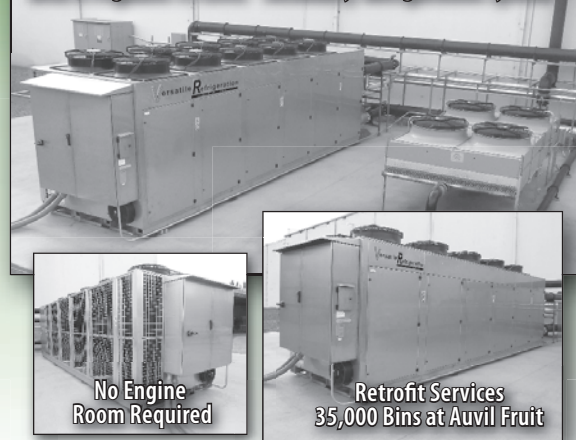
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Trunk diseases in Washington

As Northwest vineyards age, trunk diseases become more of a concern.

by Shannon Dininny

Trunk diseases infect a wide array of crops worldwide, including apples, cherries, blueberries and apricots, as well as grapes. In Washington, they are a growing concern for grape growers as more acres are planted in wine grapes and as the trunks on the region's once-nascent grapevines age.

That's because older grapevines are more susceptible. In addition, a trunk disease can remain latent for as long as a decade, and symptoms can take one to three years to develop once it's active. For growers, that means the proportion of affected vines to healthy vines could reach as high as 20 percent before a problem is detected.

Knowing what pathogens are already prevalent in the

region — and how to prevent them — will be crucial for growers as their industry and grapevines mature.

Washington survey

Fungal pathogens infect vines through wounds, such as those caused by pruning, and can cause wood canker symptoms years later. The fungi infect the cordons, spurs and trunk, resulting in stunted shoots, shoot dieback and dead spurs — and cumulative yield losses.

Five wood canker diseases cause the most problems in North American vineyards: *Eutypa* dieback, *Botryosphaeria* dieback, Esca (also known as black measles), *Phomopsis* dieback and young vine decline complex.



Leslie Holland, a former Washington State University graduate student and current doctoral candidate at the University of California, Davis, conducted a grapevine survey to determine the prevalence of trunk diseases in Washington and what fungi are commonly associated with those diseases.

Holland gathered wood samples from symptomatic vines of multiple grape varieties and isolated diseased tissue for analysis in the summer of 2014. She focused on seven vineyards in the Yakima Valley and Horse Heaven Hills appellations, with a total of 1,495 vines surveyed across more than 3,800 acres.

Holland found that two species of *Eutypa* accounted for 73 percent of the canker fungi: *Eutypa laevata* and

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PHOTO COURTESY OF KENDRA BAUMGARTNER

The most common symptom of the dieback-type trunk diseases (*Botryosphaeria* dieback, *Eutypa* dieback, and *Phomopsis* dieback) is a dead spur. It can take several months to several years for an infected spur to die, depending on the aggressiveness of the trunk pathogen.

Eutypa lata. Eight other fungi caused the remaining cankers. She found symptoms in all her sample vineyards, with infection rates ranging from 3 percent to 33 percent, and the rates correlated with the age of the vines. At a 230-acre vineyard in the Yakima Valley with vines more than 40 years old, she found a disease rate of 33 percent. At a 2,000-acre vineyard in the Horse Heaven Hills with vines 30 years and older, she found a disease

Vine surgery unveiled

“The idea is to cut away wherever you think there might be infection. You can see the discolored wood. It’s visible. Work your way down the canopy, cutting away the rotted, darkened wood. As you go farther down the trunk, closer to the base, the wood ends up looking healthier and healthier. Just don’t go all the way down to the rootstock.

“It’s something that can be affordable, rather than replanting a whole block, which just costs tens of thousands of dollars. If you want your vineyard to last 20 to 30 years, and you end up having to replant in year 20 because your yields are so low, it’s just so expensive. It would be so much better, maybe in year 15, to start retraining so you can keep those vines going longer.”

—Dr. Kendra Baumgartner

rate of 18 percent. At a 170-acre vineyard in the Horse Heaven Hills with vines 16 and 17 years old, she found a 3 percent disease rate.

Prevention potential

The only means of eradicating an infection from a grapevine is by cutting out the infected wood, but healthy-looking wood can also harbor infection. In California, researchers have identified the two most effective preventative practices:

—Delaying pruning to a time when the risk of infection is lower (rain induces spore release, and cold weather can lengthen the time a vine needs to heal from pruning or another wound).

—Double pruning, which requires two passes through the vineyard. The first pass, after harvest, prunes canes to 10 to 12 inches above the previous year’s spurs. The second pass, in mid-March or later, prunes canes to the desired spur length.

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In addition, pruning wounds should be treated with a protectant before rain.

Dr. Kendra Baumgartner, a grapevine pathologist with the USDA Agricultural Research Services at the UC Davis campus, has been studying trunk diseases in grapevines. In a 2013 survey, Baumgartner found that California growers were hesitant to use these preventative practices in newly established vineyards, presumably out of concern about potential economic losses. She followed that survey with an economic analysis in 2014, showing that early adoption of preventive practices can significantly reduce the impacts of trunk diseases, generating financial returns close to those of a healthy vineyard.

Baumgartner and postdoc Renaud Travadon joined Jonathan Kaplan of California State University, Sacramento, in a similar study of Washington's wine industry. The 2015 analysis simulated production of Cabernet Sauvignon, Chardonnay, Merlot and Riesling — the four leading wine grapes accounting for 75 percent of Washington's wine grape production.

The researchers constructed a representative bioeconomic model for wine grape production in an infected vineyard. The model simulated production from a healthy vineyard for a 20-year lifespan and subjected it to a trunk disease. In one case, it assumed no preventative action had been taken, and in the other, it simulated double pruning with varying degrees of success.

Generally, the results showed that the earlier double pruning is started in the vineyard and the greater the efficacy of pruning the disease from the vines, the more likely the positive overall net returns for the vineyard at the end of 20 years. The efficacy depends on the timing of the second pruning pass, in relation to pruning-wound susceptibility. Pruning wounds made in early winter (in California, December and January, sometimes even in February) are more susceptible to infection than wounds made later in the dormant season (March). That's because winter rains induce spore release

and there tends to be more rain (and more spores) in early winter. Also, cold temperatures are thought to lengthen the wound-healing process, and early winter tends to be colder.

Given the variation in disease-control efficacies in the scientific literature, there is great uncertainty about the timing of preventative practices, Baumgartner told *Good Fruit Grower*. Until detailed knowledge is available on the impacts of environmental conditions on infection — specifically, those conditions that favor spore release, transport, deposition and germination on pruning wounds — and the healing process of grapevine wounds, researchers are left to make uniform assumptions about efficacy.

"Nonetheless, the more wounds protected each year, even if it is only 50 percent, the better," she said. "Because the infections by trunk pathogens are chronic, each infected pruning wound eventually results in a dead spur and thus fewer fruit clusters on the vine. Along this line of reasoning, it makes sense to start preventing trunk diseases in young vineyards."

The Riesling vineyard saw a positive overall net return at the end of 20 years when double pruning was implemented in years three and five. If adopted in year 10, the results were negative overall net returns. The researchers found similar results for Cabernet Sauvignon; however, the Cabernet Sauvignon vineyard also saw positive returns when double pruning was adopted in year 10, but only at higher efficacy rates. Merlot showed positive returns only when double pruning was implemented in years three and five and only at high efficacy rates.

However, double pruning is no guarantee for less-profitable cultivars: It never produced positive returns in the Chardonnay model, regardless of how early in the vineyard's life it was implemented or at any level of effectiveness.

Overall, double pruning resulted in greater overall economic returns over a 20-year vineyard lifespan compared to doing nothing to combat trunk diseases, the researchers found.

The study focused only on using practices that prevent trunk diseases and did not examine methods for dealing with an already-infected vineyard, Baumgartner said. Growers who don't yet have a trunk disease confirmed should consider double pruning. She said those who already have a confirmed disease problem might consider something that growers in California are employing with success: retraining or vine surgery, a form of trunk renewal. It involves sawing off the dead cordon, or a cordon that has many dead spurs, and retraining a new one from new canes. For vines with more than one infected cordon (or if you only have one cordon per vine), you can retrain a new vine with a trunk sucker and saw off the old vine at the base of the trunk.

Because fungi enter the vine mostly from the pruning wounds, the infection tends to localize in the canopy, which makes this option viable as long as growers don't wait too long, Baumgartner said.

"It's something that can be cost effective as long as the vineyard hasn't suffered so many years of yield losses," she said. "As long as you haven't dug yourselves down into a deep hole already; by then, you're better off cutting your losses and starting from scratch." ●



PHOTO COURTESY OF KENDRA BAUMGARTNER

The foliar symptoms of *Eutypa dieback* appear in spring. Shoots growing from infected spurs will be stunted, with shortened internodes. The leaves are yellow and deformed, with veins that tend to grow in a parallel orientation, and have tattered, slightly scorched margins.



JACK KELLY CLARK, COURTESY UNIVERSITY OF CALIFORNIA STATEWIDE IPM PROGRAM

As late summer and fall symptoms of Pierce's disease advance on the foliage of a red grape variety, leaf blades develop progressive zones of red and brown discoloration.

Concerns about *Xylella fastidiosa*

Oregon investigates finding of bacterium that causes Pierce's disease in wine grapevines.

by Shannon Dininny

Oregon officials are investigating what is believed to be the state's first finding of the bacterium *Xylella fastidiosa*, which was discovered in a pear variety for perry, or pear cider.

Pears have not widely been considered a host for *X. fastidiosa*, which infects xylem vessels in a number of woody, broad leaf and annual grass plants, disrupting the flow of water and minerals. About 200 plant species are susceptible, including American sycamore, apricot, blackberry, blueberry, grape, maple, peach, plum and raspberry.

In North America, the pathogen has been known for causing Pierce's disease in wine grapevines. The disease has been present in California vineyards every year, resulting in dramatic losses in the Napa Valley and in parts of the San Joaquin Valley. European wine grape varieties are particularly susceptible to the disease, which has not been reported in Oregon.

Symptoms vary by host, but the most common symptom is leaf scorch, where the edge of a green leaf turns dry, similar to moisture stress. These leaves later die and turn brown.

Oregon researchers had recently examined records to determine if *X. fastidiosa* had ever been reported there — finding none — when the report came in from a grower who was testing pear varieties for cider production, said Gary McAninch, who manages the Oregon Department of Agriculture's nursery and Christmas tree program. Oregon has since ordered a 180-day quarantine

restricting shipments of susceptible pear materials for nine counties. Researchers also are surveying western Oregon, with most of the field material collected and awaiting results of laboratory analysis.

"We didn't want any potentially infected pear plants moving around until we could figure out if we had the disease all over the place, or maybe if it was only in a couple of areas, if there was a chance to eradicate it," he said.

Oregon already had in place a permanent quarantine requiring grapevines from California either to be tested or to come from an area where *X. fastidiosa* is not a concern.

Common vectors for the pathogen are xylem-feeding insects, which acquire the bacterium while feeding on xylem sap, including leafhoppers, sharpshooters and spittlebugs or froghoppers. The key vector in California — the glassy-winged sharpshooter — is not found in Oregon, but other potential vectors there include the blue-green sharpshooter and common spittlebug.

The pathogen is prevalent in warmer regions of North America, such as the southeastern United States, where it remains the biggest obstacle to growing European-type wine grapes. In recent years, it has been reported in Europe, Asia and South America, including Italy, where it is killing olive trees.

The European Union and other countries prohibit or severely restrict importation of plant materials where *X. fastidiosa* is known to occur. For that reason, the finding also is of particular concern to the nursery industry, McAninch said. ●



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Diseases

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**Researchers studying
little cherry disease try
to predict percentage
of positive trees that
show no symptoms.**

by Shannon Dininny

As little cherry disease continues to gain a foothold in Northwest cherry orchards, growers are finding that one of the biggest concerns is knowing whether trees that show no symptoms of the disease might still carry it and need to be pulled.

"It's hard to recommend how growers should proceed in terms of how many trees to remove, because we do have confusion about non-symptomatic trees that carry the disease," Dr. Andrea Bixby-Brosi, a postdoctoral research assistant at Washington State University's Tree Fruit Research and Extension Center, told growers at the Washington State Tree Fruit Association Annual Meeting in December. "Year after year, growers think they have it under control, and then the following year, there's more infection."

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“Year after year, growers think they have it under control, and then the following year, there’s more infection.”

—Andrea Bixby-Brosi

PLAY

Andrea Bixby-Brosi updates growers about little cherry virus research. Watch the video at bit.ly/littlecherryupdate

Three pathogens are associated with little cherry disease: little cherry virus strain 1, little cherry virus strain 2 and Western X. Infected trees produce small, poorly colored cherries that lack sugar and have a bitter flavor.

Determining how and when growers can reasonably predict a percentage of positive trees that show no symptoms from the disease is part of the focus of a research project that also involves entomologist Dr. Elizabeth Beers, virologist Dr. Ken Eastwell, agricultural economist Dr. Karina Gallardo, and extension specialist Tim Smith.

The team sampled 250 trees in four orchards — some randomly and some within a one- to three-tree radius of a previously identified positive tree — to determine which were positive for the disease. Field representatives then walked through the orchards to mark the trees they thought were positive and negative based on size, color and taste of the cherries. The goal was twofold: to see if infected trees could be easily identified and to determine if more education is needed for workers in the orchard.

The researchers also surveyed for mealybugs in the orchards to determine if their presence is an indicator for the disease, but none had any mealybugs. “So, mealybug can be a red flag, but it doesn’t mean an infected orchard has to have an active mealybug population,” Bixby-Brosi said.

She shared results of the research from two of the four orchards.

—**Orchard 1:** Tests confirmed little cherry virus 2 in 2010 or 2011, with additional cases identified from 2013 to 2015. During a walk-through last year, at least three of 10 field workers flagged all the positive trees. However, 85 negative trees were tagged as “suspect positive” by at least one worker — though Bixby-Brosi noted the walk-through occurred early in the season, when workers might not yet be adept at recognizing symptoms. All but five of the positive trees were located within a one- to two-tree radius of a tree that was known to be positive in the past. None of the randomly selected trees tested positive for the disease.

—**Orchard 2:** Tests confirmed both little cherry virus strain 2 and Western X. Researchers sent six field workers through the field. Of the seven trees positive for little cherry virus strain 2, only three were flagged by at least one field worker, and four trees were not flagged by anyone. The trees did not have any symptoms, but all were located within a three-tree radius of either a positive or suspect-positive tree. Four suspect trees tested positive for Western X. None of the randomly selected trees had the disease.

Overall, the researchers found that most of the additionally infected trees were located within a three-tree

Differing life cycles pose challenges for controlling little cherry virus 2 vectors

In the past, mealybugs haven’t posed a significant problem for cherry growers because they don’t cause direct damage to cherries, but because apple and grape mealybugs are vectors for little cherry virus 2, researchers are looking for ways to combat them.

Control is challenging because mealybugs differ in their life cycles: The apple mealybug has just one generation per year, while the grape mealybug has at least two, which is an important consideration when timing control methods, said Dr. Andrea Bixby-Brosi, postdoctoral research assistant with Washington State University’s Tree Fruit Research and Extension Center. With grape mealybugs, she said, “At some point in the summer, you could have eggs, nymphs, crawlers and adults on the same tree.”

Bixby-Brosi and a team of researchers tracked the life cycle of apple mealybugs at WSU’s Sunrise Orchard between Wenatchee and Quincy in 2014 and 2015. They found that females were emerging from overwintering sites in midspring, followed by males. Egg masses were laid around June, and crawlers emerged during that month.

“It’s interesting to see the difference between 2014 and 2015,” Bixby-Brosi said. “We had a hot spring and summer in 2015, and everything emerged about a month ahead of what it did the year before. That’s another thing to take into consideration when managing these pests.”

The researchers tested several approaches to controlling the mealybugs: delayed dormant pesticide applications to intercept overwintering females; systemic petal fall applications to target crawlers; and foliar summer sprays timed when 70 percent of the crawlers are estimated to have emerged.

In the 2014 trial, a combination of Lorsban (chlorpyrifos) and oil spray was found to be most effective at the delayed-dormant stage. Diazinon worked best at controlling the newly hatched crawlers later in the summer. Researchers tested again in 2015 and found the same results, with one addition: A combination of Centaur (buprofezin) and oil also was effective at the delayed-dormant stage.

For grape mealybugs, systemic compounds, Admire Pro (imidacloprid, a soil drench) and Ultor (spirotetramat) and oil, applied 14 days after petal fall showed the best results.

Research continues this year into possible chemical-control recommendation for organic growers, as well as research into natural mealybug enemies in orchards. —**S. Dininny**

radius of previously positive trees and that random sampling is not an effective sampling method, Bixby-Brosi said.

She recommended that growers ensure the root system of an infected tree is dead when removing it, because suckers from the root system also test positive for the disease. “For whole orchards, we don’t have a recommendation yet, but we’ve been hearing from growers who’ve been replanting that fumigation alone may not be enough, because some of that root system is still alive in the orchard.”

The research continues this year. ●

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PRODUCT REVIEW

GIBSON'S

**Silver Pear
Award winner leads
from the road.**

by Ross Courtney

Driving west on State Route 14 through wild arid bluffs overlooking the Columbia River, Don Gibson couldn't resist the irony.

"Where in the Sam Hill are we?" he said, cracking wise in reference to the nearby Maryhill Museum, founded by land-company owner Samuel Hill, one of several possible sources of the common American idiom.

Truth be told though, the president of Mt. Adams Orchards Corp. knows exactly where he is — inside the mobile office that is his Jeep Grand Cherokee Overland. To stay connected to the vertically integrated fruit company he leads and its 345 full-time employees, the 2015 Silver Pear Award winner drives a weekly route from his Yakima, Washington, administrative office to orchards and packing houses through the Columbia Gorge and back, a round trip of 300-plus miles. He simply prefers face-to-face interaction.

"It's a people business," Gibson said.



DRIVE

The Washington State Tree Fruit Association honored Gibson, the 57-year-old married father of two, with the Silver Pear Award during its annual conference in December in Yakima. The former banker was lauded for keeping a close eye on the bottom line and getting involved with all facets of the industry, which includes serving on the science committee of the Northwest Horticultural Council and Pear Bureau Northwest's board of directors.

"Don is an outspoken and detailed-oriented board member, which is a good thing, and he has the industry's best interests in mind," said Kevin Moffitt, president of Pear Bureau Northwest.

Gibson quickly credits his colleagues. "It's a team approach," he said.

That's why he considers his weekly trip through parts of Washington and Oregon — with stops in Alderdale, Dallesport, Hood River, White Salmon and Bingen — worth every mile.

Joining the fruit industry

Gibson grew up as the youngest of six siblings on a row crop farm near Connell, Washington, and holds bachelor's degrees in finance and economics from Central Washington University. He started his career in banking, officiating a loan for Jack Bloxom, the former president of Mt. Adams, in a 1983 orchard investment.

Gibson disliked the smoke-filled boardrooms and lack of autonomy in the banking world, so he switched to work as a field representative for brewing giant Anheuser-Busch Companies. In 1993, he nearly took an executive's position in St. Louis when Bloxom called to offer him an assistant manager's spot at Mt. Adams.

"I liked his style," said Bloxom, now the semi-retired chairman of the company's board of directors. He communicates well with employees, growers and customers, Bloxom said.

Gibson has been company president since 2008.





Above: Don Gibson, president of Mt. Adams Orchards Corp., evaluates pear trellises with Tim Pitz, assistant superintendent, at the company's orchards in White Salmon, Washington. Gibson makes it a point to visit employees, orchards and facilities during his weekly trips from the company's headquarters in Yakima, Washington, through the Columbia River Gorge. Previous page: UFO trellised pears of Mt. Adams Orchards occupy one of the higher-elevation blocks near White Salmon. The orchard runs from 1,100 feet in elevation to 1,900 feet.

As a former banker, Gibson understands the importance of the bottom line. To keep the company "sales-driven," he spends most of his week in the administrative offices, co-located with Washington Fruit and Produce Co. in Yakima. Underwood Fruit and Warehouse Co., the packing entity under the Mt. Adams ownership group, pays a commission to Washington Fruit to sell produce packed in Bingen and Dallesport. The two companies also have a history of common ownership in the past, though are wholly independent now.

Gibson didn't initiate the weekly road trips; they are a part of the company's culture. Bloxom drove the same route himself 40 to 50 times a year for 30 years during various management stints and as the company president. He still makes the trip himself once every month or so.

"You can be told anything, but it's good to see it, too," Bloxom said.

The staff in the Gorge appreciates Gibson's visits, said Brad Pickering, assistant superintendent of the company's pear and apple packing facilities in Bingen. "Having him here to see the challenges of a piece of equipment we have ... or staffing, it just makes it easier," he said.

Employees, some of whom represent the third generation with the company, smile and say hello during his plant tours in Bingen. One woman even offered to let him take over after he inspected a pear in her packing tub. He smiled and said, "No thanks."

Taking growers out to lunch is part of his routine, too. About 40 percent of the company's pears come through custom pack contracts with outside growers.

While waiting to order at the China Gorge Restaurant in Hood River, Gibson showed grower Ken Goe some pear market information on his smart phone and discussed the possibility of setting up an H-2A training session for other Hood River-area growers.

For his part, Gibson also likes the trips. "I do enjoy this," he said. "This is the good part of the job." But there are plenty of unpleasant parts.

"You grow trees, but you're also growing people."

—Don Gibson

He had to lay off people in 2012 to keep the company's pear canning facility solvent enough to attract a buyer — Seneca Foods Corp. — in 2013. The company opted out of a marketing cooperative in the late 1990s that made administrators, including himself, unpopular with some highly respected growers. Meanwhile, part of his job is to ask cost-conscious questions about efficiencies.

"That might be a little bit unpopular," he said.

Traveling the Gorge

Simply reaching the orchards at the Mt. Adams property in January was an adventure.

The company has 1,600 acres of apple, pear and cherry orchards in various spots throughout the Columbia River Gorge. But the "crown jewel" blocks mingle with fir trees high in the Cascade Mountains, 14 miles from White Salmon along the Glenwood Highway. The highest plots of the 800-acre ranch stand at an elevation of 1,900 feet. About 30 families, all connected to the company, live in homes that would resemble rustic mountain cabins if not for the Mt. Adams office across the parking lot.

With Tim Pitz, the assistant superintendent, riding shotgun, Gibson motored through 2 feet of snow to inspect steep leader pear trellises, wading through the powder to get a close look at the high-density trainings planted at 6.5 feet-by-13 feet. Mike Sandlin, the superintendent, and Antonio Quintana, another assistant superintendent, caught up a few minutes later after getting stuck at a bend in the road.

They compared the growth on young trees trellised with two leaders and three leaders right next to



Gibson inspects a pear on the company's packing line in Bingen, Washington.



PHOTOS BY ROSS COURTNEY/GOOD FRUIT GROWER

Gibson shares market information with pear grower Ken Goe over lunch at a Chinese restaurant in Hood River, Oregon.

100-year-old pear trees, gnarled and woody with bark. "We're still dealing with 100-year-old trees," said Mike Sandlin, superintendent of the White Salmon orchards. "That's a management nightmare sometimes."

Unlike apples and cherries, pear trees have no true dwarfing rootstock, sometimes making growth regulation tricky. But the company specializes in pears, which make up more than half its acreage and more than 40 percent of its shipping volume.

Gibson has witnessed a lot of changes in the fruit industry, with the move to trellising, consolidation of

sales forces and the incorporation of computerized optical scanners in warehouses. His company has poured tens of millions of dollars into new equipment, some of it under construction now at the Dallesport cherry packing facility.

Still, Gibson prefers to focus on the people involved with his fruit business. Within five or six years he will have to help the company pick a replacement for his job at the head of the table, he said.

"You grow trees, but you're also growing people," Gibson said. ●



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The BLUE WAVE

Blueberries have made big gains with consumers, but there are signs growers should be cautious.

by O. Casey Corr

The blueberry industry has grown at an astonishing rate for years in terms of prices, consumer demand and acreage. So what could go wrong?

Plenty, cautions industry consultant John Shelford. He described the industry's growth as the Blue Wave and posed the question, will growers continue to ride it or crash? His advice: Manage risks.

Shelford spoke in January at the Washington Highbush Blueberry Workshop, organized by Washington State University Extension. The workshop covered advances in horticultural management and the future of production.

Shelford has worked in the blueberry business for 40 years. He is a Florida-based industry consultant who served as president of Naturipe Farms LLC and as president of Hortifrut NA Inc. He has seen astonishing change during his career. Blueberries were a regional crop and little known nationally before 1986, he said. Today, consumer demand is strong, benefiting from research showing the health effects of blueberries. Ninety-nine percent of households believe blueberries are a healthy food, he said.

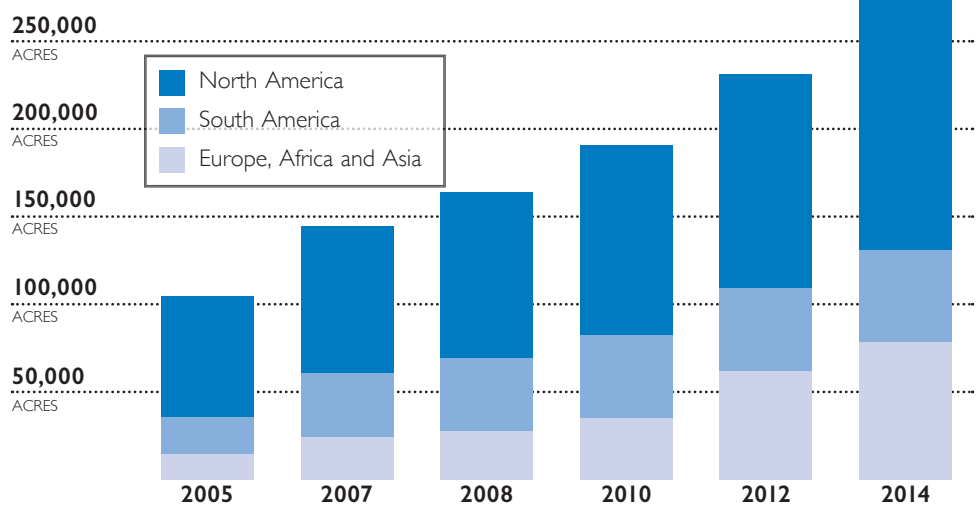
Statistics on blueberries are tracked by region and by highbush (historically described as "cultivated") versus "wild" blueberries. Highbush blueberries grow from planted bushes. "Wild" arise from areas where competing plants may have been cleared, allowing natural propagation of bushes primarily through underground runners. Wild blueberries are not necessarily "wild" as similar horticultural practices are essential, including herbicides and pesticides. Wild blueberries are often irrigated and pruned as well.

Here's how the categories are explained by Lisa Wasko DeVetter, a workshop organizer and WSU Assistant Professor of Small Fruit Horticulture based in Mount Vernon, Washington:

"'Highbush' is a way we differentiate



Worldwide blueberry acreage is growing



SOURCE: U.S. Highbush BLUEBERRY COUNCIL

JARED JOHNSON/GOOD FRUIT GROWER

among other blueberry species that are cultivated," she said. "We have low-growing 'lowbush' blueberry (*Vaccinium angustifolium*, also known as "wild blueberry") grown in the Maine area. Then we have 'highbush' (mostly *Vaccinium corymbosum*). Within highbush, we have low- and high-chill types that are commonly referred to as southern and northern highbush, respectively. Then we have rabbiteye blueberry (*Vaccinium ashei*). On top of that, we have crosses of low and highbush types called 'half-high' blueberry."

In Washington, the dominant species is the highbush.

Statics kept by Shelford show how highbush blueberry production has grown and shifted to the Northwest. In

1996, total production nationally was 164 million pounds, with the largest producer being the Great Lakes at 45 million pounds, versus 25 million pounds from Oregon and Washington. Last year, total production was 711 million pounds, with 75 million pounds from the Great Lakes versus 196 million pounds from Oregon and Washington. If you count British Columbia and California, the shift from the East to the West is even more dramatic during that period, from 38 percent to 59 percent of total production.

Blueberry plantings continue at a brisk pace. Between 2007 and 2014, worldwide plantings grew at a compounded annual rate of 10 percent. In North America, the figure for that period was 8 percent. By the end of 2014, blueberry acreage



TJ MULLINAX/GOOD FRUIT GROWER

A young blueberry field in Gleeed, Washington.

in North America totaled 143,636 acres. Worldwide, the total was 273,929 acres.

Shelford sees no slowdown in plantings, thus the basis for his cautions. He sees a number of competitive threats to blueberry growers.

For starters, said Shelford, the industry itself is parting ways. Wild blueberries are no longer an “aligned competitor” with highbush blueberries. They are now a direct competitor.

Wild blueberry growers now differentiate their product as “the better blueberry.” Wild blueberries taste better and provide twice the amount of antioxidants of planted blueberries, says the trade group Wild Blueberries of North America. Second, Shelford said population growth is slowing in the United States, the industry’s most important market. As a third dynamic, Shelford said blueberries as a consumer choice grow or hold market share at the expense of some other food choice, such as apples; he calls that “share of stomach.”

Shelford sees big change. Thus far, consumer demand and prices were strong, so much so that growers could expect profitability. Those days are ending, in Shelford’s view. He sees pressures on profitability for U.S. blueberry growers. He expects a softening in demand, greater competition from imported fruit, higher production costs and stagnation in prices, making it harder for higher-cost producers to make a profit. He’s watching to see if the blueberry market goes the way of the apple market, in which

proprietary varieties fetch higher prices at the supermarket. In the United Kingdom, blueberries can be found packaged with labels stating the blueberry variety.

Shelford sees added regulatory costs coming from the Food Safety Modernization Act that will especially disadvantage smaller producers. Regulations are far stricter on frozen berries than fresh berries, for example requiring testing for *Escherichia coli* 0157:H7 (E. coli), *Listeria monocytogenes* (listeria), salmonella and other pathogens. And yet, Shelford wonders when a kill-step will be required for fresh blueberries as a means of eradicating pathogens.

On the positive side, Shelford said the message that blueberries are healthy continues to drive sales. More than half of Americans have seen news stories about the health benefits of blueberries. Consumers today are twice as likely as they were nine years ago to buy blueberries in the coming year, said Shelford. Fresh blueberries have moved up in consumer preference over other berries. In rankings with strawberries, blackberries, boysenberries, raspberries and cranberries, Shelford reported, blueberries have replaced strawberries as consumers’ first choice.

Shelford challenges growers to strengthen their businesses by taking a number of steps, such as dedication to cost containment, food safety, strong marketing and a focus on quality. Those are key to winning “the share of the stomach.” ●



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Diseases

Pruning CANKERS

Winter pruning of cankers can help to reduce bacterial spot in peaches and nectarines.

by Leslie Mertz

The bane of peach and nectarine growers in the eastern United States, bacterial spot can lead to significant and sometimes total fruit loss, especially during the wet and warm conditions that the disease-causing bacteria

favor. Growers can, however, fight back with a management program that incorporates the active winter pruning of twig cankers, which can harbor large concentrations of the bacteria, called *Xanthomonas arboricola* pv. *pruni* (or *Xap*).

By removing the cankers, growers can significantly reduce the amount of bacteria — called the inoculum — that would otherwise thrive and spread throughout the tree and to adjacent trees during the following spring. To remove the cankers, orchard workers first have to be able to recognize them, and unfortunately that is no easy task, said Sarah Bardsley Capasso, who spoke about bacterial spot during the Great Lakes Fruit, Vegetable, and Farm Market EXPO in Grand Rapids, Michigan. She has been working on the disease as a graduate student in the Department of Plant Pathology and Environmental Microbiology at Pennsylvania State University.

“People who have been growing trees for 25 to 30 years have issues with identifying cankers,” Capasso said. That’s why the Penn State Fruit Research and Extension Center has held workshops on distinguishing between healthy wood and cankers. Usually, she said, workers first notice cankers in the spring because, unlike healthy portions of branches, they don’t bear any leaves. Cankers will also look water-soaked, although they aren’t actually wet. These darker, blacker sections, which are often at the tips of branches, enlarge as they age and, about three weeks after petal fall, may begin to cause the bark to crack and take on a slightly sunken appearance.

“What we think happens is that the bacteria originally enter the tree through the leaves and move through the leaves and underneath the bark where cankers form and

where the bacteria overwinter,” she said. “Come spring, we’ll often see a lot of bacterial spot symptoms on fruit and leaves right around the cankers.”

Although pruning of cankers can occur any time of the year, winter is opportune because much of the bacteria are holed up in the cankers at the same time that orchard workers are available to take on the labor-intensive chore of scouting for cankers tree by tree. For removal, Capasso recommends cutting beyond the canker and a bit into the healthy wood. “A good rule of thumb would be about 6 inches beyond, if it can be spared, because the bacteria are going to be invading the healthy tissue without visible symptoms initially.”

Once severed, the cankers should be removed from the orchard. “Just take them to the burn pile and get rid of them that way,” she said. “If you put them in a dumpster or pile them up, you’re not really killing the bacteria.”

Even the most diligent canker-removal program, however, will not completely eliminate *Xap*. For the best results, Capasso recommended a comprehensive management program, which includes:

- Locating new orchards in well-draining soils and avoiding low spots to lessen the wet conditions *Xap* favors. “Even small amounts of standing water in an orchard will become a big issue with bacterial spot,” she said.

- Planting cultivars that are less susceptible to the disease. “Remember that no cultivar is completely resistant to bacterial spot, so when the weather is wet and warm, for instance, even the most resistant cultivars may get some symptoms,” she said.

- Reducing tree stress by removing weeds, especially high weeds.

- Pruning trees to increase airflow within the canopy. This will help to keep leaves dry. “The faster you can dry the leaves, the less time you are going to allow for the bacteria to get into the tree,” she said.

- Spraying with copper, which is a proven treatment for bacterial spot, but combining it with other chemicals. Field tests at Penn State showed success with copper alternated either with the biofungicide Serenade Optimum or with the phosphorus acid Rampart, or with copper mixed with hydrated lime. These combinations

reduced the phytotoxicity side effect that occurs with copper, and also helped to prevent the bacteria from developing resistance to copper. Although rotations of copper and the antibiotic oxytetracycline are commonly



Cankers can be difficult to identify in the winter, but a telltale characteristic is their darker, cracked and sunken bark. Workers should snip off the cankers, plus another 6 inches of healthy wood, and then remove the trimmings from the orchard.



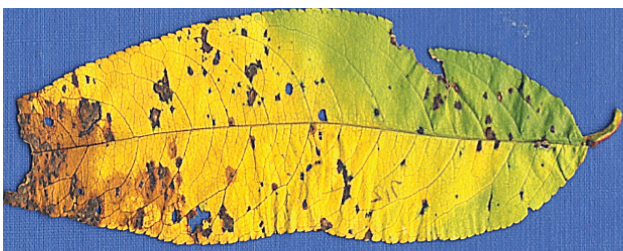
PHOTOS COURTESY OF SARAH BARDSLEY CAPASSO

Bacterial spot symptoms typically appear about three weeks after petal fall. Early-season fruit lesions may extend all the way to the pit. After pit hardening, bacterial spot causes shallower lesions that may coalesce and cause the skin to crack.

used in orchards, the field tests showed oxytetracycline didn't work as well as the copper programs under the strong disease pressure in southern Pennsylvania. She cautioned that such field tests are site- and weather-specific, so growers may have different results with copper combinations.

Growers may not be able to have totally *Xap*-free peach and nectarine orchards, but Capasso reiterated that they should be able to greatly reduce the impact of bacterial spot if they follow a management strategy that includes removal of cankers. "Overwintering cankers are large sources of inoculum. If you get rid of them, you will get rid of a lot of bacteria and will reduce the initial amount of inoculum in spring and the initial disease severity." ●

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



The symptoms of bacterial spot on fruit are similar to those of peach scab, which is a fungal disease. On leaves, both copper injury and nitrogen deficiency look similar to bacterial spot. Distinguishing features of bacterial spot on leaves include angular-shaped lesions (rather than round) that are often surrounded by a yellow halo. As the season progresses, bacterial spot lesions may fall out of the leaf, leaving behind holes.

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The RIGHT START

Dave Taber is working to maximize his chances of success with a new Honeycrisp planting.

by Geraldine Warner

When orchardist Dave Taber planted 35 acres of Honeycrisp in 2014, he was determined to do everything right in order to maximize production and profitability. The planting was split between two locations with 10 acres at one site and 25 at another.

Last fall, Taber, of Oroville, Washington, hosted a field tour at the 10-acre site, which also has a half-acre rootstock trial planted in collaboration with Tom Auvil, research horticulturist with the Washington Tree Fruit Research Commission.

Taber explained that the site, a former apple orchard, had been left fallow for about 12 years, but he followed advice to fumigate anyway. The ground was irrigated and fumigated in the fall of 2013 and the trees planted in early



"If you stumble at all with any young trees, but especially these, it will affect you forever."

—Dave Taber

spring 2014. Planting early gave the trees a head start, he said, and there was a noticeable increase in growth compared to other trees he planted a month later. "Every day counts in the spring," he stressed.

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Dave Taber wants to complete the canopy before cropping his Honeycrisp trees.

The trees were planted 2.75 feet apart with 11 feet between rows, for a density of 1,440 trees per acre. For Taber, who farms 300 acres in 14 locations, this was his first Honeycrisp planting and his highest tree density ever.

He used 14-foot poles with the intention of installing them 3 feet deep, but had difficulty digging the holes, even with an excavator, because of a layer of moraine. Some trees were planted with a tree planter, but an alarming number snapped off at the bud union in the

process, Taber said. Other trees were successfully planted by hand using a PVC pipe as a guide to ensure accurate spacing.

Despite the difficulty of installing the posts and anchors, Taber said he felt confident he could make the trellis secure enough. He tried not to cut corners on anything and used high-quality wire of the right gauge.

Once the trees were in, he fertigated and applied granular fertilizer and foliar nutrients as well. He paid close attention to irrigation and sprayed for mildew weekly.

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"We feel we did everything perfectly," he said. "We've never paid that much attention to baby trees."

By the summer of 2015, Taber was giving the block a score of seven out of 10, though he thought others probably would give it a nine or 10. Some of the trees have blind wood, which will affect future tonnage. He thinks it could have something to do with a November freeze in 2014, the year they were planted. Also, extremely hot summer temperatures could have played a role.

"I believe that both years (2014 and 2015) we may have stumbled somewhere on irrigation," he said. "If you stumble at all with any young trees, but especially these, it will affect you forever."

Taber said a soil moisture monitoring service might have helped, but as the orchard is at Oroville, close to the Canadian border, it's difficult to get people to go there. "We're at the end of the line," he said. "But if I spent the money I spent on this again, you have to have something along those lines."

To crop or not to crop

The question he faces now is whether to crop the trees this year, in their third leaf. Many people have encouraged him to crop them, but Taber feels it's critical



GERALDINE WARNER/GOOD FRUIT GROWER

Tom Auvil discusses how to get Honeycrisp trees off to a good start.

to be patient and build the bearing surface first.

"They say the top wire is the goal and anything above is a bonus," he said. "But I want to be above. We look at the growth and I see a little bit of inconsistency. I'm not where I want to be at the top. So, to me, my factory's not built, and I'm 90 percent certain I'm not going to crop them,

and I'm going to cut most of that growth off again."

Taber fears that cropping them too early would be a waste of time and cause him grief.

"I'll get a few bins in the warehouse and make some money, but I'll reduce the growth of my factory and have sub-par fruit to deal with. The orchard just

keeps eating money, but I think I'm going to pay negatively for 20 years if I crop it too soon and don't fill the space."

Auvil said the decision to crop or not to crop is always difficult. He recommended cropping trees that have reached the top wire of the trellis. The fruit might not be packable because fruit on vigorously growing trees is prone to bitterpit, but it

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would help slow down tree growth. On trees that have not reached the top wire, at least the top half should be defruited to stimulate more growth, he suggested.

Uniformity of trees will become critical as the industry adopts robotic harvesters within the next few years, he said. "Consistency of the canopy is going to be a big factor in being able to automate successfully and have the productivity of the machinery at a point where you can make money as a grower."

To avoid blind wood, Auvil recommends cutting all the feathers back to two or four buds at planting and heading the leader. Leaving a branch to grow 18 to 24 inches long with much of it blind wood doesn't help the grower, and, for automated harvesting, branches will need to be no longer than 9 to 12 inches anyway. Large caliper wood also needs to be removed as the trees grow.

Auvil said yield expectations for the modern orchard are 80 to 100 bins per acre, and he stressed the importance of building a trellis system that can support that load. For example, anchor posts should be the same distance from the bottom of the end post as the trellis is high. So, if the trellis is 11 feet high, the anchor should be 11 feet from the end post. And the tension on the trellis wires

should prevent the wires being moved more than half an inch in any direction with a reasonable amount of force.

About 100 acres of trellised orchard fell to the ground this year in the Columbia Basin, Auvil noted, and it was not even a large crop year. Trellises with wires that can be easily moved are vulnerable, particularly in wet soil and windy conditions.

Rootstock trial

The rootstock trial, planted last spring, includes Malling-Merton 106, M.9 T330, M.9 Nic 29, Budagovsky 9, and the Geneva rootstocks G.969, G.210, G.41, G.935, G.214, G.11, and G.890. After the first growing season, trees on MM.106 were the most vigorous, followed by G.210 and G.890. Trees on Bud 9 were the smallest, followed by G.41 and M.9 T337. Those on M.9 Nic 29 were intermediate.

Auvil said, in his opinion, G.890 is tough to beat for Honeycrisp on a replant site. Geneva rootstocks have the advantage over Malling rootstocks of being resistant to fire blight and *Phytophthora*, tolerant of replant disease, and, in most cases, resistant to woolly apple aphid.

Taber said some of the Geneva rootstocks already look promising in comparison to M.9 Nic 29. "G.939 and .890 look pretty interesting from that trial." ●

GOOD TO GO

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

Fresh Pear Committee nominations

Pear growers will elect nominees for positions on the Fresh Pear Committee on March 4 in Medford, Oregon.

The committee is responsible for the collection of assessments for research and promotion and advertising of all pears marketed in domestic and export markets.

Growers will vote on the FPC handler position for the Medford district, a position currently held by Ron Meyer. The first alternate is John Neilsen, and the second alternate is Doug Lowry.

Elections for this position will be held at 9 a.m., March 4, at Naumes Inc., 2 W. Barnett Street, in Medford.

FEBRUARY

February 17-18: Northwest Pear 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.


February 17-18: Food Processing Expo 2016, Sacramento, California, www.foodprocessingexpo.net.

February 24: BC Tree Fruit Horticultural Symposium, Kelowna, British Columbia, Canada. For information, email Kelly Berringer at Kberringer@bctree.com.

MARCH

March 1-2: Fruit Ripening & Ethylene Management Workshop, Davis, California, UC Davis Campus, postharvest.ucdavis.edu/Education/fruitripening.

March 14: New Technology in Apple Scab and Fire Blight Management, Hyde Park, New York, www.redtomato.org/summit.



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GOOD TO KNOW

A report from Dr. Mike Willett and Sam Godwin

WSU Tree Fruit Endowment has WORLD-CLASS goal

Thirty-two million dollars for enhanced tree fruit research and extension.

In 2013, Washington fruit growers finalized a promise for that amount — the largest gift in Washington State University's history — with the goal of WSU becoming the international leader in tree fruit research and extension. The endowments are intended to support new research and extension positions and to enhance orchard and facility operations, all focused on the Prosser and Wenatchee Research and Extension Centers.

So, how's that working out?

The \$32 million goal was based on a relatively conservative estimate of apple, cherry, pear and stone fruit production over an eight-year period — targets that have been routinely exceeded — so income is considerably ahead of schedule. Through the end of December 2015, the Washington Tree Fruit Research Commission has disbursed more than \$13 million to the endowment with another estimated \$1 million to \$2 million disbursed in late January.

Endowment activities are under the stewardship of the seven-member WSU Tree Fruit Endowment Advisory Committee (EAC). Each member is appointed by a Washington tree fruit industry organization. Priorities are set and funding decisions are made by this group in a close and positive partnership with the leadership of WSU's College of Agriculture, Human and Natural Resource Sciences and Extension (CAHNRS) that includes Dr. Kim Kidwell, acting dean; Dr. Rich Koenig, extension director; and Dr. Jim Moyer, research director. This group is supported by Drs. Gary Grove and Jim McFerson at WSU-Prosser and Wenatchee, respectively.

To date, endowment funds have enabled the hiring of Dr. Stefano Musacchi, an internationally known pomologist originally from Italy, and Dr. Desmond Layne, Tree Fruit Extension Leader, both stationed at the WSU Tree Fruit Research and Extension Center (TFREC) in Wenatchee. In December 2015, interviews were conducted to fill an endowed chair in tree fruit soil and rhizosphere ecology (to be primarily housed at WSU's Irrigated Agriculture Research and Extension Center (IAREC) in Prosser) and an extension information and technology transfer specialist with a focus on postharvest handling, storage and food safety. As of early January, negotiations were underway with candidates for both positions.

The only hiccup so far has been Dr. Layne's decision to move to Pullman and accept a joint teaching/extension position in the Department of Horticulture. To partially fill the void left by his move, Karen Lewis, long-time regional tree fruit extension specialist, has assumed some of his previous duties. In this role, Karen has moved quickly, pulling together the tree fruit extension team. The extension team has already identified critical extension needs and provided that guidance directly to the EAC.

While funds are accumulating more quickly than expected, it is important to note that endowment hiring will likely lag the accumulation of endowment funding. Since CAHNRS provides significant support for each



TJ MULLINAX/GOOD FRUIT GROWER

Endowment funds enabled the hiring of Dr. Stefano Musacchi, an internationally known pomologist originally from Italy, shown here before his inaugural talk as an endowed chair at Washington State University at the Sunrise Research Orchard in Wenatchee, Washington, in August 2013.

endowed research and extension position, the pace of hiring will inevitably be governed by legislative allocations to WSU in each fiscal year.

However, to cap this year's already exuberant hiring spurt, a notice of vacancy is being finalized to begin a search for an endowed research chair in postharvest systems. The goal of the search is to identify and hire a world-class scientist to contribute to the existing postharvest work of industry, WSU and USDA's Agricultural Research Service scientists. Additionally, an initial transfer of endowment resources will be provided to TFREC and IAREC to upgrade and support orchard infrastructure and critical equipment needs at each location.

Priorities for future research and technology transfer positions have been tentatively identified, but the endowment advisory committee intends to remain nimble, responding to emerging industry needs, such as food safety or pest management needs, and partnering with CAHNRS to ensure that WSU's internal hiring decisions mesh with the committee's priorities.

Stay tuned. And, most importantly, if additional

Advisory committee

Endowment activities are under the stewardship of the seven-member WSU Tree Fruit Endowment Advisory Committee (EAC) currently composed of Tom Butler, Washington Fruit and Produce Co.; Sean Gilbert, Gilbert Orchards; Bob Gix, Blue Star Growers; Sam Godwin, Chelan Fresh; Alan Groff, Foreman Fruit Co.; Jake Gutzwiller, Stemilt Growers; and Jason Matson, Matson Fruit Co.

information is needed, feel free to contact Mike Willett, Sam Godwin or any member of the endowment advisory committee.

Dr. Mike Willett is the manager of the Washington Tree Fruit Research Commission. Sam Godwin, an orchardist in the Tonasket area, is chairman of the WSU Tree Fruit Endowment Advisory Committee. ●

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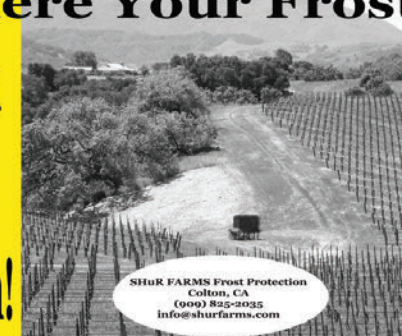
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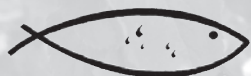


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More Young Growers at goodfruit.com/yg

Ryan Bond

grower / The Dalles, Oregon

age / 35

crops / Cherries, pears and apples

business / R&D Orchards, K&K Land Management

family background / Ryan is a second-generation grower managing about 800 acres, primarily consisting of cherry and pear trees in The Dalles and south through Dufur into the Tygh Valley.

What was your path to farming?

“I started helping out on a farm in Royal City, Washington, when I was about 12. I remember swearing that I was never going to be a farmer. So I went to Washington State University for golf course management. After a few years working at courses, my dad's boss called offering a job running an orchard in Oregon. Two months later I was suddenly in charge of 200 acres. Thankfully I had good neighbors and I worked for good people.

What were some of the important things you learned at the start?

“I had to learn how to work with people. Being able to work with a crew when you're 23 years old and you're the boss – boy, that's a lot of power. For me it seemed like, “It's going to be my way or the highway, and I'm not going to bend.” I learned early on that it's awful tough keeping a crew happy. That's something that I'm still learning.

Where do you see areas for growth?

“I've transitioned out of being the guy sitting on the tractor to being the guy that's making sure the crews have what they need to operate the tractor. I'm focused on time management because we may get done spraying a block and the next thing I need to do is drop into the office to fill out the spray record. Because if I don't do it at that time, the chances of me getting that spray record down with correct information is a little slimmer.

What were some of your struggles?

“Early on I lost a block to *Pseudomonas* and another to fire blight. It hurts. It's not a pretty thing to go out and see the trees that you've poured all of this time and energy into die. You were the one on the tree planter putting them into the ground, you rolled out the irrigation tubing, you were pruning them as little babies – then they all die because of fire blight. You've gotta move on.

What would you tell new growers?

“You're doing this because it's a pride in ownership deal. That's what it takes to be a farmer. Especially a young one – you've gotta have pride in ownership. You can't approach farming like it's just another job, because it's not. It's a way of life.

“Farming's not easy. If it was, everybody would do it.

by TJ Mullinax

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