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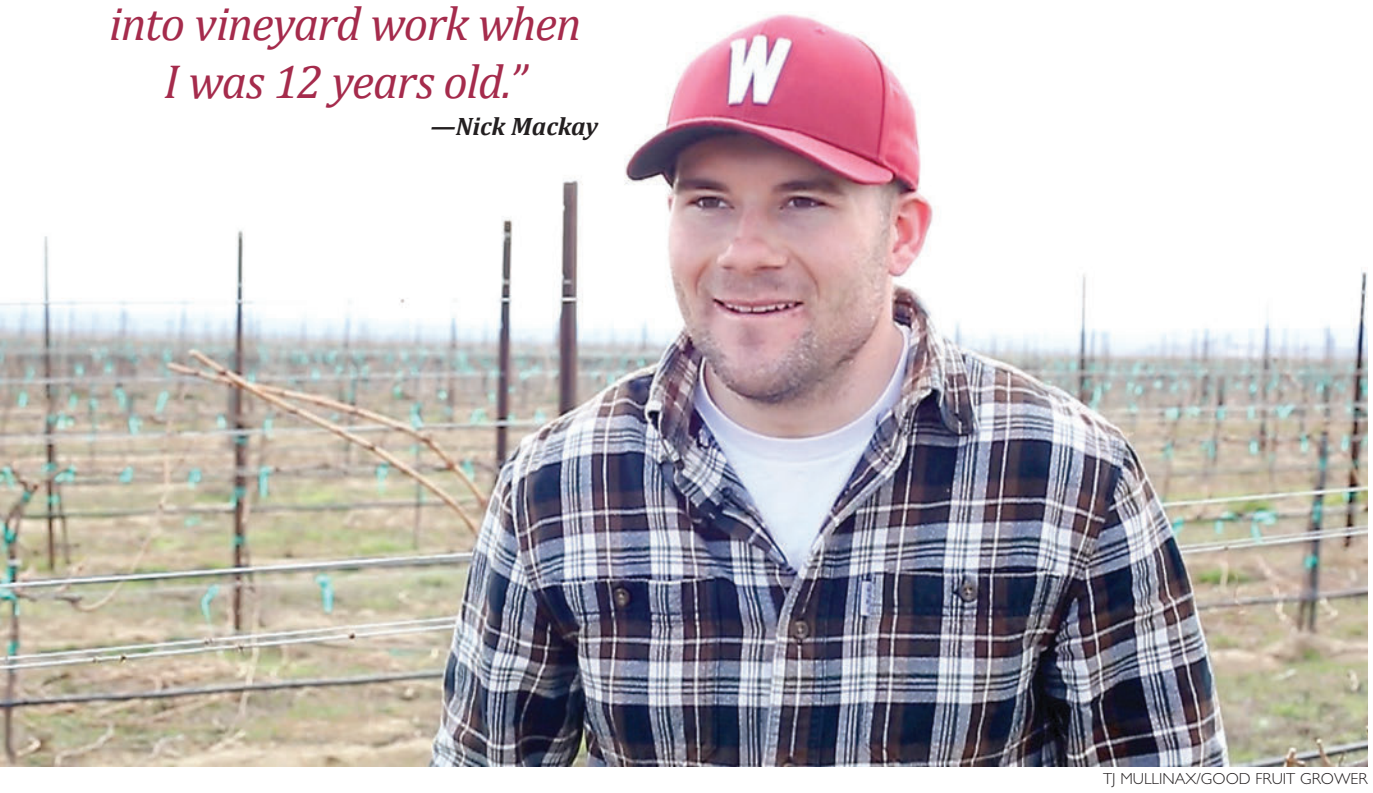
An upright hedger is displayed in January for growers during a cherry pruning field day in Prosser, Washington. Turn to page 32 for the latest research and insights on mechanical pruning.

TJ MULLINAX/GOOD FRUIT GROWER

"I got my introduction into vineyard work when I was 12 years old."

—Nick Mackay



TJ MULLINAX/GOOD FRUIT GROWER

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"Peach Blossoms"

Redhaven peach trees in Mosier, Oregon

BY PALOMA AYALA, HOOD RIVER, OREGON

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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.

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Quick Bites

People and industry in the news.
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Hudson Valley hires new tree fruit pathologist

The Hudson Valley Research Laboratory has hired tree fruit plant pathologist Dr. Srdjan Acimovic.

Acimovic earned his doctorate in plant pathology from the Michigan State University Department of Plant, Soil and Microbial Sciences. His research centered on disease management in apples through trunk injection of plant protective compounds, including control of apple scab (*Venturia inaequalis*) and fire blight (*Erwinia amylovora*) with systemic acquired resistance (SAR) inducers and fungicides.

The Hudson Valley Research Laboratory partners with Cornell University and is a part of the New York State Agricultural Experiment Station in Geneva, New York. Acimovic begins his new role in early April. He replaces Dr. Dave Rosenberger, who retired in February 2014.

Hortau expands in Pacific Northwest


Aaron Voelker


Verlyn Burgers

Hortau, a provider of precision irrigation management systems, is expanding its full line of products and services to the Pacific Northwest.

Hortau's smart irrigation management platform reports to growers how crops are faring in real time, before stresses such as drought or lack of aeration can have a negative impact on the crop. This proprietary, plant-centric approach measures plant stress using soil tension, ensuring optimal crop growth, and reducing water and energy consumption, as well as environmental impacts such as leaching.

Hortau's Pacific Northwest regional sales and grower support efforts will be managed by Aaron Voelker and Verlyn Burgers. For more information, visit *Hortau.com*. Voelker can be reached at (509) 571-028. Burgers can be reached at (509) 571-0186.

In the Box

Write us at **105 S. 18th Street, #217, Yakima, WA 98901**
or email **growing@goodfruit.com**

Plum blossoms

This picture was taken at Kate's Cackling Ranch in Trinity, Texas, from some plum trees I planted when my mother first rented this property 10 years ago. My husband, John, and I have since purchased the property and tend it, growing fruit, vegetables and berries. We also raise potbellied pigs, blue butt pigs, Nigerian dwarf goats and poultry. Most of our needs are met from right here on our small farm — it has been quite the journey! The photos were taken Feb. 25. I had just finished up dusting the web worms that were trying to take residence in the branches.

Kate Ferguson
Trinity, Texas

(Less than a week after the photo was taken, Kate added that "all of my blooms are gone, pollinated and turning into fruit. It's a good thing I got some snaps in while I was out the other day!")

Watering by the NUMBERS

Extension specialists take the mystery out of irrigating.

by Ross Courtney

There's little mystery to irrigating. Getting the right amount of water to a tree at the right time may be complicated, but it's certainly not a guessing game, said Tim Smith, long-time Washington State University Extension specialist from Wenatchee, Washington.

"The rules of irrigation are physics. It's math," Smith told growers at the North Central Washington Apple Day conference in late January at the Wenatchee Convention Center.

Throughout his 30-plus years of grower outreach and education, Smith has recommended a set of intricate but standardized rubrics for growers to determine how much water their trees need, taking into account a host of factors, such as number of sprinklers, calendar date and soil type. All of these points are knowable and can be plugged into an equation to give a grower a good irrigation recommendation.

"It's complicated, but it's important," he said.

Smith, who is semi-retired, and Tianna DuPont, the

Tim Smith

Tianna DuPont

extension specialist hired to replace him, have published a worksheet that walks growers through the process. Overall, they encourage growers to use math, science and accurate data to deliver the correct amount of water, fully expecting that figure to change with the season and weather.

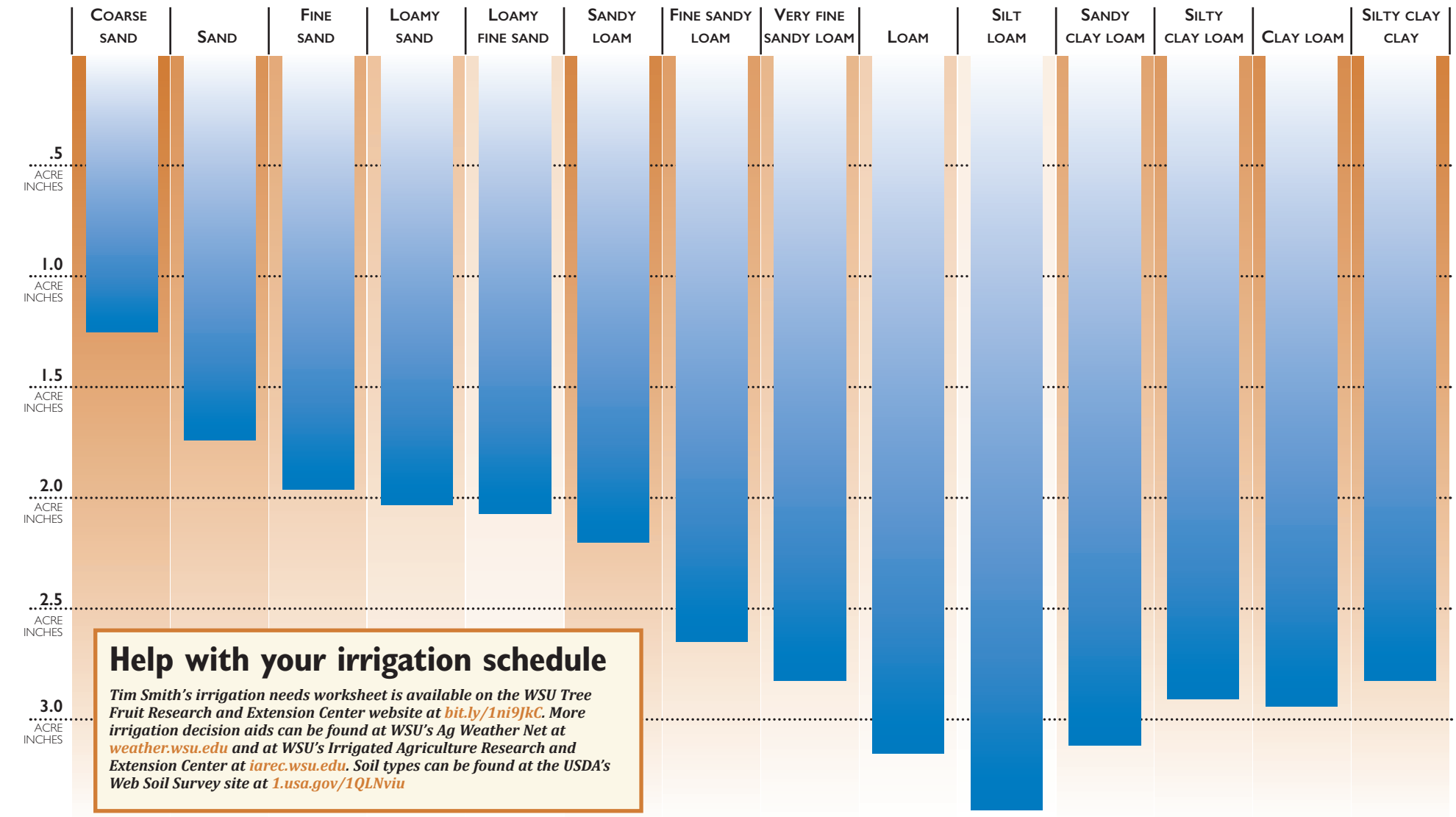
Smith bases his figures on evapotranspiration, the ever-changing rate at which trees consume water to process light and carbon dioxide to grow.

He suspects too many growers just guess in a high-stakes era of drought threats, shallow root zones and high-density plantings. "We have a problem when it comes to irrigating properly as an industry," he said.

He doesn't consider growers careless, he said, just stuck in a complex situation with a variety of planting structures, soil types, varieties, irrigation delivery systems

How much water does your soil hold?

The amount of "usable water" held in an orchard's root zone can vary significantly depending on the type of soil. This chart shows how some common soil types affect the usable water per acre inch in an orchard with a 3-foot deep root zone, which is typical for an older, vigorous rooted orchard. An acre-inch of water is about 27,150 gallons.



Help with your irrigation schedule

Tim Smith's irrigation needs worksheet is available on the WSU Tree Fruit Research and Extension Center website at bit.ly/1ni9JkC. More irrigation decision aids can be found at WSU's Ag Weather Net at weather.wsu.edu and at WSU's Irrigated Agriculture Research and Extension Center at iarec.wsu.edu. Soil types can be found at the USDA's Web Soil Survey site at 1.usa.gov/1QLNviu

SOURCE: WASHINGTON STATE UNIVERSITY

JARED JOHNSON/GOOD FRUIT GROWER

TJ MULLINAX/GOOD FRUIT GROWER

Knowing your soil type can help determine how much you should irrigate.

and, in bad years, the shifting supply of water.

For instance, sandy loam and loamy sand have two different water holding capacities, which is the amount of water left in soil after it has been soaked and allowed to drain but not dry.

"I think most growers throw up their hands and surrender to the complexity of the situation and just try to keep from falling behind," Smith told *Good Fruit Grower*.

But taking the easy way out by using a set irrigation schedule for the entire season will give them the correct amount of water only twice, once in the spring and once in the fall. At all other times, the trees' fluctuating needs rise and fall.

Meanwhile, Smith suspects many well-meaning but over-enthusiastic orchardists over irrigate in the spring when irrigation districts open the gates. He suggests leaving trees alone in April and using the water instead to wash cars, fill spray tanks, control frost and top off on-farm reservoirs, postponing irrigation until May.

"Most people can't resist putting that first set on," he said.

But that may do more harm than good, he said. The first irrigation is usually the time of the first powdery mildew infection in cherries and may even spread fire blight in apples or pears in warm weather. Also, overwatering in April can reduce root growth and flush out recently added iron and boron and reduce the trees' uptake of phosphorus.

Too much water (as well as too little water and a host of other causes) can lead to iron chlorosis in

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fruit, a yellowing of the leaves caused by iron deficiency. Iron chlorosis is a relatively mild problem, he said, but avoidable for the trees in Washington.

"They'd be a whole lot happier if they were drier in April," he said. "There's no pressure on them for water. They can be sitting in dry soil and be just as happy as clams."

"The rules of irrigation are physics. It's math."
—Tim Smith

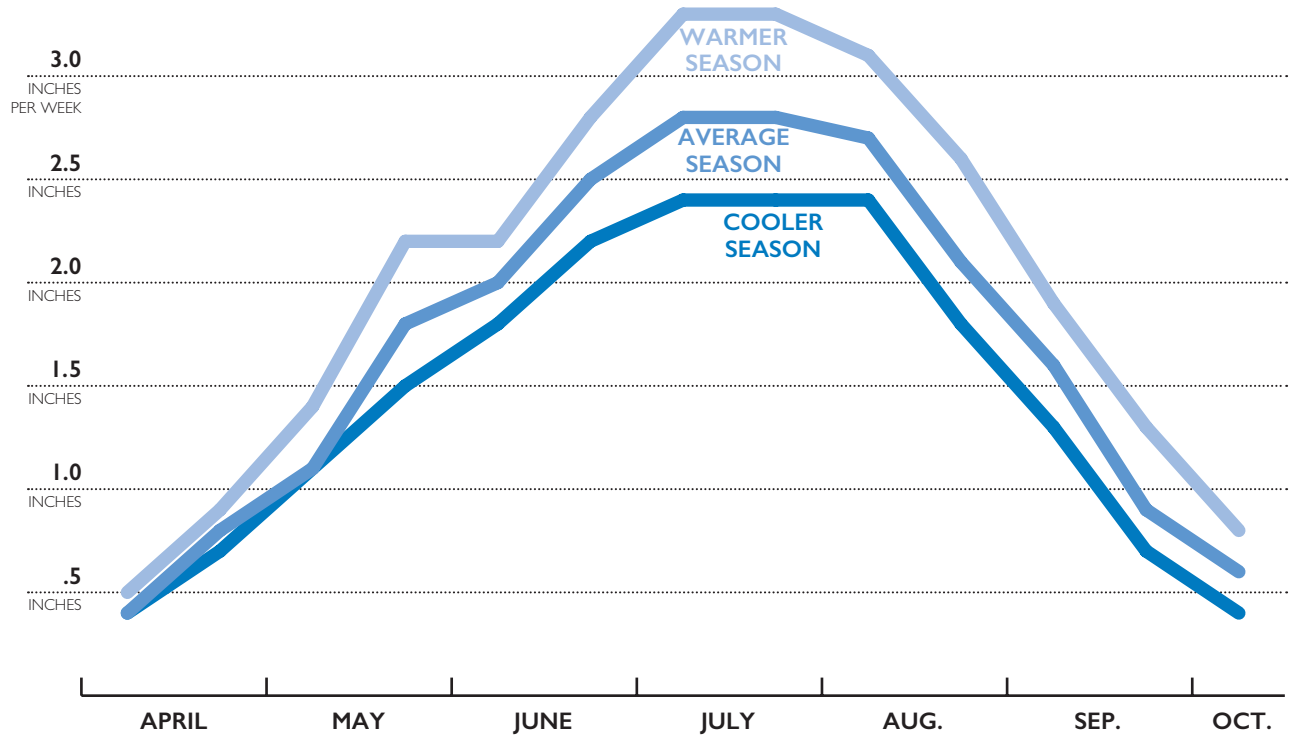
DuPont suggests growers use a common soil moisture monitor, and, as part of her research project, is volunteering to visit growers in their orchards; some have taken her up on the offer already. Growers also can send soil samples to their local soils lab.

Meanwhile, growers can access the U.S. Department of Agriculture's soil survey, also online, to help them determine their soil conditions based on address or latitude and longitude coordinates. The survey uses data from 1930s soil surveys, so it's not perfect, DuPont said. "We're just trying to get you close," she said.

And WSU's Ag Weather Net has an irrigation calculator that crunches the numbers for you, she said. For each field, the calculator will determine if plants are stressed based on soil type, the evapotranspiration for the crop and the irrigation rate. ●

How much water do your trees need?

The amount of water that trees need is calculated based on the evapotranspiration rate, which varies depending on temperature, time of year and where the orchard is located. This table, using average numbers provided by WSU Extension Emeritus Tim Smith, charts water needs per tree for a standard older style apple orchard using overhead sprinklers.



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Know your soil before picking your ROOTSTOCK

Researchers encourage growers to match a rootstock's ability to absorb nutrients to those nutrients found in the soil.

by Dave Weinstock

The arsenal of information growers can bring to bear on the question of which rootstock to use has grown again. Recently published research by a team of U.S. Department of Agriculture and Cornell University scientists says growers should match rootstocks' varying abilities to absorb minerals to the minerals available where they are to be planted.

The research points to a day when growers may be able to adjust fertilization programs according to what rootstock forages well on its own versus one that doesn't.

"Rootstocks differ in their ability to forage for minerals, and this affects fruit quality," said Dr. Gennaro Fazio, the lead researcher and a plant breeder and research geneticist with the USDA Agricultural Research Service's Plant Genetic Resources Unit in Geneva, New York.

The impact of this work could well be felt all along the fruit production and marketing chain. "Some packers measure the concentration of several nutrients in lots of apples to estimate storage ability and storage disorders already," Fazio said.

Others are giving the idea a long look. "It's something we are considering for use in the future," Lee Showalter, grower services and food safety manager at Rice Fruit Co. of Gardner, Pennsylvania, told *Good Fruit Grower*.

Gennaro Fazio

"Rootstocks differ in their ability to forage for minerals, and this affects fruit quality."

Growers might find ways to reduce input costs: If one rootstock is more efficient at potassium or phosphorus uptake, Fazio said, they may not have to apply as much of either. The knowledge can also be used to reduce the occurrence of fruit defects. "We know that too little calcium, too much potassium and too much magnesium can bring on bitter pit," he said. "Knowing how well rootstock absorbs and transports these minerals can drive the decision of which scions to graft."

Some rootstocks pass along fairly equal nutrients to scions, while others may be very good at passing along particular minerals, such as calcium.

Fazio's earlier research showed some Geneva rootstocks are up to 25 percent better at sending potassium up the chain. They also detected three chromosomes having an effect on calcium delivery and another for sodium.

But what happens after the graft needs more research. "We don't have the knowledge of how proficient scions are at moving certain nutrients," he said.

For now, however, Fazio and his team have tracked

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down a number of positive correlations between various minerals in certain apple rootstocks in New York soils. Differing soil types notwithstanding, the study's findings can be used in other fruit growing regions of the country, such as the Pacific Northwest, Fazio said, because rootstocks' genetic material remains unchanged no matter where it is planted. The same is true for rootstocks' nutrient absorption and transport mechanisms.

Trial and results

Fazio and his team took plant material — leaves and fruit — from mature apple rootstock with Honeycrip, Fuji and Enterprise scions in New York's Champlain Valley, Hudson Valley and Lake Ontario apple growing regions, as well as Cornell University's Lake Geneva Experiment Station.

They oven-dried leaf and tissue samples, then ground them up and analyzed them for nutrient levels and carbon and nitrogen concentrations. In addition, they collected soil samples from the Champlain and Hudson Valley sites and analyzed them for soil nutrients.

Soil analysis of the Hudson Valley sample showed optimal levels of phosphorus and potassium and very high levels of calcium and magnesium. After evaluating the sites' soil pH, they determined nutrient availability varied significantly. They also found some interesting relationships between nutrient levels in leaves and fruit.

For example, despite finding similar zinc and copper levels in fruit taken from both sites, the amount found in leaves was quite different, which may mean the flow of zinc into fruit is tightly controlled, according to the researchers. Leaf calcium was similar in both valleys, but fruit calcium was not, leading them to believe calcium uptake is a variety-specific process. The same may be true for boron, phosphorus and sodium uptake.

Initial site analysis showed significant differences in planting mineral content. Boron, copper, iron, potassium, sodium and phosphorous in the Champlain planting were significantly lower than in the Hudson Valley. However, fruit concentrations of magnesium, manganese, sulfur and zinc were significantly higher in the Champlain Valley.

Higher calcium in Champlain Valley soils coupled with low calcium in Honeycrisp apples on the rootstocks evaluated might mean the variety is a poor calcium transporter.

Other possibilities the researchers considered included a belief that high Champlain Valley soil pH could explain lower iron in the rootstock. Soil magnesium and manganese were less available in the Hudson Valley, which might explain their reduced presence in the fruit of the region.

The research also revealed that some rootstock in the Champlain Valley delivered far more calcium to Honeycrisp scions than others. Top performers were CG.6976 (Cornell rootstocks are classified with the prefix CG for Cornell Geneva before commercial release), CG.4002, CG.4814, Geneva 16, G.214 and Malling 7. By contrast, M.9 performed rather poorly in this function.

In the Hudson Valley Fuji planting, G.214, CG.2406, G.969, Japan Morioka 4 and CG.5757 delivered the highest fruit calcium. Where fruit calcium was high, so too were iron, copper, zinc and manganese. Boron and phosphorous values correlated in this planting. The researchers observed something new as well: a strong correlation between sulfur and nitrogen values.

New tools

Fazio and his team have proven the wisdom of considering rootstocks' abilities to absorb and transport minerals from the soil to the graft. They did this by attempting to trace and identify mineral uptake and transport mechanisms from root to fruit.

Along the way, they identified a number of rootstocks that might represent initial steps toward improving Honeycrisp's ability to do well in storage. What's missing, and the next logical step in this research's progression, is an examination of mineral uptake and transport in the scion, from the graft forward to just short of the leaves and fruit. ●

The research team

Research team members include Drs. Gennaro Fazio of the USDA Agricultural Research Service's Plant Genetic Resources Unit; Lailiang Cheng of Cornell University; Michael A. Grusak of USDA-ARS Children's Nutrition Research Center, Department of Pediatrics, Baylor College of Medicine, Houston, Texas; and Terence L. Robinson of Cornell's Geneva Experiment Station.

How different nutrients affect fruit quality

As with all plants, nitrogen plays a major role in fruit and tree growth. Fruit color development can be limited by the presence of too much nitrogen.

Fruit size increases with higher levels of nitrogen. Since flesh firmness decreases as fruit gets larger, growers need to effectively balance nitrogen so that both size and firmness are served.

Similarly, when growers reduce nitrogen to aid in fruit color development, they must be careful not to bring on biennial bearing problems with varieties such as McIntosh and Golden Delicious.

When adequate calcium is present in fruit, storage goes well and storage disorders — bitter pit and internal breakdowns, for example — are minimized. On the other hand, too much potassium interferes with calcium use and uptake, while too little creates problems with leaf development.

In earlier research, Dr. Gennaro Fazio, a plant breeder and research geneticist with the USDA-ARS Plant Genetic Resources Unit in Geneva, New York, found higher sulfur in fruit usually occurs with higher calcium. That's because calcium moves easily in acidic environments, the kind of environments with which sulfur is usually associated.

"It may be possible to formulate sulfur-based fertilizer applications that may increase calcium transport to the fruit," he said.

Magnesium and manganese also seem to be associated with calcium. "Manganese seems to use the same transport system calcium does," he said. "Magnesium seems to compete with calcium to get into the fruit but not the leaves."

This is good news for tree health because of magnesium's contribution to photosynthesis. When magnesium is not available, premature ripening and pre-harvest fruit drop are right around the corner. Blind wood and brittle spurs also result from magnesium deficiency.

Manganese, iron and copper are all involved in photosynthesis. When there is too little manganese present, it generally means photosynthesis is not occurring at optimal levels. Poor photosynthesis results in reduced tree and leaf growth.

Phosphorus' value lies in its role in creating and stabilizing fruit cell walls. Too much phosphorus in leaves can indicate a zinc deficiency, while too little may be a sign of low soil pH.

Boron is necessary to develop shoot tips, flowers and roots. Low amounts of boron result in corking and cracking of fruit and poor root development. In addition, when boron is limited, so, too, is calcium.

Zinc helps to move calcium within trees. A zinc deficiency results in poor leaf and shoot growth as well as reduced flowering, fruit set, size and coloring.

Sodium can reduce soil microbial activity if too much is available. The best way to reduce its effect is to apply gypsum. ***—D. Weinstock***

Root CARE

Remember to consider what lies beneath when maintaining a healthy orchard.

by Dave Weinstock

As growers make decisions about the care and maintenance of fruit trees, they often consider canopies, blossoms, buds, leaves and, of course, fruit. But what about the care and maintenance of roots?

After all, they fulfill some very important functions, says Emily Lavely, a Ph.D candidate in horticulture at Penn State University. "They are necessary for both establishing and anchoring plants and for water and nutrient uptake."

Lavely works with David Eissenstat, a Penn State professor of woody plant physiology, conducting plant root-microbe studies. The two made presentations on their research into the roots of fruit trees at February's Mid-Atlantic Fruit and Vegetable Convention in Hershey, Pennsylvania.

Kinds of roots

There are three kinds of tree roots, said Lavely: absorptive, transport and pioneer roots.

Absorptive roots take up water and nutrients. They are not woody and have a relatively short lifespan, typically from 30 to 60 days. "They are white or lighter in color and the target of microbes and herbivores," she said.

These lower order roots are the most active absorptive roots because they are where the fastest metabolism occurs. Owing to their finer structures, they have the greatest amount of soil contact.

Meanwhile, transport roots act like plumbing systems for trees. They move the water and nutrients collected by the absorptive roots. These roots are woody and live for more than one year.

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Absorptive roots are responsible for water and nutrient uptake from the soil. Transport roots act like plumbing systems and connect the absorptive roots to the main pioneer roots of the tree.

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Absorptive roots rarely, if ever, become woody transport roots. Transport roots are initially formed by pioneer roots. As they become woody, they make up the framework supporting the absorptive roots, creating a structure similar to scaffolding branches.

They grow quickly and become woody in weeks. Because pioneer roots develop into woody roots, their lifespan may last as long as the life of the tree.

Root colonization

Most absorptive roots are shallow, located within the top 12 to 15 inches of the soil. "That's where we apply water and nutrients," Lavely said.

This is also where a process called mycorrhizal colonization occurs. Mycorrhizae are created by a union of roots and specific soil-born fungi. They aid in improving plant growth, water and mineral absorption, disease suppression and drought resistance. Mycorrhizal fungi colonize roots faster than non-mycorrhizal fungi. This is especially true for roots aged 15 days or less.

There was no evidence in Lavely's research that increased carbohydrates increased mycorrhizal colonization of a unit length of root. A greater amount of carbohydrates below ground more clearly affected root growth than root colonization by microbes. However, once a root was colonized, it was heavily colonized.

Researchers have discovered relationships between root growth and tree fruit loads. "Trees with no fruit have more root growth than trees with fruit," Lavely said. "They also can have more mycorrhizal root length than trees with fruit."

Root management

Eissenstat said horticulturalists used to think tree roots only grow during bloom and after harvest seasons. "Now we know there is no particular evidence they grow within a particular season," he said. "They can grow at any time during the growing season."

Lavely thinks growers who wish to focus on root management need to direct their efforts on the growth of

TJ MULLINAX/GOOD FRUIT GROWER

Young trees without fruit have more root growth than older fruit-bearing trees.

healthy absorptive roots. Watering is usually a good idea, except when too much is applied.

"Too much water and too much nitrogen brings on more leaves and less fruit," Eissenstat said.

The rhizosphere, the soil located near the root structure, is much richer in nutrients consumed by microbes than bulk soil, areas located well away from roots. Some 30 to 40 percent of soil organic matter comes from plant roots.

One way to improve soil conditions may be through the use of organic mulches, Eissenstat said. He favors the use of compost, green manure and other biological waste materials to enhance microbial activity. Planting cover crops under grapevines and some kinds of fruit trees can also be a good idea for the same reason, but the practice needs to be balanced by limiting competition.

Well-drained soils can also improve populations of mycorrhizal fungi.

Soil stress can affect roots in two ways depending on the magnitude of the stress: It can cause plants to put out more roots or to cease their production altogether.

Growers should be careful not to apply too much nitrogen in the summer, Eissenstat said. Phosphorus is another double-edged fertilizer — too much phosphorus leads to less abundant mycorrhizae.

In addition, broad spectrum insecticide application can cause roots to live longer, but the long-lasting effects of this treatment are unknown, he said.

More research is needed to determine "detailed prescriptions" to improve the rhizosphere. "We know tillage is detrimental because it reduces the interaction between beneficial and nonbeneficial microbes," Eissenstat said.

He also thinks root pruning is an "iffy" practice. "You can open roots to diseases that way," he said. "The machinery used to transport the equipment can cause soil compaction." ●

Using less WATER

Study shows growers can reduce near-harvest irrigation of cherries without harming trees, fruit.

by Shannon Dininny

Many growers believe that a cherry orchard must receive a full supply of water up to harvest to avoid stressing the trees and to maximize fruit size. Others think that cutting off irrigation early — sometimes by as much as three weeks before harvest — will increase fruit firmness and improve resistance to cracking induced by rain.

So, who's right?

It's a question Washington State University graduate student Nadia Valverdi aimed to answer with a research study in Washington and Oregon over the past two years.

GOOD FRUIT GROWER FILE

Research over the past two years shows irrigation can be reduced prior to harvest without harming sweet cherry fruit yield or quality for some varieties, including Lapins.

"We have to improve water use efficiency at farm level due to resource conservation needs, and this research suggests we can conserve water without affecting fruit quality or tree health."

—Nadia Valverdi

The importance goes beyond just settling a debate. Drought conditions across the West in recent years have reduced water supplies and heightened the need for conservation. At the same time, how deficit irrigation might really affect orchards and fruit remained unknown.

Valverdi examined the role near-harvest irrigation plays on key fruit quality traits, as well as susceptibility to splitting, in early-maturing, midseason and late-ripening varieties.

Valverdi focused on four cherry varieties for the project — Chelan, Lapins, Skeena and Sweetheart — measuring soil texture, soil moisture, stem water potential, shoot growth, fruit growth, cracking index, fruit quality and yield in three commercial orchards in Washington and Oregon.

Overall, she found that irrigation can be reduced prior to harvest without harming sweet cherry fruit yield or quality for some varieties.

"We have to improve water use efficiency at farm level due to resource conservation needs, and this research suggests we can conserve water without affecting fruit quality or tree health," Valverdi said at the 2016 Northwest Cherry Research Review in Wenatchee, Washington.

Chelan

The first trial involved a drip-irrigated block of 12-year-old Chelan cherry trees on Mazzard rootstock in Pasco, Washington. The trees are planted in sandy soil referred to as "the beach," Valverdi said.

In 2014, Valverdi terminated irrigation 17 days before harvest in one row and 10 days later on another row. The

following year, she terminated irrigation 24 days before harvest and 10 days later.

Fruit from those trees were compared to fruit from trees irrigated under the standard irrigation rate for that orchard, which was every five or six days for 12 hours. The deficit irrigation showed no effect on fruit quality or yield, she found. The variety also showed high resistance to cracking both years.

As to the trees, she observed no stem water potential stress, and while soil moisture declined at all depths, trees continued to access water from deeper in the soil profile.

Lapins

The second trial involved a micro-sprinkler irrigated block of 14-year-old Lapins cherry trees on Mazzard rootstock in Brewster, Washington, planted in more acidic, heavy soil.

Valverdi terminated irrigation at 21 days before harvest and 10 days later in 2014, and at 18 days before harvest and 10 days later in 2015. Fruit from those trees were compared to fruit from trees irrigated every five or six days for 12 hours, which was the commercial standard for that orchard.

For the Lapins cherries, fruit soluble solid content increased by 10 percent to 13 percent in both years under the deficit irrigation treatments, though there was a reduction in fruit firmness both years. Lapins on deficit irrigation before harvest appeared to be slightly more susceptible than Chelans to cracking in 2014, but they showed increased resistance in 2015.

Soil moisture declined at all depths without reaching the permanent wilting point. The decline in soil water content in the top 2 feet suggested that water resources were exhausted in those zones, and the trees were under moderate stress, but the trees also pulled water from deeper underground, the study showed.

Skeena and Sweetheart

The final trials involved drip-irrigated blocks of Skeena and Sweetheart cherries on Gisela 6 rootstock in Dufur, Oregon.

Valverdi terminated irrigation at five, 10 and 15 days before harvest on different rows in a block in 2014 for both varieties and in 2015 for Sweethearts. For Skeenas, irrigation was terminated at only nine and three days before harvest in 2015 due to the early harvest. The typical irrigation set was 12 hours every third day.

For Skeena cherries, fruit size was smaller under deficit irrigation before harvest, though yield was not affected, and trees experienced moderate to severe stress. For Sweethearts, fruit size, weight and quality were reduced, even as yield was not affected.

Conclusions

The study involved mature trees with big root systems, Valverdi noted. In the case of Skeena and Sweetheart, the cultivars are on Gisela 6, a dwarfing rootstock, which may explain the effects on the fruit.

"Their root system is not as big, which may be why they are more sensitive," she said.

Overall, though, the study concluded that withholding irrigation prior to harvest does not consistently improve quality or reduce susceptibility to splitting in sweet cherries. More specifically, withholding irrigation up to 24 days before harvest did not affect splitting susceptibility on Chelan and Lapins.

The study also showed that stem water potential is a good indicator of tree water stress.

The message for growers: If there is less water available, don't be afraid to be more conservative with it before harvest. "Don't be afraid to water less than you normally do at that point, because the fruit will not be affected," Valverdi said. "The only thing the tree is doing is ripening fruit, and it has all the water it needs at that point to do that already."

The Washington Tree Fruit Research Commission funded the project. Collaborators were Dr. Matt Whiting, WSU horticulturist; Dr. Todd Einhorn, research horticulturist with Oregon State University in Hood River, Oregon; and Dr. Ines Hanrahan, projects manager for the Research Commission.

Deep WATER

WSU study shows that applying drip irrigation deep beneath the soil surface holds promise.

by Shannon Dininny

Wine grape growers can improve water use efficiency and still produce comparable yields by applying less water deep beneath the soil surface rather than through surface drip irrigation, a Washington State University study showed in its first year.

No one is advocating that growers make the switch just yet. The vineyard research will continue for several years to understand the concept in both the Cabernet Sauvignon block from year one and an additional Chardonnay block. Still to be studied is whether low-volume, root-zone deficit irrigation affects grape or wine quality. However, the initial results were encouraging to the participants.

"We're trying to find the sweet spot, both in depth and amount and style of irrigation, but this was a really good year," Dr. Pete Jacoby, WSU professor and plant ecologist, told *Good Fruit Grower*. "By the time we get to the end of the third or fourth growing season, when the vineyard has experienced different growing conditions, we should have a good indication of the appropriate application and have some recommendations for growers."

Jacoby conducted the first year of the study on a

COURTESY PETE JACOBY

Washington State University researchers are conducting an irrigation study on a Cabernet Sauvignon block on Washington's Red Mountain, near Prosser.

6-year-old block of Cabernet Sauvignon grapes at Kiona Vineyards on Washington's Red Mountain.

Scott Williams of Kiona said he was encouraged by the early results. As currently implemented, the idea probably isn't practical on a commercial scale, but that isn't the point yet, he said. The information gleaned from the research will be beneficial.

"As a grower, if you're going along and all of a sudden your water supplies are reduced by 30, 40 percent, which has happened a couple of times the last decade, knowing how you can manage that water is a significant piece of knowledge," he said.

Cabernet on deep deficit

Growers have tried before to water their vineyards from underground, only to walk away discouraged by buried lines that get clogged by soil or chewed by gophers, leaving damage that is imperceptible until it's too late to save the plants, Jacoby said. Yet most plants irrigated by drip irrigation tend to have 80 to 90 percent of their root mass in the top 1.5 feet of soil, he said, making them more susceptible to cold damage and less efficient.

Concords on DEFICIT

Subsurface irrigation shows potential for Concords, too.

by Shannon Dininny

At mid-veraison, plant water stress was substantially less in plots receiving subsurface irrigation at the 2-foot and 3-foot depths as opposed to the 1-foot and 4-foot depths.

The first year of a study into subsurface irrigation of Concord grapes — delivering water underground, rather than on the soil surface — shows the technology's potential to produce comparable quantities and quality of grapes while saving water at the same time.

And those results came during one of the driest and hottest summers in recorded history in Washington.

Dr. Pete Jacoby, Washington State University professor and plant ecologist, conducted the first year of the multiyear study on a block of Concord grapes, established in 2003, at WSU's Irrigated Agriculture Research and Extension Center near Prosser, Washington. The block was divided into 30 plots, each comprised of 30 vines planted on 6-foot (in row) by 9-foot (between rows) spacing. Jacoby placed emitters 18 inches on either side of each vine to deliver water at depths of 1, 2, 3 and 4 feet below the soil surface.

Drought conditions in 2015 forced some irrigation districts to ration water to users with junior water rights, and water was withheld at this particular site from mid-May until the second week of June. For that reason, some planned water treatments were deferred in order to saturate the soil with water until normal delivery resumed.

However, for the remainder of the growing season, all plots received no less than 75 percent of the replacement evapotranspiration rate during each scheduled irrigation, Jacoby said.

At the mid-veraison stage of development, plant water stress was substantially less in plots receiving subsurface irrigation at the 2-foot and 3-foot depths, the study showed, as opposed to the 1-foot and 4-foot depths. In a progress report, Jacoby attributed the difference to excess moisture loss to the understory vegetation as well as to surface evaporation at the surface and 1-foot depth and to the plant's inability to uptake water from 4 feet below the surface due to hardpan conditions.

The research team collected grape clusters in late July. They were consistently heavier with increased depth of irrigation delivery. The total numbers of berries were higher for the subsurface treatments than for the control surface drip treatment, and the average berry weight was greatest at the 2-foot and 3-foot depths of water delivery. They collected clusters again Sept. 12 and had similar results, with total berry numbers slightly higher for all subsurface treatments over the surface drip treatment.

The site has a highly variable soil type, including an extremely hard layer of solidified calcium carbonate below the upper 2 feet of the soil profile.

This layer may reduce the availability of soil moisture and create the need for more frequent irrigation, but that may mean other parts of the vineyard are overwatered at the same time. Vineyards with similar conditions lend themselves to site-specific irrigation technologies as they become available, the report showed. ●

The Cabernet block, planted on 6-foot (in row) by 8-foot (between rows) spacing in fine, loamy sand, previously had been drip irrigated. Jacoby and his research team installed vertical delivery tubes 18 inches on either side of each vine — rather than buried lines — to deliver water beneath the surface at depths of 1, 2 and 3 feet. Irrigation was applied at reduced rates of 60, 30 and 15 percent of the commercial rate applied by standard surface drip irrigation. The researchers also applied water both in a continuous stream and as a pulse to allow the plants to rest between drinks of water.

Remote sensors measured plant water stress in late July 2015. At the same time, grape clusters were gathered mid-ripening to determine fruit weight and average number of berries per cluster. In late September 2015, fruit on each vine was harvested and weighed.

The commercial irrigation, at a 100 percent supply, resulted in the strongest crop, at 4.5 tons or 10 pounds per vine. But Jacoby said he expected fruit weight to drop significantly with reduced water application, which didn't happen. "I was quite surprised we got as much fruit as we did," he said.

The winning rate: 60 percent of the commercial water application rate, which produced 4.1 tons or slightly more than 9 pounds per vine when applied at depths of 2 feet and 3 feet below the surface. The subsurface treatments also produced larger numbers of berries than the commercial treatment, but the berries were smaller, Jacoby said.

The results impressed Williams, though he cautioned that these were early results. The vertical application system still may not enable growers to locate an irrigation problem before the plants are too stressed any more than buried lines do, he said, and more research is needed to

A nice benefit of deficit irrigation: fewer weeds.

PHOTOS COURTESY PETE JACOBY

In the study, vertical delivery tubes installed 18 inches on either side of each vine deliver irrigation water at depths of 1, 2 and 3 feet as shown above and at left.

"As a grower, if you're going along and all of a sudden your water supplies are reduced by 30, 40 percent ... knowing how you can manage that water is a significant piece of knowledge."

—Scott Williams

measure the cumulative effects of water stress to the plants.

"Over years, it seems like when you have a consistently stressed situation, the cumulative effect can be pretty precipitous," he said. "Having said that, under the highest water treatment, which was about 60 percent of our normal application, there were few differences."

He also noted a nice side benefit of fewer weeds.

Going forward

The research continues in the upcoming growing season at the same Cabernet Sauvignon block. In addition, a new project begins at a 2-year-old Hogue Ranches Chardonnay block in Prosser, Washington, where the study was delayed by one year after the vineyard experienced significant cold damage the previous winter. Research collaborators are Drs. Markus Keller, Troy Peters, Sindhuja Sankaran and Lav Khot, all of Washington State University.

In the future, Jacoby also aims to work with researchers to study the effects of subsurface, deficit irrigation on grapes and wine quality from these vineyards.

The vineyard research is being funded by the Washington State Wine Commission, the Northwest Center for Small Fruit Research, the Washington State Concord Grape Research Council (*see "Concords on deficit," on page 26*) and the Washington State Department of Agriculture under an SCRI block grant. ●

Watering

COURTESY OF JACK KELLY CLARK, UNIVERSITY OF CALIFORNIA STATEWIDE IPM PROGRAM

Recent research shows that Riesling and other white wine grape varieties may benefit from an irrigation strategy that uses partial root-zone drying.

WHITES

Research shows growers can conserve water while still maintaining quality grapes.

by Shannon Dininny

Growers have employed deficit irrigation in red wine grapes for years, knowing that smaller berries result in a higher proportion of berry skins favorable for tannins and other phenolic compounds that improve wine flavor and color.

What about white wine grapes?

White wine grapes are not fermented with the skins, and too many phenolic compounds generally make the wine more astringent and increase instability during aging anyway. They also are more susceptible to sunburn, which can increase bitterness. For that reason, a deficit irrigation strategy that is beneficial to reds may not be suitable to whites.

"Now we're seeing the right way of watering white varieties. We're working to be more efficient, maybe use less water and still have high quality."

—Russell Smithyman

Researchers at Washington State University are examining whether white wine grapes could receive less water through a technique called partial root-zone drying and still maintain the quality of the grapes and wine.

Results from the first two years of study are promising.

"The potential benefit is that it seems like partial root-zone drying is a technique that does not reduce berry size or yield as much as conventional deficit irrigation. We think that will be beneficial especially to white wine grapes," Dr. Yun Zhang, a postdoctoral research associate at WSU's Irrigated Agriculture Research and Extension Center in Prosser, Washington, told *Good Fruit Grower*.

The technique

Both irrigation strategies impose some water deficit to constrain canopy growth and control vigor and berry size, though they differ in their approach.

Regulated deficit irrigation imposes a soil water deficit over time and is applied at specific points in the growing season. It results in a plant-water deficit and reduces berry size and yield.

Partial root-zone drying, a technique developed in Australia, imposes a soil water deficit spatially and, in this case, was applied from fruit set to harvest — essentially drying out one side of the root zone while the other side is being irrigated, supplying the vine enough water for growth.

With two drip irrigation lines running on both sides of the vine, the technique is more expensive. However, by alternating which side receives irrigation, the vines are tricked into thinking that there is soil water deficit, reducing their canopy growth, and berry size and yield reduction are less severe.

"It has enough water to support growth and photosynthesis," Zhang said. "Meanwhile, the drying part of the root zone generates hydraulic and chemical signals to trick the vine."

For the past two years, Zhang and WSU viticulturist Dr. Markus Keller have been evaluating a selection of deficit irrigation strategies, including partial root-zone drying, to try to determine when and where water is most needed, while improving productivity and grape quality.

They have focused on Chardonnay and Riesling grapes, which account for 75 percent of white wine production in Washington, applying several different irrigation strategies through the growing season for two years. They included treatments where no water stress was intended, different deficit irrigation strategies and partial root-zone drying. In all cases, soil water content was replenished after harvest and again before bud break if necessary.

Overall, the partial root-zone drying showed some clear benefits relative to conventional deficit irrigation strategies, Zhang said. The berries were bigger and the yield was heavier, and when compared to strategies that employ no water stress, the technique reduced the amount of irrigation water applied.

Partial root-zone drying resulted in similar water use compared to the other deficit irrigation trials, she said.

"It's definitely a lot less than having no water stress," she said. "The idea is that by using this technique, you still reduce the amount of water usage, compared with not applying water stress at all. At the same time, it can give you less yield and berry size reduction compared with conventional deficit irrigation treatments."

Ste. Michelle Wine Estates is collaborating on the research. Dr. Russell Smithyman, director of viticulture, said it's nice to have researchers' interest on irrigation in white varieties again.

"It goes back to trying to get the best quality and water savings that we can in the vineyard," he said. "What we're seeing is that we're maybe applying more water than we need to for the quality purposes. And with the semi-deficit, the partial root-zone drying, the nice thing about that is they're showing there are similar types of wines and maybe even better wines produced under partial root-zone drying."

Yun Zhang

Ste. Michelle completed irrigation research on Sauvignon Blanc in the 1990s, Smithyman said. "There, our focus was to see if water deficit at that time could control canopy growth. Since then, we've come to this philosophy of trying to stylize wine in the vineyard by manipulating canopy growth through irrigation or water additions," he said.

However, in the years since, most industry research has focused on red varieties.

"Now we're seeing the right way of watering white varieties. We're working to be more efficient, maybe use less water and still have high quality," he said. "We're very excited about this work in whites, and we look forward to these final results."

Another hypothesis the researchers want to study is whether partial root-zone drying will result in a slightly

Tip for growers

Dr. Letizia Rocchi's research at the University of Milan also showed that the timing of leaf removal in Chardonnay and Riesling grapes could be key to reducing the appearance of brown color in berry skin.

In Chardonnay, growers are advised to avoid any leaf removal in the morning and to remove leaves in the afternoon. Because Riesling is more susceptible to sunburn in the afternoon, growers should do leaf removal during the early morning, if necessary.

This research was carried out under the COST Action and InnoVine project, a European collaborative project involving 27 partners from seven European countries.

bigger canopy, better protecting white wine grapes from overexposure to sun. They will continue their study this year.

Sun exposure and skin phenolics

As part of this project, Dr. Letizia Rocchi, then a visiting doctoral student from the University of Milan, Italy, also studied the phenolics in Chardonnay and Riesling grapes in response to sunlight exposure under two irrigation regimes.

One featured full irrigation, where vines were irrigated to replace 100 percent crop evapotranspiration from fruit set to harvest, with no water stress imposed. The other employed deficit irrigation where vines were irrigated to maintain a moderate water stress from fruit set to harvest. She also evaluated berries exposed to direct sunlight and others totally shaded from sunlight.

Rocchi said high light regimes potentially stimulated a protection mechanism in the skin, increasing flavonols over the season. Flavanols also had their highest concentration in the sun; it could be speculated a possible involvement of these molecules in the photo-protection mechanisms of the berry, the study showed. Hot temperatures did not affect biosynthesis of flavanols, but could have had a role in significantly reduced flavanol formation in Chardonnay, especially at harvest, Rocchi said.

Flavonols, found in grape skins, contribute to bitterness and protect fruit from sunburn. Flavanols, meanwhile, polymerize — attach to each other to get bigger — and get more astringent as they enlarge. They also contribute to bitterness and to tannins in wine.

Overall, the research showed that overexposure of clusters to sunlight led to higher concentration of compounds that potentially elicit bitterness and astringency in the final wine.

No effects on flavonol and flavanol accumulation were directly due to the irrigation regimes in either cultivar (Chardonnay and Riesling). However, leaf area reduction as a consequence of water deficit, thus irrigation regime management, seems to indirectly affect the flavanols and flavonols by providing high exposure of fruit, also generating sunburn appearance.

The results suggest that when planting vineyards growers should consider orientation to avoid peak sun exposure; also, to avoid trellis systems that have excessive fruit exposure; to avoid severe leaf removal; and to manage the water deficit, thus irrigation regimes, to avoid an excessive canopy reduction, which could generate excessive cluster exposures.

Collaborating on the project were Keller, Smithyman, Dr. Jim Harbertson, WSU enologist, and Professor Osvaldo Failla of the University of Milan. The Washington Grape and Wine Research Program, the Washington Wine Commission and a WSDA Specialty Crop Block Grant Program funded the research. ●

Keeping LIMBS

Both Eastern and Western U.S. growers hedge their bets with mechanical pruning.

by Ross Courtney

ROSS COURTNEY/GOOD FRUIT GROWER

A bud grows behind a mechanical hedger cut on an apple branch.

While not exactly new anywhere, mechanical hedging is seeing a youthful surge on both sides of the U.S. as a way for fruit growers to improve fruit quality and produce a more consistent product.

Indeed, hedgers also reduce labor costs, but more importantly, they may improve canopy management, boost yields and help growers produce better fruit, not cheaper fruit, said Karen Lewis, a Washington State University regional extension specialist in Moses Lake, Washington.

"You do not buy this piece of equipment to save time and money," she said. "You purchase this machine to put into your toolbox for crop load management and canopy management."

Mechanical hedging uses motorized cutting arms mounted to tractors to shave trees into flat planes, making orchard rows more adaptable to harvesting platforms and other tools, improving worker efficiency and more evenly exposing fruit to sunlight, chemical coverage and evaporative cooling.

Trials

Researchers, for their part, have trials in all U.S. growing areas to study timing and techniques. And though Western growers typically lead the way in high volume innovation, Eastern growers have a head start in hedging. Lewis first saw a hedger in action during a European educational tour and learned that New York growers and researchers had been experimenting.

"You know in Washington, sometimes we are late," she told growers at February's International Fruit Tree Association convention in Grand Rapids, Michigan.

In fact, hedging was one of the major topics at the 2016 convention meetings and educational tours, coming up at nearly every stop. Speakers showed pictures of perfectly straight rows with harvesting platforms creeping their way through alleys within inches of the branches.

Hedgers have been around for decades, commonly used in grapes. As labor becomes scarcer and more

Above, a grower checks out a mechanically hedged app hedger at a cherry pruning field day in Prosser, Washin

ROSS COURTNEY/GOOD FRUIT GROWER

le block in early February at the Michigan State University Clarksville Research Station during a tour at the International Fruit Tree Association's annual convention. Below right, an upright gton, in January. The hedger's teeth are similar to what's seen on a handheld hedger, except each tooth is about 2 inches across at its base.

in line

PLAY
See a mechanical hedger in action at goodfruit.com/media

TJ MULLINAX/GOOD FRUIT GROWER

Hedging trials

Washington State University researchers are in the third and final year of mechanical hedging trials in apple, pear and cherry orchards to compare timings and techniques, as well as demonstrate the machinery for growers.

Here are some of the details of the experiments and results so far.

◆ Karen Lewis, a Washington State University regional extension specialist, conducted the apple trials. Fuji apples on a Nic 29 roostock planted in 2009 and trained to slender spindle. The Masilin strain of Cripps Pink apple trials were on Malling 9.337 rootstock on spindle trees planted in 2012. All apple blocks were already established.

Among the results after two years:

—In Fujis, hedging was 40 percent to 70 percent faster than hand pruning. Hedging also reduced shoot growth without reducing return bloom or fruit quality.

—In both varieties, hedging pushed fruit and vegetative buds in blind wood near the trunk.

—In both varieties, Lewis found no negative impacts on fruit quality from mechanical pruning compared to pruning by hand or a combination of the two.

◆ Dr. Stefano Musacchi conducted the pear trials in Bartlett pears on OHF87 rootstocks trained to spindle and planted in 2012 in Monitor, Washington. The block was set up specifically for hedging.

Among the results after only one year:

—A combination of mechanical hedging and hand pruning produced a greater proportion of large fruit, more than 70 millimeters in diameter, than hand pruning alone, and a smaller proportion of small fruit less than 55 millimeters in diameter.

◆ Dr. Matt Whiting led the cherry trials, which featured Tieton cherries on Gisela 5 rootstocks trained to UFO and planted in 2008 and already established.

Among the results after two years:

—Mechanical hedging was 29 times faster than hand pruning alone and 17 times faster than a combination of the two. ***—R. Courtney***

"The days of farming apple trees with permanent wood are over. That's over. It's obsolete."

—Leonard Ligon

expensive, tree fruit growers have looked for ways to mechanize that not only reduce the need for workers but also make tasks simpler with fewer rules and decisions.

A hedger makes a systematic approach simpler, using blades to shape an orchard canopy into a narrow "box," moving from three-dimensional trees to a two-dimensional wall, Mario Miranda Sazo, a Cornell University extension specialist in Newark, New York, said during his conference presentation.

Sazo began trials in 2011, hedging tall spindle trees back to 18 to 20 inches during dormancy and 22 to 26 inches in the summer. The canopy ended up about as wide as the herbicide strip around the trunks.

Rod Farrow, a New York grower and one of Sazo's collaborators, instructed conference attendees who are planting to keep their canopies narrow to maximize sun exposure and make way for mechanized tools such as hedgers as their trees age. Don't go beyond 3 feet, he warned. "Anything you plant, if you're thinking beyond 3 feet, it's obsolete, in my opinion," said Farrow, an association board member generally regarded as an early adopter of technology and high efficiency systems.

At Michigan State University, Phil Schwallier, district horticulture educator, began hedging trials in 2014 and spent the first two years demonstrating and practicing on a block of seven different varieties, most of the trees on Nic 29 rootstock, at different times of the year at the Clarksville Research Center. The tall spindle trees are 10 years old and had never been hedged.

"That's all we have to work with," he said in an interview after the conference.

Hedging is easiest when trees are trained from planting to accommodate hedgers, but the mature block will give him and his colleagues information about how to transition from hand pruning to hedging.

He will begin quantifying results this year and expects to see the best increase in good return bloom from bloom-time hedging and June hedging, some return bloom from a July hedging and no impact from August or postharvest hedging, he said.

TJ MULLINAX/GOOD FRUIT GROWER

Limbs fly as the teeth of a mechanical hedger tears through a cherry block during a demonstration by WSU researcher Matt Whiting.

"Next year we're going to really look at return bloom, return production, return fruit set," he said.

So far, he has found that sunburn protection is more effective when applied after hedging than before.

Out in Washington, Lewis and her WSU collaborators, Dr. Matt Whiting and Dr. Stefano Musacchi, are conducting trials with hedgers in apples, pears and sweet cherries.

Overall, Lewis determined the hedger combined with some hand pruning is between 40 percent and 70 percent faster in apples than with hand labor alone.

"The machine wins every time," she told the IFTA crowd.

Her research and demonstrations will continue throughout the 2016 growing season for the third and final year of her grant from the Washington State Tree Fruit Research Commission.

MORE TO SEE
Look for more IFTA Michigan tour coverage and photos online at goodfruit.com

Grower perspective

Some growers really liked the results.

Columbia Fruit Packers' Quincy and Ephrata orchards had 90 percent return bloom in their apples when they worked with Lewis and found the hedger made the work simpler for employees, said manager Ramon Gutierrez. He also liked the cost savings in labor.

"Running the hedger is so cheap," he said.

Leonard Ligon, a Traverse City, Michigan, grower uses a hedger to keep permanent limbs from taking over his tree in favor of fresh growth.

"The days of farming apple trees with permanent wood are over," he said. "That's over. It's obsolete."

Hedgers range in price from, say, $15,000-$25,000 and are available from several American manufacturers. Options include rotary or sickle bars with single or double arms and front or rear mounts. Some can be turned sideways for horizontal hedging, while others only work vertically. Sazo and Lewis work only with single row sickle bar hedgers in their trials.

The other perspective

Hedgers have drawbacks, of course.

For one, in Washington, hedgers can expose more fruit to sunburn if used too late in the summer. Meanwhile, hedger blades cause a whipping action that knocks

PHOTOS BY TJ MULLINAX/GOOD FRUIT GROWER

Above, an ideal mechanically cut limb will look similar to a hand pruner, however, some non-ideal cuts do occur, showing frayed or mashed tips as seen at left. Non-ideal cuts sometimes are caused because a limb may be growing at an off angle or does not properly align with the trimming surfaces.

apples off trees when used during fruit growth stages in mid-summer and sometimes damage limbs instead of cutting them clean.

Lewis also found the hedger blades harmed some fruit, but the farm managers she worked with put the damage estimate at about 5 percent, which they found acceptable and simple enough for a thinning crew to remove.

In fact, hedgers don't completely replace hand pruning. Most growers who use them said they send hand crews to clean up damaged wood and remove thicker, undesired limbs by hand. Lewis recommends establishing a structural architecture with loppers during dormancy to prune trees for desired crop load and prepare the tree for the hedger to later remove only the wood growers want to remove. They may have to repeat that every one or two years.

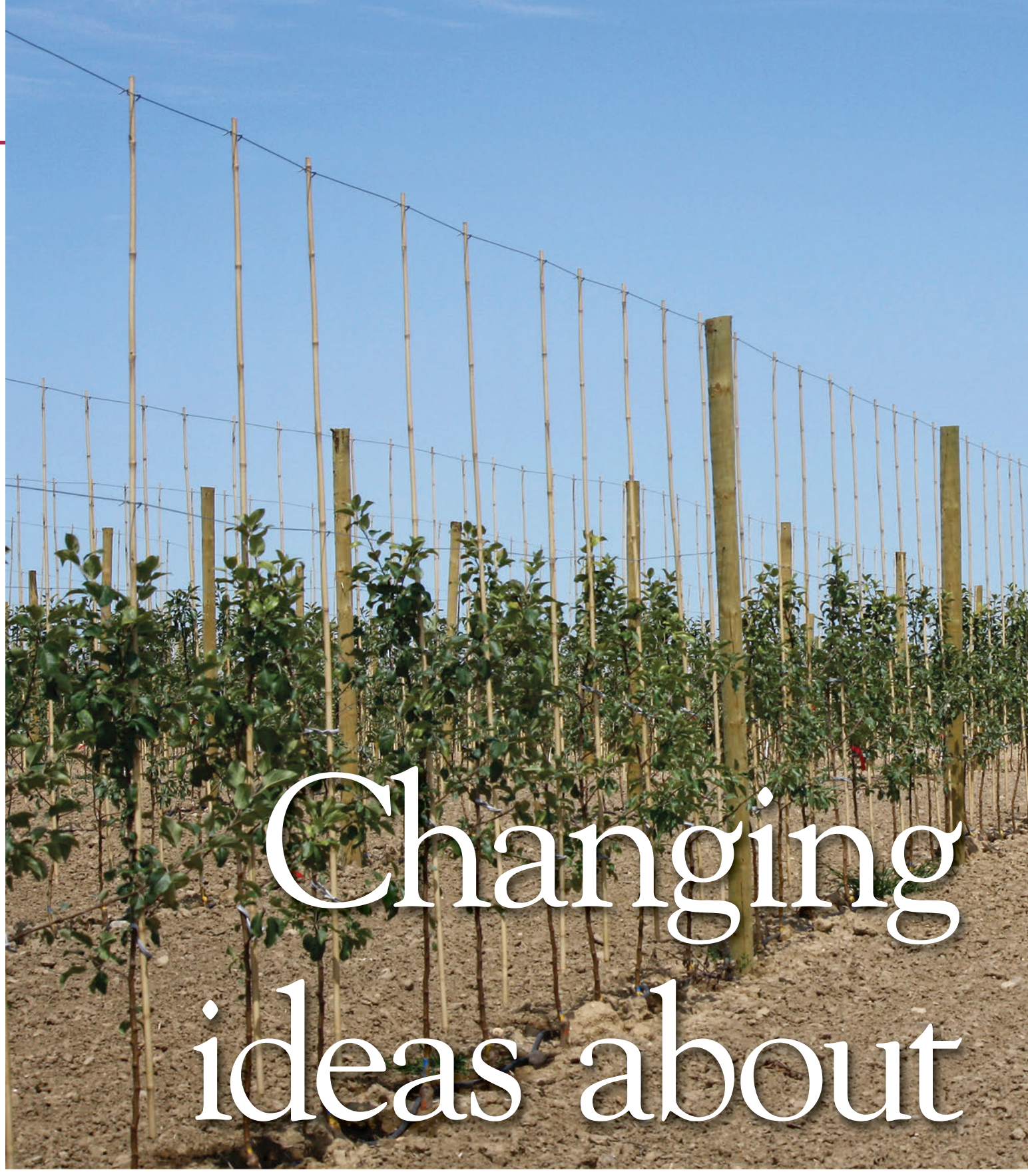
"The mechanical hedger can remove the right wood and right amount of wood if the trees are set up," she said in a follow-up interview. "Limb removal is a job for loppers."

Mechanical hedging, like loppers, also can spread fire blight. Lewis suggested growers not use hedgers during an infection period if the bacteria is in the block.

In northwest Michigan, Farrow advised one grower against hedging a block of SweeTangos because doing so would reduce the canopy size even further and potentially lower the yield. The trees on Bud 9 rootstocks in sandy soil at 4-by-12-foot spacing lacked enough vigor to provide adequate regrowth to refill, let alone increase, the canopy volume.

"Hedging isn't for every system," Farrow told him. ●

IFTA
Michigan conference



Shown a few months after it was planted in the spring of 2013, this high-density tall spindle orchard near Grand Rapids, Michigan, uses a drip-irrigation system.
RICHARD LEHNERT/GOOD FRUIT GROWER

Changing ideas about WATER

Irrigation becomes crucial tool even in well-watered East.

by Ross Courtney

Growers in the Eastern United States, with rain aplenty, once thought irrigation was just for their arid colleagues out West.

Not any more.

Today, with the push for high-density, precision orchards on shallower roots, growers in Michigan, New York and Pennsylvania more and more consider irrigation a must.

"Technically, it's not needed in the East, but if you want to be the best and minimize risk, it is," said Brett Anderson of Anderson Brothers Orchards in Sparta, Michigan.

Irrigation was a hot topic at the International Fruit Tree Association conference in February in Grand Rapids, Michigan. Several speakers called water control a crucial tool in spite of ample precipitation.

"We don't grow fruit in a desert," Anderson told growers at the conference.

For example, Grand Rapids receives 37 inches of rain every year. The desert hills of Wenatchee, Washington, get only 9 inches.

But if growers want to bump fruit quality from fancy to extra fancy and increase their size, irrigation will pay off quickly in the East, Anderson said. A drip irrigation system may cost an average of $2,000 per acre, but just a 10 percent boost in yield could mean $1,000 extra in profit per acre in one year alone, he said.

He recalls in 2008, the year after a dry summer, talking with consulting customers who complained their crop didn't set as well as their neighbors. By and large, those customers lacked irrigation.

"The one factor I saw was irrigation," he said.

Researchers in the East have been trying to convince growers of the necessity of irrigation for decades, said Ron Perry, professor of horticulture at Michigan State University.

ONLINE

The Cornell University apple-specific irrigation model can be found at newa.nrcc.cornell.edu/newaTools/apple_et.

"We keep telling the growers it's necessary," he said. "A lot of them don't think so, and then they don't get the return bloom."

It's most important in the northern part of the state, where soil is sandy, he said. Perry estimates that about 40 percent of tart cherry growers and more than half the grape growers in northwest Michigan use micro-irrigation. Southern Michigan apple growers, with fewer high-density orchards, more easily get away without it, he said.

Perry recalls trials from 1984 that showed irrigation brought a 20 percent to 25 percent increase in yield and return bloom and a 15 percent to 20 percent increase in fruit size.

Irrigation is becoming more important in the East as growers switch to high-density trees on dwarfing rootstocks with shallower root zones, Alan Lasko of Cornell University told growers at the IFTA conference. To help them, researchers have developed a mathematical irrigation model specific to apples in Eastern climates, because Western guidelines don't always add up, Lasko said.

Irrigation models normally use the Penman-Monteith equation, which estimates the effects of weather on plant water loss, using the water use of grass as a baseline. Modelers then assume their plant — in this case an apple tree — uses a consistent fraction of that amount, called a crop coefficient. That seemed to work in desert climates such as eastern Washington and California's Central Valley, but not so well in upstate New York, he said.

Using the new Cornell model, trials in the Hudson Valley of New York showed a decrease in fruit stress and increase in fruit size compared to no irrigation, Lasko said.

Lasko and his colleagues have posted the tool online in conjunction with the Northeast Regional Climate Center. It asks growers to choose a nearby weather station and then input some specifics about the orchard, such as the age of the trees, to receive irrigation information. ●

IFTA
Michigan conference

Help for GRO both big and small

Third-generation Maine grower finds conference helps with growing U-pick business.

by Ross Courtney

Trellises, growth regulators and Malling 26 rootstocks are crucial components for Libby and Son U-Picks in Limerick, Maine — just as much as live music, smoothies and restrooms with running water.

That's why Aaron Libby, 32, attended the February International Fruit Tree Association conference in Grand Rapids, Michigan. Small growers need to learn the latest science, too, he said.

"Our production of the trees doesn't vary much from the large grower of Michigan or Washington or New York," he said.

Libby is a politically savvy grower who serves on the executive committee of the Maine Pomological Society and served in the Maine House of Representatives from 2010-2014 as a Republican. He did not seek re-election.

Libby, a third-generation fruit grower, is also the son in Libby and Son U-Picks, a business that has shifted from strictly wholesale and traditional varieties to agritainment. U-pick makes up about 90 percent of the income for the farm, nestled in the rolling hills about an hour west of Portland, Maine.

Libby has musicians playing most of the open hours and boasts of his fully plumbed restrooms. His family serves homemade doughnuts and just bought a new smoothie machine. Customers come to his family's farm for fun, not groceries.

Still, they like the high-density systems where apples are easier to reach, Libby said. "The customer, when they

WERS

"The game is always changing, so you have to change with it."
—Aaron Libby

come, they're there to have that experience, but they also want to be able to find the fruit easier."

Thus, Libby has to keep up with the new techniques of precision orchards just as much as vast commercial growers. They also do some small-scale wholesaling.

Libby and his parents, Michael and Mary Libby, bought a portion of Three Hills Apple Orchard in 1999 after the farm went under due to low prices and three straight years of hail damage. The farm had mostly Cortland and McIntosh apples planted on M.7 rootstocks in the 1980s with 16-foot spacing. Aaron was in high school at the time.

They took the youngest of the apple blocks and started U-pick right away. They cut many of the McIntosh trees and planted 18 acres of highbush blueberries, adding new apples over the years. Today, they have 20 varieties, with the crowd-pleasing favorite Honeycrisp among them.

"We very much changed the outlook of what the trees look like," he said.

Though his family still has demand for Cortland and McIntosh apples, most of their trees are new now. They replanted the trees to 6-foot spacing or less with M.26 rootstocks. Their newest block is 3 1/2 acres of high-density, trellised tall spindle trees with 11-by-3-foot spacing.

Libby attended the IFTA conference eager to learn about multiple-leader fruiting walls, growth regulators and fire blight risks of dwarfing rootstocks to find the next technique to make the Maine orchard more attractive and efficient.

"The game is always changing, so you have to change with it," he said. ●

Better ways to IRRIGATE

Lee Kalcsits

WSU researcher offers tips for reducing water use.

by Ross Courtney

When we talk about water in fruit country in the West, we usually mention those things that are key to irrigation: snowpack, reservoir capacity and storage, the elements of supply.

The 2015 season is a stark reminder of why, as drought reduced water availability across the West and forced curtailment of irrigation in some orchards.

But Dr. Lee Kalcsits of Washington State University took a few minutes during the Washington State Tree Fruit Association's meeting in December in Yakima, Washington, to discuss demand, offering practical approaches to limit or reduce water use in an orchard.

After all, sooner or later, there will be another drought similar to 2015, said Kalcsits, an assistant professor of tree fruit physiology at WSU's Tree Fruit Research and Extension Center in Wenatchee, Washington.

"They're going to come along again," he said.

So, here are Kalcsits' six tips for reducing water use in an orchard:

—Maintain a weed-free strip. Weeds compete for water and nutrients with tree roots. The shallow root zones of dwarfing rootstocks give those weeds an advantage. Give your trees about 3 to 4 feet of weed-free buffer, which should be plenty for dwarfing rootstock roots.

—Use mulches to hold in moisture and reduce soil temperature, as well as to improve the overall nutritional quality of your ground. Good mulching techniques can reduce a tree's water demand by 25 percent, earlier studies have shown.

—Mow cover crops. Growing grass between rows is important for keeping down dust and for other practical reasons, but the more leaf area of a cover crop, the more evapotranspiration occurs and the more water it uses. Studies have shown cover crops can consume more than 1 acre-foot of water. Keep it short.

TJ MULLINAX/GOOD FRUIT GROWER

A weeder is pushed through a block of pears, mulching and cultivating the soil around the base of the trees. Maintaining a weed-free buffer helps minimize competition for water and nutrients.

—Water accurately. As much as possible, target irrigation only to the spots where the trees, and only the trees, will use it. That means drip irrigation, something the industry has been shifting toward for many years, Kalcsits said.

—Use an irrigation scheduler. He suggested WSU's Ag Weather Network, but other companies have designed similar phone apps. "It takes weather data and environmental data, and it tells you how much water it thinks the tree is using," he said.

—Use soil moisture sensors. There's a variety of models, but they all measure water and changes in water over time and offer a way to schedule irrigation even more precisely. If you use a set irrigation schedule with no variation, you might irrigate too little or too much at different points in the season. ●

Ambrosia SURGE

Marketing minds meet their apple match with increasing number of varieties.

by Wendy Stewart

Apple industry marketing experts are feeling pressure to find markets for an Ambrosia crop that will more than double in British Columbia, Canada, in the next five years. That growth pits Ambrosia against new club varieties and existing varieties for valuable store space.

The dramatic increase in the Ambrosia crop through new plantings, along with the growing number of new club varieties and growing pressure to market the fruit, comes as worldwide apple consumption remains flat.

British Columbia growers produced 650,000 cartons of Ambrosia in 2015, Lance McGinn, BC Tree

TJ MULLINAX/GOOD FRUIT GROWER

Ambrosia is a fairly recent variety, emerging from a chance seedling in an orchard in British Columbia's Similkameen Valley in the early 1990s.

"Retailers have many new apple varieties to choose from these days. They are only going to carry those that perform for them — those that make them money. If they don't perform they are out the door."

—Lance McGinn

Fruits director of sales, told more than 200 growers and industry representatives at February's B.C. Tree Fruit Horticultural Symposium in Kelowna, British Columbia. By 2020, Ambrosia production is expected to be 1.5 million cartons, a 131 percent increase.

"The challenge is how to move double the volume of production, how to get it to stand out," McGinn said. "We have to back this variety with marketing funds to develop programs that help the variety perform for our customers. We must focus on the consumer and create excitement around Ambrosia."

Some markets offer a bewildering range of choices. McGinn said there were 17 varieties of apples on display in a market in Berkley, California, recently.

"Retailers have many new apple varieties to choose from these days. They are only going to carry those that perform for them — those that make them money. If they don't perform they are out the door," he said.

McGinn said retailers want in-store demonstrations, display contests, point-of-sale materials and flier activity to help draw attention and move product. He is confident his agency will be able to sell the projected increase in Ambrosia volumes.

"We have to find ways of pulling market share away from current mainstay varieties as well as new, highly funded club varieties such as Cosmic Crisp, Envy, Jazz, SweeTango, Opal, Kanzi and many other new emerging varieties," he said. "We have to defend our existing turf and defend our varieties already in the market."

McGinn said there are untouched markets and room to grow in the eastern United States and Canada as well as elsewhere in the U.S., where BC Tree Fruits can make a strong stand. Marketing officials also plan to generate more demand by breaking into new markets and creating more awareness for Ambrosia.

Having a marketing strategy that's coordinated, strategic and profitable is critical to moving product where consumers have a range of choices, Chris Willett, Washington-based marketing manager for international produce company ENZA, a subsidiary of T&G Global, told growers.

ENZA manages the New Zealand varieties Jazz, Envy and Pacific Rose through its managed variety program, made up of some 50 independent Washington growers with operations ranging in size from 60 acres to over 5,000 acres. These growers currently produce 2.2 million

cartons of apples in the state and expect to produce up to 5 million cartons by 2020.

Willett says the program offers increased farm-gate returns, exclusivity, consistent quality and improved planning around supply and demand, as well as brand and promotion. Some varieties have a limited window in the market, which helps control quality and focus marketing efforts.

"Our go-to-market strategy is coordinated and strategic," he said. "There are 14 varieties coming to market, and that number will continue to grow. There's a lot of fruit coming into the system."

New club varieties have catchy names like Lady Alice, Piñata, SweeTango and Rockit. The name is matched with an equally engaging logo and graphic treatment that's used on the apple carton, large in-store displays, company trucks, transit shelter ads and graphic wraps on transit buses.

Marketing costs for managed varieties can range from a fixed cost per box to a percentage of the sale price or a combination of levies. Willett said marketing costs for ENZA is about 2 percent to 8 percent per box.

Since 2001, B.C. Ambrosia growers have paid a per-carton levy to fund research and promotional activities supporting Ambrosia as a premium variety. Growers are considering a five-year renewal of the levy, which is proposed to drop from $1 to 80 cents per carton of fresh-market Ambrosia apples.

"Our go-to-market strategy is coordinated and strategic. There are 14 varieties coming to market, and that number will continue to grow. There's a lot of fruit coming into the system."

— Chris Willett

"When you look at the cost of some of the (marketing) programs, it's kind of overwhelming," McGinn told growers as he outlined his marketing plan for Ambrosia. "Our challenge is to work toward changing consumers' buying trends, changing consumers' minds, changing consumers' tastes, educating the consumer and creating more awareness for the variety.

"Ambrosia is a premium variety with a premium price. U.S. retailers have told us B.C. Ambrosia tastes better and is better quality. We have to get people interested," McGinn added.

That means encouraging consumers to taste the apple. According to the findings of an Oppy/Lux Insights study cited by Willett in his presentation, 99 percent of 900 survey respondents said that when trying a new apple, taste is somewhat important or very important. The texture of the apple is important to 96 percent of respondents, while the importance of health benefits (71 percent), where the apple is grown (71 percent) and the different uses of the apple (57 percent) all fall off significantly.

Marketing specialists on both sides of the border will be using all of their promotional savvy to ring up apple sales for grocers, growers and consumers, but will it be profitable?

"Will market returns stay at current levels when overall Ambrosia tonnage doubles in B.C. and larger volumes are being produced in Washington state?" McGinn asked. "The simple answer is probably not. But how much will returns change when the crop volume doubles? It all depends on how effective we are at creating more demand." ●

Wendy Stewart is a freelance writer based in Penticton, British Columbia.

Rising costs HIGHER

Modern orchards and new technology can potentially reduce production costs.

by Geraldine Warner

The cost of producing apples has been rising faster than expected, largely because of increasing labor costs, but costs can be offset by higher yields, Tom Auvil, research horticulturist with the Washington Tree Fruit Research Commission, told growers at the Washington State Tree Fruit Association's Annual Meeting in December. The higher the yield, the lower the production cost per unit.

"Today, we have a number of companies that have successfully accomplished annual production of 100 bins per acre on Gala, so they're managing their costs very well," he said. "This is one of the most exciting times in the industry. There are a lot of different production systems that give high yields and a high-value product."

Besides being more productive, modern systems can accommodate labor-saving technology such as platforms and mechanical-assist equipment. There's the potential for robotic harvesting in the next few years, but it will not work in orchards where the trees have long, whippy limbs, Auvil warned. "It requires a whole different paradigm on how we prune and train the canopy to maximize the value of the robotic harvester."

Adopting new technology does not necessarily mean ripping out the whole orchard, Auvil stressed. Grafting can be a viable solution for switching to a different variety or a new production system very quickly.

However, growers are easily deterred from adopting new technology if they're uncertain about how successful it will be. Even little quirks or small problems can create difficulties with acceptance.

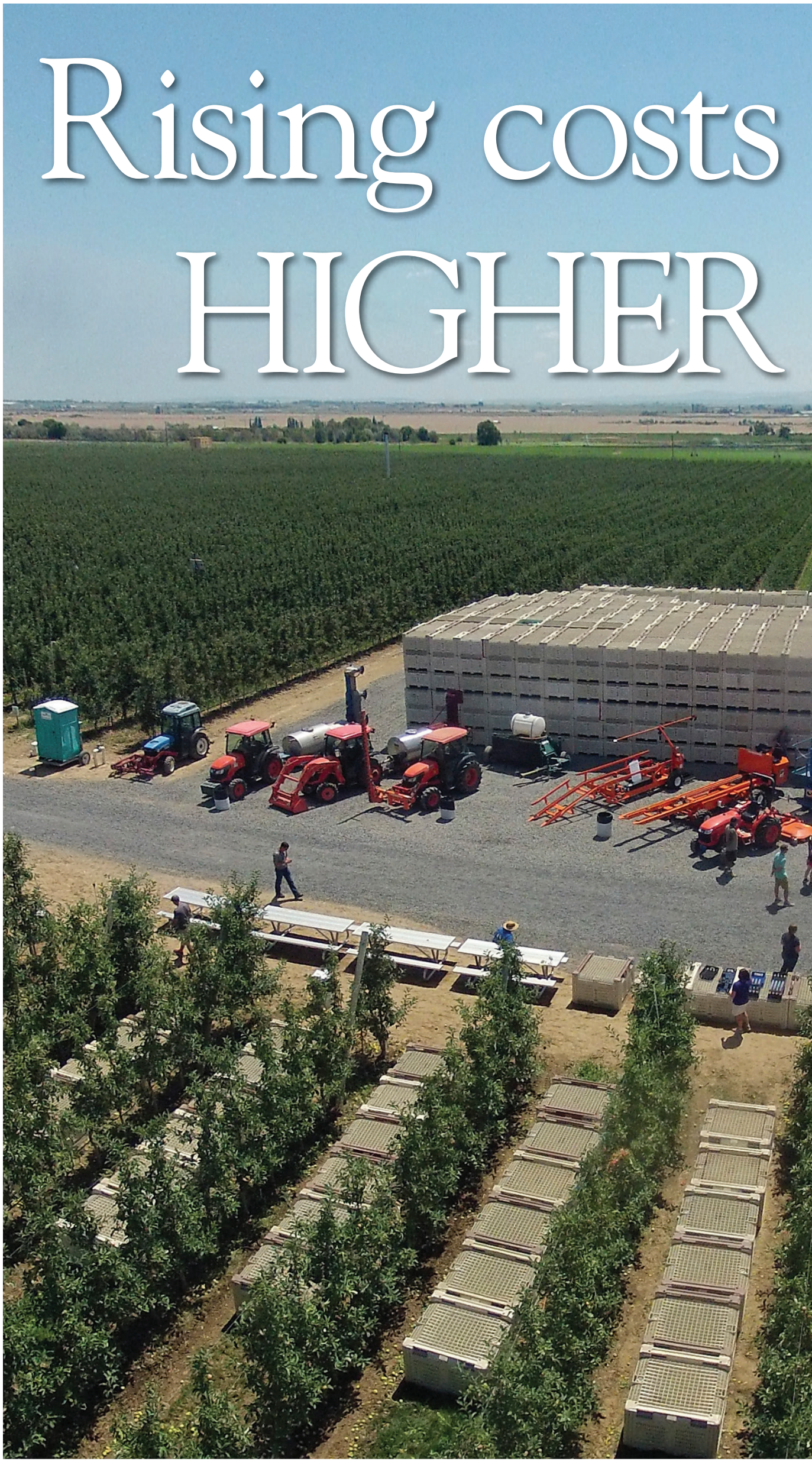
"I have found that one coffee-shop failure discussion needs about 10 success stories to overcome a minor challenge," he said.

For growers concerned about the cost of implementing new technology, Auvil said that new ideas can be introduced gradually. For example, in his own orchard he took five years to switch from wooden to aluminum ladders back in the 1970s.

"When we look at harvest tools, we never bought them all in one year," he said. So when we start looking at really expensive tools in the future, we don't have to equip the whole farm all at once. As a matter of fact, the more expensive some of this stuff gets, we need to make sure we know how to make it work really well before we buy or rent the second one.

Orchard renewal

Clark Seavert, agricultural economist with Oregon State University, said that when growers plant or renew an orchard, they tend to focus too much on the cost and not enough on having the



Harvesting, pruning, trimming and bin removal machines like these displayed during an IFTA tour last summer in Washington can

offset by YIELDS

TJ MULLINAX/GOOD FRUIT GROWER

help growers reduce labor, improve orchard production and decrease costs.

TJ MULLINAX/GOOD FRUIT GROWER

With today's modern orchard systems, yields of 80 to 100 bins per acre are not uncommon.

"This is one of the most exciting times in the industry."
—Tom Auvil

varieties and training systems that will generate the fruit prices and yields they will need to be successful.

The three key factors in successful orchard renewal are (in order of importance): fruit price; yield (how much and when); and costs of establishment and production.

Thirty years ago, a yield of 40 to 50 acres was considered good, Seavert said. Even five years ago, yields of 75 bins were impressive. Now, yields of 80 to 100 bins per acre are not uncommon. However, costs have also risen, with establishment costs as high as $45,000 per acre, and margins are getting slimmer.

There are two different business strategies growers can adopt. One is playing to win, with the focus on rewards, and the other is playing not to lose, with the focus on measuring risk. A grower might fall into both camps at different times, depending on what they're trying to accomplish, Seavert said.

Playing to win involves profit maximization and adoption of new technologies. Those playing not to lose will take a wait-and-see approach, which is not necessarily a bad thing, he stressed. If there's money to be made, both of these groups will make money, but those playing to win will make more.

Seavert recommended that growers develop a five-year business plan. Nowadays, a 10-year plan is too long range because of how quickly things change. The plan should include specific goals, so progress can be monitored. For example, a goal might be to increase gross revenue to $25,000 per acre, or to increase net farm income by 5 percent annually, or to improve labor efficiency by adopting new technologies.

Although growers have made enough money in recent years to finance new projects and purchases without bank loans, Seavert said they should use financing appropriately and not short their working capital.

He recommended planting varieties that fill gaps in the harvest window in order to use labor and machinery efficiently, and said growers should be preparing to accommodate fully automated harvesting. ●

ONLINE
Clark Seavert, agricultural economist with Oregon State University, and his colleagues are developing a suite of economic, financial and environmental decision-making tools for growers, which can be found at www.agbizlogic.com

GERALDINE WARNER/GOOD FRUIT GROWER

Mechanical orchard platforms can increase labor efficiency for tasks like pruning, but not all workers are sold on the idea. "They say, 'Give me a ladder and I'll do it myself,'" said grower Mike Robinson. "It's hard to get people enthused about working with platforms."

How to attract WORKERS

Workers go where they can make the most money.

by Geraldine Warner

The best way to attract and retain workers is to have an orchard people want to work in, and that means orchardists need to grow fruit that is easy for workers to pick and allows them to maximize their earnings.

That was the agreement among a panel of growers during the Washington State Tree Fruit Association's meeting in December.

"You've got to grow big red apples," said Dan Plath, orchard manager at Washington Fruit and Produce Company in Yakima, Washington. "Coincidentally, that's the thing that's going to make you the most on the revenue side and harvest efficiency.

"For most varieties, we target size 80," he added. "If you grow 80s, you're going to have people who want to come pick them. If you miss your target by two or three box sizes it's going to take more apples to fill the bin, and, no matter what you pay, people don't want to do that."

Mike Robinson, a grower and general manager of Double Diamond Fruit Co. in Quincy, Washington, said if a variety can be harvested in one or two passes rather than three or more, the grower will have more luck finding workers. So the orchard must be kept updated with new, highly colored strains and modern training systems.

Al Robison, who farms 115 acres of apples, pears and cherries in Chelan, Washington, said workers are informed about what they can pick in any given block. How much money they can make is important, which is why simple, vertical orchard systems are an asset in obtaining labor.

Plath agreed. "When you show someone an 8-foot ladder, they're more likely to come to work for you than if you show them a 10-foot ladder."

Robinson said, given a choice between fighting through big thick trees to pick the fruit or working on a fruiting wall system, pickers are going to go where they can be the most productive. "It doesn't matter how nice I am or how nice my foreman is, if they can pick more bins."

Crop load management

Precision crop load management is an important tool for maximizing harvest efficiency, Robinson said, though it can be difficult to get employees to count buds properly and collect the data.

"What I really need to know is how many buds are there, and I need to think about the distribution of those buds in the tree," he said. "Trees that have been pruned carefully and have fruit that's spaced out and is size 80 are a lot easier to pick, and the pickers make more money."

Plath said precision crop management has had more impact than anything else on the profitability of Washington Fruit's farms in the past five years. It is easy to do on small trees planted at a density of 1,000 to 1,500 trees per acre, where each tree has, say, 150 apples. It's been harder in old Red and Golden Delicious blocks

"When we look at any job description and talk about what the market is for that job description, we don't want to pay the 99th percentile, but we want to pay above average."

—Dan Plath

where workers might be counting 1,000 to 1,200 buds per tree but, even there, it has made it easier to attain consistent high yields and larger fruit.

Mechanization

Washington Fruit has a number of mechanical orchard platforms that it uses for pruning, thinning and tree training, and continues to buy more each year because of increased labor efficiency. The company also has one platform that can be used to harvest fruit, Plath said, but he hasn't seen enough of a gain in efficiency to justify buying more. However, others in the industry are buying platforms and making them work.

Robison said, being a small grower, he's not an early adopter and is waiting for others in the industry to perfect mechanization first.

Robinson said he's sometimes made the mistake of adopting technology too quickly. He figures mechanical-assist technology can improve labor efficiency by 25 percent at most, and it doesn't fit every situation.

"The people making it work have big acres of 2-D trees that are pretty thin and very consistent," he said. "Those companies can get a big enough group of people that can run four or five platforms and can supervise them together and run multiple shifts. It makes sense."

Management is the key to implementing precision crop management, he emphasized. "It takes a ton more management to really make it work well. A lot of us have been working pretty darned thin on management people over the years. It's common to have a 300-acre farm with one manager and 15 tractor drivers and that's it. Somebody's got to be doing the counting, and somebody's got to be doing the thinking and telling people how to use the machinery. If you don't have the supervisors, it's hard to do."

Another problem is that local workers want no part of the teamwork that's involved in working from a platform, he added. "They don't want the job. They say, 'Give me a ladder and I'll do it myself.' It's hard to get people enthused about working with platforms."

H-2A

H-2A guest workers are usually willing to give it a try, however, and Robison said hiring H-2A workers is likely to be part of everyone's strategy in the future as the traditional labor force shrinks.

Plath said that last year H-2A workers made up about 30 percent of the company's green-fruit thinning and harvesting crews.

There might have been some reluctance in the past to hire H-2A workers because of the higher wage rate and the fact that domestically recruited workers had to be paid the same rate, Plath said. Now, H-2A workers are so widely used that a grower has to pay that rate to attract workers anyway.

Robinson said he's been hiring H-2A workers for more than 10 years. They made up 60 percent of his crew during last year's Gala harvest, and he thinks the proportion will rise to 80 percent this year, just to be sure he has a crew where and when he needs it in order to get the crop picked.

Plath said his company hasn't yet put H-2A workers in supervisor roles, but it has elevated them to driving tractors and spraying,

"We have them here for a longer period of time, and we get people to come back, so you can afford to make the investment to train people to do that," he explained.

Robinson said he's been amazed by the skill level of H-2A workers. Two who work for him have their own orchards in Mexico. "Those guys know what they're doing," he said. "There's some sharp guys — and gals."

Sharing labor

Plath said Washington Fruit moves H-2A crews around between its various ranches, depending on where they're most needed. Robinson has had shared H-2A contracts with growers at the same warehouse, allowing them to work for different growers at various times during the season. However, he's careful to send them as entire crews with tractor drivers and supervisors to make sure individual workers don't run off and fail to return. One time, he had a shared contract with a blueberry grower. The crew went to pick blueberries during his slow time in August. They went off in a good mood but returned very upset five days later than he needed them.

Robison said shared contracts usually involve some sacrifice from both parties and growers need to be aware of the wage scales and the supervision provided by the other growers. "You could lose your folks, or they could lose theirs," he warned.

None of the speakers saw the H-2A program as a long-term strategy, but Plath said it's the best option for now.

"Maybe we could come up with a better plan, but I think any time we've invested in housing we've been able to pay for it that same year. It's less expensive than not getting your crop picked or even not getting the crop picked at the right time."

Robinson said he's hoping the long-term solution will be totally automated harvesting technology, so he can convert his H-2A housing to homes for his permanent workforce and hire just a few people to drive the machines.

He does not think H-2A is a long-term strategy because of the changing demographics in Mexico. People are having fewer children, and there's less financial pressure to come to the United States to work.

Asked how best to compete for the limited labor available, Robinson said that, in addition to trying to grow consistent crops and offering a consistent flow of work, he makes sure he chats regularly with the workers to find out if they have any problems or complaints and to make sure they're being treated well.

Plath said money talks. "When we look at any job description and talk about what the market is for that job description, we don't want to pay the 99th percentile, but we want to pay above average."

Robison said housing is the most important factor in attracting labor, followed by money. Growers need to know what the labor market is in their area and what their neighbors are paying. Reputation is also important, along with the work environment, good communication and full-season employment. ●

Passing on the FARM

Farm family coach offers advice for succession planning.

by Dave Weinstock

One of the hardest things many growers face is the moment they start thinking about retiring and passing the farm to their children.

Elaine Froese, a farm family coach from the small town of Boissevain in Canada's Manitoba province, calls it succession planning: devising a long-term plan to pass farm ownership from one generation to another.

It's a problem that isn't news to those in agriculture. Of 2.1 million principal farm operators in the United States in 2012, roughly one-third are age 65 and older, and 61 percent are age 35 to 54, according to the National Agricultural Statistics Service's 2012 Census of Agriculture. Just 6 percent are under age 35.

"There is a tsunami out there — three decades of backlog of farm people who know they need to plan succession and are avoiding conflict by not doing it," she said.

Speaking at the Mid-Atlantic Fruit and Vegetable Annual Convention in Hershey, Pennsylvania, Froese (pronounced *phrase)* explained the difference between coaches and counselors. "I'm not a counselor," she said. "Counselors are for recovery."

Rather, she said, "I help people to find the clarity of their expectations, the certainty of timelines and agreements and a commitment to act."

Succession planning is a crucial problem, she said. Everyone dies, and people need to have plans in place to mitigate times of crisis, whether they are caused by death, divorce, disability or conflict.

"People are not paying attention to their age," she said. "They must have plans in place to protect their legacies."

Overcoming the resistance generated by not knowing how to start the conversation is one of the biggest challenges posed by succession planning. Froese said she helps farmers to be clear about what they want and when they want to do it and then put it into action, whatever "it" is.

"'Someday' is not a day on my calendar," she said. "Family discussions on farm succession don't work like Roundup. It's an ongoing journey."

Froese said she has seen some huge family debates over the issue of the amount of money the farm can afford to pay to the founders when they leave the operation.

Farm coach

Elaine Froese brings years of experience to her work. Raised on a mixed cattle farm, she married a seed grower named Wes and worked as an extension home economist from 1978 to 1984. She taught Manitoba farm families about financial management, communication, nutrition, community development and sewing.

Over the last 10 years, Froese has coached more than 600 farm families about solutions to family conflicts, divorce, adding children as partners and one of the thorniest problems in modern farming: passing farm ownership over to children and partners.

For more information, visit *elainefroese.com*.

COURTESY ELAINE FROESE

"Family discussions on farm succession don't work like Roundup. It's an ongoing journey."

—Elaine Froese

Lifestyle needs — all the bills the farm used to cover for the family's living expenses — need to be determined well in advance of any succession event.

In the absence of life savings or an ongoing retirement plan, one of the first things to determine is how much it costs to run the household each year. Froese suggests using a program like QuickBooks or asking a bank or credit union for living expense forms.

"Experts recommend that the older generation have at least 50 percent of their retirement income from outside investments and nonfarm related income," she said. "If you are a young farm family, get a financial planner soon, so that you'll have nonfarm income streams later on."

Farm couples should plan well for the two or more decades they will live after they leave the farm.

Shifting power, wealth

With new partners and shifting equity, two key considerations are the loss of wealth and power. Along with that is the question of who will be the decision maker, and when does this power shift occur.

"Where there was only one decision-maker before, now there are two managers," she said. "This can be a good thing because critical decisions can be made in a timely manner when one of the managers is inaccessible."

Growers should be prepared to share the farm's books, she said, because it is critical for everyone in the farm business to know its income stream and what it is capable of generating.

They also should be prepared to overcome resistance to discuss the transition. "The more planning people can do while they are alive — with warm hands rather than cold ones — the more certainty they can create about the present," Froese said.

In this area, she speaks from experience. She and her husband gave their son some land so he could use it as leverage to buy his own property.

Make it a combination of gifting and buying, she said. "Who can afford to buy you out at 100 percent of the farm's value?"

Questions to answer

A good goal to aim for is to begin granting farm ownership and equity to the next generation before they are 40, she said.

The first step in this process is to decide future roles. "Create a role map for yourself, for your place within the family, your work and your community," Froese said. "At age 60, can you be an employee again? When you are 70, can you become a mentor?"

It's an issue of the heart. "Who am I if I am not the founding partner anymore?"

A grower should determine what a spouse or partner wants and if they are aligned in their goals, and then, what successors want, she said. And finally, they should determine the timeline for this process. ●

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Nachurs Alpine Solutions of Marion, Ohio, announced its newest line of high-efficiency fertilizers: Aqua-Tech. Aqua-Tech is a family of products that are specially designed for application through fertigation systems.

Poor quality irrigation water may bind to phosphorus, making it unavailable to the plant, and even worse, may cause scale build up in irrigation lines causing clogging of emitters.

Nachurs Alpine Solutions answers these water quality challenges with the addition of polyamine technology to phosphorus-containing fertilizer in the Aqua-Tech family. Greg Bame of Nachurs' technical services said the technology prevents cations from binding to phosphate, resulting in the reduction of occurrences of emitter plugging and the increase in plant nutrient uptake.

For more information, visit *www.nachurs.com.*

EPA approves new miticide

Magister SC has received federal EPA registration to control mites in almonds, cherries, Christmas trees, non-bearing tree fruits, and nuts; and powdery mildew in cherries, the Gowan Company announced. Magister was also approved in California for almonds and cherries in January.

Magister SC is a broad-spectrum miticide active against spider mites (*Tetranychidae*), broad mites (*Tarsonemidae*), flat mites (*Tenuipalpidae*), and gall mites (*Eriophyidae*). Gowan says Magister SC provides excellent contact activity against all stages, including eggs and immature and adult mites.

More information is available at *www.gowanco.com.*

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Last Bite

More Young Growers at **goodfruit.com/yg**

Nick Mackay

grower / *Pasco, Washington*

age / *23*

crops / *Wine grapes*

business / *Vineyard manager at Mercer Canyons*

family background / *After originally pursuing a degree in history and law, Nick pursued a more hands-on career through Washington State University's viticulture program. He was hooked after the first couple of weeks of classes. Mercer Canyons, south of Prosser, Washington, hired him right out of college.*

How did you get your start?

"My grandpa was a dryland wheat farmer in Kahlotus, Washington, and farming's pretty much been part of my family. In college, I spent my summers working on my dad's small 12-acre estate vineyard on Red Mountain. That's how I got my introduction into vineyard work, about when I was 12 years old.

What are your main tasks?

"When I started at Mercer Canyons, I was basically responsible for irrigation. With it you can control the canopy and grape quality by knowing when to stress the vines by restricting water at the right time. Also to control active growth after verasion time, which is after the berries start changing colors and begin accumulating sugars.

What are some of your challenges right now?

"Controlling water delivery on 2,000 acres of vines with very limited access to soil moisture probes and not having much of a crew that is able to perform pressure bomb testing and things like that. It comes down to something I call roadside viticulture — essentially driving around in your truck and probing the ground yourself and making decisions based off your own findings. Recently I've been promoted to take on all of the hand-labor crews, which ups my responsibility from about seven to eight guys to about 100.

What would you tell younger growers?

"After changing degrees toward viticulture, the work I put into obtaining the degree was more applicable to what I'd be doing after college. I hear so many stories about folks having a degree in a particular field, but they can't find a job anywhere. If you go through the viticulture and enology program and you're motivated and ready to use the knowledge you've learned — especially in the Washington industry — then you're going to find a job, and you're going to do great in it.

"(Viticulture classes) ...provided me a foundation to come out of college and get a job.

by TJ Mullinax

More from this interview and other Young Growers at goodfruit.com/yg.

Play

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Apple growers need to do many things early season at the same time to ensure quality fruit at harvest. Four of the most important early seasons tasks are 1) maximizing calcium uptake into the developing fruit, 2) improving fruit size 3) managing terminal growth and 4) managing tree fruit load. Sysstem Cal from Agro-K can improve the performance of the most important PGR tools used for sizing, thinning and managing terminal growth that are critical to maximizing fruit quality and grower profitability. **Now you can do all these critical tasks while also supplying systemic calcium during peak demand. Sysstem-CAL®, Agro-K's foliar calcium is the perfect apple PGR tank-mix partner.**

Effects of Sysstem-Cal & Maxcel on Size of McIntosh Apples

Treatments		
Petal fall	**10 mm**	**fruit wgt (gr)**
Untreated Control	Control	156 c
Carbaryl 1 lb/100 gal + NAA 7.5 ppm	Carbaryl 1 lb/100 gal + MaxCel 100 ppm	191 b
Carbaryl 1 lb/100 gal + NAA 7.5 ppm + Sysstem-CAL 2 qts/100 gal	Carbaryl 1 lb/100 gal + MaxCel 100 ppm + Sysstem-CAL 2 qts/100 gal	255 a

Trial conducted by Duane Greene, University of Massachusetts 2010

Effects of Sysstem-Cal on Size of Gala Apples

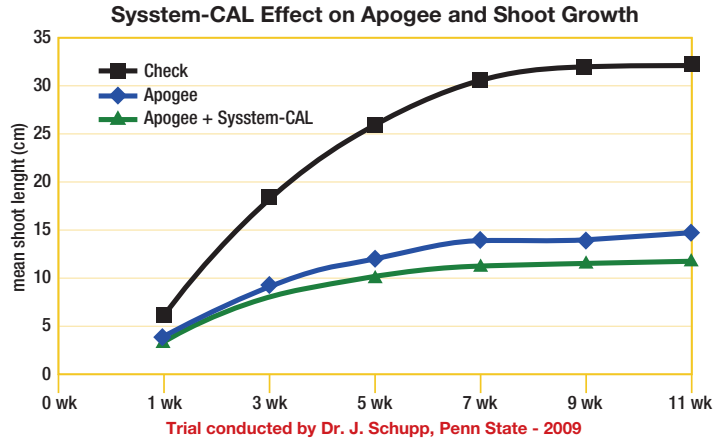
Treatments		Fruit Size		
Petal fall	**10-13 mm**	**<2.75"**	**2.75" -3"**	**>3"**
Carbaryl 24 oz	Carbaryl 24 oz + Maxcel 2qts	46.0	41.0	13.0
Carbaryl 24 oz + Sysstem-Cal 2qts	Carbaryl 24 oz + Maxcel 2qts + Sysstem-Cal 2qts	39.0	37.0	24.0

Trial Conducted by Reality Research, Wayne Cty, NY - 2010

Large, firm apples, free from bitter pit generate the highest per acre return. Private and university research shows Sysstem-Cal's positive effects on size. Dr. Duane Greene, UMass stated, *"clearly Sysstem-CAL when combined with MaxCel® had a profound effect on increasing fruit size."* Not only does Sysstem-CAL aid in maximizing fruit size, but it also supplies needed calcium at the same time for better firmness and storage life.

In 2011 Dr. Fallahi (Univ. of ID) saw similar results as Dr. Greene (UMass) and had these comments: *"Un-treated controlled had smallest fruits. But those with Sysstem-Cal™ 2Qts + MaxCel® 128oz at 5-10mm@200G/A had the largest fruit of any of the treatments. Fruit from trees receiving Grower's Treatment (Sevin and NAA) had lower firmness at harvest as compared to control and the Sysstem-Cal™ and MaxCel® treatments. Enrichment with Ca from Sysstem-Cal™ could have also contributed to higher firmness in Sysstem-Cal™-treated fruits."*

Sysstem-CAL Effect on Apogee and Shoot Growth



Trial conducted by Dr. J. Schupp, Penn State - 2009

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Effects of Sysstem-Cal™ (Sys) and MaxCel® (Max) Yield and Fruit Quality

Treatment	Avg. Weight (g)	Yield Kg/Tree	Sunburn %	Firmness 2.5mths Storage	Rotten %	Ca (ppm)
Control	188.2	29.77	8.2	6.950	5.82	5.45
Maxcel 128oz PF	217.7	29.67	11.1	6.953	8.04	6.02
Sysstem-Cal + Maxcel 128oz 5-10mm	227.1	46.17	6.7	6.699	5.56	6.25
Grower Std.(Sevin & NAA)	221.6	36.78	8.4	6.146	10.71	6.05

Dr. Essie Fallahi, Univ. of Idaho, 2011

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