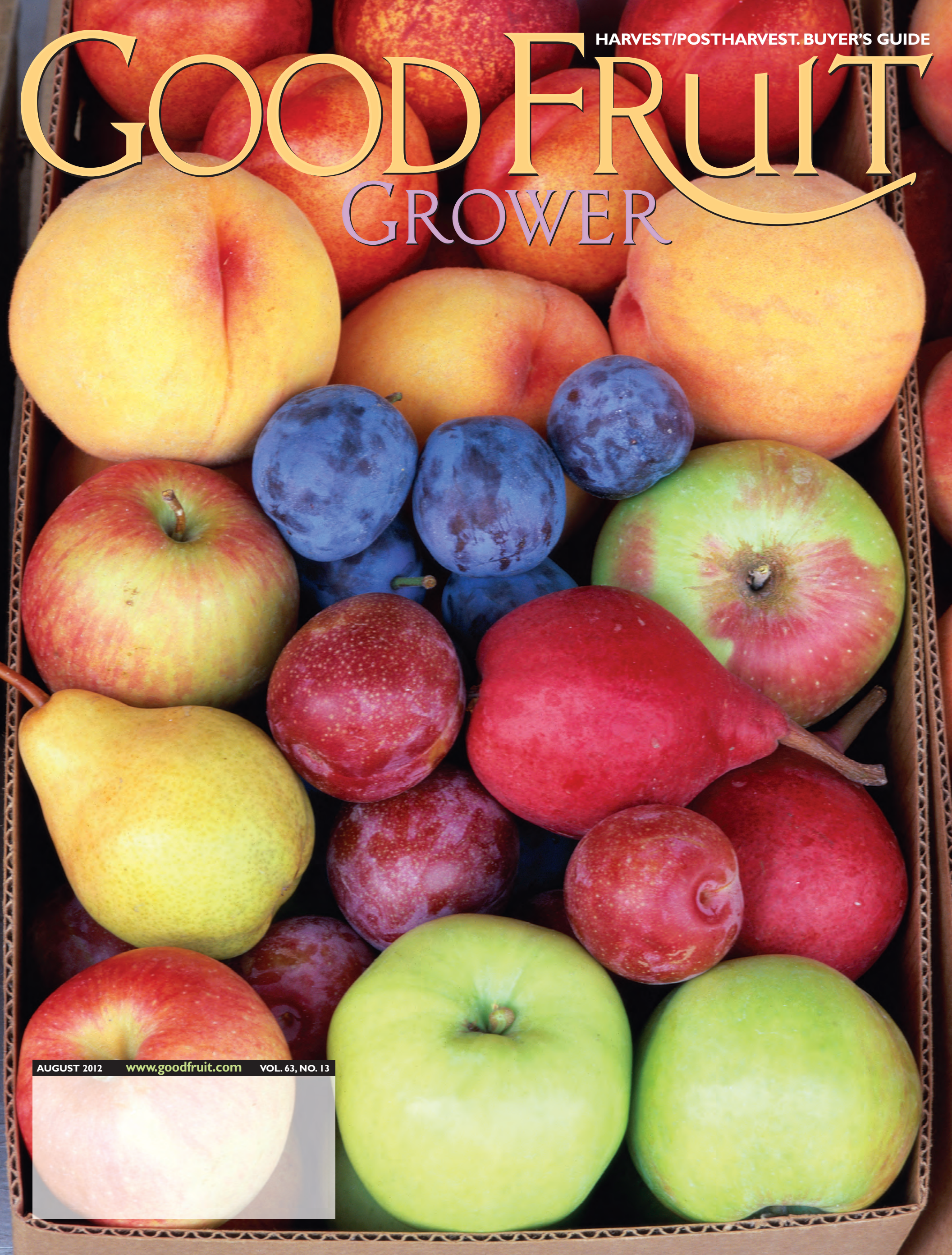


HARVEST/POSTHARVEST.BUYER'S GUIDE

GOOD FRUIT

GROWER



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GOOD FRUIT GROWER

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Mixed fruit display near Wenatchee, Washington

PHOTO BY LANCE JOHNSON
YAKIMA, WASHINGTON



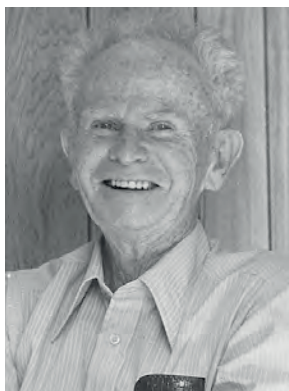
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A legend

The late George Carter, former Washington State University wine grape researcher, will be inducted into the Legends of Washington Wine Hall of Fame on August 10



George Carter



Brian Carter

during a gala at the Walter Clore Wine and Culinary Center. Inductees are selected for their contributions to the community and industry.

Carter graduated from the University of California, Los Angeles, with a bachelor's degree in chemistry and did graduate study at both UC-Berkeley, and WSU. He worked as a WSU enologist alongside viticulturist Dr. Walter Clore and developed a system for classifying American, European, and hybrid grape varieties. Carter was elevated to Supreme Knight in the International Brotherhood of the Knights of the Vine.

After retiring in 1977, he continued to make wine and worked in the family vineyard until he died in 2007 at the age of 94. A scholarship in honor of Carter and his wife, Susan, has been established with the Washington State Wine Industry Foundation.

Winemaker Brian Carter of Brian Carter Cellars in Woodinville, Washington (no relation to George), was invited to blend a special wine for the Legends gala. The wine is a blend of Counoise, Mourvedre, Syrah, Cinsault, and Grenache.

Brian Carter has been working in the wine industry since 1980 and is the only three-time recipient of the Pacific Northwest Enological Society's Grand Prize.



Katharine Grove

Grove joins CMI

Katharine Grove has joined the marketing team of Columbia Marketing International in Wenatchee, Washington, which is one of the state's largest shippers of conventional and organic apples, pears, and cherries.

Grove has seven years of marketing experience and will be responsible for CMI's Web site content and social media. She will also collaborate on marketing materials, attend industry shows, and provide market research to benefit CMI's customers.

Cherry inventory compiled

A new inventory of the Michigan sweet and tart cherry industry has been compiled, based on a census of commercial fruit farms conducted in 2011.

The inventory found 400 farms growing sweet cherries and 450 growing tart cherries. The number of farms growing cherries fell over the last five years, with sweet cherry farm numbers falling from 470 to 400 and tart cherry numbers declining from 540 to 450.

Michigan is the nation's largest producer of tart cherries. There were 32,000 acres of them at the end of 2011, unchanged from the last inventory conducted in 2006. Acreage declines in southwest and west central Michigan were offset by increases in the northwest. More than half the state's acreage is located in six counties surrounding the Grand Traverse Bay of Lake Michigan.

The largest single tart cherry-producing county is Oceana, located in west central Michigan, where 7,900 acres are grown. Leelanau County has the second most tart cherry acres at 7,800.

Between 2007 and 2011, 4,500 new acres of tart cherries were planted.

Sweet cherry trees were growing on 7,200 acres at the end of the year, down 300 from the last inventory conducted in 2006. Since then, there have been 720 acres of sweet cherries planted.

The survey was conducted by the Michigan field office of the National Agricultural Statistics Service. The fruit survey covers all fruits and berries, and the cherry report is the first of nearly a dozen that will be published.

Correction

In the article "B.C. releases blush cherries" in the June issue of *Good Fruit Grower*, the names of two new cherry varieties were transposed. Cultivar 13N-07-39 will be named Starletta and SPC 207 will be named Starblush.



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Robotic harvester would be costly

Robotics expert Dr. Sanjiv Singh says fully automated robotic harvesting systems are looking more feasible technologically than a few years ago, but whether they would be robust enough for orchard work and affordable to the growers is still in doubt for the time being.

Singh, a researcher at Carnegie Mellon University's Robotics Institute, is leading a multistate project on Comprehensive Automation for Specialty Crops, which aims to develop methods to improve production efficiency,

identify threats from pests and diseases, and respond to food safety hazards.

What it doesn't aim to do—at least, not yet—is develop a robotic apple harvester.

Singh said when the CASC project began in 2008, the scientists involved decided not to work on automatic harvesting. It would be such a huge endeavor, they agreed, that it would overwhelm the rest of the project. Not only that, but what would be the use of developing a machine that cost \$2 million dollars? Or could only pick one apple every ten seconds (10 times slower than a human)?

"The gee-whiz factor runs cold pretty quickly," he said. "We could have done it,

but we needed it to be all three of these things for it to be a success: affordable, robust, and technically feasible. Those are the reasons I personally think it's not a short-term or even medium-term solution. It would require some significant funding, and I don't know if there are deep enough pockets to go after that."

CASC faculty decided instead to work with DBR Conveyor Concepts in Michigan who are developing a harvest-assist machine that improves harvest efficiency by eliminating the need for workers to climb ladders.

That's the type of technology that will reach growers quicker, Singh points out. Tests with the DBR last season in Washington State showed that workers were 20 percent more efficient working with the machine than when picking fruit conventionally. Singh said the developers and scientists think it reasonable to expect that the machine could increase worker efficiency by 100 percent within three years, which would mean the grower could get by with half the number of workers.

"That's something that people can go to the bank with," he said. "There's a lot more that can happen to the machine."

Automated harvesting

Meanwhile, scientists at Carnegie Mellon are wondering, four years after the CASC project began, whether the time is ripe to begin looking at fully automated harvesting. Tree architecture is changing, with more growers adopting formal training systems where there is less

An automated harvester would need to be affordable and robust, as well as technically feasible.

by Geraldine Warner



PHOTO BY GERALDINE WARNER

Tony Koselka, right, is pictured with colleague Derek Morikawa, center, during a visit to Auvil Fruit Company's Vantage ranch in 2006. Koselka, a founder of Vision Robotics, tells orchard manager Del Feigal that the system would be ideal for robotic harvesting.

obstruction of fruit by the foliage, and the cost of technology continues to decrease.

"We may start to consider this," Singh said. "We've been doing some experiments in our lab, trying to see how hard it is."

For example, they've done trials with industrial robotic arms—the kind that would survive repeated motions—to find out how precisely they can locate something and reach out and grab it.

"When you watch them, they're cartoonish," Singh said. "Right now, they have slow, deliberate motions, and the kinds of grabbers we have are pneumatic and don't look quite right."

Whereas a person who's good at picking might pick an apple per second, these robotic arms might take ten seconds per apple.

But the good news is that the robotics are far cheaper than they used to be. Five years ago, one robotic arm might cost \$150,000, which didn't make economic sense. Now, they are ten times cheaper.

"If the scout gets you 25 percent more efficiency, that's enough to pay for the cost of it."

—Tony Koselka

(Continued on page 8)



Sanjiv Singh is leading a multistate project on automation research.

scout. Vision Robotics was never able to secure funding to develop the harvesting part of the system, but saw potential for the scout as a crop estimating and yield mapping tool.

When the CASC program began, Vision Robotics became a collaborator. Carnegie Mellon's Robotics Institute has since taken over the scout project. Singh said they are working on making it more compact and lighter so it would be cheaper and easier to pull with a tractor. They have also integrated the scout with an autonomous orchard vehicle that they've developed. The university is looking for a partner to commercialize it.

“The gee-whiz factor runs cold pretty quickly.”

—Sanjiv Singh

He believes it is technologically feasible, and perhaps even cost effective, but he thinks it would be difficult. Manipulating the apples without damaging them is the hardest part. Apples can't just be plucked from the tree. It's challenging to have a machine grab apples from a variety of different angles and replicate the way a human lifts and turns them to detach them from the tree.

The project would be easier if all the orchards had formal training systems where all the fruit was visible and hanging vertically, he said. The scout would be 100 percent accurate, and the harvester could have shorter arms and could pick all the fruit from the same orientation.

Having a scout to map the fruit before harvesting might not be necessary in orchards where all the fruit is immediately visible, but a scout would make it more efficient, Koselka said. “The biggest factor is how fast you can get the fruit off the tree. If the scout gets you 25 percent more efficiency, that's enough to pay for the cost of it.”

Initially, a robotic harvesting system might not save growers money, but it would reduce their labor needs. Koselka said the economics are less favorable in apples than in citrus, however, because citrus is harvested for ten months of the year versus a few weeks for apples. Machines for apple harvesting might need to be multipurpose so they can be used for other jobs such as pruning, he said. Vision Robotics has developed a robotic pruner for grapevines, which should be commercialized within the next two years. ●

Singh said these are informal experiments to gather preliminary data that could be used in writing a proposal.

“We want to make sure we don't oversell the technology,” he said. “We want to make sure when we come out there that people think it's credible. We've taken a pretty conservative approach to this.”

Once a project is launched, he thinks it could take three to five years to develop a system with the right accuracy, speed, and price.

Vision Robotics

One of the important aspects of a harvesting system is the ability to locate the apples on the trees.

Six years ago, Vision Robotics of San Diego, California, began a project to develop a robotic apple harvester. Other manufacturers who had attempted robotic harvesting had run into problems with end effectors that tried to locate fruit as they picked it. Vision Robotics took a two-step approach. One robot would act as a scout, develop a three-dimensional map of the fruit and interfering branches, and work out a picking strategy for a separate machine that would come along later and pick the fruit.

The Washington Tree Fruit Research Commission provided \$283,000 initially to Vision Robotics to develop the orchard scout, while the California Citrus Research Board paid a similar amount to the company to develop a citrus scout. Vision Robotics was never able to secure funding to develop the harvesting part of the system, but saw potential for the scout as a crop estimating and yield mapping tool.

Tony Koselka, founder and chief operating officer of Vision Robotics, said his company is still interested in developing a robotic harvester, but it would be an expensive project that would be best tackled by a consortium because various scientists around the country are making progress on different aspects of it. It would be a multi-million-dollar project.

CROP estimating project

Dr. Manoj Karkee, engineer at Washington State University's Center for Precision and Automated Agricultural Systems, is working on a machine-vision system to improve apple crop estimating. He has designed an over-the-row platform to carry a color camera, a three-dimensional camera, and an orientation sensor along apple rows.

When he tested the system in an orchard of Allan Brothers, Inc., in Prosser, Washington, he was able to



WSU engineer Manoj Karkee is designing an over-the-row crop estimating system.

capture images of both sides of the trees, which allows better identification of apples than when images are taken from only one side. The sensor records where the camera is oriented so that a 3D map of the fruit can be created. Mapping fruit in 3D should help eliminate duplicate fruit counts and improve the accuracy of the crop estimate, which can be made on a block-by-block basis, Karkee reports. The system should be able to identify an apple that is 10 millimeter (3/8 inch) or larger.

Karkee, who will receive \$34,402 in funding from the Washington Tree Fruit Research Commission for the project this year, plans to redesign the platform to make it lighter and easier to operate and to include lighting so it can operate at night. He will also investigate blowing air onto the trees to move the leaves and improve the ability to detect fruit.

Karkee is also exploring the use of 3D cameras in an automatic pruning system for apples with the aim of reducing the manual labor needed for pruning. The system would employ machine vision to identify where on the trees cuts should be made. In tests, the system was able to do that with 90 percent accuracy.

—G. Warner



FOCUS SHIFTS to full automation

WSU is developing a roadmap for research on mechanical harvesting of apples.

by Geraldine Warner

Faculty at Washington State University's Center for Precision and Automated Agricultural Systems plan to focus the bulk of their efforts in the future on the pursuit of a fully automated apple harvesting system. And they're compiling a roadmap to guide their efforts and to help secure funding for the research.

Forecasts of large tree fruit crops in the Pacific Northwest this year have got growers wondering how they'll harvest them. This season could see record cherry, apple, and pear crops. Increased production coincides with a smaller number of migrant workers entering the country from Mexico, and there is no immediate prospect of federal legislation that would help increase the labor supply.

At least two machines are under development in the United States that would relieve pickers from the task of climbing up and down ladders to pick fruit and then empty the contents of their picking bags into bins. This could increase worker productivity as well as expand the potential labor pool to the less physically able.



Karen Lewis

“Most new acreage being planted in the Columbia Basin is a formal system.”

—Karen Lewis

But scientists say the increase in productivity from such labor-assist technologies is modest in relation to the potentially huge shortage of workers and that such machines are just a stepping stone to the fully automated systems that the industry needs.

Karen Lewis, WSU extension tree fruit specialist and an associate director at CPAAS, said that it was during a trip to the World Ag Expo in California earlier this year that a group of industry representatives and scientists realized that research efforts in automation could be more effective

if the center devoted 60 to 70 percent of its efforts on solving the one problem—moving from human-assisted technology towards fully mechanized harvest. CPAAS has an interdisciplinary team with horticulturists, engineers, computer scientists, and extension specialists who are working to develop technical solutions for tree fruit production.

Lewis said this shift in focus will require a major shift in the industry towards simple orchard systems that will be compatible with automated harvest. The formal system used at Auvil Fruit Company's ranch at Vantage, where each limb of the tree is trained along a trellis wire, is the one where successful automation is likely to come the quickest. Success there should help get the industry excited to see the possibility, she said.

Similar systems are now being adopted by other major grower-packers in Washington, she noted. “Most new acreage being planted in the Columbia Basin is a formal system. It's not so random any more, and formal is what you need for automation.”

However, the other 90 percent of the acreage in the state would still need to be converted. Even at 5 percent per year, that would take 20 years.

Roadmap

Dr. Qin Zhang, director of CPAAS, said the university's role will be to create knowledge and core technologies, and deliver that knowledge to manufacturers who can deliver the product to the users. He said robotic harvesting is probably ten years away from being commercially available, but the university needs to be forward looking and get the ball rolling. The roadmap for mechanical harvesting of apples, which will complement the existing Tree Fruit Technology Roadmap, should be completed in time to present to the Washington Tree Fruit Research Commission for funding at its December meeting, Zhang said.

Following its Technology Research Review this spring, the Research Commission approved funding for a new project at CPAAS to develop an automated apple harvesting system with the potential to improve harvest efficiency and reduce labor needs.

Graduate student Mark DeKleine, who is working with professor Dr. Manoj Karkee on the project, told the commission that the aim is to develop a system to harvest undamaged fruit for the fresh market using as many off-the-shelf components as possible.

The Research Commission is providing almost \$54,000 in funding for the first year.

Several years ago, the commission gave funding to the California company Vision Robotics to work towards robotic harvesting. Initial efforts focused on developing a machine vision system to locate the fruit, which was seen as a necessary precursor to a harvesting system.

Dr. Jim McFerson, manager of the Washington Tree Fruit Research Commission, said the commission is willing to consider investing in any kind of technology that offers potential impact, whether long- or short-term.

“I think it's a mistake to identify or to qualify engineering solutions as more expensive. If you look at what we spent on codling moth over the past ten years, you would have to say that's an incredibly expensive project.

“I do feel that the commission and its committees are taking a balanced approach and looking for solutions that offer near-term impact and those we need to invest in now or we won't see the progress that's necessary in the next five or ten years.” ●

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Bin dog under development

An intelligent bin-moving system could reduce harvest labor needs.

by Geraldine Warner



Qin Zhang

An intelligent bin dog system—a self-propelled bin carrying system that could follow fruit pickers through the orchard—is one of several labor-saving devices that scientists at Washington State University's Center for Precision and Automated Agricultural Systems hope to develop.

Dr. Qin Zhang, director of the center, which is based in Prosser, envisions that the electric bin management system would carry an empty bin into the orchard and follow the pickers until the bin was full. It would then transport the full bin to a central collection station. It would be operated remotely by a picker who would signal when the full bin needed to be removed and a new empty bin was needed.

The goal is to improve the efficiency of picking in both cherry and apple orchards by eliminating the need for pickers to walk to the bin and back to empty their picking bags.

Karen Lewis, WSU extension tree fruit specialist, who is also working on the project, said walking from the ladder to the nearest bin and back could account for as much as 20 percent of the total time a worker spends picking, depending on the variety, crop load, and density of bins. The bin dog would likely be most useful in an orchard being color picked where the bins are relatively far apart. The picker would be the master and the bin mover

would be the slave, and they would be connected electronically.

The system would also eliminate the need for bins to be moved around by workers driving tractors and trailers,

which would be another savings. However, one carrying system would be needed for each bin.

The project, which will receive almost \$70,000 in funding from the Washington

Tree Fruit Research Commission in the coming year, is in the design phase. The next step is to develop a prototype to test in Washington orchards and figure out how it can work on sloped ground. ●

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Harvest ASSISTANCE

The DBR harvest-assist system continues to be refined with commercialization in mind.

by Geraldine Warner

After five weeks of testing in Washington State apple orchards last fall, the DBR harvest-assist system has been extensively modified for further tests this season in preparation for commercialization in 2013.

The system, developed by DBR Conveyor Concepts in Michigan, is on a platform and has four flexible tubes into which workers place apples as they pick them. The apples are transported through the tubes by vacuum into a bin on the platform. A straddle trailer at the back carries empty bins that are loaded onto the system as full bins are discharged in the row.

Mike Rasch, a partner in DBR, believes that a 50 percent increase in efficiency is possible, compared with traditional apple picking from ladders. In a fruiting wall system, the gain in efficiency could be 80 percent or more.

Karen Lewis, Washington State University extension tree fruit specialist, who has been testing a prototype built for Washington conditions, said last year's trials focused primarily on how to reduce bruising to the 5 percent tolerance level. The harvesting system was tested with many different apple varieties, and an Impact Recording Device was used to measure impacts as it traveled through the system. The IRD showed that impacts were highest in the machine's tubes that carry apples up to the platform, though not all the impacts caused damage. Speed and vacuum power affect the amount of impact.

A comparison of Fuji apples picked with workers using the harvesting system versus workers using ladders showed that there was bruising of fruit even when it was harvested in the traditional manner, Lewis reported to the Washington Tree Fruit Research Commission.

DBR field validation work is supported by the Comprehensive Automation for Specialty Crops project, in which she is a cooperator. Equipment costs for the DBR 2011 prototype that was built to Washington specifications were shared by CASC and the Washington Tree Fruit Research Commission.

Modifications

Rasch told the *Good Fruit Grower* that he and his colleagues have made a number of modifications to the system since last season. These include:

- A self-leveling trailer to ensure that the bins are evenly filled with fruit, even when the system operates on slopes. The platforms will stay perpendicular to the trees, rather than the ground, helping with the positioning and access to the tree and fruit.
- A shelf above the elephant ears in the bin filler to ensure even filling of the bins even when the volume of fruit being picked varies from one side of the row to the other, or when picking outside rows.
- LED lighting, so that the system can be used for two shifts per day. Rasch said LED lighting is close to natural light and doesn't cast shadows, and also has a low amp draw.
- A telescoping tongue between the tractor and the platform that can be retracted when turning rows.
- A remote steer/shuttle shift system on the tractor that can be operated from the platform to eliminate the need for a driver in the row, and a creep gear so that the tractor can move at about 0.2 miles per hour.
- Replacement of the safety rail with harnesses, which workers in Washington are more accustomed to.

“It will be a landmark year to get it out and get some time on it.”

—Mike Rasch

Rasch said the system compared favorably with hand picking in terms of the quality of the fruit last season, but modifications have also been made to the fruit handling aspect. Each of the system's four tubes can handle apples at a rate of up to two per second.

More tests

In August, the system will be tested in processing peach orchards in California. In late August and early September, it will be tested in California pear orchards. From the second week of September until the end of the season, it will be tested with apples and pears in Washington on more sloped terrain than last year.

Rasch said the system was designed to handle any round fruit or vegetable that's not larger than the 4.5-inch diameter of the tube holes. However, it probably won't be suitable for picking fresh peaches because friction between the fruit and the tubes removes the fuzz.

It has already been tested on Asian and European pears. If the European pears are oriented correctly, there seems to be no problem, but he's not sure how well it would work if pears were put into the tube stem first.

“I think it's all doable,” he said, “ But it's going to be a learning curve. I think it will be a landmark year to get it out and get some time on it.”

Another model of the system will be tested in Michigan this season. Though the state only has between 10 and 15 percent of a full apple crop, this will be a good season to test it, Rasch said, because all the crop is in the tops of the trees.

“I think it will really shine this year for that reason, but we won't get the efficiency on it because of the limited crop.”

Return on investment

Rasch said more refinements might be made before the system goes on sale in 2013 at an estimated cost of between \$85,000 and \$95,000. The cost does not include a tractor to pull it. Phil Brown Welding in Michigan will manufacture many of the trailer and platform components, and DBR Conveyor Concepts will manufacture the vacuum and other components of the system.

Rasch expects the grower's return on investment to be good. The system is designed so that the harvesting part can be separated and the platform used year round for such jobs as pruning, thinning, trellis tying, and hanging of pheromone dispensers. “It's the whole gamut of things a grower has to do in the tops of the trees,” Rasch said.

The partnership has already been contacted by interested potential buyers both in the United States and abroad, he said. “The interest is there. We're excited about where it's going, and we feel good about what we've achieved so far.”

Collaboration with the Washington tree fruit industry, the Michigan Apple Committee, Pennsylvania State University, and the CASC project has helped move the project along more quickly, he said.

With labor availability becoming an increasing concern, Rasch senses a greater willingness among growers to consider mechanization. “Labor is an issue, and the industry seems to have turned the corner towards looking at mechanization. Labor is really going to dictate the need for it.” ●



PHOTO BY MELISSA HANSEN

The decelerator has a large wheel inside with foam wedges to remove apples from the vacuum environment. Large elephant ears of foam gently distribute apples in the bin.



PHOTO BY GERALDINE WARNER

Chris Hendrickson, technician for Oxbo, looks on as pickers test the machine at a Stemilt orchard in Quincy, Washington. The two picking platforms on the machine can be hydraulically raised or lowered to adjust the area of the canopy within reach of the upper pickers.

Harvester is READY TO GO

Adopting new harvest technology should help growers to address labor shortages and to remain competitive.

by Geraldine Warner

Ask Vince Bryan III what increase in picking efficiency apple growers can expect from using the Picker Technologies mobile harvest system, and he'll say it depends.

It depends on how fast the picking crew can pick, because the machine can go faster than they can.

"When people ask me, 'What are our productivity aims?' I always turn it around and say, 'How fast can your pickers pick? People are the limiting factor.'"

Looking at a return-on-investment analysis of the technology, there's not just one big thing that returns money to the grower, he explained. Bryan, chief executive officer of Picker Technologies, has compiled a list of almost 50 ways that the system can benefit the grower in the areas of added value, productivity, fruit quality, and worker safety, compared to using ladders or platforms.

"We have made a machine that can go faster than the pickers can sustain their picking. The problem is not the machine. The industry has not yet recognized that where you get the productivity gain is in training your teams to work with the machine, and—depending upon the fruit varieties you're growing, the orchard configuration, and the yield—there are subtle things you can do that have a dramatic impact on the productivity."

An important factor is fruit size. Though growers refer to yields in terms of bins, a bin might contain anywhere from 1,500 large apples to 3,000 small ones, so the smaller apples could take twice as long to pick. Growers should be thinking in terms of apples per minute sustained (APMS) rather than bins, Bryan said.

Picker Technologies sought the advice of growers in designing the harvest system and has come very close to delivering on everything they asked for, Bryan said. The focus was on addressing all the aspects that take away from the time the workers spend actually picking, including climbing up and down ladders.

Prototypes have been continuously tested since 2008 in both apples and citrus. A couple of final changes were made during the past year. One modification allows the picking platforms to be lowered to just two feet above the ground for working in young orchards or in those where the crop is mainly in the bottom of the trees. Another change improves the navigation of the system around large trees that don't form a fruiting wall.

Bryan said it's now up to the growers to run with it.

The company has invested \$10 million in the project, and is handing it over to its partner, the equipment manufacturer Oxbo, which is ready to take orders for commercial models. So far, there have been no takers, much to Bryan's surprise and frustration.

Eye opener

"In the last year, I've had an opportunity to travel and talk to a lot of people around the world," he said. "It's been an eye opener. The startling thing to me is that we have here, in the United States, an attitude that we're leading the world in agriculture. We are blessed with our soils and climate and locations, and all of those things, but we're not leading the world in the technology to bring this forward. In fact, we're last, and we've gotten away with it because of the bounty that we harvest."

With looming labor shortages in the Pacific Northwest, now is the time for growers to seriously consider buying a harvesting system and to figure out how to maximize the use of it to get the fastest possible return on investment, he said. Changes to immigration laws are not going to solve the lack of labor, even if they happen.

The solution, he believes, is to create a work environment where pickers don't need to be athletes who have to climb up and down ladders carrying 60 pounds of fruit, getting tired and slow as the day goes by. The harvest system increases the potential labor pool because the work becomes less demanding.

"It doesn't need to be my machine," he stressed. In fact, Bryan and the developers of the DBR harvesting system in Michigan

have discussed the possibility of working together. While growers might think competition is beneficial and might help keep pricing low, Bryan said the opposite is true.

Picker Technologies' self-propelled harvest system has adjustable platforms at the front where two pickers can stand to pick from the tops of the trees while two more pickers go down the row in front of the machine on foot. Workers place the apples into pneumatic tubes that carry the fruit up to an electronic sorter at the top. The fruit then goes into either a fresh or cull bin, to eliminate the need to take culls to the warehouse, and electronic data on the quality and size of the fruit can be accessed immediately by the grower and the packing house.

At other times of year, the system can be used to carry workers doing tasks other than picking.

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PHOTO BY GERALDINE WARNER

Vince Bryan says the PickerTech mobile harvest system is not designed just for fruiting walls. It has been tested successfully in this 6- by 12-foot planting at Cave B in George, Washington.

Each of the machines has patented components—which include the transport tubes and the dry bin filler, in the case of PickerTech. By combining their efforts and incorporating the best aspects of each system, an improved harvester might more easily be developed.

Bryan sees his harvesting system as a core technology that might incorporate other technologies in the future as they are developed, rather than become obsolete. Bryan said it would not surprise him if, in 20 years, the machine has four robotic arms in place of the four pickers, but robotics experts will develop that technology.

In the meantime, the harvesting system can help increase productivity by making human pickers more productive.

“You have to make the decision that it has to be done and it has to be done now,” he said. “What we’ve tried to do is give you a tool that makes a big jump in your productivity. Now, you have to do it.”

Mechanized

Bryan said the urgency comes not just from the potential labor crisis in the Northwest, but the fact that other apple-producing countries around the world are already becoming more mechanized. He recently visited a large grower in Germany who was using a less sophisticated European harvest machine and was looking to upgrade to a more efficient system.

“I could sell the machine in Australia, and Europe, and Chile right now,” he said. However, PickerTech’s agreement with Oxbo stipulates that the harvesting system will be released first in North America.

By PickerTech’s calculations, buying or leasing a harvester would make economic sense for a grower with 80 acres of orchard as long as it is diversified so that harvest stretches over eight to ten weeks. If the trees form a fruiting wall, so much the better, but the flexible tubes into which the workers put the fruit allow them to walk around and harvest from the bigger trees in low-density orchards also. Bryan said when PickerTech began working on the project, it knew that the system had to be able to improve productivity in plantings of different ages and systems, because the typical orchard has both.

Since every orchard is different, PickerTechnologies has created economic models where growers can input their own data to calculate the return on investment. To get the most out of the system, growers will have to train their workers to use the machine and operate it for two shifts a day seven days a week. They might want to share a machine with a neighbor.

The harvester can be used to pick other types of fruits, such as peaches and pears, because the patented tubes can accommodate objects of various sizes and shapes. In fact, with the fruit harvester complete, Bryan is now focusing on developing fish passage and handling systems using the same tube design, and is renaming the company Whoosh Innovations.

For more information, go to www.whooshh.com. ●

URBAN orchards

An effort is underway to rebuild cities, complete with tree fruit.

by Richard Lehnert

For more than half a century, the great industrial cities of the northeastern United States have been decaying. From what used to be dynamic urban centers, people and industries have moved out, sprawling over adjacent farmland with homes, factories, roads, and shopping centers.

They leave behind abandoned houses and factories, abandoned land appropriately called brownfields. People are left behind, too, people too poor and unskilled to move, left trying to pay for city infrastructure too expensive to maintain. Poor education, poor crime control, poor fire control, poor roads, poor nutrition, unemployment, ever poorer people, are the result.

Instead of shopping for fresh fruits and vegetables at nice malls and supermarkets, inner city people buy food at small stores protected behind steel-barred windows. Often, it's junk food.

In cities like Detroit and Flint, Michigan, many abandoned buildings have been demolished. In some areas, whole neighborhoods have been cleared and large fields have reappeared, land open for the first time in more than a century.

“Maybe now it is Detroit’s turn to feed those suburbs.”

—Stephen Jones

people and their needs rather than industries like automobiles and steel.

Fruit trees symbolic

Community produce gardens have been popping in cities for many years. But something about fruit orchards spells permanency, a long-time commitment.

“We plant orchards anywhere we can find a core group of people committed to care for the orchard for the benefit of the local community,” Akin said. “We have a full application process. When we find a suitable sponsoring organization, then we look at the horticultural details.

“We provide many angles of support. We organize workshops, educate and train people, and make return visits. We make sure recipients are able to care for and maintain the orchard.

“We work all over the world. Our goal is to inspire the planting of 18 billion fruit trees,” he said. “We’ve done hundreds of projects.”

Recipients of trees must be nonprofit organizations, public schools, or government entities that own the planting site, are committed to caring for the trees, have irrigation available, and can coordinate volunteers on the day of planting.

The Fruit Tree Planting Foundation was started in 2002 by Dr. David Wolfe, who is the president. It's located in Pittsburgh, Pennsylvania, and has a small staff of people scattered about the country who can work with local organizations that want to improve their communities by providing fresh fruit to local citizens.

All projects are implemented by the foundation's arborists, including Rico Montenegro, Erik Wilson, and Akin, who coauthored *The Home Orchard Handbook: A Complete Guide to Growing Your Own Fruit Trees Anywhere*. Wilson went to Flint to supervise the planting there, which was carried out by more than 200 volunteers—local residents, students from Mott Community College and Kettering University, Mt. Morris Township police and firefighters, volunteers from United Parcel Service, and local and state officials, including the mayor of Flint. The program was sponsored by FTPE, UPS, and Earth Day Network.

The foundation has different kinds of programs aimed at different kinds of groups. “Fruit Tree 101,” for example, is targeted to public schools. “Communities Take Root” aims at city parks and community gardens. “Fruit Relief” is targeted at low-income neighborhoods and international hunger relief sites. “Reservation Preservation” builds projects on Native American reservations. “Roots of Recovery” targets health centers. And “Orchards for Animals” is for animal sanctuaries.

Ironic twist

This spring, Dr. Stephen Jones, a Detroit resident and an assistant professor of history at Central Michigan University, wrote an opinion piece in the online magazine *Dome*. He was responding to news reports that Michigan State University was proposing to create an urban-agriculture research center in the city, a project that could eventually cover 100 acres and involve an investment of \$100 million. Researchers at the center would explore the possibilities of “vertical agriculture,” growing crops in multistory buildings, as well as new approaches to food cultivation that could conserve water and even produce energy.

“Over the last century, the city of Detroit has provided much of the human and economic capital that was needed to develop the vast suburbs of southeastern Michigan,” Jones wrote. “A century ago, the farms of Macomb, Oakland, Washtenaw, and western Wayne counties fed the urban center, but many of those farms have disappeared, replaced by houses, factories, and strip malls.



The Fruit Tree Planting Foundation depends on local volunteers not only to plant the trees but to learn how to maintain them and make them productive in the future.

Not surprising, perhaps, a fruit orchard was planted in Flint, Michigan, this spring—210 bare-root peach, cherry, pear, and apple trees on 2.7 acres of land.

That wasn't the only one. Orchards were also planted this spring in St. Louis, Cleveland, Atlanta, Chicago, and in Pittsburgh, to name the larger cities. It's part of a plan being propelled by a nonprofit, charitable organization called the Fruit Tree Planting Foundation to plant orchards in communities across the United States. This urban orchard project is called Fruitful Neighborhoods.

It's not just about trees, according to Cem Akin, the executive director. It's about building new communities on the rubble of old cities—organized this time around

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This lot was cleared of trash and a cover crop established to prepare it for planting.

THE KINGS of Flint

Jacky and Dora King have been urban farmers for about six years. The six acres that they farm now contain two hoop-style greenhouses, vegetable gardens, and a 200-tree fruit orchard. The property used to hold a row of abandoned houses and a commercial business that repaired cars, Dora King said.

It's located on the north side of Flint, Michigan, in an area called Beecher, which used to be a thriving community with a strong main street, she said. In the 1980s, General Motors began reducing its automobile manufacturing business in Flint, and with it went Turnstead, an automotive parts manufacturing company located in Beecher. Michael Moore's movie, *Roger and Me*, documents the effects of GM's decision to set up factories in Mexico and end the jobs of 30,000 of the 80,000 GM workers in Flint.

Dora and her husband moved to Beecher 24 years ago. They started a business, King Karate, teaching martial arts to young people, and from that base they built a nonprofit organization called Youth Karate-Ka Harvesting Earth Educational Farm.

They applied to the Fruit Tree Planting Foundation for the trees, help in planting the orchard, and the training to manage them. The urban orchard was planted on May 20 by about 200 volunteers, including the Kings' students.

Dora calls it "the process of reinventing ourselves," using vacant urban land to make city dwellers more self-reliant and healthier. From using martial arts as a way to teach low-income kids self-control and self-esteem, they went into produce gardening to teach youngsters how to work and how to profit from work, and to bring fresh produce into the community.

The Kings learned quickly how to tap into the traditional land-grant university services rural farmers use. They found Michigan State University Extension and educator Bob Tritten, who serves horticulturists in all of eastern Michigan. He set up classes for them and their students. The latest was in fruit tree pruning.

They were the first urban farmers to win the state's Small Farmer of the Year Award, selected in 2011 for their conservation efforts by the Natural Resources Conservation Service in Michigan.

The Kings and their students spent three years clearing lots and then growing cover crops and otherwise preparing the soil for planting. The vacant land had been a dumping ground for trash and was filled with broken concrete, old tires, couches, and other junk. They began selling produce in 2008.

Their unheated hoop houses operate year-round. In winter, the Kings grow spinach and other cold-tolerant crops. The rest of year, they grow carrots, potatoes, tomatoes, onions, peas, broccoli, lettuce, peppers, and they also raise chickens. They grow vegetables outdoors, on vacant lots, as well. Youth Karate-Ka, the nonprofit, now owns 33 vacant lots in Flint and Beecher.

Young people who work on the farm earn money from selling produce at the Flint Farmers' Market, to local restaurants, and to local residents. The principles that apply to vegetable produce will be used with fruit from the orchard.

One key thing that has helped the Kings and others like them was the state of Michigan's decision a decade ago to create the Michigan Land Bank. It streamlined the process for returning tax-reverted properties to productive use. Instead of waiting seven years and then auctioning off the properties—with title remaining clouded—the Land Bank system hands reverted properties to the local county treasurer, along with clear title, and then works with the treasurer to determine the best use of the land. Vacant lots are often sold to adjoining property owners for as little as a dollar.

Vacant houses and other buildings are either demolished or rehabilitated. Abandoned buildings, as well as being an eyesore, attract drugs and crime, cost money to police and maintain, and lead to further degradation of the neighborhood. The Michigan Land Bank currently has for sale 8,000 residential or commercial properties that were foreclosed for delinquent real property taxes.

Another of the Kings' benefactors is the Ruth Mott Foundation. She was the wife of Charles Stewart Mott, one of the original founders of General Motors, which began in Flint in 1908. The Motts were very much concerned about the vitality of their city, and created supportive foundations.

The Kings say their goal is to make the farming operations self-sufficient, and not dependent on foundation funds.

The Kings have been featured in newspaper articles, film documentaries, and videos. Find them on YouTube by searching for *The Kings of Flint*. —**R. Lehnert**

"Maybe now it is Detroit's turn to feed those suburbs. There is a lot of open land in the city, and there is rapidly increasing interest in local production of food for ecological reasons.

"A number of interested groups have been eagerly promoting the idea of city farming for several years, but Detroit officials have been slow to embrace the idea. I don't fully understand why, but I suspect a significant part of the reluctance is simply the conceptual issue: It is difficult to imagine farms as anything but the antithesis of cities.

"Farmland is what we've always cleared to build cities. To reverse the process can feel like we're giving up on cities altogether."

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Do low yields make better wines?

Gallo's Nick Dokoozlian says there's more to making good wines than low tonnage.

by Melissa Hansen

America's wine industry has a split personality. Growers and winemakers use New World methods, like irrigation and modern winemaking techniques, but much of the Old World mentality has been retained, says the head viticulturist for E. & J. Gallo Winery. But until better yield and wine qualitative metrics are developed, changing century-old traditions will be difficult.

Years ago, the idea that lower grape yields always make better wines, a European perspective brought to America, wasn't that far off, said Dr. Nick Dokoozlian, vice president of viticulture, chemistry, and enology for E. & J. Gallo of Modesto, California. Early wine-grape vineyards in California were unirrigated and planted to wide spacings (8 by 12 feet) with noncertified plant material under a hodgepodge of soil and vineyard conditions.

However, today's vineyards feature high-density spacings of six by eight feet or closer, drip irrigation, virus-free planting stock, and canopy management to keep vines in balance, a term used to describe vines that have adequate leaf area to ripen and mature the crop load. While strides have been made in modernizing plantings, Dokoozlian said research in the wine industry is still lacking and has not kept pace with technologies in other commodities.

"Our industry hasn't advanced much compared to others," Dokoozlian said, noting that winemaking techniques have moved from wood to stainless steel tanks, but most other things are still the same.

In contrast, table grape and raisin growers in California have doubled yield and quality in the last two decades by applying advanced technology, said Dokoozlian, who before joining Gallo spent 15 years with the University of

California's viticulture and enology department, working with the state's table, raisin, and wine grape industries. "But we've not done that in wine grapes."

The problem as Dokoozlian sees it is that the New World wine industry in the United States has retained Old World mentality. "From a research platform, we've failed to take into consideration all these things that we've changed from a production system and how they allow us to really unleash the power of new technology to change this traditional view of yield and quality," he said during a session at the annual meeting of the Washington Association of Wine Grape Growers.

Yield-quality research

At Gallo, Dokoozlian is focused on a wide area of research for grape and wine production, including development of growing practices that improve yield and quality of grapes and wines and development of grape and wine chemical quality metrics. In looking at the yield versus quality question, he has studied a variety of quality aspects at different crop loads, from color and sugar to positive and negative aromas (beta-damascenone and methoxypryrazine), odor and mouth feel intensity and activity. He's also looked at canopy and trellis systems and their effects on leaf exposure and photosynthesis.

In short, there's no easy answer to the yield versus quality question. Low yields do not make higher quality wine, but there's more going on in a vineyard than just yield, he says. For example, in tracking the grape anthocyanin levels at different yields in hundreds of vineyards in California's Lodi area, he found high anthocyanin levels in both high- and low-yielding vineyards.

Pruning weight to leaf area ratios (also called yield to pruning weight ratios) are used to determine if vines have enough canopy to ripen the fruit. This concept of a balanced vine, a measure of the pruning weight divided by leaf area, has been used by the industry for more than 25 years, Dokoozlian said. Optimum values have been developed for vines in balance: a ratio of 5 to 8 is in balance; a ratio of 4 or less is undercropped; and more than

"Our industry hasn't advanced much compared to others."

—Nick Dokoozlian

10 is considered overcropped. Dokoozlian uses vine balance in his research instead of tons per acre because it accounts for differences in vineyard design, plant density, vine vigor, and site capacity.

Odor and mouth feel

In Dokoozlian's research looking at undercropped, balanced, and overcropped Cabernet Sauvignon, the undercropped vines (yield to pruning weight ratio of 3 and equivalent to 2 tons per acre) reached 24° Brix two weeks before the balanced vines (7 tons per acre, yield to pruning weight ratio of 8), while the overcropped vines (12 tons per acre, yield to pruning weight ratio 14) hit that sugar level two weeks later than the balanced vines.



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Grapes



Nick Dokoozlian

When he measured odor activity of beta-damascenone and soluble solids or Brix, balanced vines had higher odor levels than under- and overcropped vines, even though Brix levels were about the same.

In another trial that examined dark fruit aromas versus green fruit aromas, he found that balanced vines were above the threshold (having adequate dark fruit aromas) earlier and at much lower soluble solids than undercropped vines. The undercropped vines eventually reached the threshold but at much higher soluble solids in comparison to the balanced vines. However, the overcropped vines never got there.

Dokoozlian found cultivar differences when measuring positive and negative aromas, mouth-feel, and color levels in balanced, under-, and overcropped vines. Aroma intensity in Cabernet Sauvignon was highest in vines in the 7 to 10 yield to pruning weight ratio, but for mouth feel intensity, the highest levels were in yield to pruning weight ratios ranging from 4 to 7. In Chardonnay, a variety that is generally insensitive to crop load, he found little impact on aroma or mouth feel from the crop load.

Canopy and trellis style also have an impact on fruit quality. When looking at the impact of three canopy or

trellis systems (Geneva double curtain, vertical shoot position, and California sprawl) on photosynthesis and fruit ripening, he found that the Geneva double curtain was the most efficient in terms of leaf area to crop weight ratio because of the difference in leaf exposure. The Geneva double curtain had 75 percent exposed leaf area compared to 45 percent for California sprawl and 35 percent for the vertical shoot position system.

He noted that removing the shoot laterals in a vertical shoot position Cabernet Sauvignon trial dramatically increased the aroma concentration and mouth-feel activity compared with the control because the amount of exposed leaf area was increased.

Improved grape quality measures and metrics are needed to advance the industry's understanding of crop load, he said, adding that growers need to be able to accurately measure yield in real time. Other needed areas of research include a better understanding of wine grape varieties and their quality attributes in response to crop load, the relationship between the total leaf area exposed to sunlight and the vine's response to crop load, and a better understanding of carbon partitioning in the berry.

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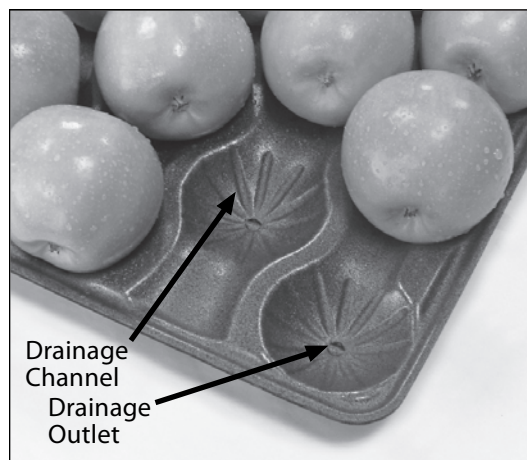
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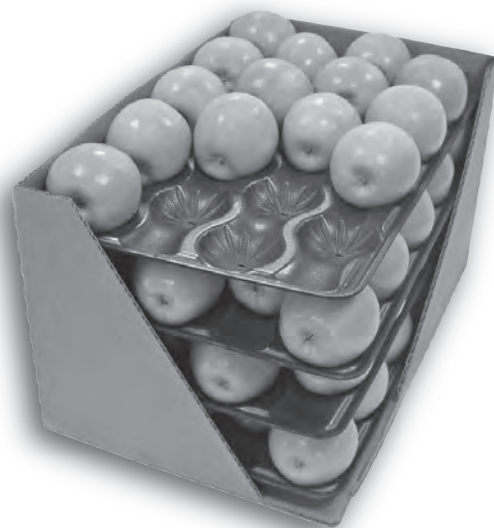
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Grapes

Busting the low-yield MYTH

The size, condition, and character of the canopy determines the ability of the vine to ripen the fruit, and the effective crop load.

by Melissa Hansen

One of the most contentious issues between grape grower and winemaker is the long-held belief that lower yields make better wines. Though research has uncoupled the linkage of low yield to premium wine, some U.S. winemakers still cling to the European tradition.

Old World

Dr. Nick Dokoozlian, vice president of viticulture, chemistry, and enology at E. & J. Gallo Winery, one of the world's biggest wineries, says winemakers in Europe believe low tonnage equates to quality, a perspective he believes is prevalent throughout America's wine industry. It's no wonder, he mused, considering that roots of the U.S. wine industry and culture came from Europe, where grape growing and winemaking go back thousands of years and the industry is steeped in tradition.



"If I were growing grapes in Europe and trying to make decent wines—based on their shallow soils, natural precipitation, virus-infected plant material, and other variables—I'd be thinning crop, too, to try to get quality," Dokoozlian said.

But New World vineyards in the United States, especially eastern Washington, with carefully applied irrigation and managed canopies, are vastly different than the French vineyards.

Dokoozlian took part in a panel discussion debating the myth that low yields always mean better wine quality held during a winter meeting of the Washington Association of Wine Grape Growers. The panel included: grape grower Tedd Wildman of StoneTree Vineyard in Mattawa, Washington; Eric Brasher, wine and vine consultant from Portland, Oregon; and Brennon Leighton, winemaker for Efeste Winery of Woodinville, Washington.

Although the panelists agreed that low yields *do not* always make better wine, they also agreed there are still winemakers out there hanging onto the myth.

"Quality goes down when you overcrop, and it also goes down when you undercrop."

—Brennon Leighton

Winemaker viewpoint

Leighton said that as a winemaker, he looks for phenolic development in a vineyard and strives to achieve as much phenolic ripeness as possible in the berry without losing acidity.

"There is correlation between quality and yield in the sense that there's a mid-area where it really works," Leighton said. "Quality goes down when you overcrop, and it also goes down when you undercrop." He tries to find balance in the vineyard and often hangs more crop in a warmer year.

Consultant Brasher, with clients in Oregon and Washington, believes there is a more pervasive change in quality due to yield when growing grapes in marginal climates. He also believes that thinning in cool climates is sometimes justified to hasten ripening. In warmer climates, the bell curve of quality is broader and there is less quality difference between yields than in cooler regions where grapes might have difficulty ripening in cool years, Brasher explained.

Historically, winemakers trying to reach phenolic maturity have used lower yields as an easy way to have a conversation with the grower to ensure that ripeness can be reached. "This conversation has helped develop the myth that you automatically hasten phenolic maturity by reducing crop load," Brasher said, adding that phenolic maturity has been the driving reason winemakers he's worked with in the past have asked growers to drop crop.

Grower perspective

Sharing a grower's viewpoint, Wildman said that each vineyard has a sweet spot when vines are in balance, but the sweet spot is different for each vineyard and depends on many variables, from site and variety to weather and canopy. Some of the state's highest quality grape years have also been years of the highest average yields, he noted.

Wildman stressed that crop load is important, but not so subjectively that it should become the driving factor behind winemaker decisions. "There's this European, mythical view of ultralow crop that seems to be ingrained in the

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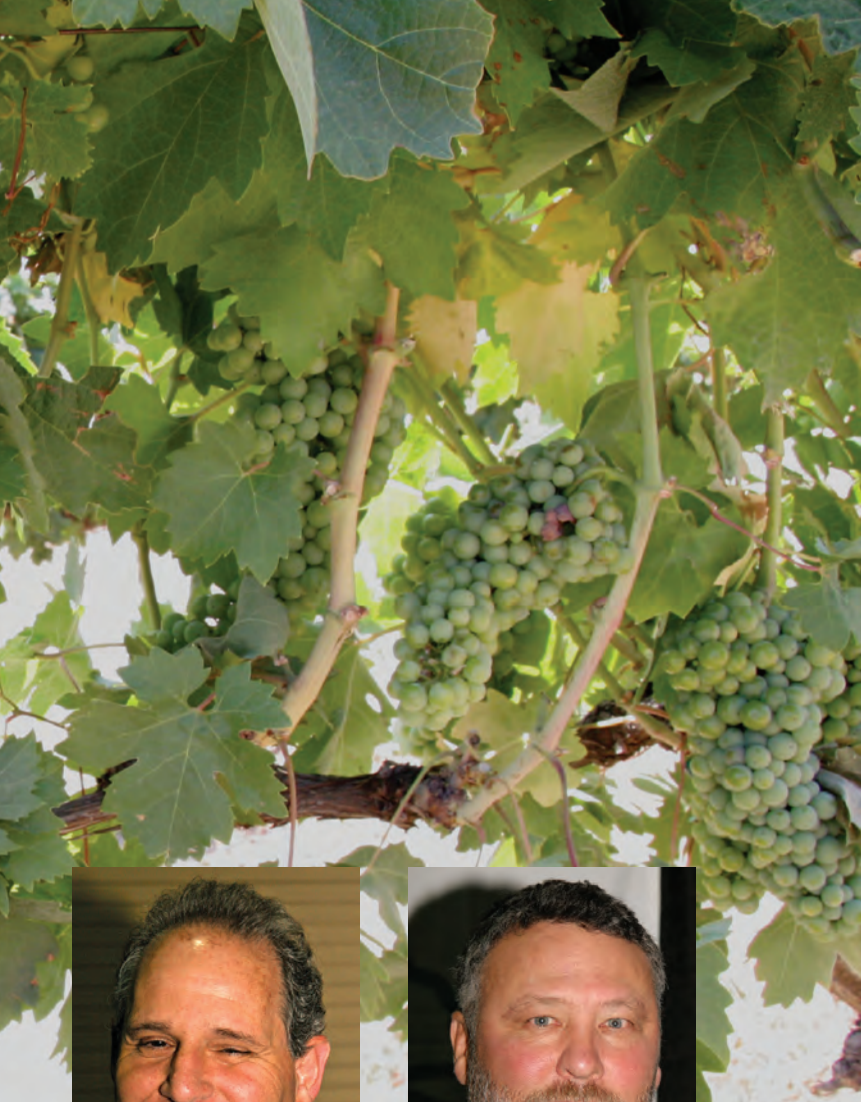


PHOTO BY MELISSA HANSEN

Some winemakers still insist on low yields regardless of the vine's balance or capacity to ripen fruit to maturity. In some winery circles, these Zinfandel grapes could be candidates for cropload adjustment.

winemakers from making unreasonable demands.

Better metrics needed

Gallo's Dokoozlian believes the industry has difficulty defining yield and quality with the metrics currently available. Yield is typically defined as tons per acre, but more is going on in the vineyard than just yield. "We fail to integrate what's really going on. It's not just the amount of fruit, but it's really the canopy—size, condition, and character—that determines the ability of the vine to ripen the fruit and effective crop load," he said, adding that the

industry hasn't paid enough attention to canopy size and capacity relative to yield and quality.

"Vineyardists don't have compositional metrics in place to look beyond sugar [soluble solids] and color when talking to winemakers. Sugar and color are just two of the many components involved with grape and wine quality." ●



Nick Dokoozlian



Tedd Wildman



Brennon Leighton



Eric Brasher

wine industry and winemakers," he said, adding that the U.S. wine industry has a lot of historical baggage and tradition tracing back to France.

"There's good reason why French vineyards tend to crop low, and it's usually an artifact of the soil, site, vine density, age of the vines, and such," he said. "Winemakers, perhaps unconsciously, gravitate toward the low end of the scale. And while every vineyard has a different sweet spot, when winemakers go beyond and below that theoretical sweet spot artificially, just for the sake of low crop because it's a talking point, it's a mistake, and the myth should be busted."

Crop load management is best done by pruning, he said, adding that while he prunes aggressively because he's on a low-vigor site and not worried about overly vigorous vines, some growers tend to leave extra buds when pruning to compensate for spring frosts and must later come back to thin the crop. Even with knowing his bud count and with his severe style of pruning, he still can have a problem of higher cluster counts than desired.

Wildman said he's had some years where yields ended up a ton more per acre than what was planned. "But if the vines seem to be in balance, I let it hang, and so far, it's worked out and I've not had complaints."

For winemakers who insist on low tonnage, Wildman suggested that growers use contracts based on acreage instead of production or yield. He believes acreage contracts help remove conflicts of interest on the part of growers who may want to maximize tonnage and keep

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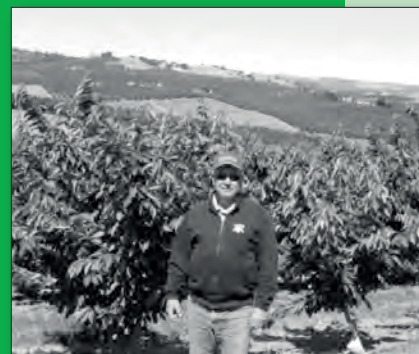
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New cherry sorters

Chelan Fruit Cooperative has about 600 year-round employees, but needs an additional 1,000 packing house workers during the cherry season. It installed a new cherry grader at its Brewster plant this season to reduce its labor needs.

After just a week of working with the new equipment, Rick Lancaster, Chelan Fruit's director of operations, said it should, indeed, reduce the need for human sorters, but the ability to sort for internal defects, including softness, could create a new marketing dynamic.

The ten-lane electronic grader from GP Graders of Melbourne, Australia, uses vision technology from the Dutch company Ellips. It's the same software used in the mobile apple harvest system developed by Picker Technologies.

Color can be sorted into any number of different grades, and the equipment can sort out external defects, such as limb rubs and cracking. It also uses near-infrared light to detect internal defects, such as bruising, cell-wall breakdown, and softness, said Stuart Payne, director of GP Graders. And it does this at a rate of 1,500 pounds per lane per hour.

Based on reducing the number of human sorters and processing more cherries, the payback period for the new grader was estimated to be three to four years.

The cooperative Blue Bird recently installed a similar four-lane grader at its Wenatchee plant. Eventually, Payne plans to begin manufacturing in Wenatchee.



Rick Lancaster said Chelan Fruit's new cherry grader will help ensure that only firm cherries go to export markets.

Unitec

Northern Fruit Company in East Wenatchee also upgraded its cherry line this season with new sorting equipment from Unitec in Spain. It is the first Unitec sorter in the United States, though there have been numerous Unitec installations in Chile.

Doug Pauly, operations manager, said the new Unitec line replaced an old Rainier line where limited color sorting or sizing could be done. The new line has optical sizing and has the capability of sorting for both external and internal defects.

"We hope it's a little more efficient with labor, but the primary reason for installing it was the ability to separate by size and color," Pauly said.

Bird control

A new formulation of an old bird-repellent chemical is being sold in its second season after receiving EPA registration late in 2010.

The active ingredient is methyl anthranilate, and it's being sold under the name Avian Control by Avian Enterprises LLC, Sylvan Lake, Michigan. It is being used to protect fruit crops such as grapes, cherries, and blueberries, but is also used on grain crops, on golf courses, and in airports to reduce bird strikes with aircraft.

The bird-repelling properties of methyl anthranilate were discovered more than 50 years ago, but it was expensive to use because of its short residual life, according to Dan Kramer, technical director of Stone Soap Company, which manufactures Avian Control for its affiliated company. The new, patent pending, method of formulation gives it a residual life in an orchard of 10 to 14 days in the absence of heavy rain, he said.

The chemical is dispersible in water and can be applied with an airblast sprayer at 16 to 24 ounces per acre, at a cost of about \$25 an acre at the higher rate, Kramer said. Sales have been "brisk," he added.

Methyl anthranilate is not the first or only chemical repellent, but it has one huge benefit that methiocarb (Mesurol) did not have: It is not poisonous. It is a food-grade chemical, generally regarded as safe (GRAS), that is used in food manufacturing to give the grape flavor to Kool-Aid. It's also used for flavoring candy, soft drinks, gum, and other products. It occurs naturally in grapes and some other fruits.

The company is in the process of establishing a distribution network. To make direct contact, call (888) 707-4355 or go to www.solveyourbirdproblems.com.

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