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JULY 2021 ISSUE

SPOTLIGHT ARTICLE:

ALMOND PROCESSOR LOOKS AT NEXT-GEN ROBOTICS FOR AUTOMATION

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JCS MARKETING PUBLICATION

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WEST COAST NUT

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IN THIS ISSUE

SPOTLIGHT ARTICLE: Almond Processor Looks at Next-Gen Robotics for Automation

Manteca-based Travaille and Phippen Inc. embrace robotics technology to improve production efficiency and manage a dwindling labor pool.

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Travaille and Phippen of Manteca, California, produce mostly brown-skin almonds for upper-end export markets (all photos by V. Boyd.)

After going through several machines and color sorters to remove extraneous material and defective kernels, the kernels then are run through robotic sorters. A hand sorting crew gives the nuts a final once-over before they are put in boxes.

Travaille and Phippen partnered with Premier Tech to develop the next generation of robotic almond sorters.

ARTIFICIAL INTELLIGENCE DRIVES DEFECT SORTING DECISIONS

MANTECA ALMOND PROCESSOR LOOKS TO NEXT-GENERATION ROBOTS TO SORT KERNELS

By **VICKY BOYD** | *Contributing Writer*

ADMITTED INNOVATORS, THE FAMILY members behind Travaille and Phippen Inc. embrace technology to improve their production efficiency and bottom line and manage a dwindling labor pool. So, when Scott Phippen, one of the partners in the Manteca-based almond grower and processor, stopped by a World Ag Expo booth that featured robotic corn seed sorting several years ago, his interests were piqued.

"'What do you think about robotics for sorting almonds?'" Scott Phippen said, recalling a question posed by Eric Pflueger of Bratney Cos. "I said, 'I think that's real interesting. Can you do it?' They were wanting to try it, and I said I'm up for that. The next thing I know, a contingent was here from Des Moines, which was where they were headquartered."

Travaille and Phippen partnered with Bratney Cos. to develop a prototype and eventually installed four lines, each featuring two pick-and-sort robots, in 2013. Now they are working with Premier Tech, a Canadian firm that acquired the patent from Bratney, to develop the next generation of robotic sorters that uses artificial intelligence.

As Scott Phippen and his brother, Dave Phippen, were quick to point out, robotics won't turn a poor quality crop into a good one. Instead, they view the technology as one of the final steps to ensure a high-quality product that begins with proper cultural practices in the orchard, timely harvest, knowledgeable post-harvest handling and careful shelling steps.

Batting Clean-Up

Travaille and Phippen hulls and shells its own almond crop as well as those from other growers. Nearly all of their nuts go to export as brown skins, with much of the volume destined to discerning high-end markets.

As such, the Phippens said they're focused on growing and producing a quality product that far exceeds USDA's Fancy grade, which allows for 5% chipped or scratched kernels and 2% other defects, among other tolerances.

Even before the nuts reach the robotic sorters, the Phippens run them through several machines and optical sorters to remove most of the extraneous material and defective kernels.

The robotic sorting system relies on cameras above the conveyors to image each nut as it goes by. It then sends the data to a computer, which determines whether the nut is sound or needs to be removed. Should the nut or extraneous material need to be culled, the computer sends a message to the robotic picker, which vacuums it up in an instant and sends it via a pneumatic tube to a bin. All of this occurs in a fraction of a second.

A human eye relies on the RGB, or red, green and blue, spectrum. This also is referred to as visible light.

The current cameras over the sorting belts use hyperspectral imaging, which involves a multitude of light wavelengths ranging from 400 to 1,000 nanometers, said Pflueger, who now works for Premier Tech.

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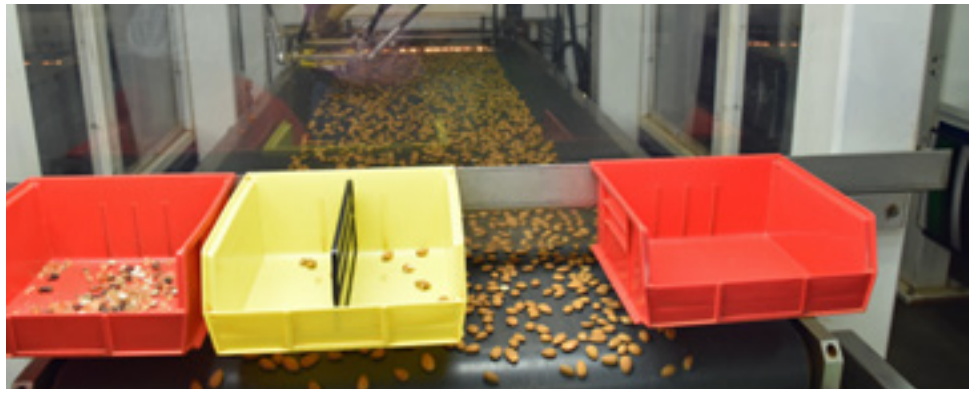
Dave Phippen shows off a prototype of the next-generation robotic sorter from Premier Tech.



The robotic sorting arms are enclosed in glass housing to help protect the machinery. After passing under a camera and robots, the nuts move onto another conveyor to be hand sorted.

Continued from Page 4

The next-generation sorter uses very high-end RGB imaging. Each image also carries a spectral signature. As the computer accumulates the signatures, it continues to "learn about crop characteristics" using artificial intelligence. This only improves its decision-making capabilities.

In fact, Pflueger said, the new system can class individual nuts as they pass under the camera.

"At the end of the day, we can tell you exactly what's in that bin because we have classed everything that's come through," he said. "It also monitors what's going into the bin because we have sensors going into the bin—something we didn't do before."

Plans for the Future

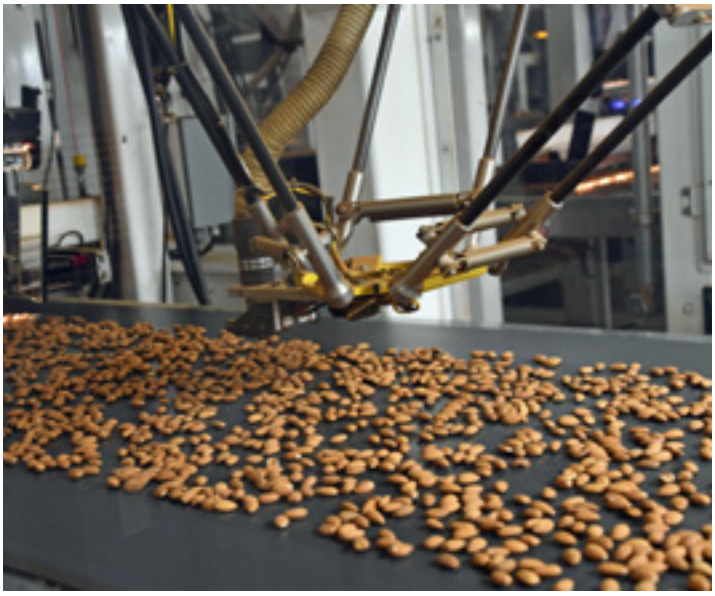
One of the issues the Phippens had with the old system is it dumped all of the culls into one bin. Then he had to re-sort it to remove nuts that were just chipped or scratched and could go into a processed product such as almond milk, those with worm damage or mold that would go to animal feed, and other culls such as shell that were not consumable.

The new system can separate the defects into different categories and different bins, such as three in the case of Travaille and Phippen, Pflueger said.

The old system also relied on two robotic arms per line, and each robot transited the entire width of the belt. The new system uses four robots per line, and each robot covers slightly more than half of the belt width, with an overlap in the middle. Because the robotic arms don't have to travel as far, belt speed can be increased. Belts with the old system typically ran up to 34 feet per minute, whereas the new belts can run up to 60 feet per minute.

The actual speed of the system and sorting belts depends on the cleanliness of the crop and buyer specs. But Scott Phippen said they try to shoot for 3,000 pounds per line, or 12,000 pounds per hour, with the old system, and they run 12 hours per day six days a week.

Currently, the enclosed room where the nuts are sorted houses four lines with two robots each. Because the new robots require a slightly narrower support frame and conveyor belt, Scott Phippen said he hoped to squeeze in six lines of four robots each to increase their throughput. Installation of the new system could begin as early as the next few months.



Installed in 2013 at Travaille and Phippen, the original robotic sorters have become obsolete.

A Place in Pecans

While sound almond kernels have a fairly smooth surface, pecan kernels are just the opposite with deep crevasses and ridges. But the latest developments in imaging can provide views of hidden defects, Pfleuger said.

He recently installed a four-robot, single-line system in a Valdosta, Ga. pecan processor that runs around the clock. Each robot can do 100 picks per minute, or 400 picks per line per minute, without a decline in sorting caliber as the shifts wear on.

Unlike most almonds in California, pecans are infrequently grown in managed orchards and harvested in a timely manner. Instead, a landowner may have a handful of trees, collects the nuts in buckets or burlap sacks after they fall and sells them to a processor.

As a result, sticks, rocks and other debris are often mixed in with the nuts. Pecan quality also varies widely.

In addition, pecan kernels are more fragile and contain significantly more oil than almonds, further complicating sorting, Pflueger said. That means scrapers, pneumatic lines and other parts of the sorting system have to be cleaned or replaced more frequently to prevent damaging oily buildup.

Worker Availability Remains an Issue

Dave Phippen said their agreement with Bratney prohibited them from talking about the cost of the first robotic system. But he said they're on the positive side of obtaining a payback on their original investment.

The Phippens said they began thinking about replacing their old robotic system after Bratney quit supporting it. In addition, the technology became obsolete.

What attracted them to Premier Tech was the company had the various divisions, such as computing technology and engineering, all in-house. So, one call typically resolves an issue.

"These guys have horsepower," Scott Phippen said.

Dave Phippen said they originally looked at robotics in the early 2010s because of challenges finding workers, which has only grown worse.

"It was very difficult to get labor, even back in those days," he said. "I just want to know my labor will show up and is healthy."

Nevertheless, Dave Phippen said, the operation will continue to employ a small hand sorting crew to give the nuts a final once-over after they exit the robotic sorters and before they go into the box.

"We'll always have hand sorters because we sell to the upper-end markets," he said.

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Potential Effects of Drought and Climate Change on Insect Pests Including Navel Orangeworm

By **JHALENDRA RIJAL** | *UCCE Area IPM Advisor*
and **TAPAN PATHAK** | *IPM Program Specialist*
University of California Agriculture and Natural Resources

CLIMATE CHANGE IS THE LONG-TERM statistically significant change in climate parameters due to increases in greenhouse gas (GHG) emissions in the earth's atmosphere, including carbon dioxide (CO_2). Increased temperatures, increased intensity and frequency of extreme events such as drought and flood as well as increased precipitation variability are examples of climate change. These parameters can have significant impacts on agricultural production and pest management, among other broader implications. Since temperature is most strongly related to insect pests, we will discuss the effect of increased temperature on insect pests and then present a navel orangeworm case study in a later part of this article. But first, we'll discuss two other parameters in general terms: elevated CO_2 and unpredictable precipitation.

CO2 Levels and Pests

Elevated CO_2 concentration can have an impact on both crop plants and pests. In general, a high CO_2 level to a certain degree favors plant growth by increasing photosynthetic activity, which can change both quantity and quality (i.e., chemical composition) of the leaves. However, we should not take this as a standalone factor as plant growth is the result of multiple environmental and other factors such as crop type/variety, temperature, humidity, soil moisture, soil fertility and more. Several studies have shown that increased CO_2 levels can influence the insect fecundity, consumption rates, insect density and abundance, all of which can directly or indirectly increase the risk of individual insects causing damage to host crops as insects are more attractive/responsive to these plants and can feed more.

Studies show a fifth generation of Navel orangeworm may result from changes in climate in several nut producing counties of California (photo by J. Rijal.)

Figure 1. 23 California counties (shaded) included in the study.

Precipitation and Pests

Water is the most critical resource for commercial crop production; however, studies reported that natural water sources have become scarce (i.e., drought) or unpredictable (i.e., high-intensity flash floods) across major crop-producing regions globally. In California, a prolonged period of drought has been reported from 2011 through 2019 (source: US Drought Monitor). A recent report from May 2021 suggested that ~74% of California land is under the "extreme drought" condition (drought.gov/states/california). Droughts affect plant-feeding arthropods (i.e., herbivores) in the following ways: 1) dry conditions may favor the development and growth of herbivores. For example, spider mites do well in hot and dry environments; 2) drought-stressed plants can release stress signals that attract certain insect species. For example, plants lose moisture through transpiration, and as a result, there is a gap or break created in xylem water columns. That condition produces an ultrasonic acoustic emission detected by certain beetle pests that attack those trees; and 3) drought-stressed plants are more susceptible to herbivore (plant feeding insects and other organisms) attack as the plants cannot produce enough secondary metabolites to defend against the pest attack.

In California, we observed an increased problem with flatheaded borer, a wood-boring beetle pest in walnuts in the last four to five years. Several growers and PCAs were caught off guard by this pest as this was never a big issue in the past. Although multiple factors might be contributing to this problem, including sunburn, increased walnut acreage, sub-standard land quality for walnut orchards inducing stress in the plant, etc., the most plausible explanation is the prolonged drought (circa 2011-19).

Temperature and Pests

Temperature is the major driving factor of global warming and climate change. In California studies (e.g., Pierce et al. 2018), it has been reported that future statewide temperature is projected to increase by 2 to 7 °C by the end of this century. More importantly, the rate of increase in the minimum temperatures has been substantially higher than the maximum temperatures. Temperature changes directly affect the biology, physiology and behavior of insect pests, impacting

Continued on Page 10

1	Shasta
2	Tehmama
3	Glenn
4	Butte
5	Colusa
6	Yuba
7	Sutter
8	Yolo
9	Napa
10	Solano
11	Sacramento
12	Placer
13	El Dorado
14	San Joaquin
15	Stanislaus
16	Tolumne
17	Merced
18	Mariposa
19	Madera
20	Fresno
21	Kings
22	Tulare
23	Kern

Figure 2. Number of navel orangeworm generations (A=third, B=fourth, C=fifth) for 23 counties in California (almond/walnut model). Dark red color indicates a higher probability.

Continued from Page 9

their survival, development and reproduction. Also, temperature influences insect mobility and migration, leading to shifts in insect pest dynamics, abundance and distribution.

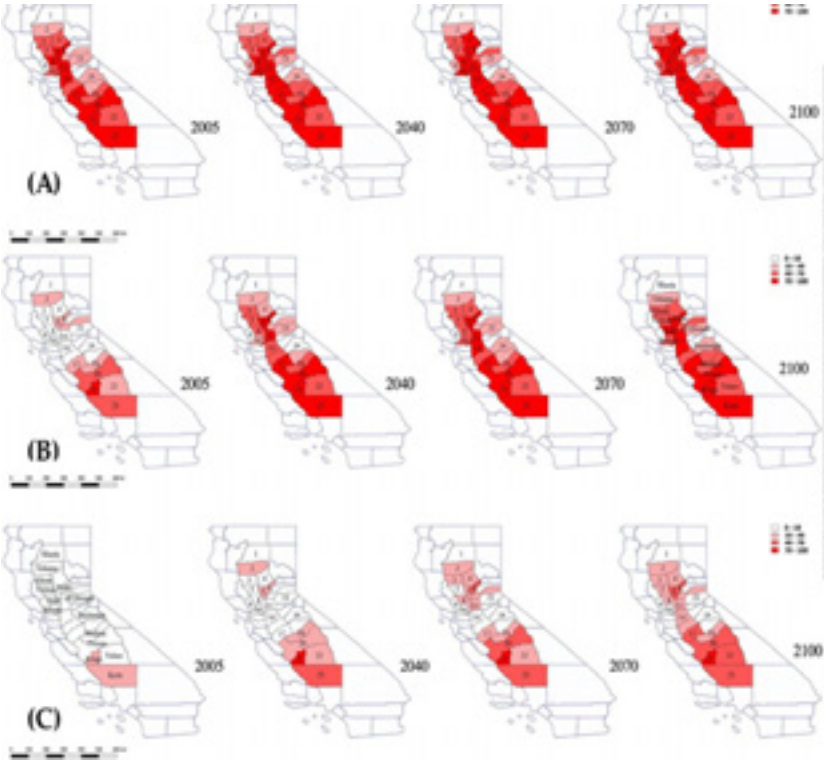
Elevated temperature level impacts the pest population and the performance of the natural enemies by altering the synchrony of pest-natural enemy interactions. Although insect growth and development are highly dependent on temperature, plants are also affected by the temperature change, which has several implications in pest management. For example, some existing host plants of insects can be more or less favorable, and in some cases, the plants become a new host (attractive) to the insect. This is due to the physiological and biochemical changes within the plant systems mediated by increased temperature and other associated factors.

Since insect and plant growth tend to respond to temperature differently, elevated temperature can alter their synchrony, positively or negatively affecting the insect-host plant relationship. The general assumption is that increased warming can change or expand the geographic range of the pests and predators, increase the risk of invasive pests, increase insect winter survival and begin in-season pest activities earlier as well as increase the number of generations, desynchronization of pest and natural enemy dynamics or pest and host plant interactions. Not all insects and plants respond to environmental cues the same way. Therefore, individual pests and their interactions with natural enemies and host plants under increased temperature conditions must be studied separately.

Navel Orangeworm and Climate Change: A Case Study

Navel orangeworm (NOW), a primary pest of almonds, walnuts and pistachios, directly feeds on nutmeat and causes economic damage. In addition, the infested nuts become an easy target of *Aspergillus* mold and increases the risk of aflatoxin contamination in otherwise healthy nuts. NOW is an opportunistic, highly mobile and multi-host pest with up to four generations in the Central Valley. With more than two million acres of the major host crops in the valley and increased drought and dry conditions in the last decade, this key pest has become a significant risk to nut crop growers.

Recently, we published an article (doi.org/10.1016/j.scitotenv.2020.142657) looking at the potential impacts of climate change (primarily focused on temperature) on the population dynamics of NOW. For this study, we selected 23 Central Valley counties (**Figure 1, see page 9**) and used five temperature data points to represent each county. Temperature (max/min) data were derived from 10 climate models (GCMs or "General Circulation Models"). We categorized the climate period into historical (1950-2005) and future (2005-2040; 2040-2070; 2070-2100). We used two emission scenarios based on "Representative Concentration Pathways" (RCP)



1	Shasta
2	Tehmama
3	Glenn
4	Butte
5	Colusa
6	Yuba
7	Sutter
8	Yolo
9	Napa
10	Solano
11	Sacramento
12	Placer
13	El Dorado
14	San Joaquin
15	Stanislaus
16	Tolumne
17	Merced
18	Mariposa
19	Madera
20	Fresno
21	Kings
22	Tulare
23	Kern

Figure 3. Number of navel orangeworm generations (A=third, B=fourth, C=fifth) for 23 counties in California (pistachio model). Dark red color indicates a higher probability.

of 4.5 and 8.5. RCP. 4.5 is a "medium" emissions scenario that models a future where societies attempt to reduce GHG emissions, while RCP 8.5 is more of a "business as usual" (i.e., lacking the stringent climate mitigation) scenario.

All results presented here are from the RCP 4.5 scenario. We used one calculation of the model for walnut and almond together and a separate calculation for pistachio because of the shorter generation period of NOW in pistachio. We assumed April 20 (i.e., 148 degrees C degree days from January 1) as the spring egg-laying biofix for this analysis. Biofix is when 50% or more of the egg traps in an almond orchard have NOW eggs on them. Biofix date is used to begin accumulating heat units (i.e., degree days). The duration to complete the first generation used for the calculation was 565 degrees C degree days. In contrast, the duration used for the subsequent generations

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was 444 degrees C degree days for the almond/walnut model and 402 degrees C degree days for the pistachio model. Degree days measure heat units over time and are calculated based on daily maximum and minimum temperatures.

In this study, we looked at two important aspects of NOW population dynamics: 1) the timing of the occurrence for individual generations; and 2) the duration of each generation for the historical and future periods mentioned above. The results showed four complete generations (in contrast to the current three to four generations) of NOW could occur consistently throughout the Central Valley within the next 20 years in almond and walnut. By 2040, the study predicted that an extra generation (i.e., fifth generation) is likely to occur in the three southernmost counties evaluated (Kern, Kings and Fresno) in the almond/walnut model (**Figure 2, see page 10**) or seven counties in the pistachio model (**Figure 3, see page 11**). By the end of this century, the occurrence of the fifth generation will extend to 11 (almond/walnut model) or 17 (pistachio model) of the 23 counties included in the study.

Additionally, NOW spring activity will begin earlier than in the past, and it will take fewer days to complete each generation due to projected future temperature increases. The study reported that the duration of the first generation of NOW was shortened by almost six weeks in some cases. For example, in Sacramento county, NOW was expected to complete its first generation in almonds and walnuts around the 193rd day of the year historically, whereas it ranged between the 154th (by 2100) and 180th (by 2040) day under future climate scenarios. Similarly, in pistachio in Tulare county, model results showed NOW was expected to complete the fifth generation around the 292nd day (approximately October 19 of the calendar year) historically, while according to future climate scenarios, this could occur as early as the 262nd day of the year (approximately September 19).

To summarize the results of this case study, climate change models predicted an increase in NOW pest pressure for three major, high-value tree nut crops, and the fifth generation of NOW is likely to occur under future climate conditions. The study presented here is based on models that estimate and predict the effects of climate change in different areas. Of course, there is underlying uncertainty with these scenarios because we don't know what accelerates different model parameters and to what degree. Therefore, the information provided here should be taken as general guidance about a potential future scenario. Our study aimed to inform the industry and allied stakeholders about possible future threats so that we all can think about the potential mitigating measures needed to address impacts of climate change on the integrated management of NOW. These may include creating awareness, designing experiments around this topic and potentially proactively engaging the industry to address its future needs.

Implications for Pest Management

Climate change directly impacts the pest and natural enemies population dynamics in agricultural production systems. Indirect impacts include changes in insect pest composition, expansion of geographic range for pests and host crops and plants, increased occurrence of invasive species and the reemergence of the minor pests with different pest status.

Adapting pest management practices to a changing climate is an ongoing process. These adaptations can be achieved by formulating modified IPM practices, developing regional networks for monitoring certain high-risk pests, redesigning sampling plans, rethinking insect pest thresholds and using pest population prediction models and tools.

The solution is not just adjusting the pest management strategy by growers; it should be bigger. We all should encourage and help formulate crop production and pest management strategies and policies around these matters. These may include provisional incentives to farmers, enabling robust investment in research to address these issues in the long term while maintaining the viability of production and pest management systems.

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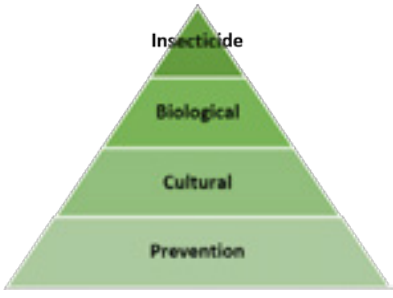

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MRLs	Varies	**Exempt**

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Water availability and lower navel orangeworm pressure are two advantages of pistachio production in the Sacramento Valley (all photos courtesy C. Parsons.)

Pistachio Production Grows in Northern California

Growers see advantages in planting pistachio trees in Sacramento Valley

By **CECILIA PARSONS** | *Associate Editor*

EVEN THOUGH ONE OF THE FIRST PISTACHIO TREES PLANTED IN California put down roots in the northern Sacramento Valley town of Chico, the majority of the state's expanding pistachio production is in the central to southern half of the San Joaquin Valley.

It stands to reason: pistachio trees are native to a country with a hot, dry climate and were thought to be best suited for the counties of Kern, Tulare, Kings and Fresno where summers are hot and dry. In the last decade, there has been a shift in that thinking, UCCE farm advisors and nurseries agreed, noting that planted acreage in the Sacramento Valley has increased from about 2,000 acres to 10-12,000 acres.

Most of that new acreage is in Yolo County, though trees are still being planted farther north, and production could be possible as far north as Anderson in Tehama County, according to Cliff Beumel of Agrimillora Nursery.

"Wherever almonds and walnuts are growing, they can too," Beumel said.

Although the Sacramento Valley was always well-suited for pistachio production, Bob Klein, manager of the California Pistachio Research Board, said the bulk of the early plantings were done in the southern San Joaquin Valley due to relatively lower land prices. Fungal diseases, more prevalent in the north, were harder to control in the past before development

of effective fungicides.

Pistachio acreage is expanding in the north, Klein said, but most orchards tend to be smaller than those found in southern growing areas, and most of the growers are new to pistachio production.

Unique Growing Conditions

Pistachio growers are taking advantage of some unique growing conditions in the north, said UCCE Orchard Systems Advisor Katherine Jarvis-Shean. In areas of the Sacramento Valley where water and soils are high in boron, pistachio trees can thrive, unlike almond and walnut trees. This was a driver in the earlier pistachio plantings there, she said.

Jarvis-Shean, who advises growers in Solano, Yolo and Sacramento counties, noted in a 2020 UC Pistachio Short Course presentation that, given fewer low-chill winters are predicted in the future, chances for a pistachio tree's winter rest may be better up north.

"Lack of low chill may not be quite as severe up north, but they are not going to be immune to it either."

Threat of freeze damage is no worse than in it is in the south valley, Jarvis-Shean said.

"Similar to chill, when it's bad in the San Joaquin Valley, we experience it up here, too. That said, I have not yet seen it take out trees the way it seems to in Craig Kallsen's district (Kern County). There's certainly an interaction between salt stress and freeze damage, and we don't have as much salt stress up here. Maybe that's why the damage is not so bad. But we're still figuring that out."

There are some environmental conditions that could pose challenges to tree health.

Botryosphaeria and anthracnose are two diseases that could have more of an effect on pistachio production where environmental conditions are wetter than in the south SJV. Life cycles for these diseases need water, Jarvis-Shean said, and wet late springs could put trees at a higher risk of infection.

"Growers will need to have more of a fungal disease management program. There is a higher risk here for infection and they may need to apply one more spray. It is not unmanageable though," Jarvis-Shean said.

She said presence of soil pathogens and nematodes are not likely to be major issues in the north compared to southern growing regions.

> **Lack of low chill may not be quite as severe up north, but they are not going to be immune to it either.**– Katherine Jarvis-Shean, UCCE

Infrastructure Issues

Reid Robinson with Sierra Gold Nursery predicted the northern production growing pains will be mainly due to lack of infrastructure.

Currently, there are no pistachio processing plants north of Sacramento.

That could be an issue when a large amount of the acreage comes into production. Other support, including work crews that have pistachio pruning experience and budding experience, is needed. Harvesting could also pose a challenge, but Jarvis-Shean noted that the crop maturity in the north is about a week behind southern production and that it is possible equipment could migrate north for harvest.

Klein pointed out that even though there currently are no pistachio pro-

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Lower split nut percentages due to fewer heat units in northern growing areas is one disadvantage cited.

Much of the young pistachio orchards in the Sacramento Valley have been planted in Yolo County.

Continued from Page 15

cessing facilities north of Sacramento, there are several that have been built farther north in the San Joaquin Valley.

As production increases, he said that hulling and drying facilities would likely be built.

Reid also said that the industry in the north might need optimized rootstocks that can withstand the heavier soils and rootstock pathogens. Early research, he added, does show that Platinum is a bit more resilient in those conditions.

Reid and Jarvis-Shean also mentioned issues with a lower split nut percentage.

Splits are driven, Jarvis-Shean said, as kernels expand in size. Expansion is driven by heat units, which the nuts may lack with a nut maturity that is later in the north.

"Advantages to growing pistachios in the Sacramento Valley are plenty," Reid said.

"Water availability is huge. Lots of strategic growers are moving north to capture water.

You are also able to optimize heavy boron areas which aren't suitable to almond or walnuts."

Navel orangeworm pressure is lower in northern counties, Reid said. Natural winter mortality is higher in the Sacramento Valley and fourth flights are less common. Orchard sanitation is still strongly recommended, but growers can expect to make fewer pesticide applications in their orchards.

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3014	32-inch	14'0"	35"	13'9"	33'9"	23'2"
	Blade Dia.	Number of Blades	Cut	Hedge Height	Topping Height (90-deg max)	Maximum Topping Height (45 deg Max)
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EMERGING PESTS IN PISTACHIOS

WATCH OUT FOR CHANGING ACTIVITY OF GILL'S MEALYBUG AND OTHER POTENTIAL PESTS

By **MITCH LIES** | *Contributing Writer*

Adult female Gill's mealybugs are flat and oval, ranging in size from two to five millimeters, and have a pink body covered with white wax, giving them a striped appearance. First instars, or crawlers, can be seen emerging from one of the females here (photo by K. Daane.)

WHEN IT COMES TO EMERGING PESTS IN PISTA-chios, a scale and a moth loom large outside of the U.S. Then there is the brown marmorated stink bug: It is present in California and causing damage to almonds, but has yet to be reported in pistachios.

And any discussion of emerging pests in pistachios has to include Gill's mealybug, not so much because the pest is new to North America, but because problems with it are accelerating.

As UCCE Entomology Farm Advisor for Kern County David Haviland reported in *West Coast Nut* last spring, insecticide programs that formerly controlled Gill's mealybug are no longer providing the same level of control. Further, Haviland reported, nobody knows why.

UCCE Entomologist and Biocontrol Specialist Kent Daane said he and Haviland plan to spend the next few years studying the pest in hopes of uncovering answers to that question.

Daane is concentrating on the biology of the pest, while Haviland is looking at how the pest is responding to different chemistries.

One theory for the reemergence of Gill's mealybug as a pest of concern in pistachios is that changes in the environment or orchard practices over the past 15 years have altered mealybug development to the point it is less synchronized than it once was. What used to be a synchronized start to mealybug activity in March has now become spread out. And where one spray in June formerly provided season-long control, today it doesn't.

"Maybe what is happening is that the population age structure of the mealybug has changed," Daane said. "Today, some part of the population is a third instar when another part is a first instar, so when you put on the insecticide, which kills the small stages,

Feeding damage to the pistachio hull causes shell staining that can devalue high-quality split-inshell nuts (photo courtesy David Haviland, UCCE.)

Growers also should watch for signs of brown marmorated stink bug, which is a potential threat to pistachios (photo courtesy Oregon State University.)

"WE ARE FINDING THAT EVERYTHING – THE IGRS (INSECT GROWTH REGULATORS), THE NEONICS (NEONICOTINOIDS) – EVERYTHING IS NOT DOING AS WELL TODAY AS IT WAS 15 OR SO YEARS AGO." – KENT DAANE, UCCE

well, you've got an adult out there and the adult is about ready to produce crawlers, and she is not feeding, she is not molting, and so the insecticide misses a tiny portion of the population."

Insecticide Issues

Researchers also are looking at the potential that the pest has developed resistance to commonly used insecticides, but Daane doesn't think the answer lies there.

"We don't expect it to be resistance, because it would have been unusual for the mealybug to develop resistance to insecticides with completely different modes of actions," he said. "We are finding that everything—the IGRs (insect growth regulators), the neonics (neonicotinoids), everything—is not doing as well today as it was 15 or so years ago."

Still, researchers aren't ruling out resistance, and that will be one avenue Haviland will be studying.

The loss of chlorpyrifos, or Lorsban, also has surfaced as a possible reason for the reduced efficacy of insecticide control programs. "In the past, Lorsban might be used as a leaffooted bug control, and maybe with that being removed from the arsenal… that has allowed Gill's mealybug to come in," Daane said.

And there are concerns that broad spectrum insecticides, such as the pyrethroids that are sometimes used to control navel orangeworm in pistachios, are killing the natural enemies of Gill's mealybug.

"We are now trying to look at all control facets to see if we are able to figure out why the insecticides are not working as well, and to see if there are ways to manipulate natural enemies and just have the parasitoids do the work," Daane said.

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First Sighting in the Late '90s

Gill's mealybug, *Ferrisia gilli*, was first found in pistachios in California in the late 1990s. By 2006, it had spread to at least 3,000 acres in 11 counties. Adult female mealybugs are flat and oval, ranging in size from two to five millimeters, and have a pink body covered with white wax, giving it a striped appearance.

Mealybugs damage pistachios by sucking plant juices through their straw-like mouthparts, robbing trees of carbohydrates intended for fruit development. Feeding damage to the pistachio hull causes shell staining that can devalue high-quality split-inshell nuts. Severe feeding on the rachis or hull can cause nuts to dry up and shrivel prior to harvest. Mealybug feeding also results in the production of honeydew that acts as a substrate for black sooty molds.

The most common predators of mealybugs in pistachios are green and brown lacewings and lady beetles. Several parasites have been found in almonds and grapes that also attack Gill's mealybug in California; however, these parasites have not been found in pistachios, likely, researchers surmise, because of the use of broad-spectrum insecticides used for controlling true bugs.

Daane added that while softer chemistries have been shown to be effective at controlling the smaller mealybug stages in other crops, they are not as effective as the conventional systemic materials more widely used in pistachios to control the pest and may not have a fit in pistachios, given the current off-synchronistic stages of the pest found in the crop.

"The softer materials best impact the smaller mealybug stages and they aren't systemic," Daane said "So, for any mealybug that has an off-synchronistic population, with larger as well as smaller stages, the biologicals won't work as well. And, for any mealybug that has a part of its population hidden in the cracks and crevices of a tree, those materials won't contact that bug and won't work as well."

Gill's mealybug control is further compounded in pistachios by the fact that coming in with a second treatment to try and control the pest later in the season can cause issues with maximum residue levels (MRL) in cases where pistachios are exported, particularly in cases where the crop is exported to European countries, many of which are working on a default MRL, or essentially zero tolerance of any pesticide residues on the nuts.

Daane said it could be two or three years before the researchers can provide answers to the multiple questions surrounding this issue. In the meantime, the researchers are recommending growers stay with the treatment program first identified in the mid-2000s of treating for the pest when the majority of its crawlers are out and feeding, typically late May to early June.

Watch for New Pests

Daane added that growers also should keep an eye out for possible new pests in pistachios, including the pistachio twig borer moth, which is currently considered the third most important pest of cultivated pistachio trees in the tree's country of origin, Iran, and the yellow pistachio hard scale, which also has become a pest of economic importance in pistachios in the Middle East.

"Insects are being moved around the world," Daane said. "We are sharing each other's pests at this point in time. There is so much movement of people and commerce, and you might have one of these insects as a pupa get into something else and make it over here."

Daane advised growers to watch for any new moth damage or for any new scale pests and if seeing something of concern to contact their local farm advisor or county agriculture commissioner.

"We don't want those pests here," he said.

Growers also should watch for any sign of brown marmorated stink bug, Daane said. "It is here," he said. "It has been reported to be a pest of almonds, and it is a potential threat to pistachio, even though it is not a pest of pistachio, per se. It is another trash insect in that it will feed on so many different hosts."

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Storing and Managing Harvested Nuts for Maximum Quality

Larger harvests mean most handlers are stockpiling almonds until they can be processed.

By **CECILIA PARSONS** | *Associate Editor*

Almonds are unloaded at a processor and stockpiles are built to hold them until processing. Larger volume harvests make stockpiling necessary (all photos by Almond Board of California.)

LARGER ALMOND HARVESTS MEAN MANY HULLER-SHELLER FACILITIES will need to build stockpiles until nuts can be processed.

Storing harvested nuts in stockpiles until they can be hulled and processed requires careful management on the part of growers and processors to preserve nut quality and avoid food safety issues.

Tim Birmingham, director of quality assurance and industry services for Almond Board of California, said increasing harvest volumes mean processing can take months after the last loads of nuts are delivered.

"Early in the harvest season, they can keep up with incoming nuts, but stockpiling is more common, and they could be processing nuts until the end of the year," Birmingham said.

The adage 'quality in, quality out' applies with stockpiles.

To prevent mold or other quality issues from invading stockpiles, the grower has the responsibility of delivering nuts that can be safely stored for months.

"A big part of that is delivering nuts with less than 6% moisture in kernels or less than 12% moisture in hulls," Birmingham said.

The work to deliver quality nuts begins prior to harvest. Guidelines for Good Agricultural Practices state that orchard floors should be dry, hard and clean to not only reduce dust, but to ensure the harvest won't be contaminated. Smoothing floors and removing as much orchard debris as possible along with scouting the floors for any deceased wildlife is advised prior to start of harvest.

Birmingham also recommends watching the weather forecast. Rain during harvest can increase risk of mold growth and concealed damage in almonds.

Nuts will fare better if left on the tree until threat of rain has passed. But, holding off shaking may not be an option for some growers. If nuts are already on the ground at the time of a rain event, they will need extra time to dry. They should be blown away from the tree trunks and not windrowed. Windrowed nuts that are rained on may need to be conditioned to accelerate drying. Blowing away leaves and other orchard debris from the windrows can help the drying process.

"Give them time to dry. Turn the windrows if necessary to help them dry," Birmingham said.

If nuts are destined to be stockpiled at the processor, it is important to take samples to know moisture levels, especially if it has rained after the nuts were shaken.

Taking Samples

Taking nut samples from across the orchard floor and along the tree row provides a complete sample of the almonds. There is variability between drying on the orchard floor and in windrows. Sampling should take this variability into account.

Almond Board also recommends taking samples from places in the orchard which are likely to be wetter. Those places include the north side of the canopy next to the tree trunk where moisture can be about 2% higher than other areas. Samples taken from windrows should be chosen from the bottom layers.

The ABC guidelines for almonds to be stockpiled is below 6% moisture for the in-shell kernel, less than 9% for the total in-hull almonds and less than 12% moisture content for the hulls. If moisture levels exceed the percentage for in-shell kernels or hulls, the nuts should not be stockpiled.

Ensuring food safety and quality begins in the orchard. Even if nuts are not going in a stockpile, they should be adequately dried and picked up from a clean orchard floor.

Nuts exposed to excess moisture in the orchard can develop mold. Certain molds produce aflatoxins, which are health concerns. Molds may live in the soil or they can develop in nuts from navel orangeworm feeding. Maximum allowable levels of aflatoxin contamination have been set by many countries that import California almonds, making it important to ensure early prevention of contamination.

Concealed Damage

Research funded by ABC has resulted in development of best practices for stockpile management to prevent both aflatoxins and minimize the formation of concealed damage, a condition in which off-flavors and off-colors are revealed after roasting.

Exposure to excess moisture at harvest can cause concealed damage in almonds. This quality issue does not

Continued on Page 24

"ENSURING FOOD SAFETY AND QUALITY BEGINS IN THE ORCHARD. EVEN IF NUTS ARE NOT GOING IN A STOCKPILE, THEY SHOULD BE ADEQUATELY DRIED AND PICKED UP FROM A CLEAN ORCHARD FLOOR."

Almond stockpiles are covered to protect them from rain, but they must be managed to prevent moisture buildup under the tarps.

> "GIVE THEM TIME TO DRY. TURN THE WINDROWS IF NECESSARY TO HELP THEM DRY."
>
> – TIM BIRMINGHAM, ALMOND BOARD OF CALIFORNIA

Continued from Page 23

become apparent until after the nuts are heated during processing.

"We saw this at the 2012 harvest which had a lot of rain," Birmingham said. The moisture remained in nuts, and, after processing, kernels were discolored and had an off-flavor.

If nuts are exposed to high moisture levels and nothing is done to expedite drying, concealed damage can occur. In wet conditions, one option is to pick the nuts up off the orchard floor and dry them artificially.

Creating Stockpiles

Almond stockpiles are not common on-farm, but as huller-sheller capacity is reached, they are an option for a grower.

The ideal site would have a slight slope to drain away moisture and a hard surface. The shape and positioning of the stockpile can also control moisture and mold growth. An even, flat top helps prevent pooling of moisture in low spots. Positioning the long side of the stockpile from north to south also helps prevent condensation from forming.

Stockpiles built at a processing facility are covered with tarps, which can protect nuts from contamination by birds or rodents. Use of a tarp requires some attention. For properly dried field-run nuts, black/white or white tarps are recommended, and if the field-run nuts have a moisture level greater than the moisture levels suggested by the guideline, the stockpile can be occasionally uncovered to avoid condensation buildup.

Moisture is also a significant factor in the growth of mold Aspergillus that produces aflatoxins. Moisture in the stockpile, coupled with hot weather temperatures, can trigger growth of this mold. Monitoring the moisture in the nuts or humidity in the stockpile and adjusting conditions can limit fluctuation of the moisture in the stockpile. Removing tarps during the day and covering during the night is recommended, especially for the stockpiles with higher moistures from field runs.

ABC has a chart to calculate the moisture content of a stockpile based on relative humidity, which can be found at almonds.com/sites/default/files/2020-03/grower_stockpile_management_best_practices_from_abc_2014%5B1%5D.pdf.

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RESEARCH UNCOVERS NEW DEVELOPMENTS IN BAND CANKER IN ALMONDS

By **THEMIS MICHAILIDES** | *Department of Plant Pathology, UC Davis*
and **YONG LUO** | *Kearney Agricultural Research and Extension Center, Parlier*

BAND CANKER WAS FIRST REPORTED IN the late 1960s as a minor problem in California almonds. However, over the years, its occurrence had been very sporadic in the northern San Joaquin and Sacramento valleys.

In the last decade, UCCE farm advisors, as well as PCAs and growers from various counties, have reported and/or submitted numerous trunk samples from young almond trees with presumed band canker symptoms. Over the last few years, surveys and diagnoses have revealed that this disease is prevalent in several major almond-growing counties, including Stanislaus, San Joaquin, Sacramento, Yolo, Solano, Yuba/Sutter, Colusa, Glenn, Butte, Tehama, Madera, Merced, Fresno and even as far south as Kern County.

To support the almond industry in identifying and combating this disease, Michailides and a team of researchers and experts conducted research to better understand the severity of band canker in almonds and also to determine which disease management strategies may work for almond growers.

Figure 1: Band canker symptoms on the trunk of a young almond young (photo courtesy of T. Michailides & Y. Luo.)

Figure 2: Bark of an almond tree with band canker showing aggregates of Botryosphaeria dothidea pycnidia (photo courtesy of T. Michailides & Y. Luo.)

Understanding the Disease

Disease epidemics caused by band canker pathogens are complicated. Asexual spores, called conidia, are considered the most common reproductive inoculum source for band canker and can be affected by interrelationships of the specific pathogen, the plant surface microorganisms, the physiological stage of the host and the environmental conditions. For example, conidia require water to spread, germinate and infect plant tissues. In addition, the ambient air temperature must be favorable and the host plant must be susceptible.

In California's Mediterranean climate, rains occur in winter and early spring when temperatures are relatively low, allowing conidia to spread and initiate infections. These infections do not immediately develop into disease because of the unfavorable temperatures and physiological stages of the tree. However, the infections do establish in the plant epidermal layers and "wait" until the physiological stage of the tree changes and environmental conditions become favorable (high temperatures). These infections are called "latent infections", and the duration of time without any disease symptoms developing from a successful infection is called "latency". During the latency period, the pathogens exist in close association (parasitic phase) within the almond trunk tissues.

Symptoms

Band canker symptoms include amber-colored gummosis (or gummy galls) exuded on the trunk, usually in a band pattern (**Figure 1**). Upon scraping the bark, one can see continuous or intermittent black tissues underneath. When using a lens, one may observe spore fruiting structures (called pycnidia and/or pseudothecia: see **Figure 2**) on the bark. Severe cases result in tree death.

Current Research Findings

Research conducted by myself, Dr. Luo, and a team of experts and researchers allowed us to witness a dramatic example of how severe the damage from band canker can be. We studied an orchard located in Kern County where, within a two-year period, the grower removed and replanted 1,700 trees due to band canker infection.

Isolates taken from the bark of trees with typical band canker symptoms consistently produced fungi species

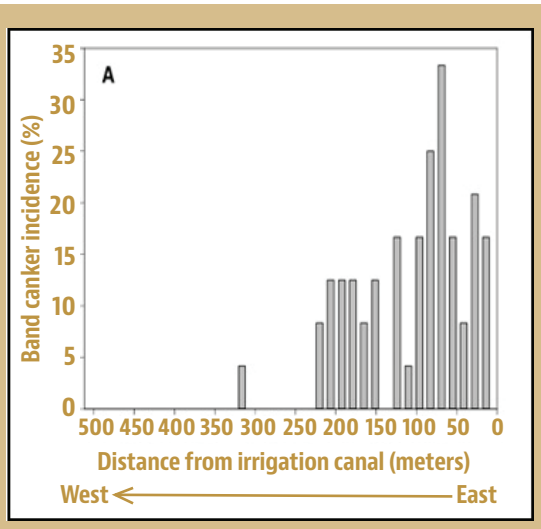

Figure 3: Spread of band canker in a third-leaf Nonpareil/Padre almond orchard from the source of inoculum located in riparian trees along the irrigation canal next to the east border (notice that there is no disease among the trees at the west side in the orchard.) (photo courtesy of T. Michailides & Y. Luo.)

that belong in the fungal family *Botryosphaeriaceae*. While initially this disease was attributed to *Botryosphaeria dothidea,* molecular analysis showed that eight different *Botryosphaeriaceae* species can cause the disease. Among these, the most aggressive and frequently isolated are *Lasiodiplodia, Neofusicoccum* and *Botryosphaeria*.

Over the last decade, first-, second- and third-leaf orchards have shown high levels of band canker incidence, much higher than that of previous decades. Previously, detection of the disease was associated with an external source of inoculum (i.e., riparian

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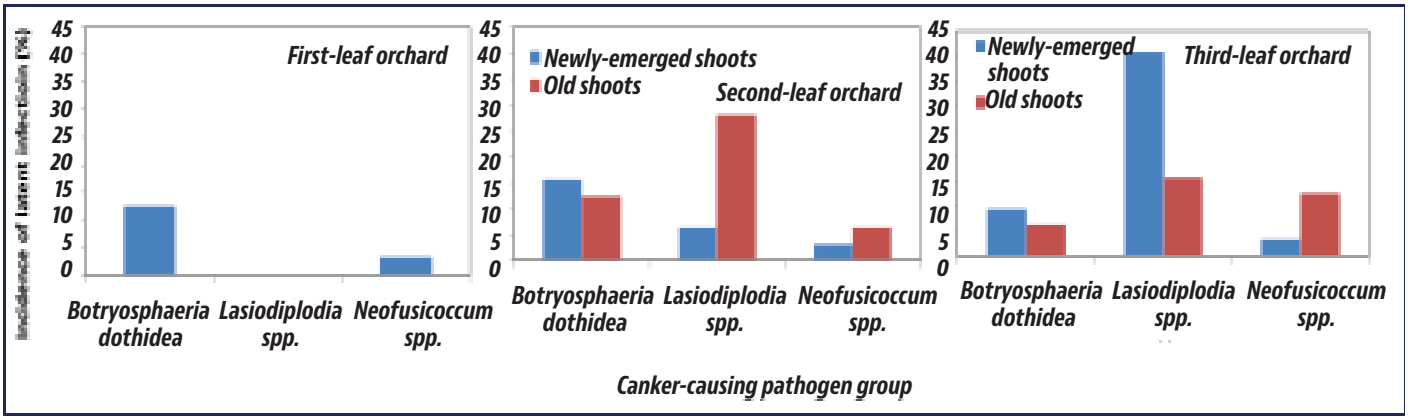

Figure 5: Incidence of latent infections of young symptomless almond shoots of different-age orchards using molecular technique (quantitative polymerase chain reaction, qPCR) that quantifies the DNA of specific canker pathogens (courtesy of T. Michailides & Y. Luo.)

Continued from Page 27

trees along canals or older walnut orchards next to the almond orchard; see **Figure 3, see page 27**.) However, in recent years, severe infections have been found in young orchards in which the disease was distributed uniformly throughout the orchard, attacking the susceptible Nonpareil variety (**Figure 4**).

The apparent uniform pattern of this disease brought our team to hypothesize two theories: Either trees are infected as soon as they are planted from external inoculum in the proximity of the orchard from all sites; or trees have brought these infections with them, and these infections develop into disease soon after the trees are planted in the field.

The first hypothesis was rejected because in many young orchards with severe and uniform occurrences of band canker, detection of any obvious source(s) of inoculum within the proximity of these orchards was not present.

Therefore, we focused our research on the second hypothesis: Infections may preexist in the young trees as latent infections, and after planting the trees in the field, these infections develop to disease with apparent symptoms (gummosis, cankers and tree death).

Previously, it was very difficult to identify or isolate the pathogens using a conventional plant pathological methodology. However, we designed and developed a very sensitive and efficient analytical method (*q*PCR assay) by using pathogen-specific DNA primers and a specific protocol for DNA extraction from plant tissues to target the specific pathogen groups.[1] Using this analytical tool, we were able to study and figure out where these initial infections of the *Botryosphaeriaceae* pathogens originated and how the disease can develop in such young orchards.

Figure 4: A 3rd-leaf almond orchard with gaps due to band canker (Stanislaus Co.) (Photo courtesy of R. Duncan)

To make this determination, we collected healthy looking (symptomless) almond shoots from first, second, and third-leaf orchards and, using the *q*PCR assay, we detected latent infections even in newly emerged and one-year-old almond shoots (**Figure 5**). We also found the existence of some of these pathogens in newly emerged and one-year-old shoots, which supports the hypothesis that symptomless trees have latent canker pathogen/s infections by the time they are planted in the commercial field.

When trees from two nurseries were

> **…the increased incidence of band canker on treated trees recorded 15 months after Topsin-M applications suggests that one spray may not be enough to control the disease.**

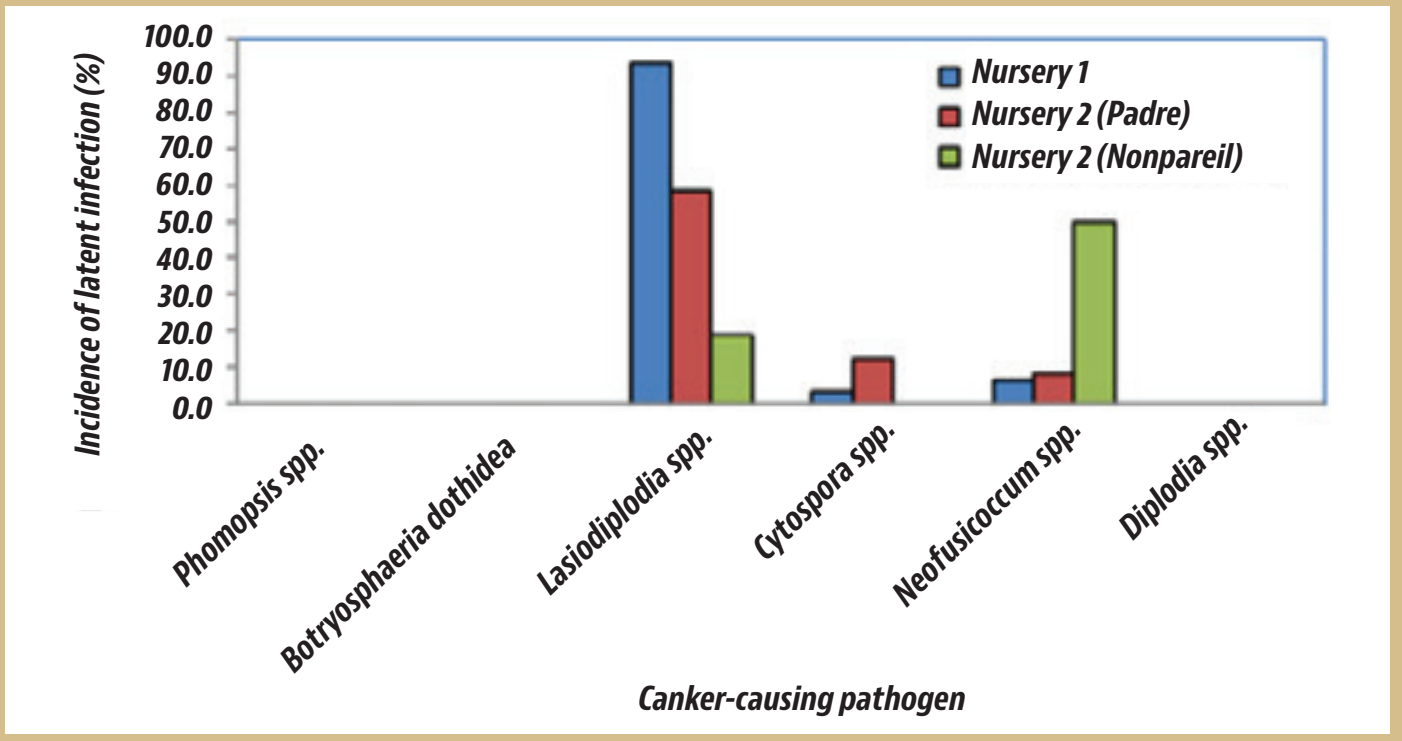

Figure 6: Latent infection levels can vary among different cultivars and nurseries, and in some cases can be very high (i.e., nursery 1) (courtesy of T. Michailides & Y. Luo.)

processed, three fungi (two causing band canker) and a species of *Cytospora* (a pathogen causing Cytospora canker) were detected in very high levels (**Figure 6**). The nursery industry takes all kinds of proactive measures, including treating nursery stock material with fungicides, to reduce any type of infection.

These results suggest that additional treatments may be required, first to improve the methodology and treatments done in the nurseries, and second to introduce new cultural practices that suppress disease development and protect the newly planted trees in the orchard.

Similar levels of these fungi were also detected in budwood collected directly from mother almond trees. When processed with the *q*PCR assay, budwood obtained from two nurseries showed DNA detection (and thus the latent infections) of *Cytospora* spp., *Neofusicoccum* spp. and *Phomopsis* spp. at different levels among nurseries and varieties.

These results imply the possible risk of budwood material that may be carrying these pathogens and can cause canker diseases in young trees after being planted in the field. However, these findings should be further confirmed and compared with large numbers of conventional isolations, using multi-year assessments and working with more nurseries.

Disease Management Strategy

Based on our findings and the mechanism of band canker epidemics in young almond orchards, our team designed disease management strategies for early in-season applications

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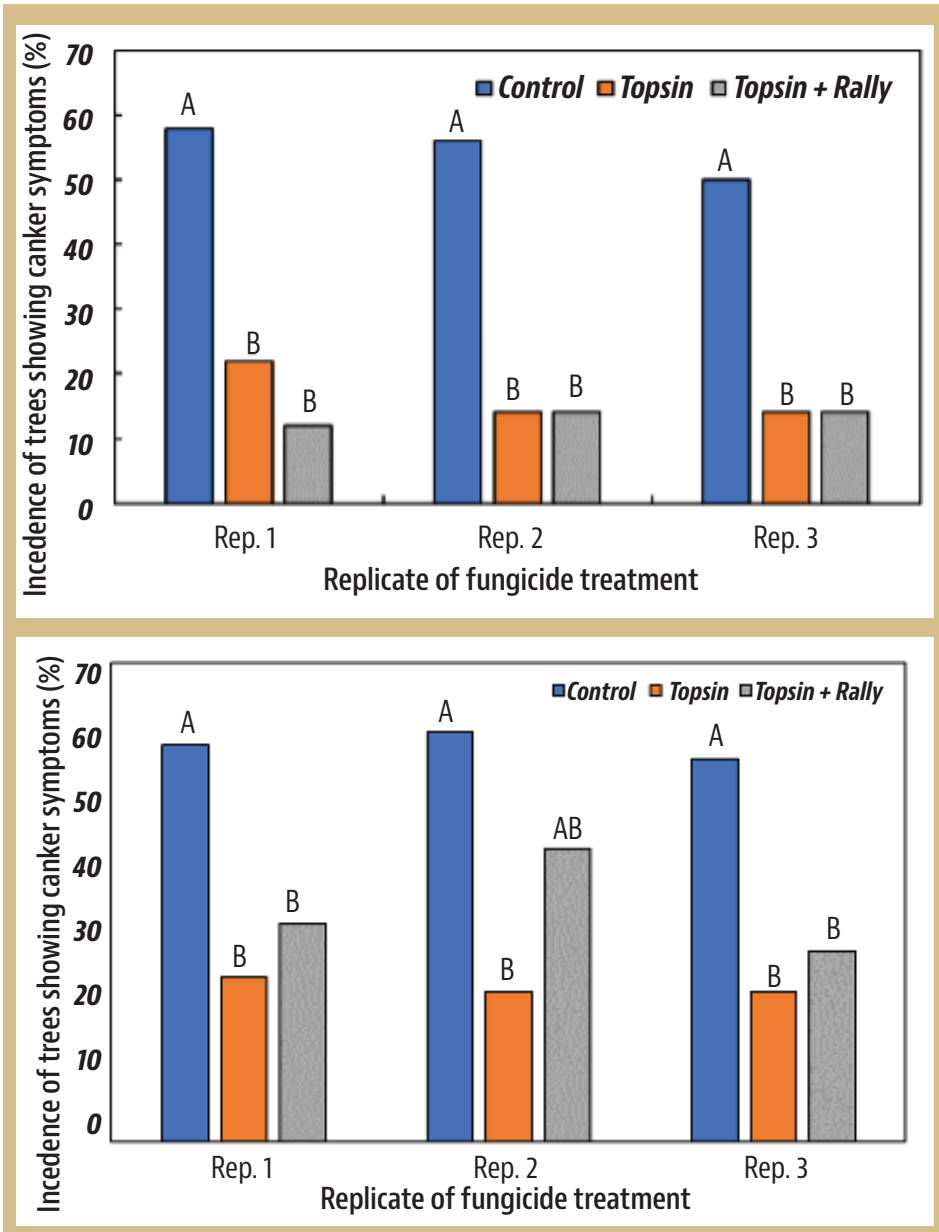

Figure 7: Top: Effect of single fungicide spray applied early March on young almond trees before the appearance of any disease symptoms [disease recording after 10 months]. Bottom: Effect of single fungicide spray at 15 months after treatment. Each replication includes 50 trees (photo courtesy of T. Michailides & Y. Luo.)

Continued from Page 29

that take into account the age of trees.

To test our hypothesis, we sprayed an effective fungicide on tissues where latent infections were located to see whether this fungicide could prevent the latent infections from developing disease symptoms. Previous studies showed that the Topsin M 70WP (a.i. thiophanate methyl) fungicide was very effective against canker fungi. Therefore, young almond trees in a second-leaf orchard were sprayed in early March at a 1.5 pounds per acre. The spray was done mainly to sufficiently cover the trunk and main scaffolds of these young trees.

The disease was then evaluated in November (about six months after the spray) and showed that the application of Topsin M 70WP significantly reduced the incidence of band canker disease when compared to the untreated trees (**Figure 7**).

These results indicate that when Topsin-M is sprayed on the trunks of young almond trees before the expression of any symptoms of band canker disease develop, growers can obtain a significant reduction in the incidence of band canker up to 10 months after the applications.

> **…in recent years, severe infections have been found in young orchards in which the disease was distributed uniformly throughout the orchard, attacking the susceptible Nonpareil variety.**

However, the increased incidence of band canker on treated trees recorded 15 months after Topsin-M applications suggests that one spray may not be enough to control the disease. Instead, annual sprays in early spring may be needed to maintain suppression of the disease at low levels and to protect the trees from external infections.

If you have any questions, please contact Dr. Michailides at tjmichailides@ucanr.edu.

References

[1]Specific pathogen groups include *Botryosphaeria dothidea*, *Diplodia* spp., *Lasiodiplodia* spp., *Neofusicoccum* spp., and *Phomopsis* spp. (Luo et al., 2017).

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STAY OUT OF THE HEAT

UNDERSTANDING THE HEAT ILLNESS PREVENTION REGULATIONS

By **ANGELINA CEJA** | *MPA, QAL, VP and Chief Education Officer, AgSafe*

The amount of shade present shall be at least enough to accommodate the number of employees on recovery or rest periods so that they can sit in a normal posture fully in the shade without having to be in physical contact with each other (all photos courtesy AgSafe.)

AS WE START OUR SUMMER MONTHS and temperatures continue to rise, it is important to understand not only the precautions to take to keep employees safe while working in the heat, but also the elements of compliance.

According to the Division of Occupational Safety and Health (Cal/OSHA), their most frequently cited violations in agriculture under the Heat Illness Prevention Standard are failure to have a heat illness prevention plan in the field, a lack of heat illness prevention training and a failure to provide adequate shade and water. If that's the case, it begs the question: What exactly does the standard require?

Heat Illness Prevention Plan

A company must have a written Heat Illness Prevention Plan with the following elements and include specific details as to how you will ensure that the provisions are met:

- The designated person(s) that have the authority and responsibility for implementing the plan in the field.
- Procedures for providing sufficient water.
- Procedures for providing access to shade.
- High-heat procedures.
- Emergency response procedures.
- Don't forget your lone workers (e.g., irrigators).
- Acclimatization methods and procedures.

When drafting your plan, it is important to consider the size of your crew, the length of the work day, the ambient temperatures and any additional personal protective equipment (PPE) that contributes as an additional source of heat. The plan needs to be in English and also the language understood by the majority of the employees. The plan must be located at the worksite and accessible to employees.

Heat Illness Prevention Training

Employee training needs to be done before an employee begins a shift which could result in the risk of heat illness. Training should cover the following information:

The environmental and personal risk factors for heat illness as well as the added burden of heat load on the body caused by exertion, clothing and PPE.

The employer's procedures for complying with the plan's elements, including the employer's responsibility to provide water, shade, cool-down rests and access to first aid as well as the employees' right to exercise their rights.

The importance of frequent consumption of small quantities of water throughout the workday.

The concept, importance and methods of acclimatization.

When drafting your plan, it is important to consider the size of your crew, the length of the work day, the ambient temperatures and any additional personal protective equipment (PPE) that contributes as an additional source of heat.

The different types of heat illness, the common signs and symptoms, and appropriate first aid and emergency responses to the different types of heat illness. In addition, that heat illness may progress quickly from mild symptoms to serious and life-threatening illness.

The importance to employees of immediately reporting to the employer, directly or through the employee's supervisor, signs or symptoms of heat illness experienced by themselves or their co-workers.

The employer's procedures for responding to signs or symptoms of possible heat illness, including how emergency medical services will be provided should they become necessary.

The employer's procedures for contacting emergency medical services and, when necessary, transporting employees to a point where they can be reached by an emergency medical service provider.

The employer's procedures for ensuring that, in the event of an emergency, clear and precise directions to the work site can and will be provided as needed to emergency responders. These procedures shall include designating a person to be available to ensure that emergency procedures are initiated when appropriate.

Supervisor training needs to be completed prior to supervising employees and include the following topics:

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All of the topics covered during employee training.

- The procedures the supervisor is to follow to implement the heat illness prevention plan procedures.
- The protocol a supervisor is to follow when an employee exhibits signs or reports symptoms consistent with possible heat illness, including emergency response procedures.
- How to monitor weather reports and how to respond to hot weather advisories.

Adequate Shade and Water

Shade

Adequate shade means blockage of direct sunlight. One indicator that blockage is sufficient is when objects do not cast a shadow in the area of blocked sunlight. Shade is not adequate when heat in the area of shade defeats the purpose of shade, which is to allow the body to cool. For example, a car sitting in the sun does not provide acceptable shade to a person inside it, unless the car is running with air conditioning. Shade may be provided by any natural or artificial means that does not expose employees to unsafe or unhealthy conditions and that does not deter or discourage access or use.

> **Adequate shade means blockage of direct sunlight. One indicator that blockage is sufficient is when objects do not cast a shadow in the area of blocked sunlight.**

Shade needs to be available when the temperature exceeds 80 degrees F. How do you know when temperatures hit 80 degrees F? Cal/OSHA urges employers to not rely on your cell phone because it does not reflect the site-specific temperatures. The best practice is to invest in and use an outdoor thermometer daily.

The amount of shade present shall be at least enough to accommodate the number of employees on recovery or rest periods,so that they can sit in a normal posture fully in the shade without having to be in physical contact with each other. The shade shall be located as close as practicable to the areas where employees are working. Shade also needs to be available, even when the temperature does not exceed 80 degrees F, upon employee request.

Water

Employees shall have access to potable drinking water. It must be fresh, pure, suitably cool and provided to employees free of charge. The water shall be located as close as practicable to the areas where employees are working. Where drinking water is not plumbed or otherwise continuously supplied, it shall be provided in a sufficient quantity at the beginning of the work shift to provide one quart per employee per hour for drinking for the entire shift. Employers may begin the shift with smaller quantities of water if they have effective procedures for replenishment during the shift as needed to allow

employees to drink one quart or more per hour.

Indoor Heat Illness Prevention Standard Coming Our Way

In 2016, the legislature passed and Governor Brown signed into Senate Bill 1167, which directed Cal/OSHA to propose a heat illness and injury prevention standard applicable to employees working in indoor places of employment. The agency developed a proposed standard, and the language of the proposed standard has been open to several public comment periods. On April 22, 2019, the most current revised draft standard was posted. Cal/OSHA is preparing rulemaking documents based on that draft. No further changes prior to rulemaking are expected.

In summary, the most current version of the draft language addresses the issue of mitigating heat illness in indoor places of employment, including agriculture, as follows:

Applies to all indoor work areas regardless of industry when workers wear clothing that restricts heat removal and the temperatures equal or exceed 82 degrees F.

Applies to all other indoor work areas not previously mentioned where temperatures equal or exceed 87 degrees F when employees are present.

Similar to the outdoor heat illness prevention standard, including provision of water, cool down areas.

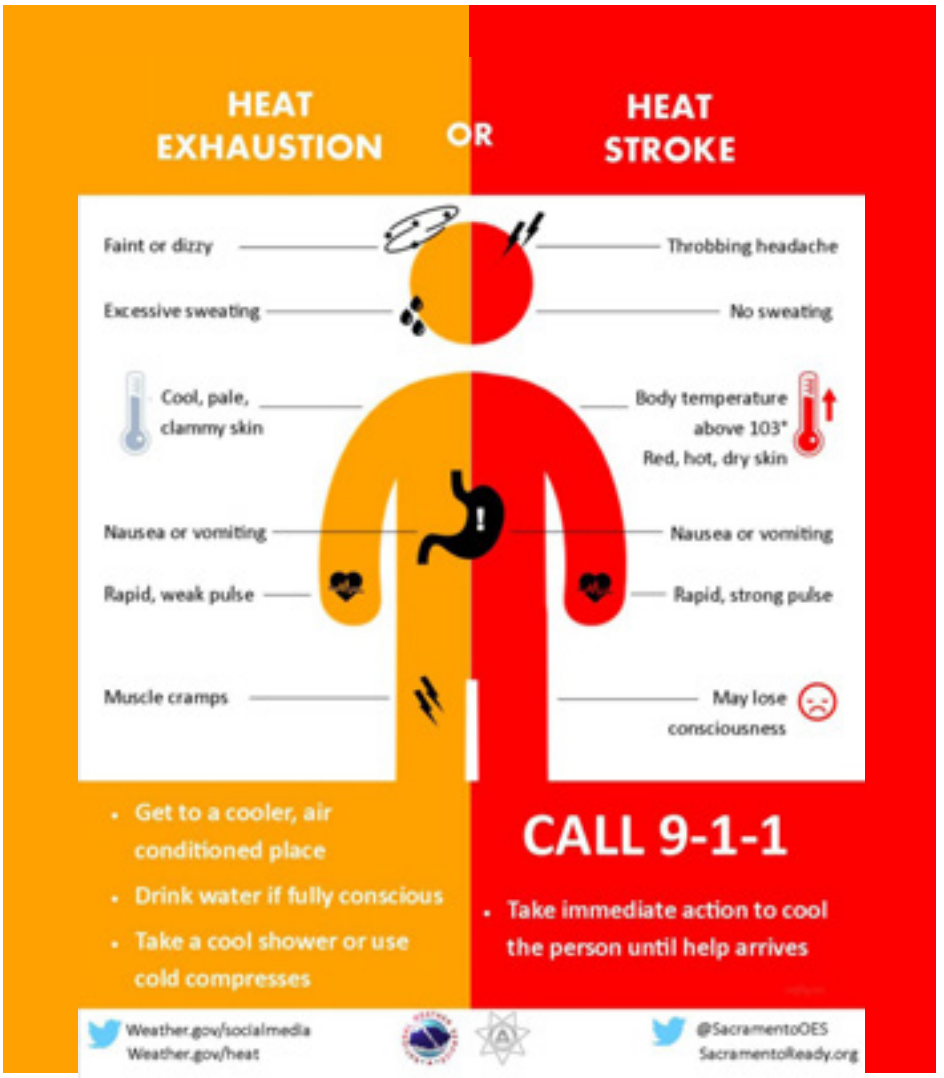
Provide appropriate first aid/emergency response if employee exhibits signs or symptoms of heat illness.

Implement temperature assessment, documentation and control measures when temperatures equal or exceed 87 degrees F.

Have a written Indoor Heat Illness Prevention Plan that includes appropriate emergency response procedures.

Ensure close observation of employees during acclimatization.

Provide training for employees and supervisors prior to possible exposure.



Training must include the different types of heat illness, the common signs and symptoms of heat illness and appropriate first aid and emergency responses to the different types of heat illness.

To read the complete draft text and stay up-to-date on the process as it continues to unfold, visit dir.ca.gov/dosh/doshreg/Heat-illness-prevention-indoors/.

For more information about heat illness prevention, worker safety, human resources, labor relations, pesticide safety or food safety issues, please visit www.agsafe.org, contact us at (209) 526-4400 or via email at safeinfo@agsafe.org. AgSafe is a 501c3 nonprofit providing training, education, outreach and tools in the areas of worker safety, human resources, labor relations, pesticide safety and food safety issues for the food and farming industries. Since 1991, AgSafe has educated nearly 75,000 employers, supervisors and workers on these critical issues.

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Five Things You Want to See in your Walnut Orchard in July

By **CECILIA PARSONS** | *Associate Editor*

Both photos taken in the same block of Chandler shows uneven development of walnuts due to an extended bloom period.

A MATURE WALNUT ORCHARD IN JULY CAN BE A PRETTY QUIET and hopeful place. Healthy trees are soaking up sunlight, water and nutrients to produce a quality crop of nuts.

Anticipating a good harvest in the weeks ahead, growers are paying attention to pest and disease levels in their orchards, aware that their stewardship this month can have an effect on the quality of their crop.

While there are important horticultural considerations in their crop in the month of July, walnut growers are also experiencing ongoing economic challenges. Pairing crop considerations with economic concerns requires some tough decisions and trade-offs.

Providing insight from a grower perspective is Davin Norene, a California Walnut Commission member and third-generation walnut grower. Sharing her observations and experience in Tulare County walnut production is UCCE Tulare County Farm Advisor Elizabeth Fichtner.

Five things growers would like to see in their walnut orchard in July:

1. Growing, Healthy Shoots

Norene said while he is watching the maturity of the current crop of walnuts and managing to achieve the highest quality, he knows next year's crop is already developing.

"I want to see new growth in the orchard canopy and I try to manage a canopy that continuously develops new fruiting wood. If your canopy isn't growing, then your trees and your yields are shrinking."

Fichtner said healthy elongation of neo–form (in-season) growth in developing orchards is an indication of good irrigation management. If the orchard is overwatered, these shoots can become chlorotic and stunted.

Orchard conditions in mid-summer not only indicate how well water and nutrition are being managed in the current season, but effects of last year's management can be evident. Healthy shoots and fruiting buds and the absence of

The larger-size nuts (above) are from early flowers and smaller nuts from late flowers (photos by Elizabeth Fichtner.)

Davin Norene, a third-generation walnut grower with Norene Ranches in Rio Oso, grows five varieties of walnuts (photo courtesy California Walnut Commission.)

blight mean next year's crop is off to a good start.

2. Good Irrigation and Water Penetration

Norene said that during the dog days of summer, the soil in an orchard can seal up and prevent good water infiltration. To maintain good water penetration down into the root zone, Norene said maintenance applications of calcium or gypsum can help open up the soil.

Standing water in an orchard is an inefficient use of irrigation water and can also contribute to unhealthy environmental conditions for trees. Slow water penetration can cause mid-season depletion of deep soil water. Ponding on orchard floors causes aeration problems for the trees and prevents orchard access. The orchard may experience reduced vegetative growth and yields. There can also be higher

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incidences of root disease or nutritional problems resulting from poor soil aeration.

Prevention of soil crusting includes application of soil amendments, soil organic matter management and improved irrigation management.

3. Clean, Well-Placed Walnut Husk Fly (WHF) Traps

Norene said he wants to make sure his WHF lures and traps in the orchard are clean and effective. He also wants to be sure the traps are placed in the tree where they will catch WHF. Knowing orchard history is key to good trap placement. Increasing trap density should be done in the absence of orchard history as WHF infestations can be very localized.

UCCE recommendations for WHF trap placement is high in the canopy on the north side of the tree to gather good information for treatment decisions. A well-timed spray application will provide about three weeks of protection.

> **"If your canopy isn't growing, then your trees and your yields are shrinking."**
>
> – David Norene, walnut grower

Finding very few uninfested nuts is a sign that a grower's integrated pest management program is working, Fichtner said. Checking for spider mites and their predators, sixspotted thrips, through August is advised. Allowing low populations of spider mites in the orchard and avoiding broad-spectrum insecticides will help beneficial insect populations to increase and control insect pests, saving costs of spray applications.

Walnut aphid and two spotted mite

are two insect pests that can cause tree stress and affect nut quality.

4. Good Leaf Sample Analysis

A leaf sample analysis taken mid-summer can reveal need for any corrective or supplemental nutrient applications pre-harvest. Norene said that as he begins to develop his fall and spring nutrient budgets and information from the samples help him make those decisions.

Samples help growers check on the effectiveness of nitrogen management programs as well as potentially monitor for deficiencies in potassium and zinc and toxicities in chloride and boron, depending on site and orchard history.

For a representative sample, take four terminal leaflets from at least 29 trees, each at least 100 feet apart, on the same rootstock, scattered throughout the orchard.

5. A High-Quality Crop!

This goes without saying, but a lot of factors must come together for an evenly mature, high-quality crop and an orchard achieving yield potential.

Fichtner said that for a good nut set, a healthy bloom can get the potential crop off to a good start. Good weather and overlap of female flower bloom and pollen shed are two factors in setting a crop.

Fichtner said an extended bloom, which was experienced in some walnut growing regions this spring, can lead to uneven nut maturity. Cool temperatures during 'Chandler' bloom in April resulted in an extended bloom period. As a result, flowers that had matured early gave rise to large nuts. Flowers maturing later gave rise to smaller nuts. Even after bloom has passed, this difference in nut maturity is evident even on the same tree. The difference in maturity will be realized at harvest as not all nuts will be shaken off the tree.

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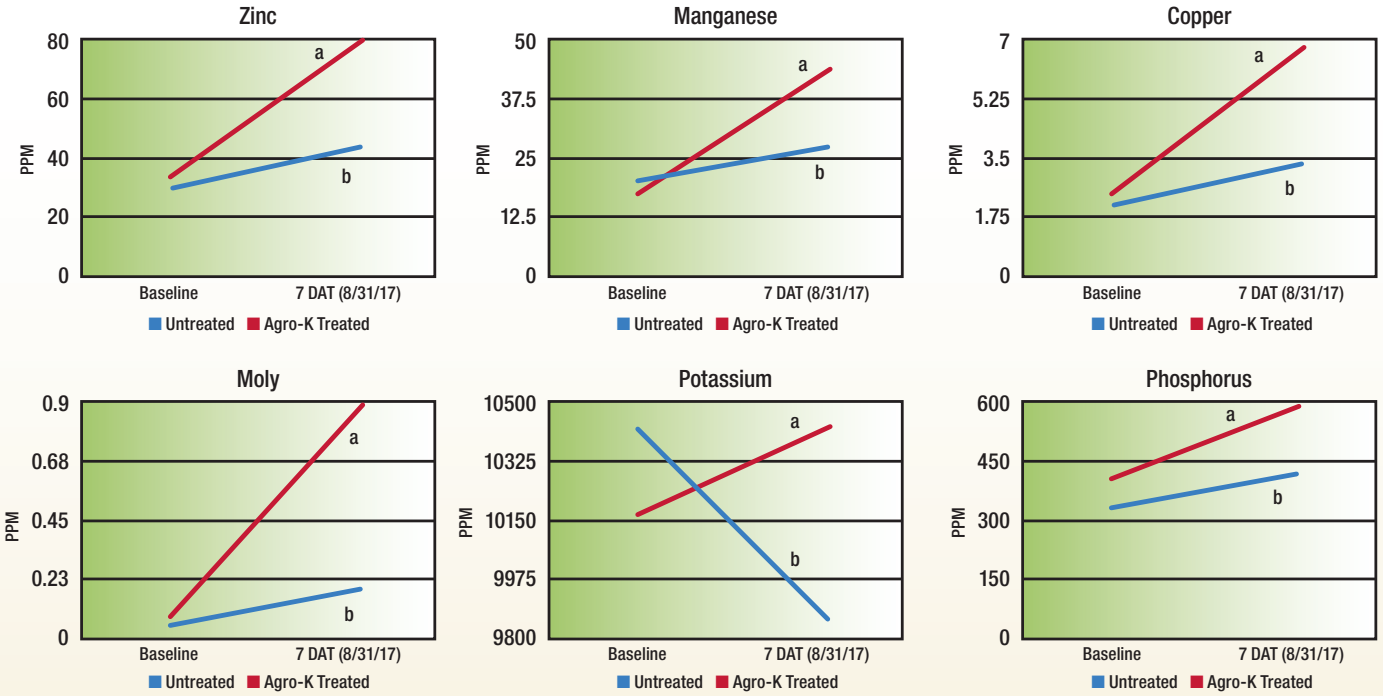
Hull Split N.O.W. Applications – A Increase Yield And Improve Yield



Data by Bisabri Ag Research

Foliar nutrients applied with your Hull Split Navel Orangeworm (NOW) sprays provide a win-win opportunity to increase this year's nut size, splits and yield and set the stage for higher yields next season. However, many conventional foliar nutrient formulations do not penetrate well and are largely ineffective from mid-summer onward once the pistachio leaf has hardened off and developed a thick waxy cuticle. But Agro-K's Sysstem® and Dextro-Lac® foliar product lines are not only designed to rapidly and completely move through even the oldest, toughest, hardened off and waxy pistachio leaf, they are also research-proven to do so.

In a replicated trial conducted in late-August, a mix of Agro-K nutrients, both micro and macro, were applied to 'Golden Hills' pistachio trees and analyzed for nutrient uptake. The results, as determined via leaf sap analysis and displayed in the above charts, demonstrate statistically significant changes in the levels of "free" or immediately plant available nutrients within the leaf sap for six different nutrients 7 days after application. Leaf sap levels for zinc, manganese, copper, molybdenum, potassium and phosphorus were significantly increased compared to the control as measured the week after application. For more on leaf sap analysis, see the text box below.

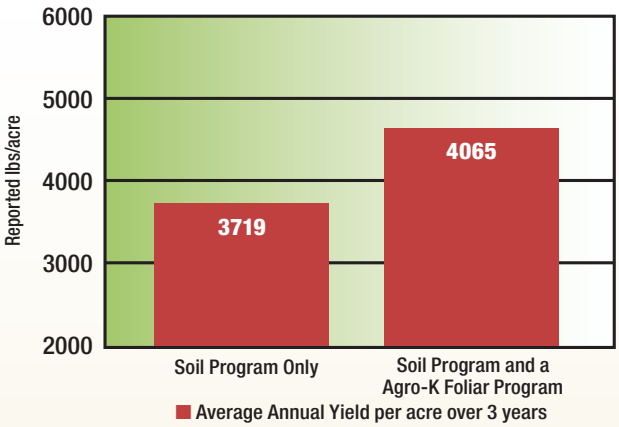
Leaf Sap Analysis

This sample extraction protocol and analysis quantifies only those nutrients found in the leaf sap. Since this extraction protocol does not grind the leaf tissue or rupture the cell structure, the results only represent "free" nutrients that are immediately available for plant use. In contrast, conventional tissue testing methods grind and analyze whole dried leaves measuring not only the nutrients found in the sap, but also nutrients already bound within the leaf tissues, and those nutrients found on or imbedded in the leaf cuticle. Nutrients within the leaf structure, on the leaf surface, or in the cuticle are mostly—if not completely—immobile and unavailable for immediate plant use. Measuring sap nutrient levels effectively detects recent nutrient changes and excludes structurally-bound and other immobile plant nutrients.

Win-Win Opportunity To Consistency Year Over Year.

3 Year Trial Increases Yields 350 lbs *Annually*

Bisabri Ag Research - 'Golden Hills' Pistachio - 2017-2019



Agro-K's Science-Driven Nutrition℠ starts with the **5-R's** of plant nutrition, using and applying:

- the **R**ight nutrients,
- at the **R**ight time,
- in the **R**ight form,
- in the **R**ight mix,
- targeting the **R**ight place in the plant.

This approach results in effective, penetrating applications that make measurable differences in plant available nutrients. For pistachios this means larger nuts, more splits and increased returns per acre this year. Likewise, the right foliar nutrients when added to Hull Split NOW sprays will also increase set, nut size, kernel weight, and yield consistency for next year's crop. So even while this year's crop continues to mature on the tree, growers can influence next year's flowers and early leaves that are already developing in the wood through proper nutrition.

This year, apply early-season peak-demand nutrients like zinc, phosphorus and boron with your Hull Split NOW spray to build stronger buds and provide critical nutrients that can be stored in the wood and buds for quick mobilization during next year's budbreak. Agro-K's **Sysstem®-LeafMax**—with zinc and manganese in rapidly absorbed and systemic phosphite forms—also contains magnesium, iron, copper, molybdenum, sulfur and nickel to provide eight key nutrients required for vascular development and complete chlorophyll production and function. Along with other materials like **Agrobest® 0-20-26** and **Top-Set D.L.**, Agro-K's products are specifically designed to help growers meet the specific needs their crops demand.

Building nutrient levels in your pistachios now sends trees and buds into winter with larger carbohydrate reserves and more stored nutrients for a stronger, more uniform bloom next spring. By increasing carbohydrate and nutrient reserves within the wood and buds through the addition of foliar nutrients with Hull Split NOW applications, growers can increase next season's set and reduce the number of "blanks" at harvest, increasing per acre yield. Contact your Agro-K distributor and PCA today to discover how Agro-K's Science-Driven Nutrition℠ can make your pistachio orchard more profitable.

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Congestion at West Coast Ports Strains Tree Nut Shipments

Frustrated ag exporters seek action against delays and rising costs from supply chain disruptions.

By **CATHERINE MERLO** | *Contributing Writer*

Import cargo has flooded into the U.S. at record levels. The Port of Oakland has set records this year for the amount of import containers it's handled. April marked the first time the port handled more than 100,000 import containers (photo courtesy Port of Oakland.)

IN MORE THAN 20 YEARS OF EXPORTING tree nuts from California, Jim Zion of Meridian Growers has experienced port strikes and other shipping problems.

Such headaches come with the business of selling almonds, pistachios, pecans and walnuts to Meridian Growers' 60 worldwide customers.

"But it's never been this bad," said Zion, managing partner at the Madera-based company. "And we're not the only ones. Everybody is in the same boat."

Zion is referring to the crisis that California, Oregon and Washington agricultural exporters have been confronting at West Coast ports since last fall. At issue are inadequate access to shipping containers, shortages of truckers and warehouse space at ports, shipment delays and cancellations, increased costs and fees, and unhappy overseas customers.

The pressures have overwhelmed marine terminals at the ports of Long Beach, Los Angeles, Oakland, Seattle and Tacoma. Dozens of export-dependent U.S. commodities, including almonds, pistachios and walnuts, have been pulled into the logjam.

"There are disruptions all the way through the supply chain," said Zion. "If this doesn't get resolved by the time the almond harvest starts in August, things are going to get ugly."

'At Breaking Point'

The port crisis is the result of "a perfect storm of events," said Geoffrey Bogart, principal specialist in Global Technical and Regulatory Affairs for the Almond Board of California. Among the problems:

- **The COVID-19 pandemic has upended the shipping industry.**

Lockdowns and other restrictions closed ports, shipping offices and more. That resulted in severe backups, disrupting every link in the maritime supply chain.

Moreover, American demand for imported products has reached record levels as consumers shift toward mass home delivery. Since last summer, import cargo has flooded into the U.S. in unprecedented volumes, while foreign demand for tree nuts and other U.S. exports has been strong, said Peter Friedmann, executive director of the Agriculture Transportation Coalition (AgTC) in Washington, D.C.

The robust import-export demands have caused congestion in and around ports as well as uncertainty about schedules and container locations and availability.

The "import surge has placed many terminals, rail and trucking networks at breaking point," said Paul Snell, CEO of British American Shipping, LLC. The company is a major freight forwarder serving California's nut, dried fruit and fresh produce industries.

- **There are extended delays at ports.**

Waits to berth vessels at Long Beach

and Los Angeles terminals have been lasting between eight and 15 days, Snell noted. At one point in March 2021, more than 140 cargo ships were waiting to unload at the two Southern California ports. In late May, the Port of Oakland in Northern California had 28 vessels awaiting a berth.

The bottleneck of ships waiting at ports has, in turn, affected people like Bill Carriere, CEO of Carriere Family Farms, a California walnut producer and handler. The company, based about 90 miles north of Sacramento, uses the Port of Oakland almost exclusively for its export shipments.

"Shipments are severely delayed," Carriere said. "We are booking cargo at least three weeks before we expect cargo to actually sail. In addition, we are double-booking cargo with the expectation of one of the bookings being cancelled or rolled."

When shipments get delayed long enough, customers sometimes cancel their orders completely.

Both shipping and trucking prices are expected to rise through next spring (photo courtesy Port of Oakland.)

"We have had shipments headed to the port, the booking gets rolled several weeks at the last minute, or the ship skips the port, or they are overbooked or whatever," he said. "The container sits in Oakland for several weeks, and then the customer cancels the contract due to non-shipment completely out of our control. We lose a sale we thought we had and have to bring the product back, typically repack it in another package, and resell it. [That causes] months of delay for cash flow."

Continued on Page 44

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► **Carriers are returning to China with ships full of empty containers.**

Rather than wait to load containers at West Coast ports, foreign-owned carriers are returning unfilled shipping boxes to China for a quick turnaround to retrieve more Chinese-made products for the U.S. That may be more lucrative for the ocean carriers, but it has left U.S. ag shippers unable to export reliably.

"Overseas production of finished goods has grown to a higher importance than USA raw food production," said Snell.

► **There are fewer ocean carriers in business.**

Industry consolidation has left just 10 foreign ocean-carrier lines, down from more than 20 in the 1990s, noted AgTC's Friedmann.

"U.S. exporters don't have many choices," he said. "They are completely dependent on these carriers to deliver our ag and forest production to overseas customers. Carriers are frequently declining to carry U.S. export cargo, and, when they do, they continue to impose very large additional charges, even though many of those have been deemed unreasonable by the Federal Maritime Commission (FMC)."

► **U.S. exporters are being forced to pay higher shipping costs.**

Since January, average freight prices to ship tree nuts to places like China, India and Europe have increased by 25% to 50%, said Snell. And those numbers are likely to climb.

"Shipping prices are expected to rise through March 2022 with the record crop volumes from 2020 and those expected for 2021," Snell said. "Trucking prices are also likely to increase with domestic fuel prices rising."

► **U.S. exporters have been hit with "unreasonable" detention and demurrage fees.**

Ocean carriers are charging truckers, importers and exporters daily fees, known as "detention" or "per diem", when they don't return the carrier's container to the terminal within the time allotted under the contract of carriage. Those fees have been imposed "even when such delay is not the fault or even within the control of the exporter," Friedmann said.

The carriers and marine terminals also charge "demurrage" when the trucker or shipper doesn't remove an import container from a terminal quickly enough or returns the container to the terminals before the terminal wants it.

Exporters frequently have been stymied from moving containers to the ships by carrier and terminals actions, noted Friedmann. Such hindrances include changing ship schedules, a lack of terminal-gate appointments and failure to give timely notice of ship arrival and loading windows.

The fees, ranging from $125 to $425 per container per day, total hundreds of millions of dollars, he added.

"Most disconcerting, carriers and terminals are charging these fees even when it's not possible for truckers or shippers to actually access the terminal to return or retrieve the container," Friedmann said. "The fees are not only unreasonable according to the FMC investigation and rule but are jeopardizing the financial viability of exporters and importers."

Carriere added that his business was also accruing fees from its trucking company for holding equipment.

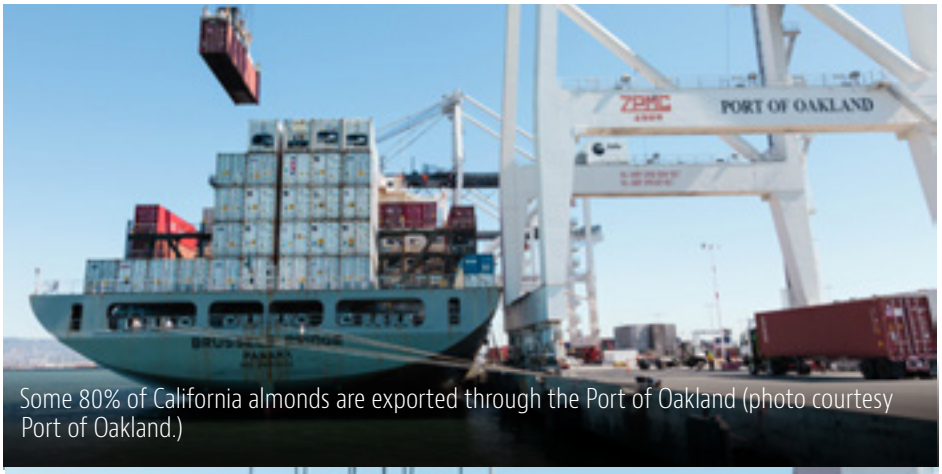
► **U.S. ports offer limited operations.**

A major complaint by ocean carriers is that U.S. ports aren't running 24/7 as foreign ports do. "They are correct," said Friedmann. "Our marine terminal gates are generally only open for 12 hours at a time, 4.5 days a week. That's a major hindrance."

Quest for Resolution

Led by the AgTC and member organizations representing specific commodities such as almonds, walnuts and other tree nuts, agricultural exporters are working to resolve the port crisis.

In February, 71 national and region-



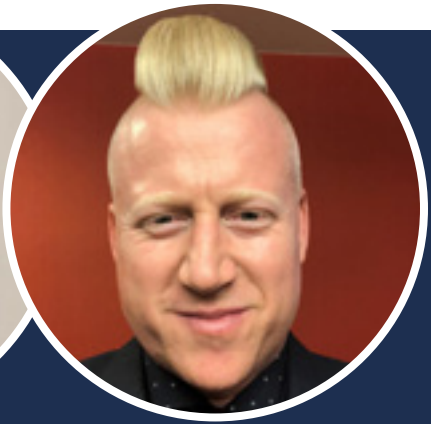
Some 80% of California almonds are exported through the Port of Oakland (photo courtesy Port of Oakland.)


Since January, average prices to move tree nuts from the ports of Oakland and Los Angeles to China and Vietnam have risen by $1,000 per container, says shipping executive Paul Snell (photo courtesy Port of Oakland.

Like other tree-nut shippers, Jim Zion of Meridian Growers has struggled with export delays and higher costs this year.

Walnut producer and handler Bill Carriere has seen foreign customers cancel sales with his family-owned business due to non-shipment "completely out of our control."

Peter Friedmann of the Agriculture Transportation Coalition is among those urging the Federal Maritime Commission to stop the "unreasonable" fees that carriers and ports are imposing on ag exporters.



An import surge has pushed many shipping terminals to the breaking point, says Paul Snell of British American Shipping.

al ag exporters sent President Biden a letter pointing out the refusals by ocean container carriers to carry export cargo from U.S. ports. The associations urged Biden and his administration to investigate whether the cargo denials violate the 1984 Shipping Act.

During March and April, more than 160 members of the U.S. House and Senate wrote to FMC Chairman Michael A. Khouri. Their letters expressed concerns over the unwillingness of vessel-operating common carriers to ship U.S. ag commodity exports from U.S. ports and the imposition of debilitating demurrage and detention fees.

On April 27, nearly 300 U.S. agriculture and forest products companies and associations delivered a letter to Department of Transportation Secretary Pete Buttigieg, calling for immediate intervention to protect U.S. exporters and their access to foreign markets. "We need action now," the letter said. Co-signers included AgTC, which authored the letter; the Almond Alliance of California; the California Walnut Commission; Carriere Family Farms; Diamond Foods, LLC; Grower Direct Nut Company; Horizon Nut Company; Hughson Nut; Mariani Nut Company; and the American Farm Bureau Federation.

Meanwhile, AgTC and other ag exporters are pressing the FMC to enforce its "Interpretive Rule on Demurrage and Detention under the Shipping Act." Their goal is to stop the "unreasonable" charges they say violate the rule. Ag exporters also are lobbying congressional committees to develop legislation that would statutorily prohibit such excess charges.

In addition, U.S. ag exporters are working with port management and labor to increase the hours of West Coast marine terminal gate operations to accommodate the increased shipping volumes. They're supporting efforts by U.S. ports to expand terminal space and modernize operations to better handle the growing volume of both imports and exports. They're also pressing ocean carriers to return to overseas ports with a greater portion of their containers loaded with U.S. products.

Many expect the port crisis to continue well into the third quarter of 2021. Efforts to end the congestion and delays can't come soon enough for U.S. exporters like Carriere and Zion.

Until the situation is resolved, Zion said, "we're at the mercy of the ocean carriers and the ports."

Comments about this article? We want to hear from you. Feel free to email us at article@jcsmarketinginc.com

What Will the Next 70 Years of Walnut Breeding Bring?

By **PAT J. BROWN** *and* **CHUCK LESLIE**
Walnut Improvement Program, Department of Plant Sciences, UC Davis

Before the UC Davis Walnut Improvement Program was founded in 1948 by Gene Serr and Harold Forde, there was no Chandler, Howard or Tulare. Popular cultivars at that time were terminal bearing, including Franquette, which was introduced from France in the 1870s, and Hartley, which won a blue ribbon at the 1915 World Fair. Serr and Forde worked together to combine the late leafing and blight avoidance found in Franquette with the lateral bearing and precocity from Payne, a fence-row seedling from California, and 23 cultivars later, the rest is history.

Combining Genetics

Today, we can use DNA technology to understand Serr and Forde's accomplishments. We found an allele, a segment of DNA, from Franquette on one of its 16 chromosomes that confers late leafing, and an allele from Payne that confers lateral bearing. Chandler and Howard are both heterozygous (containing one copy) for both of these alleles. Tulare is heterozygous for the late leafing allele and homozygous (containing two copies) for the lateral bearing allele.

In spring 2021, we released UC Wolfskill, the Walnut Improvement Program's twenty-third cultivar. Like other recent releases, including Ivanhoe and Solano, Wolfskill is heterozygous for the lateral bearing allele but does not contain the late-leafing allele from Franquette. For this reason, Wolfskill leafs out in mid-March, sometimes during spring rains (remember those?), and does not follow the "blight avoidance" strategy of late-leafing Chandler, Howard and Tulare. What is going

Continued on Page 48

PREMIUM WALNUT TREES

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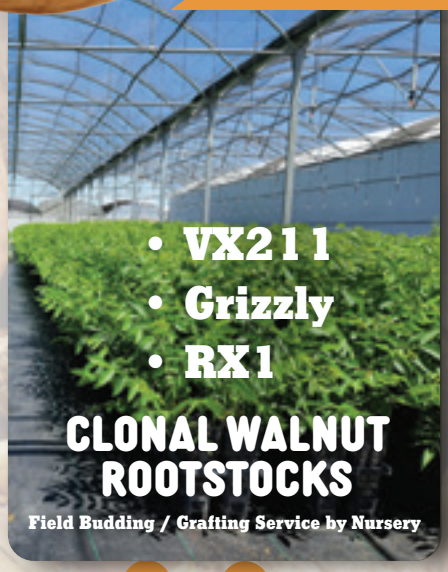

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on? Why is the Walnut Improvement Program changing direction?

The Catch-22 for blight avoidance through late leafing is that in walnut, as in most other deciduous tree crops, late leafing is correlated with higher chill requirement. Our data show that Chandler, Howard and Tulare all have higher chill requirements than Wolfskill, Solano and Ivanhoe, and we all know that chill hours (or units or portions, if you prefer) are declining in California. There may be some healthy disagreement over exactly how quickly this is going to happen, but it's a fair bet that, as we are already seeing in some years, late leafing cultivars will have more staggered bloom and other problems related to inadequate chill in the decades to come.

Early-leafing walnut varieties may come with another hidden benefit: increased precocity and yield. Our recent analysis of the early leafing allele in the breeding program shows that homozygotes for this allele (like Wolfskill, Solano and Ivanhoe) are on average more precocious and more lateral bearing (producing more flowers and nuts from the previous winter's lateral buds) than heterozygotes (like Chandler, Howard and Tulare.) Of course, there are other factors affecting precocity and lateral bearing. Tulare is the only cultivar of these six that is homozygous for the lateral bearing allele from Payne. Homozygotes for both early leafing and lateral bearing are expected to be the best, but there are no released cultivars like this yet.

Genetic diversity in plant breeding cuts both ways. There are two lateral bearing alleles that we know of: one from Payne, which predominates in the breeding program, and another from Xinjiang Province in Western China, which seems to be associated with higher precocity. Actually, heterozygous individuals carrying one Payne allele and one Xinjiang allele (but homozygous lateral bearing) are most precocious of all; most of these trees produce nuts in their second year as seedlings, indicating that they begin producing female flower buds within six months after germination. However, you can't take precocity to the bank, and higher yields may not be worth it if they come with greater variation in nut quality. Genetic changes that enable higher yields could require adjustments to tree spacing and pruning before becoming profitable. Ultimately, we rely on data from regional trials of advanced selections hosted by growers to determine which selections to advance for additional testing and, eventually, cultivar release.

Crafting Future Cultivars

As we have moved over the last 70 years to varieties earlier then Franquette, we have sacrificed blight avoidance, and management options for control have predominated. But incorporation of genetic resistance into new varieties is an important goal. Genetic improvement is slower but, when it arrives, can be adopted into new plantings at no extra cost to the grower. Here in the Walnut Improvement Program, we were probably the only walnut growers in the state to be disappointed by the lack of blight development this spring. But the fact is, if we don't see blight, we can't select for blight resistance. We are examining methods to impose blight pressure more uniformly from year to year on material of interest.

Perhaps the most difficult puzzle in walnut breeding is how to craft a cultivar that is not only more profitable for growers, but also produces a product with superior nutrition, appearance and taste. It is no secret that walnuts are healthy; the kernels contain high levels of polyunsaturated fatty acids, a kind of healthy fat also found in seafood and flaxseed. And the walnut "skin", or pellicle, contains high levels of tannins, which have been associated with a variety of health benefits. But polyunsaturated fats have a shorter shelf-life at room temperature than other fats, and some consumers find the astringency of tannins unappealing.

To begin solving this problem, we're working with food chemist Selina Wang to find walnut varieties in our collection with increased shelf life. So far, we've found one promising variety with increased shelf life that is already in widespread use in the breeding program. Called PI159568, it comes from a tree in Paghman, Afghanistan from which nuts were collected by the USDA in 1937 and planted at Chico. Years later, one of those seedling trees caught the eye of Serr and Forde. 70 years later, it is catching our eye once again.

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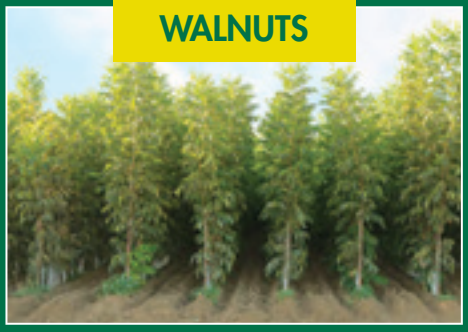

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HAZELNUT GROWER FEATURE: WAYNE AND JOANN CHAMBERS

YEARS OF DEDICATION HELP TO PRESERVE OREGON'S HAZELNUT INDUSTRY AND ENSURE ITS FUTURE.

By **HAZELNUT MARKETING BOARD** | *Contributing Writer*

Wayne and Joann Chambers have been growing hazelnuts in Oregon's Willamette Valley for 58 years, receiving multiple industry accolades and awards (photos courtesy Hazelnut Growers of Oregon.)

HAZELNUTS ARE A FAMILY INDUSTRY—a community of close-knit growers who help each other no matter how expansive the industry becomes. And much like any other family, hazelnut growers look to those members who paved the way before them for wisdom. In Oregon, everyone bends an ear to listen when Wayne and Joann Chambers share their hazelnut wisdom.

The Chambers family, Wayne's grandparents, moved to Oregon from Minnesota in 1905 and settled near the town of Lebanon in the fertile Willamette Valley. Throughout the decades, the family farm would grow, and they raised nearly a dozen crops and livestock species in that time. The Chambers family would spread across the valley, including the land near Albany, Ore. that Wayne and Joann call home to this day.

Help from All Around

Wayne Chambers attended Oregon State University and graduated with a bachelor's degree in horticulture. It was during his stint as an undergrad that he meet Harry Lagerstedt, an Oregon State professor and hazelnut expert. The two would form a close bond and Wayne credits much of his success to Lagerstedt's mentorship. Whether as the mentor or mentee, the

theme of mentorship and paying it forward is a recurring element in Wayne's story.

Wayne and Joann were married in 1963 and immediately started planting hazelnuts while still farming with Wayne's father and brother. While the rest of the family focused on other crops, Wayne and Joann took a special interest in the hazelnuts. They would eventually take over all the Chambers family hazelnuts from Wayne's uncle and expand the acreage. Nestled between the Willamette and Santiam rivers, the Chambers were blessed with some the best soil in the Willamette Valley.

Wayne and Joann would split off from the family in 1999 and found W&J Orchards, focused solely on raising hazelnuts. At their peak, they owned 165 acres of hazelnuts and managed orchards for several neighbors and friends. Among those orchards were some planted by more of Wayne's neighbors and mentors—Bob Groshong and Marvin Fletcher. Both were seasoned hazelnut farmers who always made time to help the Chambers and other growers in need of assistance.

As with Harry Lagerstedt, Wayne would ask Groshong and Fletcher a litany of questions about best practices and how to make his trees thrive. Both were generous with their time, talents and expertise. Without their willingness to educate a young and ambitious Wayne Chambers, the Oregon hazelnut industry may look very different.

The Groshong and Fletcher orchards constitute some of the oldest trees still standing in America, with the oldest dating back 100 years. Many of these trees were purchased at the original Dorris Ranch, Oregon's first commercial hazelnut farm. These orchards are also home to rare and classic hazelnut varieties that exist nowhere else in Oregon and possibly the U.S.

This mentality and willingness to give back lives on through Wayne and Joann. Fellow grower Dave Buchanan credits much of his knowledge to them.

"When I have a question, Wayne is the first person I call. He always knows what he is talking about and not only offers answers, but they are the right answers," Buchanan said. "He is my mentor and hazelnut guru."

Skip Gray also looked to W&J Orchards when he needed wisdom.

"I've been lucky to have Wayne and Joanne as neighbors. They've always been special people to our family; Wayne's parents and mine traveled the world together, so we've known each other a long time. I learned never to ask Wayne a question if I didn't want a blunt answer. Our hazelnut community is a special place because we get along well, and Wayne and Joann have contributed mightily to that endeavor," Gray says.

The Chambers' dedication to both preserving the history of the hazelnut industry and ensuring its bright future has also made them a go-to partner for Oregon State University researchers. The college is home to the world's foremost hazelnut research programs,

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Many within the hazelnut industry credit the Chambers for much of their knowledge and success.

"I LEARNED NEVER TO ASK WAYNE A QUESTION IF I DIDN'T WANT A BLUNT ANSWER. OUR HAZELNUT COMMUNITY IS A SPECIAL PLACE BECAUSE WE GET ALONG WELL, AND WAYNE AND JOANN HAVE CONTRIBUTED MIGHTILY TO THAT ENDEAVOR."—SKIP GRAY, HAZELNUT GROWER"

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largely due to the collaboration between academia and industry. When the university has needed orchards for field studies, they've frequently turned to W&J Orchards for assistance; through this partnership, the entire industry has benefited from discoveries on everything from EFB-resistant varieties to smarter irrigation practices.

"They have always been on the cutting edge of new varieties and working with Oregon State to try out new varieties," says Buchanan. "They have done a lot for the industry in that regard, too, and helping figure out which varieties will flourish."

Years of Achievement

It has been 58 years since Wayne and Joann Chambers started growing hazelnuts together. They have received every possible industry accolade and have routinely been recognized by their peers for their dedication to hazelnuts; Wayne was the Nut Growers Society "Grower of the Year" in 1994 and is a multi-time recipient of the Oregon Hazelnut Commission "Service Award". They also support the Hazelnut Cooking Challenge at Linn-Benton Community College each year, which encourages student chefs to creatively incorporate hazelnuts into an original dish.

Even with all the accomplishments and nearly 60 years of work, the time has flown by for both of them. According to Joann, Wayne has never complained about the hazelnuts, even in the most perilous times for the trees. They continue to spread this positivity to other growers and share their wisdom the way Harry Lagerstedt, Marvin Fletcher and Bob Groshong did for them. The phrases "we asked Wayne" or "that's how Wayne does it" are not uncommon to hear amongst growers. Even some of the industry's most seasoned and successful growers credit their knowledge and best practices to the wisdom imparted by the Chambers.

And what is their advice for other growers as they trend toward retirement? Communication and conversation is key for keeping the hazelnut community thriving. Rely on the kindness of fellow growers.

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PISTACHIO GROWERS MAKE SIGNIFICANT INVESTMENTS IN ORGANICS

GROWTH IN CONSUMER DEMAND FOR ORGANIC PRODUCTS DRIVES AN INCREASE IN ACREAGE THROUGHOUT CALIFORNIA.

By **MITCH LIES** | *Contributing Writer*

ORGANIC PISTACHIOS, LONG AN AFTERthought, today are experiencing unusually high interest among growers.

The estimated acreage in organic pistachios increased approximately 60% last year, going from what many believe was a long-time state average of between 1,500 and 1,800 acres to 3,000 acres. And growers are expecting more acres to come on board this summer, including from Touchstone Pistachio Company, whose chief operating officer said the company is "poised to become a significant organic grower in the industry this coming harvest."

"We see interest all over the globe for organic pistachios," Touchstone COO Mark Sherrell said. "This demand, coupled with our farming efficiencies, puts us in a good place to grow demand, have healthy yields, while ensuring a premium return to the grower."

The high interest in organic pistachios is driven in large part by the ever-increasing popularity of organic foods, according to growers. Organic sales, according to a recent report from Organic Produce Network and Category Partners, increased 9.3% in the first quarter of 2021 over the same period a year ago. Conventional pro-

Steve Couture (left) pictured with his brother Chris Couture in one of the farm's organic pistachio orchards, said it can be difficult and costly trying to get enough nitrogen to trees in an organic production regime (all photos by M. Lies.)

duce sales in the same period, conversely, increased less than 3%. And, while there aren't any nuts on the top 10 list of organic food products, some growers and processors are finding good demand for organic pistachios, both domestically and internationally, and growers are bullish about the future of organic pistachios.

"You couldn't find a product getting better press than organic," said Steve Couture of California Pistachio Orchards out of Kettleman City, one of the largest organic pistachio producers in California. "We are very optimistic about the future for organic pistachios. We put money into a new building, and we're committed to staying in it."

"There could be some rough spots over the next few years as all these acres come on," said Chuck Nichols of Nichols Farms in Hanford, widely believed to be the largest organic pistachio producer in California. "But long-term, I don't see it as a phenomenon that is going away. People want organic, and we want to provide it for them."

Despite a drop in the price and the premiums paid for organic pistachios last year, going organic has been a successful venture for the dozen or so producers who have been in the field. Nichols noted that margins over conventional have been in the 50-60% range in recent years, more than offsetting the increased production costs and the decreases in yield that come with organic production, yield reductions that Nichols said come to about 15-20% in a normal year.

Finding Markets

The hard part for farms entering the organic market is finding outlets for the crop, said Couture, particularly for small producers who can't meet large orders.

"Ten years ago, one of the large chain stores suggested that they would need at least 2 million pounds of organic to get started," Couture said, "and there hasn't been 2 million pounds yet in the industry."

In recent years, Couture has been able to take advantage of strong demand for organic pistachios in Europe by shipping multiple 44,000-pound containers overseas.

"There is excellent demand for organic foods in Europe," he said.

His domestic sales, conversely, have remained small by comparison. "We sell a lot of small quantities in the U.S.," he said.

Domestically, Nichols observed, numerous regional chains have branded or private-labeled organic pistachios. "Costco is a big organic supporter and does significant organic pistachio volume, primarily on the West Coast," he said, "and Whole Foods, long associated with organic and natural foods, is a significant seller nationwide."

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Gene Zannon of Santa Barbara Pistachio Company, another longtime producer of organic pistachios, said his sales volumes have risen steadily in 14 years of marketing flavored organic pistachios. Zannon, who was one of the first to go into organic pistachio production, sells to retail outlets, like Whole Foods, across the country and at farmers' markets in California.

Steve (left) and Chris Couture, pictured in one of their organic pistachio orchards near Kettleman City, have found a good market in Europe for organic pistachios.

Agronomic Challenges

Producing pistachios under an organic regime is easier for some producers than others, according to growers, depending largely on weather conditions and other environmental factors that affect crop production.

Zannon, whose farm is at 3,000 feet elevation, said he benefits from low insect and disease pressure. "We deal with weeds and we deal with a lot of rodents and a lot of the other things others deal with, but it certainly is manageable," Zannon said.

Nichols Farms, which is located on the west side of the San Joaquin Valley, produces organic pistachios in an area that Nichols describes as very dry with no disease pressure. "It is conducive to organic," he said.

Even in cases where sites are conducive to organic production, doing so is a challenge, growers said.

"You've got to walk it and watch it," Couture said. "You have to see where the weeds are coming up. You can't put down an overwintering herbicide. You have to go through orchards and decide where you are going to send guys through with weed whackers.

"Then you have to fight the nutrition, especially trying to get nitrogen to the crop," he said. The price for organic fertilizer has increased dramatically over the years, he said. "It probably costs four times as much now as it did 15, 20 years ago. And you aren't going to get as much wood production in your trees, so they are going to stay smaller longer.

"And that is the easy part," he said. "The biggest issue in organic production is the navel orangeworm (NOW). That is the single biggest sleep-depriving part of the organic business." Couture said his NOW program consists primarily of mating disruption and winter sanitation. "And we try to get our nuts

harvested as early as possible, and we never do a second shake unless we send it to a conventional buyer, because second shakes always have problems."

Then there are what Nichols described as "black swan events," where a pest ravages a crop. "With organic, particularly in the pest arena, you can have a black swan event once every eight or ten years where you have substantially lower yield," he said. "We had that happen once in the history of our organic production, where we had a migrating pest come in (stink bugs) and it lowered our yield by 50%."

The problem, he said, is there are no rescue sprays when going organic. "You just can't catch up with it," he said. The farm, he said, was a little slow to recognize the issue at the time. "We are well aware of them now. It is a learning process."

Future Outlook

Looking forward, Nichols said the farm is "pretty happy where we are at volume-wise" and isn't recruiting any additional growers for purchasing organic pistachios for processing and marketing.

"Part of the reason why is because we don't know what the rest of the industry is doing," he said. "If there is a whole bunch of acres converted, it won't be a good short-term financial decision for growers to go organic, and we don't want to recommend growers do that and take conventional prices and organic costs for the near future.

"There is good demand from the retail trade in the U.S. and we are seeing a little more interest in Europe," he said. "But it is a fairly thin market at present and I don't know where margins will go."

Organic margins dipped last year to about 35% over conventional, Nichols added.

Still, the outlook among organic pistachio growers remains healthy, if not for the short-term, definitely for the long-term.

"In pistachios, in general, we have had a very good run for the last almost 20 years," Nichols said. "So, we've done well in the industry, and organic has shared in that success."

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"WE ARE VERY OPTIMISTIC ABOUT THE FUTURE FOR ORGANIC PISTACHIOS. WE PUT MONEY INTO A NEW BUILDING, AND WE'RE COMMITTED TO STAYING IN IT."

– STEVE COUTURE, CALIFORNIA PISTACHIO ORCHARDS

Pest, Nutrition and Irrigation Considerations in a Lean Year

By **TAYLOR CHALSTROM** | *Assistant Editor*

Leaffooted bug damage on almond. As with PTB, NOW and spider mites, May spray insecticide applications for leaffooted bug are the exception, not the norm (photo by Kris Tollerup, UCCE IPM Advisor.)

LOW ALMOND PRICES MAY ENCOURAGE ALMOND GROWERS TO reduce or alter management inputs for pests, nutrition and irrigation in their orchards. But experts say growers need to consider when it is safe for the crop and the tree to cut costs and resources without damaging the tree or future yields, and decisions should be made on an orchard-by-orchard, case-by-case basis.

Nutrition Management

The decision to cut back on nutrient inputs will depend on the orchard. More often than pest management, there will be instances where cutting an input will not be feasible. One question to ask is: What nutrients are heavily drawn down and need to be attended to every year?

According to Patrick H. Brown, professor of Plant Nutrition at UC Davis, nitrogen and potassium are typically drawn down heavily in almond orchards, and micronutrients are critical to almond production as well. In all cases, these nutrients will need to be replaced every year to maintain long-term productivity; however, smaller potassium applications or no micronutrient applications in a lean year may be adequate if there are reserves within the orchard.

"I think if you've got a moderately rich soil, you can cut back on potassium 30% to 40%," Brown said. "You can cut back on foliar fertilizers and use basic fertilizers, and keep zinc and boron levels up because they're essential for next year's flowering."

Brown noted that in all cases, aim for replacement of removed nitrogen at the very least. "Growers should always maintain their nitrogen according to the demand of the crop," he said.

If growers are simply looking for a cheaper source of nitrogen, Brown said that there is none cheaper than the nitrogen present in irrigation water, and he recommends testing for nitrogen at a lab to offset any fertilizer costs.

Cutbacks on nutrients in a lean year will ultimately depend on previous soil and leaf tissue analyses and if they

show that there are reserves in the orchard. "If [growers] have got good records, they can make that choice to cut back this year," Brown said.

Irrigation Management

Due to low precipitation this past winter and low surface water allocations, growers are going into the season with lower quality water than previous years. High salinity, high sodicity, high toxic ion counts and/or high bicarbonate counts can cause irrigation water to be low in quality.

Irrigating with low-quality water requires a more thought-out approach, and it is recommended by UCCE personnel that growers get a sense of where they're starting from before making any decisions. Katherine Jarvis-Shean, UCCE orchard advisor for Yolo, Solano and Sacramento counties, said that irrigating with low-quality water depends on how long the water shortage is presumed to last.

"When it comes to irrigating with low-quality water, it matters if it's a one- or two-year issue or if we're going to be in a drought," she said.

Damage induced by low-quality water can come in the form of growth and yield reduction, water infiltration issues and potential for plugging. These short- and long-term impacts can end up potentially costing a grower more in the long run as a result of lasting damage. Thus, Jarvis-Shean said that in certain situations where growers are seeing severe forms of damage as a result of low-quality water, irrigating less may be a viable corner-cutting option.

"If you're getting well into the red zone [for salinity damage], that might be a time to think about adding less water because what you're adding is going to be so high in salts that it will be hard to undo the damage of that over many years," she said.

Jarvis-Shean noted that if growers have to use low-quality water to irrigate their crop, summer is the most preferable time to do so as later stages of the crop are less vulnerable to stress related to water quality. "We're getting into the stage in almonds right now where it isn't too detrimental to stress the crop."

To learn more about ways growers may be able to cut corners in a lean year, visit cecolusa.ucanr.edu/newsletters/Orchard_Topics89319.pdf.

Growers may get by with smaller potassium applications or no micronutrient applications in a lean year if there are reserves within the orchard (photo by Danita Cahill.)

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Pest Management

Cost cutting for pest management depends mainly on the type of pest being managed.

Arthropod pests, including navel orangeworm (NOW), spider mites, peach twig borer (PTB) and leaffooted bug, do not require the same spray treatments every year, and, according to David Haviland, UCCE entomology farm advisor in Kern County, sprays can be reduced at the timing referred to as 'May sprays'.

May sprays originated with PTB and referred to the timing at which insecticide applications should be made, based on degree-day models, to control PTB if they had not already been controlled during the dormant season or bloom, he said. However, damage by PTB has become almost irrelevant in California orchards.

"They really aren't needed anymore," Haviland said referring to PTB sprays. "Biological control is pretty good. We just don't see damage for peach twig borer like we did 15 or 20 years ago. For old school, traditional growers that still put on sprays for peach twig borer, that's certainly not something that's needed anymore."

Haviland noted that on rare occasions, growers may only need May sprays for PTB if at least four shoot strikes are easily visible on mature bearing and young non-bearing trees in late April.

Similar to PTB, NOW also presents a tricky situation for growers when it comes to May sprays. Haviland said that some growers want to treat in May as a way to get ahead of NOW before hullsplit, but the timing is not as effective as spraying at hullsplit.

"For growers that want to spray once, hullsplit is definitely when you want to do it," he said. "If they want to spray twice, hull split and then two to three weeks later would be the best time to do that.

"As far as navel orangeworm sprays in May, the only time you would really want to do that is if you are in such a dire situation that you need more than two sprays, in which case May sprays can help, although there are questions on whether or not that's actually a good return on investment," he said.

Another common target for May sprays is the spider mite. In the early 2000s, May sprays were common for controlling spider mites before hullsplit to prevent population growth later in the year. However, Haviland said treatment looks much different today.

"We don't see that that's the case anymore," he said. "Things have changed with almond production where growers are using very "green" production practices in terms of pesticides, and as a result, biological control for spider mites is typically very good in April and May such that miticides are rarely needed."

Haviland recommends cost-conscious growers consult a PCA for monitoring spider mites, noting that miticides should only be applied in April or May if a treatment threshold of 40% of leaves infested has been reached. Additionally, he said, if predator traps show at least one sixspotted thrips in one sticky trap card per week, the threshold for adequate biological control is achieved and May sprays will not be necessary.

As with PTB, NOW and spider mites, insecticide applications for leaffooted bug are the exception, not the norm. From March to May, Haviland said to monitor almond orchards for the presence of leaffooted bugs, gummosis associated with a puncture mark on the almond hull and aborted nuts, especially in orchards with a history of leaffooted bug damage or that are near good overwintering sites like riparian areas.

"If found at levels that are not acceptable, consider a treatment. Otherwise, save your money," he said.

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Irrigation Management Considerations for Summer

Automated, pulse irrigating can help reduce heat stress and energy costs.

By **RICH KREPS** | *CCA, SSp., Contributing Writer*

THE HEALTH EXPERTS RECOMMEND 6 TO 10 CUPS OF WATER per day for the average human depending on your activity level. Wouldn't it be great if you could get up in the morning, decide how much work you were going to do that day and, after careful calculations, suck down that much water at breakfast and be good for the day? It doesn't work that way. We need water throughout the day.

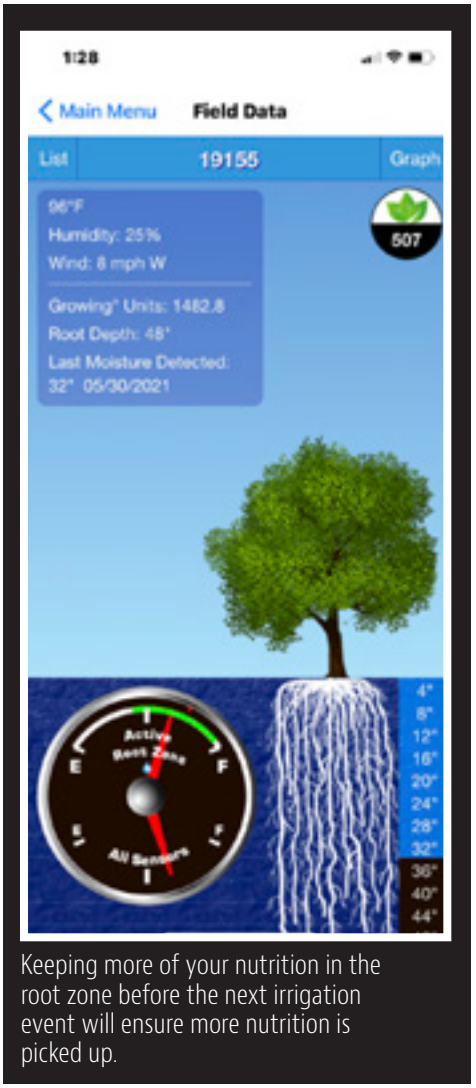
Unfortunately, due to logistics and timeframes, that's how we irrigate our crops. Load them up for a day or two and then let them fend for themselves for the rest of the week. Pulse irrigating can be much more beneficial. Full disclosure, its often much easier for me, with only 40 acres of pistachios on the farm on which I live, to run down the hill in shorts and flip flops and turn the pump on or off at any hour of the day or night. Most of my farmers can't do that. So, how do we handle that?

Changing Our Practices

With bigger farms, the need for automation has never been greater. Our energy charges are astronomical, and they're even worse between 5 p.m. and 8 p.m. due to peak rates. If we were to calculate those charges and be able to run 12-hour sets three to four days a week instead of 36 to 48 hours straight, we'd find that over the course of the summer, it would add up to thousands of dollars in savings. Clicking on a well at 8 p.m. and off at 8 a.m. will do that. Watering at night will also make your water go farther with less evaporation. As more and more restrictions squeeze profit margins in agriculture, we need to be cognizant of every penny we spend. The question arises as to what, if any, other benefits we would notice by changing our irrigation practices.

We know that our trees don't eat their food, they drink it. Water solubilizes some nutrients, softens soils and brings much of the nutrition to the roots. So much of the microbiology in our soil depends on water to propagate and thrive. They transform many nutrients into forms a plant can use and symbiotically exchange their nutrition for root exudates. But they don't do well underwater.

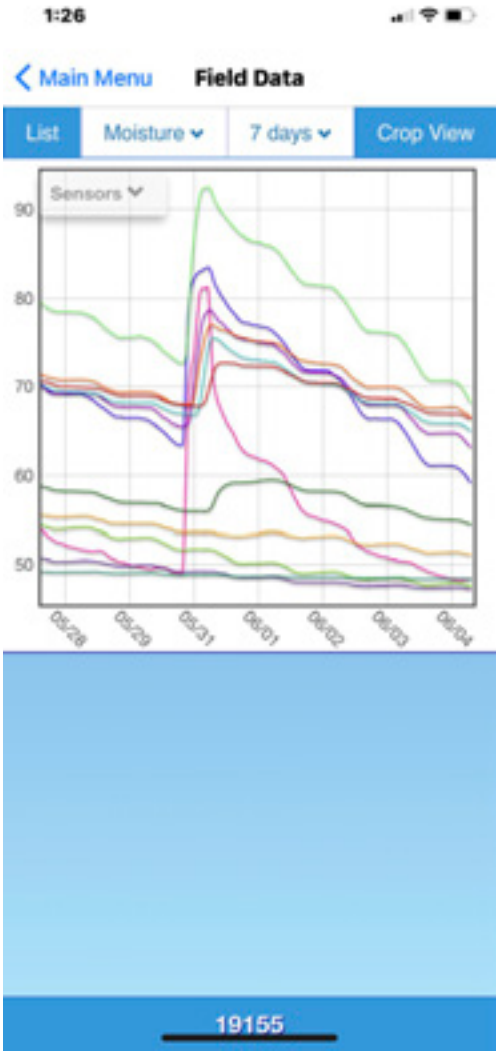
What we often overlook is that soils also need oxygen in pore spaces to function properly. When we run long sets with microirrigation systems or old-fashioned flood blocks like many of my walnut farmers, the soil stays anaerobic for way too long. Much of the good microbiology and even macrobiology get overrun by water and the bad guys. Typical anaerobic bacteria and fungi provide little to no nutritional value to the soil. They also give off ammonia gas and hydrogen sulfide, that rotten egg smell often found in swampy ground. Soggy roots don't perform like well aerated feeder roots high up in the soil profile. Worms die, matter rots and bad players can take over. In soils that drain quickly, long irrigation sets push much of our soluble nutrition below the feeder root zone and render it ineffective. We paid for it and put it on, but our trees never had a chance to drink it.



Keeping more of your nutrition in the root zone before the next irrigation event will ensure more nutrition is picked up.

Improving Quality and Yield

In California, more so than other states, we have to make every drop of water count. Growing a crop is not easy, and the last thing I want to do is put more on my clients' plates. But what if there was a better way? How much better can our



It is crucial to monitor soil moisture to know exactly how quickly water gets from the surface to 12" where most of the feeder roots are (all photos by R. Kreps.)

quality and yield improve with pulse shots on our irrigation and, more importantly, fertigation? Calculate how long our sets need to be to meet ET (only running specific hours doesn't cut it if one system puts out 1000 gallons a minute while another well puts out 600gpm.) Run soil probes, a good old-fashioned soil auger, shovel or soil moisture meters. You want to know exactly how quickly your water gets from the surface to 12" where most of our feeder roots are. Fertigation for that amount of time and keeping more of your nutrition in the root zone before the next irrigation event will ensure more nutrition is picked up. Drying down a bit and opening pore space will allow more of our beneficial soil biology to transform more nutrition quickly and make sure it is absorbed. If you have to run longer irrigation sets, try to fertigate with smaller pulse shots in between.

Adding humates to your nutrition plan will also enhance soil health. Increasing organic matter by just 1% will allow an acre of soil to hold 20,000 more gallons of water. That can go a long way during a well issue or lengthy harvest period. The extra carbon will also chelate much of that nutrition that isn't picked up quickly during the current fertigation event. It'll help keep it from tying up with other ionic components as soils dry down a bit and keep it available for later use. The last thing we want is for a nutrient to lock itself back up into the original form we mined and attempted to solubilize in the first place to get it on our field. Humic and fulvic acids go a long way. Compost works well, but try to incorporate it and don't let it degrade and volatilize in the soil surface. Even adding forms of sugar to nutrition can have benefits with the extra carbon.

Every time we are faced with the issues farmers realize on a daily basis, we have to be willing to make changes. Oftentimes, those voluntary changes can have dramatic effects on our bottom line. Water and power are two of those crucial elements that become significant. Better management of those two can have lasting effects on how our nutrition is assimilated as well. The money you can save can go into your nutrition budget or more automation. As new practices become more efficient and beneficial, that extra money you earned and saved will be well worth the effort.

Comments about this article? We want to hear from you. Feel free to email us at article@jcsmarketinginc.com

Gemperle Farms Uses Regenerative Practices to Improve Soil Health

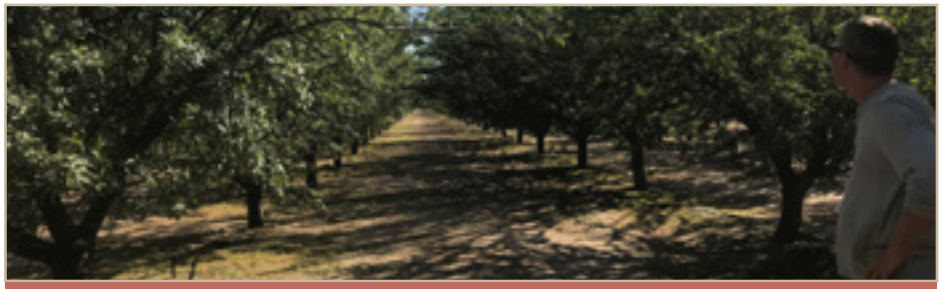
By **PAUL LUM** | *Agricultural Specialist, American Farmland Trust California*

The cover crop provides habitat for beneficial insects, suppressing insect pests and allowing Gemperle to reduce reliance on insecticides (photo courtesy P. Lum.)

American Farmland Trust (AFT) recently released a Soil Health Farmer Profile of Rich Gemperle, who successfully adopted regenerative farming practices to improve soil health on his orchard. His family grows almonds and owns a large-scale egg business in Stanislaus County. The farmer profile describes the changes Gemperle made to his 67-acre orchard, originally planted in 2008. Gemperle had been applying compost annually, but in 2016, he started planting cover crops and practicing nutrient management. He reports improved soil tilth, water infiltration and increased organic matter content since adopting the practices. The grower also experienced gains in net income through reduced costs and greater yields, and AFT documented the improvement to water quality and carbon sequestration in this farmer profile.

On-farm and university research has demonstrated that healthy, fully functioning soils offer significant benefits to farmers, including greater soil aggregation and structure, improved water holding capacity, water infiltration rates and increased nutrient cycling. As a result, the plants may be healthier and more productive, and growers may experience increased yields and reduced production costs.

AFT recognizes that many growers are hesitant to adopt one or more of these growing methods. They may be uncertain of the benefits or hesitant to take the financial risk of trying something new, especially on leased land. The Gemperle profile expands AFT's growing library of case studies and farmer profiles nationwide, which provides evidence of how sound farming practices can improve soil health, farm profitability and carbon sequestration to mitigate climate change. AFT has evaluated corn-soybean farms in Illinois and Ohio, diversified farms in New York and wine grapes in California, Oregon and Washington. The Gemperle profile was funded by a competitive grant from USDA's National Institute of Food and Agriculture.



Gemperle attributes improved soil health to yield gains of 9% over the past six years. Inflation, tree maturity and annual weather conditions were all considered when evaluating crop yields over time (photo courtesy P. Lum.)

Evaluation of Practices

To develop the profile, AFT's California staff interviewed Gemperle and his daughter, Tanya Gemperle-Goncalves, who serves as the farm's director of sustainability. AFT evaluated the growing practices that were implemented in the orchard. Gemperle explained his growing concerns are soil compaction, poor water infiltration and low nutrient availability. So, he adopted regenerative agricultural practices to improve the orchard's soil health and enhance the long-term sustainability of the farm.

"We consider how everything we do in the orchard affects the soil and the health of the trees," Gemperle said. "Since we farm with coarse soils, we do a lot of work to keep the soil alive. Our program of cover crops and composting is well worth the effort and we are seeing numerous benefits, especially with reduced production costs and increases in yield."

The transition to cover cropping presented early challenges to the Gemperle family. Rich experimented with different planting dates, seed mixes and mowing heights. After several years, Gemperle found a seed mix that worked for him. He plants the Project Apis m. clover mix in every other row of the middles and allows native vegetation to grow in the alternate rows instead of maintaining bare floors. The cover crop and vegetation are terminated by a low mowing pass in early summer in preparation for harvest. The cover crop provides habitat for beneficial insects, suppressing insect

BENEFIT & COST ANALYSIS T-CHART

RICH GEMPERLE, GEMPERLE FARMS
Stanislaus County, CA
February 2021

RESOURCE CONCERNS/BENCHMARK CONDITION
67 acres of almonds planted in 2008
Sustainably farmed with regenerative agricultural techniques.
Resource concerns include soil compaction, poor water infiltration, poor water retention and nutrient cycling.

SOIL HEALTH PRACTICES
Nutrient Management—began in 2016
Cover Crops—began in 2016
Compost Application—began in 2006

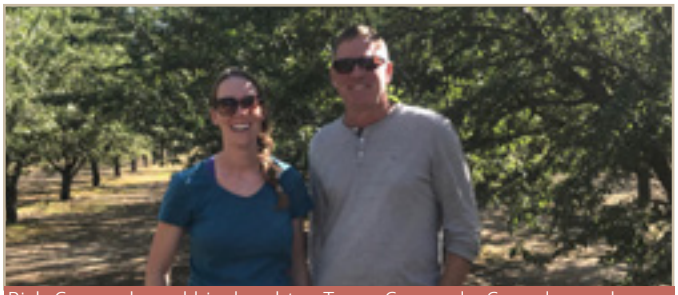
POSITIVE EFFECTS	
REDUCED COSTS	$/AC/YR
Decreased fertilizers ▪ Eliminated UN32 & CAN17 ($100/ac) ▪ Eliminated potash ($100/ac)	$200
Decreased insecticides and applications as a result of cover crops	$53
Decreased herbicides and applications as a result of cover crops	$46
Total Reduced Costs	$299
INCREASED REVENUE	
Increased almond yield due to soil health practices (9% increase) ▪ (Comparison of the average yields during 2013–2015 to the average yields during 2016–2019)	$309
Total Dollar Benefits = $608/ac/yr	$608

NEGATIVE EFFECTS	
INCREASED COSTS	$/AC/YR
Foliar fertilizers	$32
Cover Crop costs ▪ Seed, equipment and labor	$63
Compost Costs ▪ Chicken manure, produced on-farm ($70/ac) ▪ Spreading ($18/ac)	$88
Total Increased Costs	$183
Total Dollar Costs = $183/ac/yr	$183

$608/ac/yr Total Benefits – $183/ac/yr **Total costs = $425/ac/yr Net Benefits**

NRCS Level III T-Chart, Soil Quality Improvement • NRCS Economics Technical Note No. TN.pro.ECN-1

Benefit & Cost Analysis T-Chart, which captures the changes in costs and yields from 2013 to 2015 (prior to practice adoption) with 2019 (current period of practice adoption) (courtesy AFT.)



Rich Gemperle and his daughter, Tanya Gemperle-Goncalves, who serves as the farm's director of sustainability, work together on Gemperle farms (photo courtesy P. Lum.)

pests and allowing Gemperle to reduce reliance on insecticides. Weed competition from the cover crop reduces herbicide use.

AFT calculates the impacts to net income with partial budgeting analysis. Water quality is assessed with the NRCS Nutrient Tracking Tool, and benefits to carbon sequestration or greenhouse gas emissions are evaluated with USDA's COMET-Farm or COMET-Planner tool.

The combination of cover crops and compost improved soil microbial activity, increased nutrient cycling (nutrient availability) and enhanced soil structure. Gemperle applies four tons per acre of composted chicken manure sourced from the family's egg business. The improved soil health allows Gemperle to reduce UN-32 and CAN-17 fertilizers and still meet the crop demand. Potassium levels are more stable throughout the growing season, eliminating potash applications.

Gemperle has seen rich benefits from increased yields, and he attributes improved soil health to yield gains of 9% over the past six years. Inflation, tree maturity and annual weather conditions were all considered when evaluating crop yields over time.

Provided is the Benefit & Cost Analysis T-Chart, which captures the changes in costs and yields from 2013 to 2015 (prior to practice adoption) with 2019 (current period of practice adoption). The left column, "Positive Effects", lists the reduced costs for fertilizers, insecticides and herbicides as well as the increased revenue, resulting in a combined total of $608/acre. The right column, "Negative Effects", lists the practices that generated increased costs equal to $183/acre. In sum, the net income benefit is equivalent to $425/acre/year.

In addition to the T-Chart analysis, AFT tracked environmental benefits from Gemperle's adoption of these growing practices. Water quality impact was assessed with USDA's Nutrient Tracking Tool (NTT), which found a 27% reduction in nitrogen loss and a 58% reduction in sediment loss. A reduction in greenhouse gas emissions was quantified with USDA's COMET-Farm tool, which estimated a sequestering of carbon equal to 403 CO_2 equivalent, or that of 6,660 tree seedlings grown over ten years.

Gemperle says his farming practices will continue to evolve as he learns more about the best methods to manage his orchards. "We want to grow our trees on living soils that are healthy from year-to-year," he said. "With three generations on the land, we try to farm in ways that sustain the soil over time and benefit the environment."

Scaling Up Healthy Soil Practices

AFT disseminates these farmer profiles to educate growers that are on the fence about adopting soil health practices. Over the past year, a series of webinars were held for agricultural professionals to provide training on methods to quantify soil health impacts in tree crops and wine grapes.

For more information about past webinars, case studies or profiles, or to discuss soil health practices, please contact Paul Lum, American Farmland Trust California's Agricultural Specialist, at plum@farmland.org. To read more case studies and profiles, visit farmlandinfo.org/publications/soil-health-farmer-profiles/.

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Alternatives to burning for small orchard removals remains an issue (photo courtesy Almond Board of California.)

THE END OF AG BURNING IN THE SAN JOAQUIN VALLEY

By **ROGER A. ISOM** | *President/CEO, Western Agricultural Processors Association*

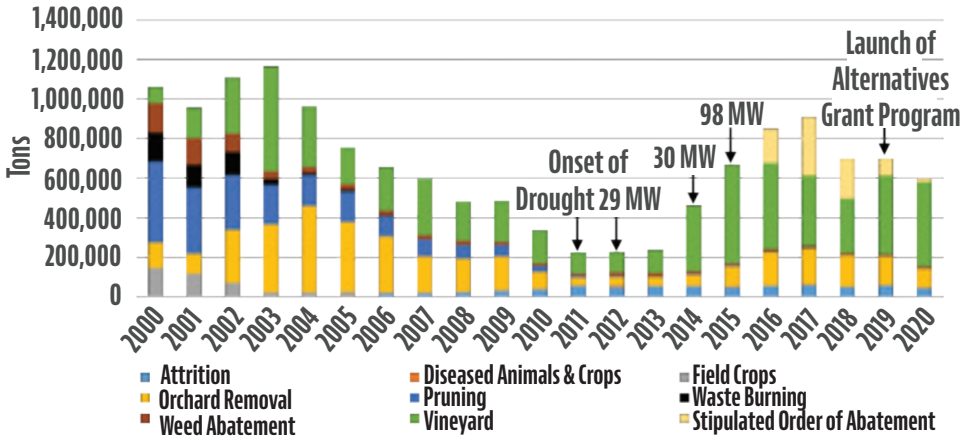
THE END TO AGRICULTURAL BURNING IS NOW IN CLEAR SIGHT for the San Joaquin Valley. Beginning Jan. 1, 2025, nothing but diseased trees, and possibly some attrition, will be allowed to be burned after that date. The California Air Resources Board (CARB) set forth this mandate when they mandated amendments to the proposed partial phaseout from the San Joaquin Valley Air Pollution Control District. CARB was pressured by environmental activists leveraging major smoke impacts from this past year's devastating wildfires that lasted for months. The activists jumped all over the opportunity, which coincided with the Valley Air District's required five year report to CARB, and demanded that ag burning be ended once and for all.

Under state law (SB 705), open burning for agricultural crop categories are required to be phased out under a prescribed schedule, unless certain findings are made with respect to the availability of funding and economically feasible alternatives to open burning. As required under District Rule 4103, every five years, the District must review and make recommendations to the Board regarding the phaseout of agricultural burning in the Valley.

In accordance with these requirements, in December 2020, the Governing Board approved the *2020 Staff Report and Recommendations on Agricultural Burning* (2020 Report) and directed staff to submit this report to the California Air Resources Board (CARB). On Feb. 5, 2021, CARB staff published their recommendations regarding the District's 2020 Report, and on February 25, CARB approved their staff's recommendations.

This CARB action included full short-term concurrence with the District's 2020 Report and recommendations through Aug. 31, 2021, longer-term concurrence with many of the District's 2020 Report recommendations through 2025, and additional criteria for longer-term concurrence beyond Aug. 31, 2021, including a timeline for the near-complete phase-out of open burning for the majority of remaining crop categories by Jan. 1, 2025 (with some exceptions such as diseased crops.) Additionally, in supporting their concurrence action, CARB highlighted and affirmed the critical role that the state plays in securing needed state incentive funding to support the transition and addressing barriers to the establishment of new bioenergy solutions.

Driving attention to this issue is the fact that burning had actually been on the increase due to the closure of 15 of the



Ag burning has been on the increase in recent years due to the closure of many of the state's bioenergy facilities (photo courtesy WAPA.)

Valley's 20 biomass plants, along with the recent increase in the pullout of vines that contain wire that cannot be chipped or shredded. But nonetheless, SB 705 is state law, and the District and State have to continue to find a way to end the practice of agricultural burning. The following is a summary description of the District's revised plan to address CARB's comment and is focused on those portions of the plan that address tree nuts.

Orchard Removals

In the District's 2020 Report, the District found that there were no economically feasible alternatives for small orchard removals due to fixed and minimum contractor costs. In addition, the availability of contracts for small orchard removals remains an issue. Contractors often refuse small removal requests as they are not a priority over large removals. Wait times for small removals are often extended in comparison to a larger removal. Recognizing these feasibility issues, the District recommended postponing the prohibition of burning orchard removals ≤15 acres at a single location per year.

In response to the District's 2020 Report, CARB's assessment included recommendations to introduce prohibitions on burning of ≤15-acre removal projects at large agricultural operations, effective in 2022, followed by phased-in prohibitions for small agricultural operations. In accordance with CARB's recommendations, the District has developed a recommended phase-out

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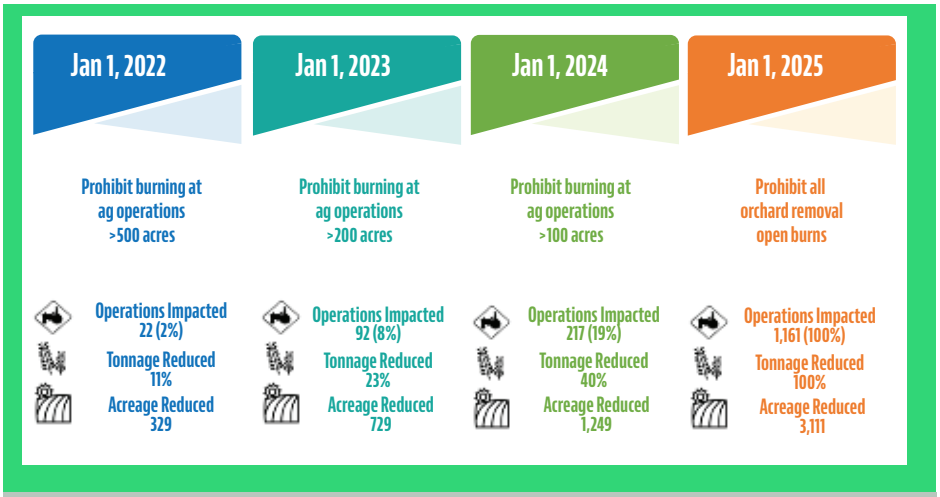


Phase-out schedule for open burning of orchard removals (photo courtesy of WAPA.)

Continued from Page 67

schedule for the open burning of small orchards.

The proposed schedule requires the phase-out of open burning for large agricultural operations by January 1, 2022 and progressively more stringent requirements for the phase-out of open burning for smaller operations (providing the most flexibility for smallest operations.) Consistent with CARB mandates, the proposed schedule includes the complete phase-out of open burning of small orchard removals by January 1, 2025.

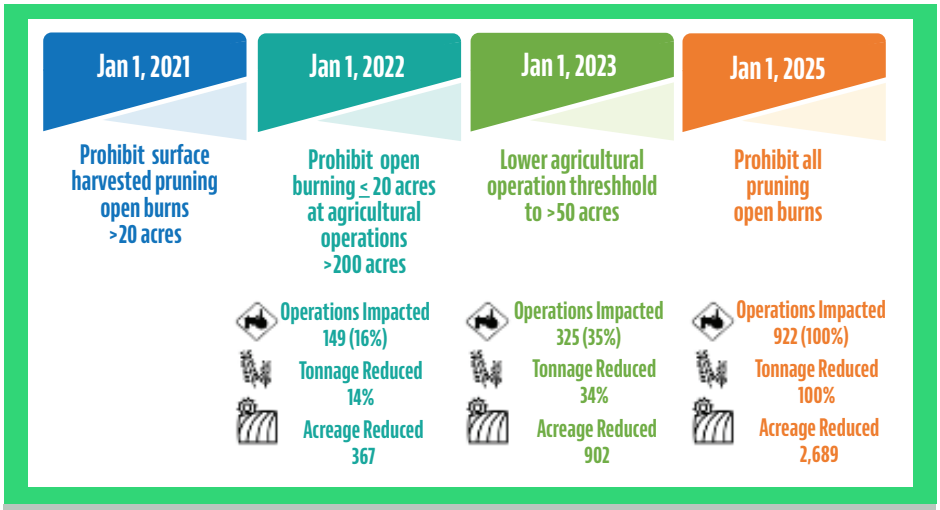
'IN THE END, A LONG-TERM SOLUTION TO REPLACING BIOMASS PLANTS IS NECESSARY. NOT ONLY WILL IT HELP THE AGRICULTURAL INDUSTRY, BUT IT COULD ALSO BE A SIGNIFICANT HELP TO THE TREE MORTALITY PROBLEM IN THE FORESTS AS WELL.'

Surface-Harvested Prunings

In the District's 2020 Report, the District found that there were no economically feasible alternatives to open burning for surface-harvested prunings from almond, walnut and pecan crops without incentives. However, to reinforce the ongoing transition to alternatives, the District recommended a phase-out schedule to prohibit open burning ≤20 acres of total prunings per year for almond, walnut and pecan crops for agricultural operations whose total nut acreage at all agricultural operation sites > 50 acres. CARB's assessment provided concurrence with the District's determinations. In addition, to support the near-complete phase-out of open burning by January 1, 2025, the District has included an additional recommendation in this supplemental report to phase out all remaining surface-harvested open burns effective January 1, 2025.

Funding

All of this hinges on the State coming up with funding to help growers achieve this new mandate. The state knows full well, and admitted so, when CARB's recommendations were approved. A coalition of agricultural



Phase-out schedule for open burning of surface harvested prunings(photo courtesy of WAPA.)

groups, led by the Almond Alliance, California Citrus Mutual, California Association of Winegrape Growers, California Fresh Fruit Association, Western Agricultural Processors Association, California Farm Bureau and the Nisei Farmers League, is working hard to obtain the funding in this year's state budget.

The coalition submitted a request for $290 million in funding to assist in three critical areas:

$135 million for Alternatives to Ag Burning Incentives Program. This includes direct incentives to not burn for up to $600 per acre for chipping with soil incorporation and up to $300 per acre for chipping without soil incorporation. There is a maximum of $60,000 per grower, per calendar year.

$55 million for Air Curtain Burners and Chipping, Shredding and Spreading Equipment.

$100 million for Bioenergy/ Bio-Economy Investment Projects.

At the time of writing this article, the Governor had included $150 million in the May Revise Budget, and the Senate had put forth $180 million for ag burning. A full-scale effort is underway to get this increased to as close to $290 million as possible.

In the end, a long-term solution to replacing biomass plants is necessary. Not only will it help the agricultural industry, but it could also be a significant help to the tree mortality problem in the forests as well. Again, this all hinges on the Governor and the legislature coming through with the money. Stay tuned.

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Weed Management in Young Nut Orchards

Proper Weed ID, Targeting Vulnerable Stages are Keys to Control

By **CECILIA PARSONS** | *Associate Editor*

SUNLIGHT AND WATER ARE MAJOR drivers of young tree nut growth, but they also contribute to problematic weed populations that can steal nutrients and water from vulnerable young trees.

Fewer effective herbicide options for growers and increasing herbicide resistance in some formulations can be roadblocks to effective weed control in orchards, making it important for growers to up their game. Identifying weeds in their early stages of growth, knowing if they are perennial or annual and timing herbicide applications when they will be most effective are strategies recommended by weed control experts.

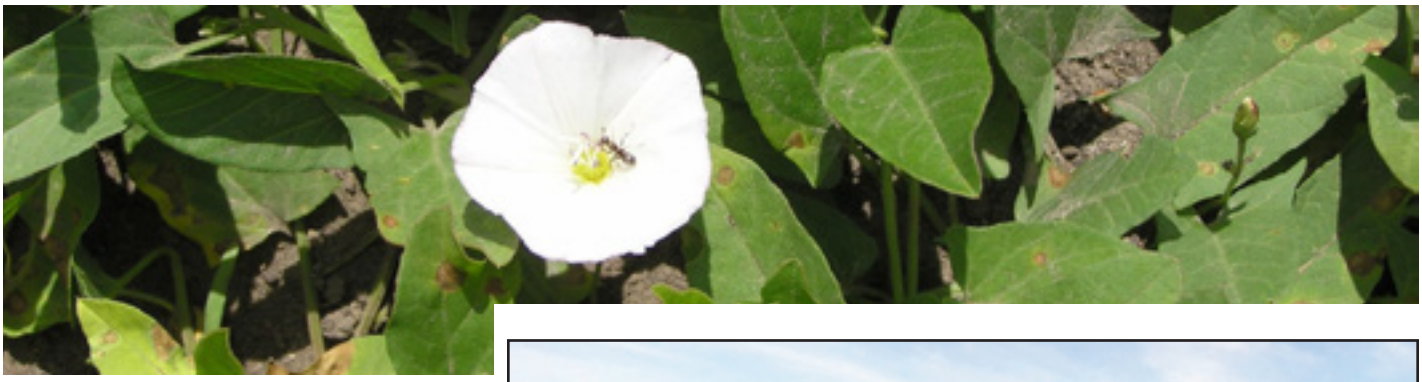
Drew Wolter, Almond Board of California's new senior specialist in pest management, said changes in weed populations plus new, invasive weed species pose challenges for tree nut growers every year.

Drought can cause weed populations in an orchard to shift, Wolter said. Fertigated orchards can have salt build up in the soil and species that are salt- and drought-tolerant can become more prevalent over time. New, invasive weed species can spread unless control measures are developed quickly. Weeds are easier to control in early stages of growth, but correct identification of the species and using timely and appropriate control is important, Wolter said.

Some of the most challenging weed species currently found in nut orchards in the San Joaquin Valley include Horseweed or mare's tail (*Conyza canadensis*), field bindweed (*Convolvulus arvensis*) and Italian ryegrass (*Lolium perenne ssp. Multiflorum).* There are a few new amaranth species in California that growers should keep an eye on, namely Palmer amaranth (*Amaranthus palmeri*) and Waterhemp (*Amaranthus tuberculatus var. rudis*)

Another amaranth species not yet identified in California, waterhemp, is a potential cause for concern. Photo shows difference between leaves Palmer (right) and waterhemp amaranth species.

Palmer amaranth is a summer annual that grows rapidly and has a rooting system capable of penetrating compacted soils.



Preemergent and postemergent programs are necessary with field bindweed, one of the most difficult weeds to control. Systemic herbicides should be applied when field bindweed is in the full bloom stage (all photos by Lynn Sosnoskie, Assistant Professor, School of Integrative Plant Science Horticulture Section, Cornell AgriTech.)

Horseweed or Mare's Tail

Horseweed is an older species, and the biology of the plant makes it particularly difficult to control. Horseweed produces an enormous number of seeds that can be dispersed over a long distance. This weed also has two different germination periods, fall and spring, and widespread herbicide resistance.

Wolter said horseweed only reproduces with seed that is wind dispersed, and due to its feather-like appendages, it can be carried long distances. Fortunately, studies have shown that the seed is only viable for about three years.

Early management is key to controlling horseweed in an orchard. As the season progresses, horseweed goes from a rosette stage of growth to bolting with a central stem and rapid growth.

Wolter said that there have been confirmed cases of herbicide resistance to EPSP synthase inhibitors and PSI Electron Diverter, making management much more difficult. He advises a sound preemergent program and postemergent alternatives for glyphosate-resistant biotypes. Postemergent alternatives for glyphosate resistance include saflufenacil, glufosinate and 2,4-D. Preemergent recommendations are isoxaben, simazine, rimsulfuron and flumioxazin.

Continued on Page 72

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Field Bindweed

Field bindweed, a member of the morning glory family, produces trumpet-shaped, white to pinkish flowers. Bloom occurs from spring through fall. Wolter emphasized that once field bindweed has invaded an orchard, it is one of the most difficult weeds to control.

Its persistence is due to a vigorous horizontal rhizomatous system that can give rise to new roots and shoots once aboveground vegetative matter is knocked down or when roots are disturbed. This weed can wind up tree trunks, hide under protective trunk cartons and work its way into irrigation emitters. Seeds can last up to 60 years dormant in the soil.

Again, a sound preemergent and postemergent program is necessary. Since the seed are so long-lived, the goal should be to make timely applications that gradually deplete the seed bank.

Applications should target this species phenology. Due to the rhizomatous system, the timing of herbicide applications is important. Systemic herbicides such as glyphosate should be applied when the plant is in its full bloom stage. During this stage of growth, the roots' carbohydrate reserves are at their lowest and the sugars produced in the leaves are being moved downward to the root system. By applying a systemic herbicide at this stage, the herbicide will be translocated with the sugars down to the rhizome system. That does not necessarily mean that management practices should not take place earlier as well. Early season treatments provide a reduction in seed production and plant vigor.

Italian Ryegrass

Italian ryegrass is a winter annual or biennial that easily hybridizes with closely related plants (same genus), making it difficult to identify and tough to develop a specific management program for this species. Most seed germinates in fall, but under the right environmental conditions, this species can germinate year-round.

'Fewer effective herbicide options for growers and increasing herbicide resistance in some formulations can be roadblocks to effective weed control in orchards, making it important for growers to up their game.'

The genetic diversity of the species has led to numerous cases of resistance in California. Currently, there are a total of five different modes of action (MOAs): ACCase inhibitors,

ALS inhibitors, EPSP synthase inhibitors, Glutamine Synthetase inhibitors and PSI Electron Diverter.

Palmer Amaranth

Palmer amaranth is a tall, erect summer annual broadleaf weed that has become a significant issue in tree nut orchards in recent years. It can be especially abundant in young or widely spaced orchards and can be found on the outer edges and skips in mature orchards. It is a prolific seed producer, Wolter said.

Lynn Sosnoskie, formerly with the UC Weed Science department at Davis, noted in 2013 that when Palmer amaranth started to become prevalent in California, it was originally an issue in cotton production.

Amaranth species are sometimes difficult to distinguish from each other, especially at the seedling stage. Palmer amaranth has petioles that are as long as or longer than leaf blades. Male and female flowers are held on separate plants in long, terminal spikes. Female flowers have pointed bracts that make the flower heads sharp to the touch. Male flower heads are softer.

Under ideal conditions, this weed grows rapidly and has a rooting structure capable of penetrating compacted soils.

Aside from it's prolificacy, Palmer amaranth has developed resistance to dinitroanilines, photosystem II-inhibitors, ALS inhibitors, HPPD inhibitors and EPSP synthase inhibitors. This is particularly problematic since there are few products registered for managing young orchards.

Control options include Saflufenacil, glufosinate, 2,4-D, carfentrazone for post emergence and flumioxazin, rimsulfuron and oxyfluorfen for preemergence.

Waterhemp

Waterhemp (*Amaranthus tuberculatus var. rudis)* is unlike other weedy amaranth species found in California in that it is dioecious, meaning it produces male and female flowers in separate plants, which helps with identification.

Waterhemp flowers from summer through fall and is becoming a weed of concern in the Central Valley because of herbicide resistance. It has already shown resistance to multiple modes of action, including EPSP synthase inhibitors, ALS inhibitors, Photosystem II inhibitors, PPO inhibitors, HPPD inhibitors, Synthetic auxins, Long Chain Fatty Acid Inhibitors.

Wolter said that while there have been no confirmed cases in California to date, this level of resistance found throughout the country should make identification of this species a primary concern when scouting to prevent widespread resistance issues from developing in California.

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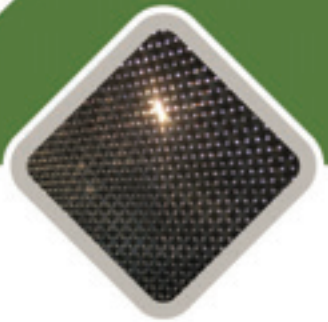

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Almond milk yogurt is among the products Billings Ranches is working to develop (all photos courtesy M. Billings.)

Grower Insights: Matt Billings
Showcasing Almonds Through New Ventures

By **SABRINA HALVORSON** | *Contributing Writer*

Ask almond grower Matt Billings what matters most to him, and he'll tell you, "Integrity and family." As he worked to develop a new almond product, those are the things he had on his mind.

Billings grew up in the Central California town of Delano, but with both of his parents coming from multi-generational farming families, he spent much of his childhood on the family farms.

"It was great. I remember as a little kid getting in cotton trailers and stomping down cotton. I remember going out, sleeping in pick-ups with flashlights all night long when we were harvesting wine grapes. I remember almond harvest, grain harvest, irrigating alfalfa with my dad," he said. "It was magical."

Though during his childhood his extended family grew several different crops, the focus for Billings now is almonds. Since graduating from college in 1995, Billings has farmed in Delano. He now shares the farm with his wife, Eva, and their three kids. In addition to growing conventional and organic almonds at Billings Ranches, the family also has a hulling, shelling and processing company that processes for other growers. Billings said a few years ago they decided to try something new.

Going Direct

"We started looking for a way to get our almonds, which we really, truly love, into the community and consumers directly. Because everything we're doing is commodity-based, typically. You go to the store shelf or the cereal aisle or the candy bar or wherever you are, and you'll never know they're ours," he explained. "We wanted to put some sort of a brand to it because I think it is really unique in the world that you know exactly where your food comes from. You can go to farmers' markets and see it or some other places and see it, but really, you don't see it very often."

They considered options like roasting and bagging almonds for sale, almond butter and almond milk.

"My wife likes almond milk, and I was eating yogurt all the time, and one day it just kind of came to us. 'Why don't we try an almond milk yogurt?' Not try to imitate a dairy yogurt, but really showcase the almonds," he said as to how the idea for AYO almond yogurt was formed.

He said AYO almond yogurt is not an attempt to be an alternative to dairy yogurt, but rather a product on its own accord that highlights what his family grows.

"We roast the almonds before, so they have a little almond flavor, use organic fruit, use organic almonds only from our ranch. That's what we were trying to develop and showcase, a whole new product," he said. "We're not trying to imitate or be fake and make some alternative product. That's not what we're trying to do. We're really trying to showcase the almonds. When you taste it, you taste the almonds."

Introducing a new product can be an ordeal in the best of times, and AYO started out during a difficult period. Though it was developed and ready for the public in late 2019, the following

Matt Billings shares the Delano-based Billings Ranches with wife, Eva, and their three kids.

Billings Ranches innovates but also carries on the traditions of the multi-generational family farm.

months were more arduous.

"Our biggest challenge has probably been trying to roll it out during COVID," Billings said. "Just to get brand awareness and explain this to everybody when for the first six to eight months of our rollout people weren't even going to grocery stores or were just going through trying to make sure they had toilet paper and canned food. So, to present something new, that's been really challenging."

He pointed out perhaps the only worse time to present a new product in recent history would have been during the great depression. Still, he said he is hopeful the consumers will form a bond with the person who is growing the product.

"Believe in Your Idea"

For other growers who are considering trying something new, he had some words of wisdom.

"You have to believe in your idea. Take advice from other people but don't let them skew what you truly believe. There's going to be probably a lot more downtime and negatives [than you expect], but as long as you keep pushing and you truly believe in it, I think you'll have success in it," he said. "And I think more than anything, be genuine. Be truthful and honest with what you're trying to produce. Don't make something that doesn't fit your values."

Values are important to Billings, and he said it is his goal that his company's values mimic his personal values.

"My number one value is integrity. I think without that, you don't really have anything," he said. "My second is family and friends. I think it goes back to being a multi-generational farm."

He recalled some early memories of sitting on his grandfather's porch listening to stories that at the time he just regarded as funny stories. Now, he said, he sees the values that were woven into the tales.

Those values he now hopes show through the new product his family farm is producing.

"That's our goal. It's to be as honest as we can and as transparent as we can in what we're growing and what we produce," he said. "We're proud of the product that we produce as a family."

Comments about this article? We want to hear from you. Feel free to email us at article@jcsmarketinginc.com

WCN Team Captures Fresno Co. Farm Bureau Media Award

West Coast Nut Contributing Writer Vicky Boyd was recognized in June by the Fresno County Farm Bureau for her article "New Tool for Predicting Nitrogen Needs in Walnuts" in the September 2020 issue of _West Coast Nut_ magazine. Here Vicky is presented with the Fresno County Farm Bureau's Trade Print media recognition award by Farm Bureau board member and almond grower Daniel Hartwig.

Marketing Dollars at Work: Mid-Year Campaign Recap

By **AMERICAN PECAN COUNCIL** | *Contributing Writer*

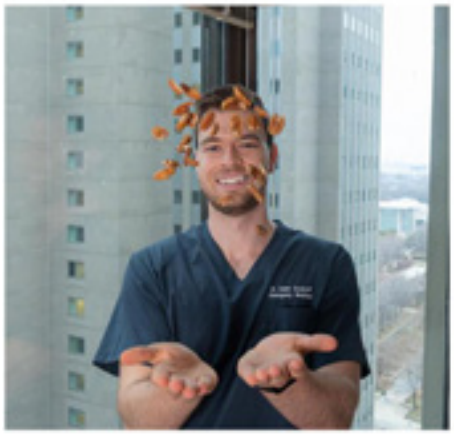
IN THE FIRST TWO QUARTERS OF THE 2021 fiscal year, the American Pecan Council saw the strongest campaign performance in brand history! Consumer reach was at 447 million, exceeding the original goal set. During the six-month period, snack and holiday recipes reached over 500,000 views, which is an indicator for purchase intent.

First Quarter Campaign Activations & Results

The "Super Safe Pecan Debate" was a hardworking campaign garnering the best yet media results, going viral. This campaign helped American Pecans rank #1 on Share of Voice amongst other leading nut commodities during the first quarter. The "debate" around pecan pronunciation drove record-breaking online engagement. The buzz of the Debate continued into the rest of the quarter as we inspired consumers with "undebatably delicious" holiday snacks and seasonal recipes on the American Pecan site.

Second Quarter Campaign Activations & Results

During the second quarter, American Pecans partnered with actress Angela Kinsey of "The Office", who still enjoys fresh pecans from her grandparents' trees in north Texas, to help people clean up their snacking habits with nutrition education and easy snack inspiration. Kinsey highlighted the snack reset movement to encourage consumers to clean up their snacks in Lifestyle magazine. On top of that, she took to social media and polled fans on how they eat pecans, garnering close to 10,000 votes. American Pecans also had a sweepstakes for consumers where more than 3,300 consumers submitted photos showing off messy, snack-riddled desks for a chance to win Pecans and workplace swag. Social media advertisements showcased nutritious pecan snacks and drove visitors to featured recipes on the site and the "Clean Up Your Snacks" landing page, totaling over



By partnering with social media influencers, American Pecan Growers calculated the cost to generate the same amount of impressions, likes and comments with paid advertising to be $95,600, showing a Return on Investment of 301% (all photos courtesy American Pecan Council.)

Debate Landing Page

Holiday Hub Landing Page

The "Super Safe Pecan Debate" campaign helped American Pecans rank #1 on Share of Voice amongst other leading nut commodities during the first quarter.

167,000 clicks, 65% more than estimated. One out of four visitors entered the sweepstakes to win a Pecans prize pack. Our website visitors were hungry for snacking ideas, consuming nearly 120,000 pageviews of snack recipes, exceeding our goal of 100,000 pageviews.

Omni-Channel Campaigns

We use the omni-channel campaigns to access multiple platforms to message via Power of Scale and Frequency. Hyperfocusing on key markets for our industry in which we have engaged the core audience segment of Gen X Mothers with frequent messaging. There have been 16 major cities airing over 23,000 commercials to date through television, broadcast radio, podcasts, targeted social videos and targeted geofencing. This campaign alone has delivered almost 350 million consumer reaches.

Strong Results from Influencer-Led Marketing

Aspire IQ continues to allow us to reach our target audience efficiently and effectively by contracting directly with social media influencers who produce and share quality content showcasing pecans. From lifestyle and mommy bloggers to Olympians, RNs, chefs and Bachelor stars, we've worked with 26 creators in FY21 who have produced 133 posts for us. 1,718,000 people have seen that content and our engagement rate is 12.3%, which is well above the average. By calculating a metric called the Total Media Value (TMV), we're able to see how much it would cost to generate the same amount of impressions, likes and comments with paid advertising. In our case, the TMV would equate to a spend of $95,600, showing us our Return on Investment is 301%! Last, but not least,

Continued on Page 78

American Pecans partnered with actress Angela Kinsey of "The Office" in the second quarter to help people clean up their snacking habits with nutrition education and easy snack inspiration.

Continued from Page 77

our own @AmericanPecan Instagram account has grown over 13% with 1,400 new followers keeping up with pecans. Follow along at @AmericanPecan and look under our tagged content to see and share the vast array of sponsored content our army of influencers is producing for the industry.

Reaching Nutritionists and Dietitians

Another very important and influential segment of our target audience is the health professional community. These highly motivated individuals are receptive to hearing about the health benefits, heritage and versatility of pecans. Though activations have moved to the virtual stage, our education efforts have successfully put pecans top of mind to enjoy and recommend, and our engagement

with this audience remains strong and consistent. Read on to learn about some of our recent touchpoints with nutritionists and dietitians.

RDBA - Nutritious Pecans Meet Today's Consumer Needs

This past April, American Pecans partnered with the leading membership organization of grocery store dietitians, the Retail Dietitians Business Alliance (RDBA). With RDBA, American Pecans hosted an interactive educational webinar on Snacking Solutions for Consumers: Three Trends Driving Purchasing Decisions in 2021. The webinar featured two registered dietitians, Allison Webster, Ph.D., RD, Director of Research and Nutrition Communications at the International Food Information Council Foundation, and Rabiya Bower, RD, LDN, Program Coordinator for the MS/RDN Program at Thomas Jefferson University and former retail dietitian. During the webinar, the speakers shared insights into three emerging consumer trends (convenience, nutrition and flavor), highlighted the ways in which pecans directly meet these consumer needs and discussed how health professionals can apply these trends in their everyday practice to inspire positive habits. This engaging webinar reached over 6K health professionals, with 11 major grocery retailers represented among the attendees.

In tandem with this event, the American Pecan Council collaborated with registered dietitian and culinary expert Kristy Del Coro to develop two brand-new culinary resources supporting these evolving consumer trends, which are now available on the Health Professionals Resources page of our website (americanpecan.com/for-health-professionals/resources/). Though designed with health professionals in mind, these handouts are available for industry use as well. They offer a variety of pecan inspiration, whether it be innovative pecan pairing ideas or simple ways to incorporate this delicious nut into everyday meals.

Pecan Powerhouses Network

On May 5, we hosted the second event of the **Pecan Powerhouses Network 2021 Quarterly Webinar series**, during which attendees heard from second-generation organic pecan farmer Laura Harper. Laura shared about her fascinating journey in the pecan industry, helped the health professionals understand what a true "day in the life" looks like for a farmer and gave them a unique glimpse into how pecans move from the trees to their tables. A big thank you to Laura for representing the industry so excellently! In our final two 2021 webinars, we'll feature other special guests, including a culinary expert and registered dietitian. Stay tuned!

Diversified Marketing Plan Raises Pecans to the Top

Through all the diversified marketing campaigns and activations direct to consumers and health professionals, consumption rose to 8.5% since the start of the Federal Marketing Order efforts. During FY19/20, consumption was up to 36.5%. All the marketing activities described above have garnered over 770 million reaches to consumers in the first two quarters of FY20/21 alone. What does all of this mean and how does it impact industry members? By reaching consumers with messaging, the marketing is putting American Pecans at the top of mind and encouraging purchase intent in a variety of different ways. The more consumers are aware and educated about the many benefits of pecans, the more apt they are to buy pecans. The more product purchased by end users, the more product moves throughout the chain beginning from the grower. When we look at the industry data published in the Pecan Positions Reports, shipments are up 13% and inventory is down 27%. The increased shipment of pecans means there is an increase of movement through the chain of commerce. A displaced pecan is a win for all pecan industry members from the grower all the way to retail.

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