

WEST COAST NUT

MAY 2020 ISSUE

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ROOTSTOCKS

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WEST COAST NUT

By the Industry, For the Industry

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SPECIAL SECTION: Varieties and Rootstock

This special section highlights the latest efforts to develop improved varieties and rootstock, as well as practical advice for growers planting new orchards.

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Maximizing BIOLOGICAL CONTROL AGENTS

In Standard Nut Orchard Systems

By KATHY COATNEY |
Contributing Writer

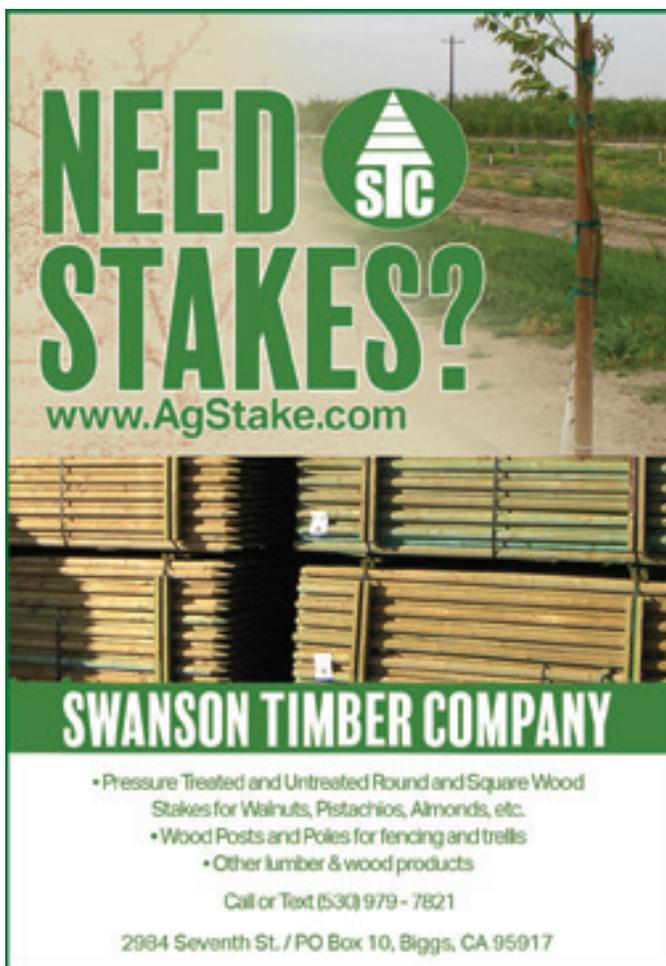
THERE ARE LIMITED NUMBERS OF pesticides coming down the pike, so preventing resistance and stretching the pesticides currently in the toolbox is critically important. Biological control can be a good solution, particularly if it reduces the number of sprays in a given season.

Emily Symmes, UCCE Sacramento Valley Area IPM Advisor, said there are several things growers should know when working with beneficials in their orchards.

- ▶ What beneficials are active in the orchard environment.
- ▶ What beneficials already exist in the native environment.
- ▶ What pest species are in the orchard.
- ▶ How to best use the available biological control agents (e.g., conserve and enhance those already present, or purchase and release additional numbers or species).



Exit holes reveal signs of parasitized walnut scale (photo courtesy UC Statewide IPM Program.)



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“An acute understanding of the natural enemy lifecycle is important,” Symmes continued.

This can be done by monitoring for predators and parasitoid activity. In almonds and walnuts this has historically been more of a visual observation system, Symmes said.

“For example, with scale pests in walnut or almond, you’d be looking at the scales themselves. You’d be looking at evidence of parasitization, meaning the exit holes where the parasitoid has emerged or whether they

have the visual appearance of being parasitized, which can appear as darkening in the nymphal stages,” Symmes said, adding this is also a similar method for monitoring aphids.

In the past, searching for spider mite natural enemies (predator mites and sixspotted thrips) has been done by looking at the undersides of leaves. This has changed in recent years for sixspotted thrips, as Symmes and UCCE Kern County Farm Advisor David Haviland conducted work on a sticky card method for evaluating sixspotted thrips populations.

Haviland’s research was in the south part of the Central Valley and Symmes in the north. They hung sticky cards in the orchard to monitor for thrips and determine their numbers in the orchard and when they were most active.

Haviland has developed thresholds for almond orchards in the south and Symmes is working to validate thresholds in the north and determine thresholds for walnuts as well. These thresholds will help guide growers in making treatment decisions that minimize damage while preserving beneficials.

Continued on Page 6

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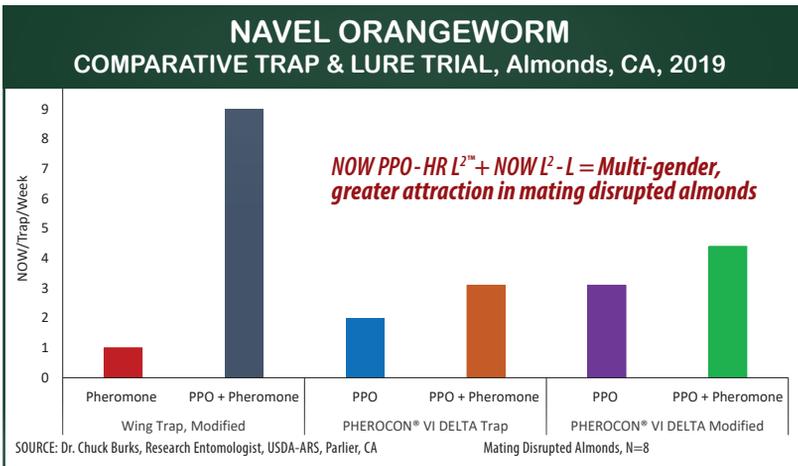


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Continued from Page 4

“It’s a measure of how much spider mite pressure you have, how many spider mites you’re seeing on the leaves, plus predator mites on the leaves as well as this card-based monitoring method for sixspotted thrips,” Symmes said.

Haviland was expecting to complete a three-minute video on employing the card-based threshold system for spider mites and sixspotted thrips in April and publish it on the almond page in the IPM guidelines, Symmes said.

Symmes typically places about three yellow cards per block. She currently advises growers to place one or two traps in known mite hotspots and one or two internally in the orchard to monitor non-hotspots.

“We have basically put them where we would get out of the truck and do our leaf sample evaluations for mites, and/or where we already have our trapping stations set up for other pests like

“Sixspotted thrips is a really good predator of spider mites and spider mite eggs, and it’s really quite abundant if protected properly in the almond system, and actually I’m seeing it quite a bit in the walnut system as well.”

—Emily Symmes, UCCE

navel orangeworm” she said. “And again, it’s detection—are they there, are they not.”

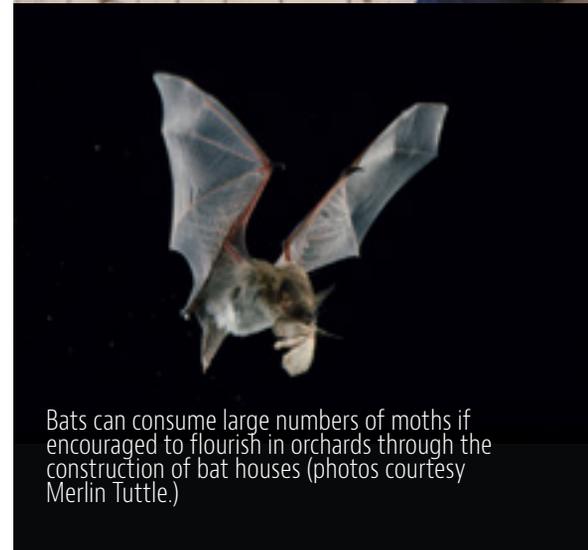
Symmes said the thrips monitoring cards are available from Great Lakes IPM and Trécé.

Protecting the Beneficials

The first step is to protect what’s already in the orchard, then finding out when a predator or beneficial is most effective against a targeted pest. This information is necessary so that the beneficials are protected whenever a spray application is made for any pest, and not necessarily just the targeted pest.

For example, some spray applications made for navel orangeworm (NOW) can cause a secondary problem by impacting predators and causing spider mite populations to build up to far greater numbers, Symmes said.

Continued on Page 8



Bats can consume large numbers of moths if encouraged to flourish in orchards through the construction of bat houses (photos courtesy Merlin Tuttle.)

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Visually looking for predators such as this aphid parasitoid is an important step in biocontrol (all photos courtesy UC IPM Program.)



Predator mites seen here feeding on spider mites.

Continued from Page 6

This makes it important to consider the impact of the sprays being applied, and what the consequences are on that particular natural enemy. At the bottom of each pest management guideline on the University of California Statewide Integrated Pest Management Program (ipm.ucanr.edu/agriculture/), a link summarizing the impacts of commonly-used pesticides on natural enemies and pollinators is available.

“You could actually go out and release some additional predators in the orchard, especially at kind of those peak mite times of year and get some additional knockdown. So that’s something that we need some research on.”

—Emily Symmes, UCCE

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“That’s a good starting point to choose a particular pesticide that might have the least impact on the natural enemies in the system,” Symmes said.

Timing for applying certain pesticides is important, too. “If it’s a time when the natural enemies aren’t terribly active that can be a way to avoid particular damage to the natural enemy population,” Symmes said.

“Depending on the pest, if you can do an environmentally safe dormant application, sometimes that’s better than later season with regard to protecting natural enemies,” Symmes said.

Timing Spray Applications

Applying spray applications for pests while protecting the beneficials can be challenging, Symmes said. For instance, trying to protect predator mites while treating for spider mites can be tricky, as miticide modes of action, even if selective, may impact both the “good mites” and the “bad mites.”

In addition, “Sixspotted thrips are extremely susceptible to pyrethroids and abamectin, which may be used in almonds and walnuts to control



Parasitized aphids seen side by side with healthy aphids. Monitoring parasitoid activity can help guide treatment decisions.



The sixspotted thrips adult, a natural enemy of spider mites, needs enough food (mites) to survive in the orchard.

worms and spider mites,” Symmes said. “Sixspotted thrips populations can be completely wiped out, particularly with ‘May sprays’, at the exact time of year when you want them to be building up to keep pace with your spider mites.”

“Sixspotted thrips is a really good predator of spider mites and spider mite eggs, and it’s really quite abundant if protected properly in the almond system, and actually I’m seeing it quite a bit in the walnut system as well,” Symmes said.

Most pest control advisors Symmes has been in contact with plan to start monitoring for sixspotted thrips in their orchards using the card-based method, which is more reliable and efficient than the older method of looking for them on the undersides of leaves. “That’s amazing to have some new information come out and see it almost 100-percent adopted by folks really wanting to track those populations and make decisions based on biocontrol,” she said.

Symmes’ take-home message on spray applications is: If sixspotted thrips are working in the orchard, avoid early season preventative applications of abamectin for spider mites and avoid spring pyrethroid sprays for NOW.

Beneficial Successes

There are several beneficials in almonds thanks to changes in how growers have managed the balance between beneficials and pests in recent years.

“San Jose scale has great parasitoids, and honestly, San Jose scale is not a problem in almonds anymore,” Symmes said.

The transition away from many of the in-season broad-spectrum pesticides has allowed the parasitoids to manage San Jose scale. Currently, Symmes advises monitoring parasitoid activity and treat only when there isn’t parasitoid activity in the orchard.

Walnuts have walnut scale and frosted scale, and they both have some good parasitoids. Several years ago, there was an increase in these species, and a lot of orchards required treatment for one or both species. In Symmes research

and observations, she saw a significant amount parasitoid activity rebound in walnut scale over the last few years.

As a result, growers may not need to treat every year. Instead, a treatment may only be needed every two to four years to knock down populations.

“This allows that parasitoid population to build up,” Symmes said.

Aphids appear to have good para-

Continued on Page 10

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sitization in walnuts, but walnut husk fly, in comparison, has nothing. Codling moth has an egg parasitoid, but it doesn't consistently appear to have a huge impact, Symmes said. Navel orangeworm, a continual pest in almonds and walnuts, has a couple of parasitoids that lay their eggs and kill the larval stages, but they don't typically occur naturally in large numbers. One of them, *Goniozus legneri*, can be purchased and released, Symmes said.

More research on releases of parasitoids for NOW is needed, she noted.

"[We should be] looking at new release mechanisms like drone release and different things like that to see if we can actually get some increase of parasitization for navel orangeworm. We haven't researched this aspect of NOW management in recent years, and don't necessarily know the impacts of our current chemical practices on NOW parasitoids.

"Again, it goes back to know what's there, know what effect whatever ma-

terial you're putting out in the orchard might have on them, try to protect them, try to leave them a little bit of a food source by tolerating a little bit of a pest population. David Haviland always says the trick is, 'don't starve them and don't kill them,'" Symmes said.

Beneficial Purchase and Release

An orchard system is different from a greenhouse operation where predators are purchased and released in a confined space where they can't escape. In orchards it's typically more about protecting the beneficials that are already there and allowing them to flourish—rather than a system of purchase and release, Symmes said.

But this may be changing, she continued. "I found out just a few weeks ago that one of the insectaries is actually producing sixspotted thrips this year for purchase and release."

While there isn't any data from the university, Symmes finds it, "particularly intriguing".

"You could actually go out and

release some additional predators in the orchard, especially at kind of those peak mite times of year and get some additional knockdown. So that's something that we need some research on," Symmes said.

Keeping Beneficials Working

The sixspotted thrips are very effective in knocking down the pest spider mites, so keeping them alive and active will help limit the number of miticides used in an orchard system, Symmes said. Sixspotted thrips thrive in dusty, webby, environments where spider mites also flourish, which makes it a very effective predator.

In order to keep beneficials active, Symmes noted that they need the pests to feed on. If they don't have food, they will either die or go elsewhere. With mites, she said, "You've got to be a little bit tolerant of some spider mite pressure in your orchard."

Almonds, and tree crops in general, Symmes continued, can withstand fairly significant pressure before there is economic damage such as reduced yield the following year, very early defoliation, etc. The key is maintaining a good balance of the pest and predator in the system that keeps the spider mites in check throughout the season, Symmes said.

Other Options

Other options for protecting beneficials include things like cover crops and hedgerows to provide supplemental resources for predators and parasitoids. This in turn can help keep them close to the orchard environment, Symmes said.

"Bats and insectivorous birds are fabulous biological control agents, and I'm always a little remiss that I don't talk more about them," Symmes said. Bats consume massive amounts of moths, she continued. "If you're talking about codling moths in walnut, navel orangeworm in almond, or in walnut, or in pistachio, bats can do a tremendous service," Symmes said, and she strongly encourages grower to build bat houses and let the bats work for them.

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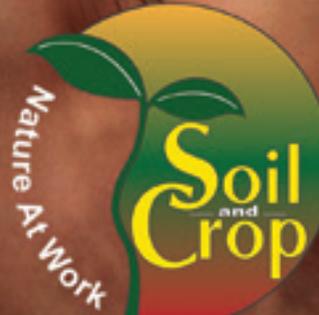
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THE DIRT ON SOIL

Understanding How Water and Nutrients Behave in Different Soil Types

By RICH KREPS, CCA | Contributing Writer

AS FARMERS, EVERY TIME WE ATTEND another seminar on soils, we get the rundown on the soils chart: Sand v. Loam v. Clay. Thirty percent of “this” gives you “that.” Percolation models, clay lenses that perch water, sand streaks and grandpa’s “bitch” alkali flats are important to note. Eighty-five percent Whitney Mollic Hyploxeralfs of fan remnants from a back slope is great for my rock geek buddies that work for Geosyntech or Exxon Mobile, but without geoen지니어ing, they are just pieces of information to most of us. What’s truly important to farmers is how quickly water and nutrients move through that soil.

You care most about those first 12 inches of soil around your roots. This is the easiest and most efficient part of our soils to manipulate and feed our trees. Of course, we need a soil test to see its constituents. Knowing how much calcium, magnesium, potassium, and sodium are present in soils and what

forms they are in is critical to making a nutrition plan. Central Valley westside soils with very high magnesium levels are the toughest soils to manipulate. Magnesium is sticky. It’s a powerful little dynamo of a nutrient that just happens to be the central element in chlorophyll. It’s pretty important but difficult to get into your trees if your soils aren’t fertigated properly. Add in soil below 60-percent calcium and high pH, good luck getting gypsum to make a difference. Increase your clay and sodium content and you’ve got soils pulling very hard on nutrients compared to a roots’ osmotic potential. Sandy soils will have a much harder time holding potassium. Its smaller size and identical charge to sodium allow it to move deeper into your soil than calcium, magnesium and phosphorus. With nitrate’s negative charge, the same thing happens, deeper soil penetration more quickly.

“Thanks Rich, you just went into everything I hate about soil seminars.” So, what’s the point? Track your water movement and timing. If you know you have sandy soil, you can’t hold nutrition in the root zone like a heavy clay ground, especially potassium. You have to adjust your

irrigation schedule to shorter run times more often. Our pistachio trees are only going into sixth leaf, but on ground, with a range from 3 to 11 CEC (river sand to loamy sand) we’ve never run a summer set longer than 12 hours. However, I ran the water three times that week. In our efforts to manipulate the nutrition, we also ran nutrition in every set. More importantly, we tried to match tree nutrient demand to fertigation inputs. The trees needed P and K at that time and, of course, always need more calcium for new cell development and cell wall structure. Phosphorus and calcium are hard to deliver together in large quantities. K is difficult to hold in sandy ground. It’s important to alternate the two applications often and in smaller shots.

From what I can tell, “Herein lies the rub”. When I recommend this type of approach to the growers I consult for, they automatically think of the expense those nutrients cost on normal applications, so in turn, they think that budget will go through the roof. It is important to remind them to use less product each time. Give the trees a constant drink of essential nutrients matching demand. Today’s fertigation systems are allowing for a constant flow of nutrients and essential timing changes. Many can even be controlled from a cell phone. Safety factors are built in as well to avoid pressure changes, plugging, system interruptions and tank flushes.

In heavy clay ground we can apply



everything I hate about soil seminars.” So, what’s the point? Track your water movement and timing. If you know you have sandy soil, you can’t hold nutrition in the root zone like a heavy clay ground, especially potassium. You have to adjust your

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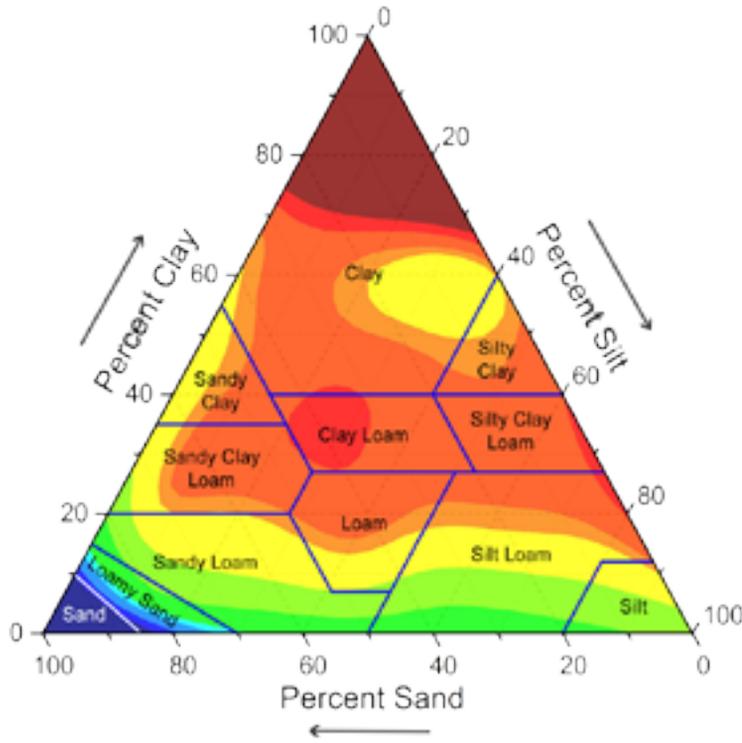


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Representation of the soil textural separation percent of clay, silt, and sand (courtesy USDA Natural Resource Conservation Service.)

bigger nutrient shots without worrying about leaching, but need to manipulate our water treatment to keep pH and undesirables in check. Often, running water too long on heavy soils creates anaerobic conditions. Root rot issues and beneficial soil biology often gets overrun by the bad stuff. Knowing how far out the water expands and how quickly it infiltrates the top foot of soil is critical. Moisture sensors are very important for managing your water. From previous research we know that sandy ground has a more vertical component to the water infiltration pattern. Clay soils have a much squattier, more horizontal pattern. But remember, the roots grow where the moisture is, especially when we manage it well. We are still trying to get our nutrition to the feeder roots in the top foot of soil.

Another concern is deep moisture. I hear this often. Growers are always chasing that deep moisture. Using moisture sensors to monitor





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how quickly and how far water moves after an irrigation event will help you maintain that deeper moisture. Smaller shots more often will do the same. It still allows for ample water while not causing longer periods of anaerobic conditions. A more constant flow of soil moisture will also help keep the deep moisture from subbing up in longer periods between sets. Starting the season with smaller, more frequent shots will translate to keeping that deep moisture intact.

Knowing your soil types and its components will help you deliver the proper nutrients to your trees. Changing your approach can go a long way to improving yields. A tree can't move, so as farmers, it's our responsibility to get nutrition to the roots in amounts and forms pertinent to nutrient demand. Knowing how water moves through your soil will dial that in. As your operation grows and logistics become more difficult to micromanage your fertigation, an investment in new technology may quickly pay for itself. Keeping

INFILTRATION RATES FOR VARIOUS SOIL TYPES

SOIL TYPE	BASIC INFILTRATION RATE (MM/HOUR)
Sand	less than 30
Sandy Loam	20-30
Loam	10-20
Clay Loam	5-10
Clay	1-5

track of how your soil functions will not only keep us grounded, but let our trees know we are rooting for them!

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RESURGENCE OF PERENNIAL PHYTOPHTHORA CANKER DISEASE OF ALMONDS

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PHYTOPHTHORA DISEASES ON ALMOND

Many species of *Phytophthora* continue to cause serious losses in California almond orchards. Collectively, these pathogens affect almond trees of all ages, causing decline and death in young orchards in their first few years of development as well as in bearing and fully mature orchards in their prime. We tend to name diseases caused by *Phytophthora* with reference to the tree parts most obviously affected, for example, *Phytophthora* species cause “root rot,” “crown rot,” “trunk and scaffold cankers,” and “pruning wound cankers.” At least 10 different species of *Phytophthora* are known to infect almonds, varying in tree parts they attack and general aggressiveness.

Phytophthora spp. belong to a group of organisms sometimes referred to as oomycetes or “water molds” because they thrive in wet conditions and have an unusual cell wall composition including cellulose. As such, they differ from typical plant pathogenic fungi, such as pathogens that belong to the Botryosphaeriaceae family, and are not controlled by chemicals that target true fungi. In periods of wetness, all *Phytophthora* spp. can produce and release infective, swimming zoospores. In dry periods, *Phytophthora* species can persist in thick-walled spores indefinitely. Soil fumigation can reduce but will not eliminate populations of *Phytophthora*. Wounds may facilitate but are not necessary for infection by *Phytophthora*.

In California almonds overall, *Phytophthora* species are probably best known as root and crown pathogens (See Figure 1). They are soilborne, yet many of them can also occur and move in surface water sources, such as rivers, canals, and storage reservoirs. *Phytophthora* can also be distributed on seemingly symptomless planting stock. Periods of soil water saturation, especially around the root crown, favor reproduction and infection by *Phytophthora*. In recent years, Kern County, as well as in counties to the north, many farm calls have involved *Phytophthora* crown and root rot of newly planted almond orchards up to a few years of age.

Despite their recognition as soilborne pathogens, *Phytophthora* species can also infect almond trees above ground. In the late 1990s and early 2000s, for example, a malady we described as Perennial *Phytophthora* Canker (PPC) caused high incidences of tree loss in many previously high-yielding

almond orchards in the southern San Joaquin Valley. On a high percentage of the trees, the cankers were limited to above ground tree parts. Following intense late-spring rains in 2019, we observed a resurgence of PPC in several Kern County almond orchards (See Figure 2, pg. 18). Unfortunately, these orchards were entering, or had reached, their prime producing years, and incidences of tree loss were unacceptably high, involving up to several thousand trees.

Additional Insights on Perennial *Phytophthora* Canker (PPC).

Because of its recent resurgence in Kern County, and its sporadic, lesser-known nature compared to that of *Phytophthora* crown and root rots, we offer additional insights on PPC of almond. As mentioned, it affects mature trees that typically have been bearing for several to many years. The most common site of the aerial infections is in “pockets” that naturally form where several scaffold branches join the trunk in close proximity (See Figure 3, pg. 18). Less commonly, infections are centered near joints of two scaffold branches. At the pocket and branch junctures, “growth cracks” can form in the bark due to opposing pressure. The pockets and other rough tree surfaces tend to collect debris (e.g., leaves, soil, twigs) from the orchard floor at harvest. Our previous research demonstrated that the debris can contain inoculum of *Phytophthora*, including *P. citricola*, the main species associated with PPC. In winter or spring months, it is likely that extended heavy periods of rain favor *Phytophthora* infections in the pockets and at branch junctures. As mentioned earlier, the free water stimulates *Phytophthora* species to produce and disperse infective zoospores.

To a lesser extent, we have also observed PPC developing from the root and the crown area and moving up the main trunk into tree scaffolds. In our previous surveys with Farm Advisor Mario Viveros (retired UCCE), *P. citricola* was the predominant species causing PPC cankers of aerial origin, while *P. cactorum* was associated with cankers that developed below the soil or at the crown region. Our recent Kern County surveys suggested similar associations between these *Phytophthora* species and infection sites in 2019.



Figure 1. Infected 2-year almond tree with root and crown rot (Photo courtesy M. Yaghmour, UCCE.)

Continued on Page 18

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Continued from Page 16

PPC, whether originating from a pocket, trunk or root crown infection, will exhibit profuse gumming, which is yellow to amber in color. Removing the bark will show the development of a perennial canker that can expand rapidly over time leading to main scaffolds decline (See Figure 4, pg. 20). However, the symptoms can be confused with those caused by other pathogens, especially fungi. So, it is important to conduct lab tests to confirm whether a *Phytophthora* sp. is involved and thereby reach a solid position from which to select appropriate management practices. We also observed that some of the infected trees with *Phytophthora* will express early defoliation in the fall, compared to healthy trees. In many cases, trees infected with *Phytophthora* also developed Foamy canker, which is, in this case, a secondary issue and is not the main cause of tree decline and mortality (See Figure 5, pg. 21).

The best time to isolate and diag-

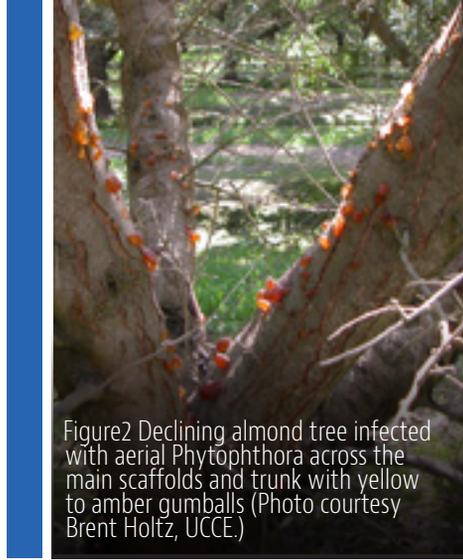


Figure 2 Declining almond tree infected with aerial *Phytophthora* across the main scaffolds and trunk with yellow to amber gumballs (Photo courtesy Brent Holtz, UCCE.)



Figure 3. Pocket formation with debris, leaf and rain collected at the crotch area of an almond tree (Photo courtesy Brent Holtz, UCCE.)

nose the disease caused by *Phytophthora* is when the cankers are active and expanding. In Kern County, we isolated the pathogen as early as mid-January to April and later in the season when the cankers were active and fresh gumming was exuded from the trunk and main scaffolds. Optimal samples are collected by exposing the edges of the cankers, as characterized by brown necrotic tissue bounded by healthy white tissue (See Figure 4, pg. 20). Samples

should be collected to contain the margin of the canker where the pathogen is actively growing. The samples are kept cool but not frozen and sent to a lab for isolation and identification using traditional or molecular methods. Once we have positively identified *Phytophthora* spp. as the causal agent(s), we are in a good position to implement cultural and chemical control methods to manage the disease on already infected

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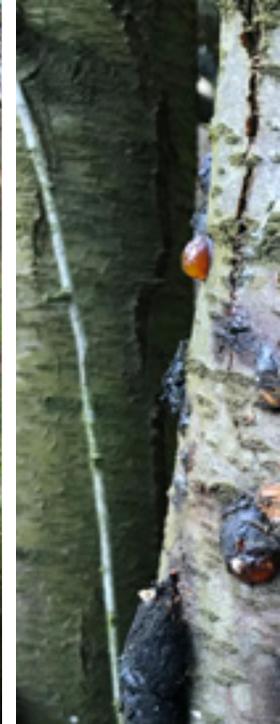


Figure 4. Dr. Greg Browne inspecting a symptomatic almond tree with gumming (Left). Removing the bark on affected trees will show the development of a perennial canker. The arrow points to the edge of the canker (Right) (photos courtesy M. Yagmour and B. Holtz, UCCE.)

Continued from Page 18

trees and prevent its spread to other healthy trees.

It is important to note that though PPC has expressed its highest incidence in Kern County, it has occurred in most other almond growing regions in California's Central Valley.

Cultural and Genetic Management of Phytophthora

For PPC management, proper main scaffold selection during the early stages of tree training is a very important first step. Scaffolds should be selected to space them apart vertically on the tree trunk to reduce the incidence of pocket formation in the crotch area where all the infested debris and water from rain may collect. This practice will also help in reducing the incidence of other types of cankers caused by fungi such as *Botryosphaeria* cankers.

For both *Phytophthora* crown and root rots and PPC, several early orchard design decisions can profoundly impact management of *Phytophthora*, for example: rootstock choice, land preparation and drainage, irrigation system design and operation, and timing and depth of tree planting are all important. Rootstocks need to be chosen for best general environmental adaptation to the soil environment, but growers

need to be aware that peach-almond hybrids (e.g. Hansen 536) are relatively susceptible to *Phytophthora* root and crown rots, at least in their first few years after planting. Regardless of rootstock, it is important to leave the graft union above the ground at planting and avoid covering it with soil as the almond scion is very susceptible to *Phytophthora* spp. Growers should typically avoid planting trees in very late spring or summer (i.e., as is sometimes done for potted trees on dual drip lines) because this schedule can set a grower up for a *Phytophthora* challenge; out of necessity, to meet the critical watering demands of the undeveloped root systems, the drip lines are placed "on" the root crown, where water saturation can lead to infection by *Phytophthora*. Additional "tried-and-true" cultural practices to control *Phytophthora* crown and root rots include planting on berms and resolving water infiltration problems.

Although all scion varieties of almond are highly susceptible to *Phytophthora*, marked differences in genetic resistance are known among almond rootstocks. Generally, peach-almond hybrids are more susceptible to *Phytophthora* than peach rootstocks, while some plum hybrid rootstocks can offer an additional increment of resistance to some species of *Phytophthora*, compared to peach. The Almond Board of California is supporting long-term research to develop rootstocks with improved resistance to *Phytophthora* and other soilborne pathogens. We are monitoring the prevalence and aggressiveness of different *Phytophthora* species on almond to ensure that our rootstock screens for resistance adequately represent *Phytophthora* challenges in orchards.

Chemical Management of Phytophthora

Systemic oomycete "fungicides", including mefenoxam and phosphites, have been used for control of *Phytophthora* crown and root rots. In addition, we are cooperating with Dr. Jim Adaskaveg (UC Riverside) in an Almond Board-funded project to test new oomycete fungicides that show promise for almond industry use.

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Figure 5. Declining almond tree showing symptoms of foamy canker and aerial *Phytophthora* (photo courtesy M. Yaghmour, UCCE.)

For control of PPC, previous Almond Board-funded research in Kern County showed efficacy of phosphite products. Best results were obtained from foliar applications during summer or fall, before leaf senescence, though spring chemigation resulted in a less-consistent benefit. Phosphites move systematically from source to sink inside the tree and can suppress cankers and infection for up to five months after effective application.

As we have suggested, staying ahead of problems with *Phytophthora* can require judicious orchard design and planning; timely, precise execution of orchard tasks; early awareness of potential *Phytophthora* problems as indicated by visual orchard scouting; and accurate diagnosis of *Phytophthora* diseases as supported by lab confirmation. Even after planting, early identification of a *Phytophthora* problem can facilitate integrated and timely corrective actions that will help to avoid further loss, such as soil water management adjustments and the use of protective chemicals, etc. It is expected that continued teamwork among growers, advisors, and researchers will facilitate additional improvements in cultural, genetic, and chemical control strategies for *Phytophthora* on almond.

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

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A WORD FROM THE BOARD: THE ALMOND BOARD OF CALIFORNIA

Almond Board Sustainability Tour Shows Food Companies

A DAY IN THE LIFE OF A GROWER, HANDLER

By ALMOND BOARD OF CALIFORNIA | Contributing Writer

THIS FEBRUARY, THE ALMOND BOARD of California (ABC) hosted more than 20 influential supply chain stakeholders at its first-ever Almond Sustainability Tour. These stakeholders represent food companies from across the globe, including General Mills, Campbell Soup Company, Coca Cola and Seeberger, and hold various roles within their company's sustainability programs, from leaders of entire sustainability programs to directors of supply chain and sourcing to heads of global procurement.

Led by ABC's Trade Stewardship and Sustainability teams, the tour was aimed at providing key decision makers in the supply chain with a first-hand look at the California almond industry's responsible growing practices. Over the course of three days, attendees visited four almond growers and one handler to learn about the unique benefits and complexities of growing almonds in California, from water availability and pest challenges to Whole Orchard Recycling. These insights provided sustainability professionals with greater understanding of the challenges facing growers, and the broader industry, in providing a high-quality product to consumers worldwide.

"Prior to the Coronavirus pandemic, not a day went by without the word 'sustainability' in the headlines, as more and more consumers are seeking transparency in how the products they buy make their way through the supply chain. For food brands who use California almonds in their products, this consumer trend means it is imperative to understand the almond industry's responsible, sustainable growing practices and how we are documenting them," said ABC's Associate Director of



Brian Wahlbrink of Sperry Farms in Denair explains integrated pest management and other sustainable almond growing practices to sustainability supply chain stakeholders at the Almond Board's first ever Almond Sustainability Tour (all photos courtesy Almond Board of California.)

Trade Stewardship Harbinder Maan.

CASP Shines Among Sustainability Professionals

On day one of the tour, attendees visited fourth-generation almond grower Eric Genzoli at his family's operation in Turlock. Genzoli, a graduate of ABC's Almond Leadership Program, shared his passion for environmental stewardship and explained how his desire to preserve the land for future generations motivated him to complete all nine modules in the California Almond Sustainability Program (CASP).

Launched in 2009, CASP is a nine-part self-assessment that helps growers compare current practices against industry standards and identify areas of improvement across their operations. Through the CASP online portal (SustainableAlmondGrowing.org) growers can assess their practices, determine opportunities for further efficiencies and utilize free decision-making tools, all while meeting regulatory requirements.

To gain an even greater understanding of CASP and how it relates to almond organizations' sustainability

initiatives, the group visited Monte Vista Farming Co., a grower and processor in Denair. Monte Vista CEO Jonathan Hoff led the group on a tour of his facility while explaining CASP's vital role in sharing the industry's responsible growing practices with businesses who need that information to satisfy consumer demand.

Hoff, an ABC Board member, was one of the first handlers to participate in the CASP Supply Chain program, which officially moved from a pilot program to an industry-wide effort in 2020. Hoff explained how the program allows growers to share their data anonymously, in aggregate, with Monte Vista, who then can share it with their buyers. This helps food companies—like those represented by the sustainability professionals—meet their sustainability goals and answer questions from consumers who are demanding more information about how their food is grown.

When speaking with Hoff, the group was most impressed by the type of reporting CASP generates. Food companies must be able to measure progress toward increasingly sustain-

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The tour gave an opportunity for growers to share insights, strategies and information on the almond industry's 2025 Goals.

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able growing practices for each of their products in a way that is meaningful to the supply chain and consumers; information from CASP can do just that for almonds. Representatives from SureHarvest, the organization ABC partnered with to develop and maintain CASP, and the SAI Platform, the organization that benchmarked¹ CASP and translated the almond-specific program to international sustainability standards, were also on hand to demonstrate how industry data gathered and analyzed by CASP can help food manufacturers meet sustainability goals and help companies address growing demand from conscious consumers who want to know how their food is grown.

Tour Highlights Industry's Almond Orchard 2025 Goals

In addition to CASP, the California almond industry's Almond Orchard

2025 Goals – which work together with CASP – were on full display during the tour. The 2025 Goals build off decades of previous industry achievements and are a tangible example of the California almond community's commitment to continuous improvement.

Established by the industry in 2018, these goals state that by 2025, the California almond industry commits to: reduce the amount of water used to grow a pound of almonds by an additional 20%,² achieve zero waste in the orchard by putting every-

thing grown to optimal use, increase the adoption of environmentally friendly pest management tools by 25%, and reduce dust during harvest by 50%.

“In the last few years, the fastest growing area of interest from the food industry has been sustainability,” said Maan. “We knew nothing would be more impactful than inviting these sustainability professionals to California to see first-hand how dedicated and invested the almond industry is in sustainability.”

To learn about the industry's progress toward the 2025 Water Goal, the group visited Blom Ranch in Modesto, where they met grower Nick Blom and ABC Senior Manager of Field Outreach and Education Tom Devol. Blom took the sustainability professionals on a deep dive into the history of groundwater recharge in the California almond industry and shared the outcomes of recharge research trials that the University of California (UC) Davis and Sustainable Conservation conducted on Blom's property in 2016.

Blom and Devol showcased various irrigation methods as well as ABC's Almond Irrigation Improvement Continuum, addressed how different soil types necessitate different irrigation strategies and explained how precision agriculture and advanced irrigation technologies are helping growers attain “more crop per drop” in their orchards.

From there, the group stopped in Ceres to speak with grower Christine Gemperle on three other key areas of consumer interest for food companies, which are also relevant to the 2025 Goals – bee health, soil health and zero waste.

Gemperle spoke to the relationship between almond trees and honey bees, as well as the industry's efforts to protect pollinators, as detailed in its Five-Point Pollinator Protection Plan.³ The Almond Board also invited spokespersons from the Pollinator Partnership and Project Apis m. (PAm) to speak alongside ABC Chief Scientific Officer Josette Lewis about the various ways in which these organizations are working closely to promote honey bee health and reinforce the importance of the

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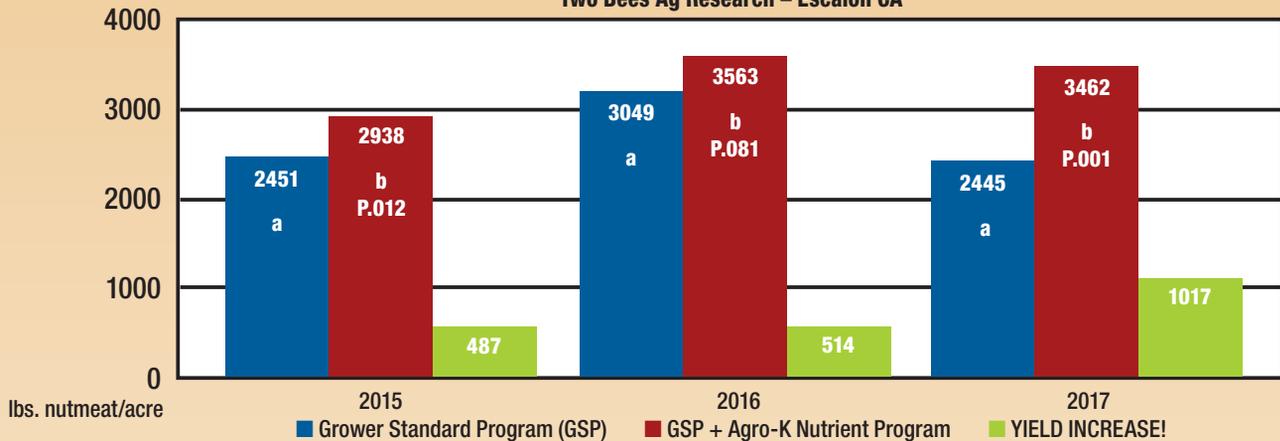
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Honey Bee Best Management Practices⁴ among the almond growing community. They highlighted ABC's work with PAm's Seeds for Bees program, which encourages the use of cover crops to increase the amount and diversity of bee forage in California almond orchards.⁵ Gemperle, who has participated in the Seeds for Bees program for six years since its inception shared how she's seen cover crops planted in her orchard support biodiversity and provide variety in bees' diets over the years, allowing the bees to be healthier and the hives to be stronger once they've left her orchard.

In addition to pollinator health and cover crops, Gemperle discussed her experience with Whole Orchard Recycling,⁶ which involves grinding old almond trees into small chips, spreading the chips across a bare orchard floor and disking them into the soil (about six inches deep). This form of "regenerative agriculture"—that which increases biodiversity, enhances ecosystems and enriches the soil—was a

big hit among the visiting sustainability officers, whose companies and customers increasingly want to hear how commodities are finding responsible uses for their by-products and working to achieve zero waste.



The sustainability tour gave food companies a first-hand look at the California Almond Sustainability Program, now is in its 10th year.

That afternoon, the group met with grower Brian Wahlbrink of Sperry Farms in Denair, who explained how California almond growers employ environmentally friendly integrated pest management on their operations, as well as California guidelines and regulations. Wahlbrink's pest control advisor (PCA) joined him in the orchard to provide perspective on the importance of PCA's relationships with almond growers and their integral role in the industry.

At the end of his discussion, Wahlbrink, who chairs ABC's Harvest Workgroup and sits on ABC's Board of Directors, showed the group Sperry Farms' harvesting equipment and explained the harvesting process to them.

To round out the second day of the tour, ABC introduced the group to Bill Lyons, CEO of Mapes Ranch and former Agricultural Liaison to Gov. Gavin Newsom. Lyons, who served as Secretary of Food and Agriculture under Gov. Gray Davis from 1999 to 2004, spoke to California's regulatory environment and the state's engagement in key issues impacting agriculture.

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His perspective as a long-time grower, rancher and voice for the ag community shed new light on the challenges faced by California almond growers.

Learning Beyond the Orchard

On the final day of the tour, sustainability professionals visited the U.S. Department of Agriculture (USDA) Agricultural Research Service (ARS) research facility near Berkeley to learn more about ABC's collaboration with USDA-ARS on almond coproduct research. The visit offered another example of how the almond industry is investigating new, higher value uses for everything an orchard grows.

During a tour of the facility, the group learned of potential high-value uses for almond hulls and shells that go beyond the traditional uses of feed and bedding for livestock, such as using sugar extracted from hulls as an ingredient in beer or cider, or using torrefied almonds shells to strengthen recycled plastics. Tour attendees were impressed by the ingenuity of this ongoing research and pleased to see the



Christine Gemperle, a second-generation almond grower, discussed bee health and the use of cover crops to support pollinators during almond bloom.

almond industry so vested in the area of zero waste.

Providing plenty of boots-on-the-ground experiences and learnings from various almond stakeholders, ABC's Almond Sustainability Tour offered sustainability professionals a vast amount of information about the California almond industry's journey toward continuous improvement via a more responsibly grown, safe and

sustainable crop.

"In holding this tour, ABC provided a forum for growers, handlers and the broader almond industry to share research insights and information on CASP and the 2025 Goals, information that food companies can, in turn, use to help meet the needs of their customers," said Maan.

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In addition to the orchard and facility visits, ABC and sustainability professionals participated in a facilitated discussion led by ABC Director for Sustainability and Environmental Affairs Gabriele Ludwig about the challenges large food companies face and the ways organizations like ABC can help them achieve sustainability goals. Top among each sustainability professional's wish list for the industry was increased grower participation in CASP, as greater participation will allow for more broad storytelling and transparency among consumers making purchasing decisions based on how sustainably their food was grown. The professionals also asked ABC to continue providing information on the industry's soil health and water use efficiency initiatives so they may share those details with interested customers. This discussion provided greater perspective of the demands placed on sustainability professionals by their companies and customers, giving ABC

staff insights on how they may support these professionals to ensure they have the information they need to continue meeting their companies' sustainability goals and drive consumer demand of almond products.

"Helping connect these large companies with the grower and handler community is just one more way ABC strives to support demand and foster greater collaboration for the California almond industry," Maan said.

Sources

¹ For more on this global benchmarking effort, visit <http://newsroom.almonds.com/content/california-almond-sustainability-program-recognized-globally-by-sai-platform>.

² In the past 20 years, California almond growers have reduced the amount of water it takes to grow one pound of almonds by 33%, thanks to research-based farming improvements and the adoption of water-saving technology. Source: University of California, 2010. Food and Agriculture Organization of the United Nations, 2012.

Almond Board of California, 1990-94, 2000-14.

³ The California almond industry announced its Five-Point Pollinator Protection Plan in January 2020. For more information, visit newsroom.almonds.com/content/california-almond-community-announces-five-point-pollinator-protection-plan.

⁴ Visit Almonds.com/Pollination for more information on the Honey Bee Best Management Practices.

⁵ For more information on the Seeds for Bees program, visit <https://www-projectapism.org/seeds-for-bees.html>

⁶ For more information on Gemperle's experience with Whole Orchard Recycling, visit <http://newsroom.almonds.com/content/considering-whole-orchard-recycling-keep-mind-0>.

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TAKE ADVANTAGE OF FERTIGATION OPPORTUNITIES

Running Nutrients Through Pressurized Irrigation Systems Offers Many Benefits

By CECILIA PARSONS | Associate Editor

TREE NUT GROWERS USING PRESSURIZED IRRIGATION SYSTEMS in their orchards have the opportunity to fertigate, but may not be maximizing the opportunities it offers.

Fertigation—injecting crop nutrients through the irrigation system—enables a more precise fertilizer application, flexibility in timing applications, saves labor, and can reduce production costs.

Advantages of using fertigation are lost if growers or farm managers choose the “one size fits all” approach of standard fertilizer rates and irrigation timing. Water and nutrients are delivered to the trees, but growers won’t achieve maximum nutrient use efficiency. The four Rs of nutrition still apply in fertigation: right rate, right source, right placement, and right timing. Attention to these factors will provide adequate nutrition for crop production while minimizing the risk of loss of nutrients to the environment.

Optimizing Fertigation Systems

Estimating tree demand, monitoring tree nutrient status, and allowing for orchard variability and environmental conditions will optimize use of a fertigation system. Sebastian Saa, senior manager of agricultural research for Almond Board of California, said about 80 percent of California’s almond growers/orchard managers have micro-irrigation systems that are capable of fertigation. Saa said growers are adopting fertigation for applying nitrogen but may be leaving potential benefits behind by not adopting it properly.

“For the case of nitrogen, I would say there might still be some technological barriers. However, I would say that the limiting factor is not the adoption of this technique, but the proper use of it,” Saa said.

In other cases (i.e. some micro elements such as Zn or macros such as K), fertigation might not be the exclusive way of delivery, giving room to other methods such as foliar sprays of micro elements or direct and concentrated application of K to avoid K immobilization in the soil.

Cory Broad, key grower development manager with Jain Irrigation USA, said one of the biggest fertigation misses in the field is not planning applications around crop need, but rather applying based on irrigation scheduling. A balance between irrigation scheduling and fertilizer application rates needs to be developed, Broad said.

Fertigation can increase nutrient use efficiency by providing the right amount to the tree for the stage of production. More efficient use of the nutrients provided can allow for a reduction of overall nutrient use over the course of the growing season, Broad said.

Saa added that a common misconception about the practice of fertigation is that it is management of nitrogen to enhance yield, instead of managing nitrogen to support yield.

Nitrogen is not a solution for all production problems, Saa said. If trees are small or do not grow well due to a pathogen issue (i.e. phytophthora) that issue cannot be solved by applying more nitrogen. Nitrogen is a function of yield, meaning, for instance, that aiming to achieve a yield of 2,000 pounds of kernel, the trees need about 120 pounds of N to support that yield. Applying 120 pounds of N, Saa stressed, will not guarantee that production level. Growers should avoid applying the same amount of nitrogen every year without taking into account expected yields.

In addition, Saa said growers sometimes make the mistake of fertigating too early in the season, before 70 percent leaf out, and applying nitrogen at the beginning of the irrigation set or

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just before a long irrigation cycle, which can reduce efficiency and lead to leaching beyond the root zone.

Proper Technique to Improve Efficiency

Saa said proper fertigation techniques could improve nitrogen use efficiency if nutrients are positioned in the active root zone and the irrigation system has a good distribution uniformity.

Broad said he also sees growers and managers who opt to apply an average rate of fertilizer across the field for an entire season, not fully recognizing the benefits of implementing fertigation. The ability to match supply with demand not only lowers the risks of volatilization and leaching, it ensures the crop has access to the necessary nutrients it requires during different production stages.

There are also physical reasons that efficiency is lost. Soil types can play a role in fertigation efficiency if applications are not managed. Broad said excess application of water in an orchard with fast draining sandy soils can allow nutrients to leach beyond the root zone. On the other hand, he said, heavy soils can hold water in the soil pores and deny use by trees.

Saa pointed out that most growers have other production operations going on besides fertigation at the beginning of the busy growing season. Managing fertigation at a high

level of precision can be difficult due to the time and dedication needed.

The system must also be properly maintained. The same rationale used in timely oil changes in vehicles applies to irrigation systems, Saa said. Checking filters, checking distribution uniformity, using the programmer correctly, and proper mixing of fertilizers in the fertigation tanks will assist with maximum efficiency.

Broad said systems need to be set up appropriately for the types of fertilizer and crop stage and not the “set it and forget it” category. He also advised making sure the correct amount of fertilizer is flowing as the system is running and making sure all equipment is maintained throughout the season to prevent plugging or flow rate changes.

Broad said he doesn't see many growers or managers following specific protocols in regard to fertigation. They may be on point with their fertigation but referencing the many materials online can be helpful in improving efficiency. Broad said he uses the Cal Poly ITRC Fertigation handbook to answer questions.

Fertigation systems, Saa said, are a fantastic tool that if used properly can result in optimal nitrogen use efficiency. Each production unit should be evaluated early in the season and fertigation plans adjusted as the season progresses and ability to predict yield improves.

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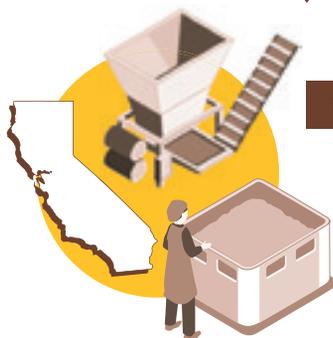
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IN SEARCH OF CHANDLER 2.0

UC Breeders Work to Improve on Popular Walnut Variety

By MITCH LIES | Contributing Writer



UC Davis walnut breeder Chuck Leslie evaluates seedling trees on a university research orchard as part of his work in the Walnut Improvement Program. Leslie is evaluating varieties for leafing and flowering dates, bearing habit, flower abundance and other traits (all photos courtesy C. Leslie.)

IT'S BEEN MORE THAN 40 years since the University of California's Walnut Improvement Program released a variety as successful as Chandler, which today comprises more than a third of California's walnut acreage and is the standard to which all others are compared.

That's not for lack of effort. As Chuck Leslie, who has worked for the program for 35 years, said: "Chandler is a tough competitor."

Because of its good yields, premium quality and desirable growth characteristics, even today, California growers continue to plant Chandler in high numbers. In 2017, for example, there were more than 16,000 acres of nonbearing

Chandler in the ground, according to figures from the National Agricultural Statistics Service, in addition to the more than 120,000 bearing acres.

The main drawback to Chandler, in fact, is something caused precisely because of its popularity: When the variety is ready for harvest, walnut processors are overwhelmed with nuts.

"We are trying to push out varieties with earlier harvesting dates than Chandler with good quality."

—Chuck Leslie, UCCE

Developing a variety that harvests earlier has long been a focus of the Walnut Improvement Program.

In Search of Early Varieties

"We are trying to push out varieties with earlier harvesting dates than Chandler with good quality," Leslie said.

Over the years, the program has released several early harvesting varieties that have attracted growers, including three in the past 10

years alone. It is preparing to release another one this year.

The variety doesn't have a name, nor a release date, and Leslie said he is hesitant to talk about it until release plans are further along. Still, he and fellow UC Davis walnut breeder Pat Brown provided *West Coast Nut* a snapshot of what to expect.

"What is nice about this one is it has good solid yield in a time frame well ahead of Chandler, and when we had samples tested by commercial scorers, they often scored as well as Chandler," Leslie said. "That makes me feel comfortable that both the quality and the appearance of the nut are there to compete in that (earlier harvest) time slot."

The variety's leafing date is another promising characteristic, according to Brown, in that it blooms after several of the recently released early-season varieties, reducing its exposure to walnut blight, frost and codling moth.

"It is not a real short-season variety," said Brown, director of the Walnut Improvement Program, "but it is shorter than Chandler."

Leslie said that breeders never know for sure whether a variety will succeed until it has been in production for several years. But he said: "I am pretty optimistic about this one. We have had it out in some fairly good numbers with several good growers, and one of the growers is putting it in a larger block under test agreement right now, so that kind of thing is encouraging."

The variety still has to be reviewed by the University of California Intellectual Property Office and then go through the patent process before release, a process that Leslie said can take a couple of months. He said to look for its release sometime this summer.





Leslie collects pollen in a UC Davis workroom to use for making controlled crosses in breeding new varieties for the Walnut Improvement Program.



Leslie and student assistants place bags over female flowers before they open to exclude cross pollination from random wind-borne pollen. Leslie eventually will apply the pollen of a chosen male to the flowers by using a syringe.

New Varieties in the Pipeline

If it is released this year, the new variety will follow suit with the program's trend of releasing a new variety once every three or so years. It released Ivanhoe in 2010, for example, Solano in 2013 and Durham in 2016.

"We are trying to stay on that schedule, releasing things at least every three or four years," Leslie said.

Leslie compared the yield of the new variety to Solano, which has yielded well to date, and the quality to Durham. "I think the quality of Durham has been excellent," Leslie said. "We are now watching to see if it really comes in

.....
"We are trying to stay on that schedule, releasing things at least every three or four years."
.....

—Chuck Leslie, UCCE

with enough yield, but I think its yield is okay when it is mature."

The Walnut Improvement Program has several other promising varieties in the pipeline that it anticipates releasing in the next few years, Leslie said, including several early-harvest varieties with a range of leafing dates.

Looking further ahead, Leslie said growers could see releases with multiple beneficial traits, in large part because of what Brown has brought to the program.

"He has brought much more of a ge-

Continued on Page 36



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Continued from Page 35

nomics approach. He is sort of modernizing the program," Leslie said. "We are using more DNA information, using markers for traits, and using the marker information to select earlier in the process."

The main benefit of the new approach, Leslie said, is that by using genetic markers, the program today can eliminate hundreds of poor candidates in the greenhouse before taking them to the orchard.

"Those trees now don't go in the ground. We aren't evaluating a lot of seedling trees in an orchard that end up not being good trees, so we don't have those farming expenses and those evaluation expenses. And we are committing the same amount of ground to a larger number of trees that are likely to go forward," Leslie said.

"Pat has brought a lot of stuff into the program that we weren't able to do before," Leslie said. "And he is moving fast on it. It is working out well."

Genetic Marker for Color

To date, Brown has developed a genetic marker for lateral bearing and one for early harvest. More are in the works, Brown said, including next up, a marker for pellicle color.

"We know that developing a marker for pellicle color is going to be harder," Brown said. "Hopefully next year by this time, we will have something we can use."

Down the road, the program hopes to have markers in place for several traits that have proven difficult to advance in the past, including for blight resistance and walnut husk fly resistance.

"If we get a marker for color, we can take blight-resistant parents, make crosses from them and screen the crosses with markers to throw out a lot of stuff," Leslie said. "So, we will be working with a better set of seedlings and that can accelerate the breeding process for incorporating those traits."

"That is the direction we are heading," he added. "That is where the DNA information starts to really come into play in terms of efficiencies."

"We can theoretically develop a marker for any trait that we have good enough data from," Brown said. "The caveat is that if the trait is complex, and if the genetic control of the trait involves a lot of genes, it gets a lot tougher."

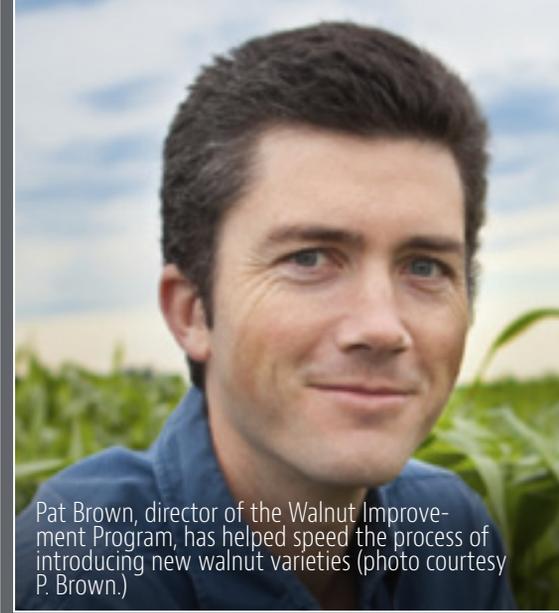
Someday, given the scientific advancements, maybe walnut growers will even have a variety that improves on Chandler. But Leslie isn't holding his breath on that, noting that he's been down this road before.

"We never want to say something is equal to Chandler," Leslie said, "but we certainly are trying."

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NUT CROPS BREEDER ENERGIZED BY OPPORTUNITY

By MITCH LIES | Contributing Writers



Pat Brown, director of the Walnut Improvement Program, has helped speed the process of introducing new walnut varieties (photo courtesy P. Brown.)

IN JULY 2017, NUT CROPS BREEDER PAT Brown came to UC Davis from the University of Illinois, where he worked for seven years.

Brown, who holds a Ph.D. in plant biology from Cornell, said the move has energized him.

“It has been exciting for me coming into trees,” Brown said. “It is a world of opportunity, because we are starting out at a pretty basic level and because the genetics are more challenging than working with corn, sorghum, wheat and soybeans.”

Brown, who is currently focusing on walnuts and pistachios and is director

of the Walnut Improvement Program, said grower assistance has been vital to his research since arriving in California.

“We have a couple of stages on campus that the trees can move through, but once we are pretty sure that something looks good, we need growers across the state to trial it before we release it,” Brown said. “That is a key step in putting out new varieties.”

“And before we get to that stage, we are constantly trying to figure out what growers are looking for, what new things they have tried that they like and don’t like, and whether there is

anything additional that we need to be selecting for, any niches that need to be filled.”

“The grower input and the grower help has been extremely important,” Brown said.

To offer input, see related article in this issue on walnut breeding surveys by Andreas Westphal.



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THE NEXT GENERATION OF WALNUT ROOTSTOCK AIMS AT RESISTANCE TO SOIL-BORNE PATHOGENS

By JULIE R. JOHNSON | Contributing Writer

A MULTI-DISCIPLINARY COLLABORATION IS UNDERWAY TO DEVELOP and deploy walnut rootstocks with resistance to the major soil-borne pathogens, specifically crown gall (*Agrobacterium tumefaciens*), Phytophthora root/crown rot (*Phytophthora spp.*), and lesion nematodes (*Pratylenchus vulnus*).

According to Dr. Ali McClean with the USDA’s Crop Pathology and Genetics Research Unit at UC Davis, a significant proportion of the walnut industry uses either seedling or clonal ‘Paradox’ rootstocks, which is susceptible to disease caused by several soil-borne pathogens.

McClean said since there are limited preplant and post-plant management strategies for these stresses, rootstocks with elevated levels of genetic resistance/tolerance to these pathogens offer the most promising solution to soil-borne threats.

“We have four specific aims,” he said. “The first one is screening wild walnut species and looking for natural resistance to the pathogens. The second thing we wanted to do is take those wild species and cross them with English walnuts, make new hybrids, and then screen those hybrid genotypes to find ones that have resistance to one or more pathogens.”

Once this has been accomplished, researchers scale those up and have them mass produced at nurseries, then test them in the field.

“The end result is that we want to make these disease-resistant rootstocks available to the growers,” McClean said.

Looking for Natural Resistance

McClean said the team has evaluated 11 wild Juglans species and one non-Juglans, the Chinese wingnut (*Pterocarya stenoptera*), that are available at the USDA-ARS walnut germplasm collection at University of California, Davis for disease resistance.

“We had open-pollination seedlings that were grown under greenhouse conditions from different accessions of all these 11 species. We did some preliminary disease testing and from those 11 species we narrowed it down to one species, *J. microcarpa*, which is the Texas

Objectives of the Project

- 1 Generate/exploit a genetically diverse Juglans germplasm collection.
- 2 Identify hybrid Juglans germplasm resistant to key soil-borne pathogens.
- 3 Generate and clonally propagate hybrid disease-resistant genotypes for validation in field trials.
- 4 Deliver disease resistant rootstocks to growers.

black walnut,” he added.

According to McClean, the reason they selected this species was because

Continued on Page 40



Most California walnut orchards are English walnut grafted onto Paradox rootstock, which is highly susceptible to crown gall disease, lesion nematodes and Phytophthora (photo courtesy USDA-ARS.)



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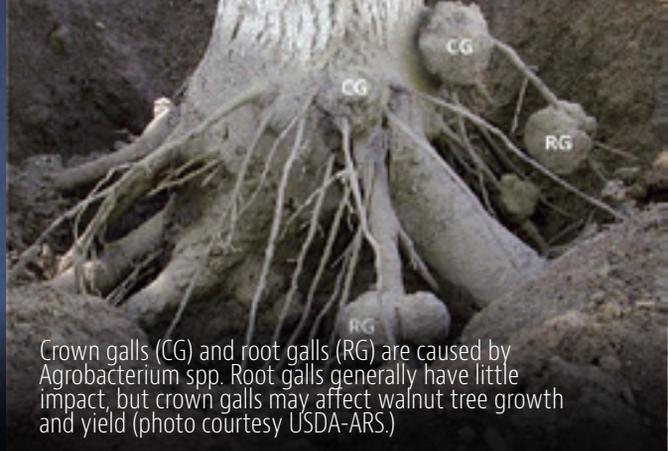
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Dr. Ali McClean, USDA Crop Pathology and Genetics Research Unit at UC Davis, is part of a multi-disciplinary collaboration working to develop disease-resistant walnut rootstocks (Photo courtesy J. Johnson.)



Crown galls (CG) and root galls (RG) are caused by *Agrobacterium* spp. Root galls generally have little impact, but crown galls may affect walnut tree growth and yield (photo courtesy USDA-ARS.)

Continued from Page 38

accessions from it drew off resistance to one or more of the tree pathogens.

“So, we decided to use this species to create our hybrid, *J. microcarpa* with *J. regia*. We took these selected mother trees that were throwing off the resistant progeny and crossed those with pollen from cultivar ‘Serr,’ which is our English walnut donor,” he said.

Researchers collected nuts from each of those directed crosses, 300 nuts from each cross. They then took the nuts back to the lab and, using tissue culture methods, grew clonal plants in the lab. The team then took those plants to the mist chamber and rooted them, then transferred them to the greenhouse.

“We produced up to 300 clonal plants from each single embryo from hundreds of seeds. From this we got thousands and thousands of plants to grow pathogen resistant for testing under greenhouse conditions,” McClean said.

Through this testing, researchers found their source of resistance and created the hybrids.

Crown Gall Evaluation

The next step was to go through all the hybrids and find the ones that are resistant to crown gall, *Phytophthora* root/crown rot, and lesion nematodes.

“We started with crown gall disease, which is a major bacterial, soil-borne disease,” McClean said. “Under greenhouse conditions, each plant was stabbed twice in the stem above the crown area with bacterial suspension and the wounds were wrapped with Parafilm. We then evaluated them for disease symptoms at two months post-inoculation.”

Researchers waited one post-dormancy period longer to see if a gall would develop after dormancy.

They found a range of resistance, or lack of, in the genotypes.

“Some proved to be more susceptible and others more resistant. On this outcome, we made a selection on what was to be mass produced for field testing,” McClean said.

Phytophthora Evaluation

McClean said the research for *Phytophthora* root/crown rot evaluation was about the same as for crown gall.

“Again, we did testing on the hybrids to find the ones that were most resistant. We also did this under greenhouse conditions,” he added.

In the greenhouse, 10 seedlings or clonal saplings of desired genotypes were transplanted into tubs. Eight of the 10 plants were inoculated with *P. citricola* or *P. cinnamoni*, for crown rot and root rot symptoms.

Starting one week after inoculation, all plants were subjected to bi-weekly 48-hour flooding episodes, McClean explained.

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From the first crop, six out of 232 clonal hybrids were resistant to Phytophthora, seven out of 260 for the second crop, and two out of 35 for the third crop.

“So, we have 15 that were resistant to Phytophthora in greenhouse testing, and these are the ones we want to test under field conditions,” McClean said.

Nematode Evaluation

“We tested the hybrids for nematode resistance,” he added. “We looked at resistance in this way: looking at the nematode population, if you have high nematode population, that would indicate a susceptible climate. If you have low nematode population, then that genotype won’t support very high nematode numbers and you can consider that resistant. We also consider tolerance to how the plants responded to the presence of the nematodes.”

Like the Phytophthora and crown gall testing, each nematode testing plant was inoculated. This time the plants were inoculated with field soil containing vermiform stages of *P. vulnus* or *M. incognita*.

The testing for nematodes took more than two growing seasons to determine hybrid resistance or susceptibility.

Roots prone to nematode infection were collected from each candidate tree after two growing seasons, and submitted to mist chamber nematode extraction, enumeration and statistical analysis, according to study reports.

Six clonal copies of each of the members of the mapping population are undergoing evaluation in the field, with resistant and susceptible results being determined.

Field Testing

Through the research, the team has found some hybrids that are resistant to crown gall, Phytophthora, and nematodes, according to McClean.

“Except for nematodes, all the other testing was done under greenhouse conditions,” he said. “The next step is to scale this up to do actual field testing.”

With help from Sierra Gold Nurseries, the research team has four clonal genotypes that are currently out in the field in five different counties, and four

other genotypes ready for the field.

“Working with Sierra Gold, we have another 25 hybrids that have resistance to either crown gall, Phytophthora or lesion nematodes,” he added. “These went out into the field last year, so we currently have about 2,000 plants out there that will be ready to go into field trials in 2020-21.”



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BY **ANDREAS WESTPHAL**, University of California, Riverside
DAN KLUEPFEL, USDA-ARS
ANNETTE LEVI, California State University, Fresno

WALNUT PRODUCTION IS A LONG-TERM COMMITMENT OF resources in land, labor and management. Because of the lag time from field preparation and planting to first harvest, walnut production is a fiscally demanding endeavor. During production operations, orchard management is a critical factor for improving yield; this includes tree protection from soil-borne maladies. Soil-borne plant diseases include plant-parasitic nematodes (root lesion nematode, *Pratylenchus vulnus*, root-knot nematodes, *Meloidogyne* spp.), crown gall (*Agrobacterium tumefaciens*), and Phytophthora root and crown rots (*Phytophthora* spp.).

Among the biotic stresses there is also the so-called “re-plant problem”, where the walnut tree has growth depression when it is planted in an outgoing orchard of the same crop.

The microbial cause of this malady is poorly understood but different rootstocks may provide advantages in coping with this problem. Other demands on rootstocks may include anchorage, and the tolerance to water stress (surplus during winter flooding or scarcity during summer). Rootstocks will also play a role in the development of black-line disease. In this pollen-transmitted viral disease, severe necrosis (dying walnut tissue) develops at the graft union. The response of the rootstock will impact the development of the disease, and on certain rootstocks the tree remains healthy. These are just some of the considerations growers may include in their decision-making process on which rootstocks to choose for their new orchard.

A team of research scientists from the University of California, USDA-ARS, and California State University at Fresno have come together to further improve rootstocks available for commercial production. In this comprehensive project, supported by federal and California Walnut Board funding, the team has started off with breeding populations of so-called “inter-specific hybrids” of different types of walnut. This allows scientists to explore the genetic basis of many of the different accessible walnuts. The draw-back is that these crosses are infertile, and no further cross-breeding is possible after this one cross. Accessing this rich pool of the new hybrid walnuts is only possible because plant scientists have developed the technology to “rescue” the new walnut embryo from the seed where it may not germinate by itself. By removing it from the nut, the scientists can grow it in tissue culture, on artificial media, and regenerate new plants via various steps of propagation. In fact, the clonal rootstocks VX211, RX1 and Vlach routinely go through these tissue culture steps in their production. They are clonally (vegetatively) produced. This vegetative production of new walnut plants results in much more uniform plants than the traditional seedling rootstocks.

In this research program, after plants have



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WALNUT ROOTSTOCK GROWER SURVEY

A research study aims to determine walnut growers' preference in their rootstock selections as they prepare to (re) plant an orchard. Please take a moment to complete the survey, and help drive future investment in new rootstocks. Walnut growers can access the survey to share their preferences through the internet address or by scanning the QR code with your cell phone.

tiny.cc/walnuts19



grown to the size of liners, they are placed in the disease testing pipelines for the different pathogens. Phytophthora root rots and crown gall susceptibility are tested under greenhouse conditions. Susceptibility to plant-parasitic nematodes is tested under field conditions in a two-year process. Other biotic and abiotic stresses are investigated in a combination of greenhouse, shadehouse and field experimentation. These procedures are involved and lengthy, but data of the different evaluations are combined, and elite plants with resistance preferentially to multiple maladies are selected for further testing. "Front-runners" of these efforts then require several years for vetting under commercial conditions prior to going to the marketplace.

Overall improving walnut rootstocks is a lengthy and tedious process. However, the potential benefits of saving growers money, labor and time are significant due to growers having to worry less about some of the maladies mentioned in this article. This prospect along with decreasing the use of inputs that adversely impact the environment has a two-fold advantage in walnut production by 1) increasing orchard productivity, and 2) improving public perception of agricultural production practices.

Part of the research study discussed in this article is to determine what walnut growers prefer regarding their rootstock selections as they prepare to (re)plant an orchard. Because the development of walnut rootstock is a lengthy process, research activities need to prioritize on what growers believe to be the most important issues. To this end, a grower survey has been developed to ascertain the rootstock characteristics California walnut growers prefer that will improve the productivity of their orchard. We are asking walnut growers to take our 10-minute rootstock survey; the survey results will assist

researchers in targeting rootstock characteristics that will be most beneficial to growers. Benefits of taking the survey will yield more refined outcomes that will lead to cost savings and increased productivity that directly benefits the walnut community. Understanding the preferences and concerns of walnut growers is crucial to the success of this project that serves the walnut industry with the best possible, and most useful, results.

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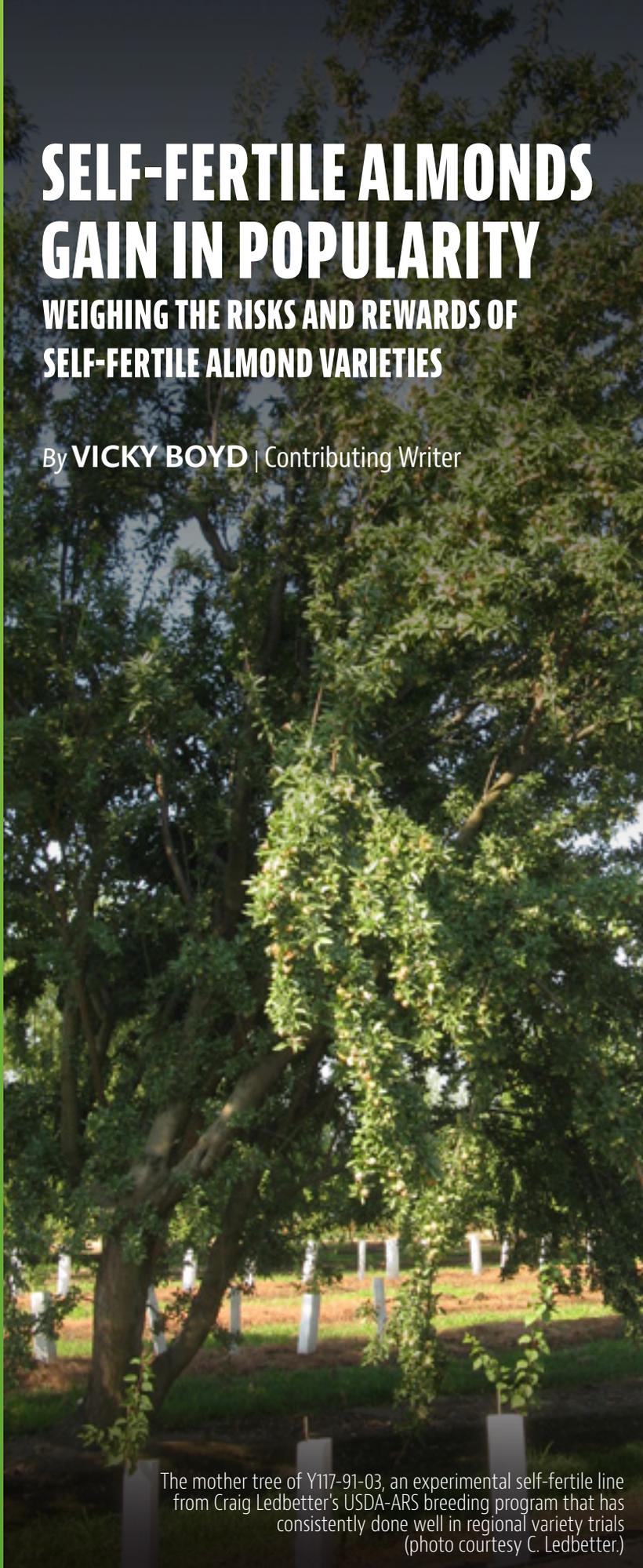
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SELF-FERTILE ALMONDS GAIN IN POPULARITY

WEIGHING THE RISKS AND REWARDS OF SELF-FERTILE ALMOND VARIETIES

By **VICKY BOYD** | Contributing Writer



The mother tree of Y117-91-03, an experimental self-fertile line from Craig Ledbetter's USDA-ARS breeding program that has consistently done well in regional variety trials (photo courtesy C. Ledbetter.)

SELF-FERTILE ALMOND VARIETIES that don't require a pollinizer, need fewer or even no beehives to set a crop and allow one-pass harvests are gaining market share as growers look to maximize profit per acre.

Although there will still be a place for varieties, such as Nonpareil, that have unique kernel characteristics but require a pollinizer, industry leaders say self-fertile varieties are here to stay.

Independence, a self-fertile variety developed by Zaiger Genetics and licensed to Hickman-based Dave Wilson Nursery, entered the market about 15 years ago. Since then, acreage has continued to increase and now accounts for about 2 percent of California bearing almond acreage and 24 percent of non-bearing acreage, according to figures from the 2019 California Almond Nursery Sales Report, the most recent year for which data is available. That compares to Nonpareil, the most widely planted variety, with 37 percent non-bearing and 39 percent bearing acreage.

"It looks like there's a bit of a plateau in the last data. In previous years, (the Independence acreage) had been going up and up and up," said Franz Niederholzer, a University of California Cooperative Extension farm adviser in Colusa County and research coordinator at the Nickel's Soil Lab in Arbuckle. "There will be a lot of Independence in the market in the next two to three years, so we'll see how the pricing looks going forward."

He was referring to Independence's kernel trait and handler pricing, which typically puts it between California varieties and Nonpareil.

Shasta is a relative newcomer from Oakdale-based Burchell Nursery, accounting for only about 3 percent of non-bearing acres and few bearing acres, according to Almond Board figures. It, too, is gaining popularity, said Robert Gray, a Burchell sales representative for Modesto and west Stanislaus County.

"We've seen a lot of interest," he said. "It's actually becoming our top almond variety as far as orders."

Handlers consider its kernel a California-type similar to Monterey

or Carmel and price it accordingly, Gray said.

Varieties in the Pipeline

Several other self-fertile varieties are in the pipeline from Zaiger, Burchell, the University of California, Davis, and the U.S. Department of Agriculture Agricultural Research Service.

“There’s a lot of interest, and I think this is going to be the future of the industry,” said Roger Duncan, a UCCE farm adviser in Stanislaus County. “We expect year in and year out over the long term to see more consistent yields and better set in years where there’s less bee activity. So I think this is the wave of the future and certainly is a major emphasis of most breeding around the world and in California.”

That’s not to say breeders will forget about more traditional varieties, especially in light of global climate change, water shortages and ever-changing markets, said UC Davis breeder Tom Gradziel.

“The new challenge is to develop self-fruitful as well as more traditional varieties to meet these novel, and sometimes poorly characterized, needs,” he said. “The good news is that the efforts required to bring self-fruitfulness from wild almonds and peach have also brought in novel genetic options that have promise to meet these novel industry needs.”

As part of his work, Duncan is conducting one of three regional UCCE variety trials. The study near Salida is similar to ones conducted by Farm Advisors in Butte and Madera Counties. Of the 30 experimental varieties, 10 are experimental self-fertile lines from UC and ARS. Not included in the trial are Independence and Shasta. Now entering the seventh leaf, some self-fertile varieties have performed better than others.

“We’re still in the process of evaluating all of these things – time will tell,” Duncan said. Before any are released, several years of production data is needed. That is on top of screening early crosses to weed out ones with little potential. Altogether, it may take a breeder 10 to 15 years – and sometimes longer – to develop a new almond variety, he said.

Of the four USDA varieties in Dun-

can’s trial, ARS breeder Craig Ledbetter said three have looked good and will be sent to the Foundation Plant Service to be screened and cleaned of any plant viruses before they’re eligible for release. The process will take a couple of years, after which the numbered experimental lines will be given variety names.

Although the regional trials are funded by the Almond Board, Ledbetter’s breeding program is federally funded.

Continued on Page 46



Independence is a self-fertile almond variety developed by Zaiger Genetics and licensed exclusively to Dave Wilson Nursery (photo courtesy Dave Wilson Nursery.)

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ARS breeder Craig Ledbetter has a number of self-fertile almond varieties in the pipeline (photo courtesy USDA-ARS.)

Continued from Page 45

UC’s Gradziel has more than 20 advanced selections of self-fruitful almonds that have been tested for 10 years or more.

Fewer Bees, Single Harvest

Bob Livak, who farms with his son, Keith, near Hilmar, liked what he saw in Shasta and ordered trees to plant 10 acres.

“They’re self-fertile – I’m looking at less bees and one

harvest. Those are two big factors,” he said. “I do love the one harvest.”

In another orchard by his house, Livak has three varieties, and he joked it seemed like he was harvesting from mid-August to mid-October.

Based on reports, he said Shasta tends to also yield well. In addition, everybody he knows who has the variety has said they’re easy to shake during harvest and winter sanitation. Another characteristic Livak liked was the variety’s low chill hour requirement.

“With our so-called climate change, we’re getting warmer,” he said. “If we need a tree for the future, maybe we need one that doesn’t require as many hours.



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To Bee or Not to Bee

While Burchell Nursery recommends a half stocking rate of bees – or about one hive per acre – for Shasta, Dave Wilson Nursery said no bees are needed to pollinate Independence. Nevertheless, questions remain about whether placing a reduced number of hives, such as 0.5 hives per acre, increases yields compared to no hives.

Harbir Singh, Northern California sales representative for Dave Wilson Nursery, said his research has shown Independence yields are similar with and without bees. But he said some growers still use a reduced number of hives to appease insurance and their neighbors.

Duncan is currently conducting a field trial to try to answer the bee question. It involves enclosing Independence almond trees with screen cages to exclude honeybees.

“We had a very significant increase where we had bees present compared to where we didn’t,” Duncan said, adding he plans to expand the trial this year.

Continued on Page 48



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Experimental self-fertile lines from the Agricultural Research Service and Craig Ledbetter's breeding program, Y117-91-03 and Y116-161-99, compared to the industry standard Nonpareil. Y117-91-03 has consistently done well in trials and has a nonpareil-type kernel (photo courtesy C. Ledbetter).



Dormant Y117-91 and the same tree at full leaf (photo courtesy C. Ledbetter).

Continued from Page 46

Another advantage of planting a solid block of a self-fertile variety is uniform timing for cultural activities, he said.

“You have one bloom to cover, one hull split spray period to cover, one harvest operation, fewer bees required – so it’s cheaper to farm that way,” Duncan said. “We also would expect through the years you

would have a more consistent yield.”

Cutting equipment passes in half during harvest also will help growers significantly reduce the amount of dust produced, Duncan and Niederholzer agreed.

Independence

Independence trees tend to be slightly smaller than, for example, Nonpareil especially if they’re grafted onto standard sized root-

stocks like Nemaguard, Lovell, Atlas, Viking or Krymsk 86. As such, growers may lose out on yield potential if they plant them on traditional Nonpareil spacings, Niederholzer said.

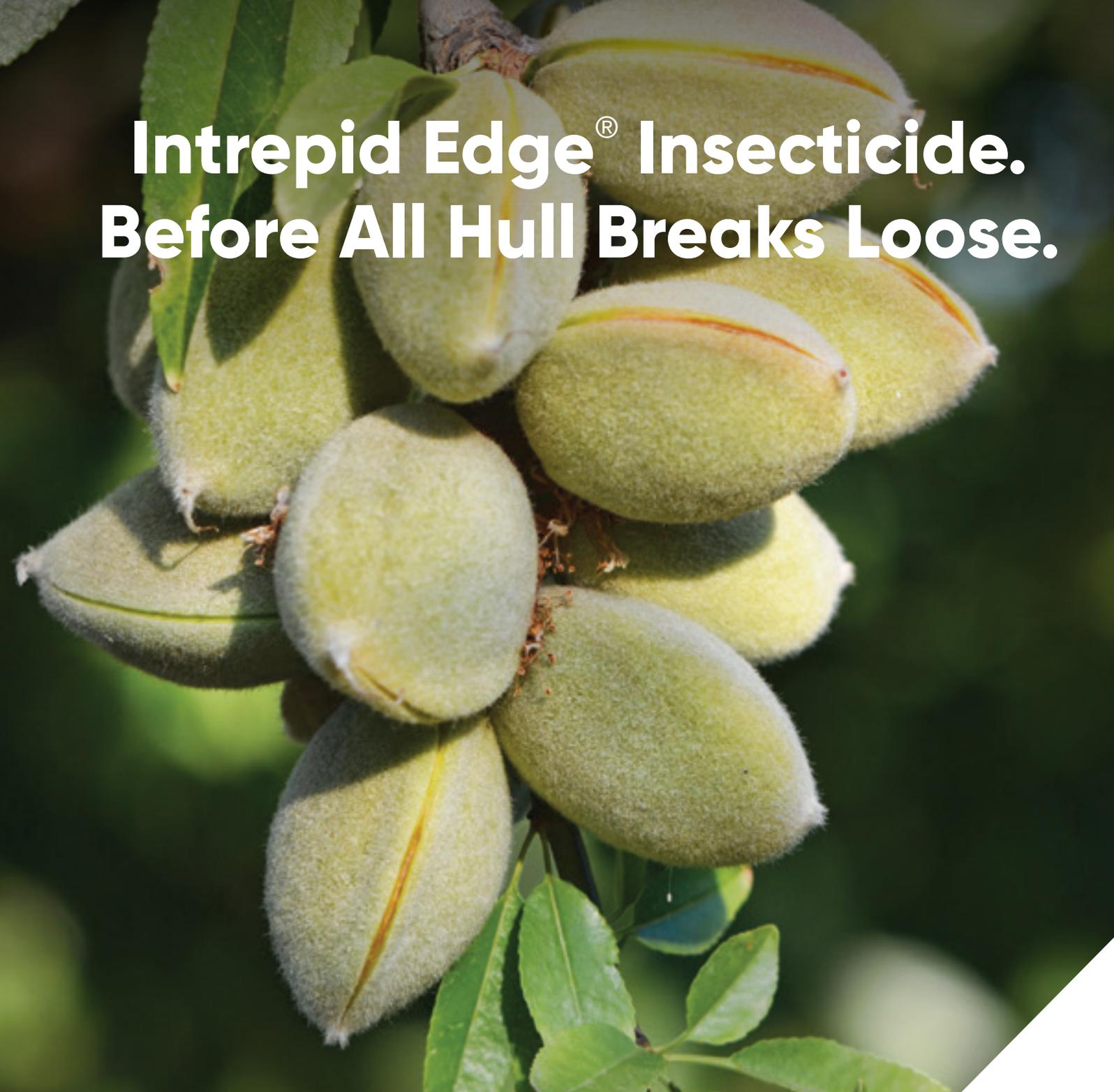
Dave Wilson Nursery has increased production of Independence grafted onto hybrid rootstocks, such as Hanson, that result in a larger tree. Jerome Fromm, Dave Wilson Central California

sales representative, said typical Independence plantings average about 21 by 15 feet or 140 to 160 trees per acre, depending on growing region, soil type, and equipment.

And depending on those factors as well as fertility, Independence trees may begin bearing a crop during the second leaf. But Singh said growers would be wise to remove the crop and wait until third leaf to let the trees funnel more energy into building a stronger architecture and taller tree. In addition, two-leaf trees aren’t sturdy enough to take mechanical shaking, and growers who do so risk permanently damaging the tree.

Initially after Independence was released and trees came into production, some growers reported difficulty shaking and removing the

Continued on Page 50



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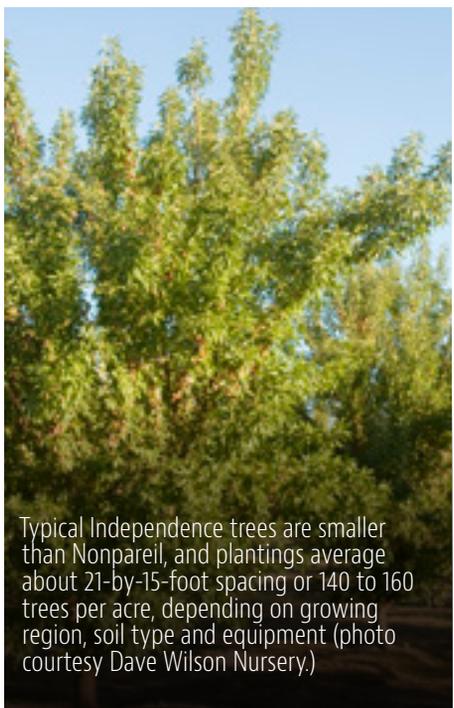
Inshell (left) and kernel Independence nuts (center) (photos courtesy Dave Wilson Nursery.)



The experimental self-fertile line Y117-91-03 budded on Hansen 536 rootstock (photo courtesy C. Ledbetter.)



Self-fertile varieties, such as the Independence, require fewer bees to pollinate and set a crop (photo courtesy Dave Wilson Nursery.)



Typical Independence trees are smaller than Nonpareil, and plantings average about 21-by-15-foot spacing or 140 to 160 trees per acre, depending on growing region, soil type and equipment (photo courtesy Dave Wilson Nursery.)

Continued from Page 48

nuts. Through trials, Singh said, they found that applying the bulk of the season's nitrogen early significantly reduced the stick-tight problem. In the southern and central production areas, growers should not apply nitrogen after the end of April. In the northern area, the cutoff is May 15. Growers can still apply all other macro- or micro-nutrients as needed, he said.

Shasta

Burchell Nursery offers Shasta grafted onto both peach and hybrid peach-almond rootstocks, Gray said. The self-fertile variety tends to be precocious, meaning it comes into production early and produces a heavier crop earlier.

Shasta trees are semi-upright to spreading, having a structure similar to Monterey. Because of that, he said growers should tie the scaffolds from the first through second or third dormant season.

The variety leafs out as it blooms and will be one of the last varieties to drop leaves in the fall, Gray said. The nuts, which shake easily, mature at about the same time as, or slightly ahead of, Nonpareil.

Most Shasta orchards are still in their third or fourth leaf. But an eighth-leaf orchard in Salida with 138 trees per acre yielded 3,145 pounds per acre, and a sixth-leaf orchard

in Firebaugh with 135 trees per acre produced 3,694 pounds per acre, according to Burchell Nursery information.

Factor in Your Risk Tolerance

Regardless of the new variety, Duncan and Niederholzer said growers should first ask themselves how much risk they're willing to take before deciding to plant one.

"For big growers, it makes sense to be looking at everything because they plan to be in the business for a long time, want to stay up on new stuff and can afford to take a relatively small loss if it doesn't pan out," Niederholzer said. "If you're a small grower, say 20 acres, the self-fertile varieties make perfect sense mostly because it's easier to get someone to custom farm them. But those people in the middle who are professionally farming have to ask themselves how much can they afford to lose because it's possible for a new variety to not prove out."

"We're only 10 to 12 years into Independence and just barely on the road with Shasta. There's a lot of interest in a lot of new stuff, but we also have 50, 60 and 70 years' experience with varieties that are proven winners."

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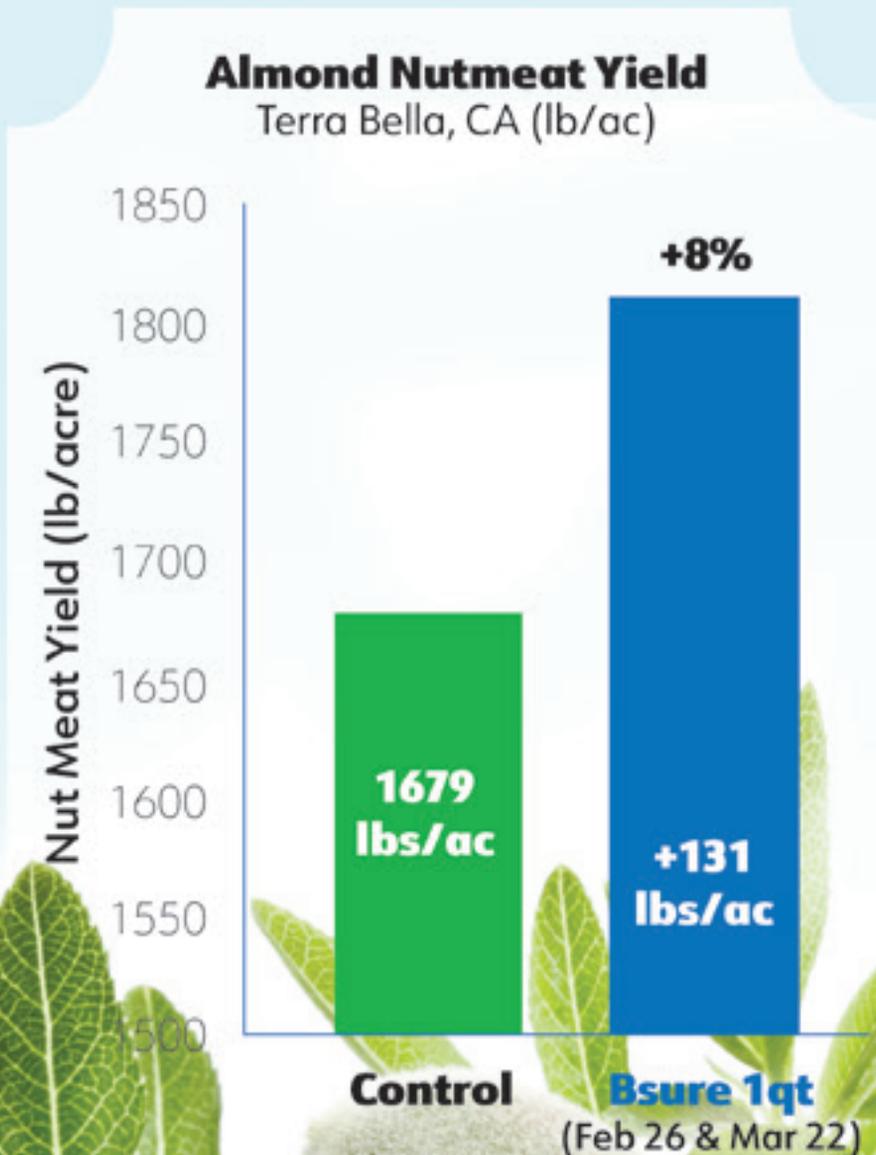
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Finding and Choosing a Reputable Supplier for Hazelnut Trees

By THE HAZELNUT MARKETING BOARD |
Contributing Writer

IN THE MID-1980s, A NEW disease threatened to wipe out the entire U.S. hazelnut industry. Eastern filbert blight (EFB) made its way from the East Coast to Oregon, and the trees of the Willamette Valley were not resistant. After years of research and collaboration, the Oregon hazelnut industry pulled through with new varieties resistant to the blight.

Integral to winning this battle were the responsible hazelnut nurserymen and propagators. These gatekeepers of the industry are responsible for supplying a growing orchard landscape and take their role very seriously. Trees arriving in the Willamette Valley from unapproved sources may not be EFB-resistant and could be damaging to all orchards and diminish the progress made through decades of hard work.

To pre-

vent this, it is imperative for all growers to know his or her options, how to find a reputable supplier and the background information on the new plantings.

Micropropagation Process

Growers in the Willamette Valley are fortunate to have one of the world's premier micropropagators in their own backyard. North American Plants was one of the first companies to micropropagate hazelnut trees, and to date, remains the largest to do so.

"We began working with plant tissue cultures (micropropagation) in 1998 and the business has been growing over the last two decades. We are propagating approximately 16 million trees per year. Now we are the largest tissue culture facility in the USA," says Dr. Yongjian Chang, president of North American Plant. The company propagates a wide array of nut and fruit trees, as well as berries.

The micropropagation process begins when a new hazelnut variety is bred and released for sale. These new varieties often come from universities, and in the case of hazelnuts, from Oregon State University.

"We receive the mother material of new hazelnuts from Oregon State University and multiply them in our tissue culture lab. We then grow the plants in our greenhouse to about three-to-six inches in height. Finally, we move them on to our customers, many of them nurseries in Oregon," said Dr. Chang. "We also grow up the trees in gallon pots for hazelnut growers directly."

Throughout the entire micropropagation process, the



plants are kept in a highly controlled, sterile environment so they are not exposed to any danger or disease; factors like temperature and humidity are also meticulously regimented. Each type of plant is fed with its own specific recipe, dialed in to the exact nutrition mixture ideal for vitality. For example, the hazelnut trees receive a different recipe than the raspberries or pistachios.

Once the plants reach a final stage and are too large to be stored in jars, they are transplanted into individual plugs. The stock is then moved into a large greenhouse where the plants live until they are shipped to a buyer.

Bare-Root Trees

The Bruck family has been in the nursery business since 1962 and remain one of the most reputable names in the industry.

"We are glad to see a variety of propagation methods—such as tissue cultures—become viable options for the growers," said Dylan Bruck, who operates VP Bruck Nursery with his father and brother.

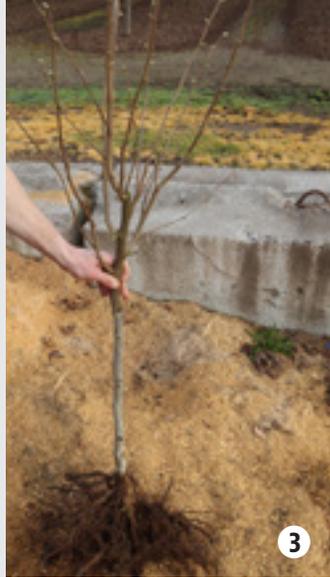
For the Brucks, however, they prefer to establish layering beds and begin the bare-root process. The trees grow in the layering beds through their first year and are then transplanted into the



2



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3



4

1. Hazelnut trees are micro-propagated in jars at North American Plant Company (photo courtesy Hazelnut Marketing Board.)

2. Once the trees outgrow the jars, they are moved into one of many large greenhouses at North American Plant Company (photo courtesy Hazelnut Marketing Board.)

3. An individual hazelnut tree at VP Bruck Nursery near the right age for transplanting (photo courtesy Hazelnut Marketing Board.)

4. McDonald hazelnut trees grow at VP Bruck Nursery; the nursery typically ages their trees to two or three years before selling to growers (photo courtesy VP Bruck Nursery.)

soil, where they grow until two or three years of age and are then sold.

“We are hazelnut growers, too, so that enables us to know what fellow growers are experiencing in the field; we are able to provide guidance on variety, age and size,” said Bruck.

The Brucks also recommend working with your nurseryman to identify the correct trees for your acreage; different varieties perform differently based on soil types, water demand and other environmental factors.

“It’s important for us to really listen and know what our grower wants. We value helping them achieve what they want to do,” said Bruck. “We need to know everything about trees so we can help the growers make informed decisions.”

Finding a Reputable Nursery

The Oregon hazelnut industry and Oregon Department of Agriculture (ODA) take the approval and recommendation of hazelnut nurseries very seriously. The hazelnut industry recommends anyone purchasing hazelnut trees in any quantity do so via a certified nursery rather than a retail location like a grocery store.

Most nurseries request that buyers make their orders six to nine months in advance, as the boom in the hazelnut industry since the mid 2010s has caused annual sellouts.

“It’s really great news for the industry; it’s a sign we are all growing together. However, that means anyone looking to plant trees for the first time or expand their orchard really needs to

plan ahead,” Bruck said. “We may be able to supply someone with a handful of trees on short notice, but anyone looking to plant serious acreage will need to book those trees at least six months in advance.”

Whether the nursery sells micro-propagated trees, bare-root stock or another method, they must be certified and licensed by the Oregon Depart-

ment of Agriculture. All licensed nurseries are listed in a searchable database on the ODA website, Oregon.gov/ODA.

The Oregon hazelnut industry office also houses this database and contact information for all approved nurseries on its website, oregonhazelnuts.org.

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NEW WATER BLUEPRINT LOOKS AT IMPACTS OF WATER SUPPLY SHORTAGES

Study Shows Regulations Could Imperil 327,000 Acres of California Tree Nuts

By **MIKE WADE** | *California Farm Water Coalition*

Surface water reductions and regulations, if fully implemented for groundwater, the San Joaquin-Sacramento River Delta, and San Joaquin River restoration, will have dramatic economic consequences in the San Joaquin Valley (photos courtesy M. Wade)

A NEW EFFORT IS UNDERWAY TO HELP solve some of California's most difficult water supply challenges. The Water Blueprint for the San Joaquin Valley (Blueprint) evolved out of discussions among water users in the San Joaquin Valley to address surface water reductions, groundwater overdraft, subsidence, and meeting the requirements of the Sustainable Groundwater Management Act (SGMA).

The Blueprint is supported by a broad coalition of water users that are continuing to seek input from all stakeholders including local governments, public water agencies, agriculture industry representatives, disadvantaged communities, environmental organizations, academia, and others.

The Blueprint group recently commissioned UC Berkeley researchers Dr. David Sunding and Dr. David Roland-Holst to complete an economic impact assessment. The assessment shows that roughly half of the economic impacts and job losses due to water supply shortages in the San Joaquin Valley would occur off of the farm and in many cases will also affect business-

es that are outside of the Valley. The impacts will be felt first by farms in the Valley, but will quickly spread to the rest of the state.

Farmland at Risk

With up to 1 million acres of productive farmland at risk of being permanently fallowed in the San Joaquin Valley, the impacts translate to a farm revenue loss of \$7.2 billion per year. That equals one-fifth of all the farmland in the Valley and roughly 14% of California's total farm production.

The assessment breaks down projected acreage losses within the eight-county San Joaquin Valley into seven distinct categories: hay and pasture, tree nuts, tree fruits, vines, corn, vegetables, and field crops and grains. The largest projected acreage loss in any single category is tree nuts, accounting for 327,815 acres, or one-third of the projected 991,870 fallowed acres. The report goes on to say that expected fallowing is permanent and would not be recoverable under the report's expected water supply scenario.

Using USDA crop production data,

the projected amount of land fallowing for fruit and vegetables is sufficient to produce enough food to meet the annual needs of about 7.6 million households.

The assessment found that impacts are regressive and would affect a disproportionate number of disadvantaged communities. The greatest number of full-time equivalent job losses would occur in disadvantaged communities, a somewhat expected result, given that farmworkers represented the largest number of direct job losses identified by the study.

It also concluded that without restoring water supplies to offset the existing imbalance, California, as a whole, stands to lose more than 84,000 jobs annually with more than half of them in the non-farm sector. The total loss in employee income would be approximately \$2.1 billion annually, almost half of which is non-farm income.

The economic assessment was completed based on an existing water deficit in the San Joaquin Valley that has grown significantly over the past couple of decades, and the following

THE ASSESSMENT SHOWS THAT ROUGHLY HALF OF THE ECONOMIC IMPACTS AND JOB LOSSES DUE TO WATER SUPPLY SHORTAGES IN THE SAN JOAQUIN VALLEY WOULD OCCUR OFF OF THE FARM AND IN MANY CASES WILL ALSO AFFECT BUSINESSES THAT ARE OUTSIDE OF THE VALLEY.

four assumptions that will impact the availability of future anticipated water supplies:

1. **Full implementation of the San Joaquin River Restoration Plan**
2. **Maintaining existing water management activities under the 2008/2009 Biological Opinions for Delta water exports if the proposed 2019 updates are not implemented**
3. **Climate-induced sea level rise**
4. **Implementation of State Water Board staff recommendations for unimpaired flow requirements on the San Joaquin and Sacramento rivers**

Funding for government services is at risk as well. Tax revenue for local and state government is expected to drop by approximately \$535 million per year, based on \$242 million in lost city and county tax revenue and \$293 million in lost state taxes, impacting state and local government services all Californians rely on, including roads, law enforcement, and fire protection.

Mitigating the Impacts

A second phase of the study is expected to be released later this year and will identify the water policy reforms and infrastructure investments required to mitigate these impacts. Initial discussions by stakeholders centered

Continued on Page 56



An estimated 327,000 acres of tree nuts could be lost under current threats to water supplies in California.

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WITH UP TO 1 MILLION ACRES OF PRODUCTIVE FARMLAND AT RISK OF BEING PERMANENTLY FALLOWED IN THE SAN JOAQUIN VALLEY, THE IMPACTS TRANSLATE TO A FARM REVENUE LOSS OF \$7.2 BILLION PER YEAR. THAT EQUALS ONE-FIFTH OF ALL THE FARMLAND IN THE VALLEY AND ROUGHLY 14% OF CALIFORNIA'S TOTAL FARM PRODUCTION.

Continued from Page 55

on projects that might take advantage of flood flows using innovative, fish-friendly options to convey water. Water could be moved to highly-impacted areas within the Valley using existing as well as new, yet to be constructed conveyance facilities. Potential projects could include repairing State and federal facilities, including the Friant-Kern Canal, California Aqueduct, and Delta-Mendota Canal. Additional projects could include the construction of new, more localized projects designed to move critical water supplies to multi-purpose recharge basins that provide groundwater recharge opportunities to offset overdraft, improve access to clean water supplies for small communities, and create new or enhanced wildlife habitat.

Expanding the list of stakeholders participating in the Blueprint process is an important step in generating support for projects that will help restore water supplies to the Valley. If successful, those actions will help regions minimize the permanent fallowing of farmland while at the same time helping them comply with SGMA requirements. The Blueprint process is not an attempt to repeal SGMA. It is an effort to engage a diverse group of stakeholders to work collectively to find viable solutions to the Valley's most pressing water supply challenges. Protecting agriculture in the Valley also helps prevent the significant economic impacts expected to occur in other parts of the state.

The report is available in full at the Blueprint website at www.waterblueprintca.com. Stay tuned for more information and updates as they become available.

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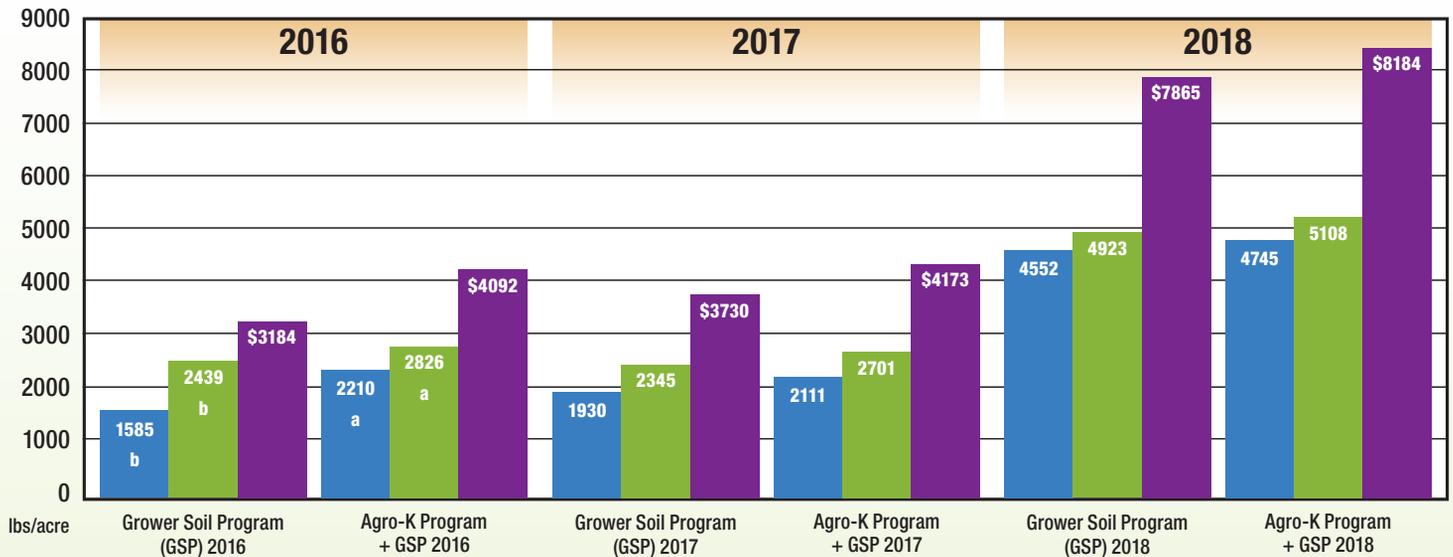


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*Unmanned Drones May Provide New
Control Measure for Crows and Other
Orchard Avian Pests*

By **CECILIA PARSONS** | *Contributing Writer*

HEARING THAT LOUD ‘CAW CAW CAW’ sound in your pistachio orchard can be a signal that one of the most destructive bird pests has invaded.

Scare tactics including rotating distress calls, cannons and gunfire have been standard procedure to convince crows to feed elsewhere. Now, new drone technology may offer improved crop protection.

There are several bird species that can cause substantial crop damage by feeding on developing nuts in almond and pistachio orchards, but crows have nested as the primary bird pest due to their size and habits. In almond orchards, crows will start feeding in the early summer months before, during and after hull split. In pistachio orchards, they feed close to harvest, knocking nuts on the ground and feeding on them. Studies show that a single crow can consume up to a pound and a half of nuts per day from the time of hull split through harvest. Growers report that crows knock even more nuts to the ground than they eat. Crows

congregate in large flocks, making their control in orchards difficult, according to guidelines published on University of California Integrated Pest Management program website.

Know Your Birds

With any pest bird species, identification is critical to determine its status and if a depredation permit is required. No permit or depredation order is required for starlings or crows. For crows, the owner or manager must verify the crop damage is due to crows and that a non-lethal means of removal has been tried first. If a legal take occurs, the owner or manager is required to document the take and report it to the Regional Migratory Bird Permit office. Details of this requirement can be found on the Vertebrate Pest Control Research Advisory Committee website vpcrac.org.

According to the Pistachio Production Manual, early morning is the best time to monitor for crow movement or other pest bird feeding. Observing

flock movement and noting numbers can help determine

probability of crop loss or damage. Watching for bird movement into or within a field, roosting sites and identification of species is advised. Inspection for bird damage in the developing nut crop is also important.

Quality and frequent observations are needed to identify pest birds before their populations increase and damage is done.

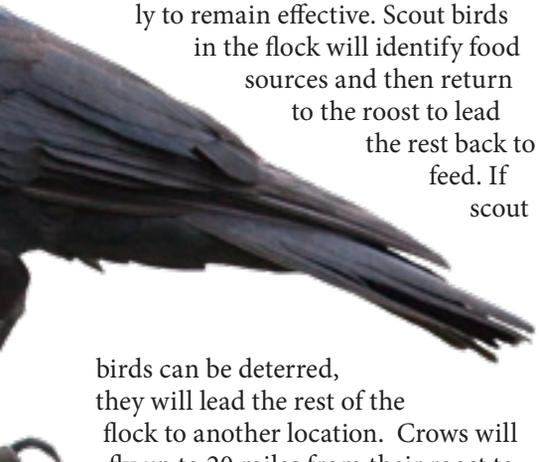
Crows, *Corvus brachyrhynchos*, are large, black birds with black bills and feet. They fly and feed in large numbers, following their scouts into favored



feeding areas.

California Fish and Wildlife regulations allow crows to only be taken by landowners or tenants where it is proven they have caused crop damage. Shooting, however, has not been the most successful control method, in part due to time and labor involved. It can be an early intervention strategy, by sending crows elsewhere to feed before they have formed the habit of coming into your orchard.

Crows can adapt readily to control measures and human activity, meaning distress signals and propane cannons need to be changed or moved frequently to remain effective. Scout birds in the flock will identify food sources and then return to the roost to lead the rest back to feed. If scout



birds can be deterred, they will lead the rest of the flock to another location. Crows will fly up to 20 miles from their roost to feeding areas.

Another potentially destructive bird species, European starlings, are an invasive bird species with a wide habitat range. They do not feed on nuts, but congregate in trees in large numbers and their droppings can contaminate the crop. These dark colored birds are 7 to 8 inches long and have speckling on feathers. Their bills are yellow during the summer and darken in the winter. As an invasive species, they can be lethally taken at any time.

Scrub-jays, magpies, sparrows and house finches are also listed as possible pest species. They feed in smaller numbers, but can congregate in larger flocks when orchards are located near perennial thick vegetation. Sparrows and house finches can damage fruit buds during the dormant season, leading to loss of production.

Evaluating Drones

Dr. Page Klug, Supervisory Research Wildlife Biologist with the USDA National Wildlife Research Center at the North Dakota Field Station, has

conducted evaluations of unmanned aircraft systems as a tool to protect agricultural crops from bird damage.

UAS are known to elicit behavioral and physiological responses in wildlife and have been proposed as a means to protect crops from birds. Klug evaluated behavior responses of blackbirds to fixed wing and rotary wing drones. The UAS platforms used in the study were Fourthwing Vireo (fixed wing) and the DJI Inspire and different hazing approaches were tested.

The birds showed no response to the fixed wing UAS, but did show a response to the rotary UAS and responses were more pronounced with lower altitude approaches. Klug concluded that the rotary UAS has the potential to modify bird behavior in a way that may reduce crop damage, but emphasized in her research that no studies have been done to assess potential effectiveness.

Klug said that to be effective in protecting crops from blackbird depredation, modifications to the physical UAS might be needed. Modifications include addition of an audio system

to produce distress or alarm calls or firearm discharge sounds, adding lasers or lights or shapes that mimic an aerial predator.

In addition, a fully automated UAS may be a more effective strategy. This modification could potentially reduce labor, Klug wrote. The UAS could also be programmed to fly patterns which would be most likely to deter birds. Environmental conditions also come into play with UAS use as low temperatures can affect battery packs. Klug noted that their evaluations were done with specific UAS models and other types of drones and responses by birds to approaching UAS can vary based on the specific platform and are likely species and context specific.

While understanding the efficacy of drones may be a way off, they offer one more potential tool in an arsenal required to outwit bird pests in nut crops.

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REGIONAL BOARD RULES PUT WALNUT HULLERS UNDER THE MICROSCOPE

By CHRIS MCGLOTHLIN | Western Agricultural Processors Association

OVER THE PAST YEAR, THE AGRICULTURAL industry has observed as the Central Valley Regional Water Quality Control Board (Regional Board) make sweeping changes to discharging regulations specific to agricultural regions and specific processing facilities. With the passage of SB 200 – Safe Drinking Water Fund (Monning), as well as the passage of the Central Valley Salinity Alternatives for Long-Term Sustainability Program (CV-SALTS) by the Regional Board, water quality and discharges from agricultural operations are now even further under the microscope. Late last year, a notice was sent to interested stakeholders that the Regional



Water sampling being conducted at a walnut huller discharge pond as part of WAPA's sampling protocol study to understand the actual contents of water huller discharge water (photo courtesy WAPA.)

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Board would be taking up a vote on an agenda item targeting small wineries, walnut hullers and other food processors to try and bring these facilities under the scope of the Waste Discharge Requirements Program (WDR's).

The waiver noticed by the Regional Board had been originally presented several years ago as a means to bring the listed facilities into compliance with current WDR-regulated industries. While the waiver is not an automatic WDR program, the waiver would lay the regulatory groundwork for the future program. In other WDR-applicable industries, the programs can be overarching, and require permit holders to comply with numerous conditions. Conditions include quarterly groundwater sampling conducted by a licensed lab, extensive discharge pond design requirements, free board limits of that pond, as well as a substantial yearly fee determined by a facilities' threat potential to the groundwater basin below. The fees associated with WDR programs have risen by over 160 percent in a 6-year period, and State Water Board staff

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anticipates having to increase these fees to cover State Board payroll with the increased workload of additional industries. The fees easily reach thousands of dollars every year, with no sign of reductions or increase limitations in the near future.

This waiver would separate facilities into tiers based on the amount of water that these facilities discharge in a given season. This tiered value will also be utilized to determine the yearly waiver fee charged to those facilities to remain active and in compliance, with the highest tier paying the highest amount. The waiver would also include free board limitations for the pond, much like the WDR program. Per-acre limits on discharges of both water and solid constituents found inside of the pond could be applied to a facility's ground or agricultural fields. Another alarming aspect of the waiver includes the requirement that all discharged water contained within the pond must be removed and utilized prior to Dec. 31

of a given operating year. With the threat of the Sustainable Groundwater Management Act (SGMA) looming over producers, this waiver would not be workable for the industry.

We at the Western Agricultural Producers Association (WAPA) have been working on this specific Walnut Huller Waiver issue since the proposal. On this latest effort, WAPA put together a letter of opposition, one of only two responses submitted to the Regional Board. Regional Board representatives quickly reached out to WAPA and opened discussions on the opposition letter, highlighting that this current effort was a continuance of the current waiver format. It also noted that a future WDR effort would be worked on as required by the passage of SB-200 and the passage of the CV-SALTS program. Within the current waiver language, the Regional Board admits having limited or no information on the actual make-up of walnut huller discharge water.

This point was also an emphasis during the first waiver proposal, and so WAPA had previously volunteered to sample four walnut hullers to identify the makeup of water they were using. For four years, WAPA conducted the sampling protocol, looking at well water, as well as several samples of the discharge pond throughout the season to see the difference. Sampling also included walnut hulls since they were included in the regulatory language. This sampling is the only known data of walnut huller discharge water. WAPA is hopeful that this information will help reduce the potential regulatory burden that could be placed on walnut hullers throughout the Central Valley region, and also help craft a more workable program. Stay tuned for more updates.

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HEALTHY SOIL PRACTICES

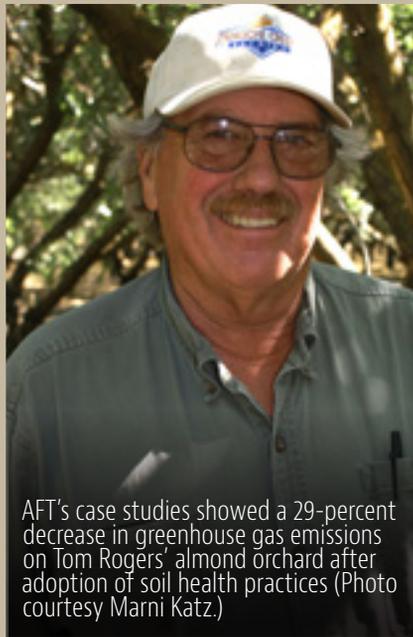
Bring Economic and Environmental Benefits to Almond Growers

By PAUL LUM | American Farmland Trust

IF ALMOND GROWERS ARE WONDERING about the economic and environmental benefits of healthy soils farming practices, new evidence shows investment in healthy soil practices has definitely been worthwhile for two almond farms in California's San Joaquin Valley.

American Farmland Trust (AFT) released eight "Accelerating Soil Health" case studies recently, which document the benefits of soil health growing practices on farm incomes and the environment. For almond production, healthy soils practices include cover cropping, nutrient management (leaf sampling, fertigation and targeted fertilizer applications), mulching the prunings, and compost application. The participating growers for the two California case studies were Ralf Sauter of Okuye Farms in Merced County and Tom Rogers of Madera County. By adopting healthy soils practices and improving soil health, both growers saw economic gains.

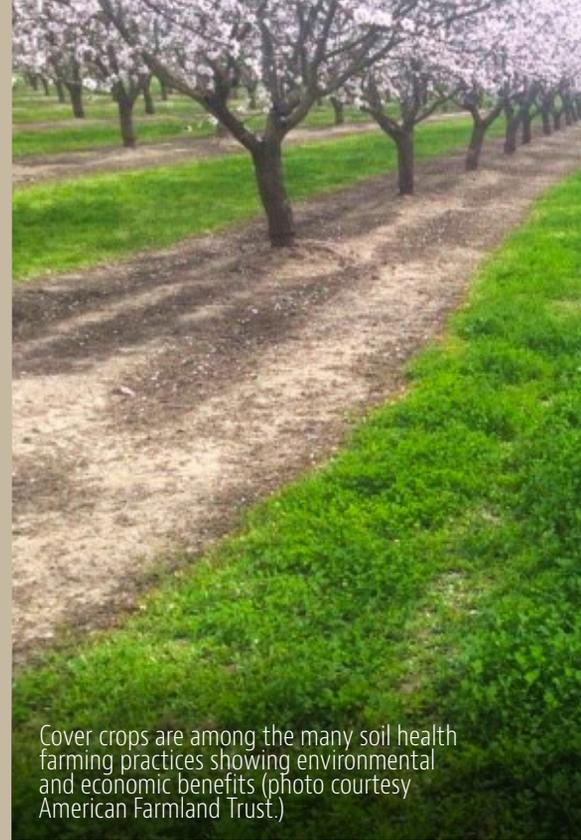
Sauter improved his bottom line by \$657 per acre over a period of 14 years, resulting in a re-



AFT's case studies showed a 29-percent decrease in greenhouse gas emissions on Tom Rogers' almond orchard after adoption of soil health practices (Photo courtesy Marni Katz.)

turn on investment (ROI) of 198 percent. Tom Rogers experienced a net return of \$991 per acre over 10 years for an ROI of 553 percent.

"Our trees are more productive, the soil is healthier, and the orchard is providing environmental benefits like better local air and water quality and lower climate emissions," Rogers said.



Cover crops are among the many soil health farming practices showing environmental and economic benefits (photo courtesy American Farmland Trust.)

"My philosophy is simple: take care of the soil and it will take care of the trees."

On-farm and university research shows that healthy, fully functioning soils offer substantial benefit to California growers, including better soil tilth and water retention, less runoff and soil erosion, improved nutrient storage, and higher soil organic matter levels. As a result, the almond trees are healthier and more productive, while growers see reduced production costs, increased yields, higher profits, and environmental benefits such as carbon sequestration and greenhouse gas reduction.

Growers often hesitate to adopt these soil health methods, because they fear the financial risk of trying something new, especially on leased land. That's why AFT is using these studies to build a growing library to scale up these soil health practices throughout the state and nation. AFT won a competitive Conservation Innovation Grant from the USDA's Natural Resources Conservation Service to produce



Ralf Sauter cited benefits including increased yield, water quality and nutrient management after incorporating soil health practices (photo courtesy American Farmland Trust.)

two California almond case studies, four corn-soybean case studies featuring farmers from Illinois and Ohio, and two New York case studies featuring diversified crop farmers. AFT is in the process of disseminating the case studies to growers, agricultural professionals, and the general public to encourage farmers to adopt soil health and climate-smart methods. The evidence is compelling.

Healthy Soils Case Studies

In 2019, California staff from AFT interviewed Sauter and Rogers, both of whom transitioned from conventional farming methods to healthy soils practices over a period of 10 to 14 years, depending on the practice. AFT staff analyzed farm inputs, equipment, and management data, which were entered into an Economic Calculator developed by AFT to run a Partial Budget Analysis (PBA). The PBA for both growers showed decreased production costs and increased net returns as a result of adopting healthy soils practices.

In addition to the Partial Budget Analysis, AFT used USDA's COMET-Farm tool to determine greenhouse gas reductions and USDA's Nutrient Tracking Tool (NTT) to quantify water quality benefits such as reductions in nitrogen losses. The almond case studies summarized the results of these climate and

Continued on Page 64

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Economic Effects of Soil Health Practices on the Rogers Farm, CA (2018)

Increases in Net Income			
Increase in Income			
ITEM	PER ACRE	ACRES	TOTAL
Increased almond yield due to soil health practices (10%)	\$689.93	175	\$120,738
Total Increased Income			\$120,738
Decrease in Cost			
ITEM	PER ACRE	ACRES	TOTAL
Fertilizer savings due to nutrient mgt (\$160/ac on potash & \$10/ac on N)	\$170.00	175	\$29,750
Fertilizer savings due to compost (50 lbs less N)	\$15.00	175	\$2,625
Pesticide savings due to compost (stopped fungicide)	\$100.00	175	\$17,500
Pesticide savings due to conservation cover (56% less herbicide)	\$99.68	175	\$17,444
Reduced irrigation water use by 25%	\$95.00	175	\$16,625
Total Decreased Cost			\$83,944
Annual Total Increased Net Income			\$204,682
Total Acres In this Study Area		175	
Annual Per Acre Increased Net Income			\$1,170

Decreases in Net Income			
Decrease in Income			
ITEM	PER ACRE	ACRES	TOTAL
None Identified			\$0
Total Decreased Income			\$0
Increase in Cost			
ITEM	PER ACRE	ACRES	TOTAL
Leaf sampling	\$3.00	175	\$525
Increased mulching cost	\$15.00	175	\$2,625
Compost application cost	\$158.00	175	\$27,650
Combined practice learning activities cost (22 hrs/yr)	\$3.07	175	\$537
Total Increased Cost			\$31,337
Annual Total Decreased Net Income			\$31,337
Total Acres In this Study Area		175	
Annual Per Acre Decreased Net Income			\$179

Annual Change in Total Net Income = \$173,345

Annual Change in Per Acre Net Income = \$991

Return on Investment = 553%

Table 1: Partial Budget Analysis table for the Rogers Farm.

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Continued from Page 63

water quality analyses.

Rogers' 175-acre almond orchard showed a 29-percent decrease in greenhouse gas emissions after adoption of these soil health practices.

As seen in **Table 1**, the left-hand column shows a 10-percent increase in yield over a 10-year period and cost savings for fertilizers, pesticides, and water, made possible over time as soil health improved, allowing for lower input requirements. The right-hand column shows the increase in costs from mulching and compost applications. As a result, after a period of adopting four soil health practices, this grower attained a significant return on investment.

Sauter was an early adopter of soil health farming methods. He told AFT that the increase in yield and environmental benefits at Okuye Farms far outweigh the costs of implementing the practices. Sauter also emphasized the water quality benefits through nutrient management that protects groundwater from nitrate pollution.

"I do all these soil health practices for their economic benefit," he said. "A lot of people talk about 'sustainable farming.' What is that? For me it's being profitable each year with healthier trees and healthier soils."

Scaling Up Healthy Soil Growing Practices

This year AFT plans to disseminate the almond case studies to fellow agricultural professionals to encourage them to

Continued on Page 66



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Continued from Page 64

use the new innovative education and outreach materials with growers who are on the fence about adopting soil health practices. AFT will also train agricultural professionals to conduct their own case studies featuring “soil health successful farmers.”

AFT is interested in finding almond growers in the San Joaquin Valley who have not yet adopted these soil health practices but are curious about them. AFT will conduct a “Predictive Assessment” for such growers to predict potential, future economic benefits from adopting the practices based on the grower’s current farming practices, as well as run the water quality and climate analyses.

For more information about case studies, predictive assessments, or to discuss soil health practices, please contact me at plum@farmland.org, or call 707-480-1893. To read more case studies, visit farmland.org/soilhealthcasestudies.

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Understanding pH

Soil pH is a standard characteristic measured by a soil test, but what does the number mean, and how does the pH affect plant growth? pH is a measurement of the power of hydrogen (hence “pH”) or H+ ions. The measurement of pH is on a 0 to 14 scale, with 7 being neutral. Note, both low pH and high pH are damaging to plants.

Understanding pH is important because it directly affects nutrient availability. Most nutrients are available in good quantities of around 6.5. The main elements affecting soil pH levels are the following:

20
Ca
Calcium
40.078
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12
Mg
Magnesium
24.305
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K
Potassium
39.0983
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11
Na
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22.98976928
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THE IMPENDING IMPACT OF CalSavers

By **AMY WOLFE** | MPPA, CFRE/AgSafe

FOR MANY years, both the state legislature and California's governor have expressed concern over the long-term future of our workforce. Across industries, many employees do not have access to company-sponsored retirement programs. While opening personal individual retirement investment accounts is an option, in the eyes of our elected officials, without an employer serving as the impetus for that action, it just wouldn't happen. This train of thought led to the creation of CalSavers, a California-sponsored individual retirement program, which continues to move forward throughout this COVID-19 pandemic. It is essential that agricultural employers understand the program, their role in it and how it will impact their workforce.

What is CalSavers?

In 2016, the legislature passed, and the governor signed into law, Senate Bill 1234, which established the CalSavers program. Employers with five or more employees who do not offer a company-sponsored retirement program are required to enroll in the CalSavers program. The program is also available to self-employed individuals seeking a retirement savings vehicle. Participants will then have an Individual Retirement Account (IRA) set-up and managed by the CalSavers team. Critical deadlines are approaching for

employer enrollment that has not been extended amid the current COVID-19 crisis (see table, pg. 69).

Employer Responsibilities

Employer registration will require the submission of the following information:

"If an employer does not register or fully engage in the program 90 days after service of notice from the state, the state can levy a penalty of \$250 per eligible employee."

- ▶ Federal Employer Identification or Tax Identification Number (EIN/TIN)
- ▶ California Employer Payroll Tax Account Number
- ▶ CalSavers access code from your employer notification

In addition to registering, employers will need to provide information on all employees at the time of registration and then on an on-going basis moving forward. The employer is responsible for sharing with CalSavers their

employees' names, Social Security or Tax Identification Number and their applicable contact information. It is important to note that an employer must provide the information for all workers, full-time, part-time, regular, and seasonal, and regardless of the length of time they have worked for the business. Once the initial registration is complete, employers must report new eligible employees within 30 days of their date of hire to CalSavers. The program has developed templates to assist employers in organizing and submitting this information.

Employers are also responsible for coordinating payroll deductions for each pay cycle. The funds will be withheld from an employee's wages after taxes and automatically provided to CalSavers for inclusion in their IRA. For 2020, employees under the age of 50 will contribute an annual maximum of \$6,000 and employees over the age of 50 will contribute an annual maximum of \$7,000. Employees will be charged a fee between 0.825% - 0.95%, depending on their investment choice. Those fees will be taken directly from their contributions and they will not receive a bill. CalSavers will work with employers to ensure the correct amount is being withheld each pay period relative to these maximums.

It is essential to understand that employees are automatically enrolled in CalSavers. Once an employer provides employee information to CalSavers, they will contact the employees directly about their participation and investment options. If the employee does not want to participate, he or she must opt out within 30 days of the employer providing their information to CalSavers. In addition, the employee must opt out

COMPANY SIZE	EMPLOYER ENROLLMENT DEADLINE
More than 100 employees	September 30, 2020
More than 50 employees	June 30, 2021
Five (5) or more employees	June 30, 2022

Employer enrollment for CalSavers program.

Employers with five or more employees who do not offer a company-sponsored retirement program are required to enroll in the CalSavers program

with CalSavers directly and not with the employer.

This latter detail is critical to understand and should be the cornerstone of employer communication about CalSavers with their workforce. It is incumbent upon employers to inform all employees of the program when the employer has provided employee details to CalSavers, that the employees should expect to receive communication from CalSavers directly about participating in the program, and how the money will be provided to CalSavers. Many in the agricultural workforce will be confused and even frustrated when additional post-tax money is taken out of their paychecks and ultimately, it will fall on the employer to communicate the legal mandate of the program, along with information on how the employee may opt out.

The program is also very prescriptive about an employer's responsibility to remain neutral about employees' decision to participate in the program. Communication should be focused on the facts about CalSavers and encourage contact with the program directly when employees have questions or concerns. Senate Bill 1234 did include language noting that employers shall not have any liability for an employee's decision to participate in the program, for their investment decisions or, for the performance of those investments. The final point is obviously critical in these current times and CalSavers has released the

following details regarding investment performance:

We continue to ensure the safe custody and investment of your contributions and timely processing of account requests. We are closely monitoring the financial markets and the performance of the CalSavers portfolios. Please know that our program and portfolios were developed with the understanding that

markets can be volatile. In addition, unless you have actively chosen otherwise, the first \$1,000 of your CalSavers contributions are invested in a Capital Preservation Fund that helps protect your savings from market volatility. We deeply hope that our savers do not experience financial hardship, but if you do find yourself in need, you may call

Continued on Page 70

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Continued from Page 69

us to learn more about your options to access your contributions.

CalSavers has also issued the following statement to employers about participation moving forward:

We know that many employers are facing unprecedented challenges right now. CalSavers is committed to supporting employers through these uncertain times by offering extra support and flexibility. If you're ready to begin facilitation, please engage with our support team so we can make it easy for you. If your deadline is coming up on June 30th and you aren't sure you will be ready to participate, please call us.

All that being said, the program continues as originally planned and that includes the penalty structure for an employer's failure to participate.

Employer Penalties

Senate Bill 1234 included monetary penalties for employers that fail to allow eligible employees to participate in CalSavers. If an employer does not register or fully engage in the program 90 days after service of notice from the state, the state can levy a penalty of \$250 per eligible employee. Should non-compliance extend beyond the initial 90 days and the employer is found to still not be complying 180 days after the notice, an additional penalty of \$500 per employee will be issued. Ultimately, the failure to register and provide the needed support to participating employees can become quite costly. To learn more about CalSavers, visit www.calsavers.com

For more information about worker safety, human resources, labor relations, pesticide safety or food safety issues, please visit www.agsafe.org, call (209) 526-4400 or email safeinfo@agsafe.org. AgSafe is a 501c3 nonprofit providing training, education, outreach and tools in the areas of safety, labor relations, food safety and human resources for the food and farming industries. Since 1991, AgSafe has educated over 85,000 employers, supervisors, and workers about these critical issues.

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FARM ADVISOR PROFILE

DAVID HAVILAND

FINDING A MEANINGFUL CAREER AT COOPERATIVE EXTENSION

By **CRYSTAL NAY** | *Contributing Writer*

UCCE Entomology Farm Advisor David Haviland

SOMETIMES, A BOYHOOD FASCINATION with bugs starts by being surrounded by flowers.

With a father who managed a large rose production nursery, David Haviland, UCCE Entomology Advisor for Kern County, often found himself working in the nursery and the packinghouse, and thus became quite familiar with the production of ornamentals.

Growing up in a small town just north of Salinas, Calif., also meant that most of Haviland's closest friends were from families also heavily involved in agriculture, particularly vegetable production. Agriculture just simply became a part of him.

As kids often are, Haviland was captivated by insects from a very young age. And while strong intrigue can be enough to pursue a particular field, it was much more than his appreciation for insects that led Haviland into entomology.

"Insects have always fascinated me, I've always loved agriculture, I enjoy interacting with people, and academics have always come relatively easily to me. There aren't a whole lot of jobs available that match every one of those," Haviland said.

Haviland may have gotten his early start in agriculture at the rose nursery, but he took his interests and background to Brigham Young University (BYU), where he studied zoology with an emphasis on invertebrates. While a student there, he took two years off and served as a missionary in Argenti-

na, where he became fluent in Spanish. After earning his degree, Haviland returned home to Monterey County and began working for the UC Cooperative Extension office there.

His two-and-a-half years as a technician with UCCE in Monterey County presented incredibly valuable experience working in entomology, viticulture, weed science, plant pathology, and with the county's other farm advisors by helping them with their research projects. After gaining a solid understanding of how UCCE works, Haviland decided to pursue graduate school at UC Davis. In graduate school, he worked on integrated pest management strategies in field crops, and was hired as a UCCE entomology farm advisor in Kern County shortly before his thesis was signed.

"And I've been here ever since," Haviland said.

Over his 20-plus years with the Cooperative Extension, Haviland has certainly seen some changes in the agricultural landscape. As an entomologist, the biggest shifts have occurred in pesticide availability and use patterns. Historically, Haviland was born the year dichlorodiphenyltrichloroethane (DDT) was banned. At the start of his career, organophosphates were very common and served as the basis for core insecticide programs. Now, the transition is toward reduced-risk pesticides, including techniques such as mating disruption and other, greener methods.

"This shift affects not only how products work, as in whether or not you can kill something, but any time you apply something to a field, it impacts something else, such as beneficial insects," Haviland said.

Because of this, one of the biggest changes Haviland notes is moving from more broad-spectrum, pesticide-heavy programs that negatively impact bio-control to much more sustainable programs with very targeted, reduced-risk pesticides that work in conjunction with biological control.

"It's very much an integrated pest management, sustainability type of shift. It's been very neat to see and be involved in," Haviland said.

Though trends may be changing in pest management, Haviland adheres to the philosophy that his job is to explain all the available options to growers so that they can make the most educated decision based on their own factors.

"It's not my job to tell growers what to do. Even with research projects, the purpose isn't to tell someone what to do, but to give them the information they need to make an informed decision," Haviland said.

The correct, or best, decision for a grower is dependent on a unique set of circumstances. Some growers are more risk averse; some like to take risks. Some growers are more environmentally conscious, while others may have economics as a higher priority.

"[Farm advisors] have to help growers understand through science

all the different pros and cons of all the different approaches,” Haviland explained. “It’s ultimately up to the farm managers and owners to decide how they’re going to run their farm, which is essentially their business.”

In many cases, varying perspectives can make these topics tougher to navigate. A grower may see things differently than a pest control advisor, who might see things differently than a field worker, who can also differ compared to a processor, salesperson, or even a consumer. Trying to find what is best for everyone requires a collaborative team effort and an understanding of how people think differently.

Haviland has seen this often firsthand. “As a farm advisor, sometimes you find yourself trying to understand where everyone is coming from as much as you’re a scientist working in hard numbers.”

Perception is a powerful thing, and Haviland sees it stretch beyond the personnel of agriculture and into how the public is influenced in its view of farms, which isn’t always favorable. As someone who is based in science and numbers, Haviland is disappointed by many of the things he sees posted on social media— things that help drive public perception— that are completely false or only partially correct, and are driven by those with a particular agenda.

“It’s very frustrating when you want to recommend something that’s totally environmentally conscious and appropriate for a farmer to use, but then, in some cases, having markets and consumers reject that over perceptions that are not based in truth,” Haviland said. “That’s one I wish I could fix, but don’t have the answer for.”

Despite the industry’s hiccups, Haviland’s greatest experiences have been when the industry and university system work together to solve a problem.

“For example, when a new, exotic pest shows up in California, it’s not my job, or the grower’s job, or the pest control advisor’s job to solve it,” Haviland said. “It’s our job to work together to come up with a response.”

Being based in Kern County, Haviland has experienced nothing



Haviland talks to growers during a recent Kern County field day. (Photos courtesy D. Haviland)

but phenomenal support from growers, commodity organizations, and pest control advisors as they all work together to solve these problems.

As the industry continues to evolve, Haviland is excited to be along for the ride. It has been quite a journey from his childhood days in the rose nursery, and he wouldn’t have it any

other way. “I couldn’t have asked for a better match— a match for what I love and what I’m good at. I’ve been very blessed.”

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Your Federal Marketing Order at Work: **BUILDING DEMAND FOR U.S. PECANS**



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

IT HAS BEEN A YEAR AND A HALF SINCE the American Pecan Council (APC) has hired a permanent executive director with full time staff. In that time, we have undergone a thorough Strategic Planning process and have implemented numerous programs that benefit the

pecan industry as a whole. Industry's unified labor is coming to fruition. The encouraging metrics and results seen from these programs thus far have shown how the federal marketing order (FMO) is succeeding.

ican Pecans, The Original Supernut—was launched, the reporting forms were approved by USDA, and APC began collecting the first-ever industry data. Additionally, APC began adopting programs, policies, and procedures to guide the industry in the years to come.

In 2018-19, APC set out to conduct a strategic plan by global consulting firm BCG to identify current challenges and key areas of focus to better position the U.S. pecan industry in the market for future success. Marketing events and activities, as well as data collection continued, official Council committees and working groups were established, and the first Pecan Congress to unify industry association efforts was held.

During the 2019-2020 year thus far, marketing programs are in full swing, and monthly data collection continues with the first round of compliance handler audits being conducted on the data received. There has been an expansion of marketing activities, industry relations, and grades and standards, and results and metrics from APC programs are being recognized. The second Pecan Congress was held in August 2019. Currently, nominations and elections for Council representatives are being held. In the upcoming 2020-21 year, we will continue to build on programs, with the first referendum right around the corner.

First Three Years

The first 18 months following the inception of the APC were a time of laying the groundwork of the FMO and starting to build an office staff. Beginning in 2016-17, the American Pecan Council was approved, an office was established, an interim director was hired, assessment collections began, and reporting forms were developed. During 2017-18, the Council chose Weber Shandwick to be our domestic marketing agency and hired a permanent executive director and staff. The first official national marketing campaign—Amer-

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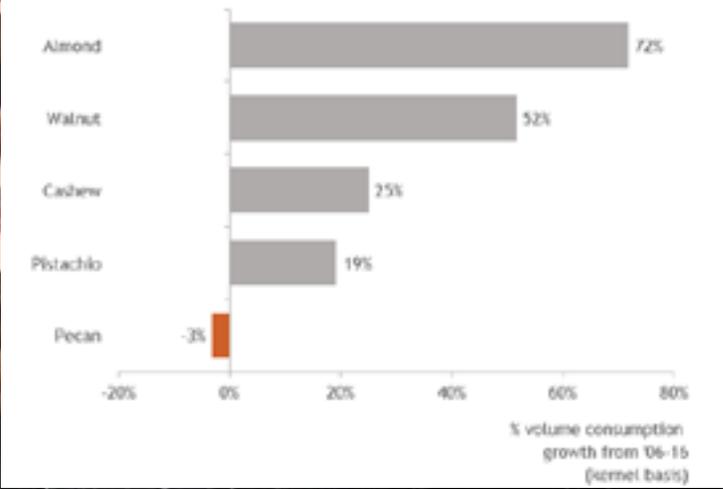
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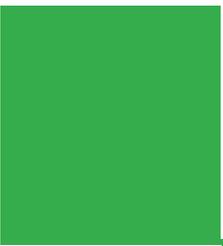
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Ten-year US pecan consumption stagnant while other tree nuts experience growth

U.S. Consumption trends since the advent of the federal marketing order for pecans reveal an upward trajectory.

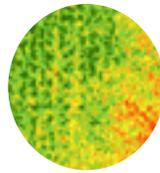
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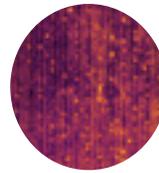
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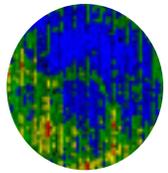
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Continued from Page 74

The Critical Need to Grow Demand

The strategic plan revealed that pecans lag other tree nuts on several critical dimensions of growth. Specifically, the domestic consumer demand has been stagnant, with U.S. awareness and growth behind other tree nuts. The same applies when we look at the overall global market. Global supply is forecasted to grow at ~6% per annum over the next 10 years. Supply is growing 33% faster than demand under the current projections. If there is no corresponding change to consumer demand, the market will be hit with surplus & potential price depression. The supply outpacing demand could lead to a gradual oversupply of up to 15% by 2027, which may have a negative impact on prices. The American Pecan industry must stimulate demand to capture new supply and diversify global demand beyond China.

'The supply outpacing demand could lead to a gradual oversupply of up to 15% by 2027, which may have a negative impact on prices. The American pecan industry must stimulate demand to capture new supply and diversify global demand beyond China.'

Made for Marketing

As a Federal Marketing Order, APC's priority is to engage in marketing activities to grow consumer demand for American Pecans. Over 75 cents of each industry dollar is invested in marketing.

Growing demand requires marketing to the end consumer to generate pull throughout the entire value chain. APC's marketing efforts are focused on the end purchaser through "pull" marketing strategies. This includes targeting our key audience primarily through digital and social campaigns.

Our vision is to increase top of mind awareness and link what we promote to consumers' choice for American Pecans at point of sale.

Diversifying the Marketing Mix

In the 2019-2020 year, APC has charged our marketing firm, Weber Shandwick, with the task of focusing their efforts solely on public and media relations as well as amplified consumer campaigns. In all messaging, healthy snacking continues to be a strong emphasis. As our Weber Shandwick team continues to raise the bar with the level of excellence and creativity they bring to this sphere, APC has also been able to reinvest valuable resources elsewhere. Repurposed dollars have enabled APC to develop a more robust and diversified marketing mix. We have laid the foundation for a highly effective integrated marketing communications

approach of reaching our target audience across multiple channels. We've accomplished this through establishing partnerships with companies such as Learfield IMG, iHeart Media, and Eat Well Global, as well as moving some influencer marketing in house through the utilization of the renowned platform, Aspire IQ.

Through Learfield IMG, we have targeted placement of advertisements to 25- to 45-year-old, nutritionally conscious mothers on NCAA athletic sites for powerhouse conferences, including the SEC, ACC, Big 12 and Pac 12. We have seen huge success with the football banner ads. In the first quarter campaign alone, there were more than 25 million actual views!

Another way in which we've reached strategic regional markets is through a 12-plus market omni channel advertising campaign conducted with iHeartMedia. Some of the regions targeted were Atlanta, Wash. D.C., El Paso, Portland, Seattle, Tucson, and Tulsa. iHeartMedia utilizes an array of marketing mediums to get messaging out, including broadcast radio, targeted audio, targeted social videos, OOT TV commercials, and targeted digital display. Since the initial launch, there have been more than 4,200 radio commercials, 2,700 television commercials, and amplified audio and banner ads. To date, pecans have had 113.9 million total views. IHM clickable assets have driven a total of 89,000 clicks to the APC website.

Eat Well Global has expanded our marketing efforts into the health and nutrition space. The purpose of this effort is to build a pecan influencer network of nutritional experts and registered dietitians. We have worked with Eat Well

Global to develop a unique "Pecan Powerhouse" brand, newsletter, and network to directly educate and equip highly motivated and influential professionals in the key sphere of health and nutrition. To date, Eat Well Global has displayed a strong presence at FNCE food and nutrition conference and expo, contracted with high-profile chefs and influencers in the health professional community, and is preparing for virtual conference, Today's Dietitian Spring Symposium, taking place this month.

Marketing Management, Measurement and Results

With all these marketing programs and activities in place, we measure success utilizing third-party analytics. This includes Digital Magnet, Aspire IQ, Nielsen data, and Trendkite. Through all these marketing efforts, pecans' share of voice during November rose from 19 percent to 32 percent compared to the previous year. This is partially a result of

the more than 200 million digital views in the first quarter alone.

We are seeing very positive results for the industry on all key tracking metrics, be that an increase of pecans on restaurant menus, exports, or social media engagements and views. Since the inception of the FMO, consumption has been up 12.5 percent. In one year, we were able to raise consumption 33.5 percent. We share all this to encourage our industry. Our united efforts are working! Yes, there are many challenges we face, but if we continue to pursue a common goal of raising demand and awareness for American Pecans, we will continue to pave the way forward toward future success.

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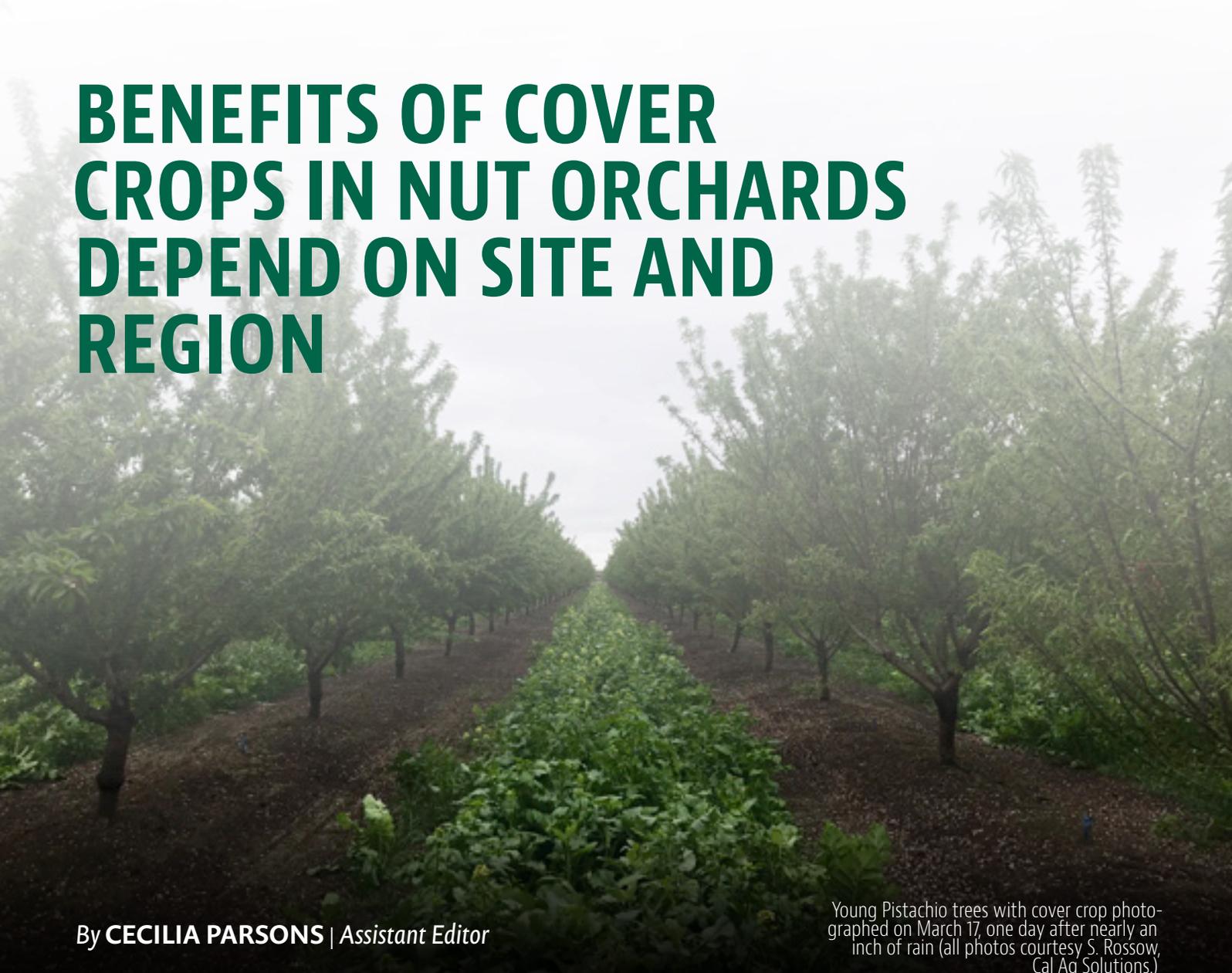
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BENEFITS OF COVER CROPS IN NUT ORCHARDS DEPEND ON SITE AND REGION



By **CECILIA PARSONS** | Assistant Editor

Young Pistachio trees with cover crop photographed on March 17, one day after nearly an inch of rain (all photos courtesy S. Rossow, Cal Ag Solutions.)

INTEGRATING COVER CROPS INTO TREE nut orchards can promote soil health and dust reduction benefits, but achieving the desired results may take a reality check. The grower should consider their goals with a cover crop and how it fits into their management system, sources said. They should understand that cover crop goals are not achieved in one season and benefits from this practice may not be realized until the system has been in place for several years. As soil organic matter increases over time, cover crop viability also increases.

Choosing the Right Seed Mix

Pistachio and almond growers in the southern San Joaquin Valley have

additional challenges establishing cover crops in their orchards compared to their fellow growers to the north. Germination isn't always achieved with rainfall there, and the cost and effort of planting can be wiped out with a poor stand.

A recent cover crop trial in Kern County was designed to show how different cover crop seed mixes fared in the tougher growing conditions of that region. Kern County UCCE Community Education Specialist Shulamite Shroder said scarcity of fall/winter rainfall and compacted and erosion-prone soils presented challenges for the five seed mixes planted. The mixes chosen were not planted in nut orchards but planted in an open field

and a vineyard to determine if a good stand could be obtained. Shroder said the mixes were supposed to be hardy enough to grow without irrigation, but to ensure germination, water was applied in November. Plantings received another irrigation at the end of February. The mixes were planted Nov. 5.

All the mixes would be suitable for planting in tree nut orchards, he said, but should be chosen based on site-specific conditions. Regions with high winter rainfall and orchards with less compacted soils are best suited to establishing good cover crop stands. Ease of decomposition is a factor in a

Continued on Page 80

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Rainfall at the right time, as shown in this mature pistachio orchard, can usually provide enough moisture for germination.

Continued from Page 78

decision to plant in almonds, while a mix that would take longer to decompose would work better in a pistachio orchard.

Shroder's mixes included an annual plowdown mix, an erosion control mix, a soil crack mix, a clover mix and a mustard/pollinator mix. When considering a mix of species to plant, the main considerations are orchard irrigation system and water demand of cover crop, soil type and tillage,

price and availability of cover crop seeds. The mustard/pollinator mix consisting of canola, mustards, and daikon, has the best stand of the five mixes and was planted in the vineyard test plot.

Silas Rossow, with the crop management company Cal Ag Solutions, said cover crop planting has accelerated in almond, pistachio and walnut orchards as growers look to address water infiltration and nutrient cycling challenges. Due to increased interest in cover crops, Rossow said

CAS designed a simplified seeding tool adapted to California planting conditions. Their no-till cover crop seeder sets the seed into the soil with minimal soil disturbance. Several thousand acres of cover crops were planted with this tool starting just prior to the first rains last fall. Rossow said they continued to plant cover crops into February.

"We are trying to match the seed with the resource concerns," Rossow said. Depending on the orchard needs, they are planting a seed mix that will work in specific conditions including compacted soils and erosion-prone soils.

"You can't just throw seed out. There has to be a long-term goal for the cover crop to be a benefit for years to come. It takes time," he added.

Cover Crop Research Review

A team of UCCE researchers and farm advisors reported in a cover crop research review that the practice is compatible with almond production, but has not been widely implemented throughout all growing regions due to operational and management concerns.

Shroder said growers might not have access to seeding equipment. They may also have to make time for removal of the crop prior to harvest.

The UCCE team said that while cover crops can provide significant soil health benefits, there remains a need for development of a management system growers can use.

The UCCE team's cover crop trial in Kern County showed that after the first season where soil was

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Planting multi-species cover crops spreads out the weather risks, as shown in this almond orchard with cover crops.

heavily compacted, soil aggregate stability improved. Water infiltration improvements were also predicted for the second year. These changes suggest reduced risk of water runoff during rain events.

Their research also showed that if nitrogen released from a cover crop is synchronized with tree demand, less applied fertilizer is needed. Vetch in a cover crop provided rapid carbon and nitrogen turnover with 90 percent of nitrogen released within four weeks of termination when moisture levels were adequate. Compared to resident vegetation that grew in an orchard, a planted cover crop can contribute more nitrogen. In a Tehama County trial, the cover crop contained on average 5.5-percent nitrogen compared to 3.7 percent in the resident vegetation. Merced County nitrogen was at 3.1 percent in the cover crop compared to 2.4 percent in resident vegetation.

Additional benefits cited by the research team are habitat and nutrient sources for pollinators and, if stands are good, weed suppression. Some brassica species showed potential as bio fumigants, but successfully using a cover crop to suppress nematodes depends on the level of infestation.

Residues, Water and Sanitation

The UCCE research team concluded that mowing and herbicide applications post bloom effectively removed the potential for interference with a clean harvest. Equipment, including the StickJack, can be used to remove larger woody residue.

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Planting multi-species cover crops spreads out the weather risks, as shown in this almond orchard with cover crops.

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According to the research team, cover cropping does not seem to interfere with NOW sanitation, and it may facilitate it by providing better access to orchards in the winter. The crop can also provide overwintering sites for beneficial insects and predatory mites.

If terminated at the right time and controlled adjacent to trees, competition for irrigation water can be minimal. Resident vegetation, weeds and native grasses in an orchard have been shown to require 35 percent more water than orchards with bare floors.

Mowing during the winter months may be necessary to control cover crop stand height. Frost risk in the spring can be mitigated by mowing the cover crop. Termination of the crop to prepare for almond harvest can be done with herbicides, mowing or rolling.

Justin Nay, pest control advisor on almond and pistachio ranches in the north and south Central Valley, agreed cover crops provide important benefits including improved water infiltration and better equipment access during winter months. The downside, he said, is that most cover crops, except those that are grass, tend to foster plant bugs, and mowing may disturb these pests and send them into the trees where they can cause crop damage. His strategy is to mow right before bloom and leave the crop until the end of May or early June. If the cover crop is intended to attract bees, he said, that may create pest control challenges in treating for plant bugs when bees are present.

Grower goals for their cover crops can vary as much as the seed mixes they plant in their orchards. Whether they plant for bee forage, soil health, or to just be able to access their orchards after a rainfall, a cover crop can be a solution for orchard challenges. Growers just need to make decisions for planting and managing those crops based on their specific site conditions.

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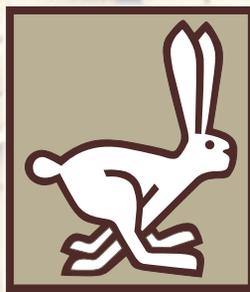


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FINDING PRACTICAL ALTERNATIVES TO AGRICULTURAL PPE DURING THE CURRENT SHORTAGE

By WHITNEY BRIM-DEFOREST |

UCCE County Director, Sutter and Yuba Counties

LISA BLECKER | Coordinator, Pesticide Safety Education Program

A. KATRINA HUNTER | Pesticide Safety Writer, UCIPM Program



If the pesticide label requires a particulate respirator, such as an N95, you can wear an elastomeric mask respirator with organic vapor filtering cartridges, but only if N95 particulate pre-filters are added.

IN MARCH A NATIONAL EMERGENCY WAS DECLARED FOR THE novel Coronavirus and the Defense Production Act invoked to ensure that ventilators and PPE are distributed to healthcare workers in response to the pandemic.

This act empowers the Federal Emergency Management Agency, or FEMA, to work from the top of the supply chain and directly with manufacturers of PPE, such as 3M and Dupont, to prioritize supplies of N-95 respirators, protective clothing, and other PPE for medical staff, ensuring that they receive the supplies necessary to address the pandemic.

Before the pandemic, 10 percent of N-95 respirators from 3M went to healthcare; that number is now 90 percent.

This has led to significant backorders of PPE supplies for distributors. Carl Atwell, president of Gempler's, explains that normal lead times for PPE before the crisis was up to 10 days. Now, current reports from suppliers shift daily as manufacturers work to address the executive order.

Estimated times for the availability of disposable respirators suggest fall of this year; and the estimated wait for other PPE supplies is August.

Suppliers are working to significantly ramp up production of PPE: The company 3M announced plans to produce 50 million units of respirators in the U.S. by June for domestic distribution, compared to the 13 million manufactured in the U.S. before the crisis.

"There is a tremendous need, but when you put that much supply chain resources behind it, you intuitively believe that we should catch up at some point," Atwell says. He encourages agricultural producers to find ways to communicate with each other and distribute PPE as one way to mitigate the shortage. Atwell also suggests looking for lesser known brands of PPE: "Don't just go to your first tier of choice."

On their company website, disposable protective clothing is available from brands like Keystone rather than the more recognizable Tyvek® coverall from Dupont, including reusable chemical-resistant clothing as opposed to their disposable counterpart. Supplies in high demand include reusable and disposable nitrile gloves, protective clothing, and disposable respirators, including certain protective eyewear, such as goggles and face shields. Although this could change in the days ahead, half-mask and full-mask respirators are more available than disposable N-95 respirators for now.

Since there are many of us in agriculture that will be applying pesticides soon or in the near future, here are some common questions and answers on how to meet PPE requirements as the shortage continues.

Q. I heard that the CDC is loosening regulations on PPE requirements for healthcare workers. Is this the case for agriculture?

Answer:

No. The label is the law. PPE requirements on pesticide la-

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Some common chemical resistant materials for gloves are barrier laminate, butyl rubber, nitrile rubber, neoprene rubber, natural rubber, polyethelyene, polyvinylchloride (PVC), and viton rubber.

For applications using a backpack sprayer, where contact with spray residue is likely, coveralls should be added.

bels are written by the U.S. EPA, while state PPE regulations are overseen by the California Department of Pesticide Regulation; neither of these agencies have loosened their regulations for PPE.

Q. Should I stock up on PPE?

Answer:

No. Purchase the PPE that you anticipate needing for the growing season to avoid overstocking and shorting available supplies. Choose reusable PPE whenever possible.

Q. What if I can't find the respirator that is required on the pesticide label?

Answer:

Option 1: Seek alternative, more protective respirators:
 Applicators may not know how to decide which is the appropriate respirator to choose if the one the label requires them to wear is not available. For example, if the label requires a particulate respirator, such as an N-95, wearing a half mask respirator with organic vapor filtering cartridges will not protect you from particulates. However, wearing an organic vapor filtering cartridge with N-95 pre-filters will.
 With an increase in PPE, the risk for heat illness increases.

If an employee or applicator is wearing a different respirator than normal,

they will need to repeat their medical evaluation, annual fit test and annual respirator safety training to correspond with the new respirator.

Option 2: Seek alternative pesticide products that do not require a respirator:

Currently, there is not one central list of pesticide products that require respirators, so a grower, applicator, or pest control advisor will need to consult all potential pesticide product labels for respirator requirements. Consider visiting www.agrian.com to review PPE requirements quickly in search results under the "safety" tab of a product.

Q. What if I can't find the right chemical-resistant gloves that are 14 mils thick?

Answer:

Nitrile gloves are in high demand. Handlers must always wear gloves

made of the material listed on the label but consider searching for reusable chemical-resistant gloves made of other materials that still comply with the requirements of the label. Some common chemical resistant materials for gloves are barrier laminate, butyl rubber, nitrile rubber, neoprene rubber, natural rubber, polyethelyene, polyvinylchloride (PVC), and viton rubber. With the exception of barrier laminate and polyethylene, chemical resistant gloves are required to be at least 14 mils thick.

Disposable gloves made out of chemical resistant materials listed on the label less than 14 mils thick can be worn, but for no more than 15 minutes at a time and then disposed of. This may be an option for mixers or handlers who are conducting tasks that require more dexterity. Consider that removing and replacing disposable gloves every 15 minutes is likely

a requirement that is not feasible to comply with. Also, thinner gloves cannot be layered on top of one another to add up to 14 mil.

15 mil disposable nitrile gloves are manufactured by suppliers such as, Showa and Cordova Safety among others. If available, they can be worn for the duration of the handling task, so long as they remain intact.

Label Code	Materials Required by Law	Material Code
A	1,2,3,4,5,6,7,8	1: Laminate
B	1,2	2: Butyl
C	1,2,3,4,7,8	3: Nitrile
D	1,2	4: Neoprene
E	1,3,4,8	5: Natural
F	1,2,3,8	6: Polyethylene
G	1,8	7: PVC
H	1,8	8: Viton

All but Laminate and Polyethylene must be 14 mils or thicker

Glove Category Selection Key developed by the California Department of Pesticide Regulation (DPR) to help label readers identify the correct glove material.

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Reusable cotton coveralls can be used if Tyvek coveralls are not available.



Face shields protect against splashing during mixing and loading. Goggles and safety glasses that meet all the requirements are an appropriate substitute for other handling tasks.

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Reusable 15 or 22 mil nitrile gloves are compliant with the majority of handling tasks.

Q. How do I know when to wear a coverall and which ones will protect me?

Answer:

Coveralls must be worn if the pesticide label specifies they are required in the PPE section, or if handling a pesticide with a DANGER or WARNING signal word. For applications

where contact with spray residue is likely, such as a backpack or air blast application, coveralls should be added. They can be made of any closely woven fabric, most commonly Tyvek or a tightly woven cotton.

Coveralls must be provided by the employer and if a reusable cotton coverall is chosen, the employer is responsible for laundering them. A chemical resistant suit worn over work clothing is an appropriate substitute for coveralls, but there is an increase in the risk of heat illness when worn because they are made of a heavier material than

most coveralls.

Q: What if I can't find a face shield?

Answer:

Face shields protect against splashing during mixing and loading and must be worn if specified by the pesticide label. The only substitute for wearing a face shield is using a full-face respirator.

If the label does not specify that eyewear is required, or if it requires "protective eyewear", you can choose to wear either a face shield, goggles, or safety glasses that provide front, side, and brow protection and meets the American National Standards Institute (ANSI) Z87.1 standard for impact resistance.

If questions or concerns arise, contact your county agricultural commissioner for more information and assistance during this time.

Carl Atwell from Gempler's is willing to be a personal resource at this time for those wanting to discuss supplies of PPE and with other related questions. He can be reached at: carl@gemplers.com.

Alec Garcia from Woodland Farm Supply in California is available to help with requests for supplies of N-95s or other masks that comply with regulations that come available. You can reach out to her directly and she can provide you with updated information regarding restocking at agarcia@growwest.com.

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— Steve Gruenwald, Grower’s Choice Crop Consulting

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— Douglas Light, Ph.D., United States Department of Agriculture (USDA)/ Agricultural Research Service (ARS), Retired



Brad Higbee, Director of Field Research for Trécé and Dirk Ulrich, almond grower/consultant

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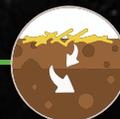
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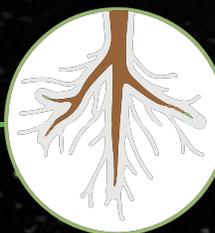


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