

WEST COAST NUT

May 2018 Issue

SPOTLIGHT:

First Sterile Insect
Release is a Test for
Pistachio Industry

See page 4

In This Issue:

Ant Control is Important in Almonds

What You Need to Consider Before
Building a Walnut Huller

What Every Grower Should Know Before
Choosing a Pistachio Rootstock

Understanding Grower Liability in
Nutrient Management Planning



JCS MARKETING
PUBLICATION

Central Valley

Almond Day

June 20, 2018

7:00am - 2:00pm

FREE EVENT
& Trade Show

Fresno Fairgrounds Commerce Building

1121 S. Chance Ave, Fresno, CA 93702

Central Valley Almond Day Agenda

2.0 PCA CE Credits (2.0 Other) (pending approval)

3.0 CCA CE Credits (pending approval)

7:00am - 7:30am	Registration
7:30am - 8:00am	Trade Show* (0.25 PCA: Other)
8:00am - 8:30am	Overview of ABC and It's Technical Toolbox: Water, Nitrogen and Sustainability* (0.5 CCA) Almond Board of CA, Sebastion Saa
8:30am - 9:00am	Whole Orchard Recycling and Nitrogen Considerations in Second Generation Orchards* (0.5 CCA) Brent Holtz, UCCE Farm Advisor, San Joaquin County
9:00am - 9:30am	Influence of Almond Spur Characteristics on Productivity Elizabeth Fichtner, UCCE Farm Advisor, Tulare County
9:30am - 10:00am	Canopy Light Interception and Yield Potential in Almond Bruce Lampinen, UCCE Walnut Specialist, UC Davis
10:00am - 10:30am	Trade Show
10:30am - 11:00am	Irrigating Almonds - Summer through Postharvest* (0.5 CCA) David Doll, UCCE Farm Advisor, Merced County
11:00am - 11:30am	Almond Canker Disease Identification and Management* (0.5 PCA, 0.5 CCA) Florent Trouillas, Assistant Cooperative Extension Specialist
11:30am - 12:00pm	Managing the Top 10 Most Wanted Weeds* (0.5 PCA, 0.5 CCA) Kurt Hembree, UCCE Farm Advisor
12:00pm - 12:30pm	Navel Orangeworm Monitoring and Management* (0.5 PCA, 0.5 CCA) Brad Higbee, Field Research & Development Manager for Trécé
12:30pm - 1:30pm	Industry Tri-tip Lunch Yara Sponsored Presentation: To Be Announced
1:30pm	Trade Show* (0.25 PCA: Other)
2:00pm	Adjourn

*Sessions counted toward CE credits (pending approval)

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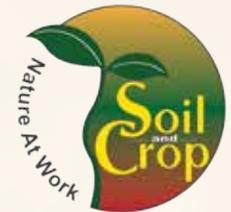
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WEST COAST NUT

By the Industry, For the Industry

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FEATURED ARTICLE

Aiming to suppress burgeoning navel orangeworm (NOW) populations in California pistachio orchards, the pistachio industry is following in the footsteps of the cotton industry and continues to pursue a sterile insect program adding another control tool for growers.

See the full story on page 4



STERILE INSECT RELEASE SHOWS PROMISE FOR NOW CONTROL IN *PISTACHIOS*

By Cecilia Parsons | Associate Editor

Aiming to suppress burgeoning navel orangeworm (NOW) populations in California pistachio orchards, the pistachio industry is following in the footsteps of the cotton industry and continues to pursue a sterile insect program adding another control tool for growers.

Delivered to a 1,250 acre test plot in western Kern County this spring will be five million sterile navel orangeworm adults. Taking a page from the cotton industry's successful pink bollworm eradication program, the project is aimed at reducing numbers of NOW early in the season to head off much larger crop damaging NOW populations later.

Sterile Insect Releases

The release plan, said Bob Klein, director of the California Pistachio Research Board, is for one million moths per day to be delivered via fixed wing aircraft, to the test plot. The releases will be made in the early morning hours from 500 feet up. Another 1,250 acre block of pistachios will be used as a control. Both blocks will continue to receive standard NOW control with sanitation, mating disruption and pesticide applications.

These releases, Klein said, are the first in a three year program focused on NOW suppression and lowering crop damage percentage and to determine success of the delivery method.

Sterile insect releases are being scheduled to match emergence of native adult NOW moths from overwintering sites. The aim is to end the reproduction cycle for as many NOW adults as possible by releasing sterile NOW when males are seeking females to mate. High numbers of sterile insects are needed to out-compete native NOW.

Klein said the sterile insect releases are believed to work best early in the season when NOW populations are lower. The sterile Insect program is a suppression program, Klein stressed, and if it proves successful, can be another tool for growers to protect their pistachio crops.

Crop Loss

Navel orangeworm (*Amyelois transitella*) has caused record high crop damage in pistachio nuts for the past two harvest seasons, reaching two percent in 2016 and over two percent last year. From those crops, there were 18 million pounds of pistachio nuts rejected by processors each year. In addition, there were uncounted millions of pounds of damaged nuts left in orchards. Navel orangeworm feeding on pistachios also introduces the toxic mold, aflatoxin, in the nuts, causing loss of export markets.

Loss of pistachio crop volume and processing costs to sort out the damaged nuts, plus market rejection due to aflatoxin are costing pistachio growers and

processors \$400 million per year, Klein reported at the annual Pistachio Day event. Stories about consumers finding NOW larvae in their bags of pistachio nuts made the rounds on the Internet last year.

NOW Management

Pistachios are not the only nut crop affected by NOW feeding, but their split shells offer an easy feeding opportunity and a depository for NOW eggs. NOW is also a pest in almonds, but after that crop is harvested, NOW readily moves into pistachio orchards to feed and lay eggs in split nuts.

Most pistachio growers have adopted better orchard sanitation practices, are using mating disruption and have chemical control programs in place to combat NOW. Each of those activities adds to total production costs and in the case of chemical control, growers have experienced lower efficacy due to resistance development to many chemicals.

Sterile Insect Research

The Administrative Committee for Pistachios and the California Pistachio Research Board committed funding in 2017 to continue sterile insect research. The first step was to determine if NOW could be raised in sufficient numbers to

Continued on Page 6



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Continued from Page 4

have an impact. The mass rearing project has been conducted at a United States Department of Agriculture (USDA) operated facility in Phoenix, Arizona which was used by the cotton industry for many years to rear pink bollworm for their sterile insect eradication program. With funding, the Pistachio Research Board has been able to keep the facility open while determining if NOW can be mass raised.

Mass raising pink bollworm, sterilizing the adults and releasing them in cotton fields was hugely successful, Klein said, as the facility was able to produce 60 million per day when needed. Mass rearing of NOW has some challenges due to its biology.

Producing high numbers of adult NOW are critical to the feasibility of the sterile release project. Jeff Gibbons with Setton Pistachio said that unlike pink bollworm, NOW fly away after pupating and capturing the one-third inch size moths is difficult. Progress in mass rearing has been made in the last year, however, and the facility can now produce about one million NOW a day. Work at the facility has also included development of a NOW diet, conducting NOW irradiation testing for sterilizing the moth. A new, more fertile colony of NOW has also been established at the facility.

Gibbons, who serves on a technical subcommittee with Western Agricultural Processors Association, said another benefit of testing the efficacy of the sterile insect release would be gaining interest of the almond industry.

Irradiation

Irradiation or sterilization of the NOW moths to be released is the final process prior to release. Klein said the Arizona facility now has the capacity to irradiate only one million moths per day. Scaling up the process will eventually be possible, but would add to the cost. Gibbons also said that additional material for the radiation process would be required. The facility can handle the volume, he said, but costs will increase at higher production numbers.

If this season's sterile release program proves successful, Gibbons said generating the numbers of sterile NOW to cover all of the state's producing pistachio

acres would be critical to success of the program.

Trapping

Following release of the sterile NOW, Klein said there would be a trapping program to determine the ratio of released and native NOW. The sterilized moths, he said had a pink dye in their diet prior to release and when they stick to the trap and are squashed, they can be identified by the pink dye. Researchers will also monitor egg laying rate in the almond orchard. Klein noted that the desired result at the end of the season will be a lower percentage of NOW damaged nuts harvested.

Incentives

A Sterile Insect Program is expected to cost the industry \$45 million per year or about \$30 per acre for growers. The incentive for grower support are processor bonus programs that pay 40 cents per pound for quality. With yields of 3,000 pounds per acre, the bonus payments can add another \$1,200 per acre for a \$30 cost.

Relying on chemical controls for NOW suppression will cost growers more in the long run. Navel orangeworm has a propensity to become resistant in fewer generations, making it difficult for chemical companies to develop new insecticides that will be effective.

Roger Isom, president of Western Agricultural Processors Association said support from all commodities affected by navel orangeworm damage would be critical to the success of a sterile insect program. There are still unanswered questions about the impact the sterile releases will have on the native NOW population, he said.

"There has to be total buy in from all involved in fighting this pest. There is a high level of interest from some and some are skeptical, but one thing is for sure: what we are doing now is not enough."

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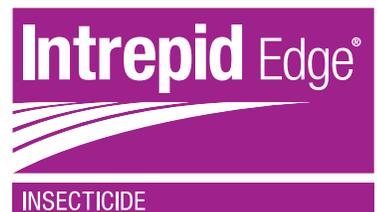
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Walnut Husk Fly Control

By Dani Lightle | UCCE Orchards Advisor, Glenn, Butte & Tehama Counties

Walnut Husk Fly. Photo courtesy of UC Statewide IPM Program, University of California.

Many growers lucked out in 2017, as walnut husk fly (WHF) didn't bother to make much of an appearance in most locations. That doesn't mean we will be off the hook this year: some pupae overwinter for two years in the soil, and the weather conditions across the state were much drier and possibly less damaging to overwintering WHF as the winter of 2016-17. Since a bad WHF year can result in multiple sprays within a walnut block, it's best to get a handle on your WHF control plan prior to the first insect trapped this season.

Walnut husk fly has one generation per year. It overwinters as a pupa in the soil. Adults begin to emerge in June and continue emerging through August. The first two weeks of a females' life, she mates and matures eggs, after which she oviposits in clusters in the husks of de-

veloping walnuts. The maggots develop over the next three-to-five weeks, then drop to the soil and pupate for the winter.

Symptoms of husk fly damage are initially small oviposition stings that can be easy to overlook, followed by the husk turning black and mushy (pretty difficult to overlook). Later season infestations lead to shell staining that cannot be removed by bleaching and cannot be sold in-shell. Early season infestations result in husks that do not separate from the shell at harvest at all, and may also impact kernel quality and color.

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Hang your monitoring traps by June 1st. A standard option is the Trécé Pherocon AM NB yellow sticky trap charged with an ammonium carbonate lure. Research in 2012-13 by University of California (UC) Berkeley entomologist Dr. Bob Van Steenwyk and University of California Cooperative Extension (UCCE) Farm Advisor Janine Hasey found that the Alpha Scents back folding trap baited with an Alpha Scents RHA-COM lure; Alpha Scents back folding trap baited with a Trécé Mega lure; and Suterra WHF trap with a Suterra WHF lure performed as well as, or better, than the standard ammonium carbonate lure. Traps should be placed in hot spots from previous growing seasons, on the north side of the tree in a shady location, and as high in the canopy as practical, with approximately two traps per 10 acres. Check traps two to three times per week (plan on three times per week to catch the first flies), and replace the sticky trap as needed when the trap loses its stickiness due to dust or high insect catches. Look for colorful flies roughly the size of a house fly (1/4 inch) with a yellow spot on their back. Both genders have a dark or black V at each wingtip.

Decision making for treatment timings of WHF typically take one of three forms (listed below from most effective

for control method timing to least effective). Suggested treatment timings are listed for each option (the exception is control using GF-120®, page 10).

1. The “squish” test: identify whether the flies in the trap are males or females. Females can be distinguished by the pointier abdomen and the yellow front leg (males have a rounded abdomen and black on the upper part of the leg). Once females have been identified, squish away! Gently press on the abdomen and squeeze out the small eggs resembling rice grains. Once the first female with eggs has been found, treat as soon as possible.
2. The overall trap count method: keep track of trap counts each trap check (two to three times per week). When there is a sharp increase in WHF trap counts, treat as soon as possible.
3. The damaged nuts method: observe nuts in the orchard for WHF stings. Treat when stings are observed. This is obviously less than ideal since crop damage has already occurred—much of it in the

Continued on Page 10

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upper canopy, which you aren't able to see as well. However, keeping an eye out for stings can give you an indication of how well your treatment program is doing and if adjustments need to be made.

Control using GF-120® is the exception to all suggested timings listed above, as you will want to begin GF-120® bait treatments as soon as catching the first fly instead of waiting for females with eggs or spikes in trap catches.

All WHF treatment options should be applied with an insect bait (GF-120® already has a bait included). Because the bait lures the fly to the treated leaves, full coverage is not as critical unless the orchard has a history of high WHF damage. When treating organic orchards, be sure that both the active material (e.g. Entrust®) AND the bait are organically acceptable. Assuming that all flies have been killed by each application, the treatment interval for WHF is typically approximately every 3 weeks.

The efficacy table is a summary of WHF efficacy

Efficacy Table

ALWAYS CHECK CURRENT LABEL FOR REGISTRATION STATUS, ALLOWABLE RATES, AND OTHER RESTRICTIONS.				
Trade Name	Active Ingredient	IRAC Group	Rate/Acre	Efficacy Rating *
Assail	acetamiprid	4A	6.0 oz	++++
			4.0 oz	+++
Athena + Brigadier	bifenthrin and abamectin + zeta-cypermethrin and chlorpyrifos	3A, 6 + 3A, 1B	20.0 fl. oz + 12.8 fl. oz	+++
Athena	bifenthrin + abamectin	3A	20.0 fl. oz	++
Baythroid	beta-cyfluthrin	3A	2.8 fl. oz	+++
Belay	clothianidin	4A	6.0 fl. oz	+++
			3.0 fl. oz	++
Brigade + Brigadier	bifenthrin + zeta-cypermethrin and chlorpyrifos	3A + 3A, 1B	16.0 oz + 12.8 fl. oz	++++
Danitol + Belay	fenpropathrin + clothianidin	3A + 4A	21.3 fl. oz + 6 fl. oz	++++
Danitol	fenpropathrin	3A	21.3 fl. oz	+++
Delegate	spinetoram	5	3.2 oz	++
Intrepid Edge	spinetoram and methoxyfenozide	5, 18	12.75 fl. oz	++
Leverage 360	beta-cyfluthrin and imidacloprid	3A, 4A	2.8 fl. oz	++++
Malathion	malathion	1B	64.0 fl. oz	—
Stallion + Brigadier	zeta-cypermethrin and chlorpyrifos + bifenthrin and imidacloprid	3A, 4A + 3A, 1B	11.8 fl. oz + 12.8 fl. oz	++++
Warrior	lambda-cyhalothrin	3A	2.56 fl. oz	++

*Rating scale: ++++ Excellent Efficacy (95-100% control), +++ Good Efficacy (75-95% control), ++ Moderate Efficacy (50-75% control), + Little Efficacy (20-50% control), --- No Efficacy (0-20% control)

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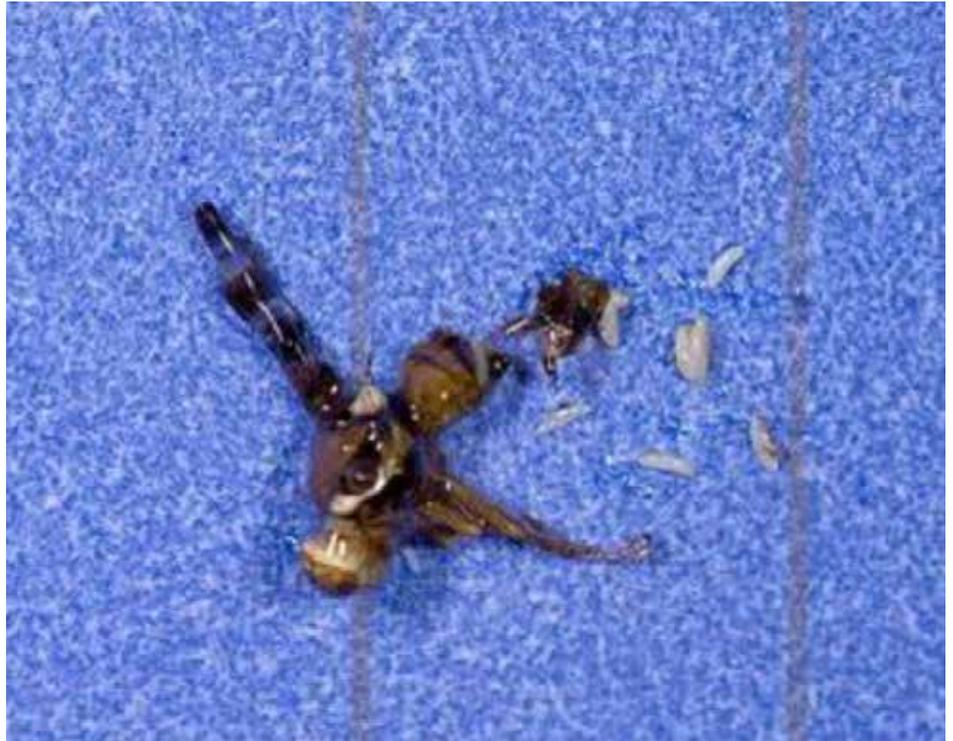
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Female that has undergone the squish test. Seven eggs can be seen to the right of the fly's abdomen. Photo copyright: UC Statewide IPM Program, University of California.

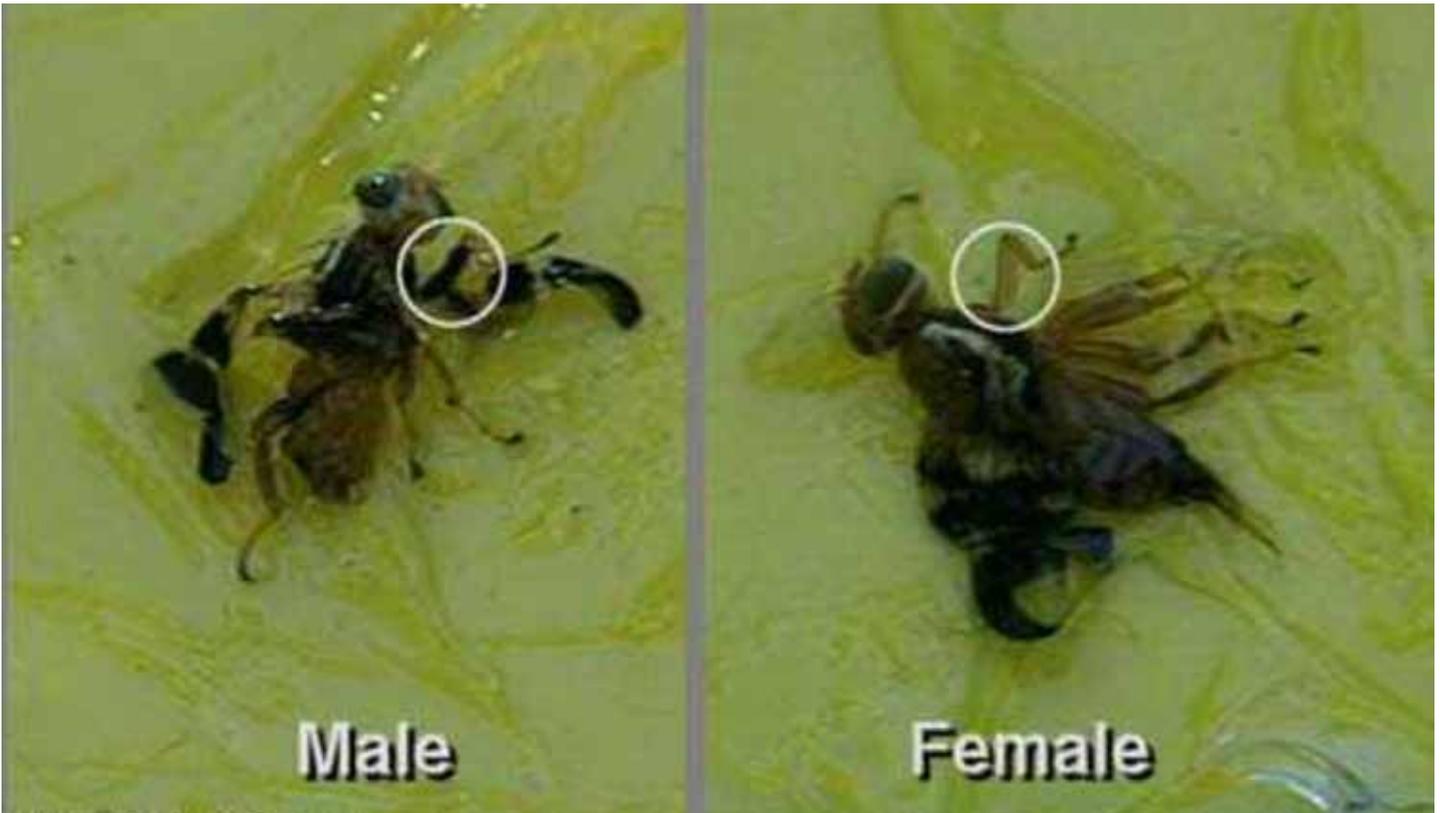
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data from a decade of research by Dr. Bob Van Steenwyk and UCCE Farm Advisor Bill Coates in a high WHF pressure orchard in San Benito County. Treatments were applied with a hand-gun orchard sprayer operated at 200 psi with a final spray volume of 300 gal/acre. All applications included NuLure® bait and an adjuvant at label rates. Three to four treatments a year were applied, with timings decided using the trap catch method described above. Each trial had four single-tree replicates. Efficacy ratings are based on nut infestation levels on 125 nuts just prior to harvest.

More information on walnut husk fly can be found on the UC IPM Walnut Guidelines (<http://ipm.ucanr.edu/PMG/selectnewpest.walnuts.html>) or at Sac Valley Orchards (www.sacvalleyorchards.com/walnuts).

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





Sticky trap with male (left) and female (right) walnut husk flies. The sexes can be distinguished by the forelegs, which are yellow in females and black in males (circled). Photo copyright: UC Statewide IPM Program, University of California.

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WHAT EVERY GROWER SHOULD KNOW

BEFORE CHOOSING A PISTACHIO ROOTSTOCK

BY CECILIA PARSONS | ASSOCIATE EDITOR

Pistachio acres and growers keep increasing in numbers, but since this crop is in relative ‘infancy’ compared to other nut crops, knowledge gaps remain.

The Rootstock

The foundation of an orchard, the rootstock, may be one of the least understood elements of pistachio production, yet it is a dynamic part of the industry. Choices in pistachio rootstocks, limitations of rootstocks and what growers can and cannot expect in productivity are all important aspects of pistachio production.

Cliff Beumel, executive vice president of Sierra Gold Nurseries in Yuba City, said rootstock availability and

unknowns in their adaptability to soil conditions and disease resistance have spurred development of new rootstocks since the 1970s.

Southern San Joaquin Valley pistachio grower Brian Blackwell noted that pistachio rootstock breeders and growers are still learning about how the trees grow over time and how they adapt to the relative comfort of California growing conditions compared to their native Iran.

Rootstock Research

University of California Cooperative Specialist Louise Ferguson who has conducted extensive research into pistachio physiology said the industry still lacks long term rootstock trials with clonal varieties. Rootstocks adapt the scion variety to

the soil. How well they perform in the conditions present will determine tree health and productivity.

Conditions are the deal breaker with a rootstock. Soil salinity or sodicity, freeze events and disease all affect the ability of a rootstock to thrive. Their tolerance or resistance to conditions when verticillium wilt was affecting thousands of acres of pistachios in the 1970s and 80s, the rootstock Pioneer Gold 1’s tolerance to that disease saved the industry.

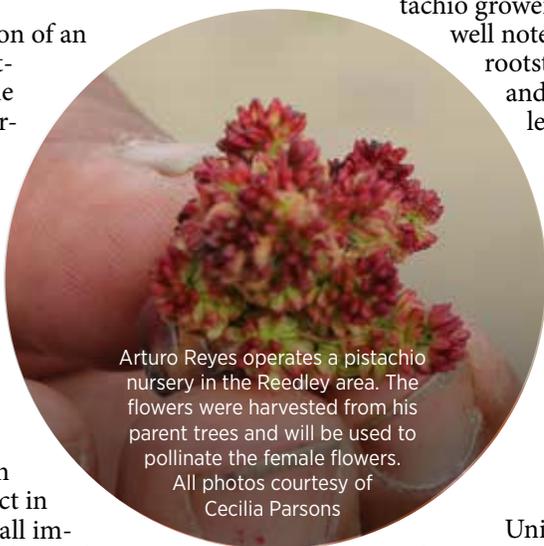
The Orchard Site

The orchard site, said all three sources for this article, is the first thing a grower should consider when choosing which rootstock to use.

“With high sodium you go one direction, if conditions are better, you have other choices,” Blackwell said.

“We really don’t make recommendations to growers as to what they should plant,” Beumel said. Instead his nursery will give the grower information he

Continued on Page 16



Arturo Reyes operates a pistachio nursery in the Reedley area. The flowers were harvested from his parent trees and will be used to pollinate the female flowers.

All photos courtesy of Cecilia Parsons

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needs to make a decision on planting, given the specific conditions at the grower's orchard site. As pistachio plantings expand, many orchards are going into soils and areas with harsher growing conditions. The trees are growing, Beumel noted, but their productivity over time will depend on the rootstock choice.

Rootstock Choices

Rootstock choice is more grower specific than region specific, Beumel said. Many growers will also try several different rootstocks.

While rootstocks can address certain problems like salinity, vigor or disease resistance, he said the industry lacks long-term side-by-side trials for rootstocks and needs data generated by replicated trials.

Beumel said there is a split among several rootstock choices for planting and not just one rootstock prevails over all others.

In the last ten years, he said that the majority of pistachios planted were on either UCB1 clonal or UCB1 seedling rootstock. Pioneer

Gold I, the first commercially significant pistachio rootstock and the new hybrid Platinum made up the rest of the rootstock sales. Beumel said some growers who have had success with Pioneer Gold I have continued to plant it. This 'tried and true' rootstock was planted at the rate of at

least several hundred thousands of plants a year until a few years ago and it is still being planted today, he added.

Platinum hybrid rootstock has attracted a share of the market, Beumel said, but there was a limited supply of plants from tissue culture labs and in the early years this rootstock was offered

only by one nursery. He estimated that Platinum would have been planted at a much higher rate had it been available. This rootstock, he said, has many of the same attributes as UCB1, but has been observed to be more vigorous and slightly more salt tolerant, though the industry lacks definitive trial data on this. Platinum also has never been associated with Pistachio Bushy Top Syndrome (PBTS), a point which is very important to some growers.

Development of this syndrome in newly planted pistachio trees has caused growers to pull more than 20,000 acres in the past few years and caused growers to rethink some of their rootstock choices. The positive news about PBTS, Ferguson reported, is that there does not appear to be a replant problem in the orchard. Once affected trees are removed, new trees will not acquire the syndrome from the soil.

Beumel said most growers want greater vigor, cold tolerance, and salinity tolerance than what PG1 has traditionally offered. They are also wary of clonal UCB1 due to PBTS. Then, he said, there is a belief by some growers that seedling



Arturo Reyes

Continued on Page 18

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Continued from Page 16

UCB1 has too much variability.

Rootstocks and Alternate Bearing

Ferguson said rootstocks do have some effect on nut quality and yield in pistachio production. The larger tree size of UCB1 means it can produce more nuts per acre.

Rootstocks can also make a difference when mechanical pruning is used to mitigate the effects of alternate bearing.

Recent data produced by Bob Beede demonstrates alternate bearing in trees on UCB1 and PG 2 rootstock, the predecessor to Platinum, responded equally well to pruning entering the on or off crop year.

Alternate bearing in mature trees on the PGI, and now commercially unavailable Atlantica rootstock, will be decreased by about 50 percent if pruned entering the off crop year.

Variability, Ferguson said, is one of the disadvantages of seedling rootstocks. There will not be the absolute tree uniformity that clonal propagation can provide, but there is also less chance of losing an entire orchard to a disease or pest if the rootstock is susceptible. She said the recent PBTs is an example.

Clones, selected from a known and proven quality, produced in rootstock trials can produce a superior tree, but there are still some genetic unknowns. There have also been compatibility issues with newer scions.

Arturo Reyes, who operates a pistachio nursery in the Reedley area, believes he strives to achieve very low variability with

his seedling UCB1 rootstocks with his propagation process.

Reyes only propagates UCB1 seedling rootstocks and said he uses strict controls to help ensure their genetic uniformity. His parent trees are enclosed at bloom, pollen is collected and the flowers are hand pollinated. Seeds collected are planted in containers and as they emerge and grow, they are inspected for off-type characteristics.

Reyes said he sorts out about 5-10 percent of the seedlings for vigor and uniformity.

Reyes, who participated in rootstock research at the nearby UC Kearney Agriculture Research and Education facility said earlier production is also one of the key traits of UCB1 rootstocks provide to growers.

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What You Need to Consider Before Building a Walnut Huller

By Kathy Coatney | Editor

Upgraded equipment that was added in recent years that includes touch screen technology. All photos courtesy of Kathy Coatney.

A wet harvest is a concern for many walnut growers. Will I have a home for my nuts or will I be left out in the cold?

A major motivation for growers to move into hulling is ensuring their own nuts, according to Bill Carriere, president of Carrier Family Farms in Glenn, California. Carriere farms have been hulling walnuts since 1974.

- More energy usage
- More permitting, depending the location
- More labor issues

Installing a huller is a big capital outlay, Carriere continued. "Some of it is basically just insurance that you have a home for your walnuts at the time you want it."

Carriere said he thinks the bigger the better to a certain degree, just because of the economy of scale.

"There are hullers out there that have very little of their own production. They're strictly a custom operation, but that's unique," Carriere said.

"We used to say if you had 300-500 acres you could build a huller, and run it yourself, and bring in a few outside growers," Carriere said, but today his gut feeling is that more acreage may be needed to make it pencil out.

Individual Versus Commercial

Roger Isom, CEO of the Western Agricultural Processors Association (WAPA) said, the first thing to consider is are you doing just your own nuts, or are you going to do a commercial operation that includes your nuts and other growers?

"In the old days, it was very common to see a huller just for the grower and doing his own. Most of the installations I see going in today, if they're going to the expense of building a huller, it's for multiple growers," Isom said, adding the only way to make it pencil out is with a commercial operation.

"You've got to run it 45, if not 60 days, and put a lot of nuts through it to help pay for that capital expenditure that you're putting out," Isom said.

With a Commercial operation size alone comes with more problems, Isom said.

Carriere said that a huller is a huge

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investment that will only be in operation for a month and a half maybe, and at capacity for three weeks.

“The rest of the time it’s going to sit there and rust,” Carriere said.

“We’ve looked into a lot of other options on how to utilize the equipment or the building,” Carriere said, but in the end, nothing else really worked for us.

Alan Reiff, Owner of Wizard Manufacturing Inc. in Chico, California, agreed the majority of growers take this step for the sake of control.

“It really smoothes out your harvest practices when you have your own processing facility,” Reiff said.

Spread out the Harvest

Another reason to have other growers is to spread out the harvest, Carriere said.

It’s also important to have earlier varieties, not just later varieties like Chandlers, Carriere continued.

“If you have your own production, you can get more control. For example, we spray quite a bit of Ethephon (used to accelerate hull cracking and separation from the shell) on our own production so that we bring it in early. So, when the rush hits, we’re kind of done with ours, or at least well into it. And then some orchards we don’t spray, and we try to keep them for last just to spread that window out as much as possible,” Carriere said.

Installing a huller/dryer is a decent investment, and with a properly sized facility the initial investment, including interest, can be recouped in seven to eight years, Reiff said.

It’s important not to over size them or under size them, because then it’s not a good investment, Reiff said. And the longer the huller/dryer is in operation, the sooner the investment is recouped.

“Typically, the reason you can run it longer is not more products, but more varieties,” Reiff said.

With just one variety, it’s a 14 day season, but with two or three varieties it

can be up to a 28 day season, Reiff said.

Labor

When a grower is running a farming operation, a lot of the work is contracted out for everything from pruning to harvest, Isom said.

“When you’re talking about running a huller or dehydrator, now all of the sudden you’ve got full time employees,” Isom said.

And this change means:

- Personnel policies—what do those policies mean
- A lower overtime trigger—these employees can’t be worked like they were in the orchards
- Sexual harassment policy
- Finding competent employees

Continued on Page 22

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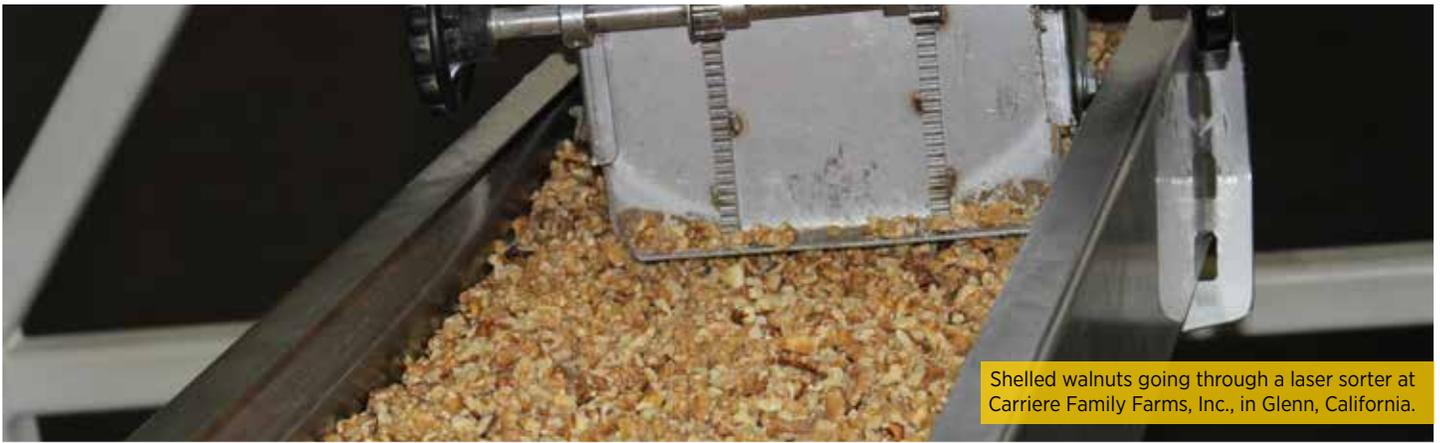
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Continued from Page 21

As labor becomes tighter and tighter, finding labor is difficult, but there is also competition from neighboring farms, Isom said.

You may offer \$12 an hour, but the grower down the street is paying \$12.50 an hour, so you may have to increase wages just to get employees, Isom said.

“Along with that, your labor pool is shrinking. You might be taking people that probably aren’t the first ones you’d want to hire,” Isom said.

“So, what does that mean?” Isom asks.

It could mean you’ll have a higher potential for more accidents, Isom said.

“We’ve seen a whole host of issues with people that you probably would have passed on before, but because the labor pool is small, you’ll take whoever you can get. And so that’s a huge issue,” Isom said.

“Hiring temp labor to come in to do some of the major jobs at a huller is problematic, unless they just randomly have that experience,” Carriere said.

“You can hire sorters, you can hire people to sweep, you can hire somebody to shovel something, or pick up sticks, or whatever, but bringing somebody in to run the huller, he needs to be one of your permanent employees in my opinion,” Carriere said.

Planning

Carrier also recommends planning ahead because the companies that build the huller are generally booked out a long way in advance.

“If we want to add significant parts or pieces of equipment to our hulling operation, we definitely need to let them know earlier rather than later,” Carriere said.

Between designing and permits you want to be at least 18 months out, Carriere said.

“It’s all planning. The nice part about what we’ve talked about here a lot is, when you plant an orchard, assuming you did your preplanning there as well, now you have four years before that kicks in with significant volume,” Carriere said, adding this gives you time to plan your huller.

Carriere said, we continue to plan. We know how many trees are in the ground and how much production is expected off of those non-bearing trees.

We also track what we’re going to tear out or replace, and then we talk to all of our growers and ask how many acres they planted last year, and if they are planning on bringing them to us and what variety, Carriere said. “We try to plan all that,” Carriere said.

Inspections

Running a huller

brings a lot more scrutiny than would potentially be seen on the farm, Isom said.

There will be inspections, and depending on where the huller is located, there will be inspections from:

- The air district
- The California Department of Food and Agriculture (CDFA) as part of the Food Safety Modernization Act (FSMA)

Continued on Page 24


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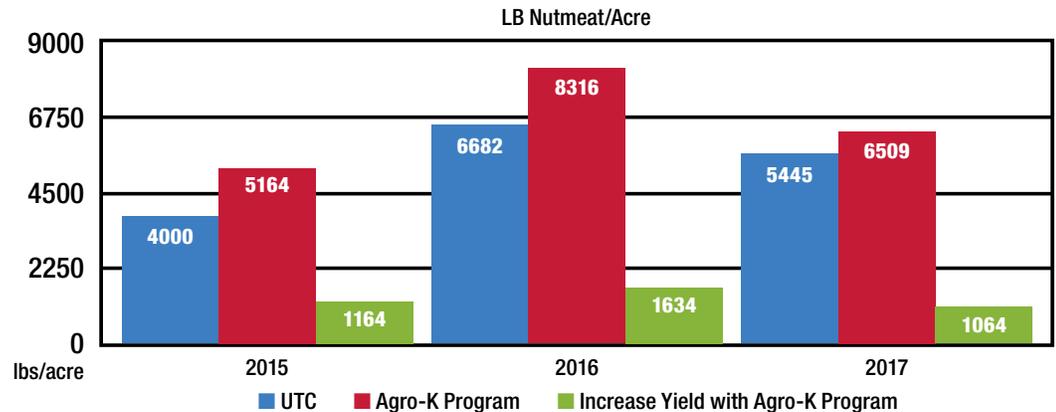


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“Typically, if you’re only doing your own, all those same things apply,” Isom said, but you’re probably not as big an operation, so you don’t need as many people, and it is less likely that some of these things will occur.

“If you’re commercially doing outside product, there’s no doubt you’re going to need an air pollution permit, whichever county you may be in,” Isom said.

The Sacramento Valley is probably less onerous than San Joaquin Valley, or the Yolo/Solano Air Quality Management districts where there’s a lot of scrutiny, Isom said.

Automation

Automation does raise costs initially, but with things like wages, overtime, and worker’s compensation, Isom thinks that

automation may be the answer.

“I think people are willing to spend a little more money now for increased automation to avoid the (labor) issues,” Isom said.

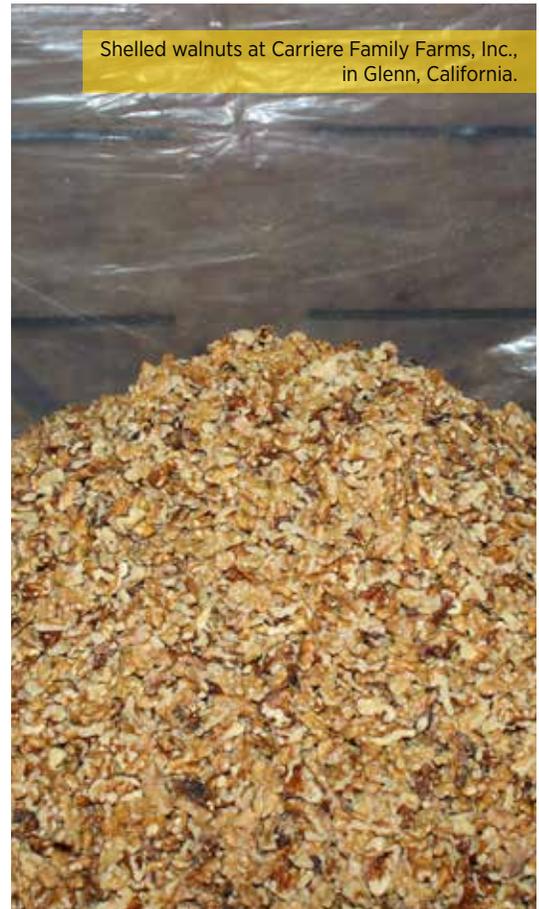
Isom uses robotic sorters as an example. Initially, the technology wasn’t quite there, but it’s pretty much mastered now, and one company has replaced 32 people with two machines that cost a \$1 million each.

The company estimates it will pay back that expenditure in three years with the savings from salary, sick leave, overtime, and workers compensation, Isom said.

Carriere agreed that more and more automation is the future. “Strictly from the labor perspective, if not for accuracy,” he said.

Equipment upgrades are not cheap, Carriere said, but one thing we do is rent our camera sorter.

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and get it after harvest, and take it back, and give it all the software upgrades, and bring it back right before harvest and reinstall it,” Carriere said.

“The direction is toward more and more technology to minimize labor and human error,” Reiff said.

Reiff said, growers are investing in redundant color sorting systems and eliminating all human hand sort labor. They’re also investing in automated bin filling and automated dryer controls to eliminate the need for labor to fill bins and monitor moisture content.

Do the Math

Isom advised growers before making this investment to do the math, not just short term, but into the future.

“You can’t look at just the year ahead. You’ve got to be looking five-10 years down the road before you make that investment,” Isom said.

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Understanding Grower Liability in Nutrient Management Planning

BY CECILIA PARSONS | ASSOCIATE EDITOR

Almond orchard in bloom. Photo courtesy of Kathy Coatney.

Tree nut crops cover millions of acres in California, making growers' use of irrigation water and nitrogen fertilizer come under increasing scrutiny by state regulators. The latest mandate from the State Water Board directs growers who have irrigated crops to test their domestic water wells for nitrates. The testing and reporting are responsibilities of the grower, not their water quality coalition.

New Rule

This new rule was adopted by the State Water Resources Control Board on February 7, 2018.

State-certified laboratories must collect the samples and analyze for nitrates. If the sample exceeds the state's nitrate drinking water standard, the landowner must report that information to all users of that water within 10 days. If a coalition member is renting a farm and is responsible for a house on the property, they must report the nitrate exceedance to the property owner within 24 hours. The state requires documentation the reporting was done.

Parry Klassen, manager of the East San Joaquin Water Quality Coalition

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(ESJWQC) notes that this new domestic well testing mandate places a spotlight on growers as the results of the testing are posted on a State Water Board website.

The well test requirement is another out of pocket expense for growers. Klassen said there are a number of laboratories certified to do the testing, and he expects costs to vary based on location of the wells distance of a farm from the laboratory and number of wells. Growers can expect to pay \$200 to \$300 per well for sampling and analysis, he said.

Irrigation and Nitrogen Management Plan

Growers are also now responsible for adding an irrigation reporting component to Irrigation and Nitrogen Management Plan (INMP) which is filled out and kept on the farm. Selected information from the INMP is then due for the 2019 crop on March 1, 2020 for ESJWQC members. The new requirements will likely be in a place a year later in other coalition regions. The INMP must be completed by all coalition members, not just those farming land in state-declared "high vulnerability" areas. However, the INMP must still be certified by a crop advisor for land in high vulnerability areas. Growers can also sign off on the plan if they have completed the certification training. A high vulnerability region is where the coalition determines that the groundwater may be at risk of having nitrate at a concentration that exceeds the drinking water standard. Klassen said the coalitions are revising the INMP template and summary report based on the new requirements.

Previously, growers were required to have a nitrogen management plan and if their land was in a high vulnerability area, submit an annual report to their coalition.

Now, plans must be in place in 2019 and beginning in 2020, growers in high vulnerability areas must submit their INMP summary reports to their coalition in the event that the Regional Water Board has the revised orders in place for all water quality coalitions by the end of this year. Growers in low vulnerability areas must begin submitting their INMP by March 2021.

In the plan, the state wants to know if the grower or farm manager is using

sound irrigation and nitrogen application practices to prevent groundwater contamination. The coalition's report to the state does not identify individual growers and their plans, but the coalition will analyze plans looking for water or nitrogen applications that are outside of normal parameters. Klassen said that while some grower reports can be "outliers" compared to other INMPs, some variability is expected each year due to different growing conditions. The reports by themselves do not trigger any regulatory process, he said, but provide an opportunity for improving nitrogen and water use efficiency.

New Language

New language added to the revised regulation addresses a fear by many Certified Crop Advisors (CCAs) that they are liable if they sign an INMP. The new language clarifies that the person signing the INMP certifies that the plan was prepared under their supervision and the information and data reported is, to the best of their knowledge to be accurate and complete. When a CCA signs the plan, they are allowed to rely on the information and data provided by

Continued on Page 28

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East San Joaquin Water Quality Coalition (ESJWQC) member meeting in Modesto, California. Photo courtesy of Parry Klassen, Executive Director, ESJWQC.

Continued from Page 27

the grower and are not required to verify.

Additionally, CCAs will not be held liable if the grower does not adhere to the plan. Growers will be held liable if they do not submit a plan.

The one positive change in the water board requirements for the Irrigated Lands Regulatory Program is that growers only need to complete a farm management plan every five years rather than annually.

Klassen said the INMPs stay on the farm and are not submitted to the coalition or regional water board. Growers still must keep records of data including evapotranspiration, nitrogen applied from all sources and total water applied to crops. Klassen, who also writes Watershed Coalition News, reports that growers have been fined for ignoring earlier program requirements. Fines for failure to obtain regulatory coverage for discharges from irrigated cropland have been levied against growers who either did not obtain a permit to discharge or who had not joined a water quality coalition. Klassen reported that the East San Joaquin Water Quality Coalition was targeted first by state regulators because it was the first to obtain a Waste Discharge Requirement permit in 2012. To date across the Central Valley, he said all growers except one have become members of a coalition.

Nitrogen Crop Coefficients

Klassen said coalitions are now in

the process of developing nitrogen crop coefficients that estimate nitrogen uptake and typical ranges of nitrogen use for crops grown in the area. That information for almonds is already in place according to Gabriele Ludwig, Almond Board of California's (ABC) director of Sustainability and Environmental Affairs. The focus is on helping growers become more efficient with their water and nitrogen use, she said, but development of the crop coefficients also helps growers assess demand for water and nitrogen plus timing of nitrogen applications.

Almond growers also have tools available to assist with achieving efficiency in water and nitrogen use. Ludwig said the existing almond Nitrogen Calculator and Irrigation Calculator, found on the ABC web site would be updated to provide reports that meet the new INMP requirements.

Spencer Cooper, senior manager for Irrigation and Water Efficiency at ABC said the tools would take some of the pressure off almond growers, making the develop-

ment of their INMP plans easier.

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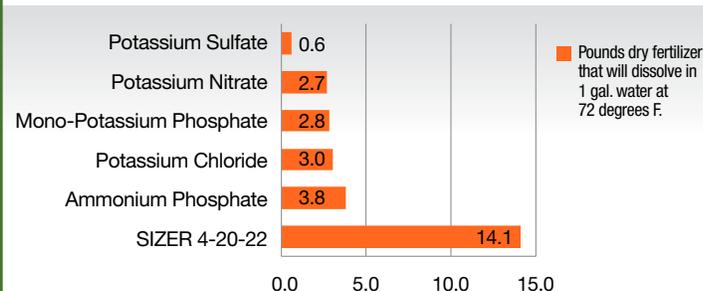
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In recent U.C. research on Almond Hull Rot, foliar applications of alkaline fertilizers, specifically Di Potassium Phosphate were similarly effective as fungicide treatments and significantly reduced the disease. While research rates of 1.5 -2 quarts were utilized, **SIZER** can be applied at rates up to 1 gallon/acre with little to no phytotoxicity. Di Potassium Phosphate may have the ability to neutralize the fumaric acid that contributes to the occurrence of the disease. Further work has found that sprays timed to the b-2 stage (deep V split) are most effective against Hull Rot infection. While Nonpareil variety has the greatest incidence of Hull Rot, U.C. recommends the use of two applications for proper timing to protect multiple varieties.

SIZER's superior degree of effectiveness in placing nutrients into the plant system is due to it's high level of solubility. Uptake of nutrient elements via the plant cuticle depends on the element's ionic concentration, as well as how long the nutrient remains in solution on the leaf, (Oostrhuis, 2009). Nutrient absorption increases dramatically with the increase in duration of solubility, (M.B. Hossain, K.S. Ryu, 2009). **SIZER** 4-20-22 Urea, Di Potassium Poly Phosphate Combination should always be your first choice for optimum foliar nutrition.

(Solubility Determines Availability)



For more information including research results and scientific publications, contact:
Mark Brady, Western Marketing Manager, Plant Food Systems, Inc. (559) 731-1267
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Managing Small Bugs and Stink Bugs in Pistachios

BY CECILIA PARSONS
ASSOCIATE EDITOR



Small bugs can cause large amounts of damage in pistachio nut crops.

These early season pistachio pests include Calocoris bug, Phytocoris bug, Lygus bug and California buckeye bug. At the 2018 Pistachio Day event, Kent Daane, Cooperative Extension Specialist at UC Berkeley and Kearney Agriculture Research and Education Center, said these bugs can only cause crop damage for short period of time early in the growing season if they build to large numbers and damage more nuts than the cluster would normally drop off.

Pistachio nuts are vulnerable to small bug feeding from bloom until the shell begins to harden. Cooler springtime weather can delay shell hardening and lengthen the time the nutlets are vulnerable to small bug damage.

What to Look for

Daane said when in the nymph stage, it could be difficult to tell small bugs apart from beneficial insects such as the big eye bug. Adult Phytocoris, Calocoris and lygus bugs are all about one quarter inch in length. Buckeye bugs are slightly larger.

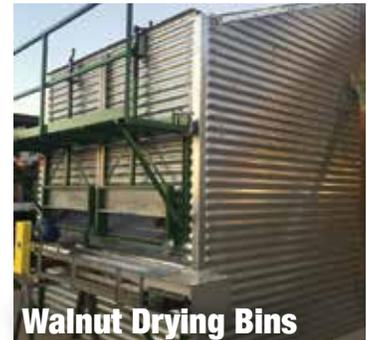
Adult calocoris have green color bodies and their wings have a reddish brown tint, becoming black where they overlap. Calocoris also has two black

spots on the thorax. It prefers weedy hosts and migrates into pistachio trees as ground covers dry or are cultivated in the spring. It over winters in the egg stage on weedy host plants and produces one generation per year.

Lygus adult colors vary from brown to green and they also have a yellowish triangular shaped area on the back between the wings. Lygus can move from drying weedy vegetation or harvested forage crops in the spring into pistachio orchards. When rainfall and spring

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temperatures are ideal for the growth of broadleaf weeds, lygus numbers can be very high.

Phytocoris overwinter in the egg stage on one-year-old fruitwood on pistachio and other deciduous trees. These small bugs are grey in color with flecks of black and white. They also have long antennae and legs and move rapidly when disturbed. Phytocoris can be a pest species or a beneficial, depending on numbers. This small bug is a predator of other insects including immature soft scale in March and April. They also feed on navel orangeworm eggs in spring.

Buckeye bug adults are straw colored and slightly hunched. They overwinter as eggs at the base or leaf petiole scars on one-year-old pistachio wood. The nymphs are greenish with brown markings on the back. These small bugs are identified by a long, hairy first antennal segment and brown and white bands on the legs and antennae. California buckeye bugs have only been found in orchards near their native plant host California buckeye.

Evidence of small bug feeding will



Pistachio orchard. Photo courtesy of Cecilia Parsons.

be large numbers of BB size dropped nuts. Before shell hardening, small bugs can insert their mouthparts into the nut causing epicarp lesions which appear on the inside of the nut as white netting. Damage to small nuts results in blackening and nut drop. As nuts enlarge, the hull turns brown and necrotic and the outside will often have a sunken appear-

ance. On the inside of the nut there will be a small black spot or irregular-shaped pit in the area where the bugs fed on soft shell tissues. Nuts that continue to grow after small bug feeding may have stained shells which lowers value.

Daane said when there is ground cover in an orchard and it dries or is mowed early in the season, small bugs move into the trees where they feed and drop large numbers of nuts, affecting fruit set. If numbers are low, the trees can compensate for the dropped nutlets. But, Daane said in large numbers they can cause so many nuts to drop that fruit set is affected.

Stinkbugs

Stinkbugs can be important early in the season—just like the small bugs—but can continue to damage nuts later into the season because of their larger mouthparts. They may overwinter in the orchard or fly in when other host plants become dry. These bug species typically have two generations per year.

As mentioned, stinkbugs do feed on pistachio nuts early in the season, but they cause damage with their stronger mouthparts late in the season, piercing the hardened shells to feed. Their feeding not only causes crop damage, it also spreads pathogens in the orchard. Botryosphaeria and fungal pathogens are known to be spread by stinkbugs, Daane said. The feeding damage also contributes to off grade nuts at harvest. There may not be obvious signs externally, but

Continued on Page 32



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Continued from Page 31

kernel necrosis causes darkened nutmeat. Brown pinpoint marks are signs of stinkbug feeding in July and August.

Four common stinkbugs species in pistachios are the red-shouldered stink bug, green stink bug, Uhler's stink bug and Say's stink bug. The red-shouldered stink bug is mostly green and may have a red band across the shoulder at times. During the winter it can be brown in color. The green stink bug, while in the nymph stages can have several different colors and patterns prior to the fifth instar stage when it finally has a green appearance and wing pads develop late in that stage.

Uhlers and Says stinkbugs are look somewhat similar to the green stinkbug. In the nymph stage, Daane said, they can all vary in colors and be difficult to correctly identify. He suggested using an online "Bug Guide" to help with identification.

An invasive stinkbug, the brown marmorated stinkbug (BMSB), may also pose a threat to pistachios. Last year,

BMSB was found in Fresno County and to date has been trapped in 34 California counties. It has been proven to feed on pistachio nuts and cause kernel necrosis in a laboratory. To date, it has not been found in commercial pistachio orchards, but it has been found in California almonds—so it is a pest of interest to pistachio growers.

Brown marmorated stinkbug has mottled brown coloring and white stripes on its antennae. It can be mistaken for a beneficial stinkbug. Growers who suspect they have this stinkbug in their orchards should take them to the county agriculture commissioner for identification, Daane said.

This large bug has built up large numbers on the East Coast where it has become a pest in many crops. Daane said the concern is that BMSB will be able to build large numbers in the Central Valley and move into nut orchards where it can feed aggressively. Hot, dry summers in the Central Valley, Daane said, could be the limiting factor to BMSB expansion. In studying the BMSB population in Sacramento for over a year, he said trap counts show a dip in

July and August.

Monitoring for Bugs

Studies show that monitoring for small bugs is best done with a sweep net. Using a beat tray after an insecticide spray can indicate large bug numbers. Monitoring for crop damage also indicates feeding and percent of crop damage. Critical times for monitoring are April to June in pistachios and March to May in almonds.

Daane recommended monitoring each year to measure year-to-year changes in populations. If sampling finds lots of small bugs early and some large bugs early to mid season, insecticides are the most reliable option. Pyrethroids are a common choice for control, but they may cause other pest insect populations to rise. If navel orangeworm is present, the sprays may contribute to resistance development.

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The advertisement for Beeler Tractor Co. features a collection of blue agricultural machinery. At the top left is the **Magnum X Self Propelled Harvester**. In the top center is the **2850 Sweeper**. To the right is the **B87 Blower**. Below these are the **9800 PTO Nut Harvester**, the **2830 Sweeper**, and the **2930 Sweeper**. The **Weiss McNair** logo, with the tagline "NUT HARVESTING EQUIPMENT", is prominently displayed in the center. The company name **BEELER TRACTOR CO.** is written in large, bold, blue letters across the bottom. Below the name are three locations: **YUBA CITY** (887 Onstott Rd • CA, (530) 673-3555), **COLUSA** (1954 Hwy. 20 • CA, (530) 458-5196), and **ANDERSON** (2025 Barney Rd • CA, (530) 378-1116). On the far right is the **CNH INDUSTRIAL GENUINE PARTS** logo. The website **www.BeelerTractor.com** is listed at the bottom center.

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The Benefits of Planting Honey Bee Forage in the Fall

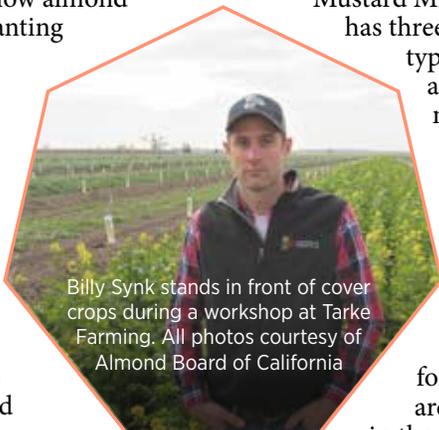


By Almond Board of California

If you're looking for ways to improve your soil, while at the same time enhance the vitality of honey bees during bloom, you might think of planting cover crops this fall.

That's the message from Billy Synk, director of pollination programs for Project Apis m., an organization that funds projects and directs research to improve the health of honey bee populations while also improving crop production.

Earlier this year, Synk hosted on-farm workshops to show almond growers how planting flowering cover crops between rows of trees or on the perimeters of orchards may improve bee health as they provide an alternate source of honey bee nutrition before and after almond bloom.



Billy Synk stands in front of cover crops during a workshop at Tarke Farming. All photos courtesy of Almond Board of California

"Why would an almond grower want to plant a cover? For the bees' sake,"

Synk said during a field day at Tarke Farming near Sutter.

Project Apis m. offers called Seeds for Bees, which designs and provides seed mixes and methods to establish forage that supports pollinators. The program's offerings include the PAM Clover Mix, which includes Balansa, Crimson and several other types of clover, and the PAM Mustard Mix, which has three different types of white and yellow mustard as well as canola and Daikon radish.

When forage seeds are planted in the fall, they should germinate with normal precipitation in fall and

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early winter so that they're blooming by January, in time for almond bloom. The advantage of having bees "boosted" by forage is that it provides a robust source of nutrition that nurtures more vigorous foragers, Synk said.

Synk explained that colonies trucked to California often haven't had contact with a flower in months. However, growers need not worry that forage will distract honey bees from pollinating their almond trees. Almonds provide honey bees with large quantities of high-quality pollen in a relatively small area, making it very easy for bees to collect, as opposed to hard-to-get pollen on a cover crop.

Having other pollen sources available, such as attractive pollen from forage, promotes a pollen-collecting cycle and keeps bees working and stimulated. This cycle motivates the queen to lay more eggs and the bees to collect more pollen to feed their young, allowing colony populations to expand rapidly and ultimately create a larger fieldworker force.

Continuing studies funded by Al-

mond Board of California have examined the health, growth and survival of honey bee colonies that were fed supplemental feeds and forage. The results indicate that planting forage could increase queen and colony survival, as well as provide healthier colonies.

Aside from bee health, cover crops also help prevent soil erosion and "keep precious top soil on site," Synk said. As all growers must now have a nitrogen management plan under the state's Irrigated Lands Regulatory Program, cover crops can play a key role in protecting surface water quality, partly by supplementing nitrogen without the use of fertilizers.

"It's a win-win situation," said Synk. "You're not going to get every one of the attributes every year, but there are always some benefits."

For Tarke Farming owner Michael Tarke, this was the first year he planted

cover crops. He planted different varieties in several rows between his almond trees and on a strip of land next to his orchard. He said a pest control advisor told him about the Seeds for Bees program.

"I had just wanted to do it as a soil amendment, but we have about 4,000 bee hives, so it'll benefit the bees, too," Tarke said.



Michael Tarke, owner of Tarke Farming, hosted a workshop on cover crops for growers with Project Apis m. in February.

There is "a bit of a learning curve" for growers, particularly if they're used to a bare-ground management system, said Tom Johnson, an agronomist for Kamprath Seeds in Manteca. He explained that to get mustards to bloom on time, they have to be planted by October, which isn't always possible if early rains come.

There's also a "comfort factor" to

Continued on Page 36

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Tom Johnson, an agronomist for Kamprath Seeds in Manteca, discusses key considerations for planting a winter cover crop in the orchard.

Continued from Page 35

consider for growers who encounter the cover crop as they're doing their normal orchard activities, such as sweeping, Johnson said. The mixes Seeds for Bees offer can be planted in every fourth row and still cover the orchard adequately, he said. If row plantings are not an option for the orchard, forage can be planted along orchard margins or in open fields nearby. Hedgerows, with their long bloom periods, are also an option to provide bee forage, beneficial insects and soil benefits.

Another important consideration is the water requirement for forage. When sowed in the fall and winter, most cover crops should germinate with normal precipitation levels. However, seedling growth should be monitored to determine if irrigation will be needed to supplement rainfall in dry years.

Contact Billy Synk at Project Apis m. (billy@projectapis.org) to sign up for the Seeds for Bees program and visit Almonds.com/BeeBMPs for the hand-out, "Forage Your Way to Better Honey Bee Health."

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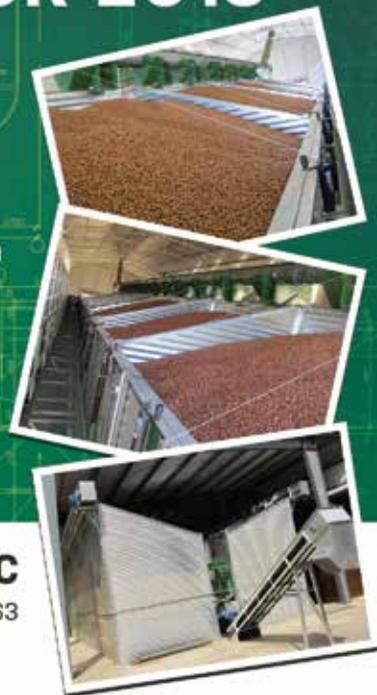
The culmination of tough legislation, and six months of negotiations has resulted in the approval of \$135 million for agricultural equipment in California. This momentous event occurred at the California Air Resources Board (CARB) hearing in Riverside in March. This funding will replace agricultural tractors and harvesters, ag trucks and ag irrigation pump engines. While this is a major development statewide, this is absolutely critical in the San Joaquin Valley because the California Air Resources Board is forced to consider a mandatory tractor replacement regulation in the San Joaquin Valley, due to the imposition of incredibly restrictive federal ambient air quality standards by Federal Environmental Protection Agency (EPA). Without federal action to delay those standards, CARB is obligated to consider all potential measures, including a mandatory tractor replacement rule, such as those already being implemented on trucks and construction equipment.

The Western Agricultural Processors Association (WAPA) pushed for this funding, as it is the only way agriculture can comply without being forced out of business. At the hearing, WAPA President/CEO Roger Isom stated “the

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problem with agriculture is that we have no way to pass along the cost.” Also commenting was WAPA Board member Dan Pronsolino of Dunnigan Hills Hulling and Shelling who highlighted the competition issue by pointing to an example of one of the industry’s world competitors, commenting that “a similar hulling operation in Australia recently purchased a brand new loader from China that had a Tier 0 engine in it, making the purchase price one-sixth of the price of one equipped with a Tier 4 final engine.” Nonetheless, this is a major win for air districts throughout the state, especially the smaller rural air districts like those in the Sacramento Valley, who typically only get a few hundred thousand dollars annually. The funding plan was approved unanimously and money should start flowing to the air districts in the late spring.

Funding Sources

Most of this funding will work like the existing Carl Moyer Program in each District, but some funding will not have the same restrictions depending on the air district. For example, one new program being developed is one that

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Glenn	\$1,453,200
Imperial	\$1,186,200
Monterey Bay	\$1,298,200
Sacramento Metro	\$989,200
San Diego	\$1,269,700
San Joaquin Valley	\$108,000,000
San Luis Obispo	\$906,800
Santa Barbara	\$666,900
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Ventura	\$1,234,100
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Districts with less than 1%	\$5,572,100

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Continued from Page 39

would replace existing diesel and gasoline utility terrain Vehicles (UTVs) with an electric UTV, such as electric John Deere Gators, or other electric vehicles. This is new to agriculture, but has been available to municipalities in some Air Districts for a couple of years now.

As for the regulation, CARB and the SJVAPCD claim they need more to achieve attainment of a very low standard set by the Federal EPA, and that the last untapped source is agriculture. So, what should we expect from CARB in terms of a tractor regulation? Well, the good news is that agriculture has done a tremendous job utilizing incentives in advance of any regulation. When CARB first announced they were going to have a tractor regulation, they put forth a potential goal of 5 to 10 tons per day of NOx emission reductions by 2017. Through the use of incentives from programs like the Carl Moyer Diesel Emission Reduction Program, the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP) and the Federal EPA Diesel Emission Reduction Act (DERA) funding, agriculture has replaced over 6,500 tractors and harvesters, and thereby reduced NOx emissions by almost 17 tons per day! This has been so successful, CARB has indicated they will give consideration to the use of incentives in setting the backstop dates. With this new \$135 million shot in the arm, agriculture can go a long way in keeping ahead of the next regulation.

But will this be enough to keep a farmer from having to replace his equipment before its time?

Keep in mind, this money does not pay the full cost of the equipment. To date the incentive moneys have only paid roughly 50 percent of the cost of the new tractor on average. Incentives are great, but farmers still have to come up with half the money, and that could prove challenging as all production costs (i.e. fuel, labor, energy, etc.) continue to rise. And since no other area in the country, or world for that matter, will have a similar regulation, the economic imbalance for California growers will only worsen. All the more important to have this funding approved this past month!

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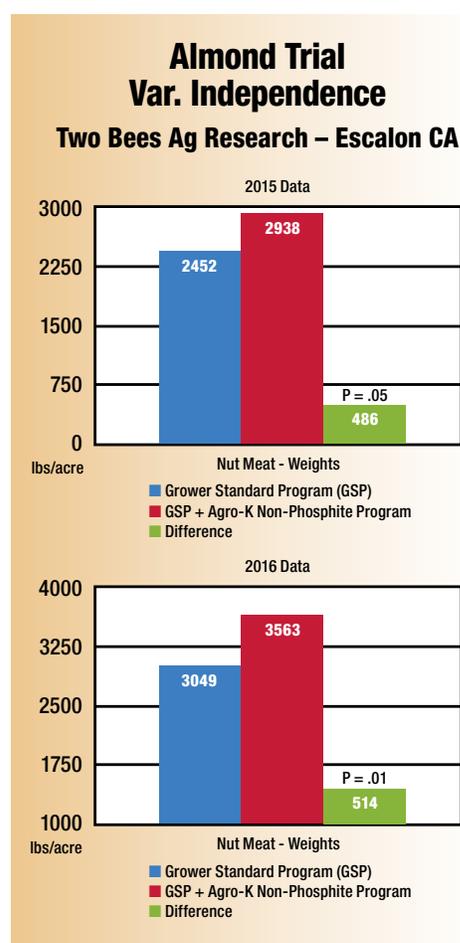
The best time to nutritionally impact next year's almond crop. Don't forget to take advantage of the free ride available with your Hull Split (NOW) sprays to nutritionally set the stage for maximum yield in 2019. Post-harvest while leaves are still in good condition is also a great time to "reload" your trees nutritionally for 2019.

Many almond growers with late varieties or early leaf drop who rely on custom spray application often find post-harvest applications difficult logistically. Growers in this situation can take advantage of Agro-K nutritional tools during hull split applications to help prepare their trees for future nutritional demands next season. Applying **Zinc Plus +5 D.L.**, at hull split with other early-season peak demand nutrients like phosphorus and boron, build bud strength and provide critical nutrients for next year's developing buds so they are available when the tree breaks dormancy next spring.

Building nutrient levels in the buds this year, leads to more uniform bud break, faster early growth with larger leaves that have more photosynthetic capability and stronger flower buds for increased nut set. In addition, trees that are not nutritionally stressed experience less post bloom nut drop. **Maximizing yield starts with nut set and post bloom nut retention.** Ensuring peak nutrient demand timing is met leads to higher nut set and retention. The end result... higher yields, larger and heavier nuts next season.

Building nutrient levels this year sends trees and buds into winter with more strength and energy reserves that will be available to the tree next spring at bud break when cool soils limit uptake and nutrient availability. Applying **Zinc Plus +5 D.L.** with **AgroBest 0-20-26 and Top-Set D.L.** at hull split and/or post-harvest will ensure the tree has all critical early season nutrients needed ahead of spring peak demand timing to support leaf and root development. By beginning to manage next year's nutrient needs at hull split and/or post-harvest, **Zinc Plus +5 D.L., AgroBest 0-20-26 and Top-Set D.L.** help prepare your trees for the race to higher yields while minimizing alternate bearing issues.

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OSHA'S TOP VIOLATIONS

By Amy Wolfe, MPPA, CFRE
President and CEO, AgSafe



Photo courtesy of Cecilia Parsons

The food and farming industry still ranks among the top 10 most hazardous industries in which to work. While some hazards are just inherent in the work we do, it is imperative that we take steps towards prevention. In reviewing the top Occupational Safety and Health Administration (OSHA) agricultural violations in California, October 2016 through September 2017, we can better tackle the areas of safety that need our attention. The chart below shows the top four violated code sections and the corresponding fine penalties.

Armed with this information, we can dig into the code, its requirements and more importantly, refocus our company efforts, including training our employees on these critical safety elements.

Heat Illness Prevention Program

The heat illness prevention program is designed to outline water, rest, shade, and emergency response requirements, while serving as a useful tool for both employees and supervisors alike.

What needs to be included in the program?

The plan must include the following elements and incorporate specific details as to how you will ensure that the provisions are met:

- The designated person(s) that have the authority and responsibility for implementing the plan in the field
- Procedures for providing sufficient water
- Procedures for providing access to shade
- High-heat procedures
- Emergency response procedures
 - Don't forget your lone workers (e.g. irrigators)
- Acclimatization methods and procedures
- When drafting your plan, it is important to consider the size of your crew, the length of the work day, the ambient temperatures, and any additional personal protective equipment (PPE) that contributes as an additional source of heat.
- The plan needs to be in English and also the language understood by the majority of the employees and must be located at the worksite and accessible to employees.

Shade

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

- Shade needs to be available when the temperature exceeds 80 degree Fahrenheit.
- How do you know when temperatures hit 80 degrees? Cal/OSHA urges employers to not rely on your cell phone because it does not reflect the site specific temperatures. Best practice, invest in an outdoor thermometer.
- The amount of shade present shall be at least enough to accommodate the number of employees on recovery or rest periods, so that they can sit in

Number of Violations	Code Sections	Code Description	Penalty
265	Title 8 Section 3395	Heat Illness Prevention Program	\$733,200
166	Title 8 Section 3203	Injury Illness Prevention Program	\$269,885
89	Title 8 Section 3457	Field Sanitation	\$76,915
24	Title 8 Section 3441	Operation of Agricultural Equipment	\$170,705

https://www.osha.gov/pls/imis/citedstandard.naics?p_naics=11&p_esize=&p_state=CACalifornia

a normal posture fully in the shade without having to be in physical contact with each other.

- The shade shall be located as close as practicable to the areas where employees are working.
- Shade also needs to be available, even when the temperature does not exceed 80 degrees Fahrenheit, upon

employee request.

Water

Employees shall have access to potable drinking water. It must be fresh, pure, suitably cool, and provided to employees free of charge. The water shall be located as close as practicable to the areas where employees are working. Where drinking water is not plumbed or otherwise continuously supplied, it shall

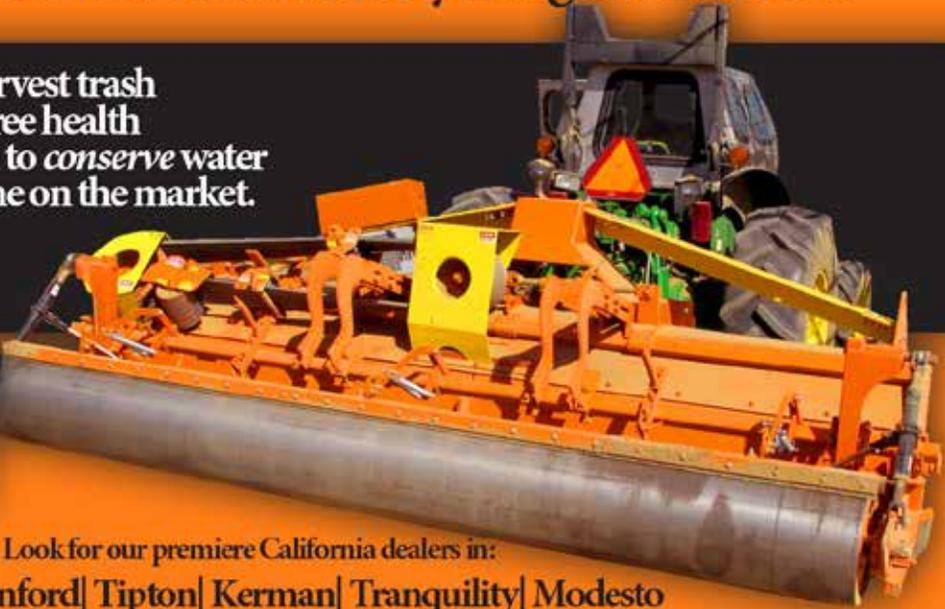
be provided in a sufficient quantity at the beginning of the work shift to provide one quart per employee per hour for drinking for the entire shift. Employers may begin the shift with smaller quantities of water if they have effective procedures for replenishment during the shift as needed to allow employees to drink one quart or more per hour.

Continued on Page 44

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Continued from Page 43

For more information on the program and training requirements, visit CalOSHA's heat illness prevention eTool at: <http://www.dir.ca.gov/dosh/etools/08-006/index.htm>.

Injury Illness Prevention Program

Employers are required to have an Injury Illness Prevention Program, an IIPP. The IIPP serves as the foundational safety program. It requires employers to identify hazards in the workplace and have systems that prevent injuries and incidents associated with these identified hazards. An effective IIPP improves the safety and health in your workplace and reduces costs through good management and employee involvement. Your IIPP must include the following information:

1. **Responsibility**—Identify who is responsible for implementing the program.
2. **Compliance**—Include a system for ensuring that employees comply with safe and healthy work practices.

3. **Communication**—Include a system for communicating with employees in a form readily understandable by all affected employees on matters relating to occupational safety and health, including provisions designed to encourage employees to inform the employer of hazards at the worksite without fear of reprisal.

4. **Hazard Assessment**—Include procedures for identifying and evaluating work place hazards including scheduled periodic inspections to identify unsafe conditions and work practices.

5. **Accident/Exposure Investigation**—Include a procedure to investigate occupational injury or occupational illness.

6. **Hazard Correction**—Include methods and/or procedures for correcting unsafe or unhealthy conditions, work practices and work procedures in a timely manner based on the severity of the hazard.

7. **Training and Instruction**—For all

employees, before they perform the work, and whenever there is a new or changed procedure.

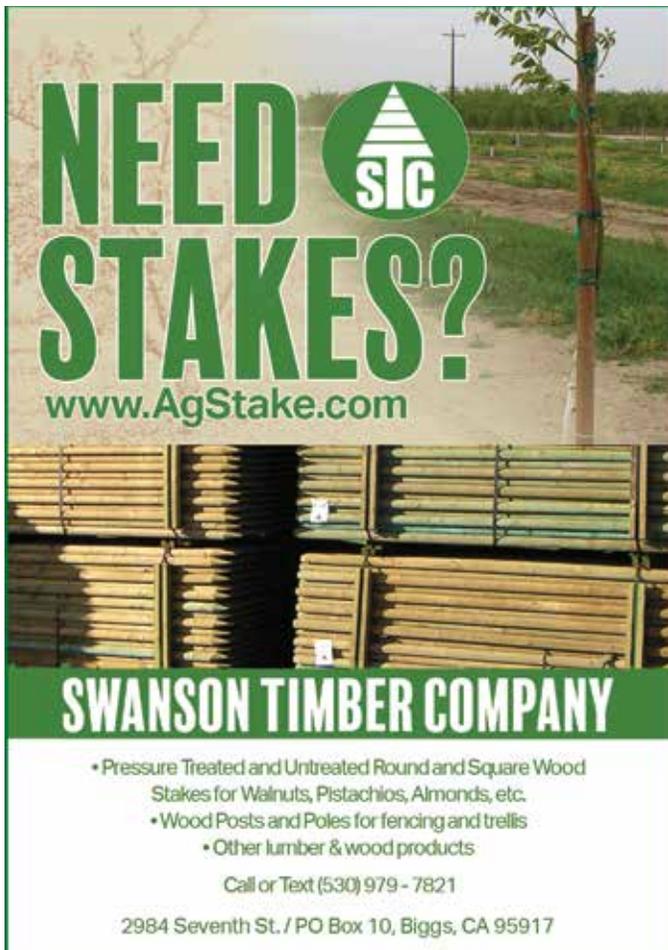
8. **Recordkeeping**—All trainings, investigations and inspections.

For more information on the requirements of an IIPP visit CalOSHA's eTool at: <http://www.dir.ca.gov/dosh/etools/09-031/index.htm>.

Operation of Agricultural Equipment

In this section, employers are required to train employees on how to safely operate agricultural equipment like forklifts, tractors, all-terrain vehicles (ATVs), and utility terrain vehicles (UTVs). Requirements also include:

- No removing of guards
- No permitting additional riders
- Inspection prior to daily use
- For the complete regulation, visit: <https://www.dir.ca.gov/title8/3441.html>.



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Field Sanitation

The field sanitation regulation requires employers to provide drinking water and toilet and handwashing facilities for their workers. Here is a snapshot of the requirements:

Provide potable drinking water

- Readily accessible
- Water shall be fresh and pure, suitably cool
- Dispensed in single-use drinking cups
- In sufficient amounts, taking into account the air temperature, humidity, and the nature of the work performed, to meet the needs of all employees.
- Water shall be free of charge to all employees

Toilet and handwashing facilities

- Separate toilet facilities for each sex shall be provided for each twenty (20) employ-

ees or fraction thereof. One handwashing facility shall be provided for each twenty (20) employees or fraction thereof. Where there are less than five employees, separate toilet rooms for each sex are not required provided toilet rooms can be locked from the inside and contain at least one water closet.

Must meet the following standards:

- Appropriately screened
- Well ventilated with lockable doors
- The facilities shall be located within a one-quarter (1/4) mile walk or within five (5) minutes, whichever is shorter.
- Provide toilet paper and keep clean

Handwashing facilities

- Pure, wholesome and

potable water shall be available for handwashing

- Provide soap and signage that the water is for washing only

For the complete field sanitation regulation, visit: <https://www.dir.ca.gov/title8/3457.html>.

This is merely a brief overview of CalOSHA regulations that effect the food and farming industries. If you have questions about the specifics, including sample policies, visit www.agsafe.org, call (209) 526-4400 or send an email to safeinfo@agsafe.org.

AgSafe is a 501c3 nonprofit providing training, education, outreach and tools in the areas of worker safety, human resources, food safety, and pesticide safety for the food and farming industries. Since 1991, AgSafe has educated nearly 75,000 employers, supervisors and workers about these critical issues.

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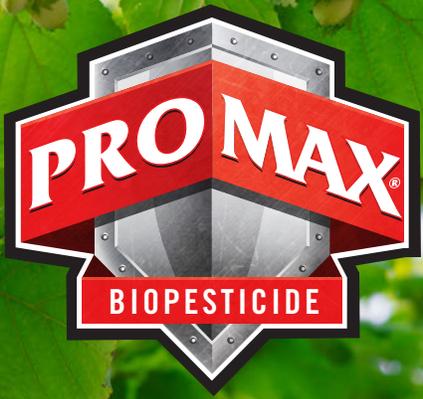
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CALCIUM

The Different Salts it Makes, Uses and Uptake

By Rich Kreps, CCA

Calcium is crucial to so many functions at the cellular level in agronomy. We depend on its availability and absorption for root growth, cellular strength, cellular division, stress and fruit development just to name a few. Many farmers are continually manipulating their farms to keep calcium at optimal levels. "My soil shows decent calcium levels, but my tissues seem to be deficient." As crop advisors we hear this often and have to take a look at a field's history to deduce the cause of the issue. Technological advances in testing and farming practices have given us more tools to take a closer look at how to best apply and use calcium.

Setting a Baseline

Of course, being the good farmers that you are, you have taken soil tests and set a baseline for your parts per million (PPM) of calcium and its base saturation. I have dealt with soil with ppm from 600 to 5,600. Knowing that soil weighs 2,000,000 pounds per acre for every six inches of depth, those differences range from 4,800 pounds to 44,800 total pounds of calcium from the surface to two feet deep! We've seen

great crops grown on both of those soil parameters. So what's next?

As a general rule of thumb we like to see calcium in the 60-70 percent base saturation range. If we are lucky, our

magnesium levels are below 20 percent and above 12 percent. Even better, when we see our potassium levels at two times our sodium levels our crop advisors will

Continued on Page 48

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		Your %	Optimal %					Result	% Total	
Potassium	143 ppm	1.7 %	3-7				Potassium	0.10 meq	1.1	2.71 %
Calcium	3,427 ppm	80.6 %	65-78				Calcium	3.49 meq	39.7	2.04 %
Magnesium	371 ppm	14.3 %	12-21				Magnesium	1.47 meq	16.7	4.81 %
Sodium	167 ppm	3.4 %	< 3.1				Sodium	3.75 meq	42.6	51.61 %
Plant Nutrient Recommendations										
Nitrogen	208.0 Lbs/Acre	Sulfur *	Lbs/Acre	Total Nitrogen	ESP	SAR	C:N	Ca: Mg		
Phosphorus		Boron	2.1 Lbs/Acre	Bray Phosphorus	3.5	2.4		9.2		

Soil test: Acetate Extraction and Water Soluble

Continued from Page 46

tell us to stick our trees in the ground and water them. But what happens when those levels aren't ideal? And why does my neighbor seem to have great crops and his calcium is at 80 percent base saturation and his potassium is less than his sodium? Is there more to the story? The answer from a crop advisor is, "Of course there is."

Using the Tools at Hand

In creating nutrient plans for our growers, we are only as good as the tools we have at our disposal. One of the new tests we should be able to ask for from our laboratories is a water test in addition to the acetate extraction. In the past we have taken the number on the base saturation acetate extraction as a bit of an absolute; that is, the test number is the total cation concentration of that soil. A scientist friend of mine was even more baffled when he ran a soil acid extraction test on the same soil sample 12 times, only to find a slight reduction in the base saturation numbers! That tells me the number is more dependent on what has been weathered and become available at that time. There are so many micro layers to soils, especially high clay soils, that tie up nutrients or have them buried in their layers. By asking for a soil test run with a water rinse, mimicking a fertigation event, we can see what is truly available, and what is tied up. And if you really want to get a handle on your specific situation, grab a water sample off your pump at the time of the soil sample and have them use that water for the water extraction test. I would imagine you'll be shocked on what your trees

actually have at their disposal for uptake in the soil solution.

You now ask yourself what do I do with that information? What products are at my disposal and which will make the biggest impact. In the Midwest, lime is the soil amendment of choice. Limestone is typically mined and heated to form quicklime or slaked lime: calcium

oxide or calcium hydroxide. They're both highly caustic and will raise a low pH soil, so in acidic soils that works. Here in the west, our pH levels are typically 6.5-8.5. Growers are very cautious to use lime. However, in smaller amounts 200-400 pounds (not tons!) at 40 percent calcium we can make fairly quick adjustments to the calcium in the feeder roots. Add smaller amounts more often.

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Gypsum is typically applied in tons and at 23 percent calcium, it needs to be applied heavier than lime to make an impact. It also has sulfate so the sulfur will help keep the soil pH the same as before it was applied. But at 0.26 percent soluble you aren't getting much soluble calcium for the crop. It does tend to condition soil and will help flocculate it to aid in water penetration. Calcium carbonate is becoming more popular but remember, that is limestone, so it needs to be very fine and still weathered to become available. Dolomite lime will help if you also need magnesium (12 percent) in your soil. Calcium Thiosulfate is a nice addition as it is six percent calcium and 10 percent sulfur (both sulfate and elemental sulfur) by weight and 100 percent soluble. It works well through micro irrigation. Quick fixes to tissues can be made with calcium and nitrogen based products, but be careful to not overdo it. Rank vegetative growth will bring a whole new set of problems and you may waste any extra nitrogen that is not absorbed.

Constant Demand

It's important to note that calcium,

unlike nitrogen, phosphorus, and potassium (NPK) tends to rise in the tissues throughout the season. Plants have a constant demand for calcium as cellular building blocks. But remember, calcium is a key ingredient to concrete. Add some water, phosphate, sand, clay and viola, you have bricks in your field. Be sure to add what you need throughout the season and incorporate it into the soil mechanically or with irrigation water. Space it out in conjunction with your phosphate applications and run shorter irrigation sets when fertigating. You'll see those tissue numbers come as well as your yields, and your trees will thank you for it.



Calcium increases nut size

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ANT CONTROL is Important in Almonds

By Kathy Coatney | Editor

Ant control is important for almond orchards, especially with young trees, according to Chris Morgner, crop consultant with Agri-Valley in Merced, California.

Young Trees

For the most part the ants don't climb into the tree and damage the nuts while they're still hanging on the tree, Morgner said.

There is an exception to that—third, fourth, and sometimes the fifth leaf can have ants climb into the trees. This can be the toughest years for ant control, Morgner said.

When the bark is smooth in the early years, the ants will climb into the trees, Morgner said.

“Once the tree gets older, the bark becomes pretty rough, and they can't really get a good trail going up that tree,” Morgner said, so they don't climb the tree much.

Some of the worst ant damage Morgner has seen was in a third leaf orchard. Third leaf trees are being harvested with crops of 500-1,000 pounds, sometimes



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more. Growers are going to harvest that crop, and they're counting on that harvest, so controlling ants is critical, Morgner said.

Irrigation

A decade ago, most almond growers used flood irrigation, but all new plantings for the past 10 years have gone to some kind of low pressure system—micro or drip irrigation, Morgner said.

“I would say that transitioning from flood to low pressure irrigation systems, definitely ants became a little more of an issue,” Morgner said, adding while there have always been ant issues, it seems to have increased the last 10-15 years.

Identification

It's important to identify which ants are in the orchard as only certain ants will cause damage.

“There are times when you find some ants, or you see ants, and you kind of question is this an ant that's going to damage the crop,” Morgner said.

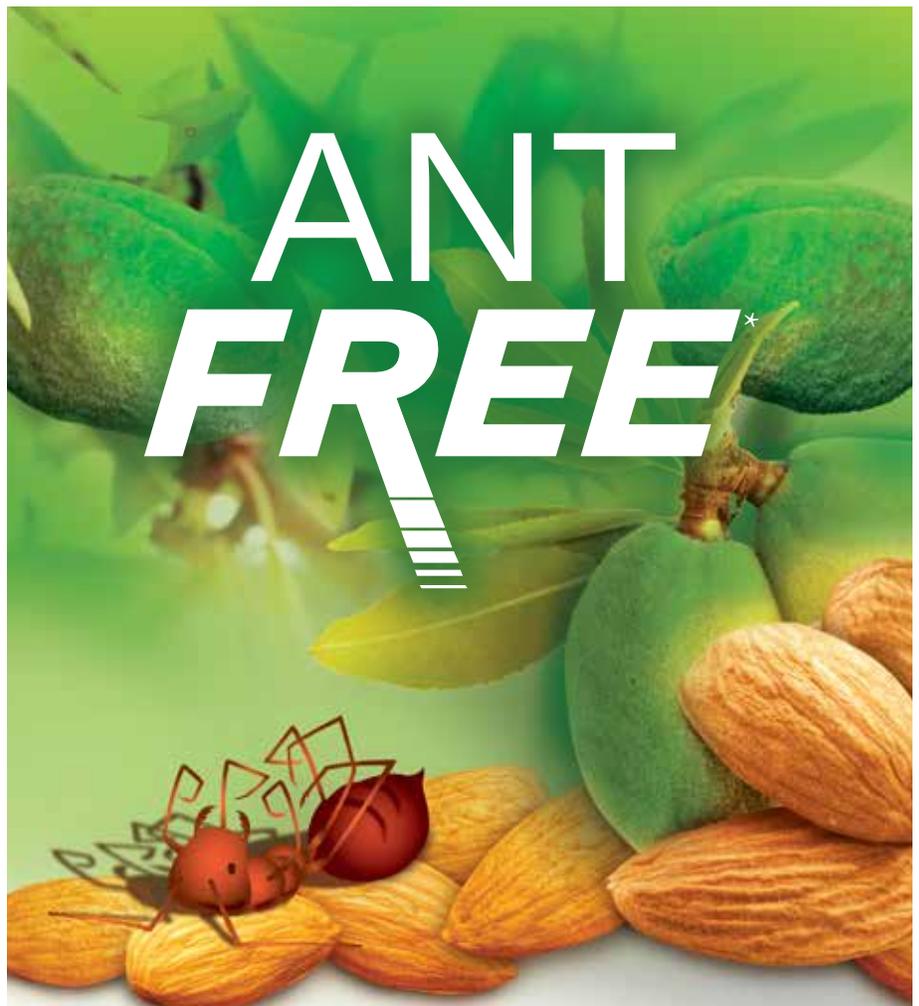
The best way to make this determination is by using ant traps. The traps are small plastic tubes with holes drilled into them and caps on the end. Almonds are placed inside, and the ants crawl through the holes to eat the almonds, Morgner said.

The ants that damage the almonds are protein feeding ants. “We don't have damage from the California Gray ant, which is actually a predator,” Morgner said, adding the Argentine ant doesn't appear to cause any problems either.

Kris Tollerup, University of California Cooperative Extension (UCCE) area wide advisor, Integrated Pest Management (IPM) at Kearney Ag Center, said, “There are maybe 10 species of ants that occur in almond orchards that have been collected, but of that, only two are the primary ones.”

Tollerup said the two predominant species that cause damage to almonds are the Southern fire ant and the Pavement ant, plus the Thief ant, which is a more minor problem.

“I don't see it (Thief ant) as being a huge issue for growers, but there may be



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Solenopsis xyloni.
Photo courtesy of www.antweb.org

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some orchards that have a pretty significant population of Thief ants,” Tollerup said.

The Southern fire ant is the main problem, and once you are familiar with them, they’re fairly easy to identify,

Morgner said.

The Southern fire ants are very aggressive when disturbed. They’re ferocious, and they will come out and attack, Morgner said.

“If you put your hand down and you start getting bit, you know they’re fire

ants,” Morgner said.

Monitoring

Morgner uses ant traps to monitor ant populations and to determine the success of the treatments. This year, in particular, it seemed there was a little more activity from the ants, even after treatment.

We saw a little more ant activity, but not enough to do damage at harvest, Morgner said.

Late April and into May, the ants are near the surface and very active, Morgner said.

“A lot of times we’ll treat in late May and treat again before harvest—two applications. And young orchards, third, fourth leaf, sometimes fifth (leaf), they almost always get two applications,” Morgner said.

“Once it gets hot, they (the ants) go a little deeper and they aren’t as active on the surface when it’s hot,” Morgner said. This means you can have an ant population out there and not really be aware of it with a casual walk through. Morgner said.

That is why it’s important to trap for them. Don’t trust a visual no ants seen and assume there are no ants in the orchard, Morgner said.

When the trees are shaken at harvest, a fairly large area of the ground around



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Ant feeding damage. Photo courtesy of Kris Tollerup.

the tree is disturbed, which jolts the ants and sends out a scout, Morgner said.

“All of the sudden there’s a smorgasbord up there. All these nuts on the ground, so they come out and of course within a few days, they’re luxuriating on the nuts that are on the ground,” Morgner said, and yet another reason to be monitoring and checking for them.

Harvest Sampling

Morgner does sampling after harvest to determine where the damage came from—whether it’s ants, navel orangeworm, or some other pest. He takes samples from the harvested crop after it’s swept and keeps a tally of what actually caused the damage using four categories—navel orangeworm, peach twig borer, big bug/plant bug and ants. We want to know the major pest problems for each block, Morgner said. “That helps us the following year to follow up and form a better focused kind of attack if you will.”

Tollerup agreed and advised growers and pest control advisors (PCAs) to go out in the field and really assess when the nuts are first on the ground and see if there are ants out there.

“Right before they pick them up, do a nut sample,” Tollerup said.

By doing this, growers won’t be caught off guard the following year with a greater ant problem than they realized. And knowing what you’re treating is part of an IPM program, Tollerup said.

Take a hard look at ants, Tollerup advises, because they don’t blow in and out. “If you have an infested orchard, it doesn’t all of the sudden become uninfested the following year unless there’s some drastic weather event,” he said.

Ant Control

Tollerup said the main cultural practice for ant control in almonds is to

get the nuts off the ground as soon as possible when harvesting.

“Don’t let them linger. When they’re ready to pick up, try to get them off as fast as you can,” Tollerup said, because the longer they’re on the ground the greater the risk of damage.

Ants will damage the nutmeat of the almond. “They (ants) can basically eat all of the nutmeat and just leave the pellicle,” Tollerup said.

Morgner agreed a prompt harvest is about the only management practice for controlling ants, after that, baiting is the best option. Younger trees generally get two treatments, while older trees receive one treatment—but there are exceptions. While age is an important factor in determining the number of treatments, soil types may also come into play, especially heavier ground with clay soils tend to have higher ant populations, Morgner said.

“We occasionally have these mature orchards that we need to also put two treatments on, but usually after you’ve

Continued on Page 54

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Tetramorium caespitum.
Photo courtesy of Michael Branstetter
from www.antweb.org.

Continued from Page 53

been treating a time or two you get pretty good control, so one treatment usually works fine,” Morgner said.

“One (treatment) is the norm, but we’re not afraid to put two on, especially with the young blocks where we see problems,” Morgner said.

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Harvested almonds following YaraVita BUD BUILDER WP hull split application. Observed leaf retention on trees.



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Brad Foster, a walnut grower in the Marysville area uses a canoe to make his way through severely flooded orchards in the winter and spring of 2017. The floods were the result of record rainfall and snowpack, and the collapse of the Oroville Dam Spillway at the Feather River. Photo courtesy of Brad Foster.

[UPDATE] ON FLOODED WALNUT ORCHARDS

BY JULIE R. JOHNSON
CONTRIBUTING WRITER

The winter and spring of 2017 produced the third highest recorded rainfall and snowpack in northern California resulting in several major flood events in the region. One of the hardest hit areas was Yuba and Sutter Counties where four major river systems flow—the Feather, Sacramento, Yuba and Bear rivers.

A recipe for disaster was created that year when the collapse of the Oroville Dam Spillway joined forces with the extreme rainfall to produce a deluge down the Feather River that pummeled several river-bottom walnut orchards with long-term flooding.

For many growers the results have been devastating.

Janine Hasey, University of California Cooperative Extension (UCCE) farm advisor for Sutter, Yuba, and Colusa Counties, said the water flows from the Sacramento and Feather rivers damaged orchards from direct flooding and indirectly via under-levee seepage.

Marysville walnut grower Brad Foster, who farms acreage surrounding the

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Marysville area, including 400 acres of walnuts in river-bottom land adjacent to the Feather River, said he had trees under river water for upwards of two weeks and as a result lost at least 100 trees due to waterlogging, and expects additional losses due to disease directly related to the continuous saturation.

Foster said nearly every walnut ranch below Oroville clear down to south of Yuba City along the river-bottom areas was impacted by the high water one way or the other, and growers below Yuba City got double hit because they were hit by the Feather and Sacramento rivers.

At times, Foster noted, there was water 10 feet deep flowing rapidly through sections of his orchards.

According to Hasey, she has never seen this type of situation in 35 years.

“There were acres of pecans under water for two months, but they love the water and weren’t harmed as far as we can tell so far,” Foster added.

In addition to damage to trees, growers also saw damage as soil was washed away by the surging rivers. “Not only have we suffered a loss of trees, and

high-quality soil, but I also lost two ag wells in the flood zones,” Foster said.

Last year Foster did very little irrigating, but this year is different. “I’m going to need those two wells repaired, and that adds up to more money lost from the flooding,” he said.

Adding salt to the wound, Foster and other growers lost acres of riverbank that served as natural buffers between orchards and the river.

The financial cost from damages has been substantial, so much so, Foster said, some growers have joined together to sue the state for the losses resulting from the collapse of the Oroville Dam spillway.

“I can’t even say we are in a state of recovery at this point,” he added. “It is still a wait-and-see situation. It’s really tough.”

Research and Results

During the 2017 flood, Hasey said she took water samples from a variety of flood and seepage sites, Sacramento and



Some of the trees in the flooded areas are nearly girdled with black canker, or Phytophthora. Researchers have taken samples to determine what species of the disease are attacking the trees. This picture of an impacted walnut tree was taken by Janine Hasey, UCCE Farm Advisor for Sutter, Yuba, and Colusa counties, in August 2017.

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Feather river water, and samples from trees to confirm aerial Phytophthora, sampling roots in a waterlogged young orchard, and observing conditions where trees died or survived.

Waterlogging

Hasey explained in an article she published with fellow researchers Greg Browne, United States Department of Agriculture (USDA) plant pathologist, UC Davis, Astrid Volder, plant sciences, UC (University of California) Davis, and Bruce Lampien, UCCE walnut specialist, UC Davis, thousands of trees were lost to waterlogging, or anoxia, meaning lack of oxygen.

“Dormant trees often survive winter flooding due to low soil temperatures, low root respiration, cold water, and a lack of active roots,” Hasey said. “Walnut root activity begins about a month after leaf out, which is in May for Chandler, and peaks in the summer. Last year, however, many orchards were still flooded into May or even longer.”

Some trees survived the flood conditions due to temperature or continued water movement which maintained high enough levels of oxygen in the water that roots could still survive.

“Also, orchards in river bottoms and near rivers where seepage occurred are often on lighter sandy or sandy loam soils and oxygen diffuses more readily through lighter soils compared to clay soils,” Hasey reported.

Researchers found survival rate for trees was poor where the water table was close to the surface at the end of summer last year.

In addition, Hasey and the team of experts said shoots from adventitious buds were seen in late June continuing through summer and fall on many waterlogged trees.

“These latent buds sprout when needed from trunks, limbs, or roots,” she explained. “Trees with vigorous shoot growth from these buds especially in lower limb/upper trunk area in late summer-fall often have the best chance



This walnut tree suffering from black, oozing, cankers due to flooding in 2017, shows areas where Janine Hasey and a team of experts took samples for research purposes in an effort to help growers recover from the crisis. Photo courtesy of Janine Hasey.



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they are in fact just getting bigger and that is going to affect a lot of acreage if it doesn't stop," he added. "In my ranch alone, there is a swatch of about 100 acres suffering from the black spots."

Hasey said the trees girdled or nearly girdled with aerial Phytophthora "may not survive, but some scion cankers may stop or 'die out'

of survival the year after flooding."

Aerial Phytophthora

Foster said what many growers in the flood zones have been seeing is significant amounts of dark bleeding spots on their post-flood walnut trees.

"We have all these black spots on our trees, cankers, and that is what we are up against at this point, and it's too early to tell how many trees we may lose to this problem," he added.

Hasey said the "water mold" Phytophthora is found in surface water and infested soils.

From tissue samples and water samples taken last spring from impacted orchards, researchers have determined aerial Phytophthora to be the cause of the dark bleeding areas on the trees—two species have been isolated from the samples, *Phytophthora citricola* and *Phytophthora gonapodyides*.

Along with Foster's observations, Hasey also saw trees differing in severity of infection, some nearly girdled with aerial Phytophthora.

Foster said where the flooding washed soil away from trees root systems he saw black spots and bleeding breaking out all around the lower parts of the trees, some up to three feet high on the tree trunk.

"Now that we've put the ground back around our trees I can't tell you exactly what is going on in the root systems, or the damage occurring because they are covered up. But the black spots on the trees that we can see aren't going away,

in heat, and phosphonate (phosphite) treatments may be beneficial against *Phytophthora citricola*.

What's Next

Hasey and Browne advocate a "wait and see" approach, keeping trees as long as they are economically productive.

"In saturated soils, fine roots die, and depending on the extent of flood-



Growers and researchers are seeing black bleeding spots on the roots and trunks of walnut trees in orchards flooded along the Feather River and Sacramento River last year. Photo courtesy of Brad Foster.

Continued on Page 60

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Hasey advises growers to replace trees killed from Phytophthora, due to flooding in 2017, with clonal Paradox RXI rootstock as is pictured here in flood seepage zone. Photo courtesy of Janine Hasey

Continued from Page 59

ing, larger roots can die as well. It takes time for the roots to regain functionality and re-start new fine root production after flooding,” Hasey added.

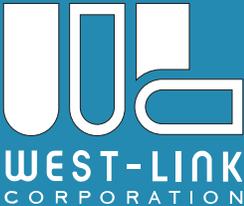
She suggest growers may consider “topping” trees with vigorous shoot growth on lower limbs, but cautioned, trees with little new shoot growth often don’t survive the season after flooding, so topping may not be advantageous in those circumstances.

“Usually, after topping, you can tell within one season if its going to work,” Hasey added.

She also provides advice concerning irrigation this year following last year’s flood, as “water management in such settings is very difficult.”

“It is easy to saturate the soil, particularly when the water table is close, so irrigate judiciously, ideally the using both soil moisture monitoring and plant

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It is unlikely this tree from a flooded orchard will survive, according to Janine Hasey, UCCE Farm Advisor for Sutter, Yuba and Colusa counties. Photo courtesy of Janine Hasey.

Continued from Page 60

pressure chamber data to aid in determining irrigation duration and frequency,” Hasey said.

In addition, she cautions growers need to be aware that pressure chamber measurements may not be appropriate where roots have been compromised, as the observed water stress in the tree may be the result of the inability of the root system to take up water rather than low water availability in the soil.

During May through early August where roots are active, Hasey suggests applying nitrogen fertilizer in small amounts where trees have been topped or have new shoot growth.

Foster said, “It’s kind of scary, we just don’t know what to expect. This is a situation we haven’t ever dealt with before and the farm advisors are doing all they can to help us out.”

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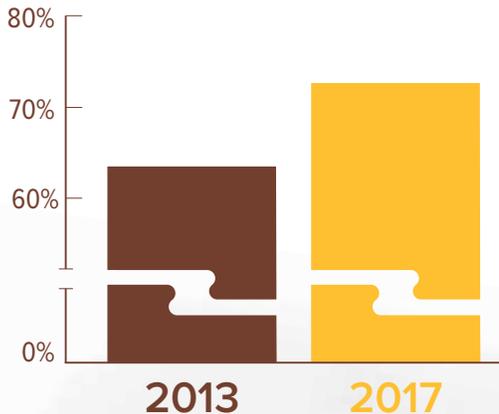
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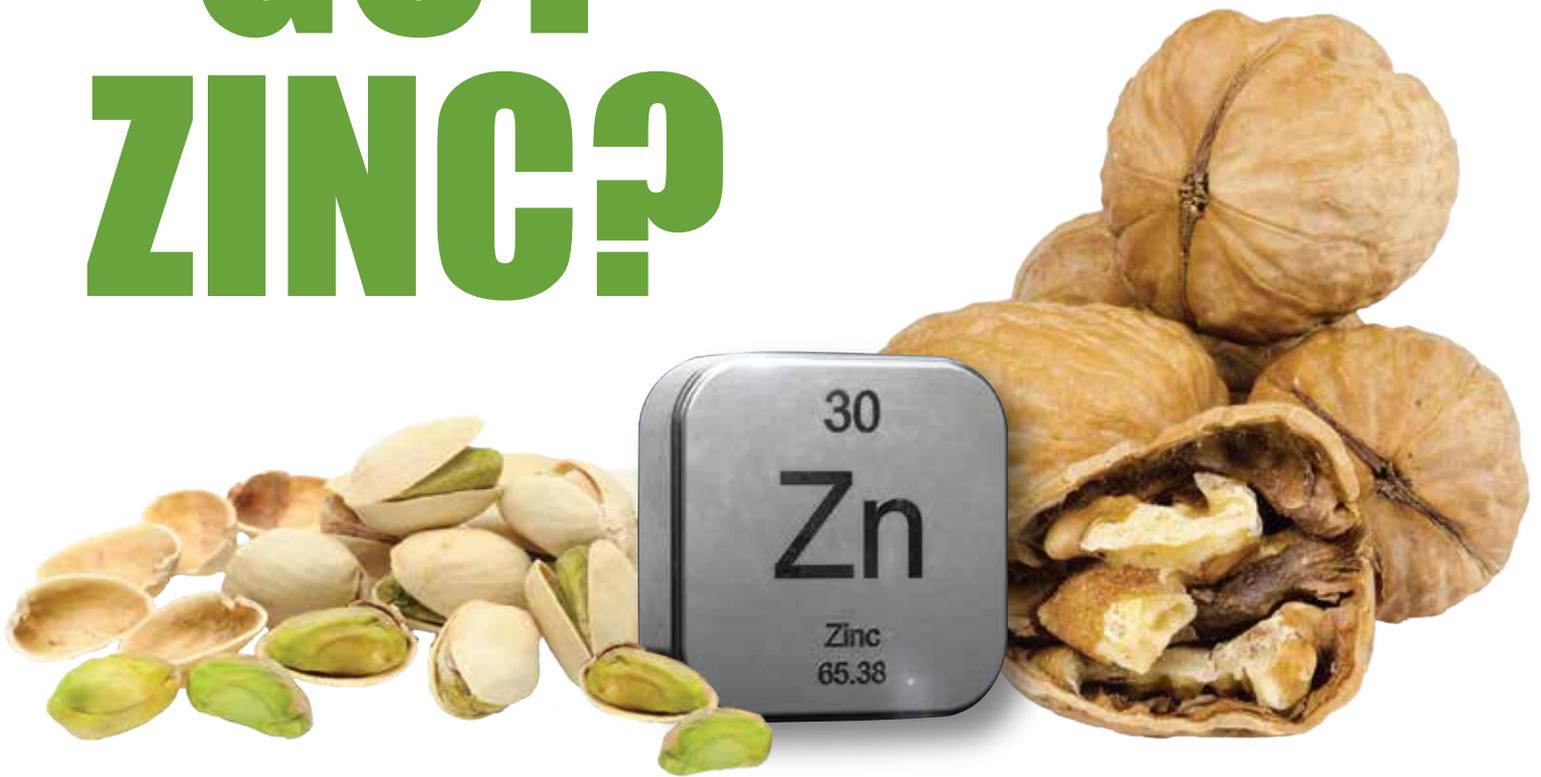
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