

WEST COAST NUT

April 2018 Issue

SPOTLIGHT:

Don't Play a Guessing Game: When to Begin Your First Irrigation

In This Issue:

Approaches to Spider Mite Management in Almonds

Water Management in Walnuts

Floral Bud Drop-What it Means for Pistachios

Nut Mania: Consumers Keep Wanting More & More Nuts





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WEST COAST NUT

By the Industry, For the Industry

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FROM THE EDITOR

Correction *West Coast Nut Issue March 2018*

How do Warm Winter Temperatures Affect Pistachio Bloom and Fruit Set was first published in the March 2018 issue of West Coast Nut magazine. The article was missing authors' names. The online article has been updated. We apologize to David Doll and Louise Ferguson. The correct byline should have read:

How do Warm Winter Temperatures Affect Pistachio Bloom and Fruit Set

By Lu Zhang, Postdoctoral Scholar | Department of Plant Sciences, UC Davis
David Doll | Merced County Farm Advisor UCCE
Louise Ferguson | Extension Specialist, Department of Plant Sciences, UC Davis

FEATURED ARTICLE

Farm advisors and professionals in orchard water management emphasize that tools to determine soil moisture in relation to water holding capacity of the soils and tree water stress in your walnut orchards are critical to irrigation decisions.

See the full story on page 4



WHEN TO BEGIN THE FIRST IRRIGATION

By Cecilia Parsons | Associate Editor

Don't Play A Guessing Game

Farm advisors and professionals in orchard water management emphasize that tools to determine soil moisture in relation to water holding capacity of the soils and tree water stress in your walnut orchards are critical to irrigation decisions.

Allan Fulton, University of California Cooperative Extension (UCCE) irrigation and water resources advisor in Tehama County, said, many walnut growers and managers in the Central Valley are using some combination of soil moisture sensors, water budgeting, and tree stress indicators to determine initial irrigation needs and they also use them to make sure trees have adequate moisture throughout the growing season.

Proper use of those tools can prevent over or under irrigation, and stress on trees, ultimately improving production, consistency and potential.

Why would a grower risk guessing

on such a critical piece (plant available water) in the complex environment that makes up their soil profile, asked Brian Bassett of H2O Optimizer.

Bassett said his company's clients ended the year by recharging the soil profile to about 70 percent of field capacity, in the event that winter rains arrive. Leaching doesn't take place in a dry soil, he noted, so having some level of moisture allows rainfall to create the leaching as opposed to filling the soil profile.



Allan Fulton, University of California Cooperative Extension Irrigation and Water Resources Farm Advisor for Tehama County. Photo courtesy of Kathy Coatney

Growing degree-days are compared to historical bud break or bloom to determine bloom or bud break for the current year. Initial irrigations are to refill soil profiles determined by the sensors.

Depending on growing region, soil profile and weather conditions, Bassett said winter irrigations in walnut begin the second week of February.

Soil profile is important, he noted because clays are slow to fill. Irrigations on sandy soils are closer to bloom or bud break to avoid water leaching.

Correct timing and length of irri-

gations is important because depletion or excess soil moisture in orchards can lower plant vigor or create an environment for the spread of fungal diseases. Nutrient uptake can also be affected.

This Winter

In mid-February, Fulton said with the continued dry conditions, he expected to see more winter irrigation in north valley walnut orchards. In a normal rainfall year, winter irrigation is not necessary in the north valley. It is more common in the south valley, for growers to do one or two winter irrigations to keep the soil moisture levels adequate. Average precipitation can exceed 20 inches in northern walnut growing regions and be as low as four inches in southern regions of the Central Valley.

With continued dry weather and recent cold streak a week later, Fulton said more north valley walnut growers are irrigating this winter in both young and mature orchards. Water applications in young orchards may be motivated to reduce risk of winter kill of shoots that were grown last season as well to refill the soil profile.

"What is different this dry year, chances are without winter irrigation, you will start out with a drier soil profile and need to irrigate earlier in the season," Fulton said. One or two winter irrigations delivering about 2 to 4 inches

of water will help refill the soil profile and allow more delay of the first crop irrigation in the spring, he added. By delaying the start of crop irrigations, he said growers can help protect their trees from low oxygen levels when the trees leaf out and are growing new roots. Also, it helps lessen root diseases that thrive in saturated soils and should provide better access into orchards for pest management unless it rains substantially in April.

Factors In Irrigation Management This Coming Season

Fulton said there can be a tendency to over irrigate in the spring and under irrigate in the summer. It's important to root and tree health not to begin irrigation too early, irrigate too frequently, or too long of a duration in the spring as the trees begin to grow. One northern Sacramento Valley irrigation experiment in Chandler walnut has shown after four years of evaluation that there is a good chance that irrigation may not be necessary during the month of April and that the start of the irrigation season may be delayed until sometime in May. When to begin irrigation in May will be orchard

specific and dependent upon the water holding capacity of the orchard soils and how the absence of rain and winter irrigation was managed.

Research in the late 1980's at the Kearney Agricultural Research and Extension Center and more recent research from 2011-16 in the northern Sacramento Valley indicate a reasonable estimate for seasonal evapotranspiration (ET) is 40 to 42 inches for mature walnut orchards. This should represent a reasonable upper limit for total seasonal water needs for mature walnut. About one fourth of the seasonal ET will occur from leaf out (about April 1st) through hull and shell enlargement (mid-June). The remaining three quarters of the seasonal water use occurs mid-June through mid-November as the kernel inside the shell develops, matures, and is harvested. Soil moisture reserves from winter rainfall or winter irrigation can contribute significantly towards this total seasonal ET and lessen irrigation needs during the growing season. Most orchard soils can contribute at least four inches (10 percent) and as much as 12 inches (30 percent) of stored water towards seasonal ET if they have been

replenished from winter rainfall or winter irrigation.

Age of the orchard does make a difference. Young trees with smaller, developing canopies have lower seasonal water requirements. Young trees in their second and third leaf with an established root system may take a longer delay in the start of irrigation than a mature orchard. Also, intervals between irrigations may be longer in young, developing trees. The exception is the first year, especially early in the season. Potted trees or bare root trees where small root systems are being transplanted into new soils, Fulton explained, may need earlier, light and frequent irrigations until the transplanted tree is able to grow new roots and establish a root system. Once the newly planted tree becomes established light, frequent irrigations may not be necessary, if the tree can acquire stored water from a larger, deeper soil profile. Pruning strategies that affect canopy development can also affect water use, he noted.

Irrigation systems that apply water

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Furrow irrigation about 18 inches from the tree row can be used for the first year on some soils where water infiltrates uniformly and moves laterally. This can also reduce weed pressure and loss of water when compared to flood irrigation. However, furrow irrigation can still be risky on highly variable orchard soils, especially when planting potted or bare root trees



Allan Fulton, University of California Cooperative Extension irrigation and water resources farm advisor for Tehama County. Photo courtesy of Kathy Coatney

Continued from Page 5

uniformly and in controlled quantities will also lessen irrigation needs during the irrigation season. Flooding the entire soil surface should be avoided in very young orchards. With flood irrigation, a lot of water will be applied in areas where the young trees have not yet developed a root system to use the water.

This often results in more weed competition and low irrigation efficiencies.

with small root balls. Drip and micro sprinkler irrigation with drip emitters or a capped sprinkler located near the transplanted trees will be more efficient.

Fulton encourages growers to have their own set of diagnostic tools to evaluate on site conditions and optimize irrigation management throughout the growing season. The general options are to monitor soil moisture, tree water stress, and budget their water using flow meter measurements, ET estimates, and

irrigation system performance information. Often there is value in employing more than one of these approaches.

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FLORAL BUD DROP

What it Means to Your Pistachio Crop

By Cecilia Parsons | Associate Editor

Dormant pruning, said University of California Cooperative Extension (UCCE) specialist Louise Ferguson, appears to be the main cultural activity that will mitigate alternate bearing in mature alternate bearing pistachio orchards.

Ferguson told growers at the 2018 Statewide Pistachio Day that alternate bearing, successive high and low crop loads, does no physical harm to a tree, but, it is not good for regular financial returns to the grower. While farming costs per acre are relatively stable from year to year, a big fluctuation in production from one year to the next makes it tough for everyone along the industry pipeline.

Pruning During Dormancy

Pruning during dormancy, both by hand and mechanically, can produce a better ratio of non-fruiting to fruiting shoots resulting in a decreased crop the season after pruning, but a higher crop two years after pruning. The type of pruning can make a difference. With hand pruning both heading and tipping thinning cuts remove fruit buds, but heading cuts produce stronger vegetative growth, producing more leaf surface area the current season with buds for the crop the following season. Thinning cuts will not. Mechanical hedging, and particularly topping, produces

the same result, but is indiscriminate. Ferguson said a mechanical pruning trial in Kern County with Kerman on Atlantica rootstock over seven years in which trees were hedged six feet from the trunk and topped at 12 feet in height, after the high crop year, entering a low crop year, mitigated alternate bearing by creating a better ratio of fruiting to non-fruiting shoots.

The final cumulative yields between the pruned trees and control trees was insignificant, while alternate bearing was controlled by hedging and topping with topping having the most effect on alternate bearing. Yield was decreased in the initial year for the all pruned trial trees, but by the third year yields were normal.

“This did nothing to change bud drop, that remained the same within an individual shoot. We just changed the proportion of fruiting to non-fruiting shoots,” Ferguson said.

There was also an inverse relationship with yield and trunk girth gain and a positive relationship with cumulative shoot growth.

A later trial at the University of California (UC) Kearney Center conducted by the former Kings County farm advisor, Bob Beede, looked at mechanical hedging prior to both off year and on years and included trees on PGI and the hybrid rootstocks produced by crossing Atlantica with PGI, PGII, and UCBI, rootstocks.

The results, detailed in the California Pistachio Research Board 2017 Executive Summaries, are also available online at ACPistachios.org. According to the research report, mechanically topping and hedging before on and off years is equally effective at mitigating alternate bearing in the hybrid trees. The data further demonstrated mechanical pruning entering the low crop year decreased alternate bearing in trees on Integerrima and Atlantica rootstocks by approxi-

A fruit bud on a current year's shoot growth wood had dropped off, a phenomenon correlated with heavy crop on the year old wood. All photos courtesy of Louise Ferguson, UCCE Specialist



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mately 50 percent.

Alternate Bearing an Evolved Trait

Ferguson speculated that alternate bearing in pistachio trees is an evolved trait that had a survival function. Domestication of the trees, assisting them in bearing heavy crops in an on year with irrigation, fertilization and pruning to maximize sun exposure, exacerbates the trait. For the short term, pruning has been proven to mitigate alternate bearing. The long-term solution, the mechanism that controls alternate bearing must be determined, the genes identified and selective breeding used to eliminate it. However, this will require years as the trial data demonstrated that even though alternate bearing occurs in the scion of a tree, the rootstock obviously affects it.

Ferguson said economic analyses demonstrated the early decrease in yield incurred with mechanical pruning was offset by the lowered costs for mechanical pruning, combined with the hand pruning that must always supplement mechanical pruning. The final cumulative crop yields for both mechanically and hand pruned trees were statistically equal.

Growth Regulators

Ferguson said the currently registered growth regulator and natural seaweed biostimulant products on the market claiming to mitigate alternate bearing in pistachios, with and without low biuret urea, have been field tested on Kerman trees on UCB 1 rootstock for two years in Colusa County. She said products did not achieve a decrease in bud drop, or significantly affect the alternate bearing cycle, as they did not address the reason for the floral bud drop.

Floral Bud Drop

To understand how floral bud drop leads to alternate bearing, Ferguson said there must be knowledge of mature tree growth and understanding of pistachio nut growth. Pistachio trees are apically dominant, meaning they grow from shoots from a single vegetative bud at the tip. The bud, Ferguson said, tends to suppress branching beneath and when pistachio trees are mature, they almost exclusively produce lateral fruit buds.

The current years' shoots are sup-

porting two crops, the current year's crop on one-year-old wood with no leaves and the new buds produced in their leaf axils.

Ferguson said that in 2008 research by Tim Spann demonstrated that by early June carbohydrates produced by previous year leaves and stored in the one-year old wood where the nuts are borne were exhausted. At that time, at about 900 accumulated heat units, the kernel begins to grow. Bud drop, Ferguson said, is correlated with kernel growth. Kernel growth uses the carbohydrates produced by the leaves of the current years shoot growth. Some researchers have suggested that the growing kernels always exert the strongest demand on a tree's carbohydrates, and that the growing kernels simply outcompete the developing buds for resources. However, the buds require so little, and are closer to the leaves, in the leaf axils, that this does not seem logical. It is more logical that the trees that had the ability to drop their buds were those that survived, thrived and reproduced.

Pistachio Tree Evolution

How pistachio trees evolved may also

answer why they developed the alternate bearing habit. Earlier investigation by UC Davis Plant Science Department graduate student Max Stevenson, Richard Rosenstock and Professor Ken Shackel theorized that alternate bearing was similar to masting in oak trees. The phenomenon in which a large crop of acorns is produced one year, followed by a much smaller crop in subsequent years. The lack of crop meant less food for pests, and less plant materials for diseases to proliferate. After the disease and pest populations decreased the tree could successfully produce crop again. Evolution of the pistachio tree could also be why it has developed an alternate bearing cycle.

Pistachio trees in unfarmed situations adapt to drought, nutrient deficiencies, pests and diseases that keep them from producing the large crops seen in current commercial production. In commercial production, Ferguson said, two things are done. Constraints on resources are removed, trees are irrigated, pruned, fertilized and protected from pests. They are also selected for high

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yield. The result of these actions is crop overload and carbohydrate depletion followed by a smaller crop the next year.

Carbohydrate Status

How does this depletion result in bud drop? Multiple studies have determined that bud drop is correlated with nut growth and branch carbohydrate status. That demonstrates correlation, but causation, Ferguson noted, is different. What actually causes the buds to die and drop is unknown. More research found that girdling the phloem between the current year's wood and one-year old wood did prevent bud drop. That suggests, Ferguson said, that there is some signal, probably a growth regulator, coming from the developing nut to buds on current year's shoots. The definition of a growth regulator is a compound produced in response to a situation in one location in a plant, translocated to another location in the plant to produce a result. This specific signal, that produces what we see, the bud death and visible drop that results in alternate bearing is



The final fruit bud had not dropped yet, but one behind had-buds drop from branch base to tip

unknown.

Dr. Maciej Zwieniecki at UC Davis explained to growers at Pistachio Day how carbohydrate status in pistachio trees at different times in the year may be linked to floral bud drop and trigger alternate bearing cycles.

In looking for a link between carbohydrate status and alternate bearing, he tracked pistachio acreage and yields from 1980 to 2015. During the first 15-20 years, there were alternate high and

low bearing years, but for a short time there was much less of a yield difference between years then another period of alternate bearing followed by a "uneven" bearing period—all while acreage was increasing rapidly statewide and the new acreage coming into bearing could be obscuring the alternate bearing of the mature tree population. This is consistent with a long-term pistachio production analysis produced by Craig Kallsen. The Kern County farm advisor demonstrated that the strongest predictor of pistachio yield is the previous year's yield, and that this potential yield can be decreased by temperatures that are too low or too high; that fall outside the optimal dormant

chilling range for this temperate tree. Dr. Zwieniecki's developing results corroborate this.

Environmental Trigger

Zwieniecki said he believes an environmental trigger allows trees to synchronize their bearing and it likely occurs during dormancy. Temperatures in the winter affect stem respiration and loss of carbohydrates prior to bloom. Frost events may have a specifically high impact, he said.

His Carbohydrate Observatory project at UC Davis is aimed at developing a tool to predict yield using starch and sugar levels in tree branches over the previous year. The project is also studying how a tree's carbohydrate reserves affect floral bud drop along with other reproductive activities.

Pistachio growers who have been submitting wood and bark samples for the Observatory Project can track the carbohydrate status through the year and use that information to make management decisions.

One of the other aims of the project is to track a large volume of samples to show statewide trends in carbohydrate levels. Zwieniecki said data collected by the observatory project in 2017 and 2016 showed how carbohydrate levels follow the alternate bearing pattern. Data from 2017 showed trees accumulated about twice as much carbohydrate as they did the previous year, so an on year is expected in 2018.

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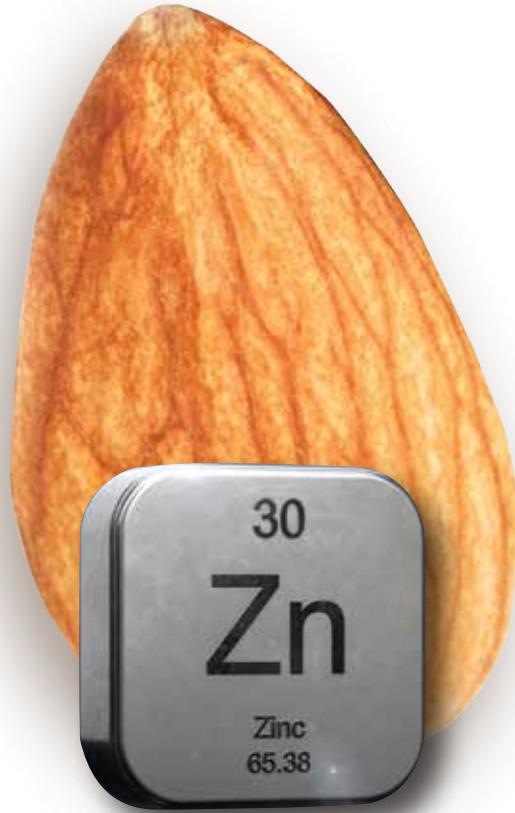
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Sweat the Small Stuff

When it Comes to Airblast Spraying

By Franz Niederholzer
UCCE Farm Advisor, Colusa/Sutter/Yuba Counties

“Don’t sweat the small stuff” is a popular saying. It is available printed on T-shirts, coffee mugs and posters. The saying goes on to tell us “..and it’s all small stuff”. I disagree.

Broken Pressure Gauge. All photos courtesy of Franz Niederholzer

partially plugged nozzle, but it’s hard to tell small to moderate changes in operating pressure by watching the nozzles. Unrecognized pressure differences can make a significant impact on spray delivery. For example, TeeJet reports a 17 percent decrease in gallons per minute (GPM) flow between 150 and 100 psi for a D4/25 nozzle. That’s 17 percent less material being applied—for example, actually applying 3.7 oz/acre Altacor®

Some Small Things Matter

Some small things matter, a lot, in airblast spraying. The trick is knowing what is really small stuff, the stuff that doesn’t matter, and what looks small, but isn’t. When spray material costs \$40+/acre (before application costs) and navel orangeworm (NOW) damage costs \$150/acre per one percent on your reject sheet, some “small stuff” matters. This article will review some of the small things that really matter in airblast spraying, why that is, and what you can do about it.

Pressure Gage

The pressure gauge on a sprayer can cost around \$20, new, over the retail counter with no volume discount. That’s a cheap part on a sprayer that costs tens of thousands of dollars; cheap but not small. Once the sprayer is working, the pressure gauge is a key tool, maybe the only tool that the operator has to check the system to make sure the sprayer is operating as calibrated; that the PCAs recommendation and the label are being followed. An alert operator can see a



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when the rec reads 4.5 oz/acre. If the pressure is higher than intended, then the application could exceed the labeled rate, possibly risking Maximum Residue Limit (MRL) issue(s) and waste money or at least cost more than planned. If pressure is off and the operator doesn't catch the change in nozzle flow when refilling, you could need more material than delivered and the crew and sprayers might have to sit until more arrives.

Even a new pressure gauge may be inaccurate. How can you tell if a new gauge is accurate? You have to compare your pressure gauge (new or used) to a reference gauge when both are attached to the same pressure source. You can make your own using air (<http://sprayers101.com/confirm-sprayer-pressure/>) or buy one that uses oil as the pressurizing liquid (for example: <http://aams-salvarani.com/en/products/manometert-ester/>).

Finally, changes in pressure gauge readings may indicate sprayer problems, such as a partially plugged filter, stuck/partially sticking pressure regulator, etc. See an article on what a pressure gauge can tell you about the sprayer or spray mixture at : <https://sprayers101.com/the-pressure-gauge-shows-more-than-pressure/>. An accurate pressure gauge can tell you a lot.

Nozzles

Nozzles are another low priced item, which, when worn beyond manufacturer's specs, can cost you more to continue using than replacing. A set of nozzles costs in the range of \$100-\$200 depending on how many nozzles you run on the sprayer. Materials for a single spray on 100 acres can cost \$5000. If the nozzles are worn (by the use of F, DF or WDG pesticide formulations that contain finely ground clay) and putting out 5 percent more spray than the rec called for, there goes an invisible \$250/spray. In this and many situations, you would be money ahead to replace the nozzles compared to a single application with worn nozzles. So, to avoid losing money through worn nozzles, replace them annually or compare the flow rate from the sprayer through existing nozzles to flow through a reference set of nozzles—a set that you purchase and use only with clean (less abrasive) water. It's your call as to where you draw the line (5 percent? 10 percent?) on unacceptable nozzle wear, but checking sprayer GPM on a regular basis helps recognize when the nozzles are

wearing and need to be replaced.

Check the GPM

There are at least a couple of ways of checking GPM from a sprayer. A quick way is to fill the sprayer to overflowing with clean water on a level surface and run the sprayer at your standard settings (system pressure, engine or PTO speed, etc.) for a set time (1, 2, or 3 minutes, etc.) while it remains parked. Refill the sprayer to the starting level using a hose with flow meter or just some calibrated buckets. Divide the total water sprayed out by the run time to get GPM. Check that number with sum of manufacturer's catalog GPMs for the nozzles used. You can also check individual nozzle GPM with homemade or custom clamp and tubing to direct all the flow from each nozzle into a calibrated bucket or cylinder when the sprayer is running at your standard settings and the fan geared to neutral (if your sprayer has a gearbox). Check the output of each hose for a set time and compare to factory settings or a previous measurement of the same nozzle (new) and sprayer settings. To check total sprayer GPM, add up all the values for each nozzle. Keep a record of all settings and measurements for comparison next time. This practice (GPM check) is also a good time to clean up and check out the sprayer ahead of the next spray job—if it wasn't done immediately after the last spray job. This practice can save time when mites flare or a spring weather forecast shifts from "chance of showers" to "rain".

Changing Nozzles

When it comes time to changing nozzles, what nozzle material is best? Brass wears too fast while hardened stainless wears more slowly than brass, but faster than ceramic. (Ceramic nozzles do wear, but slowly.) If you use separate disc/core hollow cone nozzles, replace the cores (swirl plates) when you change the tips. They wear, too. While ceramic disc/core hollow cone nozzles are very resistant to wear, they can easily break or chip if over-tightened on the sprayer or dropped on concrete. Newer plastic body/ceramic nozzle inserts (TeeJet TXR; Albuz ATR, etc.) are much less fragile and so more forgiving of over-enthusiastic wrenching on nozzle caps. These color coded nozzles make it much, much easier to check that the right nozzle(s) are in the right location

Continued on Page 14



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Continued from Page 13

on the sprayer from day to day (or night to night). More small stuff that adds up.

Check your screens, from the tank to the nozzles, to make sure they are clear, clean and working properly. To avoid plugging make sure that the manufacturer's recommended screens (strainers) are used at the nozzle. If you switch from larger diameter disc/core nozzles to the single body, plastic ones that generally deliver smaller droplets, make sure you switch to finer strainers, too. For the plastic TeeJet strainers, the red ones are 50 mesh (recommended for TXRs), while the 25 mesh are yellow and the 16 mesh are grey (recommended for the disc/core nozzles). See the manufacturer's catalog for recommended strainer for each disc/core nozzle.

Finally, don't let leaks linger. They waste money and might be a sign of a coming problem. Best wishes for a good crop.

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2018 WEED ORCHARD MANAGEMENT

By Brad Hanson | UCCE Weed Science Advisor
Mariano F. Galla | UCCE Agronomy Science Advisor, Glenn, Butte and Tehama Counties

Weeds are a major pest and recurring management concern in tree nut orchards and can significantly reduce the cropping system efficiency. Although nut trees are competitive with weeds once they are well-established and have a large canopy, weed control is critical during the first years after planting. Young, widely spaced trees allow a lot of sunlight and other resources to be available for weed growth, while small trees are both relatively weak competitors and more likely to suffer from weed competition or poorly performed weed management operations.

In addition to directly competing with trees for water, nutrients and other resources, weeds can also interfere with irrigation, harvest, and other field operations. During harvest, weeds

with robust stems or clumping growth habits can trap nuts, greatly reducing the efficiency of sweeping, blowing, and pickup operations. Weeds also can serve as alternate hosts or provide habitat for other pests of nut crops such as insects, mites, diseases and rodents.

IPM

Like management of other orchard pests, a good weed control program should utilize the familiar concepts of integrated pest management (IPM); an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of different techniques and tools. For weeds, this includes horticultural practices used on the crop, management tactics to reduce germination and establishment of weed

seeds and seedlings, and control of weed escapes before they set seed and add to the weed seed bank in the soil.

Correct Identification

Correct identification of the weed species present in the orchard based on field scouting and yearly record keeping is a very important aspect of a successful weed management strategies. Different weed species or types of weeds can respond quite differently to available control techniques; no single tool or program is completely effective or economically and environmentally appropriate in every situation. In some cases, what may be a successful strategy for one type of weed may actually favor another species or group of weeds in a field and make that problem worse.



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Young almond orchard with different weed problems and management programs in middles vs the tree rows. In the middles, tillage provided effective control of the winter annual weeds but led to greater establishment of pigweeds and other summer annuals. In the tree rows, a glyphosate-based postemergence program provided good control of most weeds, with the exception of glyphosate-resistant hairy fleabane. All photos courtesy of Brad Hanson

Weed Populations Vary

In California, tree nut orchards can be found throughout the Central Valley and weed populations can vary dramatically among locations and climate zones. Most weeds in orchards are either winter or summer annuals; however, there are also several important biennial and perennial weeds species (see the UC IPM Almond Pest Management Guidelines for a list of common species <http://ipm.ucanr.edu/PMG/r3700999.html>). Winter annual species, such as annual bluegrass, Italian ryegrass and shepherd's purse, germinate in the late fall and early winter and should be managed before they compete for nutrients and water in spring. On the other hand, summer annuals such as junglerice, crabgrass and lambsquarters germinate in late spring and grow rapidly during summer and can compete for water and interfere with harvest operations.

Perennial Weeds

Perennial weeds can be extremely problematic in orchards and they are difficult to control once established. Most preemergence herbicides do not effectively control well-established populations of weeds like field bindweed, yellow nutsedge, johnsongrass, or bermudagrass. Ideally, as part of an integrated weed management strategy, weed control of significant populations of perennial weeds should begin before the orchard is planted when the grower has more non-selective options at their

disposal.

Successful Weed Management

Successful weed management programs incorporate regular monitoring of the orchard to determine what is working and where improvements can be made. An effective year-round or multi-year strategy in an orchard will consider the spectrum of annual (both winter and summer) and perennial weeds in the locations and be based on records of what practices or products were used in previous years, what their modes of action were, and how the program performed on the key weed species. These data will help the grower or pest control consultant identify changes in the weed spectrum and develop future plans for the site.

Orchard growers can utilize many different weed control practices that can be broadly grouped into: cultural, mechanical,

and chemical control. Most growers use multiple tactics during the life of an orchard or even in different management zones within the same orchard. For example, weed control in young orchards is

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often more heavily dependent on tillage because the same operations can control weeds and also prepare and smooth the orchard floor for future harvest operations. Later in the orchard lifecycle, a common approach is to use herbicides within the tree rows (the “strips”) and close mowing between rows (the “mid-dles”).

Herbicide can be used in orchards before weeds germinate and emerge (preemergence herbicides) or after they have emerged and established (post-emergence). In established orchards, herbicides are often applied only in strips centered on the tree row because weeds in this area interfere the most with the crop and are most difficult to manage with other practices. A common herbicide program is to apply pre-emergent herbicides in the strips in late fall or early winter and the follow up with postemergence herbicides, or tillage, in late spring or early summer.

Herbicides

Many different preemergence and postemergence herbicides are available in the market. Each product or tankmix combination will have strengths and weaknesses in terms of weed control performance as well as economic considerations that include the cost of the material and application(s) needed for year-round control. Even after an appropriate herbicide program is selected for the weeds in the orchard, it is extremely important to ensure that the product is applied at an appropriate rate and timing for best performance and crop safety. Always read and follow herbicide label directions, taking particular care in young orchards where additional precautions may apply. Useful information on herbicide registration and uses in almond, walnut, and pistachio can be found in the relevant crop Pest Management Guidelines on the UC IPM website (<http://ipm.ucanr.edu/PMG/crops-agriculture.html>) and on the Weed Research and Information Center website (<http://wric.ucdavis.edu/>). A list of herbicides registered for use in tree and vine crops in California is available at this link: http://wric.ucdavis.edu/PDFs/T&V_herbicide_registration_chart.pdf

Reduce Resistance

In addition to selecting weed control

practices for the weeds present in the orchard, it is also important to select practices that reduce the selection pressure for resistant or tolerant species or biotypes. Herbicides in particular, impose a great deal of selection pressure. Repeated used of herbicides with the same mode of action can quickly result in the development of herbicide-resistant species. Likewise, both herbicides and mechanical approaches can lead to shifts in the weed spectrum to shift toward species that tolerate or avoid the practice. Herbicide resistance in California orchards is dominated by glyphosate resistance, particularly grasses such as Italian ryegrass, annual bluegrass, and junglerice and the broadleaf species horseweed and fleabane. Rotating herbicide modes of action within and among years, using multiple modes of action in tankmix or in sequence, and periodic incorporation of non-chemical weed control tactics are the best way to minimize problems with resistance. Just like with fungicide and insecticide resistance, the best way to protect these herbicidal tools from loss of efficacy due to resistance is to use them appropriately and prescriptively.

In Conclusion

In conclusion, any available weed control practice has positive and negative consequences that need to be taken in consideration before establishing a weed management program. While there is not a simple solution for controlling weeds in tree orchards, the most successful and sustainable strategies are based on the integration of different techniques. Weed monitoring and proper weed



Almond Orchard with Italian ryegrass control failure due to a combination of poor coverage with the preemergence herbicide program and ineffective postemergence control of the glyphosate-resistant population.

identification following the principles of IPM are a critical part of a successful weed management program.

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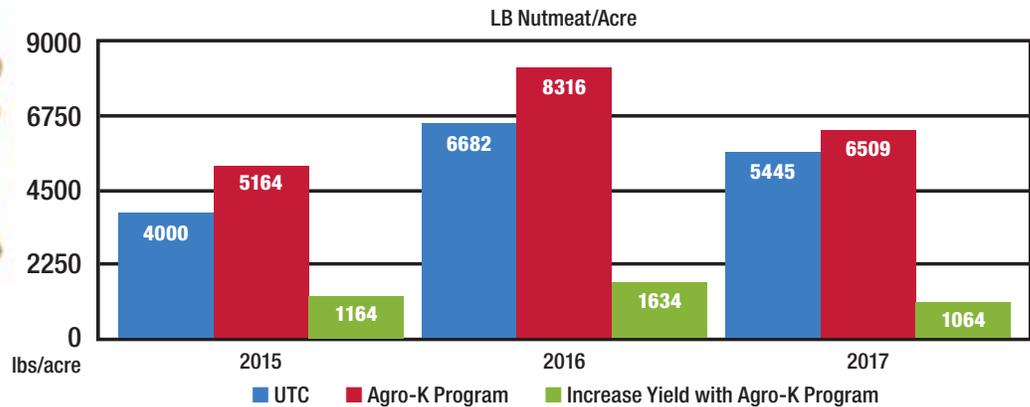
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Plus +4 D.L. is also specifically designed to be compatible with early season copper sprays.

As bloom, nut set and cell division occur demand for calcium peaks; in addition micronutrient demand is still occurring as new leaf and terminal growth continues. Applying **Vigor-SeaCal** in combination with **AgroBest 9-24-3** followed by **Zinc Plus +4 D.L.** during rapid leaf growth help growers meet a walnut tree's complex and significant nutrient demand at this critical physiological stage. Satisfying peak nutrient demand will result in improved nut set and cell division that sets the stage for large, dense nuts with maximum weight at harvest. **Vigor-SeaCal** combines calcium in a carbohydrate formulation with Agro-K's powerful seaweed extract to enhance nut cell division. Applying an energy-stimulating high phosphate NPK like **AgroBest 9-24-3** enhances seaweed efficacy helping drive more nut cell division for larger, denser nuts. **AgroBest 9-24-3** is specifically designed with minimal potassium content for early season foliar applications. Foliar spray mixes with even moderate amounts of potassium applied during cell division will antagonize calcium uptake and negatively impacting leaf cell wall integrity and nut quality. The **AgroBest 9-24-3** ratio provides more units of ortho-phosphate, for better foliar uptake, per dollar than most other NPK blends without antagonizing calcium incorporation into cell wall structures.



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Consumers Keep Wanting More & More Nuts

By Kathy Coatney | Editor

It's nut mania. Consumers are crazy about nuts whether it's pecans, walnuts, hazelnuts, pistachios, or almonds.

They can't get enough of them, and that's good news because the more products that use nuts, the more nuts that are used

and the better for the nut industry as a whole.

Alternative Dairy Products

Jennifer Williams, Marketing Director of U.S. Advertising with the California Walnut Board, said, "We've had some exciting products that launched just in the last couple of months."

Walnut milk was released by two processors in January of 2018, and we're really excited about that, Williams said.

Polly Owen, Director of the Oregon Hazelnut Marketing Board said, "There's actually some hazelnut milk being produced."

There is some pistachio milk available, too.

Jennifer Ivey, a pecan grower and an alternate on the American Pecan Council in Clint, Texas, said pecans aren't just for baking anymore, and they will be side-by-side with other nuts soon.

"It will be a snack, and it will be a year round product, just like almond has almond milk, pecan milk will be right there next to it soon," Ivey said.

Almond milk continues to do well, and it is even expanding into products like yogurt, according to Harbinder Maan, associate director of trade, marketing and stewardship with the

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Almond Board of California (ABC). “It’s really taking the concept of the almond milk, and the dairy alternative category, and building out new products,” Maan said.

Nut Butters and Sauces

Hazelnuts are best known for pastes, butters and candies, but they are also in bakery products and snack products, and they are doing well in these categories, Owen said.

Walnut spreads, butters and sauces are another category that we are excited about, Williams said. While this is a small market, it has a really huge potential, she added.

A walnut processor launched three flavors of walnut butters this year, and walnut hummus also has potential, Williams said.



Pecan butter. Photo courtesy of American Pecan Council.

Traditional Markets

There are new hazelnut products on the market that cover the gambit from confectionary and baked goods, to snack nuts.

We’re seeing an interest in hazelnuts by the consumer, and this shows that the consumer likes hazelnuts, Owen said.

We’re very happy when walnuts go into any product, but we’re even more excited when they go into products that are outside their traditional forms of banana bread, brownies and cookies, Williams said.

Pecans have been pegged as a bakery item, too, but Ivey said as demand grows, and as consumers become aware of the health benefits of pecans, more consumers will buy pecans.

There is nothing wrong with the traditional forms, but expanding the uses for walnuts benefits the entire walnut industry, Williams said.

“We see more opportunity, obviously, in premium baking, not just regular baking,” Williams said.

Regular baking are the mass produced cookies, brownies and breads that are found everywhere. Premium baking

is the small niche bakery that only makes walnut products daily for their customers, and they aren’t mass produced, Williams said.

“We want to be that premium item that sets something apart and makes something special,” Williams said, adding we want to be Pepsi, not soda.

Snack Products

Almonds are seeing new product growth in a couple of key areas.

- Traditional categories—chocolate and snacking
- Almond milk and almond butter that are different forms of almonds that have become products in their own right

“That’s where we’re seeing a lot of the growth right now,” Maan said. Nielsen data that was run in North America for ABC found that in snack nuts, almonds have continued to take a bigger piece of the pie. It used to be 60 percent ingredient usage and 40 percent snack nut usage, but that has flipped on its head, Maan said.

“Right now total snack is about 54 percent of almonds sold in the U.S. with the remainder being ingredients,” Maan said.

There also continues to be a lot of innovation in snacking. “It’s definitely a category that’s growing,” Maan said, as well as snacking occasions.

Snacking occasions could be anything from using almonds as a mini-meal to an in-between meal, Maan said. Pecans aren’t in the snack area yet, but they’re coming, Ivey said. They are in some of the snack bars, but in limited numbers.

Pistachios are in some snack bars, too, and there is a line of flavored pistachios from habanero to garlic onion. There are also chocolate covered pistachios.

Williams has seen some movement in the snack products for walnuts. “We are seeing walnuts in some trail mixes here

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Hazelnuts being processed.
Photo courtesy of Oregon
Hazelnut Industry Office



Continued from Page 21

and there,” Williams said.

“We’re working to really get the word out that walnuts are good for snack bars and other things like that,” Williams said.

Nut Oils

There is some minimal hazelnut oil being processed, Owen said.

“We do have a couple of processors who do process some oil, but it’s not large,” Owen said. “Right now, in the United States, we don’t have the volume to warrant doing a lot of oil. We do do a lot of butter and paste, so we’re seeing that.”

As non-bearing hazelnut acreage increases and comes into production, there will be more nuts, and at some point, there could be more oil made with the increase in volume, Owen said.

Pecan oil is available and many companies have been producing it for some time, Ivey said. Most of the oils are sold in specialty stores, she added.

Almond oil remains a very niche market because it has a very high smoking point. It’s typically used in salad

dressings versus cooking, so we’re not seeing a lot of increase here, Maan said.

We are, however, seeing increased usage of almond oil in beauty products—hair care and lotions, Maan said.

Niche Markets

Strong trends are being seen toward niche markets for vegan eating, particularly in Germany, Maan said. “We’ve seen various almond spreads on the market because it’s vegan.”

Dairy free and gluten free are two of the categories that have been increasing, too, as well as almond flour, Maan said.

Clean labels—meaning a product with only three or four ingredients are another trend that

we’re seeing, Maan said.



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“Almonds are a nice fit because they have a relatively long shelf life compared to some other ingredients,” Maan said.

New products face several challenges from getting shelf space in the large chain grocery stores, to slotting fees, to distribution, Williams said.

Many small processors look for non-traditional ways to market their product—starting online and with placement in small specialty stores, Williams said. The specialty stores offer more opportunity for them to get their products onto their shelves, she added.

The Future

Pecans recently created a marketing board and Ivey sees this as a huge benefit to the industry. “I think that it’s going to help us drive the demand for pecans,” Ivey said.

“Once we’re organized and unified as growers and shellers and we are working together, I think the benefits are going to be astounding,” Ivey said.

Hazelnuts have a lot of new acreage

in the ground. “We’re waiting patiently for those new orchards to come into production,” Owen said, adding very shortly, maybe even this year, we hope to see a jump in production.

Until these new varieties actually come into production, we won’t know

for sure what kind of volume there will be, but Owen anticipates that hazelnuts will go into other products as volume increases.

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



Almonds being processed.
Photo courtesy of Almond Board of California.

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BY RICH KREPS, CCA



The nuts have ample phosphorus.
All photos courtesy of Rich Kreps

One of the most overlooked nutrients in agriculture is phosphorus. Being one of the big three, Nitrogen (N), Phosphorus (P), potassium (K), (NPK) a grower would think it deserves much more attention than it receives. Phosphorus is the key nutrient for energy production which drives the metabolic processes, enzymatic responses, nutrient movement, and cellular function. However, not all phosphorus is created equal. How we apply the different forms of phosphorus and the rates we use greatly enhance or hinder the response we get and the absorption of the nutrient.

Organic Chemistry

Organic chemistry is probably not something many of us care to revisit or have even thought about outside of us having to pass those old college tests.

However, a quick refresher will help to highlight some of the important characteristics of what makes phosphorus so important to agriculture. Phosphorus is very unstable by itself and therefore highly reactive. It's what makes up most of the tip of match sticks and causes them to burn. In agriculture, phosphorus exists in our fertilizers as oxidized forms of phosphates. We mine this phosphorus in forms of apatites that are formed with chlorides, fluorides or calcium. These rocks are similar to the structure of bones and teeth. After crushing these rocks, adding sand, heat and oxygen, we get phosphoric acid which allows us to make fertilizer. In nature, phosphorus

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That's enough of the chemical jargon. You're probably thinking, "Please just tell me why I care, and how it is going to help me make better crops." You are recommended multiple forms of phosphorus fertilizers to push growth, set crops and sustain your livelihood. Forms like single super phosphate, triple super phosphate, Monoammonium Phosphate (MAP), Diammonium Phosphate (DAP), and phosphoric acids are readily available to us as farmers. How we use them and more importantly how the

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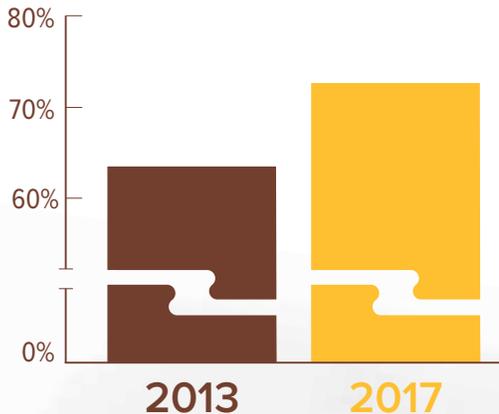
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New retail programs are designed to stimulate consumer purchase by making the connection between our advertising and marketing efforts and the shopper experience at point of purchase. During **American Heart Month in February**, California Walnuts will provide in-store support for retailers in select markets with header cards, shelf talkers, loyalty card offers, in-store demos, TV tags and radio spots. All materials emphasize our message of heart-health*, simplicity, and versatility.

Food Manufacturers

To build awareness and interest in California walnuts as an ingredient in packaged foods, print and digital ads will target food manufacturers.

The ads will communicate their premium image and heart-healthy goodness. Premium baked goods, sauces, and spreads containing walnuts are large categories with significant growth opportunities.



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◀ **72%** of consumers would purchase a food product knowing it contains walnuts. 2017 Attitude & Usage Study

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*Heart-Check food certification does not apply to recipes unless expressly stated. See heartcheckmark.org/guidelines. Supportive but not conclusive research shows that eating 1.5 ounces of walnuts per day, as part of a low saturated fat and low cholesterol diet and not resulting in increased calorie intake, may reduce the risk of coronary heart disease. (FDA) One ounce of walnuts provides 18g of total fat, 2.5g of monounsaturated fat, 13g of polyunsaturated fat including 2.5g of alpha-linolenic acid - the plant-based omega-3.

plants use them is what concerns us.

Phosphorus Fertilizers

The two forms of phosphorus fertilizers that we deal with on a daily basis are polyphosphates and orthophosphates. Plants can only take in phosphorus in the orthophosphate form. The majority of the fertilizer we buy consists of 60-70 percent polyphosphate and 30-40 percent orthophosphate. Fertilizers with 100 percent orthophosphate are rare because of the cost of making the plant ready material. They can be made with an industrial application producing a green, less pure orthophosphate, or a white, smelted furnace grade, cleaner and more expensive form of orthophosphate. Here's the good news. Polyphosphate, under normal conditions in season, with ample moisture, will convert to orthophosphate in four to five days according to most research. The bad news is early applications of polyphosphate fertilizers are usually made under less than ideal conditions. Cold soils with lethargic microbiology will hinder transformation of polyphos-

Zinc	0.0	ppm	12.5						
Iron	0.3	ppm	6.0						
Copper	0.4	ppm	8.5						
Manganese	0.3	ppm	22						
Sulfate	115.0	ppm	38.5						

	Exchangeable Cations Result	Base Saturation Acetate Extraction			Water Extraction Result	Water Extraction % Total	Extraction Ratio	
		Your %	Optimal %	Low Normal High				
Potassium	423 ppm	4.3 %	3-7		Potassium	0.83 meq	2.8	7.71 %
Calcium	3,001 ppm	60.1 %	65-78		Calcium	9.38 meq	31.3	16.26 %
Magnesium	863 ppm	28.3 %	12-21		Magnesium	6.75 meq	22.5	9.51 %
Sodium	418 ppm	7.3 %	<3.1		Sodium	12.93 meq	43.3	71.39 %

Plant Nutrient Recommendations			Lbs/Acre		Total Nitrogen				
Nitrogen	208.0 Lbs/Acre	Sulfur*			Bray Phosphorus	ESP	SAR	C:N	Ca:Mg
Phosphorus	81.7 Lbs/Acre	Boron			Ammonia Nitrogen	7.3	4.6		3.5
							CEC	24.8 meq/100g	

phate to orthophosphate for as much as 90 days. That's too late for the optimal growth pattern we see in spring.

Many phosphorus fertilizers are reacted with nitrogen to form compounds with 7-20 percent N. These reactions many times produce products with some heavy metals and acids that can harm tender young roots. In row crops we typically side dress these fertilizers to allow the soil to buffer and dilute the nutrients a bit before the roots reach them. Often times this is sufficient to start a crop or give it the bump it needs to ensure its vigor. Many farmers choose to spend a little more per unit on their fertilizer that

has a higher concentration of orthophosphate in hopes that when the soil solution comes in contact with the roots, the plant is available to immediately absorb that form of phosphate. Cleaner mixes with more orthophosphate should allow a plant to readily take in more of the P in colder, saturated spring soils.

Phosphorus is very immobile in soil so after that initial rinse of fertilizer in a fertigation event, P stays put and roots must intercept it.

In the last few years, I have made the argument that we are leaving a bit of our yield potential on the table because of

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our methods of phosphorus fertilization. Farmers that weren't able to apply ample amounts of phosphorus in their post harvest program can find their plants deficient in the spring. As the root ball expands during root flush, any remaining phosphorus that roots have intercepted has been used up. Applying fertilizer in the polyphosphate form that a plant can't take in, especially when it's cold and can't convert it, won't allow an ample energy

supply to be absorbed for our trees. One analogy can be that our trees step on the gas but the tank is empty. If we have fertilized an ample amount, but with a form unavailable to the roots we will still find ourselves deficient.

Tie Up Phosphorus

We can easily and unintentionally tie up our phosphorus as well. Unless a significant amount of acid has been compounded or is applied phosphorus cannot be applied with calcium. The two very easily revert back to their rock phosphate origin. Heavy fall applications of calcium with low solubility can very easily reduce the effectiveness of spring phosphorus applications. As soon as the irrigated water buffers itself back to near neutral pH levels we see our reactions happen. The remaining insoluble calcium reacts with the polyphosphate that hasn't been absorbed by the plants. The excess phosphorus applied with the previous heavy application of low soluble calcium makes both nutrients unavailable to our plants. We put plenty out there but tied it all up. A soil test with a water solution analysis will show us the immediate effect. We may see a parts per

million base saturation analysis of Calcium at 2000 ppm and 65 percent after an acetate extraction. But having our lab perform an analysis of a water extraction may only yield five percent calcium. We have rendered most of it useless to the plants until mother nature and the soil biology has provided its slow weathering process.

The Bottom Line

The bottom line, to affect your bottom line: Ask your plant nutrition expert to provide you with the plan of attack early in the season. Make sure the fertilizer form you are applying will promote the best uptake of the targeted nutrient. It will take a more detailed approach to your fertigation plan to spoon feed your nutrition and match plant demand to application. However, the results should be beneficial to your return on investment. Don't forget the importance of your post-harvest P applications. After your trees run their marathon, feed them! They'll reward you for it next spring.

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



The white coating on the berm is insoluble calcium.

2018 North Valley Nut Conference

A Big Success

By Jerry Crow | Contributing Writer

The 2018 North Valley Nut Conference was held on January 31 at the Silver Dollar Fairground in Chico, California. The Conference was held in conjunction with the University of California Cooperative Extension (UCCE) Butte/Glenn/Tehama Counties Almond and Walnut Day and hosted by West Coast Nut magazine.

bring the walnut and almond industries together and offer a variety of topics and speakers. The day's seminar speakers were developed by the UC Cooperative Extension and pest control advisor (PCA) CE educational credits were available for those attending.

primarily to the walnut industry and then switched to the almond industry in the afternoon. However, many of the topics were of interest to both.

Speakers and experts from the field of science, production, and industry covered various topics. Representatives from both the California Walnut Board and the Almond Board of California were on hand to provide updates on the

The goal of the conference was to

The first part of the day was devoted

Morning Sessions



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state of both industries. Those attending included a broad range of growers, pest control advisors, applicators, handlers, and others within the industry including insurance, equipment, and irrigation and pest control.

The conference opened with a report from the Butte County agricultural commissioner Louie B. Mendoza, Jr. He presented an update on the state of agri-



Louie B. Mendoza

culture in Butte County with an emphasis on walnuts and almonds. He spoke about the various challenges facing the agricultural community and the various services that his office provides to help growers meet the various state and county regulations.

Mendoza reviewed new regulations and requirements including agricultural pesticide applications for orchards near schools and worker protection standards. He also covered Chlorpyrifos, suggested interim permit conditions, and Telone fumigant restrictions.

Mendoza also answered questions about filtering face piece (face mask) respirator requirements.

He also discussed the adverse effect of pesticides on the bee population, and new regulations requiring that before pesticides be applied to blossoming plants that notice be given well in advance to beekeepers within a mile of where the pesticides are applied.

Dr. Themis Michailides, UCCE pant pathology specialist, next spoke about understanding botryosphaeria and mold



Dr. Themis Michailides

of walnut and disease management. Michailides works at the Kearney Agricultural Research and Extension Center. He provided information about the most recent techniques for controlling the various diseases growers face and how to prevent them.

Dr. Bruce Lampinen, UCCE walnut specialist at University of California

Continued on Page 30

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Dr. Bruce Lampinen

(UC) Davis was the next presenter. He focused on an update on training walnuts during the canopy development phase. He brought information about current research on the role of water and nitrogen management and canopy management approaches in high-density walnut planting and water management as it relates to insect and disease susceptibility.



Jennifer F. Williams

Jennifer F. Williams, marketing and domestic advertising director for California Walnut Board was next on the day's program. She gave an update on the walnut industry in California and the rest of the country. The board is busy marketing walnuts to the public utilizing modern advertising trends targeting markets to drive sales. The board also had a booth at the trade show where attendees could talk one-on-one with those interested in how the board is mar-

keting California walnuts and walnut products.



Dr. Jim Adaskaveg

Dr. Jim Adaskaveg, plant pathologist at UC Riverside gave an update on efforts to control walnut blight. Adaskaveg has over 27 years of experience with the University of California where he has focused his research on epidemiology and the management of nut and fruit crop diseases caused by fungal and bac-

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terial pathogens. Adaskaveg spoke about improving understanding of disease management using disease forecasting programs and the registration of new fungicides.

Dr. Franz Niederholzer, UCCE farm advisor for Sutter, Yuba, and Colusa Counties provided information on spraying wisely to get the most out of pesticide dollars. Niederholzer is an expert on orchard nutrition and serves as the chair of the UC ANR Spray Application Technology Work Group.

Lunch

Trécé Inc. sponsored the tri-tip lunch and during lunch, Bill Lingren, CEO for Trécé Inc. spoke about the current and future prospects for navel orangeworm management. The pest has wreaked havoc on both industries. Lingren provided useful information to growers about his company's products, which include pheromone and kairomone based products, kits, attractants and lures, a full line of trap models designed for a wide variety of flying and crawling pests that attack growing fruits and nuts and those which are being stored.

Lunch also provided a time for Jason Scott, publisher of West Coast Nut magazine to draw the winner of the John Deer gun safe. The lucky winner was Miguel Culzada of Big W Ranch in Orland, California.

Afternoon Sessions

After lunch, the emphasis of the conference shifted to almonds.

Dr. Florent Trouillas, UCCE plant pathology specialist at the Kearney Agricultural Research and Extension Center talked about the diagnosis and management of canker diseases in almonds. Trouillas spoke of his research to understand current and emerging diseases of major fruit and nut crops.

Irrigation was the next topic on the agenda, Allan Fulton, UCCE irrigation and water advisor for Tehama, Colusa, Glenn and Shasta Counties, spotlighted the early season in water management in almonds. He also talked about the various services on which he provides advice.

Spencer Cooper, senior manager for the Almond Board of California gave an update on the Almond industry and

the California Almond Sustainability Program.

Cooper talked about the highlights and the challenges that the almond industry is facing. He noted that the key to the future is sustainability and the best management practices that go along with that including irrigation, pest control and harvesting techniques. He also talked about the need to protect the honeybee population. He was optimistic



Spencer Cooper

and said that this was a great time to be a grower.

As Cooper explained sustainability has to do with things like the wise use of integrated pest management systems, utilizing non-synthetic fertilizers, responsible irrigation, and minimal use of soil and conserving energy. Cooper encouraged those attending to participate in the almond board's California Almond Sustainability Program which assists growers in the certification process.

Cooper was followed by Dr. Brent Holtz, UCCE farm advisor for San Joaquin County. Holtz's presentation focused on whole almond orchard recycling and the effect on second generation tree growth, yield, and fertility. His message was about the importance of growing almonds in a sustainable manner.

The topic of navel orangeworm management—relevant to both the almond and walnut industries was addressed by Dr. Emily Symmes, UCCE Sacramento Valley area IPM advisor. She focused her remarks on mite and disease manage-

Continued on Page 32

An advertisement for Kraemer & Co Mfg., Inc. The background is a dark green with a faint circuit board pattern. The main headline reads "WALNUTS, HAZELNUTS, PECANS DRYERS STILL AVAILABLE FOR 2018" in large, white, bold letters. Below this, the text "BIN FEATURES" is followed by a list of features: "Knock Down Kit", "Modular", "Corrugated/Galvanized Construction", "Do-It-Yourself-Option", "Low Lead Time", and "6 Ton Capacity". To the right of the text are three photographs showing different views of the dryers: a close-up of the interior bins filled with nuts, an exterior view of a large metal structure, and a view of the dryer's entrance and exit chutes. At the bottom of the advertisement, the company name "KRAEMER & CO MFG., INC" is written in bold, followed by the address "3778 County Road 99 W. Orland, CA 95963", phone number "Phone 530-865-7982 | Fax 530-865-5091", and license number "CA Cont. Lic #485-547".



Dr. Brent Holtz



Emily Symmes

scheduled breaks conference goers had a chance to visit the trade show held during the conference which featured over 80 exhibitors, providing an ideal chance for networking among growers and service providers.

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

Continued from Page 31

ment with an emphasis on almonds and walnuts, and the importance of sanitation. "Sanitation—just do it!" Symmes said.

She added that sanitation is really the key and that no amount of sprays or control efforts later in the season can get the desired low damage results if sanitation

is not part of the overall management strategy.

Symmes was followed by the final speaker at the conference Rachel Castanon, program coordinator for the Butte County Farm Bureau who provided an update on the Butte-Yuba-Sutter Water Quality Coalition.

In-between seminars and during



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Pecans being processed. Photo courtesy of American Pecan Council

FSMA & THE PRODUCE SAFETY RULE

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

Since 2007, following an E. coli breakout, produce growers have followed a strict self-governed food safety program. So now with the implementation of the Food Safety Modernization Act, what do growers really need to do? To answer that, let's explore FSMA, its requirements and how it relates to currently utilized food safety programs.

What is FSMA?

The Food Safety Modernization Act (FSMA) is the first mandatory federal standard for the production of fruits and vegetables in the United States. It was signed into law by President Obama on January 4, 2011. Before 2011, growers, packers, and the produce industry followed voluntary guidance like the Leafy Green Marketing Agreement. FSMA, which is enforced by the U.S. Food & Drug Administration (FDA) is aimed at preventing, rather than reacting to food safety issues and thus has strict training requirements.

What are the training requirements of FSMA?

Under FSMA all employees must be trained, including managers, farm workers, office staff, volunteers, interns, and even family members. This includes any person who comes in contact with produce covered under this rule. Farm Labor Contractors and their crews are also included. At least one supervisor from the farm must complete food safety training at least equivalent to the

standardized curriculum recognized by the FDA.

AgSafe has completed the rigorous process of FDA's approval and offers the required FSMA Produce Safety Rule class. More recently, the organization has received a contract through the California Department of Food and Agriculture (CDEA) to conduct multiple classes throughout northern California. For more information on class dates and locations visit <http://www.agsafe.org/fsma-produce-safety-rule/>.

In addition to specifying who needs training, there are requirements around how the training is conducted. The training must be appropriate for the job that the employee is doing and be given in such a way that training elements can be easily understood. Don't forget to document any and all trainings given to employees. Training is required when

employees are hired and at least once annually thereafter. See Matrix on page 35.

Beyond training, FSMA includes standards focused on health and hygiene, water both for production and postharvest, biological soil amendments,

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Which Trainings do your Employee's need?

Who needs to know?	Introduction to Food Safety	Worker Health & Hygiene	Soil Amendments	Wildlife & Domestic Animals	Production/ Ag Water	Post-Harvest Water Quality	Post-Harvest Handling & Sanitation	How to develop a Food Safety Plan
Irrigators	✓	✓	✓	✓	✓		✓	
Harvest Crew	✓	✓		✓			✓	
Sprayers	✓	✓					✓	
Consultants	✓	✓	✓	✓	✓	✓	✓	✓
Human Resources	✓	✓					✓	
Administrative Personnel	✓	✓					✓	
Supervisors	✓	✓	✓	✓	✓	✓	✓	
Managers	✓	✓	✓	✓	✓	✓	✓	✓
Owners	✓	✓	✓	✓	✓	✓	✓	✓

“It is imperative that employees receive food safety training specific to the job tasks they are performing.”

Source: AgSafe and Western Growers Training Materials May 2017

domesticated and wild animals, growing, harvesting, packing and holding activities, and equipment, tools, buildings and sanitation.

Health and Hygiene

All personnel should be trained on the principles of proper personal hygiene in correlation to food safety and its importance. Workers have the potential to introduce and spread contamination to fresh produce by carrying infectious human pathogens such as Shigella, Hepatitis A, Norovirus, and others. Something as simple as dirty hands or a sneeze has the potential to spread these pathogens during harvest or packing. This is why FSMA stresses that employees receive proper training pertaining to hygiene.

Agricultural Water

Under FSMA, agricultural water is an area that is covered extensively. Under the rule both water used during production and postharvest is included.

There are three main points to consider for your production water quality: the water source and its quality, application method, and application timing. One significant thing to ask yourself, “does my irrigation water touch the harvestable portion of the produce.” If the answer is yes, the timing of the irrigation and the quality of the water become an even more important factor. The only way to know the quality of your water is through testing.

In addition to irrigation water, FSMA

addresses the water used during postharvest activities. In these postharvest areas it is important that you identify potential routes of contamination associated with harvesting, washing, packing, storage, and transportation activities, and then implement sanitary practices that can assist in reducing the identified risks. Implementing a cleaning and sanitizing program that addresses these areas of concern is imperative.

Updates on Agricultural Water

FDA has issued a proposed rule for covered produce other than sprouts, that extends the dates for compliance with the agricultural water provisions. The proposal seeks to address questions about the practical implementation of compliance with certain provisions and to consider how they might further reduce the regulatory burden or increase flexibility. The comment period on this proposed extension closed last November. Stay tuned for FDA’s final rule concerning water compliance timelines. Updates can be found at: <https://www.federalregister.gov/documents/2017/09/13/2017-19434/standards-for-the-growing-harvesting-packing-and-holding-of-produce-for-human-consumption-extension>.

Biological Soil Amendments

Under FSMA you need to consider the risk of soil amendments, including both biological and synthetic amendments. Under this section you must explain practices for soil amendment handling and application that may help

in reducing the risk. Again, record keeping and monitoring is required.

Domesticated and Wild Animals

In this section FSMA requires that growers address contamination associated with wildlife, domestic animals and land use. This means monitoring for the potential for introduction of hazards; is there fecal material, signs of grazing, is the field prone to flooding or runoff? In addition to the site in which you are growing, consider adjacent land use, is it being utilized for animal production? All of these elements require consideration and explanation in your documentation under FSMA.

Excluded Items

The Act does include various exclusions including:

- Produce that is not a raw agricultural commodity (RAC). A RAC is any food consumed in its raw or natural state.
- Food grains, including barley, dent-or flint-corn, sorghum, oats, rye, wheat, amaranth, quinoa, buckwheat, and oil-seeds (e.g. cotton seed, flax seed, rapeseed, soybean, and sunflower seed).
- Produce that is used for personal or on-farm consumption.
- Farms that have an average annual value of produce sold during the previous three-year period of \$25,000 or less.

Continued on Page 36

• The FDA list of produce identified as rarely consumed raw. Visit <https://www.fda.gov/downloads/food/guidanceregulation/fsma/ucm576496.pdf> for that list.

How does FSMA interact with other food safety programs?

Farms that are currently third-party certified may already have some of the FSMA program elements in place and therefore will make complying easier.

Growers should review their current programs and make adjustments to their existing programs to ensure compliance with FSMA requirements.

Growers will have to develop policies and procedures that will focus on preventing food contamination on the farm. Although a written food safety plan is not required, writing and implementing a food safety plan will help in keeping food safety preventative measures like the water quality monitoring programs, organized and effective. Information, resources and guidance is widely available for growers who need help complying with the rule. The FSMA rule covers the

most commonly known risks related to food production.

Compliance Dates

• Date Passed: January 26, 2018: Covered farms for which, on a rolling basis, the average annual monetary value of produce the farm sold during the previous 3-year period is more than \$500,000.

• January 28, 2019: Covered farms for which, on a rolling basis, the average annual monetary value of produce the farm sold during the previous 3-year period is more than \$250,000 but not more than \$500,000 (small businesses).

• January 27, 2020: Covered farms for which, on a rolling basis, the average annual monetary value of produce the farm sold during the previous 3-year period is more than \$25,000 but no more than \$250,000 (very small businesses).

For more information about FSMA, or any worker safety, human resources, labor relations, pesticide safety, or food safety issues, please visit www.agsafe.org, call (209) 526-4400 or email safeinfo@agsafe.org.



Photo courtesy of Ag Safe

AgSafe is a 501c3 nonprofit providing training, education, outreach and tools

in the areas of worker safety, human resources, labor relations, pesticide safety, or food 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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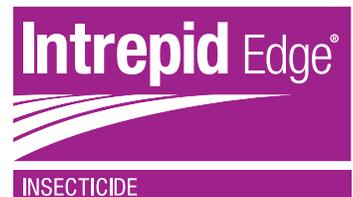
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NEW WASTE DISCHARGE RULES TO ADD WORK FOR GROWERS

By Tim Hearden | Contributing Writer



Storm water collects in the corner of an almond orchard near Yuba City, California. The state has issued new monitoring and reporting rules for growers aimed at preventing too much nitrogen and other pollutants from running off or seeping into groundwater. All photos courtesy of Tim Hearden

New rules under a California program designed to curb discharges of pollutants from commercial lands are adding work for growers.

Agricultural Requirements

The State Water Resources Control Board in February finalized an order revising agricultural requirements for the Eastern San Joaquin River watershed that state officials say is aimed at reducing nitrate runoff or seepage into groundwater. Much of the order is precedential, meaning it will apply in other watersheds statewide.

The order directs regional water boards to require the reporting of nitrogen application to crops from fertilizers, organic soil amendments, and in irrigation water, as well as data on nitrogen removed when crops are harvested and taken from the fields.

Further, the regional boards will require that growers also report on the management practices they're using to control pollutants. Beginning in 2019, those that rely on on-farm drinking water wells will have to monitor for nitrate levels in those wells and notify their users if nitrate is found to be above drinking water standards, according to a state news release. The water boards

will also begin testing on-farm drinking water wells.

Change Affecting Growers

That's the biggest change affecting growers right away, said Parry Klassen, executive director of the East San Joaquin Water Quality Coalition. The coalition is a group of growers and agricultural interest formed to represent all "dischargers," and will help implement the new rules. It is one of 11 such coalitions covering different parts of the Central Valley. "On any parcel that's under their membership in a coalition and has a domestic well, they have to sample it for nitrates," said Klassen, who grows nectarines and peaches in eastern Fresno County. "There's a cost there." Growers with the most vulnerable aquifers were already

tracking their nitrogen applications and filling out reports on crop yields as part of the state's existing nitrogen management plan, and now the same rules will

Continued on Page 40

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Nematodes, microscopic roundworms barely visible to the naked eye, pose a serious problem for walnut and almond growers. Even with proper sanitation and fumigation practices, nematodes can still become an issue after setting new trees. Nematode populations can build up in the soil, attack tree roots and impact overall tree health.

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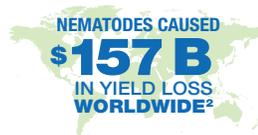
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Applications of Movento[®] in established orchards helped result in:



SUPPRESSION OF
RING NEMATODES

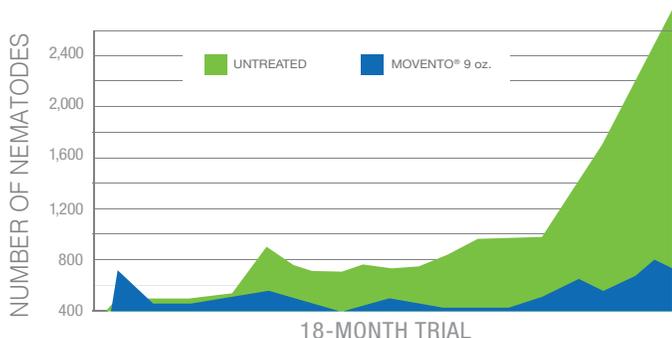


SUPPRESSION OF
ROOT LESION NEMATODES

Trial conducted by Gary Braness, Bayer CropScience, Kerman, CA, 2009–2011.

Two-year trials show

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Ring nematodes/500g sample in almonds (2009–2011)
(Butte & Padre pooled, n=24 trees)

Trial conducted by Gary Braness, Bayer CropScience, Kerman, CA.

EXPERTS SAY

“Established orchards saw better yield where Movento[®] was used to treat for high nematode pressure. The tree has a lot of vigor and doesn't stress as bad.”

According to Tim Weststeyn, a pest control advisor (PCA) with Crop Production Services in Vernalis, CA. He consults on 4,000 to 5,000 acres of tree nuts and is in his third year of treating established almond trees with Movento for nematode management.⁴

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¹Average yield loss in lbs. per acre is based on California Agricultural Statistics Review, 2014–2015. California Department of Food and Agriculture.

²Nematodes: A Threat to Sustainability of Agriculture.” Satyandra Singh, Bijendra Singh and A.P. Singh.

³University of California – Cooperative Extension. Department of Agriculture and Resource Economics. UC Davis, 2012.

⁴“The Dangers of Nematodes,” Growing Produce – 2012.

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be phased in for growers in non-sensitive areas starting in 2021.

Nitrogen Plan

The nitrogen plan was developed in response to a University of California, Davis report in 2012 asserting that nitrate problems are worsening and that agricultural fertilizers and animal wastes applied to cropland were the biggest causes of the nitrate problem in the most impacted regions.

The Davis study found that for more than half a century, nitrate from fertilizer and animal waste have infiltrated into Tulare Lake Basin and Salinas Valley aquifers, and most nitrate detected in drinking water wells today was originally applied to the surface decades ago. Many small communities can't afford safe drinking water treatment and supply, the state water board explained on its website.

Safe Drinking Water

"Safe drinking water is a huge issue right now," said Northern California Water Association director of regulatory

affairs Bruce Houdesheldt, who also runs the Sacramento Valley Water Quality Coalition. The coalition's 8,000 member owners and operators have about 1.3 million irrigated acres in the Sacramento River watershed, not including rice acreage.

"What the waste discharge requirements are doing is taking one set of dischargers—irrigated agriculture—and setting up rules for members and third parties saying, 'This is what we need you to do to characterize your discharges to groundwater,'" Houdesheldt said.

Detailed Management Plans

Growers are required to keep detailed management plans on their farm and submit summary reports to their coalition each year. Klassen said the plans aren't a huge burden for him, but the reports for some of the largest operations can be very complicated.

"It could potentially cost to have them hire new people to help them do these reports," he said. The state is expected to take years developing multi-year target ranges of applied nitrogen divided by removed nitrogen for various crops, which would theoretically tell



Michael Tarke

regulators if high levels of nitrogen are being left in the soil. All the regulations are a concern to sixth-generation farmer Michael Tarke, whose Sutter, California-based Tarke Farms grows almonds, walnuts and rice.

"There are restrictions on everything," Tarke said. "I think that's just part of being in California, though."

Tougher Scrutiny

The state began applying tougher scrutiny on agricultural discharges after the Legislature in 1999 eliminated a blanket waiver for farms. The bill required water boards to begin regulating agricultural lands under the 1969 Porter-Cologne Water Quality Control Act, which guides policies of water pollution management in the state.

In 2003, the Central Valley Regional Water Quality Control Board adopted a conditional waiver of waste discharge requirements for farm runoff that affects surface water. In 2012, the board started imposing requirements that address discharges to groundwater, too, starting with the Eastern San Joaquin River watershed. In February 2016, the board issued its first draft of revisions to that order in response to petitions from environmental groups asserting that the original order didn't go far enough to protect groundwater. Almost exactly two years later, after taking what it described as extensive public comment and expert input, the board issued its final order for the watershed on February 7, 2018.

As a result of the board's actions, all commercial irrigated agricultural operations now must be enrolled in the state's Irrigated Lands Regulatory Program. They can enroll in a regional coalition that helps them comply with the rules or obtain waivers on their own, which is considerably more costly.

Coalition Fees

The coalitions assess fees to cover their costs and state water board fees, prepare and implement mandatory

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regional water management and monitoring plans, and report the results of the efforts, the state board explains on its website. Typically, growers that obtain individual waivers must monitor runoff from their property, install monitoring wells and submit technical reports regarding their efforts to comply, the board advises. The California Farm Bureau Federation estimates start-up costs and monitoring for an individual waiver at \$10,000 for the first year and \$3,000 to \$6,000 annually thereafter for monitoring and reporting.

Failing to do either can bring big fines, warned Rob Rianda of the Shasta-Tehama Watershed Education Coalition, a sub-group of the Sacramento Valley Water Quality Coalition. The state Water Code lists waste discharge fines as \$5,000 per violation per day or \$10 per gallon of waste discharged, and growers have faced penalties of up to \$70,000 for failing to submit a farm evaluation, he said. "These are just some of the things that people need to keep in mind," Rianda said during a growers' meeting in Red Bluff, California. "They are out there. The water board is out there and they are looking."

Mobile Irrigation Lab

For help with complying, some growers may turn to resources such as the mobile irrigation laboratory offered free of charge by the Tehama County Resource Conservation District. Kevin Greer, who operates the lab, does consultations with growers looking at the efficiency of their irrigation systems. "I can help make sure the irrigation system isn't putting out too much water" and creating runoff, Greer said. "I can also help with some soil health issues. I've been doing a lot of work with cover crops. In the winter when it rains, cover crops really protect the soil."

Greer's grant-funded service has kept a full schedule of meetings with growers since the drought reached severity about five years ago, but presentations on the new regulations at several grower meet-



Kevin Greer

ings this winter gave the lab additional exposure. He already has "a good list of growers this year," he said. In some areas, the service isn't free; Greer said a similar service in Kern County charges \$500 per consultation.

"The data we collect is confidential," he said. "I do about 100 of these a year."

Confidentiality

Confidentiality is also a benefit to working through a coalition—at least for now. Grower privacy has been a matter of debate between agricultural interests and environmentalists, with farm groups arguing that maintaining privacy protections will encourage grower participation. Under the revised rule, coalitions will have to submit grower and field-level nitrogen management and application data but mask it with an anonymous identifier. But that could change, the East San Joaquin coalition's Klassen said.

"There's very likely to be a lawsuit challenging that component," he said.

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Moving up the Irrigation Continuum to Move the Industry Ahead:

A Q&A with Spencer Cooper, Senior Manager of Irrigation and Water Efficiency at Almond Board of California

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Irrigation management is dynamic and ever-changing, both by nature of each season's varying weather patterns and the evolution of technologies to improve its efficiency. Irrigation management is unique to each farm and every stage of an almond tree's development. And, there is always room for improvement.

If anyone's committed to improving water use efficiency, it's California's almond growers, who are some of the most innovative in the industry. Thanks to the adoption of practices like micro irrigation and demand-based irrigation, California almond growers have reduced the amount of water needed to grow a pound of almonds by 33 percent over the past 20 years. It doesn't stop there. Almond Board of California, (ABC), in partnership with respected experts at the University of California Division of Agriculture and Natural Resources Cooperative Extension, has rolled out the Almond Irrigation Improvement Continuum, a comprehensive manual of irrigation management and scheduling practices that meet growers at every stage of irrigation efficiency to improve their 'crop per drop.'

To take a deeper dive into the Continuum, and get the scoop on other irrigation-related issues, we sat in for a chat with Spencer Cooper, Senior Manager of irrigation and water efficiency at Almond Board of California.

Q: Can you provide an overview of the Almond Irrigation Improvement Continuum and the purpose it serves for growers?

SC: The Continuum looks at all five aspects of irrigation management:
1. Measuring irrigation system performance and efficiency

Continued on Page 44

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2. Estimating orchard water requirements based on evapotranspiration
3. Determining the water applied
4. Evaluating the soil moisture
5. Evaluating plant water status

The Continuum is broken up into three proficiency levels—1.0, 2.0 and 3.0. Level 1.0 is focused on the fundamentals and foundation of irrigation scheduling and outlines the irrigation management practices within reach for all California almond growers. As growers move up the Continuum, it progresses into more technical operations regarding irrigation management and almond production. The Continuum was developed in a way that can really bring a grower along the journey through irrigation management.

Q: What are the main differences in irrigation management practices as one moves up the Continuum?

SC: The biggest change you'll see when moving up the Continuum is in the frequency of monitoring and measurement. For example, if you're looking at soil moisture, in level 1.0, you may be using the hand-feel method monthly with a shovel or auger to determine soil moisture, whereas in levels 2.0 or 3.0, you'd be using sensors to provide weekly or daily updates, which allows for real-time monitoring. In the applied water section, 1.0 is all about understanding the system-designed application rate, and 2.0 and 3.0 involve incorporating flow meters and back-calculating the information against orchard water requirements to offer a more accurate reading for water use efficiency levels.

There is a quote that goes, "you can't manage what you don't measure," and that's really where it starts in this case and is the big step in moving up the Continuum. When growers understand and embrace level 1.0, they quickly move up to 2.0 and 3.0 because, as you've gone through the Continuum, the change is in the frequency in gathering data versus the implementation of new practices.

Q: What is the best way to determine when irrigation should begin in the springtime? What tools are available to help growers make this decision?

SC: There are a few different ways to help determine when irrigation should begin. Keep in mind, this also varies for every grower based on where they are in

the Continuum. To begin, use weather data and look at effective rainfall and evapotranspiration rates to calculate your soil moisture level (this would be more of a 1.0 method). Alternatively, a more advanced method would be using a pressure chamber to determine plant water status, and then matching the data against defined thresholds to determine when irrigation should begin.

Q: What would you recommend is the best irrigation technology investment for a grower?

SC: The number one tool is a flow meter. This is the first big step in being able to measure and understand how much water is applied to the orchard. From there, the next best investment is in understanding set duration, which allows growers to not only see how much water was applied, but how long it took to apply that water. Unexpected events can occur at any time for an irrigation system, so having a monitoring system in place with sensors can help identify and provide alerts on a variety of issues. Beyond that point, it's not really one technology or the other but one then the other. Irrigation system performance is key and something you should consider throughout the year

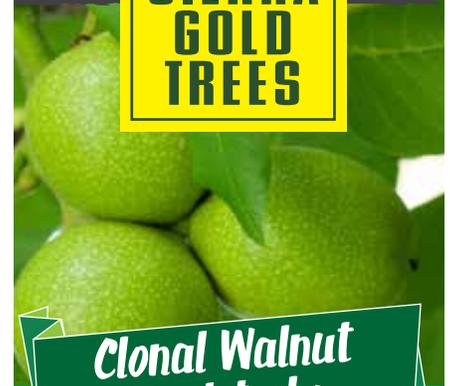
Q: What if you have different soil types on a single almond orchard? How can irrigation be controlled to be most effective in all cases?

SC: In an ideal world, your irrigation systems are designed for soil type because different soils have different water holding capacity. If there are different soil types in a single orchard, growers have to manage to the majority and, in these cases, irrigation management becomes a judgment call. The pressure chamber tool would be useful in this scenario because it can test the trees in different areas and see how well-irrigated each section was.

Q: How much can water use efficiency be improved by moving up the Continuum?

SC: Improvement in water use efficiency is site-specific. I've worked with growers who have seen massive improvements and others that have seen more minor changes. However, by advancing within the Continuum, growers may see benefits outside of their irrigation management. There are so many other variables that can be impacted when

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water management is improved. For example, improvements could be gained in enhancing overall tree health.

Q: Is there a return on investment from implementing new irrigation technology on an orchard? Will there be savings in the long run?

SC: Many of the growers I've met have seen a positive return on investment in new irrigation technology. There are so many different variables to consider, and when water use efficiency is improved, there are savings across a range of orchard functions. For example, in the springtime, there is a tendency to irrigate too early, but, by investing and utilizing a pressure chamber—which allows you to better monitor tree stress—there's potential to hold off on irrigation longer than originally anticipated. This trickles down to an overall savings on irrigation costs for the season. Savings can also come in other forms, such as more efficient use of fertilizer from having more control of the wetted front. As growers move up the Continuum, a lot more data is acquired, which can help to pinpoint particular strengths or weaknesses of the season. This, in turn, helps to determine the best pathway forward.

Q: What do you find to be the thing growers struggle with most when it comes to irrigation management practices?

SC: Successful implementation of irrigation technology. Most growers understand that there is value in the data but they may not know where to begin or which technology is best for their farm.

Q: Why should an almond grower complete the Irrigation Management Module in the California Almond Sustainability Program (CASP)? What's the value, and how does it feed into your work in prescribing best practices to growers?

SC: The benefits of completing the CASP irrigation module have both an individual impact for each farm, and one that impacts the greater California almond industry. Filling out the Irrigation Assessment allows a grower to benchmark their current irrigation management practices, and it also allows a grower to take a step back and look at their operation from the 30,000-foot level. Every grower is going to see value at a different point in the process. For example, the question about evaluating application

rate is important, because over time your emitters or sprinklers can wear causing the application rate to change. A tenth of an inch extra during each irrigation event during the season can add up quickly, resulting in increased costs.

On the other hand, CASP provides an outlet for the industry to share its story. The data gathered through self-assessments provides statistically significant information to help consumers, buyers and food companies better understand the responsible practices used to put almonds on their tables. Nearly a quarter of California's productive almond acreage has been assessed to date.

Q: Where can I go to get started?

SC: The Almond Irrigation Improvement Continuum 1.0, which outlines irrigation management practices within reach for all California Almond growers is available at Almonds.com/irrigation. The full manual is coming soon and includes the progression to 2.0 and 3.0.

To schedule an in-the-orchard visit or phone consultation for system-specific recommendations, email Spencer



Spencer Cooper.
Photo courtesy of the Almond Board of CA

Cooper at scooper@almondboard.com

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Where it Began and Where We Are Now

Greenhouse. All photos courtesy of Chuck Leslie, University of California, Davis walnut specialist.

By Cecilia Parsons | Associate Editor

A unique relationship between university walnut breeders and walnut growers has created a sustainable program dedicated to continued improvement of this iconic California crop.

The 70 year-old walnut breeding program at University of California (UC) Davis, known as the Walnut Improvement Program, has been led by a succession of dedicated individuals who provided growers with improved varieties, helping them become world leaders in quality walnut production. Growers, in turn, have provided financial support through the California Walnut Board.

University Bred Walnut Varieties

David Ramos, UC Davis walnut

specialist emeritus said that prior to the 1960s there were no university-bred walnut varieties in commercial production. Nearly all walnut trees in production were terminal bearing varieties. These terminal bearing varieties tended to be larger trees with reduced capacity for yield and lower nut quality.

Today, Ramos said, nearly all of the walnut trees sold in California nurseries are UC Davis varieties, and at least 90 percent of walnut acres today are planted with walnut varieties released by the UC Davis Walnut Improvement Program.

A substantial portion of this year's \$2 million production research funding from the Walnut Board is allocated to projects in California in-

volving walnut genomics, genetics and breeding. There are also returns from a \$3 million endowment established to ensure work will continue in perpetuity on walnut improvement.

Early Walnut Production

Early California walnut production began with seedlings from locally available trees.

A report published by the UC Genetic Resources Conservation Program gives an historical account of early walnut production, noting hard shelled walnuts brought in from South America by Spanish missionaries in the 1700s. One hundred years later Goleta rancher Joseph Sexton purchased at the dock in San Francisco a large sack of walnuts thought to be from Chile or China. Trees from these walnuts produced Santa Barbara soft shells. About the same time, Felix Gillet, a nurseryman from Nevada City imported scion wood from France and introduced the cultivar Franquette.

Over time there was a recognition that selection of offspring from controlled crosses of walnut varieties could result in more productive trees and this was the basis for improvements in walnut cultivars. Remarkable accomplishments by dedicated walnut breeders include varieties that are resistant to diseases and pests, higher yielding trees and varieties that are adapted to regional growing conditions.

Walnut Breeding Program

The UC Davis Walnut Breeding Program was created in 1948 by pomologist Eugene Serr and his colleague Harold Forde. Some early walnut breeding work was done by Luther Burbank who developed Paradox hybrids that were an important rootstock improvement that

Continued on Page 48

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Ramos said that the walnut breeding program initiated by Serr and Forde emphasized crop yield and their early work focused on cultivars which produced pistillate flowers on lateral buds because of the potential for bearing more nuts than terminal varieties. Other traits they deemed desirable were later leafing, and shell and kernel quality. Later leaf out was favored to escape early spring rains responsible for spreading the bacterial disease walnut blight. Tree vigor, strength and disease resistance were also considered in evaluating their walnut crosses. The UC report noted that Serr and Forde devoted attention to all the criteria through field observation, record keeping and collection and crack out of nuts to track tree performance over many years.

By 1956, Serr and Forde were using the best seedlings from their controlled crosses as parents. Walnut growers were taking note of their work and began to request scion wood. By 1967, 100 requests were received for one or more

of their cultivars. The popularity of their germ plasm and selections for field trials was due to their annual reports on the walnut cultivars, comparing performance of old and new cultivars in the trade journal *Diamond Walnut News*.

Varieties

After Serr's retirement, Forde continued the walnut breeding program, making five to ten crosses per year, increasing the total number in the program to nearly 200 and the number of progeny evaluated to 5,916. In 1978, a significant step in walnut quality and production was made with the release of the Chandler variety. Trial plantings proved so successful that today Chandler is the number one walnut variety planted in the state, making up almost half the total walnut production acres.

Other popular walnut varieties released by the UC Davis program under the leadership of Serr and Forde were Howard, Serr and Vina. Their work was continued with the hiring of walnut breeder Gale McGranahan in 1982. She was initially hired by United States Department of Agriculture (USDA) to de-

velop walnut varieties with resistance to blackline disease and rootstocks tolerant of the virus causing it. After joining the UC Davis pomology department in 1989 she continued with the breeding efforts, releasing the Tulare variety in 1993.

McGranahan's early work was focused on inheritance of the hypersensitive response to the virus that causes blackline disease and beginning a backcross breeding program to develop hypersensitive cultivars, as well as introduction of germplasm so that the traditional cultivar improvement program could be continued. The new germplasm is now being used in the blackline resistance breeding program. She also advanced work on Chandler pollenizers, blight resistance, earlier harvest dates and development of clonal rootstocks. McGranahan and her successor, Chuck Leslie, both worked on improving Chandler, with the aim of earlier maturity dates to spread out harvest.

Rootstock Development

Rootstock development has also been an important component of the UC Walnut Improvement Program. Early on, walnut growers recognized a need for root disease resistant rootstocks for many different soil types and growing conditions. Other valuable rootstock traits include good anchorage and vigor.

The two main rootstock choices for growers had been seedling Paradox and seedling Northern California black walnut (*J.hindsii*). In 1996, the Walnut Improvement Program made controlled crosses between English walnut and different black walnut species as part of the Paradox Diversity. Commercial nurseries assisted by donating seed and growing the seedlings which were distributed for testing of resistance to nematodes, *Phytophthora* and crown gall. Seedlings were also planted for long-term evaluation by University of California Cooperative Extension (UCCE). Two clonal rootstocks from this study, RX1 and VX211 are now commercially available, Leslie said. VX211 is very vigorous and shows some tolerance to nematodes. RX1 has shown high resistance to *P. cinnamomi* and moderate resistance to vigorous to *Phytophthora citricola*. None of the Paradox or California black rootstocks are resistant to blackline disease which is a pollen transmitted disease. Work is continuing to find solutions to this problem, primarily by breeding virus resistance into scion varieties so the virus can't

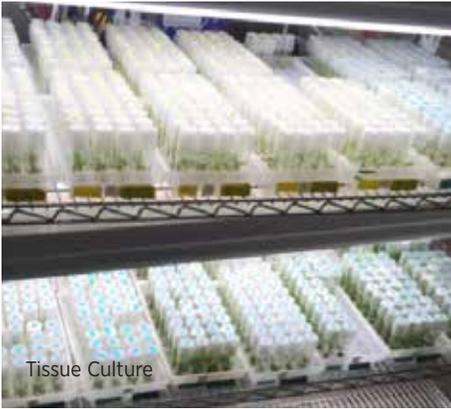
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reach the graft union, Leslie said.

Walnut Research Achievement Award

Leslie was hired by McGranahan in 1985 to work with her in the walnut breeding program and assumed responsibility for directing the program upon her retirement in 2009. His work in identifying and selecting walnut cultivars and rootstocks led to significant strides in the UC Davis walnut breeding program. In 2015 Leslie was honored by the California Walnut Board and California Walnut Commission for his leadership and contributions to walnut breeding, with the Walnut Research Achievement Award. The award was given for his dedication in development of superior walnut cultivars and rootstocks including the varieties Ivanhoe, Solano and Durham.

“Leslie has provided continuity and stability to the breeding program,” Ramos said.

Leslie will be working with Pat Brown who was hired in 2017 to direct the Walnut Improvement Program. Brown said his goals for the breeding program include making use of advances in genomics to increase the rate of genetic gain, and identifying breeding lines that can adapt to new and future threats to walnut productivity. Genetic information derived by sequencing commercial walnut DNA can be used to accelerate the rate of variety improvements. The program will also focus on resistance traits and in the future, varieties that need less hours of winter chill.

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TRE-1196, 2/18

WATER MANAGEMENT IN WALNUTS

By Julie R. Johnson | Contributing Writer

Nut growers in the Northern Sacramento Valley have the great benefit of free irrigation evaluations through the Tehama County Mobile Irrigation Lab. What is a Mobile Irrigation Lab (MIL) you might ask, and exactly what are the benefits it provides?

Those questions were answered by Kevin Greer of the Resource Conservation District of Tehama County during Tehama Walnut Day in February at the Elks Lodge in Red Bluff.

Greer, who runs the program, explained MIL is a service that provides on-site evaluations of agricultural irrigation systems with a goal of providing comprehensive irrigation information to growers through customized reports that are “snapshots” of an orchard’s irrigation system.

With that report in hand, MIL can then determine areas of improvement,

determine and explain distribution uniformity (DU) and application rate in hours, and provide irrigation scheduling information.

“In addition, we can illustrate how well the current systems performs compared to achievable standards,” Greer said. “The lab can provide tips and introduce concepts of efficiency.”

As California suffers through yet another with wet and dry weather, utilizing an irrigation system to its best performance and efficiency is something every grower should want to accomplish.

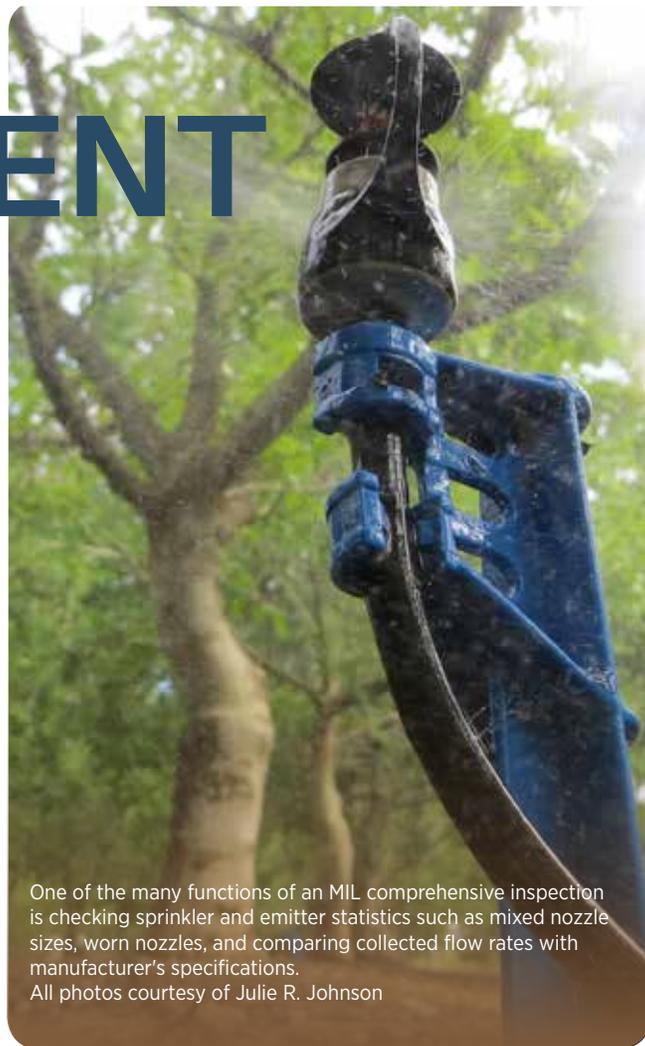
Add to that the fact California has a population of approximately 38 million, according to the conservation district,

with 80 percent of human water use being agriculture-related (9 million irrigated acres in the state), and a dwindling groundwater and snowpack supply, there is growing pressure on agriculture water use.

That is where the benefits of a MIL crew truly come into the picture as they



Kevin Greer



One of the many functions of an MIL comprehensive inspection is checking sprinkler and emitter statistics such as mixed nozzle sizes, worn nozzles, and comparing collected flow rates with manufacturer’s specifications.
All photos courtesy of Julie R. Johnson

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help growers become more aware that every drop of water counts and the contributing factors of DU.

Greer said service requests for the Tehama County MIL is growing due to California's drought conditions.

"We are now doing around 100 visits a year," he added. "Being the only MIL in the Sacramento Valley and with the number of orchards increasing, we are seeing an increase of new requests and a steady request for visits from established customers."

The Tehama County MIL is the second largest of its kind in the state, Greer stated, with the largest being in Kern County where they conduct about 150 visits annually at \$500 a visit.

"It is a great benefit to the growers we serve that we are able to provide our program free of charge," he said.

On-site evaluations and reports

Greer said one of the reasons the MIL program is so successful and beneficial is its on-site comprehensive inspections. At a grower's request and convenience, an irrigation technician crew comes to an orchard and asks the grower a series of questions relating to the irrigation system, such as how old is the system, how old is the orchard, what is the design layout, tree spacing, type of emitters/sprinklers, and irrigation schedules.



Members of the Mobile Irrigation Lab crew testing an irrigation line for efficiency in a nut orchard. The services the lab provides are free of charge to growers in the Northern Sacramento Valley.

The technician crew will then take anywhere from three to four hours to conduct a customized system analysis, during which they inspect and measure the irrigation system— "from the pump to the flush-outs and every thing in between," Greer said.

Continued on Page 52

Distribution Uniformity - DU

- A measure of how even an irrigation system applies water to an area.
- Getting the system close to 100% is the goal.
- Lower DUs = increased irrigation water.
 - The lower the DU, the less efficient the distribution, and thus the more water that must be applied to meet the minimum requirement.



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96	37.72	44.06	6.34	152	2280	Gallons

Continued from Page 51

Data collected from testing includes pressure and volume measurements, wetted area, connections, clogged screens or nozzles, and the amount of sediment in the lines.

“It can be surprising the damage sediment, such as sand, can do to compromise a system,” Greer said. “That alone can cause water distribution uniformity to be off from a range of high at 1.0 gallons per minute to a low of .8 gallons per minute.”

This range discrepancy could amount to a difference of 432 to 576 gallons over the typical 36- to 48-hour irrigation set used by a grower.

Sprinklers and emitters are also checked for mixed nozzle sizes, worn nozzles, and comparing collected flow rates with manufacturers specifications.

In addition, MIL provides flow meter readings thanks to a portable flow meter provided by the McConnell Foundation. The irrigation team takes the information back to the office where a Cal Poly Program is used to determine the system's efficiency, or DU.

One of the key components of the report generated by the MIL is the DU rating.

Greer explained DU is an essential statistic that indicates the evenness of water being applied to each plant across an irrigated block. When a system has a DU rated at 90 percent or above it indicates a high level of system efficiency which represents uniform quantities of applied water per plant.

“For example, a DU of 100 percent would mean that all sprinklers or emitters are producing exactly the same amount of water, while a moderate DU decrease down to 75 percent can indicate that the sprinklers that emit the least amount of water are, on average, producing only half as much as the highest sprinklers in the field,” he said.

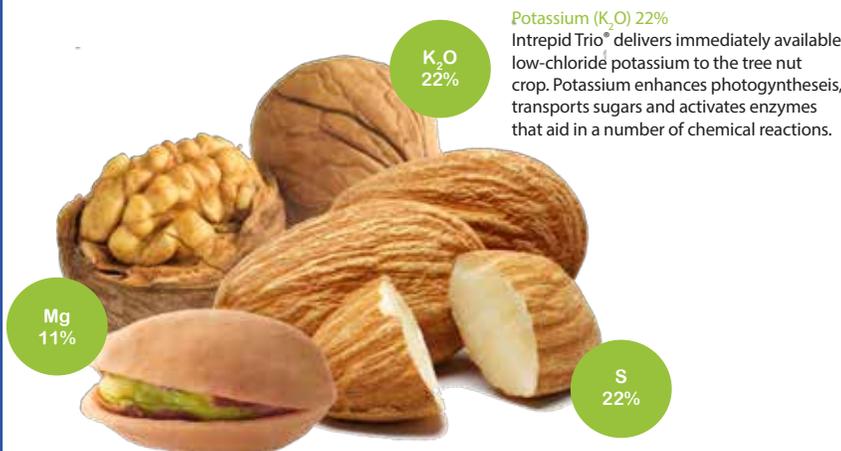
The implications of low DUs are lower crop yields due to large variations of applied water across the area that is being irrigated.

While it is very important to have a

Continued on Page 54

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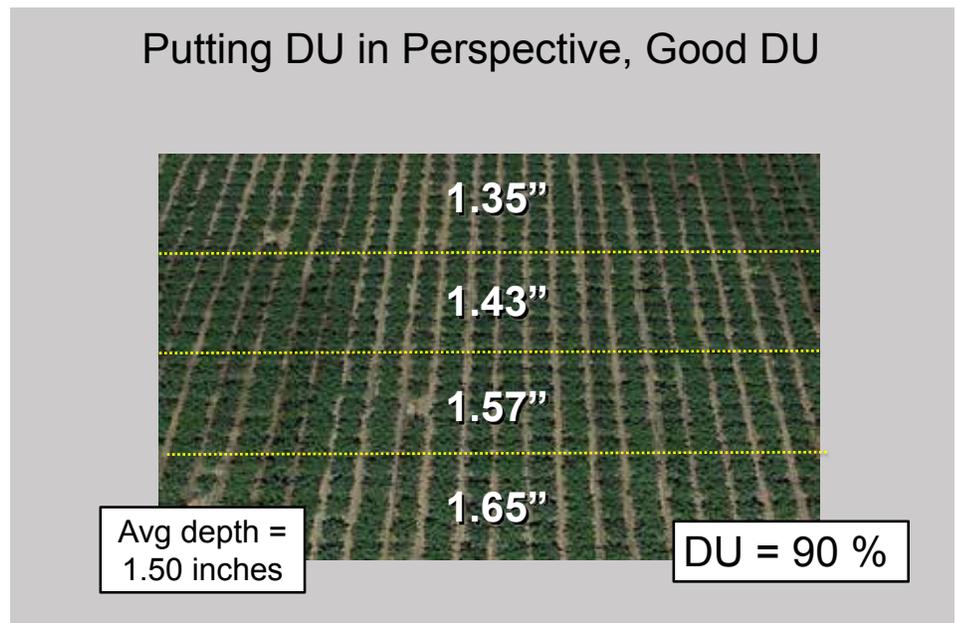
system with a high DU, this alone is not enough to ensure efficient irrigation, Greer added. This is achieved by combining the application rate of the system (quantity of water applied per acre) with the DU and proper scheduling known as application efficiency.

In the reports created by the MIL all of this information is provided along with specific details from the evaluated irrigation system.

The program then provides the grower with a confidential report compiled in a small booklet which contains:

1. A written summary report
2. Grower's application rate
3. Suggested run times
4. Soil report
5. Evaluation results
6. Distribution Uniformity rating
7. Evaluation suggestions
8. Evaluation map

Based on these evaluations, an irrigation technician can work with the grower to develop an irrigation manage-



ment plan tailored to individual needs.

Greer said key ingredients of efficient irrigation includes soil characteristics, weather and crop water use, system application rate and scheduling.

“A poorly designed irrigation system can cause a number of problems for an orchard,” he added. “We see systems not engineered to balance the ability of the pump to provide water with the ability of the lines, filters, nozzles and emitters to distribute that water in a uniform manner.”

To maintain high DU, regular irrigation system inspections are needed, along with checking wells and pumps, installation of flow meters, check filtration and psi, and good, scheduled maintenance.

Greer recommends monitoring performance of your system regularly using a flow meter at the pump and a pressure gauge at the pump before and after each filter.

In addition, the program stresses the importance of growers keeping irrigation records, as well as knowing and understanding the water holding capacity of their soil.

MIL's Roots

An arm of the Resource Conservation District of Tehama County, the program started with grants written by the Resource Conservation District of Tehama County and Department of Water Resources and Bureau of Reclamation funding in 2002 in an effort to provide irrigation water management assistance for growers in Tehama County. The success of the program soon expanded into Shasta, Butte and Glenn counties.

From that point on the program weathered some very lean years funding-wise, but it persevered.

In 2017 additional funding came through a Natural Resources Conservation Service sponsored Conservation Innovation Grant which provided collaboration between the MIL and Allan Fulton, University of California Cooperative Extension (UCCE), Tehama County. This partnership provided innovations in irrigation efficiency and a channel to introduce irrigation technology.

Program funding also comes through the Department of Water Resources continuing 2012 Ag Water Use Efficiency Grant and 2016 Prop. 1 funds, and Shasta Community College funds two interns.

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The popularity and use of the program is growing. In 2002 the program provided on-site visits to less than 20 orchards. In 2016 that number was more than 100 visits, and service has expanded throughout the Sacramento Valley as it continues to be the only MIL in the region.

Twice a year, in April and December, MIL in partnership with UCCE Tehama County hosts Irrigation Consulting Ambassadors Network meetings, a Field Day, and a Site Visit to perform an irrigation evaluation, check on workshop implementation and answer questions.

All of this occurs with the objective of creating small scale learning environments for advisors and growers where hands-on work is accomplished and concepts shared in a more intimate atmosphere.

To make an appointment for a MIL visit, call (530) 527-3013 ext. 102, or go online to kevin@tehamacountyrcd.org. For more information concerning the Tehama County MIL go to www.tehamacountyrcd.org. The MIL office is located at 2 Sutter St., Suite D, Red Bluff, CA, 96080.

Among the MIL's sponsors and partners is the Sacramento River Watershed Program, Resource Conservation Districts of Butte, Glenn and Western Shasta, the Anderson, Los Molinos and Corning irrigation and water districts, Shasta College, California State University, Chico, Natural Resource Conservation Service and Natural Resource Conservation District.

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Tehama County Mobile Irrigation Lab

All charts courtesy of Kevin Greer

The advertisement features a background image of a large array of solar panels on a roof. At the top, the Sunworks logo is displayed with the tagline "Solar Power". Below this, the main headline reads "SOLAR POWER FOR FARMS AND RANCHES" in large, bold, yellow letters, followed by the sub-headline "to lower your operational overhead" in white. A circular seal on the right side of the image commemorates "25 YEARS" of Sunworks, with "WARRANTY" written below the years. At the bottom, a white text box contains the message: "As you work your land and conduct your daily business, we are here to help you succeed. Agricultural solar projects generate long term savings, tax benefits, and near-zero electricity rates for farms, orchards, and dairy producers. We understand how to balance solar technology with your environmentally conscious agricultural operations. Solar energy is a great way to take some of the burden of operational overhead off your shoulders." Below this text box, the contact information "866.600.6800 | sunworksusa.com" is provided, along with the license number "CA Lic# 441690" at the very bottom.



Leaf stippling and webbing caused by spider mites in almonds. All photos courtesy of University of California Statewide IPM Program.

Approaches to Spider Mite Management in Almonds

By Emily J. Symmes
Sacramento Valley Area IPM
Advisor University of California
Cooperative Extension and
Statewide IPM Program

Spider mites are considered indirect pests in almonds, in the sense that they do not feed directly on the harvested product. Rather, they cause injury to plants by sucking cell contents from foliage. Signs of feeding injury include leaf stippling, yellowing, and dropped leaves. High populations of mites can also be recognized by webbing on leaves and tree terminals. (See Image on page 56) Significant spider mite injury can become economic crop damage in almonds in subsequent seasons in the form of reduced vegetative tree growth and crop reduction. In addition, excessive leaf drop can interfere with harvest operations and nut drying in the current season. The most effective spider mite management programs are focused on integrating multiple tactics including cultural practices, biological control, and miticide applications when needed.

Cultural Practices

Properly-irrigated, vigorous trees are less susceptible to spider mite damage. Ensure that trees are not stressed due to inadequate irrigation, fertilization, or other factors. Reduce dusty conditions by oiling or watering roadways and, where possible, maintaining ground cover.

Biological Control

Spider mites have a suite of natural enemies that can occur to varying degrees in the orchard environment.

The most impactful of these biological control agents in California almond and walnut orchards are typically predator mites (See Image on page 62) and six-spotted thrips (See Image on page 58). When we think of biological control in practice in most orchard environments, we are largely discussing conservation biological control—in other words, with respect to the beneficial predators naturally-occurring in the orchard, “don’t starve them, don’t kill them.” This means that we have to be willing to tolerate some level of food source in the orchard to maintain predator populations. Food sources may come in the form of other mite species early in the season (e.g., European red mite, brown almond mite) as well as subeconomic populations of spider mites themselves throughout the season. It’s also critical to understand the impacts of all miticide and insecticide applications on natural enemies (link to resources containing this information to follow).

Miticides

Managing spider mites in almonds in recent years has typically taken one of two general approaches in conventional orchards: applying a prophylactic early-season treatment or utilizing threshold-based treatment timings (later season) and conservation biological control. Both have pros and cons, and each method can be used to successfully manage spider mites. Which is “better” depends on a number of factors in your particular orchard operation, the typical abundance of natural enemies and how

effectively they are conserved, may vary depending on the environmental conditions year-to-year. Considerations for each method are summarized below.

Prophylactic Approach

Early abamectin treatments (May), once on the rise in many almond orchards, seem to be waning in popularity over the past few seasons. Growers and PCAs are increasingly reporting concerns about efficacy and resistance-management considerations. When applied properly and at the appropriate time if spider mite populations necessitate treatment and natural enemies are not abundant, abamectin can be an effective miticide and these early treatments can control mites into summer. Below are some key considerations regarding the most effective and responsible use of abamectin:

- Abamectin functions as a nerve toxin that must be ingested by mites. Once applied, the material must move into the leaf tissue, where it can then be picked up by feeding mites. This translaminal movement of the material works best prior to leaf hardening and when leaves are mostly free from dust and other residues. Applications before leaf hardening can be quite effective.
- Applying abamectin after leaf hardening (i.e., with hull-split sprays) may seem like an inexpensive insurance policy, even if the effectiveness of the material

Continued on Page 58

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Sixspotted thrips nymph (left) and adult (right).

UC Statewide IPM Program
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Continued from Page 56

at this timing is greatly reduced. However, bear in mind two additional issues: this is the time when natural enemies tend to be more abundant if preserved early in the season (more on that below) and, from a resistance-management standpoint, two applications of the same active ingredient within the same season is not advisable.

- Abamectin is highly toxic to spider

mite natural enemies, particularly six-spotted thrips and predator mites. Use of abamectin early in the season may contribute to later season spider mite flare-ups due to reduction or elimination of these beneficials in the orchard by direct toxicity and/or by reducing their food source (spider mites, European red mites, brown almond mites).

- Without beneficials to at least slow a mite flare up as the abamectin wears off (expect 60 days of activity if applied

properly and at the tight time), spider mite populations can jump up to dangerous levels in just a couple of weeks in summer heat and water stress. Juggling irrigation/sprayer access, harvest prep activities, and crew availability to spray a sudden mite flare-up can mean the fix to a fast-moving problem isn't fast enough, and that can mean dropped leaves at harvest. Lots of dropped leaves at harvest can mean slow drying nuts, slow nut pickup, longer water shut off and more orchard water stress that can translate to future yield loss.

- In years where spider mites are slow(er) to develop, "May sprays" of abamectin may be of very little value, as additional later-season sprays often become necessary regardless of early-season intervention, and natural enemies are unnecessarily disrupted. Weigh the pros and cons of the inexpensive insurance policy in treating below-threshold populations vs. destruction of natural enemies (FREE control) and consider how overuse of a particular chemistry over time can increase the likelihood of resistance development. Best to use practices that help maintain all of the tools in the toolbox so that they are available and effective when particular situations call for it.

- For a very good summary article on the uses (and misuses) of abamectin in almonds written by UCCE Entomology Advisor David Haviland, visit: thealmonddoctor.com/2013/04/12/managing-mites-in-almonds-with-abamectin/.

- A blog post from Franz Niederholzer on continued mite monitoring and management after a May abamectin treatment can be found at: sacvalleyorchards.com.

Continued on Page 60

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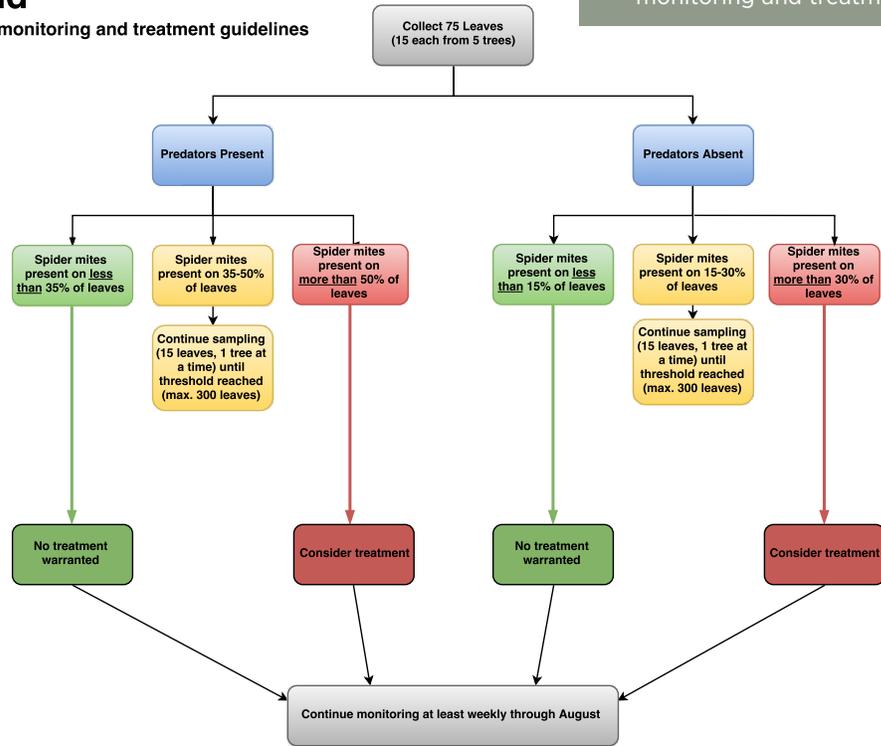
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Almond

Spider mite monitoring and treatment guidelines

Almond Decision Tree: Spider Mite monitoring and treatment guidelines



Updated 01/2017 (EJ Symmes)

Continued from Page 58

com/almonds/insects-mites/what-to-if-you-applied-abamectin-to-almonds-in-may/.ucanr.edu/PMG/r3400211.html

Threshold and Biological Control Approach

With this method, spider mites are treated once economic thresholds are reached (not before) and the overall goal is to maintain a balanced ratio of natural enemies-to-spider mites that will allow the beneficials to help suppress spider mite populations.

- Monitoring and treatment thresholds take into account the abundance of both the pest spider mites and their key natural enemies (predator mites and sixspotted thrips). For more details, refer to the decision tree (See Image on page 60) and visit ipm.

- As noted above, the basic tenet of conservation biological control (maintaining “good bugs” in our orchards to help control the pests) is “Don’t Starve Them & Don’t Kill Them.” Early season

Continued on Page 62

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Taking Control of Botryosphaeria in California Walnut Orchards

Botryosphaeria are a group of fungal pathogens that have been well-known for decades in the California pistachio industry, with initial discovery in 1984 and significant production loss to the disease in the late 1990s. However, Bot pathogens have emerged as a growing challenge to walnut tree health and yields in California in the past three to four years. In walnuts, Bot can easily spread from tree to tree by wind or water, and spores germinate with a quarter-inch of rain or as little as 90 minutes of exposure to water.

The disease has a multi-season impact on orchards. Bot infects and damages the current year’s fruit, and also the fruit wood that will produce fruit the following year.

“In some mature walnut orchards, **we’ve seen yield declines of 25 percent or more in the first year**, with additional declines the second year and potentially devastating impacts to the health of trees in the orchard,” said Chuck Gullord, a technical sales representative for Bayer.

Botryosphaeria spores germinate and enter the tree through existing wounds or scars, such as those from pruning, leaf and fruit drop or bud scars. Research conducted by the University of California in 2014 found that untreated wounds can be susceptible to infection from Bot fungi for extended periods. For example, pruning wounds in medium to large branches can be **infected for at least four months** after the pruning cut is made.

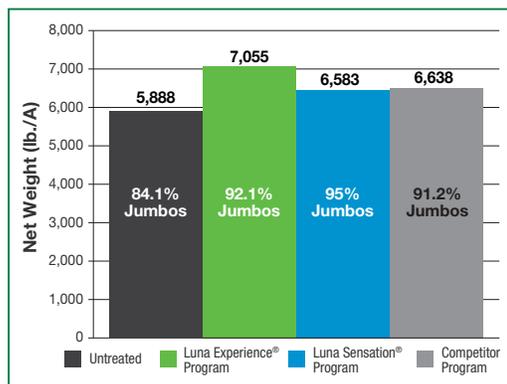
*“Walnut trees with scale infestations are **60 to 70 percent more** prone to Bot infection.”*

Chemical control programs are highly effective in controlling Bot fungi as well as scale and other damaging insects that allow disease to spread.

While walnut scale damage has historically not been considered a significant economic threat to walnut production, the lesions on trunks and old branches caused by scale are a key entry point for Bot infection. Walnut trees with scale infestations are **60 to 70 percent more prone to Bot infection.**

Bayer provides several solutions for walnut growers. Luna Sensation® and Luna Experience® fungicides are highly effective in controlling Bot fungi, and Movento® insecticide provides effective control of scale and other major insects and mite pests.

Identification of Bot infection in walnut trees can be difficult compared to identifying the disease in pistachio and other trees, because other diseases such as Walnut blight show similar symptoms. The symptoms can also be confused with frost damage or winterkill in some circumstances.



Yield (lb./A) and percent jumbos in a university/grower large plot trial at Modesto, CA, 2014. Andy Alderson (Modesto Junior College) and Dr. Themis Michailides, Tulare variety, planted 2004. Applications on 4/16, 5/15, 6/25, 7/25 and 10/30. Harvest on 9/29. Plots: 11 rows, 2 rows harvested per plot.

In addition, walnut trees in a university/grower large plot trial treated with Luna Experience® and Luna Sensation® programs delivered 1,167 and 695 pounds per acre of increased walnut yields compared to untreated controls.

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destruction of natural enemies and/or their food sources will likely mean that they will not be present, or not present in enough numbers at the right time, to provide measurable impacts later in the season when we need them to help fight flare-ups.

• Admittedly, predators alone may not be sufficient to keep spider mites below economically-damaging levels, and miticides may be needed based on your site-specific monitoring when thresholds

are reached. Know which predators are present and choose materials accordingly. Using a miticide that is softer on beneficials helps keep them around to suppress spider mites missed by the pesticide. This link contains a table of almond pesticides and their impact on beneficials, including predatory mites and sixspotted thrips: ipm.ucanr.edu/PMG/r3900311.html.

• Best practices for getting the most out of your threshold-based miticide application include choosing the right material for the job (i.e., those softer on

predators if they are present, desired residual activity and pre-harvest intervals, quick and effective knock-down if needed, etc.), obtaining optimal coverage (high volume, slow speed), and applying with oil or the recommended adjuvant.

• At the recent Almond Conference, Kern County UCCE Entomology Advisor David Haviland reported the dramatic impacts sixspotted thrips populations had on reducing spider mite levels in three orchards across Kern County in 2017 (available at almonds.com/growers/programs-and-events/almond-conference > select "Insect Pest Management Update").



Central Valley Almond Day Pre-Harvest Meeting



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Western predatory mites (top and bottom), spider mite (center). Photo courtesy University of California Statewide IPM Program.

For more information on spider mite management (in both almonds and walnuts), with particular focus on monitoring and treatment thresholds, please see my article in the May 2017 issue of West Coast Nut and visit www.sacvalleyorchards.com.

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



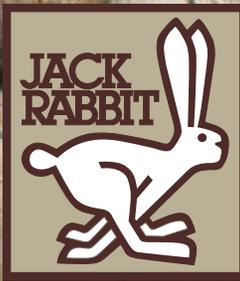

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