

WEST COAST NUT

June 2018 Issue

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New Technologies
Benefit Nut Processors
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More Growers Look to Organic Walnuts

Best Pest Management in Hazelnuts

Bee Better Certification: What Is It and Do I Need It?

Central Valley

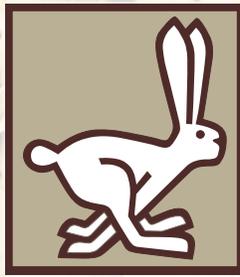
Almond Day

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WEST COAST NUT

By the Industry, For the Industry

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FEATURED ARTICLE

New technology is expensive, but many times it is worth the investment because of the savings in time, efficiency and improved product. Electrical systems have been greatly improved in recent years by the use of PLC's (Programmable Logic Controllers). PLC's allow huller/sheller operators to initiate operation of all equipment with a single control.

See the full story on page 54





Figure 1. Black streaking caused by *R. stolonifer*. The streaking is a result of toxin (fumaric acid) movement and can be traced to infected peduncle. Photo courtesy of Brent Holtz.

Dissecting ALMOND HULL ROT

By: Mohammad Yaghmour, UCCE Kern & Kings Counties
Brent Holtz, UCCE San Joaquin County
Themis Michailides, Department of Plant Pathology,
UC Davis & Kearney Research and Education Center

As the name suggests, hull rot of almond is the infection of the almond hull by one or more fungi, and it is primarily caused by *Rhizopus stolonifer* (commonly known as the bread mold fungus), or by *Monilinia* spp. (mainly *M. fructicola* the brown rot fungus). In addition to the rotting of the hulls, the

leaves near the infected almond fruit wither and dry. These symptoms are usually visible a few weeks before harvest. As the disease progresses, these fungi produce toxins that will move into the spurs and the twigs killing fruiting spurs as well the twigs. While hull rot generally does not affect almond kernels during

infection, it may increase the number of stick tights and can affect future yields due to the loss of fruiting wood. Plant diseases are usually associated with stressed orchards in the presence of conducive environmental and plant conditions favorable for disease development.

Continued on Page 6

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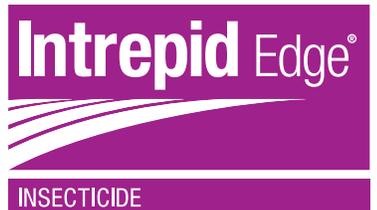


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However, this disease has been associated with well managed orchards and sometimes referred to as the “good growers disease”.

In Kern County, and the Southern San Joaquin Valley, *R. stolonifer* is more prevalent, and this fungus produces a toxin (fumaric acid) during infection which moves from the infected hull into the surrounding tissues killing the vascular tissue, and the symptoms are usually expressed as black streaks in the wood after removing the bark (Figure 1, page 4). In the recent years, however, other fungi, such as *Aspergillus niger*, have been implicated in the development of similar symptoms. During visits to orchards with hull rot during the summer of 2016, the most prevalent causal agent after visual inspection was *Rhizopus stolonifer* as compared to fruits infected with *A. niger*, while other fruits showed mixed infection of *A. niger* and *R. stolonifer*. However, *A. niger* causing significant hull rot damage was reported in Fresno, Madera, and San Joaquin counties in 2017 as well from a trial in Kern County. There were samples with more *A. niger* than nuts infected by *R. stolonifer*. Recently, *A. niger* and *R. stolonifer* was isolated from symptomatic tissue of almond peduncles and tissue exhibiting internal streaking suggesting that the tissue was colonized by both fungal organisms. *A. niger* was first reported by Dr. Beth Teviotdale, emeritus University of California (UC) specialist to cause hull rot in Kern County as early as 1990 and 1991. In preliminary pathogenicity tests in 2017, inoculated fruits in the orchard reproduced hull rot symptoms and research is ongoing to understand factors affecting disease development.

It is always important to diagnose which fungal pathogen is causing the disease in the orchard because *R. sto-*



Figure 2. Infection of almond hull with *Monilinia fructicola*. Brown lesion is visible with fungal signs visible as brown to tan spores on the surface of the lesion. Photo courtesy, Integrated Pest Management for Almonds, 2nd edition.

lonifer and *M. fructicola* have different management strategies, and the addition of *A. niger* as a pathogen of hull rot makes disease control even more difficult than before. Correct diagnosis can be achieved by looking at the signs and symptoms of the disease after the start of hull split. *Monilinia* spp. produce a brown lesion with sometimes visible tan spores and fungal growth on the outside and/or inside surface of the hulls (Figure 2, above). In general, *R. stolonifer* appears as black fungal growth (black sporulation intermingled with mycelia strands of the fungus between the hull and the shell) (Figure 3, page 7). *A. niger* appears as flat jet-black spores and it is usually located between the hull and the shell without masses of mycelia (Figure 4, page 8). In case we cannot see the signs of the fungi, it is advised to send the sample for isolation and incubation to determine the causal agent. Hull rot is considered one of the most important, difficult to control diseases that can cause significant losses in almond

orchards if it is not well managed.

Disease Development and Fruit Susceptibility

Hulls become susceptible as early as hulls begin to split. It is important to remember that *R. stolonifer* cannot infect and directly penetrate healthy tissue without a wound. Dr. Jim Adaskaveg has shown in laboratory experiments that the most susceptible developmental fruit stage for *R. stolonifer* infections is b2 compared to later stages. According to the UC IPM for Almonds publication (Figure 5, page 10), b2 marks the begin-

ning of splitting forming a deep “V” along the suture. At this stage a natural wound allows for spores to enter and infect the healthy tissue and infection can progress with hull split. He also attributed the differences among the



Figure 3. Signs and symptoms of hull rot caused by *Rhizopus stolonifer*. Black spores are visible between the hull and the shell and symptoms of dry leaves are apparent. Photo courtesy of Brent Holtz.

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different fruit developmental stages due to the hull moisture content. When *R. stolonifer* infects the hull, fumaric acid moves from the infected fruit into the surrounding tissues killing the vascular tissue and producing the typical symptoms of black streaks in the wood killing the vascular tissue. Also, there are differences among varietal susceptibility to hull rot. The major variety in California, Nonpareil, is the most susceptible variety followed by Butte and Winters. Sonora is considered to have intermediate susceptibility. While Wood Colony, Carmel, Padre, Fritz, and Monterey are considered to have low or very low incidence of hull rot compared to other varieties. The early hull splitting varieties are usually the most susceptible while the later hull splitting varieties are more resistant (probably dependent on the water stress of the orchard at the time of hull split).

Effect of Nitrogen Fertilization and Irrigation on Disease Development

Previous studies examining nitrogen rates and irrigation treatments have provided information on their association with hull rot incidence in the orchard. Previous studies done by Beth Teviotdale and her associates and by Sebastian Saa and associates had demonstrated that excessive nitrogen application over crop demand significantly increased the incidence of hull rot in the orchard. When nitrogen rates increased, so did the incidence of hull rot. It was also observed that hull rot strikes were higher in low crop years compared to high crop years. In the study done by Saa and associates, they concluded that the increase in hull rot incidence was not because excess nitrogen application prolonged certain stages during hull split, but rather excess

Continued on Page 8



Figure 4. A. *Aspergillus niger* causing symptoms of hull rot where leaves are dry, and twigs are dead. The spores are jet-black and flat between the hull and the shell. Photo courtesy: Brent Holtz.



Figure 4. B. *Rhizopus stolonifer* causing hull rot symptoms with visible black sporulation intermingled with mycelia strands of the fungus between the hull and the shell. Photo courtesy: Brent Holtz and M. Yagmour.

Continued from Page 7

nitrogen increased the susceptibility of the tissue during hull split. Certainly, understanding the physiological effect of nitrogen on hull susceptibility will help in identifying new methods to control this disease.

In another study, Teviotdale and colleagues showed that applying moderate water stress through deficit irrigation at the onset of hull split helped reduce the number of dead leaf clusters, and more importantly reduce the amount of dead fruiting wood (spurs) in the orchard.

Management of Hull Rot

Now that we understand a little better than before how the different factors contribute to disease development and incidence in the orchard, any hull rot management program should strongly consider cultural control methods and compliment such strategy with chemical control (<http://ipm.ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf>) when needed to reduce disease incidence. Such approach should include avoiding excessive nitrogen fertilization by following the nitrogen management plan based on crop load and applying nitrogen at the right rates and right times during the season, avoiding applications after kernel development has been completed. Research data suggest that nitrogen

applied after this stage in the summer will be directed to the hull increasing its susceptibility to hull rot. So, it is important to monitor tree nitrogen status using

July leaf analysis to maintain nitrogen levels within the UC critical value range of 2.2-2.5 percent.

Continued on Page 10

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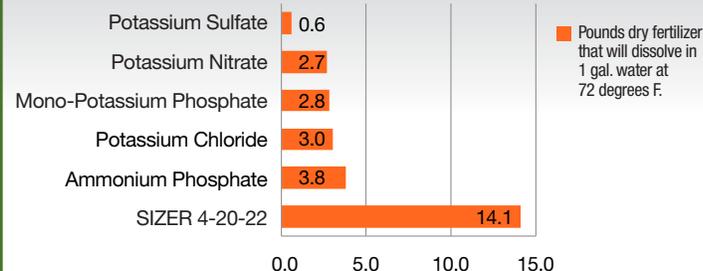
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In recent U.C. research on Almond Hull Rot, foliar applications of alkaline fertilizers, specifically Di Potassium Phosphate were similarly effective as fungicide treatments and significantly reduced the disease. While research rates of 1.5 -2 quarts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

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Another cultural control practice is applying a moderate stress using strategic deficit irrigation (SDI) during hull split. Applying moderate stress can be an effective management practice to manage hull rot and can reduce hull rot incidence by 80-90 percent. This can be achieved by applying irrigation water when trees midday stem water potential is between -14 and -18 bars using a pressure chamber. The period to apply this stress starts at hull split until we reach 90 percent hull split, a period of approximately two weeks. We must be cautious to achieve the desired mild stress by reducing the duration of irrigation and not the frequency of irrigation. After the two-week susceptible period, normal irrigation should be resumed until the harvest dry-down period.

Cultural control can be complimented using chemical control. Since b2 stage during fruit development is the most the susceptible stage, research done by Dr. Adaskaveg showed that using chemical control sprays at this stage will decrease hull rot incidence. According to the 2017 UC publication “Fungicides, Bactericides, and Biologicals for Deciduous

Tree Fruit, Nut, Strawberry, and Vine Crops”, the best time to apply for hull rot caused by *R. stolonifer* is in June when hull split is about 1-5 percent. Sprays to manage hull rot caused by *Monilinia* spp. should take place three to four weeks before hull split. Currently strobilurin (FRAC 11), and DMIs (FRAC 3) fungicides are effective to control the disease as well as fungicides in the FRAC groups 3+7, 7+11, 3+11

As for the management of hull rot caused by *A. niger*, we will need first to understand the factors that contribute to disease development in the orchard in a similar fashion to *R. stolonifer* and *Monilinia* spp. Currently, this research is under way to successfully design a disease management plan.

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

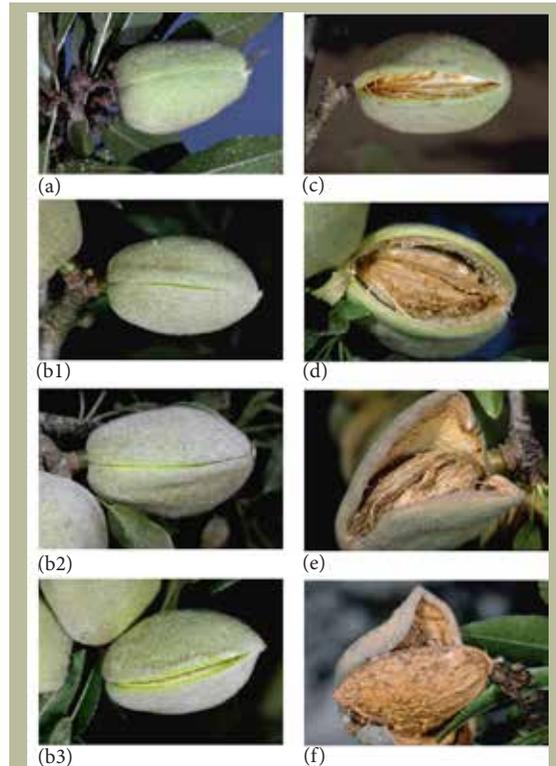


Figure 5. Stages of hull split. a. unsplit hull, b1. initial separation, b2. deep V split, b3. deep V split, but nut pops when squeezed, c. split, but less than 1 cm, d. split, more than 1 cm, e. initial drying stages, f. completely dry. Photo courtesy of Integrated Pest Management for Almonds, 2nd edition.



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MANAGING SODIUM, CHLORIDE & BORON IN ALMONDS

BY: JULIE R. JOHNSON | CONTRIBUTING WRITER

Almonds trees are a testy bunch when it comes to sodium, boron and chloride. Ask expert Patrick Brown and he'll tell you all about it. In March, Brown, professor of plant nutrition in the Department of Plant Science, University of California (UC) Davis, did just that as a key presenter at the Spring Almond and Walnut Nutrient and Water Management Field Day at the Nickels Soil Lab in Arbuckle, California, during which he spoke about salinity, boron and chloride in almonds and managing those components in irrigation water, soil and trees.

“Four or five years ago salinity was a huge issue at the end of the drought,” Brown said, “in some areas burning up trees, and as we know, the problem will come around again.”

He explained one reason of importance for discussing the issue is there is “still room economically to expand in almonds” in the state.

“The problem is, we don't have any decent water and soil, so we will be pushing into lower quality resources as we think about expanding almond growing acreage,” Brown added. “Under those circumstance, salinity and boron will always be an issue.”

The Problem

While some row and tree crops can handle some salinity stress from the toxicity of ions sodium, chloride and boron, almonds tend to struggle.

All agricultural soils and irrigation water contain salts, but a soil is not considered saline unless the concentration of salts in the crop root-zone is high enough to reduce crop growth and yield.

Brown said the reality is that often growers will have multi-



Symptoms of salt and, or, boron toxicity in almonds can be die-back at the top of the tree. Photo courtesy of Patrick Brown



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Orchard under drip-irrigation
General view

After several irrigation events. Salts are accumulated in the "boundary zone" reaching values of 8-10 dS/m

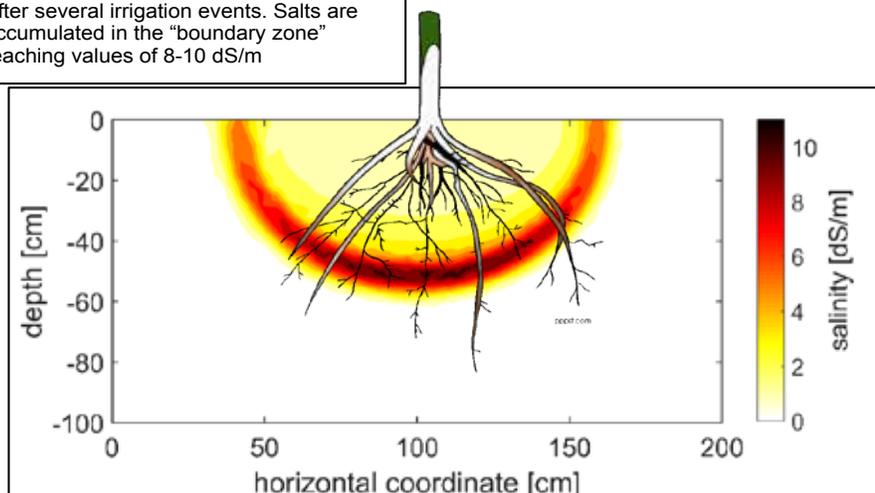


Chart courtesy of Patrick Brown

ple toxicities in some conditions, such as a combination of sodium and boron toxicity, which can produce a mix of symptoms making it difficult to identify the problem.

In addition, many of the salts are slow toxins and are slow in revealing toxicity unless under extreme conditions. For instance, like many of the salts, chloride in almond can accumulate over time, with most species showing >0.3 percent resulting in yield loss, however, outward symptoms may not appear until >0.8 percent. Soil structure is another item of concern as sodium displaces calcium and soils can become compacted and lack oxygen, impeding root growth and tree health.

Boron toxicity is unique in almond, Brown said, as prunus/malus produces a boron-carrying sugar that is not present in pistachio and walnut.

“One ppm (parts per million) boron for three months in the year is no big deal, however, one ppm boron for 12 months in a young tree, now that's a big deal. One ppm for two to three years in a mature almond tree is also a big deal,” he added.

Brown said it is pretty much the same with sodium. “Medium levels a tree can tolerate, as long as you relieve that pressure,”

The Symptoms

Symptoms of boron toxicity in almonds can be brown/black dead lesions on the bark, die-back at the top of the tree with very poor bud initiation, boron accumu-

lation in fruit, gumming on fruits and bark, increased stick tights, and death of young stems that die-back starting at the tips.

However, Brown cautioned, don't look for boron toxicity symptoms on the leaf, because there aren't any such as a grower would find in the case of sodium toxicity.

For sodium toxicity, one of the most common symptoms is leaf tissue damage, or leaf-tip burn. Brown said this is an accumulative problem and over time the symptoms increase.

“In a young tree, once you start to see the gumming, you now have a site for infection for all manner of fungal diseases and ultimately it will be the fungal disease that kills the tree,” he added.

Management Rootstock

The first and most important choice a grower can make when expanding into new ground were soil or water quality is compromised, said Brown, is the choice of almond rootstock.

“There are tremendous differences in their ability to avoid salt uptake,” he added.

Katherine Jarvis-Shean, University of California Cooperative Extension (UCCE) orchard advisor Sacramento, Solano and Yolo counties, said 2,000

Continued on Page 14



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Continued from Page 13

pounds per acre (sixth leaf) is possible in high boron conditions if the grower picks the right rootstock.

“What is beautiful about this is that the rootstocks that take up less sodium, also take up less chloride and also tend to take up less boron,” Brown added. “So you get a triple benefit by choosing the right rootstock. You choose rootstock for others purposes as well, for disease resistance, growth habit, growth control, anchorage, water-type tolerance, so there are other things to think about when choosing the right rootstock.”

Brown re-emphasized, if a grower is in a region where the water source and the salt is a primary constraint, then the choice of the rootstock addressing that issue is very important.

The results of almond rootstock trials have shown that rootstocks that take up less boron also take up less chloride and sodium, Brown said.

Rootstocks Lovell and Krymsk 86 had the highest leaf chloride levels, while all the peach/almond hybrids, such as

LEACHING REQUIREMENT

(Cl, Na, B)

Estimated using the following equation

$$L_r = EC_w / (5 EC_e^* - EC_w)$$

- EC_w is EC of irrigation water
- EC_e^* average root zone salinity 'threshold' (Mass and Hoffmann, 1977; Grieve et al. 2012)

Almond EC_e tolerance=1.5dS

if $EC_w = 1.0$

Then $L_r = 1/(7.5-1.0) + 15\%$



Brights 5 and Hansen 536, as well as Viking and Rootpac-R, had significantly lower chloride levels.

In addition, Lovell, Atlas and HBOK 50 had the highest hull boron levels, while all the peach/almond hybrids and Viking had the lowest.

Brown said Mission and Fritz, and to a lesser extent, Monterey, are very sen-

sitive to sodium, and take up salt more easily than Nonpareil, and serve as good salinity indicators.

“It's not as big a difference as the rootstocks make, but if you have a mixed planting of Monterey or Fritz, those will be your indicator trees of salt toxicity. They start to fry up faster than the Nonpareil or Mission,” he added.

Leaching

When a grower doesn't have the option of choosing a rootstock, if a not-great rootstock is already in the ground, it is important to leach the ground when salinity reaches toxic levels. Leaching is the management standard.

In an effort to determine salinity levels, annual testing of soil samples from selected locations in the orchard should be part of every growers' management program.

Brown said an equation has been developed in understanding leaching requirements.

“The equation looks very complicated, however, it is actually pretty simple as you work out how much extra water you need to apply to leach sodium or chloride out of the soil,” he added. (See chart above)

“However, all of the leaching equation work was built around flood irrigation where you have a uniform distribution in the soil because you have flooded the whole soil surface, then you apply water in excess of the tree demand to push it through the profile,”

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Brown explained. “You can imagine in a drip irrigated system, it’s a very different system, because in a drip irrigation system you are going to develop a sort of an onion-ball shape of salt accumulated around the peripheral of the wetted zone.”

Drip irrigation

Brown said studies have shown application of good quality (0.5 dS) water from September through March greatly reduced tissue/leaf sodium and chloride in the spring.

“This shows that winter leaching will relieve the salt from the soil, and an in-season leaching will also dilute the salt in the tree, just something to think about,” he added. “This illustrates the tree can respond quite quickly to getting good water during its growth season. The same is true with boron.”

In California, Brown said the reality in drip and micro-sprinkler irrigation systems is that the almond root systems are compact, with a limited root volume which is moist, having better conditions immediately under the drip/micro-sprinkler and graduating into salty conditions at the periphery.

Brown said the resulting consequences are apparent during extended dry down when the trees can become greatly susceptible to salt toxicity.

“Why, because that root-zone which was very small is now near zero, and all that salt is back in amongst the roots,” he explained. “So, not managing your water to keep those trees with a portion of the root-zone in good condition results in the collapse of that cultivar.”

Brown talked about a controlled, split-root experiment conducted during which the roots still attached to trees were split and potted into two different pots, one side treated with good water and the other side treated with salty water.

What they learned from the experiment, he said, is that almonds are remarkably good at avoiding salt if a non-saline, nutrient rich root-zone was present, however, if the saline root-zone contains needed nutrients then uptake from saline root-zone will occur.

“And, if the only source of nutrients is the salty soil, then the tree will take up

a lot of salt,” Brown said. “Think about that in managing a drip or micro-sprinkler irrigation system. During dry down toward harvest, you put down your nitrogen and it goes right into the salt zone and the only option the tree has is to take up its nutrients out of the salt zone right along with the salt. You are basically force feeding your trees the salt.”

The take home from this, Brown said, “is in managing nutrients and salinity together so that at any given time the nutrients are in the least salty portion of the root-zone is critically important.”

“This is all new stuff,” he added. “We had no idea that almond roots are really so good at finding where the good patches of the environment are.”

Boron

In terms of managing boron toxicity, Brown said it is much more difficult as boron does not leach as easily through the soil as chloride and sodium, and in general the leaching fraction for boron is much higher, maybe two to four times as much.

“I just have to say in general, because it is highly dependent on your soil type, leaching boron is hard to do and not a typically viable approach,” he added.

Brown said there is a commercial group, Boron Solutions, which is exploring how to pull boron out of irrigation water, and he thinks “they have a pretty good system that appears to be cost effective in removing boron.”

He believes in areas such as the Sacramento Valley and western San Joaquin Valley where boron in almond is “on occasion the number one issue,” something like what is being explored by Boron Solutions might be worthwhile to investigate.

Jarvis-Shean said there are rootstocks shown to handle the boron problem adequately, including Nickels, Titan SG1 and FxA.

Brown explained a component in managing boron concerns the growth of the tree and the amount of yield helps mitigate the boron toxicity.

“A smallish tree with low yield will be taking as much boron from the soil as a very vigorous, higher yielding tree, with the advantages of the vigorous, higher yielding tree is a lot of that boron ends up in the nuts and you take it away from the field,” he added. “This shows there is a relationship between vigor, potential vigor, and tolerance to boron.”

Measuring boron in the hull is a good indicator of its status in the tree, and typically a level over 200 ppm might spell trouble.

“Anything over 300 ppm is quite certainly in a high boron area,” Brown said.

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BEST PEST MANAGEMENT IN HAZELNUTS

BY CECILIA PARSONS | ASSOCIATE EDITOR

Hazelnut acres are surging in Oregon despite the challenges being raised by two significant insect pests.

The opportunistic Pacific flathead borer (PFB) preys on newly planted hazelnut trees while the invasive brown marmorated stinkbug (BMSB) continues to infest orchards and destroy nut crops.

BMSB

The brown marmorated stinkbug, a native of Asia, was introduced on the east coast in the 1990s and by 2004 was detected in Oregon. Nik Wiman, Oregon State University (OSU) orchard specialist, said BMSB damage to hazelnut crops was confirmed in 2012.

This pest has also been found in California, but mostly in urban areas. There has been speculation by researchers that the prolonged high summer temperatures in California may be a limiting factor with this pest. Oregon, with forested areas adjacent to many orchard crops, may have a bigger challenge with this tree-loving pest.

Adult BMSB has a typical stinkbug shape, white bands on its antennae and legs, rounded shoulders and a prominent light-dark banding pattern on its abdomen. BMSB eggs are barrel shaped, white to pale green in color and can be found as masses on leaves. Newly hatched nymphs are difficult to distinguish from native stinkbug nymphs.

BMSBs produce one generation per year, although two generations have been documented in California. After

mating in the spring, the female BMSB lays eggs in clusters on plant material. In the fall, mature BMSB will aggregate and move to protected places, including structures, to over winter.

BMSB Damage

Wiman said BMSB feeds on all parts

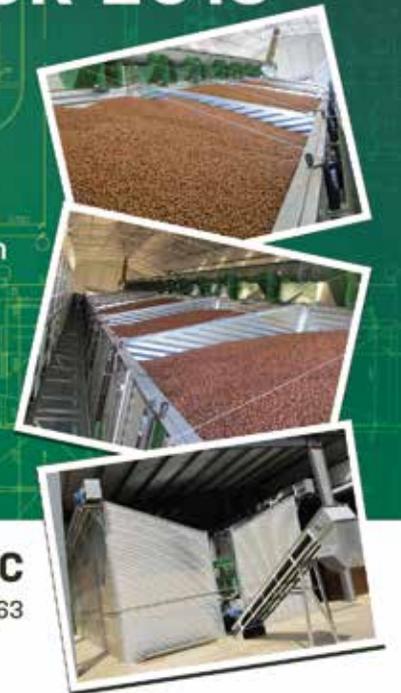
of the plant and hazelnut trees can be a single host. Economic damage comes from BMSB feeding on hazelnut kernels through the shell late in the season. Feeding can also introduce pathogens. The damage may go unnoticed at harvest, but nut sampling by processors may

Continued on Page 18

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Continued from Page 16

find damage.

BMSB feeding may go undetected as the damage to the nuts resembles other causes.

“There’s no good handle on this,” Wiman noted. There is ongoing research in BMSB early feeding habits causes for shriveled or aborted nuts.

BMSB Control Options

Growers who find high numbers of adult BMSB feeding have few choices in control. Pyrethroid products are effective, Wiman said, but studies have shown that complete coverage of an orchard may have harmful effects on beneficial insects and may cause flare-ups in populations of mites or aphids.

Spraying borders, or alternating rows in an orchard can be effective BMSB control, Wiman said. Timing can also

help, as nymphs are easier to kill than adults.

Wiman said that long term, the best bet for BMSB control will be natural enemies. The wasp, *Trissolcus japonicus*, also known as the “samurai wasp,” appears to be the best bet for biological control of BMSB, according to Wiman. The wasp originates from the same areas of Asia as BMSB. A parasitoid, it hunts for the egg masses laid by adult BMSB and lays eggs in each of the eggs. The parasitic wasps develops inside the eggs and chew their way out after hatching, destroying the BMSB eggs. Wiman said he believes establishment of the wasp in Oregon hazelnut production regions will be the long-term solution to BMSB control.

BMSB Emergence

BMSB adults began emerging from overwintering sites in April. OSU researchers reported capturing the first BMSB of the season in baited traps in

the Willamette Valley. They are working to develop trap catch thresholds to determine if spray applications are necessary. They will also be monitoring orchards for samurai wasp activity.

PFB

Newly planted hazelnut acreage became the target of the Pacific flatheaded borer several years ago. Damage by this destructive beetle came to light two years ago as acreage was expanding.

Wiman said PFB is not a threat to mature trees, but it will kill young trees. Populations of this pest are higher in foothill regions and orchards planted adjacent to forested areas seem to have more PFB infestations. Drought and water stress are also linked to PFB infestations.

Adult PFB are a quarter to nearly a half-inch in length, and are bronze or metallic in color. They are destructive in the larval stage. Female PFB lay their



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eggs in weak points of the tree. Sunburn, pruning wounds or cracks in the bark leave openings for egg laying.

These pests tend to attack weak, new trees that are showing signs of stress from drought or over watering or plantings in marginal soils, Wiman said.

PFB Damage

Chemical control of PFB is difficult as they are protected by the tree bark. Pesticide applications can prevent additional infestations, but do nothing to the destructive larvae that are already burrowing into the wood.

Larvae may feed in one area or travel to feed on the cambium layer and zylem. Their mines through the wood can resemble a spiral pattern as they girdle the tree. Frass or sawdust may be visible on the ground below the entrance hole where PFB larvae are feeding.

Tunnels through the wood are

packed with sawdust and the tunnels will be wider than they are tall. Spongy wood can be a symptom of active PFB larvae feeding. Trees that have been partially or completely girdled due to feeding generally die. Cankers form at feeding sites and block nutrient and water delivery from roots to leaves and branches. Borer-infested trees appear wilted, have yellow leaves and do not respond to irrigation water application.

PFB damage will be visible late in the growing season. Inspection for damage should start at the soil line and move up about three feet. PFB may overwinter in the center of the tree. In spring, PFB larvae will pupate and then emerge as adults in early summer.

Controlling Tree Stress

Wiman said that stress to young trees can increase chances of PFB infestation. Healthy nursery trees should be planted early in the dormant season to give them an opportunity to establish a good root

system before the onset of high summer temperatures.

Sunburn on tree trunks is a major factor in PFB attacks and Wiman noted that painting the trunks with a 70 percent dilution of white latex paint offers some protection from sunburn. Trunk guards can also protect young trees from sunburn and herbicide damage but do not protect against PFB as the trees are attacked above the guard and larvae mine downward inside the guard. The guards also make it difficult to spot PFB infestations.

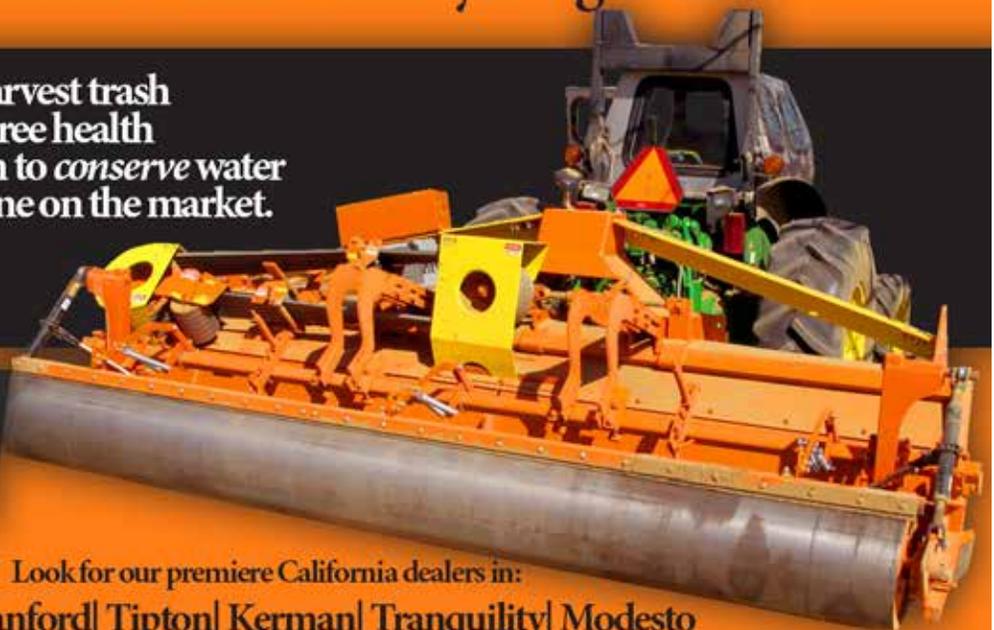
Wiman said it is also important to remove infested trees, as they are a source of new generations of PFB. Cut or diseased trees should be removed from the orchard.

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Navel orangeworm damage to almond kernels.
Photo courtesy of Jhalendra Rijal.



Integration of Mating Disruption into Management Programs for *Navel Orangeworm*

By: Jhalendra Rijal | IPM Farm Advisor, UC Cooperative Extension & Statewide IPM Program-Northern San Joaquin Valley

David Haviland | Entomology Farm Advisor, UC Cooperative Extension, Kern County

California nut crop growers, producers, and processors are quick to agree that 2017 was a bad year for navel orangeworm (NOW), especially in almonds. When conversing with growers about their 2017 experience, most report costly increases in NOW damage, particularly late in the year. Based on the Blue Diamond Growers team estimation, one percent damage on a grower's grade sheet was equivalent to a ~\$160 loss per acre, five percent to a \$1,008 loss, and 10 percent to a \$1,742 loss. These dollar values were calculated based on a 2,500 lb. yield, price of \$2.50 per lb. and taking into consideration that damaged kernels at the huller only represent about half of the damaged kernels. The other half typically get blown out when windrows are collected, or are obliterated during the hulling process. In addition to direct economic losses, higher damage by navel orangeworm also increases the efforts needed to mitigate risks from aflatoxins.

NOW Damage

Damage from NOW is impacted by several factors related to the host and insect. During 2017, key factors that influenced the increase in damage

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included:

1. High winter rainfall leading to poor mummy sanitation due to limited access to the orchards,
2. Increased contiguous acreage of host crops (walnuts, almonds, pistachios) across the valley, and
3. Unusually high summer temperatures (39 days of 100+ degree F temperature in Modesto). These high temperatures can cause early NOW flights, an increase to four flights in

northern areas that are only accustomed to three flights, making it more susceptible to late damage.

Management Practices

Current management practices for navel orangeworm primarily depend on insecticides and winter sanitation (the removal and destruction of the previous season's unharvested nuts "mummy nuts" in winter). The mummy nuts harbor navel orangeworm larvae during the winter and also serve as the only resource for the first-generation moths

to lay eggs. Winter sanitation is the most effective practice to reduce NOW damage and should be considered as the first line of defense.

Insecticides provide a second line of defense against NOW. Research has shown that insecticides that target eggs and young larvae (such as those containing methoxyfenozide and chlorantraniliprole) work best when applied when hulls are splitting during a NOW flight, such as at the initiation of Nonpareil hull split, and sometimes a few weeks later when pollinizers start to split. However, efficacy of these products is difficult to predict due to the narrow window of larval susceptibility (i.e., from the time they are an egg until the bore into the nut), the fact that all eggs are not all laid at the same time, and due to the way hulls split (often exposing untreated shells and kernels).

Mating Disruption

Research and demonstration trials in the recent decade have shown that pheromone-based mating disruption can effectively be implemented as a part of the IPM (integrated pest management) program in reducing the economic damage by navel orangeworm. Mating disruption is a male-confusing technique in which the ability of male moths in finding females is impaired with the application of artificial pheromone. Unmated females are unable to produce offspring, and females that have delays in mating produce less offspring.

Currently, there are three aerosol-based mating disruption products (NOW Puffers[®] by Suterra, @2 units/acre; Semios NOW Plus[®] by Semios, 1-2 unit/acre; ISOMATE NOW Mist by Pacific Biocontrol, @1 unit/acre) available for commercial use in tree nuts in California. All of these products have a battery-operated pheromone-dispensing device, commonly referred to as a cabinet, consisting of a canister filled with the pheromone.

Cabinets release pheromone to the orchard each night. Suterra and Pacific Biocontrol products use an internal timer to release pheromone at a constant interval (i.e., every 15 minutes) from dusk to dawn when moths are reproductively active. Cabinets from Semios work similarly, but can be manipulated by remote control to increase or decrease release

Continued on Page 22

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rates as desired throughout the season. A fourth mating disruption product from Trece, Inc (CIDE TRAK NOW) has been registered with EPA (Environmental Protection Agency) and is in the process of registration in California. In this product, the active ingredient (the same one used by other products) is impregnated into polyvinyl-based plastic strips which dispense the pheromone passively all day and night during the season.

2017 Field Research

2017 field research in Kern County was sponsored by the Almond Board of California (ABC)

to compare the efficacy of the four different pheromone systems. Data showed that all products provided similar reductions in damage compared to the control treatment. Additionally, during 2017 the California Department of Pesticide Regulation (CDPR) sponsored six mating disruption demonstration trials in the northern and southern San Joaquin Valleys. Across the nine trial sites including more than 1,200 acres, mating disruption reduced NOW damage by approximately 50 percent. Data also showed that the value of mating disruption increases with acreage (i.e., mating disruption had greater benefit in 100-acre orchards than 40-acre orchards).

It is important to note that trials in 2017 evaluated the use of mating disruption in addition to (not instead of) sanitation and one to two insecticide sprays. Observational data from interviews with growers who tried to replace sanitation and insecticides suggest that this is a recipe for failure, except when NOW pressure is already highly suppressed.

Information on the benefit of mating disruption, coupled with increased overall NOW damage during 2017, has resulted in a significant increase in mating disruption usage in 2018. Department of Pesticide Regulation (DPR) Use Reports show that more than 60,000

acres of NOW mating disruption were used during the 2015 and 2016 seasons in nut crops. However, interviews with manufacturers suggest that actual usage during those years was much higher (some growers forget to report the use of mating disruption on their monthly pesticide use reports). Current estimates are that well over 200,000 acres of California nut crops have mating disruption systems installed during 2018. This includes increases in almonds and pistachios, as well as some walnut growers.

In addition to damage reductions, many growers have also adopted mating disruption as a way to avoid risks to fieldworkers, due to a lack of pre-harvest intervals, and because the use of mating



NOW larva(e) with feeding damage on almond nutmeat. Photo courtesy of Jack Kelly Clark, University of California Statewide IPM Program." Copyright of the Regents of the University of California.

disruption does not interfere with other orchard practices once the product is applied at the beginning of the season. All of these characteristics are appealing to industry leaders in furthering the sustainability

of nut crop production.

Application Considerations

Application considerations for mating disruption products in the orchard:

- **Timing:** Apply before the moth emergence time in the spring (before April 1 if possible), and it should be good for the minimum of 180 days. Follow the product label.
- Distribute the dispenser units in a grid pattern, plus few more in upwind edges to compensate for the influence from the wind. Consider orchard size, wind direction, edge-effects, etc. while applying these products. Every orchard is different.
- Select the limb closer to the center of the tree at upper 1/3 of the tree height to hang the dispensers and apply in a way to avoid direct insecticide sprays on them.
- Make sure the nozzle is pointing away from foliage and limbs (three foot clearance if possible)

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- Mating disruption products from Suterra and Pacific Biocontrol require installation and collecting by the grower
- Mating disruption products from Semios are more expensive. However, Semios' per-acre costs include installation, maintenance, and removal from the orchard after harvest, and also includes monitoring systems for NOW, weather, and irrigation.
- Use navel orangeworm pheromone traps to check whether the mating disruption product is working or not. Complete trap shut-down is expected when mating disruption is working.
- Use ovipositional traps (egg traps, bait-based female traps) to track degree-days and seasonal pest cycle in the orchard to time insecticide sprays.

Final Thoughts

Despite the effectiveness of the mating disruption in reducing the navel orangeworm damage, the mating disruption should not be taken as a replacement for the winter sanitation and

early harvest practices. For the first few years of use, mating disruption should be considered as an additional method on top of the other control methods in place such as orchard sanitation and insecticide use. More importantly, since mating disruption works best in bigger sized and regular-shaped orchards, we need to think about area-wide approach especially in the areas with a lot of small-sized orchards. Neighbors getting together, having a conversation, and planning for area-wide mating disruption should be a strategy for future success.

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More Growers Look to Organic Walnuts

By: Cecilia Parsons | Associate Editor

Growing walnuts under organic standards may have challenges, but two growers who have different approaches in production are convinced this system can be productive.

Russ Lester, who farms and processes walnuts in the Winters area, uses cover crops and a unique irrigation system as key components to his system.

Linden area grower Greg Ferrari has a compost and nutrient program that works with his no-till system.

Dixon Ridge Farms

Lester, of Dixon Ridge Farms, started an integrated pest management program in his walnut orchards in 1979. He began to transition to organic production and has used no conventional pesticides on his trees since 1989. Illness in his family, he said, convinced him to abandon all types of pesticide use and to rely on a whole orchard system to keep his trees and soil healthy.

Organic versions of pesticides, Lester states, are expensive and not as effective. He sought a different approach to accomplish the same goals.

“Soil health comes first.”

Cover Crops

Lester has used winter annual cover crops and composted manure for the past 30 years to achieve optimum soil

health and fertility. He sows a legume mix to achieve the most benefits. The mix of legumes includes broad categories of clovers, vetches, burr medic, oats, cereal rye and barley. Diversity of the mix gives and presents more chances of success, Lester said, because some varieties do better than others in different years.

Soil fertility is just one of the reasons for the cover crop at Dixon Ridge. Lester said the cover crop attracts beneficial insects including predator wasps. Who, like bees, need nectar and pollen in their diet. The mix means cover crop blooms are present over a longer period. Letting the cover crop bloom, Lester notes, maximizes their nitrogen contribution to the soil.

Letting the plants go to seed, rather than mowing or shredding before seed set, also ensures re-seeding for the next cover crop and helps with weed suppression. Replanting is done every four to five years.

The cover crop is planted in the fall and grows when the trees are dormant and need less water. Lester said they do a light discing before broadcasting the cover crop seed over the entire orchard floor. The seed is covered and the ground is smoothed with a landplane. The crop grows rapidly before the trees leaf out and high mowing is timed to coincide with the increased uptake of nitrogen and water by the trees. It also aids in weed suppression.

The final mow is done after seed production is complete in June. The biomass created not only provides habitat for beneficial insects, but it helps conserve soil moisture and suppresses summer weed growth. Timing of the mow is critical, Lester said, so the biomass has time to decompose prior to harvest.

Composted Manure

A quality compost also contributes to the soil health at Dixon Ridge. The biologically active soil speeds up the decomposition process, aids in water penetration and balances nutrition.

The soil nutrition program of cover crops and compost are reasons why his walnut orchards do not have water runoff or loss of water below the root zone. Lester said the organic matter in the soil aids with aggregation and keeps water in the root zone.

Unique Irrigation System

Because the cover crop literally covers the entire orchard floor, Lester devised a unique irrigation system. Irrigation hoses are five to six feet off the ground, threaded through the trees. Upside down rotary sprinkler heads deliver larger drops of water that won't be blown away or lost to evaporation.

No-till System

Ferrari, who farms both conventional

and organically grown walnuts, also prefers a no-till system in his orchards, but has moved away from cover crops due to the tillage required. With options for fertilizers available, he mows for weed suppression and uses a combination of compost and bone meal that are certified for organic production.

Ferrari said he purchases bone meal from a production plant to mix with compost. The meal is very fine powder and works best if it is in a blend, about 25 percent meal and 75 percent compost.

The mix is applied in the fall and does not have to be incorporated. Rain and warmer weather in the spring move it down to the tree roots. He has used this system to deliver nutrients for the past five years and said nitrogen levels in the soil have held steady. Because of

proximity to the meal plant, he said costs are acceptable. There is one drawback to the compost mixture, he admits. It stinks.

“It’s proven to be a good system. The compost delivers nitrogen and potassium and the smell does go away.”

He said leaf samples for nitrogen levels are important to know because it tells you your fertilization plan is working. He said he also does soil testing, but not on a yearly basis.

Pest Management

Although weeds are an unrelenting challenge for organic production, Ferrari said pest management might vary from year to year.

A primary pest that is new to his area is walnut husk fly. Spinosad is the control material of choice, and it provides control comparable to conventional pesticides. In the last four years, navel orangeworm is becoming a pest of note, mainly because harvested nuts cannot be fumigated. Spider mites, a long time pest in walnuts, are becoming more difficult to control due to hotter summers. Codling moth has been less of a problem and use of mating disruption works well, he said.

Pest species seem to change up from year to year, Ferrari said.

Some years you just get hammered, he said.

Ferrari has used organic production methods in his walnuts for the past 25 years, continuing a transition from conventional to organic that his grandfather started. Organically grown walnut yields can be variable, he said, but can also equal yields from conventionally farmed walnut orchards.

Wetter springs and disease have the most effect on production.

Transition Acreage

Ferrari said he is transitioning another 50 acres of young trees to organic production. Weed pressure can be high and prevent newly planted trees from getting a good root system.

University of California Cooperative Extension (UCCE) farm advisors in Yolo and Lake counties said there is interest in organic walnut production among growers.

Rachel Elkins, pomology advisor in Lake County, said growing conditions, a nearby market and resources have spurred organically grown walnut production. Elkins said later varieties and a shorter growing season lend themselves to organic production. There is no codling moth pressure and bloom occurs during much cooler weather, lowering the chances for blight. Pest pressure comes mainly from walnut husk fly and some frosted scale and walnut aphid.

Young Trees

There are also several processors and marketers of organic walnuts nearby,

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Mowing keeps weed pressure down, allows for more uniform distribution of irrigation water. Photo courtesy of Greg Ferrari.



Weeds are an unrelenting challenge in organic production, while pest pressure varies from year to year. Photos courtesy of Greg Ferrari (Right).



Continued from Page 25

including Dixon Ridge.

“We have enough of a supply here that Lake County gets attention,” Elkins said.

She said nutrition drives the walnut yields. Growers transitioning young orchards to organic need to realize the trees are living off of the accumulated nitrogen and once it is depleted they will need a lot of compost to meet nitrogen demand. The trees can take five to six tons per acre for the first three years, Elkins said.

Cover crops are usually a big part of organic walnut production, Elkins said, but weather conditions in Lake and other northern counties can make

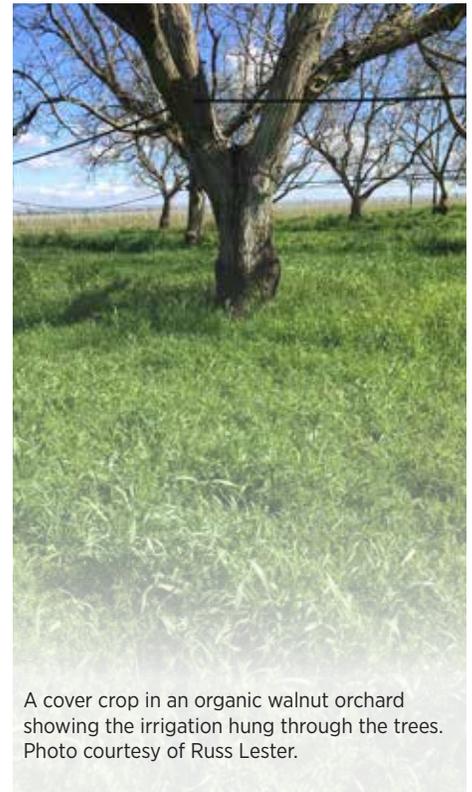
seeding and early growth a challenge. The harvests are late in Lake County, she said, and if seeding of cover crops is delayed that long, it is difficult to get a good stand.

Lake County Organic Walnut Production

Lake County’s 2017 crop report noted that Lake County produces the most organically grown walnuts in the state. The county agriculture commissioner also reported this year that total walnut acres in the county have fallen by 100 acres. Other significant regions for organic walnut production include Yolo, Solano, San Benito and San Luis Obispo counties.

A UC study on organic walnut production found that when compared

to conventionally farmed walnuts, the organic systems are subject to potential decreases in yield and quality from diseases and insects. In this study, the average yield based on grower information was 1,000 pounds per acre.



A cover crop in an organic walnut orchard showing the irrigation hung through the trees. Photo courtesy of Russ Lester.

Attention Walnut Growers

John B. Sanfilippo & Son, Inc. is signing up new walnut growers & seeking additional tonnage for the 2018 crop

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Genius Contests Picks Ag Tech as a Finalist

By: Cecilia Parsons | Associate Editor



The prototype of the pollinator drone in operation. All photos courtesy of Jared Fine/Design Monarch and Dropcopter.

A winner in a global competition for unmanned aerial systems (UAS) technology scored with a business that delivers pollination services for high value crops.

Dropcopter, a pollination UAS startup, secured \$250,000 from Syracuse, New York based GENIUS NY. They will use the funds for expansion and for a third party verification that their pollen

delivery via drone can improve crop set by 10-15 percent.

Dropcopter

Dropcopter founder and CEO, Matt Koball said the company aims to give almond growers confidence that the supplemental pollen delivered to their orchards will have the desired effect on crop yields.

Dropcopter's pollination drone is the first in the world. Koball and his partners developed the device that attaches to the bottom of the drone and there is a patent pending on the device. The pollen delivery is made with precise control of ground speed of drone. The service also has the ability to change the swath of application and the amount of material applied by acre by using precise electronics and purpose designed mechanical

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The advertisement features a background image of a pistachio orchard with rows of trees. In the foreground, a burlap sack is overflowing with pistachios. The text is overlaid on the image, with the main headline in white and the words 'attract, trap, and kill' in red. The Peterson Trap Company logo is in the bottom right corner, and contact information is at the very bottom.

equipment.

Delivering Supplemental Pollen

Delivering supplemental pollen to orchards as insurance against low bee activity and unfavorable weather conditions is not a new idea, but delivering the pollen in precise amounts in precise locations via a drone is a novel concept.

Given the location and parameters of the orchard, Koball said the drone's application pattern is pre-programmed before it is brought to the orchard. After a visual check for obstacles, the drone is loaded with the pollen and begins the application, flying eight to ten feet above the canopy.

The pollen delivery is shut off at the end of the row and starts only when directly over a tree. Delivery can be so precise, Koball said, that a single tree could be targeted to receive supplemental pollen. Or the pollinizer rows can be skipped. Pollen can be applied at rates of 35 to 70 grams per acre.

Dropping the pollen directly over the open blooms by drone, Koball said, is more effective than the current method of blowing it up into the trees from a ground rig. One drone, he said, can apply pollen to 40 acres in an hour.

Currently, he said only one drone/operator per orchard is used, but in the future, he said, one operator could fly multiple drones in adjacent orchards. Drones must be visible to the operator at all times and Koball said they use two people at each site to maintain visual contact with the aircraft.

By flying close to the tops of the trees, Koball said they can adjust to minimize drift in windy conditions, but generally do not make applications if wind speeds are above 12 mph. Dropcopter is also using their GENIUS funding to reproduce their patent-pending pollinator for planned night time deliveries, doubling their operating window.

The pollination service, Koball said, can also be an alternative to crop insurance. Earlier this year, he said, bee pollination for California cherry growers came up short because of delays in hive movement out of almonds.

Used on Multiply Crops

Since the company was founded in



Michael Schaefer, a pilot with the pollinator drone.

2017, Koball said he has compiled data on the effectiveness of drone-delivered supplemental pollen, but has had no outside verification. The delivery system has been used on almonds, cherries and pears. There will be trials with apples in New York this month. Pollen delivery has been attempted on pistachio nut crops, he said, but there are no test results.

Koball said he and his Dropcopter business partners have been working on this venture for the past four years, funding the project by themselves until the GENIUSNY program came along.

Koball and his business partners, Adam Fine and Mike Winch were competing with about 200 other unmanned

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INTELLIGENT SPRAY TECHNOLOGY REDUCES PESTICIDE USE

By: Kathy Coatney | Editor

A sprayer retrofitted with Intelligent Spray Technology. Photo courtesy of Heping Zhu.

The National Institute of Food and Agriculture (NIFA) supports research, educational and extension efforts in a wide range of scientific fields related to agricultural and behavioral sciences. Tom Bewick is the national program leader for the NIFA which is part of the United States Department of Agriculture (USDA).

The funding comes from the Specialty Crop Research Initiative (SCRI). Specialty crops include:

- Fruits and vegetables
- Tree nuts
- Dried fruit
- Horticulture and nursery crops
- Floriculture

There are three different project types:

- Coordinated agricultural projects that are fairly large projects
- Standard research and extension projects which are smaller, but many times grow into coordinated agricultural projects
- Planning projects

Application Process

SCRI has a two-stage review process. Part one of the application process re-

quires sending in a pre-application with a brief overview of the proposed project. The pre-applications are reviewed by

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Continued from Page 32

growers, processors, handlers and people who represent growers through trade organizations for relevance to industry needs and challenges.

“Based on that relevancy review, we invite people to submit full applications,” Bewick said.

The full applications undergo a scientific merit review done by technical experts either from academia, industry or government.

It is a very intense technical review, and each application is reviewed by four people, then there is a panel meeting held in Washington, D.C., Bewick said. Each application is discussed then rated:

- Very good
- Good
- Fair
- Poor

Once the scientific merit review is completed, the projects are separated: coordinated agricultural projects, standard research and extension, and planning projects. The results of the relevance review are combined with the scientific merit review to make a funding recommendations. They are ranked by funding categories:

- Outstanding
- High priority for funding
- Medium priority for funding
- Low priority for funding
- Do not fund

Depending on the project, researchers could receive all the funding up front, or for larger projects, they may receive two years of funding, and then come back to show their progress and that they are hitting their benchmarks. There would be incremental funding after that, Bewick said.

Types of Research

Most of the research NIFA funds are ways to make workers more efficient so that there would be less workers needed, Bewick said, but funding has also been

done for automation and sensor technology too, Bewick said.

They funded a project at the University of Maryland that uses a wireless network of sensors to monitor soil moisture content, Bewick said.

It began in nursery settings, and it has moved to irrigated fields. The research has found huge water savings by only irrigating the areas of the field that need water.

“We think it’s going to have a really huge impact in the West where rainfall has been a problem for a decade or more,” Bewick said.

In the East, where they still receive significant rainfall, they were able to save 50 percent of the water to grow different nursery crops, plus there was also an energy savings from pumping less water, Bewick said.

In 2008, NIFA funded a comprehensive automation for specialty crops project to Carnegie Mellon University, an engineering school in Pittsburgh, Pennsylvania, and not connected to agriculture at the time, Bewick said.

The goal was to develop an automated apple harvester using off-the-shelf technology that was very successful. The equipment that was developed improved worker efficiency by 50 percent, but it was a very large and expensive, Bewick said.

A fully robotic apple harvester is supposed to be commercially available at the end of the 2018 season that is using a lot of the technology developed through the original comprehensive automation for specialty crops funding, Bewick said.

Research is also being conducted on an automated spraying system with funding from NIFA

that can detect the presence, size, shape and foliage density of trees and plants. The Intelligent Spray Technology can significantly reduce pesticide use, too.

Heping Zhu, an agricultural engineer for USDA/Agricultural Research Service (ARS) has been doing research in collaboration with farm advisors and universities across the country, and in Australia.

It is a large research project with multiple team members from USDA/ARS, Ohio State University, Oregon State University, University of Tennessee, Clemson University, Texas A&M and the University of California.

This research has received strong support from the specialty crop industries, and 17 growers in six states have generously provided operating facilities, equipment, labor and experimental field space to test this new sprayer technology, Zhu said.

Ornamental Nurseries

Initially, the research was for ornamental nurseries. Ornamental nurseries have a more complicated structure than

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orchards or vineyards. With ornamental nurseries, even in the same row, there can be different varieties of plants.

“Some of them are very big, very small or even different species,” Zhu said. They found that in the ornamental nurseries there was an average cost savings of \$230 per acre from reduced chemical usage.

The research later expanded to include other commodities: apple, peach and pecan orchards, vineyards, and blueberry and raspberry fields, Zhu said.

Intelligent Spray Technology

Zhu and his colleagues designed a laser-sensor Intelligent Spray Technology that automatically controls the spray output and recognizes the presence, size, shape and density of the target trees or plants and applies the optimum amount of spray.

The Intelligent Spray Technology has a laser-scanning sensor in conjunction with a Doppler radar travel-speed sensor, an automatic nozzle flow rate controller, an embedded computer, a touch screen, a manual switch box and four five-port nozzle manifolds on each side of the sprayer, Zhu said.

“This (technology) will help to minimize human involvement to calibrate sprayers,” Zhu said, adding the Intelligent Spray Technology will determine the amount of spray to be used.

Spray applications vary greatly by crop variety and plant density, Zhu said. Right now a conventional airblast sprayer for orchards, sprays the trees regardless of how many trees are in the orchard or how big they are. What this means is, more chemical is lost in the air and on the ground, Zhu said.

“With our new Intelligent Spray Technology, it uses a laser sensor as a guide to spray the crops as needed,” Zhu said, which means a more precision application of the chemicals and less chemicals used.

“Our development cost is about \$9,000 for the component,” Zhu said, but at this point he is uncertain what the cost would be for mass production—it could be more or less.

“I don’t have an estimation right now,” Zhu said.

Retrofitting the System

Growers need different types of sprayers for different types of spray applications, Zhu said.

“For example, in vineyards, grapes, require specific spray types. For pecan and apple trees, they require a lot of different types of sprayers. There is no universal sprayer that can handle all the crops,” Zhu said.

Because of this, Zhu and his colleagues came up with a universal Intelligent Spray System that can be retrofitted to any sprayer.

This means growers wouldn’t have to buy new sprayers. Their current sprayers could be retrofitted with the universal Intelligent Spray System, Zhu said.

“They just attach this control system to their sprayer so that their sprayer will turn to automatic mode or intelligent mode,” Zhu said, then their sprayer can be used to automatically control spray outputs.

Sprayer manufacturers can also retrofit their current sprayers with the Intelligent Spray Technology so they don’t have to design new sprayers to use the technology.

Commercial Testing

Currently, there are 14 different sprayers that have been retrofitted with the Intelligent Sprayer Technology. They are being tested in commercial ornamental nurseries, apple, peach and pecan orchards, blueberry and raspberry fields, and vineyards across the U.S. and Australia, Zhu said.

One retrofitted sprayer is being tested in a commercial pecan orchard at Five R Enterprises in Texas, Zhu said.

They are using the Intelligent Spray

Technology on the pecans in 2018 and early results look very promising, Zhu continued.

They use a 1,000 gallon sprayer, and it takes about an hour and a half to refuel because of the size of the tank and the distance to the refueling site, Zhu said.

Their conventional sprayer uses a 100 gallons per acre, Zhu said, but in comparison, the Intelligent Spray Technology, only uses 30 gallons per acre.

That’s almost a 70 percent reduction in spray usage with the Intelligent Spray Technology, Zhu said.

With the Intelligent Spray Technology, there was also a savings for refilling the spray tank because with less product used there are fewer refills, Zhu said. This is not only a chemical savings, but a labor savings, too, he added.

Another advantage to the Intelligent Spray Technology is that more spray can be applied sooner so there is less delay getting the chemical applied to treat the disease or pest, Zhu said.

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Continued from Page 35

The Next Step

Commercial field testing will continue. The Intelligent Spray Technology has to be thoroughly tested in commercial fields to be sure it is reliable, and that it will be profitable for growers before we can recommend it to them, and this will take time, Zhu said.

Currently, there are 14 sprayers that have been retrofitted with the Intelligent Spray Technology, and they are being tested on 14 different commercial farms across the country.

There are five in Ohio for ornamental nurseries, apple and peach orchards, and also a vineyard, Zhu said.

“We have one in South Carolina in a big peach orchard. There are three in Tennessee, one in an apple orchard, two are in ornamental nurseries,” Zhu said.

There is also a sprayer in Texas, in a pecan orchard, one in Napa Valley in a vineyard in California, one is in Australia, also for a vineyard test, and two in

Oregon, both are ornamental nurseries, plus another sprayer was sent later to do vineyard testing, Zhu said.

These are being commercially tested by growers, and they will report on any problems they have, the reliability of the technology and what improvements need to be made, Zhu said.

“This way we can ensure growers can have a reliable technology in the future,” Zhu said.

Currently, several manufacturers have shown interest in the Intelligent Spray Technology and want to commercialize it, Zhu said.

“We hope within the next three to five years this should be available in the market,” Zhu said, but in the meantime they will continue to do commercial field testing to ensure they have a reliable product.

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



Pecan trees in bloom.
Photo courtesy of Kathy Coatney.

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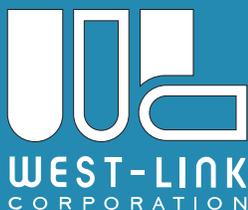
Magnesium deficient almond leaf. Photo courtesy of UC Statewide IPM Project, Regents, University of California

As farmers, when these early spring and summer tissue tests come in the first things we look at are the Nitrogen (N), Phosphorus and (K) potassium numbers. Then we glance at the calcium

numbers and usually shoot to the minor nutrients knowing that we can correct them quickly with foliar nutrition. Rarely do we take a good look at our magnesium levels. Unless we see a glaring

yellow or red number and our crop nutritionist seems concerned, magnesium is rarely a hot topic. But should it be?

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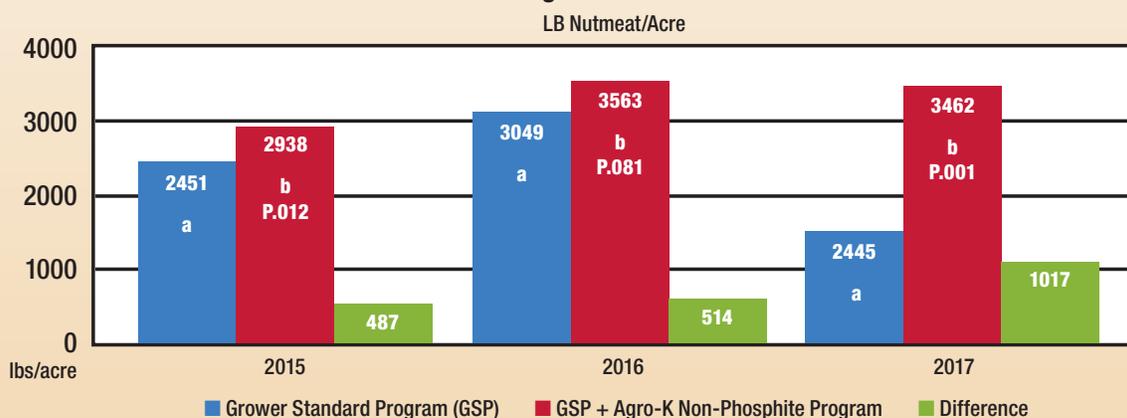
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and post bloom nut retention. Ensuring peak nutrient demand timing is met leads to higher nut set and retention. The end result... higher yields, larger and heavier nuts next season.

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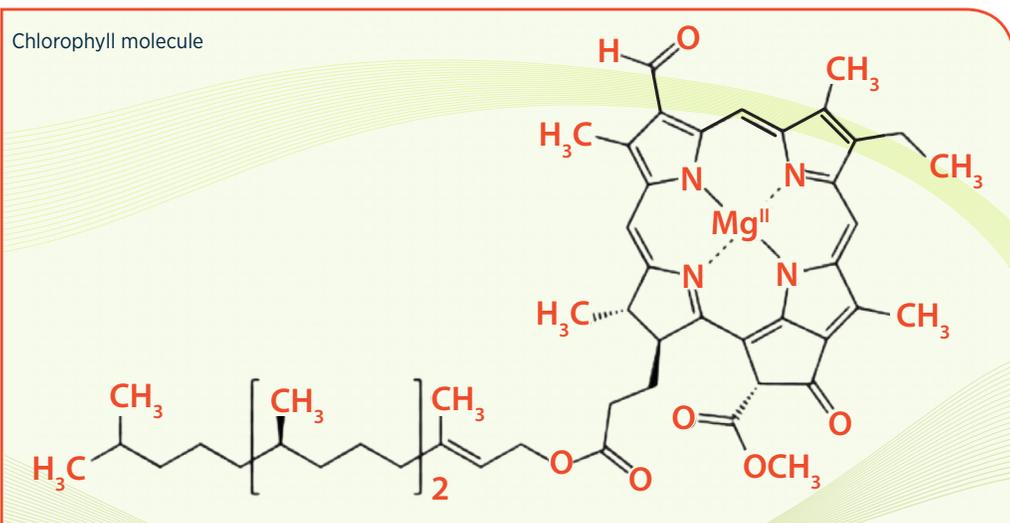
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Magnesium Facts

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Magnesium is the core element in chlorophyll. Life doesn't exist without it. Without magnesium and the chlorophyll molecule, light cannot be converted into energy. We have talked in the past about the importance of phosphorus in creating Adenosine Triphosphate (ATP). That's the million dollar word for the energy we burn. But in reality, ATP is attached to magnesium. Plants aren't green, light doesn't get converted to energy and life doesn't exist without

magnesium. In fact, in researching this article, I learned something new and profound. In an article by Dr. Mark Sircus, Ac. OMD, if you replace the magnesium in a chlorophyll molecule with iron, you get hemoglobin, the oxygen transporter in our blood!

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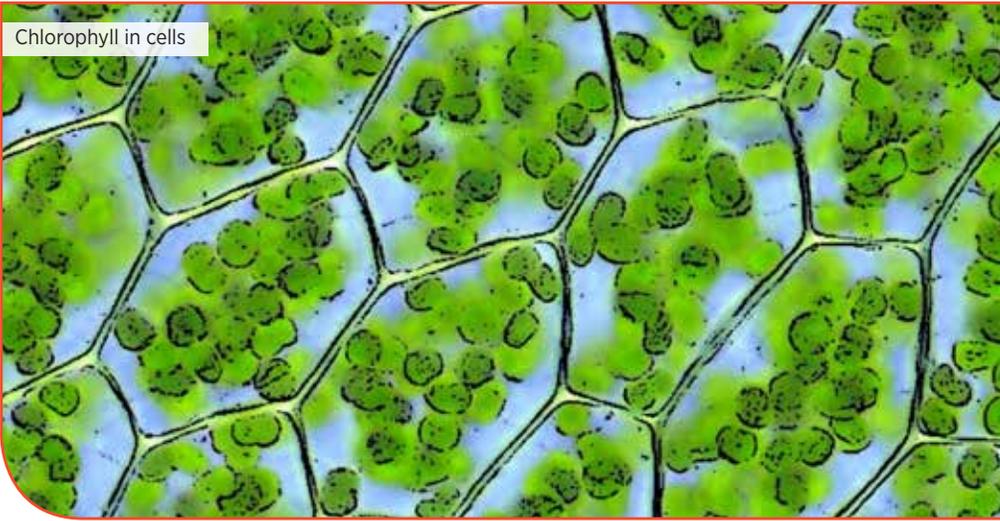


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Chlorophyll in cells



and potassium levels will compete with magnesium absorption so again the key is balance. When it gets hot and those plants are pulling hard from the soil moisture, the other cations like sodium in higher concentrations in the soil solution will prevail.

In Conclusion

The take away: Don't just rely on your eye. That deep green color that can exist with over applying nitrogen and iron may not be the fix for photosynthesis. Check your magnesium levels. Make sure you or your crop advisor is pulling tissue samples and soil samples for you and confirm your nutrients are in balance. Use your consultants to devise the proper feeding schedule to avoid any tie-up that could exist with competing nutrients. Those higher yields you achieve with better energy production will leave your farming buddies green with envy!

do we treat it? Magnesium deficiencies show up on older leaves first as it is mobile in a plant. Many times interveinal chlorosis is immediately thought to be an iron deficiency. It very well may be your magnesium. Magnesium is highly water soluble and moves into the plant through the transpirational flow. Since it moves through diffusion we can get it to the roots through fertigation.

element to penetrate the transdermal cracks in leaf tissue so foliar applications are highly effective, especially with an organic acid like fulvic. Check your tissue tests and confirm that your magnesium levels are at least 10 percent of your nitrogen levels. Both may show adequate on the test but if N is too high, you are out of balance. High manganese and aluminum will also block magnesium availability in tissues and especially in dry acidic soils. High calcium, sodium

Magnesium is also a small enough

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Changes to Irrigated Lands Regulatory Program

By: California Walnut Board | Contributing Writer



What is Irrigated Lands Regulatory Program?

ILRP

The Irrigated Lands Regulatory Program (ILRP) was initiated in 2003 to prevent agricultural runoff from impairing surface waters, and in 2012, groundwater regulations were added to the program. A range of pollutants can be found in runoff from irrigated lands, such as pesticides, fertilizers, salts, pathogens, and sediment. At high enough concentrations, these pollutants can harm aquatic life or make water unusable for drinking water or agricultural uses (Source: California Water Boards).

Changes in ILRP

So, what changes in ILRP are coming down the pipeline (pardon the pun)? On February 7, 2018 the California State Water Resources Control Board adopted expanded member reporting requirements for growers under ILRP. Beginning immediately in the Eastern San Joaquin Coalition members will need to certify their Nitrogen Management Plan, even if they are in a low vulnerability area as determined by the Groundwater Quality Assessment. Because of public health concerns the State Water Board also required coalition members in the Eastern San Joaquin to begin testing on-farm drinking water supply wells for nitrates, starting in 2019. The same requirement will be phased in elsewhere in the Central Valley and eventually statewide.

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Other changes to member reporting requirements include inclusion of irrigation management to the Nitrogen Management Plan, the requirement to develop a Management Practice Implementation Report, and continued work to develop nitrogen (N) coefficients that will determine potential impacts on nitrogen leaching into shallow groundwater which is a source of drinking water.

1 Domestic Well Water Testing

Under the new requirements, growers will need to get all domestic wells on their land tested annually for nitrates for a period of three years. If all the test results indicate that the nitrate level is at least 20 percent below the drinking water standard (10 ppm), testing frequency is reduced to once every five years. However, if the test results indicate a higher level of nitrates, the grower must notify all end users of the water. If the land is a leased property, then the landowner should be notified. Note that only state-certified laboratories must be used to analyze samples. A list of state-certified labs can be found here: https://www.waterboards.ca.gov/drinking_water/certlic/labs/documents/ALLELAPCertified-Labs.pdf

These results will be reported back to growers but also to a state-operated online database with grower identities kept anonymous.

2 Farm Management Plan (Nitrogen and irrigation management)

As mentioned earlier, growers currently only need to have a Nitrogen Management Plan. Starting in 2019, growers will also need to have an irrigation management component to the plan. A

Continued on Page 44

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Continued from Page 43

template for this will be developed and made available to growers. Please check with your local irrigation coalition. The combined irrigation and nitrogen management plan will need to be certified by a crop adviser or an agronomist. The compliance deadlines depend on whether you are in a high vulnerability zone or a low vulnerability zone. For the high vulnerability zone, compliance starts in March 2020; others get an additional year. These plans need not be submitted to the water coalitions or water boards but rather be maintained on the farm. The plan would require keeping data on irrigation water used, amount of nitrogen applied, and so on. This data will be shared anonymously by local coalitions with state water boards. The frequency for updating or reviewing the plan is once every five years.

Proactive Steps from the Walnut Industry

As most of the California walnut growers are multi-generational family farms, we take our responsibility as stewards of the land seriously. The California Walnut Board has long provided significant financial support, on behalf of the California walnut industry, for research that provides tools for both efficient use of our limited water resources through scientific irrigation management and improves both surface and groundwater quality due to reduced pesticide use within the IPM program.

1 Irrigation Management

The vast majority of walnut growers laser level orchard sites and/or use tail water return systems to mitigate runoff of irrigation waters. Not only does this make efficient use of limited supplies, it avoids runoff that may potentially contain fertilizers or pesticides to contaminate our waterways. Further, various techniques such as using pressure chambers, water budgeting and low volume irrigation help efficient irrigation water use, reduced water costs while improving water quality.

2 Nitrogen Budgeting

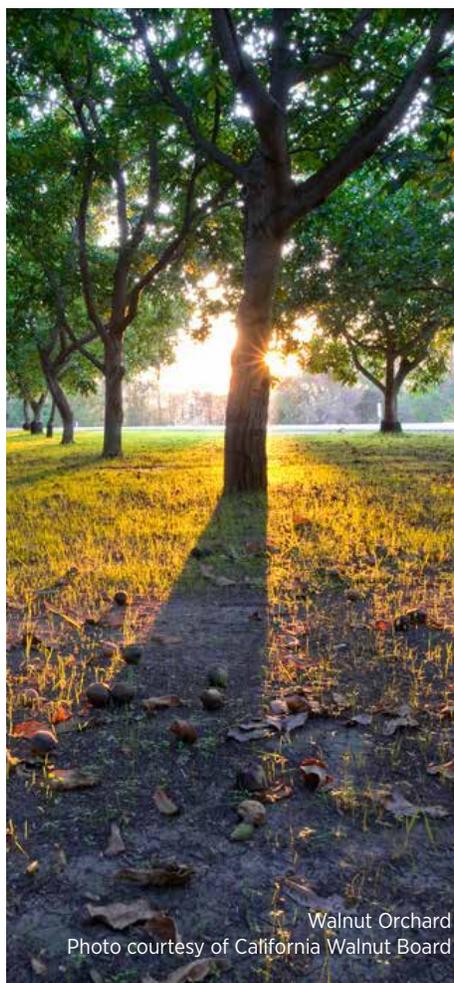
The nitrogen budget process accounts for non-fertilizer sources of N and adjusts supplemental fertilizer applications accordingly. (University of California Ag. And Natural Resource Publication 21623). Using leaf tissue analyses to determine N needs, California walnut growers determine how much supple-

mental nitrogen is required, accounting for N removed by the crop, contributions from irrigation water (using well/surface water analyses), contributions from composts and manures, and contributions from cover crops within the orchard. This technology avoids leaching excess N into the groundwater and movement off the farm into waterways.

3 Integrated Pest Management

(IPM) The California Walnut Board's research funding commitment to IPM has developed pesticide alternatives: pheromone mating disruption of codling moth, less disease prone cultivars and resistant rootstocks, refined application technologies for blight, biological control of aphids, alternatives to fumigation, and harvest management technologies. These practices significantly reduce contamination of our waterways.

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Walnut Orchard
Photo courtesy of California Walnut Board

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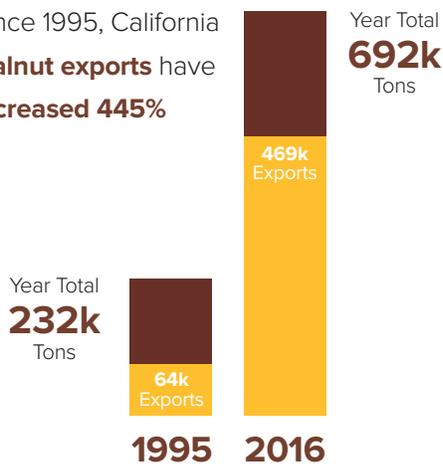
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¹ Economic Evaluation of the California Walnut Commission's Export Promotion Programs: An Analysis of the Direct and Indirect Impacts pg. 6, January 2018, Harry M. Kaiser, Cornell University

² Economic Evaluation of the California Walnut Commission's Export Promotion Programs: An Analysis of the Direct and Indirect Impacts pg. 8, January 2018, Harry M. Kaiser, Cornell University

The **New Solano** on RX1 Clonal

By: Rory Crowley | COO and EVP of Nicolaus Nut Company, Chico

After pruning this year
All photos courtesy of Rory Crowley.

Many growers in the Central Valley, and particularly up in the Northern Sacramento Valley where we farm, are experimenting with new walnut varieties. An innovative and encouraging prospect is the Solano. Borne out of the University of California (UC) Walnut Breeding Program, the Solano promises it all: early harvest date; light to extra light color; Chandler-like tree structure; less susceptible to blight than other commercially-available varieties; and large, heavy nuts with good to great yield and crackout. It is the seemingly perfect walnut—or at least so we are told.

At the same time, new rootstocks have become available, including the RX1. The RX1 also has big britches: old and new research demonstrates good to high resistance to crown gall and high resistance to phytophthora (though the data so far suggests a poor tolerance to nematodes). What is perplexing to me, which I will get to momentarily, is the 'moderately vigorous' category.

With newness comes change and challenges. The adage goes that although a grower can hedge his or her bet and possibly win big by planting an ostensibly 'unproven' variety, what he or she is



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doing is akin to a costly gamble, at least that's the perception. Without seeing plantings in multiple soil types and various regions over long periods of time (longer than research trials), there is risk.

We decided to take on the risk with Solano on RX1 on an 85-acre orchard just north of Chico. The Solano worked for us, particularly with harvest timing. We have almonds and the majority of our walnuts are Chandler, with a hundred acres or so of Howard. We needed to squeeze something in between—the Solano made sense and made the cut.

Background Field Data

Before I get into the dos and don'ts, here is some background about the orchard. The 85 acres was at one point an almond orchard, though it had been neglected for some time before we bought it. The soil consists of about 65 acres Haploxerolls clay loam with the remainder Redsluff gravelly loam. The orchard is on a North/South orientation

and was planted 28x24 spacing in 2015. Other important background information to consider is that the orchard was planted with potted RX1 clonal first and grafted in the field the following summer. Additionally, we have a seasonal stream on the north boarder, which floods almost annually; this is one

"We heard that it was imperative, even absolutely necessary to control the vigor of the Solano with minimal irrigation. 'Don't water them', they said."

reason why the RX1 was important for us. We also intentionally grafted high to deter problems at the graft site if the flooding water were to stick around for any period of time (we did plant on berms, too). Up to this point we have pruned with what I might call a 'modified minimum prune with a 6 ½ foot leader method, which I turn to below.

Nearly everything I explain here was experienced last summer after we created our 6 ½ foot trunk leader.

What We Heard and What We Saw

From the beginning, we heard that it was imperative, even absolutely necessary to control the vigor of the Solano with minimal irrigation. "Don't water them," they said. Well, full disclosure: if we stayed on the path of minimal irrigation, I'd be replanting the orchard this year because of the inevitable train wreck that would have occurred.

It was clear, though: we were seeing vigor like we had never seen. Scaffold canes were growing rapidly, leaves looked like elephant ears, and the amount of wood this tree was producing was uncanny. At the same time, we began to develop sagging and drooping in key branches on possible keeper scaffolds. Branches were bend-

Continued on Page 48

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ing and twisting, seemingly from the weight of the massive leaves. There was little to no strength. It was like they were growing too fast and too green to harden off in a timely manner to maintain the strength needed to form the tree adequately. All this caused us to think about fundamental questions and to think about the advice we were given—don't hydrate? Really? Starve the tree to control an ultimately good problem, like too much vigor? Then it dawned on us: we have to water more, and take a close look at our nutrition. Duh.

When you think about it, not irrigating is tantamount to starving an infant or child in their key developmental years and during critical stages of growth. Minimal irrigation to control vigor, from our perspective, is ill advised. Certainly, there is room to allow for some stress to push roots deep and out, but by this time, the roots have a good handle on things, literally. Our suggestions are to regulate vigor by means of controlled and thoughtful nutrition and intentional and attentive, even nonconventional, methods of pruning.

We also saw that the RX1 was vigorous in its own right. The suckers were relentless, and that's an understatement. Our Helena guy said in all his 30 years in the industry, he has never seen suckers like it. Yes, in early years on more traditional rootstocks suckers are a reality—we will have more in developmental and establishment years. But this was out of control, literally. What made it worse was that the RX1 would not 'harden off' either. The bark remained green, which meant we were extremely limited in synthetic control methods. UN32 would burn the tree (and the last thing we wanted was N out there), as well as other conventional chemical mows (though I do believe we used low rates of Gramoxone). We also had so many suckers, and so early, we didn't get ahead of them fast enough. We went through the orchard five times with a hand crew... By the time we got the paint on, we had already spent an exorbitant amount of time, effort, and money. Finally, after the paint dried, we went through with our last pass with a hand crew and we were able to apply UN32. Problem solved, but, by then, the season was coming to a close.

Again, we asked, what do we do? In the end, we concluded that the suckers on the RX1 demonstrated a highly vig-

orous, vegetative need that the rootstock was trying to fulfill, which, again, was not a bad problem to have. It wanted to grow and grow a lot, and to do so fast. The fact remained, we had a few huge problems to solve.

Dos, Don'ts, Musts and Mistakes

As we think about it in hindsight, the vigor was caused by multiple factors:

- 1) the Solano is innately vigorous;
- 2) deviating from research suggestions, the RX1 seemed highly vigorous by nature of its intrinsic veg-

etative characteristics;
3) the high graft site of the RX1 may have contributed to vigor of the suckers;

4) infield grafting kept the roots in the ground—there was no stunting from replanting, which again may have caused the suckers to explode;

5) in the year we grafted, the Solano wood took off, more so than traditional varieties and rootstocks. There was a lot of vegetation out there. Then, during the next winter prune,

Continued on Page 50



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we came in and took it all off with a 6 ½ foot leader. We, in all reality, were dealing with a tree we had never planted before, that had five times the vegetative vigor. It was nuts. So, what should growers do if they are planning to plant? Here are some suggestions.

As I have stated above, it is our opinion to be intentional and proactive in at least three areas: pruning, painting, and potassium(K)—the three Ps of Solano on RX1.

First, pruning: Given the vigor, one may want to consider a 'modified central leader with minimum pruning method,' with a 7-8 foot or even a 10-12 foot leader with first year of pruning, as suggested by UC. This will allow less wood to be taken off from the beginning, and perhaps allow more buds to push thus allowing for more even vegetation, and thus more choices on pruning in the years to come. The point here, though, is to control vigor with pruning, rather than stressing or even parching the Solano. This winter our tactic was to be

judicious and precise with pruning. Our principle was to keep wood on, not take it off and thereby push more green and possible weak tissue.

As we said, we focused a more traditional prune with a 6-6.5 foot main trunk leader the prior year, but left a lot of wood this last winter during primary scaffold pruning. Is this the right direction? Will our scaffolds hold up with the weight this year? Will this kind of prune be good long term? We obviously cannot say for sure. However, what it has produced, along with the five other aspects of vigor mentioned above, is a projected 800-1000# crop this year—only one year after we made our central trunk leader (impressive, but daunting given our challenges). Again, this suggested that the Solano and the RX1 combo is highly vigerous,



Aerial suckers that were hit with UN32 upon first emergence this year.



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even in terms of reproductive growth. The tree and rootstock wants to put on a crop, and a good one at that.

This year, our criteria in the field when pruning recently was simple: anything broken comes off, anything that may become a main scaffold that is close in proximity to another possible main scaffold comes off, and also making cuts to 'balance' the tree, which meant that if we needed more vegetation on one side, we made one to three stimulation cuts. The idea behind all of this, for us, was to keep the wood that had hardened off out there, taking advantage of its strength, while also allowing for the tree to not be as aggressive in thinking it had to push new tissue the coming season. I also wanted to test, as it were, the theory that more wood equals more yield in the early years, which seems to be a key impetus behind the new minimum and unpruned methods out of UC. Stay tuned.

Last year, we were not aggressive on painting trunks, which quite frankly was a mistake, but our strong suggestion is that growers should paint early and thick, especially if the RX1 is the root-

stock of choice (the Solano wood also stays greener for longer, in our experience; if there are low graft sites, and a grower thinks there is no need for painting the Solano, think again).. The green bark will hurt you if you are waiting around for it to harden off—if we didn't paint when we did, we would be in a much worse spot now.

We gave the Solanos a steady diet of K, both in granular form but especially soluble liquid. We will continue to do so this year, esp. fertigating SoluK at nearly every irrigation. In hindsight, we should have amended much more K prior to planting; we were deficient. The fact is, when we balanced our K, we saw tremendous response: we strengthened limbs that were bending and twisting; limbs would literally turn back upright and grow up; the drooping virtually stopped; and we averted a train wreck, so far.

Continued on Page 52



Last year's sucker leftovers.



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Promising Indeed, If You Do It Right

The Solano, as well as the RX1, are very promising from what we have observed and experienced from the field. We as growers are excited to see this combo shine in the years to come. More challenges are sure to come, too. The key with the Solano as well as the RX1, from our experience, is to be intentional and proactive: get out there and paint early, then you can hit the suckers when they are young with a UN32 treatment or something similar. We would suggest to be aggressive with K early in all forms, especially prior to panting, and give the trees a steady diet while vegetative growth is pushing. Put simply, this will give the strength needed to hold the vigor with vegetation. We still have yet to put on N (nitrogen) to any large degree (though we did put some 11-52-0 on this year for our fall build). Think critically about pruning, and be cautious about taking wood out. Though it may be more work in the future, we came to the conclusion that we will have plenty of time to choose our scaffolds in the years to come. We also want to see what this

tree can do with the vigor it produces. If the vegetation is representative of the re-production in the years to come, the risk may well have been worth the reward.

Certainly, our observations are just that, observations, and we are still in our early years with this orchard. Our comments here are circumstantial in nature based on our experience. They are not meant to be doctrine or even on par with valid research coming from the University or other advisors. Consult your local farm advisor and nutrition consultant on what is best. As we all know, 10 different farmers will tell you 10 different ways to do it.

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Clonal RX1 planting in June after April planting. With a Juvenile hawk!



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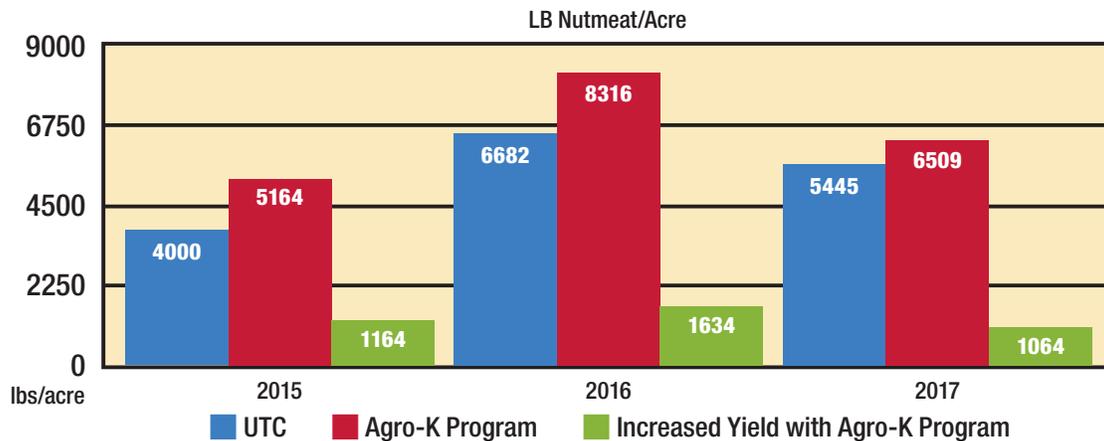
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NEW TECHNOLOGIES BENEFIT NUT PROCESSORS

BY: Kathy Coatney | Editor

Almonds being processed.
All photos courtesy of Kathy Coatney.

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PLC's allow huller/sheller operators to initiate operation of all equipment with a single control. Additionally, future equipment can be added by simply changing the PLC program. Changing the program easily allows sequencing of equipment start-up and shut down.

Precleaning

Precleaning of field harvested almonds has been improved with the advent of receiving pit vibrating feeder/scalpers. This equipment allows the operator to discharge the almonds directly onto the feeder/scalper without clogging stationary pit grates.

The feeder/scalper also removes sticks and other large foreign material, which in turn, protects the downstream

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equipment.

John Dyrseth, owner of San Joaquin Systems in Modesto, California, said the benefits to updating the precleaning equipment would be:

- Increased speed
- Reduction in equipment maintenance because it removes a lot of the trash
- Improved efficiency of the precleaner
- Increased volume

And the more volume that's moved through, the faster the ROI (return on the investment) of the equipment, Dyrseth said.

Vibrating Scalping Screens

Hulling and shelling classification of inshell/inhull volumes have been dramatically improved through the introduction of large vibrating screeners. These large screeners allow increased volumes to be processed.

The use of vibrating scalping screens has also improved the removal of half-hulls from almond meat streams. These vibrating screen scalpers are available in lengths exceeding 100 feet to accommodate most huller/sheller configurations. The continuous scalping of half-hulls from the meat stream enhances the final meat cleaning systems and quality.

Larger vibrating screens also reduce the footprint in the plant, Dyrseth said. What this means is, one larger machine replaces the need for two machines and takes up less space in the facility. More volume can also be moved with one larger machine, than two smaller machines.

Conditioning Systems

Almond hull quality has been improved with the incorporation of conditioning systems. Twigs and fine and large shells are removed through these systems to reduce the fiber content in the finished hull product. Additionally, loose almond meats are recovered from the hull stream, which reduces the cost of these systems.

This improvement has been added

recently, and it's never been done before, Dyrseth said.

"The benefits are that they reduce the fiber in the hull," Dyrseth said.

The reduced fiber in the hull is beneficial because currently only 15 percent fiber is allowed, and after that they are sold at a reduced price, Dyrseth explained.

Besides removing twigs and fine shell, it removes loose meats—this can't be avoided as some meats are lost in the hulling process, Dyrseth said.

In the past, those meats would normally go into the hull pile and be sold as cattle feed. But now, the benefit of conditioning means those meats can be reclaimed, Dyrseth said.

There would also be better quality hulls, which in turn allows them to be sold at a premium price.



Barcoding

The use of computer systems with barcoding has allowed accurate tracking of incoming product and outgoing finished commodities. These computer tracking systems have reduced labor requirements and improved accuracy of record keeping and documentation.

Barcoding can isolate each grower, barcode the incoming load and track it all the way through the system, so

Continued on Page 56

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Continued from Page 55

that the paperwork at the end is all on a computer. This means instead of having sheets of paper being shuffled back and forth, it's all scanned and it goes into a computer. This is a time reduction for office workers, and it's more accurate with less chance for error.

Electronic Sorting

Vast improvements in electronic sorting has allowed huller/shellers to produce a clean inshell product at high volumes. The improved electronic sorters handle inshell at high volumes with a reduction of clean product going into the reject stream.

While electronic sorting machines have improved dramatically, they still haven't reached the point that they have completely eliminated the need for human labor, Dyrseth said.

Most processors don't solely depend on electronic sorters. They still have sorting belts where workers hand sort the nuts, Dyrseth said.



Almonds being sorted.

"I know of some processors who only use the sorting tables for some customers, especially the Japanese who insist that they go with a visible human eye," Dyrseth said.

There is no question there has been a huge improvement in electronic sorting over the years, but that hasn't eliminated the need for human sorters, Dyrseth said.

Better Quality Product

For huller/shellers these upgrades doesn't really reduce labor, but they do increase efficiency and improve the product quality at the other end, Dyrseth said.

"As an example for, many years they would hull the product and produce inshell at very high percentages, and send it to Blue Diamond or whoever would do the final processing," Dyrseth said.

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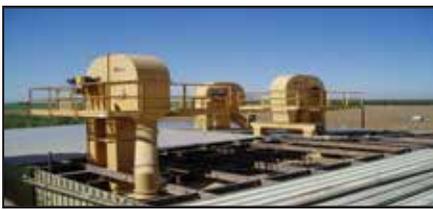

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“Now, with electronic sorters, they can produce inshell that is very good at the huller,” Dyrseth said, adding and the growers get premiums because the huller/shellers are able to produce inshell that requires very little cleanup at the processing end.

Upgrading equipment makes financial sense for huller/shellers because of the better quality product that is produced, and the fact that the equipment runs more efficiently. There is also less concern about shutdowns and equipment failure which means more product can be pushed through faster and cleaner.

“Years ago they probably ran for a month and a half to two months, and they’d run maybe a million pounds,” Dyrseth said.

Today, that’s all changed, especially for huller/shellers that run 100 million meat pounds a year. The equipment has to be more robust and be able to withstand the rigors of that kind of volume, Dyrseth said.

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

CalOSHA

Has Another Solution Looking for a Problem

By: Roger A. Isom | President/CEO of WAPA

Well, here we go yet again. CalOSHA has proposed yet another solution looking for a problem. Sound familiar? This time they are proposing to modify a distinct portion of a regulation governing conveyors, without a single injury to justify changing it. While one may question its purpose, one cannot question its economic impact, which could cost the tree nut industry alone, hundreds of thousands, if not millions, of dollars in retrofit costs!

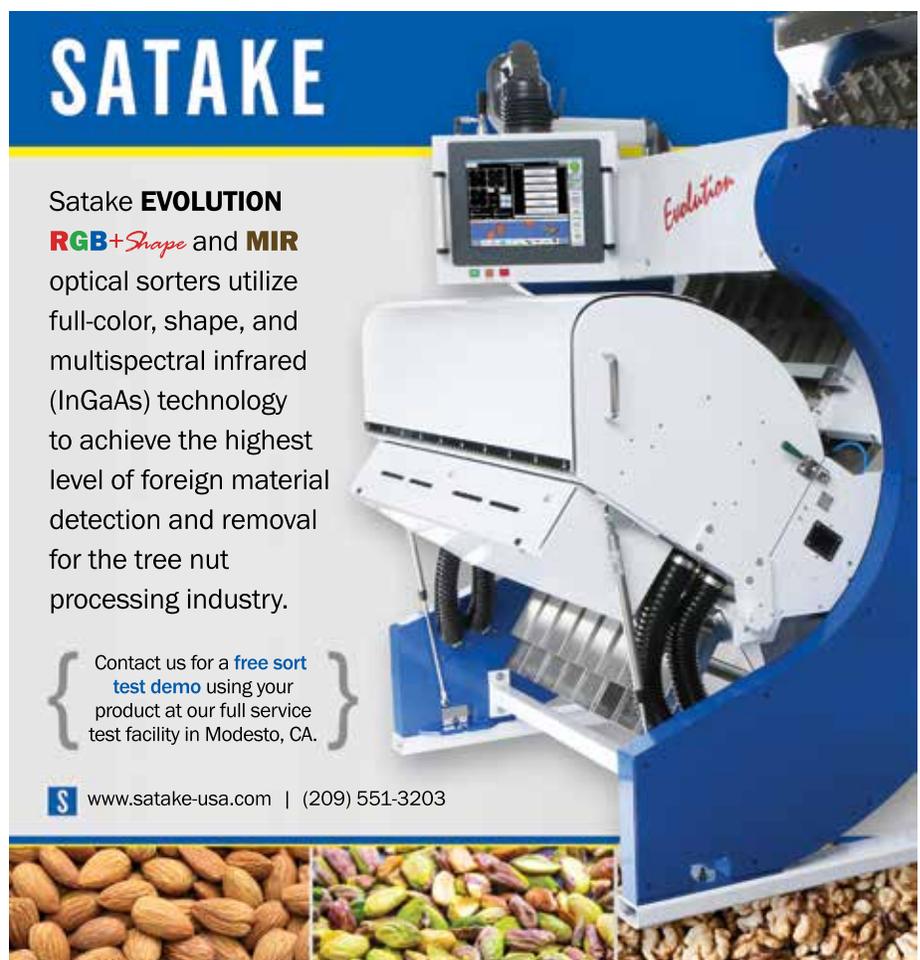
“They are proposing to modify a distinct portion of a regulation governing conveyors, without a single injury to justify changing it.”

In the California Code of Regulations, under Title 8, § 3999—Conveyors, it specifies the following requirements for conveyors typically found in nut processors:

(b) Belt conveyor head pulleys, tail

pulleys, single tension pulleys, dip take-up pulleys, chain conveyor head drums or sprockets and dip take-up

drums and sprockets shall be guarded. The guard shall be such that a person cannot reach behind it and become



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The advertisement features a large image of a Satake Evolution nut sorter, a white and blue machine with a control panel and a hopper. Below the main image are three smaller images showing different types of nuts: almonds, pistachios, and walnuts.



Figure 1. Guarded Belt Conveyor.
All photos courtesy of WAPA.

caught in the nip point between the belt, chain, drum, pulley or sprocket.

Note: Normally, conveyor belt support rollers need not be guarded unless they create a potential hazard for serious injury.

In nut processing facilities, guarding of belt conveyors is clearly understood

and implemented such as those shown in **Figure 1, above)**

Failure to guard these types of conveyors can result in serious injury, including dismemberment. This is clearly understood throughout the industry and this type of machinery is always guarded.

In this latest proposed rulemak-

ing, CalOSHA is proposing to modify Title 8, § 3999—Conveyors to remove the “Note” under subsection (b) that exempts “non-powered conveyor belt support rollers” from having to be guarded. These rollers, such as those shown in **Figure 2, page 60)**—Non-powered support rollers, do not come guard-

Continued on Page 60

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ed from the manufacturers, and do not pose safety concerns in the applications used in the tree nut industry. CalOSHA's proposal to simply remove the note, would mean every single one of these conveyor belt support rollers would be out of compliance and would now have to be guarded.

The Western Agricultural Processors Association (WAPA) submitted comments to CalOSHA strictly opposing any change to the standard, especially anything that would remove the note, which by the way had been specifically created because these types of application did not pose a threat. WAPA highlighted the fact that no injuries had been documented, commented that the change would cost the industry hundreds of thousands of dollars, and urged CalOSHA to reconsider the proposal.

In a recent publication of the CalOSHA Reporter, WAPA President/CEO Roger Isom was quoted as stating "We have never experienced a single injury with the use of non-powered rollers". This sentiment was echoed by other industry representatives. A representative from the mining industry called the proposal "...a paperwork exercise..." Even members of the CalOSHA Standards board expressed similar concerns citing a lack of supporting information for such a change.

Most recently, in a response to these concerns, CalOSHA has offered to modify their proposal to leave the exemption in the regulation, but modify some of the language. Some of the CalOSHA Standards board members have also suggested sending the proposal to an advisory committee for further discussion and debate. WAPA remains opposed.



Figure 2. Non-powered support roller conveyor.

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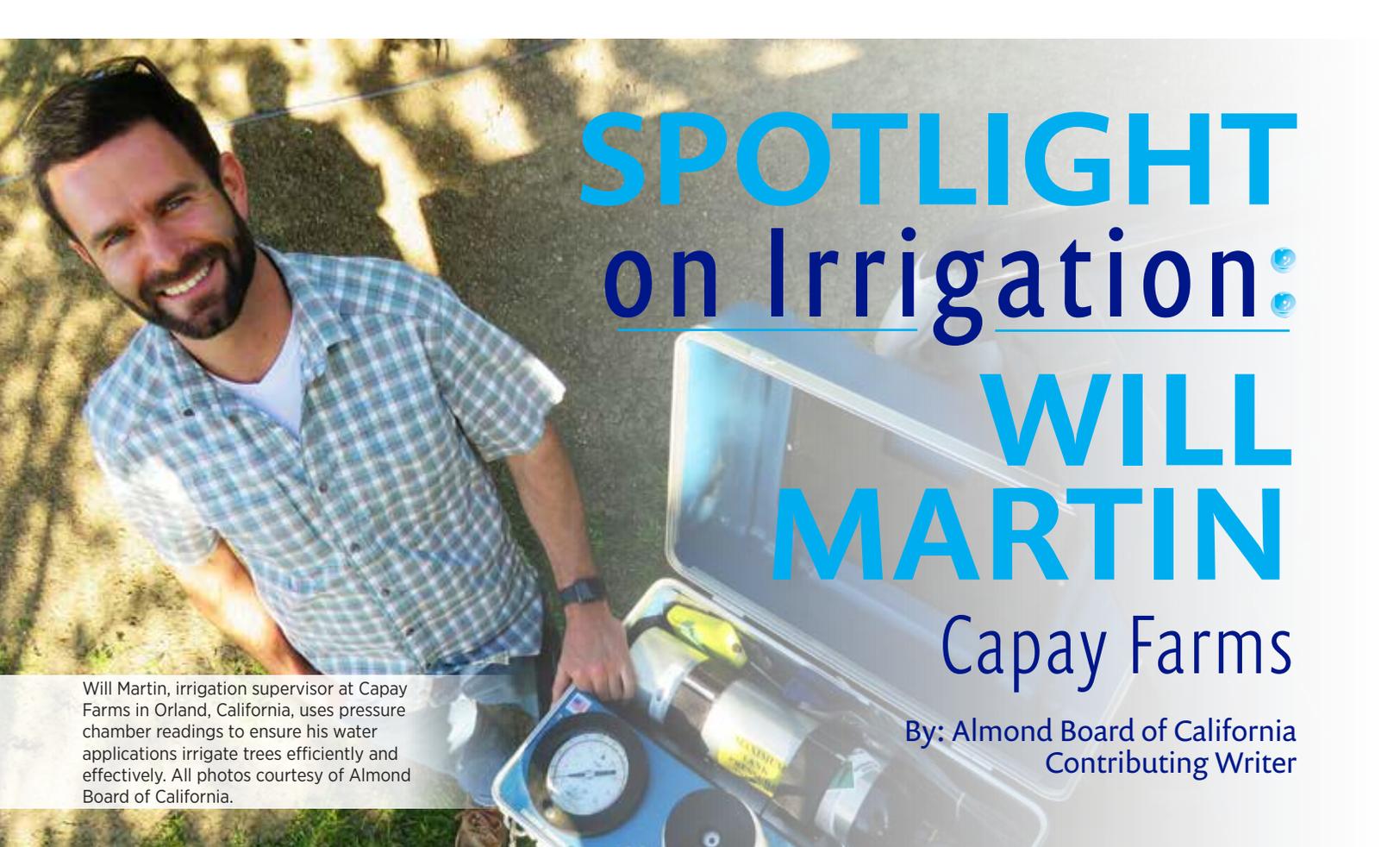
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SPOTLIGHT on Irrigation: WILL MARTIN Capay Farms

Will Martin, irrigation supervisor at Capay Farms in Orland, California, uses pressure chamber readings to ensure his water applications irrigate trees efficiently and effectively. All photos courtesy of Almond Board of California.

By: Almond Board of California
Contributing Writer

Five years ago, Will Martin realized he couldn't answer an important question about the orchard he managed: When and how much water do I run?

So he decided to find out.

Since joining Orland-based Capay Farms as irrigation supervisor, Martin's approach to answering that question has been methodical: focus on the fundamentals, use the right tools to gather information, analyze the data collected, measure performance and adjust decision-making accordingly.

Under the expertise of Martin, Capay Farms acts as a real-world example of a California almond orchard operating at the highest level of the Almond Irrigation Improvement Continuum. Developed by the Almond Board of California (ABC) in partnership with trusted and respected technical experts, the Continuum is a comprehensive manual of irrigation management and scheduling practices organized in three management levels: Level 1.0 (fundamental), Level 2.0 (intermediate) and Level 3.0 (advanced).

ABC recently sat down with Martin

Continued on Page 64

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Continued from Page 62

to discuss Capay Farms' journey to achieving Continuum Level 3.0. He shared why the pressure chamber is his tool of choice, what advice he has for growers who are new to Continuum practices and why he focuses on the fundamentals of irrigation—Level 1.0 practices—which are within reach for all California almond growers.

ABC: What can you tell us about Capay Farms?

Martin: Capay Farms is an orchard management organization responsible for orchards in Glenn, Tehama, Butte and Colusa counties. We're in our 30th year of business and we grow multiple varieties, such as Nonpareil, Carmel, Sonora, Mission and Butte. We also have a few Independence and Shasta varieties.

ABC: What are your responsibilities as irrigation supervisor?

Martin: I wear three hats here:

- 1 I manage the irrigation scheduling for our almond and walnut orchards.
- 2 I manage the maintenance and operation of our irrigation systems, as well as the designs for the new irrigation systems.
- 3 I manage our infield telemetry network, which collects readings for soil moisture, weather, pump system indicators and solar information. We use this data to try to make the best possible decisions for our trees.

ABC: What does your irrigation system look like today?

Martin: Currently, our irrigation system is 25 percent solid set sprinklers, 25 percent double-line drip and 50 percent micro-sprinkler. In our new orchards, our irrigation systems are a solid set PVC underground system, with one riser for every two trees and two micro-sprinklers per riser. The primary goal is to reduce labor. By having less of the system exposed, we should have fewer issues with rodents and coyotes damaging our lines. The underground system is also sized for frost protection, so we can take off the micro-sprinkler and put on a bigger sprinkler for better frost protection, which, as you can imagine, was important this year.

ABC: Tell us about your experience in getting to Level 3.0 of the Continuum.

Martin: When I started here five years ago, Capay Farms was already at Level 3.0 on several irrigation practices. They were using evapotranspiration rates, testing distribution uniformity of the system, using flow meters and taking soil moisture readings. However, they were operating at Level 1.0 relative to plant water status. The biggest question when I came here was "when and how much water do we run?" That led me to the pressure chamber.

ABC: What do you need to check before using a pressure chamber?

Martin: You have to look at the true fundamentals of an irrigation system. Was your irrigation system designed by an engineer? Was your pump matched to the irrigation system? When you're running water, do you have the right pressure? What's your actual distribution uniformity? If you have those things figured out, I personally go straight to the pressure chamber; it's my tool of choice. People will say it's labor intensive, but it's the one thing that tells you how the tree is handling water. The pressure chamber gives you an actual reading of how

stressed your trees are from irrigation. Then, using frequency and duration, you adjust your irrigation schedule to keep the trees in the "sweet spot."

ABC: What are you missing if you're not using a pressure chamber?

Martin: You are probably stressing the tree by under-irrigating or over-irrigating and you're losing out on a longer growth period between irrigations. We're trying to reduce the peaks and valleys of oversaturating and drying out the soil between irrigations.

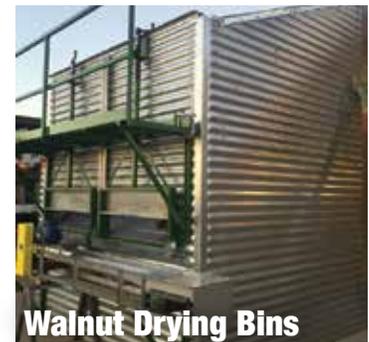
ABC: What advice would you give to a grower just starting out with a pressure chamber?

Martin: Don't measure everywhere. Measure in one spot for a while and learn how to take the measurements accurately. The next critical step is to gather the information in an easy-to-use format. I use an app on my phone that compliments my brand of pressure chamber. It makes data collection easy and immediately shows me the results so I can adjust our schedules for optimal irrigation. I would tell a grower that if you're going to use a pressure chamber,

Continued on Page 66

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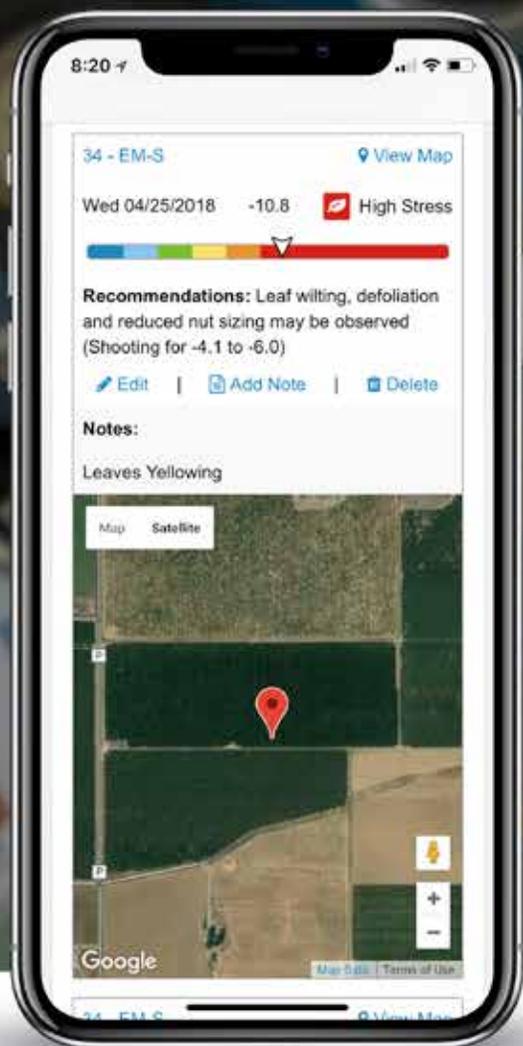
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Continued from Page 65

you have to use the app with it. Otherwise, you'll have too much information and you won't know what to do with it.

ABC: Now that you've been using the pressure chamber in combination with the app for a few years, what results have you seen?

Martin: The biggest benefit has been exposing differences and variability in the soil. I use the pressure chamber twice a week—before and after an irrigation—at one spot for every 50 acres. Last year, we ran the same schedule 10-12 hours a night on a couple of blocks. Because of soil variability and plant water availability, we ran half as much water on one block compared to the other. When you start to use the pressure chamber, you recognize how much water is applied in an hour. If you adjust an hour here or an hour there, you might save two irrigations in a season. That's real savings. Ultimately, we're talking about better growing conditions for the tree; reducing oversaturation and dry conditions.

ABC: What advice do you have on other measurement areas of the Continuum?

Martin: Automated soil moisture sensors, which qualify as a Level 3.0 practice, are a good tool. We use them and they store data over time. They tell you how deep water is going and how much is being held in the soil. Even with this great technology, we also still use the Level 1.0 practice, which is evaluating soil moisture based on feel and appearance using an auger.

ABC: How would you describe returns on investment (ROI) associated with reaching Level 3.0?

Martin: I can't put a specific number on the ROI, but the benefit is creating a much healthier growing condition for the tree. We're in year three of implementing the pressure chamber and using the results. I have the most faith in the pressure chamber compared to almost all other irrigation management tools, and we're in year two or three of better understanding water holding capacity.

Not sure where to start or how your current practices compare to Continuum

management levels? Log in to your California Almond Sustainability Program (CASP) account at www.SustainableAlmondGrowing.org and complete the short Irrigation Continuum assessment.

Don't have a CASP profile? Sign-up is free and easy. This program provides access to helpful tools, such as nitrogen and irrigation calculators, and information about in-orchard best management practices.

Growers interested in learning more about the Almond Irrigation Improvement Continuum can also contact ABC's Spencer Cooper, senior manager of Irrigation and Water Efficiency, at scooper@almondbord.com or (209) 604-3727. Cooper offers a one-on-one in-orchard consultation that is free of charge and available to any California almond grower. For more information, visit Almond Board of California's website at www.Almonds.com/Irrigation.

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A close-up photograph of a honeycomb with several bees. The honeycomb is golden yellow and has a hexagonal pattern. The bees are black and yellow, with some showing their wings. The background is a solid orange color.

BEE BETTER CERTIFICATION

WHAT IS IT & DO I NEED IT?

By: Cecilia Parsons | Associate Editor

Recognizing the importance of flower-rich forage—for both native and managed bees—a San Joaquin Valley almond growing family decided to make pollinator habitat an integral part of their farming operation.

Bee Better Certified

The investment made by Sran Family Orchards paid off when their operation gained affirmation this year as the first Bee Better Certified grower by the Xerces Society. Sran Family Orchards produces both organically grown almonds and conventional almonds between Dos Palos and Huron.

Jason Hickman, grower relations manager for Sran said there are two aspects to the value of the third party certification from the Bee Better Certification program coordinated by organic certifier Oregon Tilth and Xerces Society, the nation's only invertebrate conservation organization.

Better Foraging and Marketing

Better foraging opportunities prior to, during and after almond bloom produces much healthier bees, Hickman said. Whether they are natives or managed bees, relying only on almond blooms for nutrition is not the healthiest option, he said. The flowering cover crops including open fields and hedgerows, offer a wide variety of nutritious options to make stronger hives.



Kitty Bolte (Left), a pollinator habitat specialist with the Xerces Society. Jason Hickman (Right), from Sran Family Orchards. Photo courtesy of the Xerces Society.

The second aspect is marketing. Almonds bearing a label verifying they come from a farm that invests in bee habitat and health have the potential for premium prices, Hickman said. Labels and brochures explaining their efforts to ensure bee health will educate consumers about their efforts to protect pollinators, he added.

Third-party Food and Farming Certification

Bee Better Certified is the only third-party food and farming certification program in the world focused specifically on pollinator conservation. With the goal of giving bees a healthy place to live, the program was launched

in June 2017 by the Xerces Society for Invertebrate Conservation in collaboration with national non-profit organic certifier, Oregon Tilth.

certified to provide more habitat, including hedgerows, cover crops and meadows,” Hickman said.

Project Apis. m coordinator Billy Synk set up their original program and when they found there was an opportunity for a third party certification, called Xerces Society.

Bee Better Certified Program

Xerces Society Bee Better Coordinator Cameron Newell came to Sran to assist with writing their habitat plan. Hickman said the visit to the Sran operation also helped Xerces and Oregon Tilth develop a better understanding of the farming side of the equation.

Certification requires adherence to a plan that details how your operation meets production standards. A certifier will evaluate the plan and visits the orchards to verify the plan is being followed. Annual updates to the plan are required when there are changes in farm management.

An example is the ban on any aerial spraying in certified operations. Further discussions about the necessity of aerial pesticide applications in certain situations have at least opened the door to more discussion on the subject, Hickman said.

Sran Family Farms began to establish bee habitat before they were aware of the certification program, Hickman said.

“We saw a decline in native pollinator populations and de-



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Continued on Page 70



Flower species planted by Sran Family Orchards. Photo courtesy of the Xerces Society.

Continued from Page 69

A Bee Better plan consists of four areas:

- Pollinator habitat
- Pesticide mitigation
- Managed bumblebees
- Record keeping

Pollinator habitat is defined as areas containing flowering plants or nesting sites. Managed natural habitat and created habitats are both considered pollinator habitat. To be certified all operations must have at least five percent of their total acreage in pollinator habitat. For non-contiguous farming operations like Sran, that means there is a portion of habitat adjacent to each orchard. Some may be only one percent of that acreage while others may have 10 percent.

The habitat areas must have at least three flowering species present during spring, summer and fall. Certification also requires that at least 70 percent of the vegetation be native pollinator-attractive plants. Pollinator nesting sites must be identified and protected from human activity. At least five percent of the permanent pollinator habitat must be pithy-stemmed plants as the provide nest cell materials for native pollinators.

Newell said the plant lists for habitat

are still evolving and are being designed for different growing regions to increase chances of successful and longer lasting habitat.

Xerces Society can also provide sources for seeds and plants to establish habitat.

The pesticide mitigation portion of the plan calls for scouting and monitoring to justify pesticide use. Pesticides labeled by environmental protection agency (EPA) as moderately or highly toxic to bees cannot be applied during bloom of crops where pollinators are present. Fungicides cannot be used during bloom and soil fumigants are not allowed. Genetically modified crops that express pesticides or are resistant to herbicides are not allowed. Planting pesticide-coated seeds is considered a pesticide application.

Growers are not allowed to make aerial pesticide applications and must establish a pesticide-free buffer around each permanent pollinator habitat site. Buffer widths vary according to the method of application. Treatment with


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an airblast sprayer requires a 60-foot buffer.

Use of commercial bumblebees for open field pollination is not allowed. While not an issue with almond growers, there is a concern that non-native bumblebee species can affect native populations.

Record Keeping

As with any certification, record keeping is an important part of the process. The Bee Better plan requires maps of the parcels to be certified including locations of known nest sites, location of tillage practices and documentation of plant material origin and native status.

Records of pest scouting and monitoring are also required.

Open Ground

Newell said open ground with native flowering plants is vital to the health of native pollinators. As much of that type of ground has been converted to managed agricultural crops, the native pollinators have lost important food sources. It is important that those native species remain viable in agricultural areas, Newell said as they provide an “insurance policy” for crop pollination, working in weather conditions that halt managed bee activity.

The additional forage also provides protection for many other beneficial insects that growers look to for crop pest control.

The Bee Better program has had a very favorable response from beekeepers, Newell said.

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



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TRE-1228, 3-18

Central Valley

Almond Day

June 20, 2018

7:00am - 2:00pm

FREE EVENT
& Trade Show

Fresno Fairgrounds Commerce Building

1121 S. Chance Ave, Fresno, CA 93702

Central Valley Almond Day Agenda

2.0 PCA CE Credits (2.0 Other)

4.0 CCA CE Credits (pending approval)

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

*Sessions counted toward CE credits (pending approval)

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