

# WEST COAST NUT

February 2017 Issue



## In This Issue:

Chill In Pistachios

Walnut Production Research

Protecting Honey Bees  
During Bloom

Ag Tech: More on Phone Apps

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See the full story on page 44

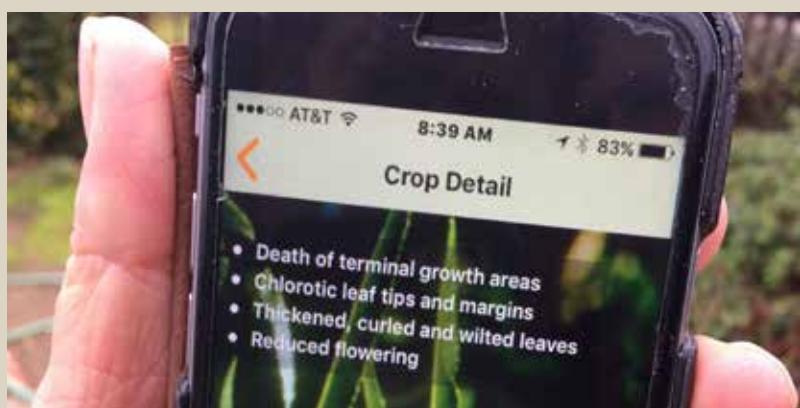


Photo Credit: Len Wilcox



Photo Credit: Cecilia Parsons

## Chill in Pistachios

Cecilia Parsons  
Contributing Writer

**F**ollowing a bad chill hour winter (2014-15) and an “okay” winter in 2015-16, California pistachio growers are looking for a larger accumulation of chill hours by the end of February to bring in a top quality crop.

“We are in better shape at this time than we were last year,” said Setton Pistachio grower services representative Mike Smith. “The rain and fog are adding more hours, but we still have a long ways to go this season.”

Chill hours, a summation of hours below 45 degrees F, are counted from November 1-February 28.

Pistachio trees in the northern

growing areas of the state are ahead in chill hours, said Bob Klein with the Pistachio Research Board. In the south, where 95 percent of the state’s pistachio trees are growing, the outlook is that chill will be sufficient, but not great, Klein said. With the memory of the warm winter of 2014-15 and subsequent poor yields, growers have experienced what very low chill hours can bring.

“When it is marginal, it’s hard to say,” Klein said, noting there are still several weeks to rack up more chill to give trees a better dormant season. Insufficient chill hours can result in delayed or irregular bloom, late vegetative development, altered leaf morphology, poor pollen production,

death of stigma, reduced fruit set, increased proportion of blanks and unsplit nuts, late maturation and general reduction of crop yield.

Using 900 hours of temperatures below 45 degrees F as the benchmark for desired chill hours, University of California Cooperative Extension (UCCE) farm advisor Elizabeth Fichtner notes that some pistachio production areas in the state did attain enough chill hours in 2015-16 but other areas fell short.

The amount of time California pistachio trees experience temperatures below 45 degrees F may not tell the entire chilling story. There is



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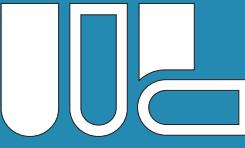


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some heat and chill interdependence according to University of California (UC) researcher Louise Ferguson.

Excess chill hours means fewer heat hours are necessary in the spring for good bloom and fruit set. Spring heat compensates slightly for winter chill deficiency. Very warm spring temperatures can adversely affect flower quality.

Ambient air temperatures may not reflect what trees are experiencing, Ferguson said. Other environmental conditions such as fog or bright sunlight may influence tree response. For example, less fog or wetness decreases evaporative cooling. More sunlight hours may warm even the shaded parts of a tree. Another method for measuring chill hour accumulations, called chill portions, places weight on intermittent warm temperatures during the November 1–February 28 time period. The chill portion formula subtracts from the total hours accumulated when temperatures reach 55 degrees. There is no correlation



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between the two chill measuring methods.

UCCE farm advisor emeritus Bob Beede, in his 2017 task list for pistachios, noted that in mid December, chill portion accumulation was about 40 percent less than last year at that time. Chill portions—the temperature measuring method that is weighted, were counted from September 1–December 13. Shafter, Delano and Blackwell's Corner areas in Kern County had accumulated only 12, 15 and 18 chill portions respectively compared to 24, 25 and 24 last year. Madera and Durham areas were closer to the 2015 mark with 21 and 22 chill portions. The only cold weather during that time occurred early in December and the state experienced unseasonably warm temperatures later in the month.

Growers can check on their local chill accumulation at the UC Fruits and Nuts Center web site, clicking on the “Weather—related Models and Services and selecting chilling accumulations models, then cumulative chilling portions. The site shows chill portion accumulation for every California Irrigation Management Information System (CIMIS) station in the state and also provides historical data. Beede cautioned that the stations were designed for irrigation scheduling, not for chill portion measurement, and the absence of fog at the stations can cause temperature differences up to 20 degrees F between ambient air and the buds.

Beede noted that research he and Ferguson did found that Kerman and Peters varieties do not grow normally when they do not receive adequate winter rest. Beede said the research suggests that Kerman requires 750 hours below 45 degrees F and Peters 850 hours to leaf out and bloom adequately in the spring.

In addition to shortening the rest period for the trees, Beede said warm temperatures also elevate the bud respiration rate which consumes carbohydrates critical for spring growth. This finding by UC Plant Sciences professor Maciej Zwieniecki, may explain why oil applied to pistachio trees to enhance rest breaking caused poor production in 2015, Beede said.

Continued on Page 8

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Photo Credit: Cecilia Parsons

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In response to the applications, the trees increased respiration rates to metabolize the oil and depleted their carbohydrate stores. At bud break, the combined deficiencies in available sugars and low chill caused poor leaf out and fruit set. Beede said due to the uncertainty of this winter's weather pattern, oil application is not being suggested.

Some growers, Beede reported, took the precaution of applying kaolin clay or calcium carbonate in early December to reflect or diffuse solar radiation. The use rates for the clay vary from 30-50 pounds per acre, he said, while the liquid calcium is typically applied at four gallons per acre. After significant rainfall, the products must be re-applied. Costs per application is in the \$80-\$90 per acre range.

The effects of winter applied kaolin clay or calcium carbonate to pistachio trees continue to be studied. Each has a different mode of action. The clay products, which are finely ground powder, work by reflecting light to

reduce the absorption of solar heat. Calcium carbonate crystals modify the incoming light, reducing its energy and dispersing it in multiple directions. These actions reduce energy absorption by the plant, resulting in lower temperatures.

Merced County UCCE farm advisor David Doll's research showed a 200-250 pound increase in California Pistachio Commission (CPC) yield over untreated trees when kaolin clay was applied prior to the 2015 season. Beede said the data suggests that the treatment to mitigate the negative effects of warm winter temperatures does not ensure a normal crop, but may prevent extremely poor yields.

Beede noted unreplicated field trials with calcium carbonate in Kern County last year were able to increase chill portion accumulation by about 13 percent due to lower bud temperatures. The trials included single and double applications January 12 and February 12. Flower bud temperatures were monitored in treated and untreated trees. The data showed bud temperatures were reduced by as much

as 10 percent and the rate of heating during the morning hours was slower. Beede said the January treatment increased chill portions accumulation by about 13 percent. The treated trees also leafed out more evenly and the second treatment in February delayed development by about four to five days compared to untreated trees. Beede said that the trial was done where the chill requirement for pistachio was satisfied during the previous winter and the outcome for trees that did not have sufficient rest could be different.

Yield improvements were found in the trial using the calcium carbonate product Diffusion and the return on the cost of application was positive. Without replication, Beede stressed, they were not reporting the actual yield increase.

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Trade show at the 2016 Almond Conference in Sacramento, California.

Photo Credit: Kathy Coatney

## New Alternatives for Biomass

Kathy Coatney  
Editor

**T**raditional markets for almond hulls and shells have been low value uses of biomass, like cow bedding with almond shells, but the future for biomass is changing.

Glenda Humiston, vice president of Agriculture and Natural Resources, University of California (UC), Davis, and Bill Orts research leader with the United States Department of Agriculture(USDA)/Agricultural Research Service(ARS), spoke on biomass at the Almond Conference in December 2016.

Humiston said, "One of the things we're doing is really trying to expand our partnerships with a wide array of public and private sector partners to look at really high value uses of biomass."

In particular, Humiston is interested in cellulosic nanofibers where they are actually breaking biomass into nanofibers that can be incorporated into a wide array of high value products.

The nanofibers can be used in high-tech plastics that go into things like car bodies, Kevlar vests, and a lot of high-end cement products.

"The analogy I love to use is when you're adding these nanofibers to these kind of products, it's kind of like you're adding trillions of little mini rebars," Humiston said, in essence, the same principle as how rebar strengthens cement.

The technology is actually being put into practice right now, Humiston said.

For instance, Kevlar produced with biomass has been lining soldiers' tents in

Afghanistan for a couple of years now, Humiston said.

Corporations like Ford Motor Company are using car body parts that have biomass, and biomass is being used in coating asphalt, which extends the life of the road base, Humiston said.

A proof-of-concept facility is running in Siskiyou County right now to show that a particular biomass will work in Kevlar production, and in the short run, they're looking at coating asphalt on some bridges in 2017, Humiston said.

"Caltrans is real interested in it," Humiston said.

The Siskiyou County Board of Supervisors pushed hard for the facility, and Fruit Growers, a large corporation in the county, was also a big player because they have a lot of biomass, Humiston said.

One of the tricks to getting a new industry like this up and running is the infrastructure, supply chain, bio-refinery, and financing, Humiston said, adding putting all those pieces together is where we're at right now.

There are a lot of advantages to using almond hulls and shells from an environmental standpoint, Humiston said.

The addition of biomass makes a stronger, better product, and typically a lot of them are biodegradable, which is much better than traditional plastics, Humiston said.

"If you're putting it into something like a cement product in a building that's there for 50 or 100 years, you're sequestering that carbon and keeping it out of the atmosphere," Humiston said, plus it reduces the amount of cement that goes

into a building.

"Cement is a huge carbon emitter, so this kind of effort really has some huge benefits in just reducing carbon emissions and sequestering carbon," Humiston said.

Orts said, "We're trying to add as much biomass as we can to anything we get."

"We could always put it back in the soil. That's not a bad answer—scientifically it's a good answer," Orts said, but there are other options like bio-energy and biofuels.

Orts has used almond hulls to create ethanol by removing the sugar.

"We think you would use the same equipment that you would use for sugarbeets, so you could use a sugarbeet mill to make ethanol," Orts said.

"Further up the value chain is chemicals and plastics," Orts said.

"Your Colgate toothpaste has little plastic beads in it or little pieces. We'd rather have that be from a natural product, like an almond shell," Orts said, plus it's biodegradable and composts safely.

Hulls have also been made into disposable diapers. "You take the hull, you take out the sugar, and you have a super-absorbent (product)—it takes up eight or nine times its weight in water," Orts said, and then it biodegrades, so it's not in the landfill.

Heat or chemically treated almond shells are being used as an additive in plastics, Orts said.

"When we make them small enough, they're called nanoparticles, but if you make them big enough they're nanofibers. And if we heat treat it, we can call it some

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Continued from Page 10

version of biochar," Orts said.

Biochar, made from of walnut or almond shells, is added to the plastic, Orts said. "It actually makes it (plastic) more heat stable, so it makes it better."

"So you take cheap polypropylene that would almost melt on a hot day, you add five percent biochar from almond shells, and the stability goes up by about 15 degrees. So, it's no longer as flexible and pliable in the sun, and industry wants that," Orts said.

Kevin Stevenson with FDS, a plastic company, wants to make their plastics greener, Orts said.

FDS makes strawberry baskets and a lot of Ag packaging, Orts said.

One of the things Stevenson is looking for is more heat stability in their plastic trays, Orts said.

"So if we add five or 10 percent of this biochar from almond shells to that, it's not as flimsy, it's more temperature stable," Orts said.

Orts purchased used equipment, and he's going to make 10 tons to send to Stevenson at FDS.

"If he falls in love with it, then we're going to try to go commercial on that," Orts said, adding we can imagine this setup going into one of the back lots of a big processors, and they would have it as a pilot process.

The equipment is the smallest commercial piece available, but it can scale up to 10 times its current size, Orts said.

Orts is also working with tire companies to make all natural tires without petroleum.

"The ultimate dream is to make a domestically sourced natural tire that has no petroleum products. That's our target, and we're not far from doing that," Orts said, adding we've already created tire formulations that meet that, but to do this scale would require biomass from across all agriculture.

"Frankly, I think once we get this system up and going, it's likely it could take everything and more," Humiston said, adding this could be any agriculture biomass—trees, vines, urban green waste, dead trees in the forest.

The Milken Institute, an independent economic think tank based in Santa Monica, California, publishes research and

hosts conferences that apply market-based principles and financial innovations to social issues in the United States and internationally.

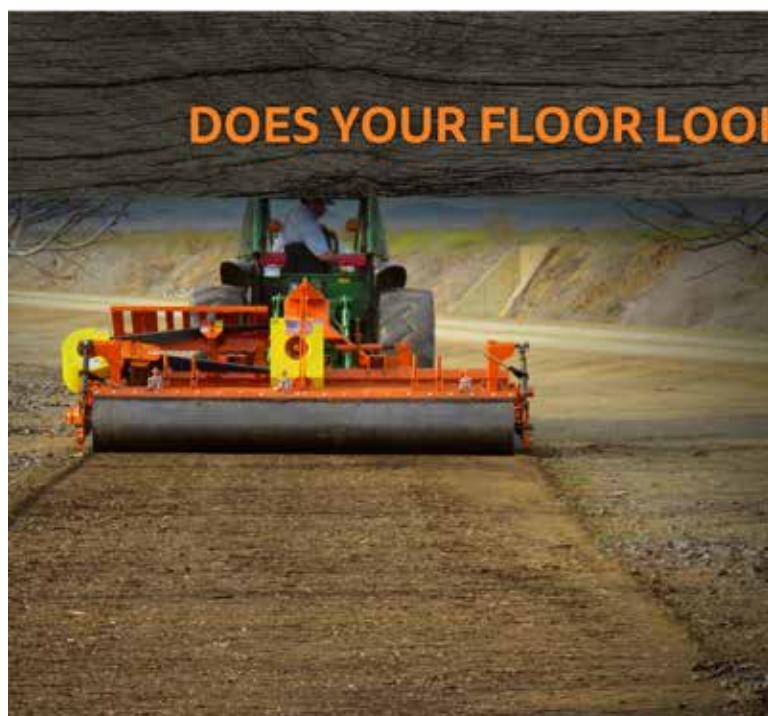
They released a report a few years ago that basically said all of the \$375 billion dollar a year industry of plastics and similar products that is currently made from petroleum, could virtually all of be made from biomass, Humiston said.

"If you think about it, petroleum is carbon, biomass is carbon, it's just our current factories and supply chains are geared for petroleum. It's a matter of just shifting them to using biomass instead," Humiston said.

"The big issue right now is cost effectiveness, supply chain, infrastructure, logistics—I think that's really what's holding us back," Humiston said.

"It's like a snowball. Once it gets going, it's going to start getting bigger and bigger, faster and faster," Humiston said.

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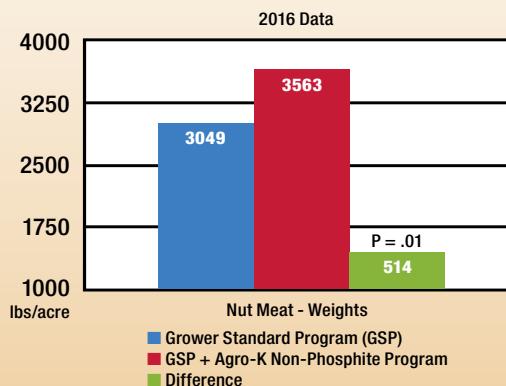
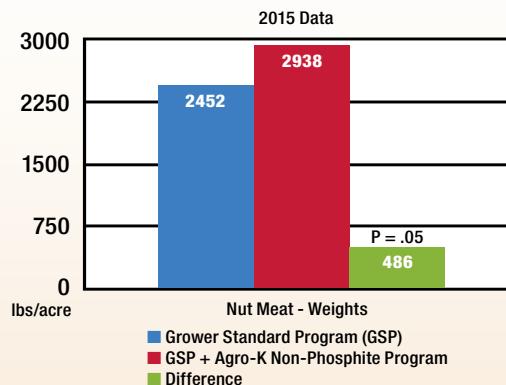
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## BEST PRACTICES

Josh Pitigliano of Pitigliano Farms stands next to new well that is used to irrigate almonds, citrus and pistachios. He reports a 25-30 percent savings in electrical bills with time of use, demand response and interruption programs SCE offers.

Photo Credit: Cecilia Parsons



# Reducing Energy Costs

Cecilia Parsons  
Contributing Writer

**W**ith potential energy savings in the agricultural sector approaching \$1 billion annually, it is understandable that California nut growers would be seeking their fair share.

According to American Council for Energy Efficiency, that \$1 billion figure is an extremely conservative estimate with the largest potential savings percentage found in the motor system—specifically irrigation pumping.

Both of the major utility companies serving California farmers continue to offer a number of energy efficiency programs and incentives designed to help save energy costs or provide credits. In addition, United States Department of Agriculture (USDA) Rural Development offers grants for up to 25 percent of the cost of energy efficiency projects. These USDA grants are competitive and producers must have an energy audit by a certified auditor prior to applying.

One of the Central Valley nut growing families—the Pitigliano family of Pixley, farms almonds and pistachios in the region served by Southern California Edison (SCE) and estimates that 90 percent of their energy expenditure is incurred pumping irrigation water.

"If you are willing to adjust, there are significant savings with these programs," said Josh Pitigliano. By making some operational changes, the Pitigliano family was able to tap into the Time of Use (TOU) rates which are calculated on time of day, day of the week and the season. One of their new water use strategies involves pumping water from deep wells into a reservoir during off-peak hours and then using booster pumps to move the water to sprinkler and drip systems. Even with the cost of building the reservoir, they will save money in pumping costs when the incentives are in place, Pitigliano said.

Additional savings for the Pitiglianos were found by synchronizing demand response with TOU schedules. The Demand Response program

provides customers with bill credit for relieving stress on the grid by reducing energy use during peak demand hours which can maximize savings with the TOU rates.

Another program, the Agricultural and Pumping Interruptible program allows Edison to temporarily disrupt electric service to pumps during peak demand in exchange for bill credit. The program is available to agriculture customers with at least 50 horsepower of connected load. To participate, a customer must already be served under an Agricultural and Pumping Rate Schedule which includes a TOU program.

The service interruptions are limited and automated. If SCE is notified by the California Independent System Operator of the need to reduce energy demand, SCE will send a signal to the load control device installed in a customer's pumping equipment which will automatically turn off the total load served for the entire duration of the interruption.

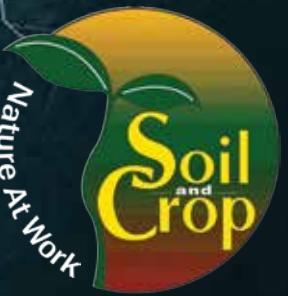
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- Enhances nutrient cycling and a reduction in nitrogen needs
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Like many other growers in the Central Valley, Pitiglianos use a reservoir to store both pumped and delivered water before it is used to irrigate crops. The Pitiglianos use several SCE programs to maximize efficiency and minimize electrical costs.

#### Continued from Page 14

"We found a 25-30 percent savings with this program last year and there were only a few instances where we lost power, but we were able to manage around them and suffered no crop damage," Pitigliano said.

SCE notes that customers will need to perform a manual reset of the main circuit breaker or pump controller after each interruption. The interruption can occur at any time. Interruptions are limited to six hours, 25 per year with a total of 150 hours per calendar year. Customers may request notifications on their phone or email. The program is offered on a one-year contract with changes or cancellations possible during the month of November.

Pitiglianos also participate in the pump testing services offered by SCE.

"With groundwater levels fluctuating, it is important that we know the efficiency of our pumps. We lose efficiency if the pump is working at a different level than originally set," Josh Pitigliano said. If the pump is operating at less than 65-70 percent efficiency, SCE gives a portion of the repair bill to bring it back to that level, he added, "They don't want us to waste energy."

"We also realize that these programs are funded by bills paid in previous years so we try to use them as much as possible," he said.

To ensure efficiency in irrigation, pump testing services are available from SCE. This service can identify components of a pumping and irrigation system that, if repaired or upgraded can save on energy consumption. Pitiglianos took advantage of this service and the recommendation to install variable frequency drives on their pumps to save more energy and allow for a smooth transition to TOU.

In 2015, \$7.3 million of Pacific Gas and Electric (PG&E) incentives supported energy saving investments by 768 agricultural customers. According to PG&E spokeswoman Ari Vanrenen those projects will save them an estimated \$8.2 million per year in energy bills.

One of PG&E's main energy savings programs for agriculture customers is the Advanced Pumping Efficiency

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Program (APEP). This incentive program is intended to improve overall pumping efficiency and encourage energy conservation. The utility is funding APEP through 2017 using Public Purpose Programs Funds with the California Public Utilities Commission. The program is administered by the Center for Irrigation Technology (CIT) at Fresno State.

The APEP is an educational and incentive program intended to improve overall pumping efficiency and encourage energy conservation in California. Since the program started in 2002, CIT has assisted with more than 2,167 pump retrofit or repair rebates and about \$12 million in incentive rebates for those projects. As a result of the projects, more than 373,000 therms were saved annually. CIT has also subsidized 35,404 pump efficiency tests and hosted nearly 200 education seminars for agriculture customers.

Cash incentives, energy surveys and payment options are available to agriculture customers through SCE as part of the California Solar Initiative.

Solar systems, when installed in connection with an agriculture well or pump irrigation system is state sales tax fund exempt (-6.5 percent) and qualifies for Sec 179 federal tax deductions (\$25K), which results in energy savings. PG&E and SCE also offer pump energy efficiency rebates along with federal and state solar energy incentives during the retrofit process.

One of the agribusiness companies taking advantage of the energy savings with solar is the Limoneira Company in Santa Paula. This citrus company installed a 1 megawatt solar facility to power its citrus processing plants. They report the cost per kilowatt is fixed for the next 20 years.

PG&E does not have any specific solar programs for agriculture, but Vanrenen reports that they support and assist all customers in solar endeavors including connecting solar systems to the energy grid.

*Comments about this article? We want to hear from you. Feel free to email us at [article@jcsmarketinginc.com](mailto:article@jcsmarketinginc.com)*



Photo Credit: Cecilia Parsons

Time of use and demand response are two of the SCE programs Pitigliano Farms of Pixley participates in to save energy costs in irrigation of their pistachio, almond and citrus crops.

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## The State Water Board's Plan to Take Our Water

Roger Isom  
President/CEO, WAPA

**T**he loss of water has been an ongoing battle in California for years. While Mother Nature takes her turn every now and then, nothing has impacted this state's available water supply more than actions by the state and federal governments in taking water for "ecological, biological or environmental purposes"; in most cases as a priority above any municipal or agricultural use. For example, the imposition of the Central Valley Project Improvement Act (CVPIA) and the Endangered Species Act (ESA) related biological opinions (BiOps) for the salmon and delta smelt resulted in a loss of over 1 million acre-feet of water south of the delta. This in turn led to hundreds of thousands of acres of valuable and incredibly productive

agricultural land in the western and southern portion of the valley being permanently fallowed. Now, the state is proposing significant impacts to northeast side of the San Joaquin Valley where they are proposing to restore salmon runs by increasing unimpaired water flows in the tributaries feeding the San Joaquin River.

Before we dive into the issue at hand, let's lay the factual foundation for what is currently taking place. The State Water Resources Control Board (SWRCB) has an obligation to address ecosystem health in the San Francisco Bay and Sacramento-San Joaquin Delta Estuary, otherwise referred to as the "Bay Delta". Accordingly, the SWRCB has filed and is recirculating a draft revised Substitute Environmental Document (SED), on the proposed updates to the Water Quality Control Plan for the Bay-Del-

ta Plan. The proposed updates (Plan Amendment) include new and revised San Joaquin River flow objectives for the protection of fish and wildlife beneficial uses, a revised salinity water quality objective for the protection of southern Delta agricultural beneficial uses, as well as a program of implementation for those objectives. The Porter-Cologne Water Quality Control Act and the federal Clean Water Act require the State Water Board to regularly review and update the Bay-Delta Plan. The Bay-Delta Plan identifies beneficial uses of water in the Bay-Delta estuary, water quality objectives to protect those uses, and a program of implementation to achieve the water quality objectives. The proposed Plan Amendment would update the 2006 Bay-Delta Plan's San Joaquin

Continued on Page 20

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Map prepared by: California Department of Water Resources, San Joaquin District, May 2003

Continued from Page 18

River flow and southern Delta salinity water quality objectives and the program of implementation for those objectives. The proposed flow objectives would require increased flows from three eastside, salmon-bearing tributaries to the San Joaquin River: the Stanislaus, Tuolumne and Merced Rivers. Therein lies the issue. Increased flows result in less diversions, and less diversions mean less water for human and agricultural uses.

In fact, at the proposed levels, it means significantly less water for cities and farms in Merced, Stanislaus and San Joaquin Counties. The plan calls for 30 to 50 percent unimpaired flows on the three eastside tributaries, with the initial starting point set at 40 percent. This proposal, if implemented, would be economically devastating. Not only would it distress cities and farmers relying upon surface water diversions from those rivers, but would severely diminish groundwater supplies as cities and farms will at-



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tempt to pump groundwater to make up the shortfall. However, when you overlay the Sustainable Groundwater Management Act (SGMA) over this scenario, you can arrive at only one conclusion. Significant farmland will be taken out of production in Merced, Stanislaus and San Joaquin Counties, and many cities will be without reliable drinking water supplies. SGMA mandates that critically over-drafted basins, including the Merced basin, have groundwater sustainability plans (GSPs) in place by January 31, 2020. Simply pumping groundwater is not an option, even by the state's own mandates!

The state estimates by their own numbers that the plan results in a 7 to

23 percent reduction in water available for human consumptive use. At a 40 percent unimpaired flow level, 288 thousand acre-feet will be sent down the river unavailable to human or agricultural use, and at a 50 percent level 485 thousand acre-feet will be lost. How can this happen? How can this be balanced? Is this meant to address all fish concerns regardless of impacts to human and agricultural consumption? Is the state ignoring the millions of dollars that have been spent in irrigation efficiency over the past several years producing more with less water? The State must answer these questions and growers need to be sure their voice and concerns are heard. In hearings held so far literally

thousands of attendees, from cities and schools to farmers and irrigation districts, have expressed their opposition to the plan. The Western Agricultural Processors Association is in the process of submitting detailed written comments in opposition to the proposed plan. The state may be listening as they have just added an additional two months to the comment deadline, which is now set for March 17, 2017. We implore you to comment! By the way, heads up! The Sacramento River is next...

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## Almond and Walnut IPM Activities to Start the Season

Emily J. Symmes  
IPM Advisor, Sacramento Valley

As the new year is upon us and the 2017 growing season begins, it is a good time to have a discussion with your Pest Control or Crop Adviser to review key issues from last season and begin planning pest management activities for the year. This will help focus efforts on the pests and pathogens that may cause problems as the season progresses. Being proactive in managing many issues early in the season can set you up for success at harvest. The following outlines Integrated Pest Management (IPM) considerations for key insect pests and diseases during the early season (February through April-May) in almonds and walnuts.

### Insect pests in Almonds:

**NOW in almonds.** Sanitation is the key element to controlling navel orange worm (NOW) in almonds. Research has shown that even diligent and well-timed spray programs against NOW are not as effective in minimizing harvest damage if not paired with adequate winter sanitation. Mummies should be off the trees before bloom and mowed before mid-March. Trapping for NOW should begin mid-March. Pheromone, kairomone, and egg traps all provide information that informs treatment timings and orchard pressure. Egg traps should be used to establish a biofix and begin accumulating degree-days. These are a proven tool to help track egg-laying activity and determine treatment need and timing throughout the season. Pheromone traps provide information as to male activity and can serve as an additional resource for tracking flights and population abundance. Kairomone-based traps largely track female flight activity, and can also be used on conjunction with other trap types to monitor flight activity and abundance. If using mating disruption for NOW in almonds, place disruptants in March.

**Peach twig borer.** There are a number of effective treatment timings if peach twig borer (PTB) is problematic in your orchard, including dormant/delayed-dormant, bloom, and in-season (May sprays). Past history is a good indicator of potential PTB pressure. While it is too late this season to consider dormant treatments, PTB is the only insect pest that can be treated safely during bloom (see below for more on honey bee safety and pesticide applications during almond bloom). Applications of *Bacillus thuringiensis* (Bt) can be made to target PTB with very minimal risk to honey bees if proper guidelines are followed. Good control has been recorded with two applications of Bt at bloom—one between popcorn and full bloom and one at petal fall. Keep in mind that if there is an extended bloom period, a third application may be needed to cover the entire PTB emergence period. Place pheromone traps in mid-March and continue to monitor for PTB throughout the season to track flights and population densities. Shoot strike monitoring in mid-April will also provide information as to the success of PTB treatments and any need for additional in-season treatment (Photo 1).

**Leaffooted bug.** Begin keeping an eye out for leaffooted bugs and their damage in March (Photo 2). If you are aware of any nearby overwintering aggregation sites (e.g., pomegranate, juniper, etc.) monitor those to get an idea of potential dispersal timing into almond orchards.



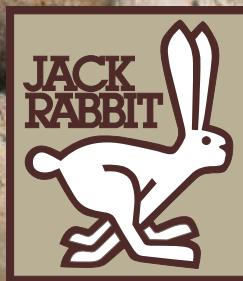
Photo 1. Shoot strike caused by peach twig borer in almond.

Look for dropped nutlets, nuts with gummosis, and/or presence of live bugs. Unfortunately, once dropped nutlets or gummosis are noticed, damage has occurred and it is possible that the dispersing populations may no longer be in the orchard. Orchard history and proximity to overwintering aggregation sites may provide additional information to determine whether leaffooted bug treatments should be considered in particular blocks.

Continued on Page 24



Photo 2. Leaffooted bug nymph (left) and adult (right).



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#### Almond Diseases:

**Brown rot.** The pathogen survives in twig cankers and on remaining diseased flower parts and spurs. Fungal spores are airborne or rain-splashed. Almond flowers may become infected from pink bud to petal fall and are most susceptible when fully open. Infection is favored by rainy conditions with temperatures in the mid-70s during bloom, or in dry years with high humidity. Managing the disease when conditions are conducive to spread involves protection of flower parts. If possible, each variety in the orchard should be treated based on bloom stage. If this is not possible, target treatment timings to the most impacted variety. Typically, brown rot can be controlled with pink bud and full bloom treatments. One application at full bloom may be sufficient in years with no rain during bloom. In high pressure orchards, or in years with extended bloom and rainfall, both treatments and possibly a third application at petal fall, should be considered.

**Anthracnose.** The fungus that causes

anthracnose overwinters in mummies and dead twigs and branches that were infected last season. Cultural practices to remove these inoculum sources are critical to control the spread of this disease (50 percent reduction in disease incidence the following season has been shown in orchards where infected wood was pruned out at the end of the season). Infections can occur with extended rain during spring, or in orchards where sprinkler irrigation contacts the tree canopy. In sprinkler-irrigated orchards, using low-angled nozzles to prevent wetting of the tree canopy can reduce disease spread. In orchards with a history of anthracnose or when weather conditions favor the disease, well-timed fungicide treatments will likely be necessary in addition to orchard sanitation. Applications beginning at 5-10 percent bloom or pink bud, with repeated applications every 10 to 14 days if rains persist can provide protection against anthracnose. Late spring rains might necessitate additional applications into May. Rotation of materials in different Fungicide Resistance Action Group (FRAC) groups is an important resistance management



Photo Credit: UC Statewide IPM Program

Photo 3. Scab lesions on twigs serve as overwintering sites for the fungus.

strategy.

**Scab.** The fungus that causes scab survives in twig lesions (Photo 3) and spores are spread by wind or rain. The disease is favored by prolonged wet springs and is typically more problematic in the Sacramento Valley. Locations in high humidity environments (along rivers, orchard low spots, frequent or sprinkler irrigation) are at higher risk of scab infection. Shot hole sprays may provide some scab protection, but pay



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particular attention to scab if rains occur in mid- to late-spring. A single application as late as five weeks after petal-fall can be effective against scab; an earlier application (2 weeks after petal fall) may improve control in orchards with high scab pressure. Be aware of resistance issues with quinone outside inhibitor fungicides (strobilurins) and avoid use of these materials in orchards where resistance is known or suspected.

**Shot hole.** If shot hole fruiting structures (Photo 4) on leaf lesions were noted last fall, there is a high risk of shot hole development this spring if conditions favor the disease (i.e., humid conditions via rain or sprinkler irrigation that cause prolonged periods of wetness). The most effective treatment timings for shot hole are at petal fall and 2 weeks after petal fall. If shot hole lesions were not observed in the orchard last fall, a petal fall treatment will not be necessary. However, it is important to continue monitoring leaves throughout the spring for shot hole lesions with fruiting structures. If these are observed, treatment is warranted. Regardless of treatment, monitoring should continue as long as conditions that favor the disease persist.

**Rust.** Rust was a significant problem in many areas in 2016, particularly in the north and in vigorous young orchards. If this was the case in your orchard, be proactive in managing this disease, particularly if conditions favor spread in 2017. Rust is a particular issue in orchards with a history of disease and under high humidity conditions, caused by late spring rains or frequent

Continued on Page 26



Photo 4. Small, dark fruiting structures in center of leaf lesion characteristic of shot hole infection.

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Continued from Page 25

microsprinkler irrigation (increasing leaf wetness hours). Excessive nitrogen levels can also increase susceptibility. Although the damage is caused by defoliation later in the season, the optimal treatment timing is five weeks after petal fall before symptoms are visible. Two to three applications may be needed in problematic orchards. In these situations, a second treatment four to five weeks after the initial treatment to control leaf infection may be warranted. Continue to monitor rust throughout the spring and early summer to (April through June) to determine the need for additional treatments (Photo 5). Blocks with one percent leaf infection are at risk if humid conditions persist.

Resistance management is important in managing pests and pathogens that require multiple treatments per season. For pathogens, use multi-site mode of action materials when possible, rotate and mix fungicides with different modes of action (FRAC groups), and limit single mode of action applications.

Fungicide efficacy and treatment timings for these and other key almond diseases can be found at: [ipm.ucanr.edu/PMG/r3902111.html](http://ipm.ucanr.edu/PMG/r3902111.html).

**Almond bloom sprays and honey bee safety:** Some general guidelines when considering any bloom pesticide treatments in almonds: Avoid insecticide applications during bloom (exception noted above is *Bacillus thuringiensis* for PTB control). When applying fungicides, avoid tank mixes and adjuvants. Make any applications late in the afternoon or evening, and allow time to dry before new flowers open the following day. For more on protecting honey bees at bloom, see the post at [sacvalleyorchards.com](http://sacvalleyorchards.com) and visit [almonds.com/pollination](http://almonds.com/pollination).

#### Walnut Diseases:

**Walnut Blight:** Early sprays and good coverage are keys to a successful blight program. If high rainfall is expected during catkin flowering, treatments may be applied when 30-40 percent of catkins have emerged. However, in most years, first applications can be delayed until 30-40 percent of the buds reach the “prayer stage” (Photo 6). Second applications should follow 7 to 10 days later to ensure adequate coverage. Additional sprays may be necessary depending on



Photo 5. Rust pustules are reddish orange on the undersides of leaves and appear as yellow spots on the upper leaf surface.

the amount of inoculum in the orchard, disease history, weather conditions, and variety. A spray prediction model (XanthoCast) is available at [www.irrigate.net](http://www.irrigate.net). Remember that a good early blight program can help mitigate navel orangeworm damage.

#### Insect pests in Walnuts:

**Scale pests in Walnut:** Although February is getting to be too late in almonds for dormant monitoring and treatment activities, if you haven’t made a dormant season scouting visit in walnuts, there is still time. An article in the November-December issue of Progressive Crop Consultant (Dormant Monitoring: Almond and Walnut Pests) provides detailed information and useful decision trees for dormant season monitoring and treatment thresholds in almonds and walnuts for scale pests ([progressivecrop.com/images/pdf/Nov-Dec\\_PCC\\_2016\\_Web.pdf](http://progressivecrop.com/images/pdf/Nov-Dec_PCC_2016_Web.pdf)). In walnuts, scout for scale pests before March to determine the need for delayed-dormant

Continued on Page 28



Photo 6. Prayer stage of walnut bud development.

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(late March) and/or crawler stage (late April-May) scale treatments. Evaluation of scale populations during the dormant season to evaluate parasitism levels and scale viability (i.e., whether they are alive or dead) will help determine the need for treatment, and may save an unnecessary spray.

Recent data has shown treatments targeting walnut scale were effective in controlling populations into the following growing season, suggesting that walnut scales may not need treatment every year. Walnut scales have a waxy cover that can remain on trees long after the actual insect is dead (Photo 7). If few live scales are detected and/or significant parasitism is evident by exit holes in the scale cover, consider delaying or eliminating treatment to allow parasitoid populations to build up and provide free (!) control of the walnut scale populations.

A number of orchards in the Sacramento Valley have presented with higher-than-usual frosted scale populations this winter (Photo 8, Page 29). Most of the recent research has focused



Photo Credit: Richard Buchner

Photo 7. Overwintering walnut scale nymphs (left); walnut scale covers, some with parasitoid exit holes (right).

on walnut scale control, and it is possible that treatments timed to walnut scale are less impactful on frosted scale. Current University of California guidelines for treating frosted scale in walnut are five or more nymphs per foot of last year's wood with less than 90 percent parasitism (black nymphs). If you have been treating for walnut scale in previous years, but are still struggling with frosted scale, consider adjusting your treatment timings. Better results may be obtained

if dormant/delayed-dormant treatments are applied prior to the development of the waxy bloom of the frosted scale in late winter/early spring, or if treatments are applied to specifically target frosted scale crawler emergence (begin crawler monitoring in mid-April; typical emergence is late April/early May).

Additionally, the main reason that scales are treated relates to their association with Botryosphaeria (Bot) infection. If your orchard has low Bot pressure,

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trees can tolerate moderate scale levels without incurring significant damage. Visit the walnut section of sacvalley-orchards.com for more information on walnut scale monitoring and management.

**Codling moth.** Place traps in early March and check twice weekly until biofix (the first date that moths are consistently found in traps and sunset temperatures are 62°F). This will be an important basis for timing treatments throughout the remainder of the season. After biofix, begin accumulating degree-days to track development and continue (minimum) once-weekly trap checks. If using mating disruption, hang dispensers in early March. In orchards under mating disruption or near disruption blocks, traps baited with 1X pheromone lures may be shut down. Using CMDA combo lures will allow you to track the populations in these situations (although traps baited with 1X pheromone lures should also be used to assess effectiveness of mating disruption). Remember that a sound codling moth control program can limit entry points for navel orangeworm prior to husk split.

**NOW in walnut.** Sanitation is an important aspect of NOW control in walnut as well as almond. Remove and destroy mummy nuts by mid-March. Research has shown that increased destruction of mummy nuts (those left on bare berm or in ground cover/weeds vs. those double-disked or shredded) results in greater reduction in surviving and emerging NOW. Remember that removing and destroying mummies not only has a direct impact by reducing the overwintering population, but also limits egg-laying and development sites for moths that may be migrating into the orchard from other areas throughout the season. Research regarding monitoring NOW in walnuts using pheromone, kairomone, and/or egg traps is ongoing, but certainly can provide important information as to the populations and activity within your orchard. Place traps in early- to mid-March to begin evaluating season-long NOW activity. A recently updated post on NOW management in walnuts is available at sacvalleyorchards.com.



Photo Credit: Richard Buchner

Photo 8. Overwintering frosted scale nymphs (left); close up of parasitized frosted scale nymph (right).



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# Walnut Production Research

California Walnut Board  
Contributing Writer

**W**alnut production research goes back several decades. But the initial research depended a lot on the University of California (UC) system and interest of researchers. It was in 1971 that walnut industry joined forces with UC Davis to formally launch an industry supported production research program. That year, one project received funding of about \$25,000. From that small beginning, this partnership has grown leaps and bounds just as the industry has and now more than a dozen projects totaling some \$1.8 million are underway. These cover orchard management, entomology, walnut breeding, pest management, and so on. The industry has benefited from this partnership in a variety of ways, from having tools to address

diseases and pests to better yielding varieties. Further, the California Walnut Board research endowment to ensure continued research into walnut breeding now stands at \$2.9 million. Part of the 'California Walnuts' brand appeal has been consistent quality, and the production research program has certainly played a major role in that.

Over the years, production research has played an important part in providing practical tools to growers.

## Orchard Management

Orchard management is perhaps the most encompassing field of research as it deals with several aspects of production—rootstock, new varieties, cultural practices throughout the year, water management, tree and soil nutrition, and so on. Since partnering with UC Davis more than four decades ago, the ongoing research

has resulted in several new varieties and rootstocks that are widely used today by walnut growers. Some of the varieties include Chandler, Howard, Vina and rootstocks include VX211, Paradox, and Vlach. Compared to older varieties and rootstocks, the newer ones can be planted more densely and are bred for disease resistance. This allows for more production while keeping the losses as low as possible. Further, improvement in orchard management practices has resulted in water conservation as flood irrigation has mostly given way to micro irrigation (drip, micro sprinklers) which can be programmed to operate in tandem with soil moisture sensors so trees are irrigated only when needed. In addition, better disease resistance has also resulted in lowering the use of chemicals. Given the current drought in California, some of the ongoing

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research is focused on improved water management strategies and managing soil nutrition to avoid leaching into ground water.

### Plant Pathology

The field of plant pathology deals with studying plant diseases and identifying solutions to it. These diseases could be a result of pathogens (fungi, bacteria, viruses) or environmental factors. Some of the common diseases affecting California walnuts include Botryosphaeria and Walnut Blight. The California Walnut Board and Commission has partnered with UC Scientists on several projects aimed at finding solutions to various diseases through a combination of strategies – suitable chemicals, improved orchard management practices or more disease resistant rootstocks. This allows the growers the option to choose from a toolkit what's best for their operation and unique scenarios.

### Genetic Improvement

Genetic improvement is perhaps

the most exciting field as development in gene analysis technology leads to a better understanding of which genes control what aspects of production, harvest time, pellicle color, lateral branching, and so on. UC Davis announced in late 2015 that the walnut genome was completely mapped for the first time. What this means is that we now have a better understanding of how the tree functions and what triggers certain functions. Aside from the obvious implications of this for future breeding efforts, we can also identify the 'culprit' genes that may be responsible for controlling how and if the tree responds to pathogens and infections. This will vastly speed up improvement in disease resistance compared to conventional breeding techniques. This is the way of the future! Some of the interesting research aims to identify genes responsible for resistance to soil borne pathogens. This, in turn, would help the industry reduce or eliminate dependence on soil fumigants, which are becoming increasingly regulated. In the same

vein, identifying disease resistance genes for other diseases like crown gall, Phytophthora, root lesion nematode or Armillaria root disease and expressing them in future rootstocks could help the industry save thousands of dollars in fumigants, fungicides and pesticide costs.

### Entomology

Just like any other commercial crop, walnuts are also susceptible to a variety of insect pests. The entomology research focuses on identifying potentially dangerous pests for the walnut tree and ways of mitigating this pest pressure. Some of the important walnut pests are Husk Fly, Coddling Moth and Navel Orangeworm. Besides the obvious commercial aspects of managing pests, identifying and dealing with them is especially important as majority of walnuts are exported and the importing countries have regulations to prevent sale of any commodity with a potential of spreading diseases for their own local crops. As such, it becomes important to manage these pests with both chemical and biological controls and better orchard management and post-harvest practices. Entomology research focuses on identifying the life stages of problem pests and various ways of controlling them so growers can have options should they need them. The variety of options in the grower toolkit also helps in preventing resistance buildup.

In sum, the walnut research program has been of invaluable help to growers by providing them with improved varieties with desirable traits, various options for dealing with disease and pests and better orchard management tips to maximize the production with optimum resource input.

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# BEST PRACTICES

Photo Credit: Almond Board of California



Working with Project Apis m., Pacific Gold planted clover and mustard mixes that will not only provide forage for honey bees, but also help fix nitrogen and improve organic matter content in the soil.

## Almond Grower Farms to Promote Honey Bee Health

Almond Board of California  
Contributing Writer

Pacific Gold Agriculture is creating a paradise for honey bees among 400 acres of almonds in Arbuckle, Calif. As part of its commitment to sustainable<sup>1</sup> almond production, the family-owned farming partnership, with 3,500 acres of permanent crops under management in Kern, Tulare and Colusa Counties, is experimenting with planting clover and mustard bee forage mixes in its orchard middles, and also setting aside fallow

riparian land to plant a number of permanent plants favored by native and domesticated honey bees.

Farm manager Blake Davis plans to create a year-round home for both native and domesticated honey bees on Pacific Gold's Sacramento Valley farmland, by providing food sources from nearly a dozen perennial plants, including manzanita, buckwheat, sage, lilac and bottlebrush.

### Experiment in Bee Forage

By early November, Davis had also just finished drilling clover and

mustard seed mixes on 120 acres of almonds in the company's first experiment in planting bee forage to help strengthen beehives and natural pollinators prior to and following almond bloom.

One sprinkler-irrigated 40-acre almond block has been planted in alternating rows to mustard mixes, which typically flower prior to almond bloom. The mustard mix provides an important food source for bees, but also develops root systems that can help build organic matter and improve soil tilth. Mustard rows

1. Sustainable almond farming utilizes production practices that are economically viable and are based upon scientific research, common sense and a respect for the environment, neighbors and employees. The result is a plentiful, nutritious and safe food product.

are alternated with rows of clover mix, which blooms just after almond bloom and helps to fix nitrogen in the soil. Because the block is on full-coverage sprinklers, Davis said irrigations will help support the cover crop after the rainy season. In another block on double-line drip, he opted for mustard mix only because it doesn't require supplemental irrigation.

Davis estimates seed costs to be about \$30 an acre, but said that is more than offset by savings on time and fuel spent mowing for winter weeds, as well as the free nitrogen source from the legume mix.

### Honey Bee BMPs

To help educate himself on the best ways to promote honey bee health in his almond orchards, Davis consulted the Almond Board publication "Honey Bee Best Management Practices for California Almonds," and also consulted with Project Apis m. (PAm), which provides resources to growers. These resources include bee-friendly seed designed specifically for almonds, along with technical assistance for planting and managing bee forage resources in and around almond orchards.

PAm has identified low-moisture-requiring seed mixes, seed suppliers and planting regimes specific to bee habitat in almonds, including specially blended mustard mix for fall and winter bloom, as well as clover mix and lana vetch for spring bloom.

A lack of year-round forage is one of several stressors scientists have attributed to declines in honey bee health in recent years, and Davis said that given the mutually beneficial relationship between almonds and honey bees, almond growers should do everything possible to protect and nurture honey bee health.

### Spray at Night to Protect Honey Bees

In addition to creating natural habitat for honey bees in and near the almond orchard, Pacific Gold has embraced recommended best management practices by revamping its spray program across the entire operation.

Continued on Page 38



Blake Davis, manager of Pacific Gold's Sacramento Valley operations, said creating habitat for native and domestic pollinators is part of the farming operation's overall sustainability ethic.

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Davis looks over clover plants just starting to germinate in the middles of Pacific Gold's sprinkler irrigated almond block in Arbuckle, Calif.

Continued from Page 35

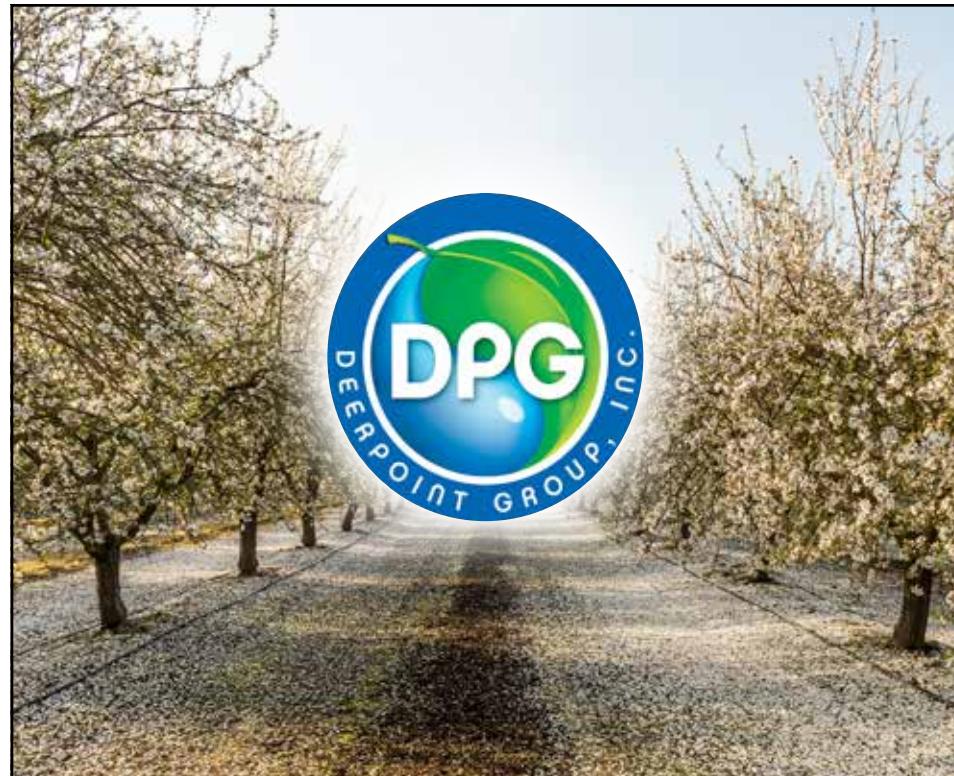
When bloom-time fungicide sprays are needed, they are done only at night, when there is no risk of honey bee activity and exposure of pollen to residues.

Converting to a nighttime spray program has its challenges, but Davis said it also provides benefits, including avoiding any potential for unintended exposure to honey bees or bystanders.

He expects, as with other sustainable farming practices at Pacific Gold, that there will be a learning curve in managing bee forage that can be converted from a challenge to an asset.

One early concern was the impact bee forage might have on harvest and pollination rates, but Davis said that after doing additional research, he feels confident there won't be a problem.

"We don't yet know the impact of



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the extra organic matter on almond harvest, but I don't expect we will have problems with material ending up in harvested nuts as long we slow down a little bit," he explained. "But that helps with dust, too, so it's a good idea anyway to slow down during harvest."

### Forage Not a Competitor

Davis is also not worried about forage crops competing with almond

blooms for bees' attention, citing Almond Board-funded research<sup>2</sup> that demonstrates the number of honey bee visits to almonds has not been significantly impacted by the presence of a wildflower planting.

"A big part of what sold me is being able to prove the bees would still go to my almonds whether or not there is a forage crop in the orchard," Davis

Continued on Page 40

2. Forage Competition, Project Apis m. (2014). <http://projectapism.org/wp-content/uploads/2014/06/Forage-tab-competition-v5.pdf>

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Continued from Page 38

said. "This will be a learning year for us, but if it all works out, we will probably do it in all our almond acreage next year."

In addition to planting bee forage, Pacific Gold's sustainable practices include installing water meters to better measure water use, and solar panels to power all of the irrigation pumps. Integrated pest management that prioritizes selective materials is also an integral part of the operation.

### Sustainability First

"Our whole outlook in farming is based on sustainability and traceability, and they really fit in well," Davis asserted. "More and more, buyers are going to want to know how crops are produced. But more than that is a motivation fueled by the love of agriculture and wanting to see it continue."

"The Blain and King families who own Pacific Gold have been in farming for ages, and they have deep connections to farming and their communities," he continued. "Ben King has a long-standing love for bees since he worked as a kid for a local apiarist and also helped his brother, who at one time had more than 1,000 colonies in Colusa County, both for pollination and honey production."

Davis, who is a 2016 graduate of the Almond Leadership Program, uses farm management software to track and record all inputs, equipment and activities in the almond orchard, and is also looking at enrolling Pacific Gold's almond acreage in the California Almond Sustainability Program.

"We are actively trying to stay ahead of environmental issues and figure out and embrace possible solutions for the issues of today and tomorrow," Davis concluded.

More information on resources for planting bee forage in almonds and other ways to benefit honey bees year-round can be found on the PAM website at ProjectApism.org, or the Almond Board website, Almonds.com/Pollination.

**Comments about this article?** We want to hear from you. Feel free to email us at [article@jcsmarketinginc.com](mailto:article@jcsmarketinginc.com)



Photo Credit: Almond Board of California

Natural rainfall will germinate and sustain the mustard-blend honey bee forage planted in this 10-year-old block of drip-irrigated Winters, Aldrich and Monterey almonds.

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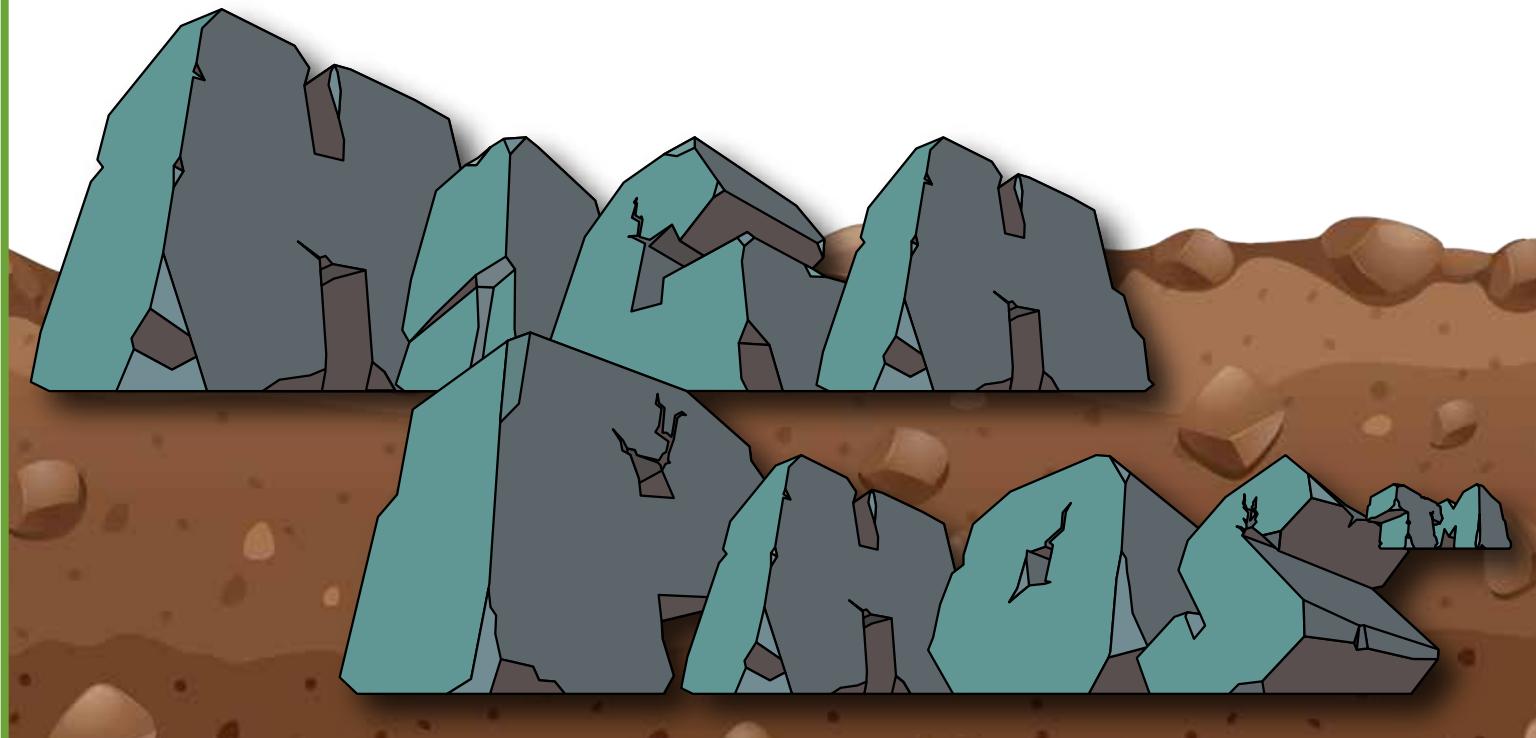
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# Protecting Honey Bees During Bloom

Emily J. Symmes  
IPM Advisor, Sacramento Valley

**W**ith almond bloom on the horizon, it is time to revisit best management practices for protecting pollinators (e.g. honey bees) during this critical time. Remember that communication is key during the bloom period. All parties should be kept informed so that beekeepers are aware of impending applications and applicators are aware of the requirements related to notification, materials, timing, location, and method of application. This includes growers, beekeepers, land owners-lessees, PCAs/CCAs, pesticide applicators, and county Agricultural Commissioners.

## General Guidelines:

Apply pesticides only when absolutely necessary based on monitoring and treatment thresholds.

Know all of the available materials and application timings.

For insect pests, there are effective alternative timings for insecticide applications aside from the bloom period.

If the weather remains dry and clear throughout bloom, there should be minimal need to apply bloom fungicides. One solid, every row application just ahead of full bloom should be adequate for good disease control under these conditions.

Be aware of the impacts of any treatments on pollinators and other non-target

organisms.

Cover or remove water sources prior to any application.

Keep water clean and fresh ensuring bees spend more time pollinating the crop than searching for water. Bees can forage up to 5 miles away seeking food and water if not available in the orchard, increasing their risk of contact with harmful pesticides.

Do not spray hives directly with any pesticide. Ensure the spray-rig driver turns off nozzles when near hives.

Do not spray flying bees with any applications. Aside from toxicity concerns, bees will not be able to fly because of the weight of spray droplets on their wings. Even water can impact their flight ability (and will also cause pollen grains to burst affecting pollination).

Avoid pesticide application or drift onto blooming weeds in or adjacent to the orchard.

Avoid applying systemic pesticides or those with extended residual toxicities pre-bloom.

Bees should be removed from the orchard when 90 percent of flowers on the latest blooming cultivar are at petal fall. Past this point, no successful pollination is taking place.

After removal of bees from an orchard, communication with neighbors remains important since other bees may still be foraging in the area.

## Insecticide Guidelines:

Do not apply insecticides during bloom. Much of the information and labeling related to honey bee toxicity is based on acute toxicity of foraging adults. In recent years, more research has indicated adverse effects of pesticides on developing brood, so even materials with "softer" reputations toward honey bees should be avoided.

One exception is *Bacillus thuringiensis* (Bt), which may be used at petal fall and shortly after for control of peach twig borer. For more information on monitoring and treatment of PTB using Bt during bloom, refer to the UCIPM Pest Management Guidelines for PTB in almonds at: [ucdavis.edu/PMG/r3300211.html](http://ucdavis.edu/PMG/r3300211.html)

Rely on other effective timing options (delayed dormant, post-bloom, in-season) for pest management. UCIPM Pest Management Guidelines for almonds provide monitoring information and insecticide and treatment timing options:

[ipm.ucdavis.edu/PMG/selectnewpest.almonds.html](http://ipm.ucdavis.edu/PMG/selectnewpest.almonds.html)

## Fungicide Guidelines:

Avoid tank mixes with insecticides, adjuvants, other fungicides. Increasing evidence shows that synergistic effects among materials can be more detrimental to both adult bees and the developing brood than applications of individual materials.

Addition of adjuvants for bloom fungicide applications are not necessary unless specified on the label, and may harm bees by increasing fungicide toxicity to the bee and/or impact their behavior directly. Limited canopy development should allow good spray coverage as long as the sprayer is well calibrated and properly set up, so addition of adjuvants should not be needed at bloom.

University of California trials are generally conducted without adjuvants, and excellent disease control is obtained with several fungicides in these trials. The most recent publication is available at [ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf](http://ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf)

Know the impacts of particular fungicides on honey bees and choose materials



Bees safety should be kept in mind during almond bloom.

accordingly.

The University of California IPM Program has published a new online resource, "Bee Precaution Pesticide Ratings." [ucanr.edu/beeprecaution/](http://ucanr.edu/beeprecaution/)

Use this database to find precaution ratings for any material you are considering applying during bloom (searchable both by common name and trade name).

These precaution rankings (I, II, III) have been created based on all of the currently available scientific studies, but are still largely based on adult bee toxicity. The table does include effects on bee brood if that information is available. If the table does not indicate toxicity to honey bee brood, that does not suggest the material has no impact on the brood, only that such data is not available yet. Always proceed with caution and err on the side of bee safety.

The output table also lists known harmful synergistic mixtures based on IRAC and FRAC mode of action (in the column "Other Effects on Bees"). Again, absence of noted synergistic effects between materials only means that the data is not yet available (there are many possible combinations that still need to be investigated).

Proceed with caution.

Apply fungicides in the late afternoon or evening when bees and pollen are not present. Each morning new flowers and anthers open to release pollen. Pollen-collecting bees often collect all of this pollen and leave the almond blossoms by mid-afternoon. Pollen that will be collected the next day is still protected inside closed flowers or anthers, which will not open until morning. It is important to ensure that fungicides have time to dry before new flowers open, anthers shed pollen, and bees begin foraging the following day.

If you suspect pesticide-related damage to honey bees, immediately report this to your county agricultural commissioner. Preserving some adult bees, brood, pollen, honey, nectar, and/or wax by immediately collecting and freezing in clean, labeled containers may be helpful for follow-up on the incident. Signs to look for:

- Excessive numbers of dead or dying adult honey bees in front of hives
- Dead newly-emerged workers or brood (developing larvae) at the hive entrance
- Lack of foraging bees on a normally

attractive blooming crop

- Adult bees exhibiting stupefaction (dazed, unconscious, etc.); paralysis; jerky, wobbly, or rapid movements; spinning on the back
- Disorientation and reduced efficiency of foraging bees
- Immobile or lethargic bees unable to leave flowers
- Bees unable to fly and crawling slowly as if chilled
- Queenless hives

**Links to additional resources can be found at:**

UC IPM Bee Precaution Pesticide Ratings [ucanr.edu/beeprecaution/](http://ucanr.edu/beeprecaution/)

California Almond Board Honey Bee Health [com/growers/pollination#tc-honey-bee-protection](http://com/growers/pollination#tc-honey-bee-protection)

California Almond Board Honey Bee Best Management Practices [com/growers/pollination#tc-BeeBMPs](http://com/growers/pollination#tc-BeeBMPs)

UC Davis Apiculture Newsletter [ucdavis.edu/apiculture\\_newsletter.html](http://ucdavis.edu/apiculture_newsletter.html)

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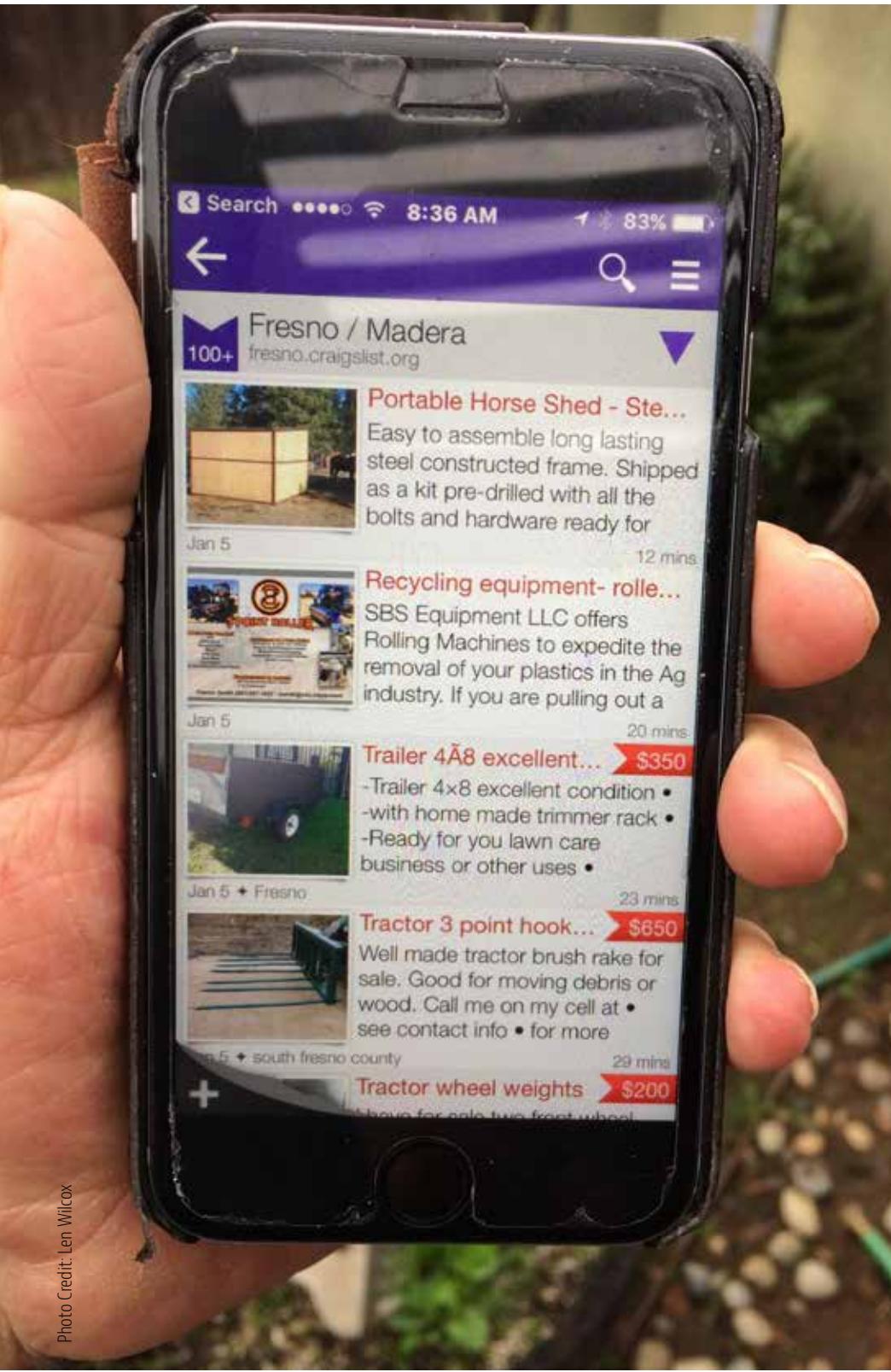
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# Ag Tech: More on Phone Apps



Craigslist uses a Web-based App to display the data from its listings. The user selects the city then the subject (in this case, "Fresno, CA", and "For Sale - Farm and Garden") to pull listings from a database that includes tens of thousands of items from every part of the world. It must be connected to its database via the internet to work.

Len Wilcox  
Contributing Writer

Last month, we started a discussion of phone-based apps, and went over several that are of interest to agriculture. We received some emails in response, and felt we needed to go a little further with explaining Apps and how they work.

Apps are software programs written for phones and tablets. They come in different flavors and sizes, but the ones created for your phone work in one of two ways: They are native and reside on your device, or they are web based and live on the internet. There are advantages and disadvantages to each. Depending on your situation, the disadvantages could make the App difficult to use, so it is important to understand the differences.

The native apps are the kind you find in Google play, the Window or Apple App store, or on a provider's website that you download to your phone or tablet. They are written in code that is specific to the operating system on your device. Apple Apps only work on Apple devices; they won't run on Android or Windows devices. And vice-versa, your Android or Window App won't run on an Apple phone.

This is a problem for App developers, as they have to create multiple versions of the same App in different programming languages to work on multiple devices. In spite of that difficulty, which increases the cost of developing an App, most experts prefer native Apps. Native Apps typically work better, faster, and are safer. Plus, they don't require constant access to the internet.

To avoid the cost and difficulty of developing the same product in several computer languages, some developers create Apps that live on the web and use html code to operate. Facebook, and many weather Apps, are a good example of web based Apps. Some of the farming Apps we've already talked about are web based; the tipoff is whether they can be

Continued on Page 46

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accessed and used by any kind of device or computer.

Obviously, the usability by all sorts of devices is a big plus for web based Apps, but there are some drawbacks. First is, the web based Apps are limited by the programming language (html). This can limit the amount of work the program can do. The App also requires constant internet access. This may be a problem and often, is not even possible with farming applications. Also, as with anything web based, security is an issue; the risk of being hacked is increased whenever a software can be accessed by others.

Unlike web based Apps, the native Apps are subjected to scrutiny by the store in which they are being sold (Google Play, Apple App Store or Microsoft App Store). They need to conform to the store's requirements. They are a little more secure when obtained from an App store (as opposed to a developer's website) as the stores screen the Apps for viruses or malicious software when they come in to their store.

In addition, the native Apps take full advantage of your device and usually operate more quickly and efficiently than a web based App.

The choice of a Web or native based App isn't made by the buyer; it is the developer that chooses the format for the App. Let's take a look at an example of each to see why the format was used.

#### CPro Craigslist: Web Based to Handle Massive Data

Craigslist is a classified advertising website. It's replaced community newspapers as the place to sell everything from old boots to used cars. It is an international company with listings for all the major cities around the world, for every kind of job or marketable item.

The site handles an immense amount of data. The data changes frequently and is being input by various users in random locations. A web based program is the only way to obtain, assimilate and publish such disparate sources of data on the same page in a timely manner. The App wouldn't work as a native App as it couldn't process the incredible amounts of data in a timely or orderly manner on

a cell phone.

#### Crop Nutrient Advisor: Native App for Speed

The Dinuba, California, based company Nutrient Technologies worked with computer App developer Michael Rummack to create Crop Nutrient Advisor, a native App that helps growers identify and treat crop nutrient deficiencies. The company has been manufacturing and selling agricultural fertilizer products since 1986 in California's central valley. They wanted to create an App that was useful but also reflected the company's values.

"Our core purpose is to serve agriculture with innovative plant nutrition products that are safe, effective, and easy to use," according to Andrea Holzman, Assistant Marketing Manager for Nutrient Technologies. "We wanted to create an App that wasn't just a product brochure for our Tech-Flo products. We wanted one growers would actually use."

Andrea explained that the choice of a non-web based, native App was important from the start of the project. "We chose to stay offline so that no matter

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where you were at, you have access to the data," she said, when asked why she did not use a web based format. "But also, we kept it small so it would execute quickly. And we are not doing any data mining—we avoid all those things that can slow an App down."

#### A Place for Both

So there is a purpose and room for both types of Apps. Just be aware of the advantages and limitations of both. Web based Apps will need Internet service, so if you're not connected by Wifi you could be consuming lots of your phone's data if you do much with the App.

After our last article, we were pleased to hear from our readers with requests for information or review of high-technology farming equipment and apps. We'd like to know more about your needs and interests in this field.

*We want to hear from you. Feel free to write us at [article@jcsmarketinginc.com](mailto:article@jcsmarketinginc.com) with suggestions of Ag Apps or Ag technology to review.*

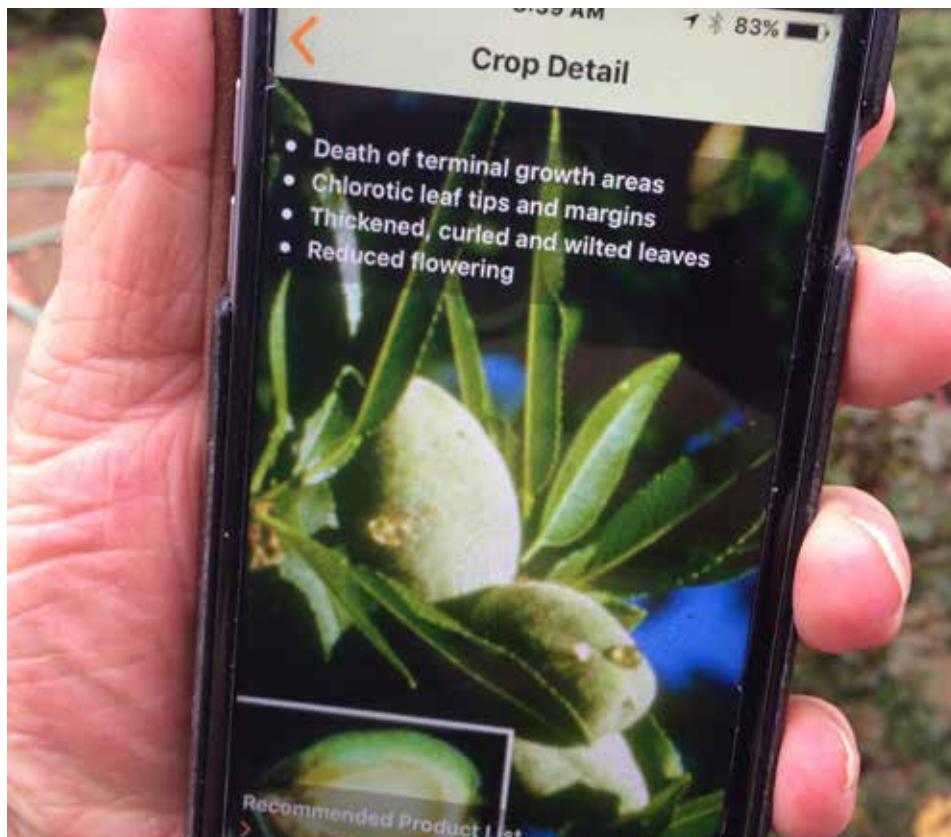


Photo Credit: Len Wilcox

Nutrient Crop Advisor is a Native App that resides completely on your phone. It works whether or not you're connected to the internet. On this screen it is showing health issues with an almond tree.

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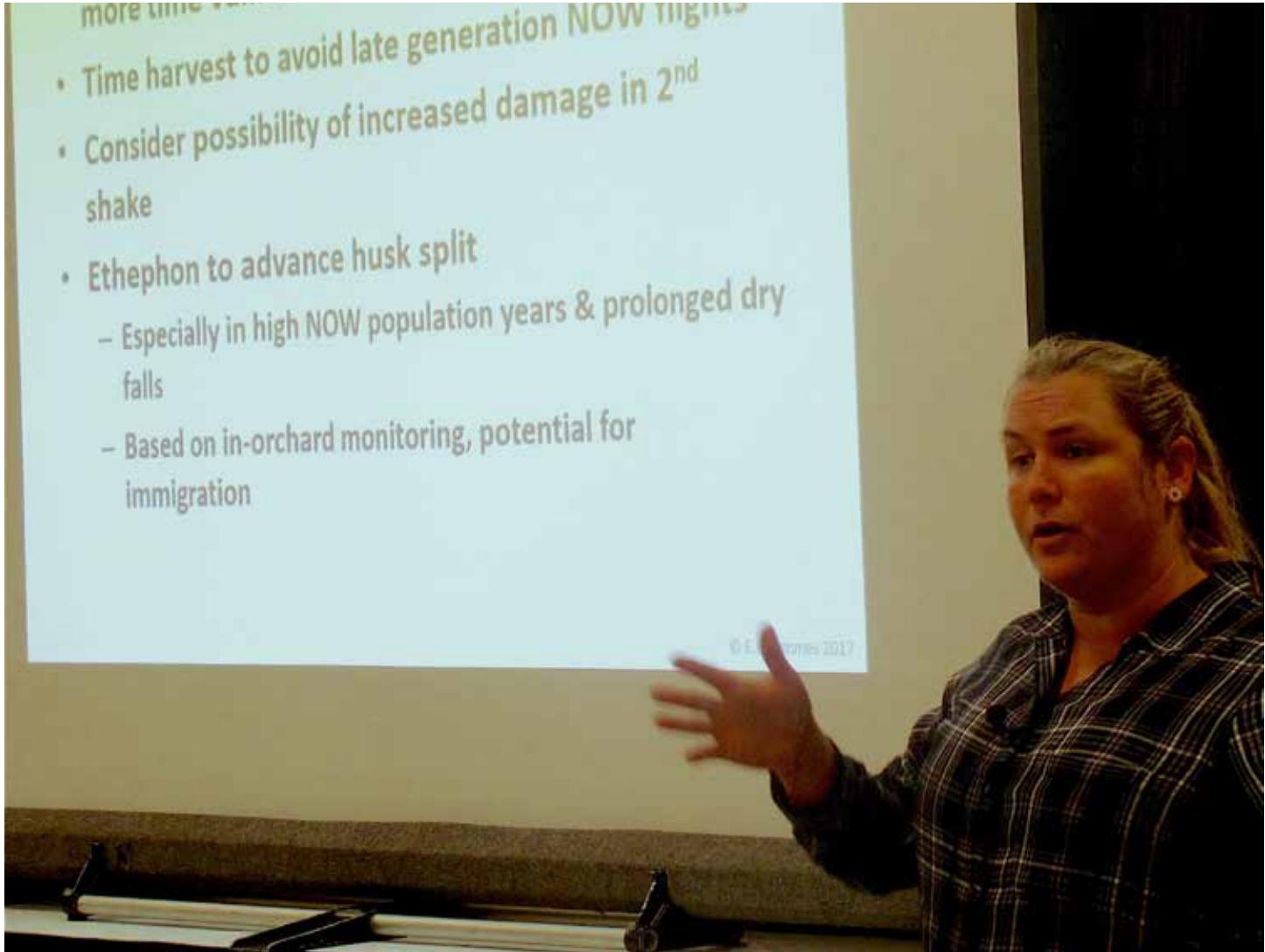
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## BEST PRACTICES

- Time harvest to avoid late generation NOW flights
- Consider possibility of increased damage in 2<sup>nd</sup> shake
- Ethephon to advance husk split
  - Especially in high NOW population years & prolonged dry falls
  - Based on in-orchard monitoring, potential for immigration

Photo Credit: Julie R. Johnson



Emily Symmes, UCCE Area IPM advisor, Sacramento Valley, discusses NOW and codling moth management during harvest at the January 6 Annual Walnut Trade Show at the Yuba-Sutter Fairgrounds.

# The Battle Against Navel Orangeworm and Coddling Moth

Julie R. Johnson  
Contributing Writer

**H**ow to fight the battle against Navel orangeworm (NOW) and coddling moth in walnuts was the take home message of Emily Symmes, UCCE Area IPM Advisor, Sacramento Valley, in her presentation at the West Coast Nut hosted Annual Walnut Trade Show at the Yuba-Sutter Fairgrounds on Jan. 6, 2017.

"Coddling moth hit pretty hard this last harvest, as did Navel orangeworm," she said. "A lot of people were caught a little off guard by both."

Of particular concern was damage seen in the later maturing varieties, which have historically been considered less vulnerable to worm damage.

"Earlier-than-typical, and spread out husk split and maturation led to many later varieties experiencing higher damage in 2016. The high NOW damage at

harvest may have been the result of large overwintering populations, the mild, dry winters over the past few years and earlier springs," Symmes added.

The earlier springs and high temperatures during the growing season is a recipe for additional generations being able to complete development, at times allowing a partial or full fourth generation in late summer through fall.

Symmes stressed the importance of considering all varieties of walnuts

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Photos of Nut Damage	Kernel	Frass	Webbing	Boring	Feeding Behavior	Other
	Deep chewing into kernel.	White, often quite a lot.	Yes, often quite a lot.	Yes, into kernel.	Larvae feed in groups. Many per kernel.	Shells of heavily infested nuts appear oily.
	Deep chewing into kernel.	Frass at point of entry into the husk.	Very little.	Yes, into husk and kernel.	Single larva feeds per kernel.	NA

in managing these pests and proposed management program options in planning for 2017, with an emphasis on Navel orangeworm (NOW) as its damage is becoming more common over the past few years.

“A key component in the battle is identifying NOW and codling moth, and the differences in their appearance and behavior,” Symmes stated.

The tip of each codling moth forewing has a coppery-tinged, dark brown band that distinguishes it from other moths found in walnut orchards.

NOW is silver-gray with irregular black patches on the forewings. The snoutlike palps in front of the head help distinguish this moth from the codling moth, as does the presence of a dark, crescent-shaped mark behind the head of Navel orangeworms, absent in codling moth worms.

“It is important to know which insect you are dealing with so you can evaluate which management practices are best so as not to waste time and product,” Symmes said.

This graphic shares the habit of dam-

age caused by the two moths in the nut and the differences:

When there is insect damage in the nut, but worms aren’t present, NOW damage can be detected by looking for insect excrement and webbing as multiple NOW will infest a single nut.

“The codling moth typically infests nuts singly,” Symmes stated.

NOW females lay eggs singly on leaves and sometimes on fruit later in the season. The eggs are smaller than a pinhead, disk-shaped, and opaque white when first laid. After about a day, they turn pink, then reddish orange.

Codling moth eggs are disc shaped and opaque white, overwinters as full-grown larvae in thick, silken cocoons under loose scales of bark or in trash on the ground near the trunk.

After hatching, the tiny caterpillars enter nuts through the soft tissue at the stem end and do not emerge until they are adults.

Overwintering and early NOW generations survive in mummies and damaged nuts prior to infesting in-season nuts.

This knowledge helps to understand the need in reducing overwintering populations and reducing early generation development sites.

“If you are in a situation where you had high NOW damage at harvest in 2016, consider that as a potential risk factor going into next year when talking about management options,” Symmes said.

She shared four key elements to management:

#### Sanitation

Remove and destroy mummies by early March. That includes on the trees, the orchard floor, bins, hulling and drying equipment, and buildings. This practice will limit NOW overwintering sites and reduce the availability of developmental sites for early generations the following season.

“Research has shown the more destroyed the mummies are, the more impact it has on reducing future populations,” Symmes said.

Continued on Page 50



A large crowd of people in the walnut industry attend Continued Education classes at the Annual Walnut Trade Show in Yuba City.

Continued from Page 49

Get orchard as “clean” as economically feasible.

While doing this, crack out a sample of mummies to determine carry-over population potential. Estimating mummy infestation helps provide a ballpark of potential native population going into the season.

Symmes recommends taking nut samples just prior to husk split from early splits or dropped nuts.

“If eggs are detected, harvest promptly to avoid damage and consider insecticide treatment,” she added.

Maintaining ground cover during winter may aid in decomposing trash nuts, but do not rely solely on this, especially in dry years.

Wet weather helps, if nuts are on the ground.

#### Minimize Damage

Minimize damage caused by other sources such as codling moth, blight, sunburn and hail. Sound nuts are most vulnerable to NOW damage after husk split, thus good codling moth, blight and sunburn management helps to reduce earlier season access and development sites.



Emily Symmes, UCCE Area IPM advisor, Sacramento Valley, talks on the subject of battling Navel orangeworm and codling moth in walnut orchards at West Coast Nut's Annual Walnut Trade Show at the Yuba-Sutter Fairgrounds on Jan. 6. She said damage from NOW is increasing in walnuts.

“Try to eliminate damage that results in entry points for damage. While there are some situations, such as hail damage, that can’t be controlled, it is important to know what entry points for NOW are out there and assessing potential damage,” Symmes said.

#### Timely Harvest

The longer nuts stay in the orchards after husk split, the more time they are vulnerable to NOW infestation.

Symmes recommended timing harvest to avoid later generation NOW flights.

“Time harvest to avoid late genera-

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tion flights," she added.

Also, growers should consider the possibility of increased damage in the second shake and the use of ethephon to advance husk split to avoid late generations of NOW.

"Especially in high NOW population years and prolonged dry falls, and based on in-orchard monitoring and potential for immigration from adjacent orchards," Symmes said.

NOW is considered a strong flier and can develop in a number of fruit and nut hosts, both agricultural and non-agricultural.

#### Insecticide Treatments

It is also important to know whether or not there is a need for treatment, Symmes said.

One component in determining need for treatment is through continued monitoring options of egg traps, pheromone traps, kairomone traps and crop phenology and egg detection.

Either delta or wing pheromone traps can be used to monitor adult male flights and activity. They need to be hung by early March and counted weekly.

There are currently three female pheromone products on the market—Suterra Biolure, Trece Pherocon NOW L2 (high and low) and AlphaScents AMYTRA, Symmes stated. She said results from research comparing these products and how they work will soon be made available in UCCE agriculture publications.

Kairomone traps, either wing or delta, for attracting and capturing females can be baited with ground nuts (almond or pistachio). This form of monitoring adult female flights and activity helps to establish orchard history.

"While some people find the delta trap is easier to use and cleaner to service," Symmes said, "the caveat is that they aren't as sensitive and tend to catch fewer moths than the winged trap. My thought is, use whichever is best for your program."

She recommends, if making changes in the type of trap or lure used, make sure to always document those changes.

Also, the use of traps help to determine the historical pressure in orchards, and immigration potential and treat-

Continued on Page 52

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ment thresholds.

Symmes said research is ongoing into the benefits and best implementation of both kairomone and pheromone traps.

"The best current guideline for NOW is to focus protection from husk split through harvest," Symmes advised.

In the area of codling moth mating disruption, she said what's new in proven technology is the use of aerosols, is the finding of effective suppression at reduced loads and shorter operating times.

"That spells out to more economical options," Symmes added.

In relations to NOW, good, early codling moth control can reduce NOW damage.

"Flexibility in spray programs can help target other pests," Symmes said. "Timing for each pest is more critical with increasingly selective pesticides."

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

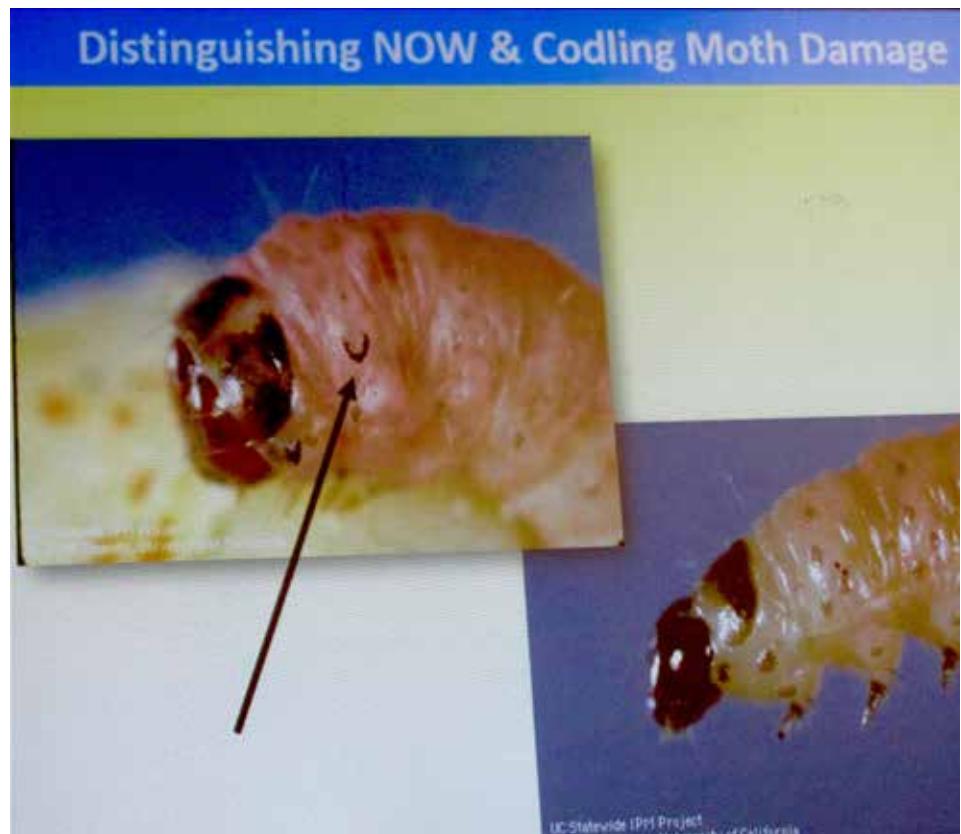


Photo Credit: Julie R. Johnson

This picture displayed by Emily Symmes during her Annual Walnut Trade Show presentation on Navel orangeworm and codling moth shows the differences between the two at worm-stage, the top worm being the Navel orangeworm.

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# BEST PRACTICES

Honey bees should be removed from almond orchards when 90% of the latest blooming variety is at petal fall, when pollination is effectively complete. A bee 'pasture' of mustard next to this orchard provides a source of nutrition following petal fall in almonds.



Photo Credit: Almond Board of California

## Hive Removal in Almond Orchards

Almond Board of California  
Contributing Writer

As almond bloom begins winding down, it is vital growers track petal fall and crop development in their orchards so that bee hives are released to beekeepers and removed from the orchard at the optimum time. Hive removal is a balancing act: Take honey bees out of the orchard too soon, and yields could be reduced due to incomplete pollination. But leaving hives too long risks exposing bees to pesticides applied to other crops, as bees travel beyond almond orchards in search of food.

### Best Practices

The Almond Board of California (ABC) publication "Honey Bee Best Management Practices [BMPs] for California Almonds" includes best practices for timing the removal of honey bees from the orchard after pollination. Here are some considerations for determining the best time to remove hives:

According to the University of California, bees should be removed when 90 percent of the latest blooming variety is at petal fall. At this point pollination in orchards is effectively complete. Bees not removed at this time may travel up to four miles outside of orchards in search of alternative food sources. During that

time they risk coming into contact with other insecticide-treated crops that may be detrimental to honey bee health.

### Honey Bee Forage

One of the ways almond growers can support pollinator populations is to provide an alternate source of honey bee nutrition before and after almond bloom.

Growers who plant forage, or 'bee pastures,' as a food source for honey bees may benefit from a number of other improvements to their orchards<sup>1</sup>, including:

- Improved soil fertility
- Improved water infiltration

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### Agreement on Hive Removal Timing

In addition to orchard observations regarding the timing of removal, the Honey Bee BMPs recommend that growers and beekeepers discuss expectations for hive removal in the development of pollination agreements prior to the pollination season. By doing this, the grower and beekeeper develop a clear delineation of responsibility and can avoid misunderstandings.

### Yearlong Considerations

As the pollination season comes to a close, it is also important growers and beekeepers monitor hives for

suspected pesticide-related incidents. Abnormal hive conditions due to suspected pesticide impacts should be immediately reported to the local county agricultural commissioner's office so that important data can be collected about these occurrences. Some specific symptoms to look for include lack of foraging honey bees in a normally attractive blooming crop, lethargic or immobile bees, and excessive numbers of dead bees in front of hives. A full list of signs and symptoms can be found on page 17 of the Honey Bee BMPs.

Even after bees leave almond orchards, almond growers can continue to play a part in protecting honey bee health. Given California's diversity of agricultural products, honey bees often remain a part of the landscape beyond almond bloom by pollinating other crops. Pesticide applicators, particularly those applying insecti-

cides, are encouraged to contact their local county agricultural commissioner year-round to give advance notification to beekeepers with nearby managed hives. According to Dr. Eric Musser, UC Davis Extension apiculturist emeritus, several of the BMP recommendations, including this one, "go far beyond the almond orchard, providing important insights regarding all crops when it comes to promoting honey bee health."

More detailed guidelines on hive removal and honey bee health considerations are available through the BMP guide and related Honey Bee BMP materials online at [Almonds.com/BeeBMPs](http://Almonds.com/BeeBMPs).

*Comments about this article? We want to hear from you. Feel free to email us at [article@jcsmarketinginc.com](mailto:article@jcsmarketinginc.com)*

1. *Growers' Guide for Planting Forage for Honey Bees*, Project Apis m. (2013).

<http://projectapism.org/wp-content/uploads/2013/10/Growers-Guide-for-Planting-Forage-for-HBs.pdf>



Photo Credit: Kathy Coatney

Almonds in bloom.

## Orchard Management Monthly: February

Kathy Coatney  
Editor

### Walnuts

The Crown gall bacterium (*Agrobacterium tumefaciens*) is a soil-borne bacterium, and it can cause significant economic loss to California walnut orchards.

Because the crown gall pathogen is a common soil-borne bacterium, there are several approaches to preventing the disease.

Research suggests:

- Fumigate fields before planting with Telone® C-35, or, in heavily infested crown gall sites, Telone® C-35 followed by chloropicrin
- Limit the time between nursery or cold storage and planting, and keep

- nursery stock cool prior to planting
- Sterilize grafting tools frequently
- Avoid planting too deep and mounding soil around the trunk
- Keep crown of tree as dry as possible

Once *Agrobacterium tumefaciens* is in a field it can survive for at least two years in the orchard soil, and at least one and a half years in non-irrigated fallow soil. Methyl bromide has been phased out, but there are alternative products available that will reduce the disease: Vapam, Telone® C-35, and Telone® C-35 followed by an additional application of chloropicrin.

It is also advised to use “clean” black walnut seeds for Paradox Production. In Paradox production, black walnut seeds are shaken to the ground, and they may lay on the ground for six to 24 hours.

The seeds can become contaminated with crown gall pathogen from the soil. Using a catch frame or tarp to catch the seeds can decrease crown gall on susceptible walnut rootstocks.

The best form of disease control has been the identification and development of disease resistant hosts. Texas black walnuts have shown resistance to crown gall. New Texas crossed with English hybrids are currently being examined under various field conditions. The clonal Paradox rootstock (RX1) has also shown moderate resistance to crown gall.

### Pistachio

Botryosphaeria panicle and shoot blight remains one of the major diseases of pistachios in California. This disease has the highest potential for crop destruction because it kills buds and fruit

clusters (panicles).

Extensive rain in the fall will result in a lot of splash dispersed spores, and then in the spring, infections will occur. Rain in the spring when the pistachios start blooming will create conditions for the blight because rain spreads the spores.

The north state tends to have more problems with the disease because it's wetter, but the disease is seen throughout the state.

Pruning out infected wood and spraying to prevent additional infections is recommended.

In late April, May, and June infected shoots will turn black and the leaves will wilt and dry. Infection of the nut starts on the tip, and it can cause cluster collapse. In orchards with severe botryosphaeria blight there will be dead buds in the fall.

Testing is available. From January to March, randomly collect 200 buds throughout the orchard and have them checked for Botryosphaeria using a bud monitoring technique called BUDMON. Fungicide spray applications also work to control the disease, and there are about 20 fungicides available. Timing of the sprays is important for good control. A fungicide application just before rain is expected, or two or three days after a rain, is the most effective timing.

#### Almonds

Peach twig borer (PTB) populations can increase dramatically and threaten next years crop without dormant insecticide sprays.

Almonds that are rejected because of PTB are costly, making it important to control this insect. Besides kernel damage, PTB feeding kills young buds and shoot tips after bloom.

Dormant sprays of Bacillus thuringiensis (or Bt) are recommended for controlling PTB during bloom. Bt doesn't have harmful side effects to applicators or the environment like other insecticide materials.

Other materials claim to be safe to bees, but they may impact bee colony health. Bt has no impact to any stage of honeybees or the health of the hive. Bt is a natural bacterial based insecticide that is toxic only when ingested by lep-



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Crown Gall in a walnut orchard.

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idopteran larval stage pests. It is completely safe to beneficial predators and parasitoids.

Bt is exempt from pesticide use regulations, and it can be used near urban or environmentally sensitive areas, and it works well in almond IPM programs. The only drawback to Bt is it requires multiple applications for complete control. Bt products are inexpensive, and they can be tank mixed with fungicides applied for blossom and leaf diseases around bloom. The total cost is comparable or less than standard insecticides.

Generally, two sprays are needed during the emergence period of the overwintering PTB worms as they crawl out from under the bark to feed on flowers and developing shoot tips.

In years when flowering and early shoot growth is drawn out, a third application maybe necessary to completely cover the PTB emergence and feeding period.

#### Pecans

The best way to control weed popula-

tions in orchards is by controlling weeds before they set seed. A year with poor weed control can result in a heavy seed set and heavy weed pressure for many years down the road.

Weed management should be considered over a multi-year timeframe and there are several steps that should be taken.

First identify the weed species for accurate selection of both pre- and post-emergent herbicides. Weed populations can change over time so it's important to monitor them twice a year—in the fall to identify summer species that weren't controlled and newly emerged winter species, and then in the late spring to identify winter weeds that weren't controlled.

Timing herbicide applications is as important as picking the right herbicide. Many weeds become difficult to control when they reach a certain size or reproductive stage.

Herbicides need to be applied according to the manufactures recommendation if they are to perform as expected.

Herbicide resistance is another problem, particularly with glypho-

sate(Roundup). Glyphosate has been the go to for post-emergent weed control for years, but heavy reliance on a single mode of action herbicide has led to resistance problems in many orchards.

To help prevent resistance from building consider herbicide rotations, tankmix combinations, sequential treatments, and incorporation of non-chemical strategies to control current resistant populations and minimize future resistance.

Pre-emergent herbicides are a good option. While a pre-emergent herbicides may have a greater initial cost, the residual weed control can often eliminate the need for one or more later spray applications.

The main drawback to pre-emergent herbicides is that they must be incorporated into the top layer of soil where the weed seeds germinate, by rain or irrigation.

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