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**Franz Niederholzer**  
UCCE Farm Advisor  
Sutter, Yuba, Colusa  
Counties

## Focus on honeybees, colony strength, and beekeeper responsibilities

*Joseph Connell, UCCE Farm Advisor Emeritus, Butte County*

Always be aware of honey bees when they're in your orchard to pollinate your crop. After all, you're paying good money for the bees to do a critical job! You can go a long way toward protecting the health of honey bee colonies by avoiding contamination of pollen and pollen foragers and by avoiding products with potential toxicity to honey bees or their larvae while bees are in your orchard. This is good husbandry and it's in the interest of both the grower and the beekeeper.

Lack of blooming pasture while bees wait for almonds to bloom can weaken colonies. Although it's too late to plant a honey bee forage mix that will bloom before almonds this year, if you have an open field, new orchard, ditch banks, field margins, or a neighboring prune or walnut orchard where a winter cover would be beneficial, you might consider planting an early blooming forage mix containing mustard next fall. When planted in late summer or early next fall it may provide flowers ahead of almond bloom in 2018 that can help with honey bee nutrition. Some cover crop seed providers have mixes particularly geared towards almond bloom timing, such as at [goo.gl/JfTJXm](http://goo.gl/JfTJXm).

**What's a good colony?** For almond pollination purposes a good colony is one that has an active brood nest with uncapped worker brood at the start of almond bloom. Bees feed pollen to developing larvae so open brood cells indicate the hive has a demand for pollen. When pollen is in demand in the hive, more pollen foragers are sent into the field to collect pollen (inadvertently cross-pollinating your almonds).

**How much colony strength is needed?** Strong colonies with 6 to 12 frames of bees should be sought. Under adverse weather conditions a 4-frame colony will not field enough workers to do the pollination job required. In a 1970 study on colony size and pollen collection, the 8-frame colony did three times as much pollination work as the 4-frame colony. Beyond about 12 frames of bees, increased colony size does not seem to increase foraging.

**How can colony strength be checked?** Dr. Robin Thorp at UC Davis developed a method that is reasonably accurate and is the least disruptive method so far to check colony strength. Dr. Thorp used cluster size observations to make a rapid honey bee colony strength evaluation. Five years of work comparing cluster observations with intensive frame by frame counts led to this quick evaluation system. A free online training course is available to teach you how to evaluate colony strength; the course may be accessed at [ucanr.edu/sites/Bees\\_and\\_Pollination/](http://ucanr.edu/sites/Bees_and_Pollination/).

**How many colonies per acre?** Our current recommendation is to have between 2 and 3 hives per acre. In orchards studied by researchers at UC Davis, when the weather was poor, orchards having 3 hives per acre had significantly better nut set (24% of blooms) than orchards having only 1.7 hives per acre (14.8% of blooms). On the other hand,

when weather was favorable for bee flight, both orchards had the same percentage set. In orchards with a self-fertile variety there is speculation that fewer colonies will be needed to set an acceptable crop. Some have suggested that 1 hive per acre should be sufficient although I have seen no research data supporting the number of colonies needed for optimum production in self-fertile orchards.

**Like California almond growers, California beekeepers are among the best.** California bee breeding is centered in the counties of Butte, Glenn, Tehama Shasta, Colusa, Yuba, Sutter, Yolo, and Solano. Honey bees overwinter well in California's favorable climate and beekeepers can build up hives in early spring when almonds bloom. Roughly 16 queen breeders produce and ship queen bees to beekeepers nationwide. The Sacramento Valley is responsible for approximately one-half of the nation's honey bee industry.

The Bee Informed Partnership's (beeinformed.org) Bee Team of trained crop protection agents hosted at Butte County's University of California Cooperative Extension office help these beekeepers monitor and improve their honey bee colonies hygienic behavioral trait that correlates with disease resistance. They identify pest presence, pathogen loads, and the optimum treatment timing to alleviate pest and disease problems to enhance colony strength and reduce colony losses.

The most severe pest problems afflicting the honey bee are *Varroa* parasitic mites and the *Nosema* gut fungus disease. These problems along with increasing almond acreage have increased concerns about the quality and availability of bees for almond pollination. Beekeepers treat for *Varroa* parasitic mites but re-infestation by bees drifting from other untreated colonies or from colonies with poorly timed treatments increases the number of treatments needed. This contributes to the development of resistance and to the loss of effective treatment materials. Foulbrood, a bacterial disease, can be treated and controlled with antibiotics but beekeepers need a recommendation and a prescription from a Veterinarian to be able to purchase antibiotics from a supplier.

**What's a beekeeper's responsibility?** California Food and Agriculture Code require that all beekeepers, apiary owners, apiary operators or any person in possession of any apiary *must register their apiary* with the Agricultural Commissioner's Office annually. To help reduce theft, an *Apiary Brand Number* can be registered with the California Department of Food and Agriculture and used on all equipment.

California Code of Regulations Section 6655 designates the procedures to help protect bees from pesticide applications. In Glenn, Butte & Tehama Counties, the Tri County Bee Notification service (530-934-6666) can be used to notify beekeepers and apiary owners of potential pesticide applications near hives. In the remaining Sacramento Valley counties, beekeepers who desire advance notifications of applications should contact their Agricultural Commissioner office. You can help ensure the safety of bees by properly notifying your Agricultural Commissioner 48-hours prior to pesticide applications so that beekeepers can be notified and take protective action if necessary.

**Are you and your beekeeper doing all you can to strengthen and protect bees?** Plan ahead to make sure you have bees for pollination. You and your beekeeper should settle on a written contract so both parties know what is expected. For the best bee health and successful crop pollination it's important that all beekeepers and almond growers talk to one another and work together for everyone's benefit.



### **Protecting honeybees during bloom**

*Emily J. Symmes, UCCE Sacramento Valley IPM Advisor*

With almond bloom on the horizon, it is time to revisit best management practices for protecting pollinators 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:

- Employ sound IPM practices:
  - 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.
- Always provide adequate clean water for bees:
  - 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.
- Agree on proper hive removal timing:
  - 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: <http://www.ipm.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: <http://www.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 [ipm.ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf](http://ipm.ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf)
- Know the impacts of particular fungicides on honey bees and choose materials accordingly.

- The University of California IPM Program has published a new online resource, “Bee Precaution Pesticide Ratings.” [www2.ipm.ucanr.edu/beeprecaution/](http://www2.ipm.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:

- [www.almonds.com/growers/pollination#tc-honey-bee-protection-and-links-therein](http://www.almonds.com/growers/pollination#tc-honey-bee-protection-and-links-therein)
- [www.almonds.com/growers/pollination#tc-BeeBMPs](http://www.almonds.com/growers/pollination#tc-BeeBMPs)
- [www2.ipm.ucanr.edu/beeprecaution/](http://www2.ipm.ucanr.edu/beeprecaution/)



### **When to apply the first irrigation?**

*Franz Niederholzer, UCCE Farm Advisor, Colusa and Sutter/Yuba Counties*

Wet soils for extended periods after leaf out can result in yellow trees due to a cold root zone and low soil oxygen levels. Spring rains can be responsible for wet soils and yellow leaves; that can't be avoided. However, irrigation - before it's needed- also causes this problem and should be managed to keep root systems (and the crop they support) as healthy as possible.

Timing of first irrigation of the year is an important early season decision in almond production. If irrigation is delayed too long and trees become water stressed, spur and shoot growth along with current and future yield may be reduced. If water goes on too soon in the season, before trees use much water, early irrigation can harm orchard health, as saturated soil conditions can be followed by root/crown *Phytophthora* infection and/or oxygen-starved roots. Roots systems stressed by early season saturated soil conditions may not be healthy enough to deliver the water necessary to meet tree needs in the summer. In addition, saturated soils are less warm than well-drained soils and this

reduces nutrient availability and/or the rate of nutrient absorption by roots. Locally-variable spring rains can complicate irrigation planning, so timing of first irrigation requires careful attention.

The short answer is to irrigate when net soil water depletion is equal to the amount of water delivered in your first irrigation set or, put another way...

Total, season-to-date orchard water use (ET) - Rainfall = Water delivered in first irrigation set

The timing of first irrigation varies from year to year depending on leaf-out date and weather conditions, including rainfall, so don't use a calendar to time first irrigation. For the best possible timing for first irrigation, you need to know the following:

- How much plant available water will your soil hold after rainfall or irrigation? Ballpark estimates of this number can be found in the NRCS soil survey for your county or online. Ask your local UCCE Farm Advisor for advice on how to use this valuable publication. Look in the table containing "physical properties" (sometimes labeled "engineering properties") to find the "Available water holding capacity" of the soil. If you are using the interactive version of the NRCS maps through <https://casoilresource.lawr.ucdavis.edu/gmap/> or GoogleEarth, click on the soil series name, then look under "Hydraulic and Erosion Ratings" to find total plant available water (cm)". [See image at the end of this article.] The SoilWeb app for iPhone (available free from the App Store) also provides plant available water data.
- How much water are the trees using? Estimates of water use by tree crops in the Sacramento Valley are available at <http://www.sacvalleyorchards.com/et-reports/>. Water use is measured as acre inches of Evapotranspiration (ET) for mature trees. Water use by young trees can be estimated from canopy volume; see the publication "Irrigating Young Trees" available at <http://cesutter.ucanr.edu/files/102712.pdf> or from your local UCCE office.
- How much water do you apply per hour or per set? If you are using a pressurized system – drip, micro-sprinkler, or impact sprinklers – the company that put in the system should have this information. You could also measure output in the field.

Here's an example of how the information listed above fits together. Suppose:

- Your orchard soil holds 5" of plant available water in the root zone (0.14" per inch of soil with a 36" deep root zone);
- Your irrigation system puts 2" of water in the soil (accounting for system efficiency\*) per set; and;
- It rained 0.5" after the trees had used 1" of moisture from the soil.

Put on your first irrigation after the orchard has used 2.5" of water (using the equation above: 2.5" of ET- 0.5" rainfall = 2.0" water delivered in irrigation set). The orchard soil has lost a NET of 2.0" of water, the same amount of water delivered with irrigation set. If you are using a micro-sprinkler system with 85% efficiency, apply 2.35 inches of water to deliver 2.0 inches to the soil profile. If you are using flood irrigation, your first irrigation should go on when plant available moisture in the rootzone is 50% depleted.

If spring weather is wet, consider applying a dry nitrogen (N) fertilizer in the herbicide strip ahead of forecast rain instead of fertigating. The rain will dissolve the fertilizer and move the N into the soil. This practice delivers N to the root zone without adding more water to saturated or near saturated soil. If using a fertilizer containing ammonium and/or urea, apply it as close to the start of rainfall as possible to avoid nitrogen loss by ammonia volatilization. An ammonium-only N source (for example, ammonium sulfate) will move the shortest distance into the soil from the soil surface (leach the least) with the rain (or irrigation) water that moves it into the soil compared to urea or nitrate.

\*General guidelines for irrigation system efficiency (from Alan Fulton, UCCE Water Advisor): 80-95% efficiency for drip irrigation; 80-90% efficiency for micro-sprinkler irrigation; 70-85% efficiency for sprinkler irrigation.

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Here is an example of where to find plant available water data – at the tip of the red arrow in this image -- on the CA Soil Resource website: [casoilresource/lawr.ucdavis.edu/gmap](https://casoilresource.lawr.ucdavis.edu/gmap) 2.54 cm = 1”

The screenshot shows a web browser window with the URL <https://casoilresource.lawr.ucdavis.edu/gmap/>. The page displays information for the soil unit **Tehama silt loam, 0 to 3 percent slopes, MLRA 17** (Symbol: Tm). Under the **Soil Profiles** section, a vertical profile diagram shows horizons Ap, A, At1, Bt2, and 2Bt with depths from 0 cm to 152 cm. To the right of the profile is an aerial map with a yellow line and a red arrow pointing to the 'Total Plant Available Water (cm): 28.05' value in the 'Hydraulic and Erosion Ratings' section.

**Map Unit Name:** Tehama silt loam, 0 to 3 percent slopes, MLRA 17  
**Symbol:** Tm  
**Component Name:** Tehama  
**Component Key:** 12039514

[Soil Data Explorer](#) | [Series Extent Explorer](#)  
[Official Series Description](#)

**Soil Profiles**

Typical Profile >

Org. Matter | Clay  
Sand | Ksat  
pH | Kf Factor  
EC | SAR  
CaCO<sub>3</sub> | Gypsum  
CEC @ pH7  
Linear Ext.

Soil Profile Diagram:  
Horizon Ap: 0 cm  
Horizon A: 20 cm  
Horizon At1: 48 cm  
Horizon Bt2: 107 cm  
Horizon 2Bt: 127 cm  
Total Depth: 152 cm

**Soil Taxonomy**  
**Land Classification**

**Hydraulic and Erosion Ratings**

Wind Erodibility Group: 6 ?  
Wind Erodibility Index: 48 ?  
T Erosion Factor: 5 ?  
Runoff: High  
Drainage: Well drained  
Hydric Rating: No ?  
Hydrologic Group: Group C ?  
Parent Material: fine-silty alluvium derived from metamorphic and sedimentary rocks  
**Total Plant Available Water (cm): 28.05**

**Soil Suitability Ratings**

Waste Related | Engineering | Irrigation  
Urban/Recreational | Wildlife | Runoff

2017 UCCE Almond Meetings		
Date & Time	Meeting	Location
January 19, 7:30am-1:00pm	Butte & Glenn County Almond and Walnut Day (in conjunction with the North Valley Nut Conference)	Silver Dollar Fairgrounds, 2357 Fair Street, Chico
February 7, 8:00am-12:00pm	Sacramento-Solano-Yolo Almond Meeting	Norton Hall, 70 Cottonwood St, Woodland
February 8, 8:00am-12:00pm	Colusa County Almond Day (held during the Colusa County Farm Show)	Stagehand Theater, Colusa County Fairgrounds

For a list of all other orchard related UCCE Meetings, see the event calendar at [www.sacvalleyorchards.com/events](http://www.sacvalleyorchards.com/events)



**Sacramento Valley Orchard Source**  
*Your source for orchard news & information in the Sacramento valley*



HOME BLOG WALNUT ALMOND PRUNE ET REPORTS PEST REPORTS EVENTS ABOUT US OTHER RESOURCES 🔍

Remember to visit us at the Sac Valley Orchard Source for up-to-date news, articles, and events!

Featuring:

- Event calendar with all orchard related CE meetings throughout the Sacramento Valley
- Newsletter articles with extra photos & resources
- Timely posts responding to current events such as frost events or pest outbreaks
- Weekly irrigation and pest reports during the growing season

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### Upcoming Events

**Jan 19** [Butte & Glenn County Almond and Walnut Day in conjunction with North Valley Nut Conference](#)  
January 19, 2017

**Jan 20** [Tehama County Walnut Meeting](#)  
January 20, 2017

**Feb 07** [Sacramento-Solano-Yolo Almond Meeting](#)  
February 07, 2017

VIEW FULL EVENTS LIST



**Save the Date! Nickels Field Day**

The Nickels Field Day will be Wednesday, May 10 on the Green Bay Road (Arbuckle) location. This site includes all the Nickels walnut plantings as well as irrigation and canker management trials. Agenda will be developed after bloom and circulated in the next almond newsletter, but save the date – **May 10.**

## Colusa/Sutter/Yuba Winter Almond Meeting

**When:** February 8, 2017

**Where:** Stagehands Theatre; Colusa County Fairgrounds, Colusa, CA

**2 hours** of PCA CE and **3 hours** of CCA CE *requested*

Thanks to: Farm Credit Services of Colusa-Glenn, ACA for coffee and donuts

**8:15 Sign-in**

**8:30 Cost saving options for farming w/ lower nut prices.**

*Franz Niederholzer, UCCE Farm Advisor, Colusa, Sutter and Yuba Counties*

**9:00 Almond production in Australia: What's up Down Under?**

*Blake Sanden, UCCE Soil/Water Advisor, Kern Co.*

**9:45 Orchard removal/incorporation studies**

*Brent Holtz, UCCE Farm Advisor and County Director, San Joaquin Co.*

**10:15 Break**

**10:30 Almond Board update**

*Gabriele Ludwig, Director of Sustainability & Env. Affairs, Almond Board of CA*

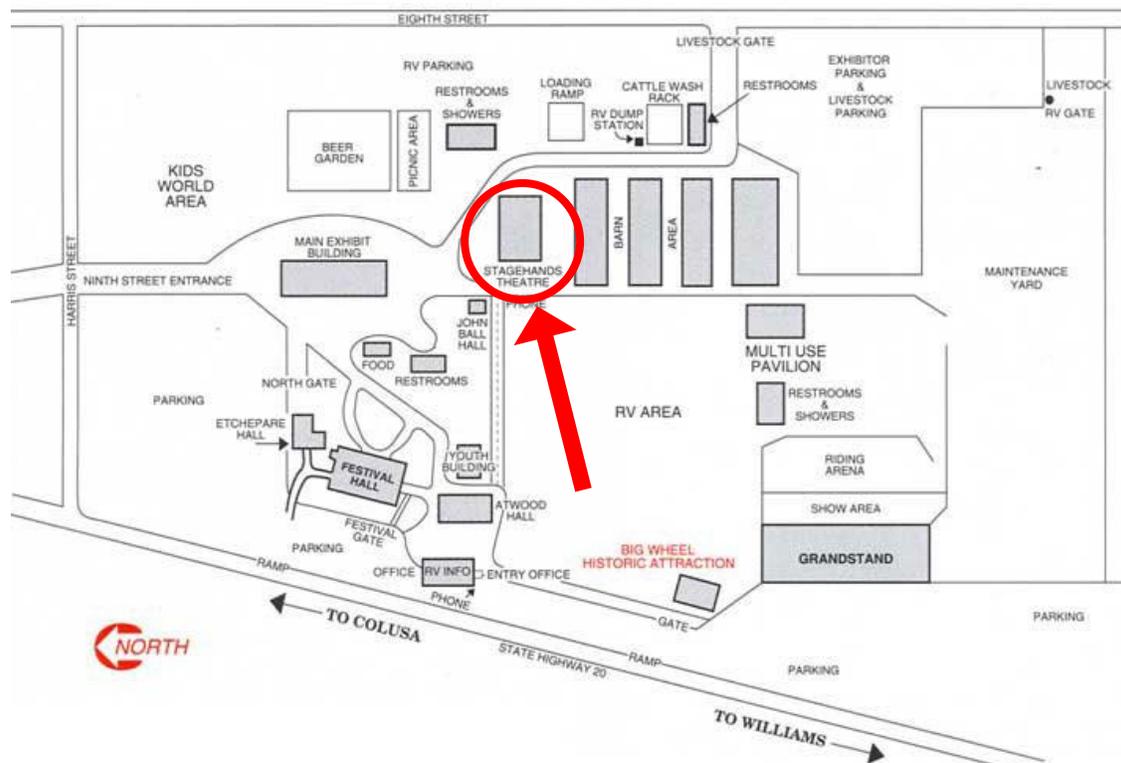
**11:00 Laws and Regulations Update**

*Colusa County Ag Commissioner's office*

**11:30 Spring/summer diseases of almond**

*Dr. Jim Adaskeveg, Professor, Dept. of Plant Pathology & Microbiology, UCR*

**12:15 Adjourn**



Location of the Stagehands Theatre on the Colusa Fair Grounds, site of the 2017 Colusa/Sutter/Yuba Almond Growers Meeting on Wednesday, February 8. Registration is at 8:15 AM.

### **Almond orchards sought for flower microbe survey**

The labs of Drs. [Rachel Vannette](#) and [Neal Williams](#) at UC-Davis (Department of Entomology and Nematology) are seeking almond orchards for participation in a research project. We aim to characterize the diversity of microbes that colonize almond flowers throughout bloom. Our goals are to 1) understand whether such diversity could be leveraged for sustainable protection against diseases such as blossom brown rot and 2) to assess the influence of flower microbes on pollinators (which are sensitive to microbes) and the pollination they provide. During this survey, researchers from our labs would visit your orchard and collect flowers, as well as observe pollinators for a short period of time. Upon completion of the survey, we will provide growers with a report highlighting findings on microbial diversity for their particular orchard. If interested and willing to let us have access your orchard during the busy bloom season, please contact Dr. Robert Schaeffer, a postdoctoral researcher that will be leading this effort. He can be reached by e-mail at [schaeffer.robert@gmail.com](mailto:schaeffer.robert@gmail.com). Thank you for your consideration.



### **SWEEP Grant Recipient Irrigation Training**

Recipients of grant funding from the State Water Efficiency and Enhancement Program (SWEEP) by the California Department of Food and Agriculture (CDFA) are encouraged to attend the SWEEP Grant Recipient Irrigation Training and develop the foundation to make efficient irrigation decisions. The session will cover the use of evapotranspiration for scheduling irrigation, the importance of distribution uniformity and how it's performed, as well as how to implement real time soil moisture sensing in making irrigation management decisions.

In addition to SWEEP grant recipients, the training is open to any interested almond growers and allied industry members serving them.

**The training is from 9 to 11:30 a.m. on Feb. 20, at Granzella's Banquet Hall in Williams and includes a complementary lunch.**

Speakers include:

- ET Scheduling - Allan Fulton, UC Extension
- Distribution Uniformity - Kevin Greer, Tehema RCD
- Understanding Capacitance Soil Moisture Sensors - Bryan Fontes, Sentek Industries
- Spencer Cooper, Almond Board of California

Please RSVP to Spencer Cooper at [scooper@almondboard.com](mailto:scooper@almondboard.com) by **February 14, 2017**.



### **Winter & Bloom Almond Orchard Management Considerations**

*Katherine Pope, UCCE Farm Advisor, Sacramento, Solano and Yolo Counties  
Dani Lightle, UCCE Farm Advisor, Glenn, Butte, & Tehama Cos.*

#### **JANUARY**

*Remove mummy nuts no later than February 1.* To minimize the over-wintering population of navel orangeworm (NOW) and reduce early generation development sites, sanitation should be completed in January. For more, see [www.sacvalleyorchards.com/almonds/insects-mites/orchard-sanitation-for-navel-orangeworm-control-2/](http://www.sacvalleyorchards.com/almonds/insects-mites/orchard-sanitation-for-navel-orangeworm-control-2/).

*Avoid pruning prior to heavy rainfall* since wind driven rain can result in costly canker disease spread and infection of fresh pruning wounds. Minimizing training and pruning can increase early almond yields. For a video on UC almond pruning research and how-to's, see <https://youtu.be/ldl68pNOydg>.

*Conduct dormant spur sampling for scale and mite eggs* before mid-January, if you didn't get to it in December. Dormant spur sampling guidelines: <http://ipm.ucanr.edu/PMG/r3900211.html>

## FEBRUARY

Consider honeybee health and safety for any disease control measures taken during bloom. For bee BMPs, see Protecting Honey Bees During Bloom (*this newsletter*):

If peach twig borer (PTB) was a problem in last year's harvest, B.t. sprays will provide control with minimal impact on honeybees. This is the only acceptable insecticide for bloom-time application for any insect pest. Thresholds and treatment timings are available here: [ipm.ucdavis.edu/PMG/r3300211.html](http://ipm.ucdavis.edu/PMG/r3300211.html)

Anthracnose management should be considered beginning with bloom if weather is warm and rainy when there is a previous history of this disease. Photos and management guidelines are here: [ipm.ucdavis.edu/PMG/r3101111.html](http://ipm.ucdavis.edu/PMG/r3101111.html)

Brown rot occurs with warm rainy weather. Flowers are susceptible from pink bud until petal fall, but most susceptible when fully open. Management differs depending on rainfall. Guidelines are available here: [ipm.ucdavis.edu/PMG/r3100111.html](http://ipm.ucdavis.edu/PMG/r3100111.html)

Extended wet, cool weather during full bloom into petal fall can lead to *green fruit rot*. If these conditions are forecast, select fungicide(s) for full bloom application that controls this problem (caused by up to three organisms). Note: FRAC Group 3 fungicides do not provide good, consistent control of green fruit rot. See details and photos at: <http://www.ucipm.ucdavis.edu/PMG/r3101711.html>.

If shot-hole fruiting bodies were found in the orchard in fall 2016, select a fungicide with shot-hole activity for a petal fall 2017 application. If no fruiting bodies were found in the orchard last fall, there is no need to spray for shot-hole unless disease symptoms (fruiting bodies) are found on new leaves after bloom. More info on shot hole is available online: <http://ipm.ucanr.edu/PMG/r3100211.html>

If scab or rust was a problem last season monitoring should begin about two weeks after petal fall. Overwintering scab twig lesions typically begin to sporulate in April. If subsequent rain is expected, initiate control. Control measures can be found at the following links. Scab: [ipm.ucdavis.edu/PMG/r3100411.html](http://ipm.ucdavis.edu/PMG/r3100411.html); Rust: [ipm.ucdavis.edu/PMG/r3100711.html](http://ipm.ucdavis.edu/PMG/r3100711.html)

Hang *San Jose Scale* pheromone traps during the last week of February.

*Remove or mow weeds and cover crops before bloom to aid in frost protection.*

## MARCH

Hang navel orangeworm (NOW) egg, peach twig borer (PTB) pheromone and NOW pheromone traps by March 15. NOW Egg Trap How-To at <http://ipm.ucanr.edu/PMG/C003/m003bcegtrapsnvl.html>. PTB and SJS pheromone trap info at <http://ipm.ucanr.edu/PMG/C003/m003bcphrmontrap.html>.

Start planning your nitrogen budget for the upcoming season. An initial estimate of nitrogen needs can be based on an average crop year for your almond block. Nitrogen management tools based on UC research are available at [www.sustainablealmondgrowing.org](http://www.sustainablealmondgrowing.org). Approximately 20% of the year's predicted nitrogen needs should be applied in late February or March.

**ANR NONDISCRIMINATION AND AFFIRMATIVE ACTION POLICY STATEMENT FOR UNIVERSITY OF CALIFORNIA. May, 2015.** It is the policy of the University of California (UC) and the UC Division of Agriculture & Natural Resources not to engage in discrimination against or harassment of any person in any of its programs or activities (Complete nondiscrimination policy statement can be found at <http://ucanr.edu/sites/anrstaff/files/215244.pdf> ). Inquiries regarding ANR's nondiscrimination policies may be directed to Linda Marie Manton, Affirmative Action Contact, University of California, Agriculture and Natural Resources, 2801 Second Street, Davis, CA 95618, (530) 750-1318.

**ALMOND: FUNGICIDE EFFICACY**

Fungicide	Resistance risk (FRAC) <sup>1</sup>	Brown rot	Jacket rot	Anthrax -nose	Shot hole	Scab <sup>3</sup>	Rust <sup>3</sup>	Leaf blight	Alternaria leaf spot <sup>3</sup>	PM-like <sup>5</sup>	Hull rot <sup>16</sup>
Bumper/Tilt/Propicure/Propiconazole <sup>4</sup>	high (3)	++++	+/-	++++	++	++	+++	ND	++	+++	++
Indar	high (3)	++++	+/-	+++	++	++	NL	ND	+	ND	---
Inspire Super <sup>4</sup>	high (3/9)	++++	++++	ND	+++	+++	+++	ND	+++	ND	+++
Luna Sensation	medium (7/11) <sup>3,7</sup>	++++	++++	++++	++++	++++	++++	ND	++++	+++	+++
Pristine	medium (7/11) <sup>3,7</sup>	++++	++++	++++	++++	++++	+++	ND	+++	+++	+++
Merivon	medium (7/11) <sup>3,7</sup>	++++	++++	++++	++++	++++	+++	ND	++++	++++	+++
Quash <sup>4</sup>	high (3)	++++	++	++++	+++	+++	++++	ND	++++	+++	+++
Luna Experience	medium (3/7) <sup>3</sup>	++++	+++	++++	+++	++++	++++	ND	++++	+++	+++
Quadris Top	medium (3/11) <sup>3</sup>	++++	+++	++++	+++	++++	++++	ND	+++	+++	+++
Quilt Xcel	medium (3/11) <sup>3</sup>	++++	+++	++++	+++	++++	++++	ND	+++	+++	+++
Rovral + oil <sup>8</sup>	low (2)	++++	++++	---	+++	+/-	++	ND	+++ <sup>9</sup>	ND	---
Scala <sup>3</sup>	high (9) <sup>3,7</sup>	++++	++++	ND	++	---	ND	ND	+	---	---
Tebucon/Toledo (Elite**/Tebuzol**)	high (3)	++++	+/-	+++	++	++	+++	ND	+	ND	++
Viathon	Medium (3/33)	++++	+/-	+++	++	++	+++	ND	+	ND	++
Topsin-M/T-Methyl/Incognito <sup>2</sup>	high (1) <sup>2,7</sup>	++++	++++	---	---	+++ <sup>8</sup>	+	+++ <sup>6</sup>	---	++	---
Vanguard	high (9) <sup>3,7</sup>	++++	++++	ND	++	---	ND	ND	+ <sup>9</sup>	---	---
Fontelis	high (7) <sup>4</sup>	++++	++++	++	++++	+++	+++	ND	+++	ND	---
About <sup>4</sup>	high (11) <sup>3,7</sup>	+++	---	++++	+++	++++	++++	+++	+++ <sup>10</sup>	+++	+++
Elevate	high (17) <sup>7</sup>	+++	++++	---	+	ND	ND	ND	ND	ND	---
Protexio	high (17) <sup>7</sup>	+++	++++	---	+	ND	ND	ND	ND	ND	---
Gem <sup>4</sup>	high (11) <sup>3,7</sup>	+++	---	++++	+++	++++	++++	+++	+++ <sup>10</sup>	+++	+++
Laredo	high (3)	+++	---	++	++	---	+	+++	---	+++	---
Rovral/Prodione /Nevado	low (2)	+++	+++	---	+++	---	---	ND	+++ <sup>9</sup>	---	---
Rhyme*	high (3)	+++	+/-	ND	+	++	ND	ND	++	ND	ND
Bravo/Chloro-thalonil/Echo /Equus <sup>11,12</sup>	low (M5)	++	NL	+++	+++	+++ <sup>15</sup>	++++	NL	NL	---	---
Captan <sup>4,12</sup>	low (M4)	++	++	+++	+++	++	---	+++ <sup>6</sup>	+	---	---
CaptEvate*	low (M4/17)	+++	+++	+++	+++	+++	---	+++	+	---	---
Ph-D	medium (19)	++	+++	---	++	+++	+++	ND	++++	ND	++
Syllit	Medium (U12)	+	---	ND	+++	++++	ND	ND	+	ND	---
Rally <sup>13</sup>	high (3)	+++	---	++	+/-	---	+	+++	---	+++	---
Ziram	low (M3)	++	+	+++	+++	+++	---	++	+	---	---
Copper <sup>14</sup>	low (M1)	+/-	+/-	---	+	+ <sup>15</sup>	---	---	ND	---	---
Copper + oil <sup>14</sup>	low (M1)	ND	ND	---	+	+++ <sup>15</sup>	---	---	ND	---	---
Lime sulfur <sup>12</sup>	low (M2)	+/-	NL	---	+/-	+ <sup>15</sup>	++	NL	NL	---	---
Sulfur <sup>4,12</sup>	low (M2)	+/-	+/-	---	---	---	++	---	---	+++	---
Fracture	low	++	+	---	---	---	---	---	---	---	---
PlantShield***	low	---	---	---	---	---	---	---	---	---	---

**Rating:** ++++ = excellent and consistent, +++ = good and reliable, ++ = moderate and variable, + = limited and/or erratic, +/- = minimal and often ineffective, --- = ineffective, NL = not on label, and ND = no data

\* Registration pending in California.

\*\*Not registered, label withdrawn or inactive in California.

\*\*\* Section 24C (special local needs) registration approved in California for silver leaf disease of almond.

<sup>1</sup> Group numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see <http://www.frac.info/>). Fungicides with a different group number are suitable to alternate in a resistance management program. In California, make no more than one application of fungicides with mode-of-action Group numbers 1, 4, 9, 11, or 17 before rotating to a fungicide with a different mode-of-action Group number; for fungicides with other Group numbers, make no more than two consecutive applications before rotating to fungicide with a different mode-of-action Group number.

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*Almond: Fungicide Efficacy, continued*

- <sup>2</sup> Strains of the brown rot fungi *Monilinia laxa* and *M. fruticola* resistant to Topsin-M and T-Methyl have been found in some California almond orchards. MBC-resistant strains of the jacket rot fungus, *Botrytis cinerea* and powdery mildew fungi, have been reported in California on crops other than almond and stone fruits and may have the potential to develop in almonds with overuse of fungicides with similar chemistry. MBC-resistant strains of the scab fungus, *Cladosporium carpophilum*, have been found in California.
- <sup>3</sup> Field resistance of *Alternaria* sp. and *Cladosporium carpophilum* to QoI and SDHI fungicides has been detected in almond orchards. AP-resistant populations of *Monilinia* spp. have been found on other stone fruit crops in California.
- <sup>4</sup> Of the materials listed, only sulfur, Abound, Gem, and some of the DMI fungicides (FRAC Group No. 3) are registered for use in late spring and early summer when treatment is recommended.
- <sup>5</sup> PM-like refers to a powdery mildew-like disease on almond fruit that is managed with fungicides. Recent information suggests an *Acremonium* species is involved.
- <sup>6</sup> Excellent control obtained when combinations of Topsin-M or T-Methyl and Captan are used.
- <sup>7</sup> To reduce the risk of resistance development, start treatments with a fungicide with a multi-site mode of action; rotate or mix fungicides with different mode of action FRAC numbers for subsequent applications, use labeled rates (preferably the upper range), and limit the total number of applications/season.
- <sup>8</sup> Oils recommended include "light" summer oil, 1-2% volume/volume.
- <sup>9</sup> Not registered for use later than 5 weeks after petal fall.
- <sup>10</sup> Efficacy reduced at high temperatures and relative humidity; experimental for *Alternaria*.
- <sup>11</sup> Bravo Ultrex, Bravo WeatherStik, Echo, Echo Ultimate, and Chlorothalonil are currently registered.
- <sup>12</sup> Do not use in combination with or shortly before or after oil treatment.
- <sup>13</sup> Efficacy is better in concentrate (80-100 gal/acre) than in dilute sprays.
- <sup>14</sup> The low rates necessary to avoid phytotoxicity in spring reduce the efficacy of copper.
- <sup>15</sup> "Burns out" scab twig lesions when applied at delayed dormant. (Chlorothalonil can be applied with dormant oil during tree dormancy).
- <sup>16</sup> Hull rot ratings are for the disease caused by *Rhizopus stolonifer*. Ratings for the disease caused by *Monilinia* spp. will be provided in the future.

**ALMOND: TREATMENT TIMING**

**Note: Not all indicated timings may be necessary for disease control.**

Disease	Dormant	Bloom			Spring <sup>1</sup>		Summer	
		Pink bud	Full bloom	Petal fall	2 weeks	5 weeks	May	June
Alternaria	----	----	----	----	----	++	+++	+++
Anthracnose <sup>2</sup>	----	++	+++	+++	+++	+++	+++	++
Bacterial spot	+	'----	+	++	+++	+++	+	'----
Brown rot	----	++	+++	+	----	----	----	----
Green fruit rot	----	----	+++	++	----	----	----	----
Hull rot <sup>7</sup>	—	—	—	—	—	—	—	+++
Leaf blight	----	----	+++	++	+	----	----	----
Scab <sup>3</sup>	++	---	---	++	+++	+++	+	---
Shot hole <sup>4</sup>	+ <sup>5</sup>	+	++	+++	+++	++	----	----
Rust	----	----	----	----	----	+++	+++	+ <sup>6</sup>

**Rating:** +++ = most effective, ++ = moderately effective, + = least effective, and ---- = ineffective

- <sup>1</sup> Two and five weeks after petal fall are general timings to represent early postbloom and the latest time that most fungicides can be applied. The exact timing is not critical but depends on the occurrence of rainfall.
- <sup>2</sup> If anthracnose was damaging in previous years and temperatures are moderate (63°F or higher) during bloom, make the first application at pink bud. Otherwise treatment can begin at or shortly after petal fall. In all cases, application should be repeated at 7- to 10-day intervals when rains occur during periods of moderate temperatures. Treatment should, if possible, precede any late spring and early summer rains. Rotate fungicides, using different fungicide classes, as a resistance management strategy.
- <sup>3</sup> Early treatments (during bloom) have minimal effect on scab; the 5-week treatment usually is most effective. Treatments after 5 weeks are useful in northern areas where late spring and early summer rains occur. Dormant treatment with liquid lime sulfur improves efficacy of spring control programs.
- <sup>4</sup> If pathogen spores were found during fall leaf monitoring, apply a shot hole fungicide during bloom, preferably at petal fall or when young leaves first appear. Re-apply when spores are found on new leaves or if heavy, persistent spring rains occur. If pathogen spores were not present the previous fall, shot hole control may be delayed until spores are seen on new leaves in spring.
- <sup>5</sup> Dormant copper treatment seldom reduces shot hole infection but may be useful in severely affected orchards and must be followed by a good spring program.
- <sup>6</sup> Treatment in June is important only if late spring and early summer rains occur.
- <sup>7</sup> Make application at 1-5% hull split to manage hull rot caused by *Rhizopus stolonifer*.

**ALMOND: SUGGESTED DISEASE MANAGEMENT PROGRAMS BY FUNGICIDE FRAC<sup>1</sup> GROUPS**

**Note:** Not all indicated timings may be necessary for disease control (*see Treatment Timing Table*). If treatments are needed based on host phenology, weather monitoring, inoculum models, or environmental-disease forecasting models, suggested fungicide groups are listed for each timing.

How to use this table:

- 1) Identify the disease(s) that need(s) to be managed. Know the disease history of the orchard, especially from the previous season.
- 2) Select one of the suggested fungicide groups. *Numbers separated by slashes are pre-mixtures, whereas numbers grouped by pluses are tank mixtures.* If several diseases need to be managed, select a group that is effective against all diseases. Refer to the fungicide efficacy table for fungicides belonging to each FRAC group. Group numbers are listed in numerical order within the suggested disease management program.
- 3) Rotate groups for each application within a season and, if possible, use each group only once per season, except for multi-site mode-of-action materials (e.g., M2) or natural products/biological controls (NP/BC).

Disease	Dormant	Bloom			Spring		Summer	
		Pink bud	Full bloom	Petal fall	2 weeks	5 weeks	May	June
Alternaria	----	----	----	----	----	2	3, 7, 3/9, 3/7, 3/11, 7/11	3, 7, 3/7, 3/9, 3/11, 7/11
Anthracnose	----	3, 7, 3/7, 3/9, 3/11	3, 7, 3/7, 3/9, 3/11 7/11 11	3, 3/9, 3/7, 3/11 11 M3 M4	3, 7, 3/9, 3/11, 3/7 7/11 11 M3 M4	3, 7, 3/7, 3/9, 3/11 7/11 11 M3 M4	3, 7, 3/7, 3/9, 3/11 7/11 11 M3 M4	3, 7, 3/7, 3/9, 3/11 7/11 11 M3 M4
Brown rot	----	1 <sup>2</sup> 2 (+oil) 3, 3/7, 3/9, 3/11 9	1 <sup>2</sup> 2 (+oil) 3, 7, 3/9, 3/11, 9 3/7, 7/11 11, 19	1 <sup>2</sup> 2 (+oil) 7, 9, 3/11 7/11, 19	----	----	----	----
Green fruit rot	----	----	1 <sup>2</sup> 2 (+oil) 3/7, 3/9, 7, 9 3/11, 7/11, 19	1 <sup>2</sup> 2 (+oil) 3/7, 3/9, 7, 9 3/11, 7/11, 19	----	----	----	----
Leaf blight	----	----	1 <sup>2</sup> 2 3, 3/7, 3/9, 3/11 11	1 <sup>2</sup> 2 3, 3/7, 3/9, 3/11 11 M3 M4	3, 3/7, 3/9, 3/11 11 M3 M4	----	----	----
Scab <sup>4</sup>	M1+oil, M2 <sup>3</sup>	----	----	1 <sup>2</sup> , 3/7, 3/9, 7, 7/11 <sup>2</sup> 3/11, 11 <sup>2</sup> M3 M4, M5	1 <sup>2</sup> , 3/7, 3/9, 7, 7/11 <sup>2</sup> 3/11, 11 <sup>2</sup> M3 M4, M5	3, 3/7, 3/9, 3/11 7, 7/11 <sup>2</sup> , 3/11, 11 <sup>2</sup> M2 <sup>3</sup> M3, M4	M2 <sup>3</sup> M4	----
Shot hole	M1	2 3, 3/7, 3/9, 3/11, 7, 9, 11	2 3, 3/7, 3/9, 3/11 7, 7/11 9, 11, 19	2 3, 3/7, 3/9, 3/11 7, 7/11 9 11,19	7, 7/11 11, 19 3/11 M3 M4 M5	7, 7/11 11, 19 M3 M4 M5	----	----

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*Almond: Suggested Disease Management Programs, continued*

Disease	Dormant	Bloom			Spring		Summer	
		Pink bud	Full bloom	Petal fall	2 weeks	5 weeks	May	June
Bacterial spot	M1, M1+M3	----	M1, M1+M3	M1, M1+M3	M1, M1+M3	M1, M1+M3	M1	'----
Rust	----	----	----	----	----	3, 7, 3/7, 3/11 7/11 11, 19 M3	3, 7, 3/7, 3/11 7/11 11, 19	3, 7, 3/7, 3/11 7/11 11, 19

<sup>1</sup> Group numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see <http://www.frac.info/>). Group numbers are listed in numerical order within the suggested disease management program. Fungicides with a different group number are suitable to alternate in a resistance management program. Refer to the fungicide efficacy table for fungicides belonging to each FRAC group.

<sup>2</sup> Strains of *Monilinia fructicola* and *M. laxa* resistant to Topsin-M, and T-Methyl are present in some California almond orchards. Resistant strains of the jacket rot fungus, *Botrytis cinerea*, and powdery mildew fungi have been reported in California on crops other than almond and stone fruits and may have the potential to develop in almond with overuse of fungicides with similar chemistry.

<sup>3</sup> Use liquid lime sulfur in dormant applications and wettable sulfur at and after pre-bloom.

<sup>4</sup> Apply petal fall treatments based on twig-infection sporulation model.