UC CE UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources Cooperative Extension

# Sacramento Valley Almond News

Pre-Harvest, 2023

## In This Issue



Submitted by:

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## Pre- & Post-Harvest Almond Orchard Management Considerations

*Franz Niederholzer, UCCE Orchard Advisor, Colusa, Sutter and Yuba Cos.*
*Adela Contreras, UCCE SRA, South Sacramento Valley*
*Katherine Jarvis-Shean, UCCE Orchard Advisor Yolo, Solano, & Sacramento Cos.*
*Luke Milliron, UCCE Orchard Advisor, Butte, Glenn, and Tehama Cos.*

**ALL SUMMER**

- **Valley smoke:** Wildfire smoke blocks sunlight from reaching the ground and increases relative humidity. Consult with your PCA/CCA to plan to head off possible trouble this summer due to wildfire smoke. Possible problems for almond growing include personal safety for anyone working outside without an N95 mask, increased risk of hull rot due to a higher relative humidity, and slower nut drying on the orchard floor (increased ant feeding and more orchard water stress due to delayed nut pickup).

**JULY**

- **Navel Orangeworm (NOW) & Peach Twig Borer (PTB):** Continue monitoring for NOW and PTB to determine when and how to manage these pests in your orchard. Consider an edge spray when sound nuts in edge trees reach hull split Stage 2C (see photo), and a full spray once nuts in the upper canopy of trees within the orchard reach that same stage. Consult with your PCA when making decisions about NOW and PTB management. Switch insecticide chemistries between generations. See the article in this newsletter for more information on NOW hullsplit sprays.

**Stage 2C of hull split.** This is the critical time for NOW insecticide and *Rhizopus* hull rot fungicide applications. The orchard is ready for harvest when all nuts are at Stage 2C.

- **Mites:** Extensive leaf drop (defoliation) at harvest due to mite damage can lead to slower nut drying on the orchard floor this year and reduced yield and shoot growth the following year. Continue weekly monitoring for mites and mite predators throughout your orchard as hull split approaches. For more monitoring and treatment information, see this article and the UC IPM site for spider mites in almonds.

- **Ants:** Monitor for protein feeding ants and consult with your PCA about ant bait materials and application timing. If present, protein feeding ants can damage almonds on the orchard floor.
- **Regulated Deficit Irrigation (RDI):** RDI can promote an earlier, more even hull split, and can help with NOW and hull rot control. However, using this practice in already water stressed trees may lead to a yield reduction.
  How can you tell if RDI is a good option this year? At the start of hull split, check stem water potential (SWP) using a pressure chamber to see if the SWP is already in the RDI target range (-14 to -18 bars). If trees are drier than -14 bars (for example, -15 bars) then there is no need for further water reduction to manage hull split. If SWP is wetter than -14 bars (for example, -12 bars), there might be slight water savings in reducing irrigation run-time, so that SWP is in the target range as nuts enter hull split. During initial hull spilt, hold SWP in the range of -14 bars to -18 bars for two weeks and then return to full irrigation (100% ETc) for the last two weeks of hull split prior to preharvest irrigation cut off. This advanced strategy should be approached with caution and precision.
- **Leaf Samples:** Take July leaf samples and submit for lab analysis to 1) evaluate your nutritional program for this year, 2) plan your nutrition program for next season, and 3) monitor for possible toxic element (chloride and sodium) accumulation in the orchard. To learn more about July leaf analysis sampling procedure and interpretation see this article from The Almond Doctor.
- **Harvest prep:** Prepare shakers, sweepers and pickup machines for harvest. Equipment distributors may have preharvest "tune up" specials that can be scheduled to ready essential equipment for the long harvest season. To limit dangerous and damaging dust at harvest, review Almond Board of California information/videos on dust management.

**AUGUST**

- **NOW Management in pollinizers:** After Nonpareil harvest you may want to spray pollinizer varieties for NOW management. In a tight money year, this may not be an attractive option, but should be considered depending on the conditions in the field. The decision to spray or not should be based on the following: existing NOW damage observed in your Nonpareil almonds, progression of the third NOW generation, and timing the start of the fourth-generation egg laying. If you do choose to spray, plan your application timing based on when you expect to harvest your pollinizers, remembering that pre-harvest intervals are based on the date that you shake—not the date that you pick up the almonds from the orchard floor. A timely harvest is the least expensive option (shake vs spray and wait the PHI to shake) and can be very effective in limiting NOW damage.
- **Hull Boron Samples:** Boron accumulates in almond hulls, making hulls (not leaves) the best source of information about boron levels in your trees. To check orchard boron status, collect hull samples at harvest (from the windrows) and submit them to an analytical lab for boron analysis. For more information on boron, see the articles in this newsletter and from the Almond Doctor on hull sampling for boron analysis.
- **Nitrogen application:** Use July leaf sample results to decide if any additional fertilizer N is needed this year. If the July leaf levels are adequate à high, research indicates no further N application is needed. If leaf levels are low à deficient, additional N may be needed. If leaf levels show additional N is needed, consider irrigation water nitrate levels when deciding on N fertilizer rates. For more information about N application in almonds and how to calculate lb. N/acre in irrigation water from lab results see the new publication "Nitrogen Best Management Practices" from the Almond Board of California.

***Harvest***

- **When to start?** Trees are ready for harvest when 100% of nuts in the orchard are at least at Stage 2C of hull split (see image in the July section, above) and test trees shake clean. This will minimize NOW damage on the harvested nuts.
- **Dust:** Dust at harvest can create unhealthy conditions for workers and community members in and around almond orchards. Plan to minimize dust at harvest by adjusting sweeper head heights, blower spout angles, and fan speed. See link to resources in the July section.
- **Shaker damage:** Shaker damage can be a major cause of orchard decline. Limit shaker damage ("barking" trees) by making sure all trees in the orchard are ready to shake when starting harvest. Test-shake trees in areas that are the most vigorous and where nuts "stay green" the longest. Where possible, clamp closer to the scaffold crotch rather than lower down on the trunk to minimize root damage and get the best shake to the canopy. Be extra careful when shaking in young (third and fourth leaf) orchards.
- **Nut Damage Analysis:** Nut damage analysis (harvest samples) can help reveal the primary sources of nut damage in the orchard and assist in planning for reducing that damage next year. Collect 500 nuts throughout your orchard after shaking and before sweeping for analysis. Use the UC IPM Harvest Sample resource and our article on Harvest Damage Evaluation for Almonds to conduct your damage analysis. If there isn't time to crack out nuts at harvest, they can be frozen for later crack out.
- **Don't stockpile wet nuts:** Nuts with hull moisture above 12%, kernel moisture above 6%, or total fruit (hull and kernel) moisture above 9% shouldn't be stockpiled. Nut quality declines with mold and conceals damage. When sampling for moisture ahead of nut pickup in the orchard, make sure to sample from the top and bottom of the windrow, as nuts on the bottom tend to have higher moisture content than those on the top of the windrow. See the 2021 article on pickup and stockpile practices for further information.

***Post-harvest***

- **Post-harvest irrigation:** Return irrigation to your trees as quickly as possible after harvest to minimize water stress. Water stress in August-October can interfere with bud development for the next crop. Dry trees after harvest = fewer flowers next spring. **Post-harvest hull rot and shaker damage assessments:** Check for hull rot and shaker damage on your trees after harvest. More information about hull rot assessment and management can be found on the UC IPM website for hull rot management in almonds.
- **Plan fall Zn and B sprays:** Use your plant tissue analysis results to determine whether you need to apply foliar Zn and B this fall. See our Postharvest Nutrition Review article to learn more about when and how to apply these nutrients.
- **Plan for your fall potassium application:** If applying fall potassium is part of your orchard nutrient management program, start preparing for application. Banded or targeted broadcasting down the tree row applications are good options for getting your money's worth out of a fall potassium application. See the Postharvest Nutrition Review article for more information.
- **Plan for improved rainwater infiltration:**
    - Consider a filter strip of vegetation (cover crop or natural vegetation) around the field edge to slow and help capture runoff water. One easy way to help do this, depending on the year and site, is to shut off herbicide booms as soon as the sprayer leaves the orchard row.
    - Cover crops reduce orchard runoff, improve soil health, and/or provide pollen for bees. If you're considering planting a cover crop this year, you'll want to get the seed in the ground

by the end of October. Start considering your options now using the UC-Almond Board Cover Crop Best Management Practices guide.

- Consider using organic soil amendments (almond shells, compost, etc.) to protect the orchard floor from sealing off due to rain drop impact and slow runoff. See article in this newsletter.

## NOW Hullsplit Spray Considerations

*Sudan Gyawaly, Northern Sacramento Valley IPM Advisor*

**Importance of hullsplit sprays and determining hullsplit in almonds.**

From the standpoint of navel orangeworm (NOW) management in almonds, hullsplit is the most critical fruit developmental stage. Almond fruits open at their suture during this period and become susceptible to NOW infestation. Moreover, if the beginning of the Nonpareil hullsplit coincides with the egg laying time of the second flight of NOW, the risk of the NOW damage increases. Therefore, understanding NOW activity and hullsplit status is vital for timely insecticide applications. The nuts on the southwest side of the canopy mature earlier, so the initiation of hullsplit in a block should be confirmed by regularly checking on the southwest side of the canopy. An orchard ladder or pruning tower can aid in reaching the fruits from the top of the representative trees to detect early split. Also, knowing the difference between true hullsplit and blank nut split is essential because blank nut hullsplit usually begins 1 to 2 weeks before the sound nut hullsplit begins. Nuts in edge trees, especially on the southern edge of an orchard, often start to split several days to a week ahead of trees within the orchard. Edge and blank splits signal the approach of hull split of sound nuts inside the orchard. Hullsplit timing varies among tree water status, varieties, geographic regions, and weather conditions; however, prediction models (link) are available to predict hullsplit timing for various locations. Research and field experience tell us that spraying earlier, rather than later, is the most effective strategy for reducing NOW damage.

**NOW traps and spray decision.**

NOW monitoring (egg, male, and female) traps do not provide a specific treatment threshold; however, they can be highly beneficial for spray decision-making since they inform the grower about seasonal pest activities. Egg traps are helpful to set the egg-laying biofix for overwintering adults in the spring and track the heat units to determine the completion of that generation and the beginning of the 2nd generation (i.e., 1050 degree-days). The 2nd generation infests the early hullsplit nuts, and the timing for that generation is critically important to minimize the nut damage. The utility of egg traps for guiding spray timing would be less clear for the later generations because of the continuation of egg-laying due to overlapping adults among generations. However, the density of egg laying in egg traps and female moth activity (in Peterson traps or similar tools) are good indicators of potential NOW pressure and, possibly, nut damage.

Experience shows that unless an orchard is in an isolated location with a history of very low NOW damage and low NOW population, most almond orchards in the Northern Sac Valley warrant at least one spray at hullsplit. However, missing proper spray timing and not practicing other cultural practices, such as winter sanitation, may result in higher than acceptable levels of nut damage. Therefore, minimizing NOW damage requires practicing cultural techniques such as winter sanitation and timely harvest, monitoring pest

populations, and making well-timed insecticide sprays. At this point of the season, spray to protect early hullsplit, watch traps tracking females (egg and/or Peterson traps), and check early split nuts for worms to make preharvest spray decisions and decide on harvest timing. If NOW pressure is high, it might be worth a talk with your processor to look at timely harvest and kernel (meats) production vs later harvest for inshell. If NOW pressure is high, damage can increase very rapidly and every day the nuts are in the trees increases the danger of further damage.

**Determining spray timing and numbers.**

The number and timing of hullsplit sprays depend on orchard history, in-season pest monitoring information, use of other cultural practices such as winter sanitation and timely harvest, and overall risk of NOW immigration to the orchard. Typically, the first hullsplit spray for NOW, is made when the eggs are being laid and the hullsplit begins. Commonly used, relatively reduced-risk insecticides only kill eggs and larvae. Some are effective against adults; however, insecticides must contact adults to be effective. Spraying during the night or early morning is more effective than sprays during the day. These insecticides can be effective for 2- 4 weeks; a second application may be necessary if you continuously find high numbers of eggs, females, and males in their respective traps, and you cannot harvest the nuts before the third flight activity. Early hullsplit pollinizers split about two weeks after Nonpareil; the hullsplit typically starts when the NOW third flight begins. For many growers requiring a second hullsplit spray, a second application can help both Nonpareil and pollinizers. Late-season pollinizer variety can be at risk from the latter portion of the third and fourth flights if not harvested on time.

**Some additional considerations.**

***Provide good spray coverage*.** Good spray coverage is essential for effective NOW control. Many years of study have indicated that spray coverage is the function of tree height, sprayer speed, and spray volume. In mature almond orchards, it has been shown that high-volume spray (150-200 GPA) with a slower spraying speed (2 MPH) provides better coverage and NOW control, though it is unconventional practice for many growers.

***Harvest on time*.** The goal of timely harvest is to get the almond harvested once 100% hull split occurs for all varieties, and if possible, before the beginning of the third generation for Nonpareil and before the fourth generation for other late varieties. Ensuring that nuts are at the proper maturity stage during the harvest is critical. Too early harvest can lead to mold development and chipping issues during the processing, reducing the nut quality.

***Know your insecticides*.** Insecticides differ in their mode of action, efficacies to NOW, and toxicity to beneficials (see Table 1). Knowing those facts can help select the best insecticide for a particular situation. Most of the insecticides labeled for NOW target newly hatched larvae and have some impacts on eggs. Some have effects on all stages. Insecticides applied for NOW management at hullsplit must kill the egg or larva before feeding damage occurs. Another difference among NOW insecticide is their potential effects on spider mite predators such as predatory mites and sixspotted thrips. Non-selective insecticides, in general, are more toxic to those beneficial than selective insecticides. Therefore, the tradeoff of using broad-spectrum insecticide should always be considered.

***Understand seasonal changes in NOW biology and behavior*.** NOW development rate changes during the season. The first and second generation NOW needs about 1050-degree days to complete one generation. However, after that, NOW can complete a generation in only 750-degree days due to better nutritional quality offered by the fresh nuts. Temperature plays a significant role, too, as higher temperatures during the summer accelerate egg hatching and larvae development.

Table 1. Some common pesticides used at hullsplit in almond for Navel orangeworm control and details that may influence use planning – Efficacy categories, IRAC number (for resistance planning), active ingredients and impact on beneficials. (Table Courtesy: David Haviland, Entomology Advisor, UCCE Kern County)

| Efficacy Categories | Pesticide Chemistry Group[1] | Active Ingredients | Example Trade Names | Impact to beneficials at hull split |
|---|---|---|---|---|
| Effective | IRAC 18- Diacylhydrazines | Methoxyfenozide | Intrepid® | Low |
| Effective | IRAC 5 and IRAC 18- Spinosyns & Diacylhydrazines | Methoxyfenozide & Spinetoram | Intrepid Edge® | Moderate (predatory thrips) |
| Effective | IRAC 20- Diamide | Chlorantraniliprole | Altacor® | Low |
| Moderately effective (depending on local levels of resistance) | IRAC 3A- Pyrethroid | Bifenthrin<br>Lambda-cyhalothrin<br>Fenpropathrin<br>Esfenvalerate | Brigade®<br>Warrior<br>Danitol®<br>Asana® | High<br>High<br>High<br>High |
| Some efficacy | IRAC 5- spinosyns<br>IRAC 5- spinosyns | Spinetoram<br>Spinosad | Delegate®<br>Success®, Entrust® | Moderate (predatory thrips) |
| Some efficacy | IRAC 11A- B.t. | B.t. | Dipel®, others | Low |

Disclaimer: Products listed in this table do not constitute a recommendation, and many of the active ingredients presented in this article can be purchased under multiple trade names. Check this link for post-harvest interval information for each insecticide.

[1] https://irac-online.org/mode-of-action/classification-online/

## Don't Neglect Your Boron

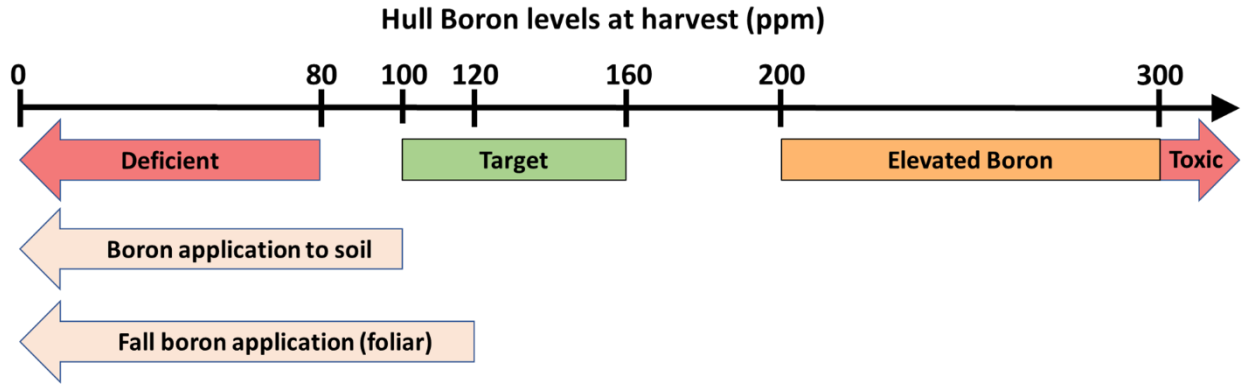
*Jaime Ott, UCCE Tehama, Shasta, Glenn, and Butte Counties*

Almonds have a strange relationship with boron: it is required for effective pollination and to set a good crop but can quickly become toxic if there is too much in the soil or in irrigation water. With its effects on both yield and tree health, dialing in the boron levels in your orchard is well worth some attention.

**The Bottom Line:**

- Boron is a necessary nutrient which can be toxic at higher levels.
- Hull sampling at harvest is the only way to understand the boron status of your orchard.
- For many orchards, a fall foliar spray of boron will increase yields the following year by hundreds of pounds per acre.
- Soil application of boron is the best long-term correction for low boron in an orchard, but this won't increase yield the following year like a foliar spray.

**Recommended Actions:**




*The target range for boron in almond hull samples at harvest is 100-160 ppm. For orchards with less than 100 ppm boron, winter applications of boron to the soil are recommended. For orchards with less than 120 ppm boron, a fall boron foliar spray is recommended.*

**The Details**

Boron is required for pollen tube development, so is necessary for effective fertilization and nut set in almonds. It also accumulates in the hull during nut development and is exported from your orchard in the form of hulls when you harvest. Having too little boron in your orchard directly affects yield, and therefore your bottom line.

The only way to know where your orchard stands with respect to boron is to take a hull sample at harvest. July leaf samples provide fantastic information about nitrogen, phosphorus, potassium, zinc, and toxic salts, but can only diagnose severe boron deficiency in an orchard*. Research has shown that July leaf samples cannot consistently distinguish between orchards with excessive boron, adequate boron, and mild boron deficiency. Excessive boron can kill trees, and even a mild boron deficiency could reduce yield by hundreds of pounds of kernels per acre; being able to tell these situations apart is crucial for orchard success. Unlike leaves, almond hulls accumulate boron throughout the growing season, making hull boron

levels at harvest a good indicator of the actual boron levels in your trees. Since boron is exported from the orchard each year, it is worth making hull sampling a part of your annual orchard routine.

Collect hull samples for boron analysis any time after shaking the nuts, when hulls are no longer accumulating additional boron. Note that hull boron levels are affected by the number of nuts on a tree (more nuts per tree leads to lower boron per nut), so it is frequently worth sampling different varieties, or "strong" and "weak" areas of the orchard, separately.

Orchards with hull boron levels less than 100 ppm will require both application of boron to the soil and application of foliar boron in the fall. The soil application should target 2-4 lbs. of actual boron per acre and can be achieved by broadcasting ~25-50 lbs. of borax, a boron fertigation, or a ground spray application of ~10-20 lbs. of Solubor® (which, buffered, can be mixed in with an herbicide application). You want to avoid banding boron, as this might result in it reaching toxic levels in certain areas.

Orchards with hull boron levels less than 120 ppm (including those mentioned above, with boron levels below 100 ppm) will benefit from a fall (postharvest) foliar application of boron. As a rule of thumb, target 1-2 lbs. of Solubor®/acre in 100 gallons/acre. This can be applied as a tank mix with zinc in the fall, though the pH will have to be adjusted to keep the zinc in solution. See this article for more information on fall foliar boron and zinc applications.

Orchards with hull boron levels between 120 and 160 ppm have not been shown to benefit from additional boron applications.

Orchards with hull boron levels above 200 ppm (and definitely above 300 ppm) may start to show signs of boron toxicity. In cases of toxicity, soil and irrigation water should be tested for boron levels, and a boron leaching plan should be considered.

Clear gumming from the suture of developing nuts can be a symptom of boron deficiency. At the boron levels where symptoms are visible, many hundreds of pounds of kernels per acre have already been lost due to reduced nut set.

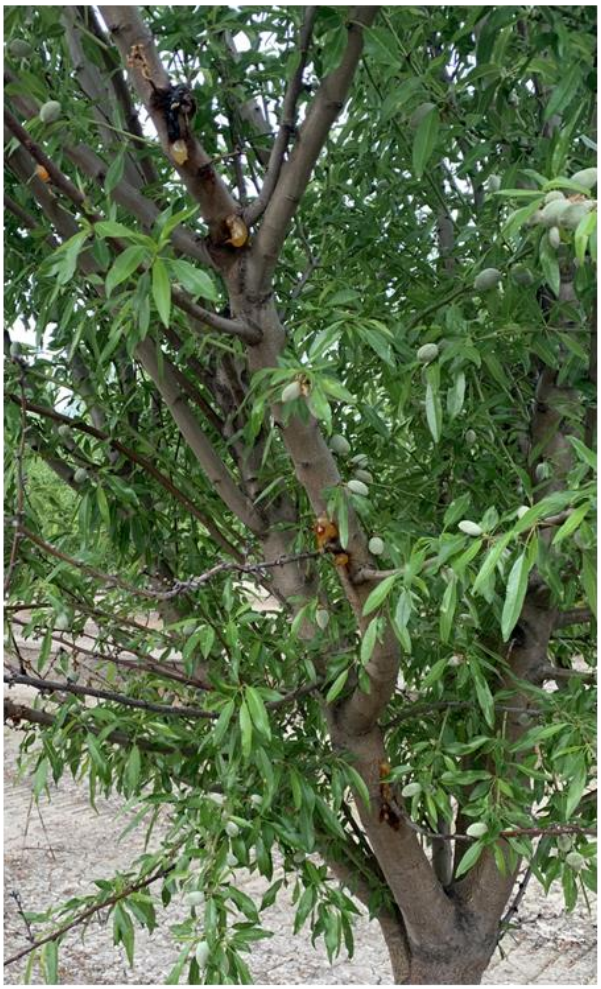
*According to Dr. Patrick H. Brown, UC Davis professor and almond nutrition expert, leaf boron levels below 20ppm indicate deficiency, but leaf sampling is not reliable at boron levels above 20 ppm.

## Spring 2023 Retrospective: Bacterial Blast

*Jaime Ott, UCCE Tehama, Shasta, Glenn, and Butte Counties*
*Franz Niederholzer, UCCE Colusa, Sutter, Yuba Counties*
*Mohammad Yaghmour, UCCE Kern County*

With our chilly winter, many growers, managers, and PCAs were finding outbreaks of bacterial blast in their almonds this spring. Blast, which is caused by the bacterium *Pseudomonas syringae*, is normally seen affecting flowers and leafy spurs exposed to cold, wet weather. Blast is a challenging disease to control, given the limited number of available tools. This year, symptoms were common even in orchards which had received one or more copper dormant sprays (copper-resistant *Pseudomonas* populations are common throughout the state). Kasumin is also available and effective for blast control, but is expensive and can be cost prohibitive, especially if prolonged wet weather necessitates repeated applications. This leaves temperature/frost control in an orchard as your least expensive and most effective blast prevention strategy.

Independence on Hansen (top), Independence on Viking (bottom left), Nonpareil on Krymsk (bottom right). Spotted and misshapen leaves, dead leaf bundles, dead flowers, and aborted nuts were all common symptoms of bacterial blast this year.



(Left, below) In some cases, blast was causing gumming at the base of infected shoots. However, the symptoms did not seem to spread into the main branch. Aldrich on Krymsk86

(Below) Jacket rot was common in Kern County this year. Unlike blast, jacket rot can be prevented with an effective fungicide bloom spray. Notice the very similar symptoms on flowers– it pays to get an accurate diagnosis to know how to prevent trouble in the future.

## New Orchard Advisor Joins UCCE Sac Valley Team

My name is Becky Wheeler-Dykes, and I am thrilled to join UC Cooperative Extension as the new Orchard Systems Advisor serving Glenn, Tehama and Colusa Counties. I'll be based in Orland at the Glenn UCCE Office. As an Orchard Crops and Weed Ecology Advisor, I'll be covering olives, prunes, walnuts, and almonds as well as emphasizing weed management research in these cropping systems. I grew up on a small prune and walnut farm in Gridley and am happy to be settling down near family. After completing my undergraduate degree in Crop Science and Business Management at UC Davis, I continued on for my Masters in Entomology, where I focused on IPM in orchards. I have since worked in ag research in several crops and disciplines, and I'm excited to bring those experiences to the Sac Valley as the newest Farm Advisor.

I hope to spend the first few months getting to know the growers, producers, and ag community of our beautiful region. I look forward to learning from and with you all, and I can't wait to build a research program to support your unique needs in Glenn, Tehama, and Colusa Counties. Please give me a call to come out and troubleshoot problems in the field, learn about the challenges you face in agriculture, or just get to know you and your orchards! I can be reached by email at bawheeler@ucanr.edu or telephone at 530-884-9313.

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# Almond Newsletter