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**Franz Niederholzer**  
UCCE Farm Advisor  
Colusa, Sutter,  
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## Fall Almond Orchard Management Considerations

*Evie Smith, UCCE Staff Research Associate, Southern Sacramento Valley*  
*Katherine Jarvis-Shean, UCCE Orchard Advisor, Sacramento, Solano and Yolo Counties*  
*Franz Niederholzer, UCCE Farm Advisor, Colusa and Sutter/Yuba Counties*

### OCTOBER

- **Weed survey:** After the first rain, scout for weeds in your orchard to inform your weed management strategy for next season. For more information about best practices for weed scouting, see [our article on post-harvest weed scouting](#). The [Weed Research and Information Center Weed Identification Tool](#) can help you ID the weeds in your orchard. If we have another dry fall, consider watering in your pre-emergent herbicide with irrigation to ensure efficacy.
- **Fall Nutrient Spray:** If your July leaf samples indicated that your trees are low on Zn or hull samples show them low on B, apply these nutrients through a foliar spray in the fall. Fall spray timing ensures these nutrients will be available to the trees when they wake up in February. See [our article on postharvest nutrition](#) for more information.
- **Irrigation Water Quality:** If your irrigation water was of lower quality this season, **take soil samples** to assess the build-up of salinity and toxic element(s) such as chloride, boron and sodium. [See video series on soil sampling from the UC Davis Fruit and Nut Center](#). Consult with your CCA regarding fall irrigation practices to help manage rootzone salinity if elevated levels are found.
- **Shot Hole:** If [shot hole fruiting structures](#) are present in leaf lesions in the fall, the likelihood that shot hole will develop in the orchard the following spring is higher. Keep an eye out for shot hole fruiting structures in your orchard after fall rains begin. If fruiting structures are present, apply a foliar zinc sulfate nutritional spray in early November; this will speed up fall leaf drop and reduce inoculum.
- **Rust:** If rust was a problem in your orchard this year, consider a foliar zinc sulfate fertilizer spray in late October or early November to hasten fall leaf drop and reduce rust carry over to next season.
- **Cover Crops:** Cover crops can improve the soil in your orchard, reduce runoff, and provide additional pollen to bees in the spring. If you're planning on growing a cover crop this winter, get your seed in the ground by the end of October. Supplemental irrigation may be required for germination and optimal growth if we have another dry fall and winter, so make sure you have an available water source to meet this possible need before seeding. For more information about using cover crops in almond orchards, see the Cover Crops Best Management Practices guide featured in this publication.


- **Mummy Nuts:** Survey for mummy nuts before or on January 15 by counting mummies in 20 trees in each orchard. Make sure all varieties in the orchard are included in the 20 trees. If there are more than 2 mummy nuts per tree, on average across the orchard, plan on sanitizing your orchard by shaking or poling nuts to the ground by February 1 and destroying the nuts before March 1st. This will reduce navel orangeworm pressure in your orchard next season.
  - If a significant number of your mummy nuts are caused by hull rot, plan on reevaluating your irrigation and nitrogen management practices in the spring of next year to help manage hull rot. For more information about how to identify hull rot in your orchard, see [UC IPM](#).
- **Pruning:** This fall and winter as you are pruning out damaged branches in your orchard, make sure to avoid pruning immediately before a rainfall event. Pruning just before rain spreads diseases more rapidly in the orchard. Consider applying Topsin-M to pruning wounds to protect against canker pathogens such as *Cytospora* and *Botryosphaeriaceae* (“Bot”).

## NOVEMBER

- Join the UCCE Sac Valley Orchard advisors and UC pest and disease experts for our Sac Valley Fall IPM Workshop online November 4<sup>th</sup>. More details will be distributed soon.
- **Pests on Dormant Spurs:** Between mid-November and mid-January, collect 100 spurs from 35-50 randomly selected trees. Evaluate them for scale and mite eggs. Check green shots for scab lesions. Use [UC IPM](#) to guide your pest monitoring work.
- **Potassium:** If you plan on making a fall potassium application, apply banded potassium to the soil in November. For every 1,000 lbs of almond kernels harvested there are 80 lbs of potassium removed from the orchard or captured in new growth. Be wary of KCl if you have been irrigating with lower quality water that may have already loaded your soil profile with chloride, or if you are uncertain you’ll have ample water to leach chloride this winter or next spring.
- **Harvest Samples:** Now that harvest has calmed down, take some time to evaluate the harvest samples that you collected and stored in your freezer. The results of these sample evaluations can inform your pest management strategy for next year. Use this [guide to Harvest Damage Evaluation for Almonds](#) to help with your evaluation process.
- **Bees:** Plan ahead for the spring by ordering 2-3 honey bee hives per acre for self-infertile orchards, and 0.5-1 hive per acre in self-fertile orchards. Make sure you have a written contract with your beekeeper that outlines the expectations of each party. See our article on [Honeybees, Colony Strength, and Beekeeper Challenges](#) for best practices for using honeybees in your orchard.

## DECEMBER

- Now that leaves are off the trees and mummies are easier to see, recheck your mummy count and update your plan for knocking and destroying mummies by February 1<sup>st</sup>.



### Announcing the UCCE Central Valley Pistachio News!

Want to receive this new regular collaborative effort from UC’s Central Valley Pistachio Advisors.

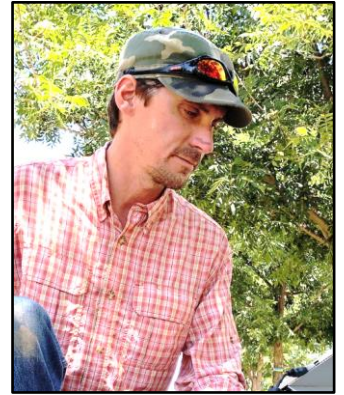
Visit <https://bit.ly/3adtvZL> to sign up!

## New Advisor Introduction

*Curt Pierce, UCCE Area Irrigation and Water Resources Advisor  
for Glenn, Tehama, Colusa, and Shasta Counties*

On October 15<sup>th</sup>, 2021, I will be joining the UC Cooperative Extension team as the Area Irrigation and Water Resources Advisor for Glenn, Tehama, Colusa, and Shasta Counties, based in Orland. I am looking forward to getting boots on the ground and working together with all of you.

I have a bachelor's degree in Agriculture and since 2016, I have been working as a Graduate Research Assistant with Richard Heerema, Pecan Specialist in the Extension Plant Sciences Department at New Mexico State University. While there, I spent two years in the Water Science and Management Master's program before moving into the Ph.D. program in Plant and Environmental Sciences with a focus on the stress physiology of woody plants.



My main areas of interest are plant water relations under water deficit, and irrigation system optimization. The research I conducted at NMSU studied methods of targeting limited water to when and where they would maximize benefit, and I look forward to continuing that work in ways that help producers and other stakeholders in the northern Sacramento valley.

In my free time I enjoy hiking with my family and dogs, trips on my motorcycle, and exploring everything I can. I'm excited to be a part of the community and look forward to meeting everyone.

I can be reached at the Glenn County office starting October 15<sup>th</sup> (530) 865-1107.



## Climate & Management Considerations for Future Almond Orchards

*Katherine Jarvis-Shean, UCCE Farm Advisor, Yolo, Solano, & Sacramento Counties and  
Joseph Connell, UCCE Farm Advisor Emeritus, Butte County*

Almond orchards are a multi-decade investment. No one can be exactly certain what the future holds, but orchard development requires that we make decisions with the best information available. While there are plenty of moving parts to that decision-making – global markets, labor cost and availability, SGMA, state and regional regulations, etc – part of that decision-making process requires thinking through what growing conditions are expected to be like in the next 20-30 years. Recent years have brought hot temperatures, heat waves, droughts and rain that have broken records. Research is finding that we should plan for more of these types of years in the next few decades, and expect future growing conditions in the Central Valley that will be warmer and both wetter and dryer. What does that mean? And what can we do to plan for it?

### Warmer Temperatures

This summer was California's [hottest summer on record](#) according to the National Weather Service, with many locations in the Sacramento Valley breaking one-day records and heat wave records. While we haven't had a consistent progress of record-breaking summers in a row, we are seeing more of them. This is in keeping with what research is telling us to expect. It's not expected that every year will break temperature records. We'll continue to experience cool spells and hot spells, but the cool spells will be a little less cool, and the hot spells will be even hotter.

Summer temperatures are expected to increase, on average, about 2° F in the next 20-30 years. Scientists expect at least 50% more extreme heat days in the summer, and at least a 40% increase in the number of heat waves (3-4 or more extremely hot days in a row) (see links 1 & 2 below for details). This will translate to higher amounts of water use by trees through increased transpiration and worker safety issues, among many other concerns. This will also translate to more growing degree days for pests in our orchards. As UC IPM Advisor Jhalendra Rijal discussed on a [recent Growing the Valley UC podcast](#), these warmer summer temperatures, along with earlier biofixes from warmer springs, will result in seeing four flights of navel orangeworm much more frequently in the Sacramento Valley (Fig 1).

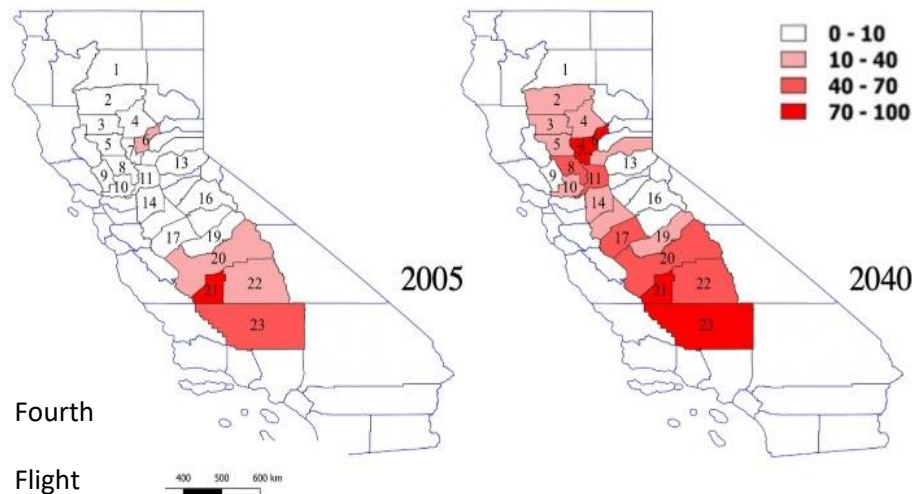


Fig 1. Increase in frequency of NOW fourth flight between 2005 and 2040. Darker red indicates higher percentage of years in which fourth flight will occur. Adapted from Pathak et al. (2021)

### Wetter and Drier? How is that possible?

There's been no rest for the weary when it comes to seasonal rainfall total in the last few years. We went from the historic drought of 2012-2016 to record-breaking rainfall the winter of 2016-2017, to the last two dry winters that have many reservoirs and water tables crying Uncle. Scientists call this 'precipitation whiplash', and as Daniel Swain explained on a [recent Growing the Valley UC podcast](#), we should plan for continued whiplash in the future, with both more extremely wet winters, and more extremely dry winters (Fig 2).

In the coming two decades, scientists expect Northern California will have about 50% more extreme wet seasons (similar to the winter of 2016-2017) than we had in the '70s, '80s and '90s. But also in the coming two decades, scientists expect an increase in extremely dry rain seasons (slightly drier than 2013-2014), about 25% more than what we had in the '70s, '80s and '90s. It's also expected that falls and springs will be dryer, meaning our rainfall, when we get it, will be compacted into fewer months. So, if you're looking at decade averages, our rainfall averages will be about the same as the past, but on a year-to-year level, we'll be experiencing more wet years and more dry years. The silver lining of these increased wet years is they should make multi-year droughts become less frequent. You can read more about this research here: <https://weatherwest.com/archives/6252>.

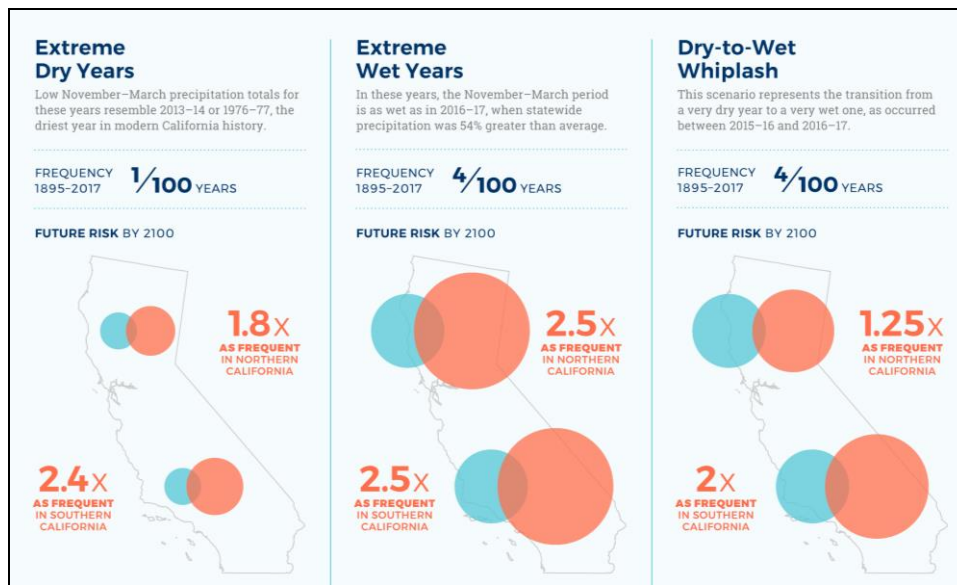


Fig 2. Scientists expect increases in both extreme wet years and extreme dry years. Adapted from <https://weatherwest.com/archives/6252> & (3) below.

### So, What Does This All Mean for Orchard Planning?

Put together, this means almond orchards planted in the next few years (and the recent past) will experience more extremes in wet and dry winters than orchards that came before them, along with more extreme heat, and more pest pressure. This will all occur under a more watchful eye when it comes to groundwater use, and likely more limitation and less efficacy from our traditional pest management tool box. Growers and advisors will continue to find innovative ways to adapt to these challenges, but here are a few things to consider:

#### For reduced water availability...

- How old are the orchard blocks in your portfolio? Is a block coming into production and will it be experiencing its best years in the future, or is it older and likely to experience higher costs and gradually lower production? Prioritize the most productive blocks for receiving available water and possibly remove the blocks that are over the hill to concentrate available water on the best orchards.
- What about varieties and the costs and returns for managing a particular orchard? Some varieties have experienced price discrimination compared to the premium Nonpareil variety. Blocks of semi-hardshells have lower costs related to pest management and harvest but they may also have lower returns. What does the overall economic situation of the block look like? Consider the profitability of each block on a cost and return basis. If there are some orchards that are likely to be less profitable in an ongoing way, those are the blocks that must be sacrificed if there is insufficient water to take care of the entire operation.
- Rootstocks differ in their ability to withstand drought and water cutbacks. Peach-almond (PA) hybrid rootstocks such as Hansen, Brights 5, Nickels and Titan are generally more drought tolerant, likely because they have a larger root system that can access more soil moisture. They are also more tolerant of higher levels of chloride and other salts often found in poor quality irrigation water than Lovell, Nemaguard, or Krymsk 86. If water is cut back, or available in only a minimal amount, a PA hybrid block should survive better and recover quicker than other rootstocks.

- Plan for changing groundwater levels, and make it easier on yourself to adapt when that happens. Have a flow meter and pressure gauge on your pump so you can know when changes are happening in your system. Set your orchard up for easy regular system maintenance. Consider a back-up plan when your system pressure drops, like manifolds to divide blocks more easily to irrigate smaller sections and keep pressure higher, variable speed pumps or the ability to drop bowl depth.

#### **When water is over-abundant...**

- Know your soils maps, where you have infiltration issues and access problems during wet winters. Consider prioritizing these areas when doing tree training, NOW sanitation, or other winter tasks that require orchard foot traffic.
- Think about soil amendments, cover crops, or resident vegetation to increase infiltration in your soils compared to bare orchard floors. Leaving a cover crop or resident vegetation in your middles will provide a significant improvement in both rainfall and irrigation infiltration.
- If, given your soils and water access, you expect too much water to be a harder problem to solve than too little water, consider rootstocks with Myro plum background, such as Krymsk 86, that often have shallower roots and better tolerance (though not total invulnerability) for wet feet.
- Plan for rapid runoff of excess water and to support crown health. During site development of relatively flat sites, consider laser leveling if the site is relatively flat and raise the tree crowns above the soil level by planting on berms, islands or mounds to reduce *Phytophthora* risk.

#### **For warmer temperatures...**

- Navel Orangeworm is an ongoing pest management issue with possibly increasing pressure. Consider the vulnerability of different varieties, in terms of shell seal and stick tights that lead to mummy build up. Also, earlier maturing varieties are less exposed to higher pressure of the later NOW generations compared to mid to late maturing varieties. Consider starting to work with mating disruption as an extra tool in the NOW tool kit.

Each orchard involves an individual set of economic and production alternatives. While it's impossible to guarantee what the future holds, it's worthwhile to consider the best information we have to plan management decisions. The more accurate and in-depth your information, the clearer your decision-making will be. Almond growers have faced huge production challenges in the past, and found innovative ways to grow and improve through them.

For more details on these projections and research:

- 1) Zhao et al (2020) "Assessment of climate change impact over California using dynamical downscaling with a bias correction technique: method validation and analyses of summertime results" *Climate Dynamics*. 54:3705–3728 <https://doi.org/10.1007/s00382-020-05200-x>
- 2) An interactive map of how climate is expected to change in different ways and different areas of California: <https://cal-adapt.org/tools/extreme-heat/>
- 3) Pathak et al (2021) "Impact of climate change on navel orangeworm, a major pest of tree nuts in California" *Science of The Total Environment*. 755 <https://doi.org/10.1016/j.scitotenv.2020.142657>



### Preparing for 2022

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

Plan for the worst, hope for the best. That’s a tough, solid, strategy as the 2021 season winds down and growers and PCAs look to 2022. The following are some considerations when following this strategy. Every operation is different, and growers must decide what works best for their business. Final decisions may not need to be made until early 2022, but planning ahead, given the stakes, is recommended.

The core issue is water, with both availability and quality of concern depending on local conditions.

The region and state start the water year (Oct-Sept) way behind on water. As of the middle of September, major reservoirs (Shasta and Oroville) serving the region and state are at 22-25% capacity, less than half of the normal storage for this time of year. The [current forecast](#) for the rest of 2021 is for equal chances for normal precipitation in the Sacramento Valley with a [70-80% chance of La Niña winter](#). 2020-21 was a La Niña winter. These are all predictions, not certainties, but the current precipitation outlook for the winter ‘21-‘22 is not great.

If the drought continues, more groundwater will be pumped to keep trees alive and, if enough water is available, productive. Using moderate to low quality water (see table) can risk decreasing yield from increasing rootzone salinity and/or toxic levels of the elements chloride, boron or sodium. For most of the Sacramento Valley, groundwater quality is good to very good. However, for parts of the Colusa and Sutter groundwater basins, water quality is not so good. Irrigation water quality levels are important to planning for next year, especially if similar quality groundwater was used in 2021.

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#### Thresholds for 3 important irrigation water quality components based on risk to almond growth or yield reduction.

Salinity (dS/m)			Boron (ppm)			Chloride (meq/l)		
No risk	Increasing risk	Severe risk	No risk	Increasing risk	Severe risk	No risk	Increasing risk	Severe risk
<b>&lt;1.1</b>	<b>1.1 - 3.2</b>	<b>&gt;3.2</b>	<b>&lt;0.5</b>	<b>0.5 - 3.0</b>	<b>&gt;3.0</b>	<b>&lt;4</b>	<b>4 - 10</b>	<b>&gt;10</b>

\*For a more extensive information on water quality for almond irrigation see: <https://www.sacvalleyorchards.com/almonds/irrigation/lower-quality-water/>

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With a worst case scenario of low/no surface water deliveries and falling well water levels, here are some thoughts to consider in planning for 2022.

Rank orchards by potential value (net return to grower) in 2022 and future years. Possible considerations and rankings for use in farming decisions are suggested in the following table. These groupings are just examples based on UC research and the author’s experience. Orchard rankings and farming decisions should be based on local conditions and grower experience with input from PCA/CCA and nut handler.

**Orchard conditions possibly influencing net grower returns (NGR) in a drought year.**

Possibly lower NGR	Possibly moderate/good NGR	Possibly higher NGR
Older orchard (15+ years) with reduced yield	Middle aged orchards with decent to good production (10+ years)	Young, productive orchards (3-10 years)
Lovell, Nemaguard rootstocks	Krymsk 86 rootstock (due to Cl and B sensitivity)	Rootstocks with low - moderate sensitivity to toxic elements (for example, peach/almond hybrids)
Lower value (\$/lb) varieties	Traditional NP/pollinizer plantings (50/50)	High value plantings (high in-shell production, etc.)
Orchards with rootzone issues (nematodes, accumulating salinity, B, Cl or Na)	Orchards with increasing rootzone issues (nematodes, accumulating salinity, B, Cl or Na)	Orchards with no to little rootzone issues
Orchards adjacent to unmanaged/unsanitized nut or pomegranate orchards		Orchards where navel orangeworm (NOW) can be more readily managed (less rejects) in a high pressure year.
Low nutrient status due to previous N and K cutbacks.	Modest nutrient status due to previous N and K cutbacks	Good soil/tissue nutrient levels in 2021
High drought stress in 2021 (reduced bloom probable for 2022)	Moderate to high drought stress in 2021 (reduced bloom probable for 2022)	Low water stress in 2021, with good bloom potential
Poor well performance and/or low water quality	Intermediate well performance and/or moderate water quality	Good well with good quality water

Fall to prebloom practices can influence production potential for 2022 and could be adjusted on a per orchard basis. For example, higher cost items such as winter irrigation/salt management, potassium fertilization, preemergent herbicide and dormant sprays could be prioritized to the orchards with higher net return potential. [Orchard sanitation is also a big cost, but lack of sanitation in one orchard can mean that increased NOW, there, can spread harm and reduced net return in adjacent orchards.] Lower yielding orchards could receive less inputs this fall and/or spring, further limiting potential net income next year, depending on what is cut out or limited. Limiting inputs to orchards considered for removal could be further savings to growers.

Hopefully, adequate rain and snow will mean that these hard choices to remove or limit orchard yield will not need to be made. In the meantime, planning ahead will make springtime decision making simpler if the weather stays dry.

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## Sacramento Valley Tree Crop IPM Webinar

**November 4 @ 7:30 am - 11:00 am**

This is a webinar for anyone directly involved with pest and disease management in orchard production. We will discuss pest and disease issues including NOW management, mites management, wood cankers and other pests.

*DPR and CCA Credits requested*

### Event Agenda

- 7:30-8:30 am      Navel orangeworm and spider mites in almond and walnut  
*David Haviland, UCCE Kern County*
- 8:30-9:00 am      Ag Commissioner Update  
*Marcie Skelton, Glenn Co Ag Commissioner*
- 9:10-9:40 am      Quick review of pest management issues ahead of 2022 season  
*Roger Baldwin, UC Davis, Luke Milliron, UCCE, Franz Niederholzer, UCCE*
- 9:40-10:10am      Differences in managing Bot Canker and Blight of Walnut from Band Canker of Almonds, *Themis Michailides, UC Davis*
- 10:10-10:40am      Almond wood canker  
*Florent Trouillas, UC ANR*

**Register at:** [sacvalleyorchards.com/event/sacramento-valley-tree-crop-ipm-webinar/](http://sacvalleyorchards.com/event/sacramento-valley-tree-crop-ipm-webinar/)

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### Winter/Spring Sacramento Valley Tree Crop meetings:

Date	Meeting	Location
January 5	Sutter/Yuba Almond meeting	Sutter Co Ag Building, Yuba City
January 12	Sprayer calibration tune up	Nickels Soil Lab, Arbuckle
January 13-14	California Walnut Conference	Yuba/Sutter Fairgrounds
January 18	Yuba/Sutter Spray Safe	Yuba/Sutter Fairgrounds
January 19	Statewide pistachio day	TBA
January 20	Colusa Almond meeting	Arbuckle Golf Course
February 1-3	Colusa Farm Show	Colusa County Fairgrounds
February 3	Tehama Co Walnut Day	Elk's Lodge, Red Bluff
February 8-10	World Ag Expo	Tulare, CA
February 24	Tehama Co Prune Day	Elk's Lodge, Red Bluff
March 1	Sutter/Yuba Prune meeting	Sutter Co Ag Building, Yuba City

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Use your phone to scan our QR code by opening your phone’s camera app and hovering over the QR image below:



### Announcing the new UC – Almond Board guide to considering and using cover crops in your almond orchard.

Download the guide at [this link](#).

