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Submitted by:

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## Post-Harvest Almond Orchard Considerations

*Becky Wheeler-Dykes, Orchard Systems and Weed Ecology Farm Advisor, Glenn, Tehama, and Colusa Counties*

**Postharvest Nutrition:** Use information from your leaf and hull tissue analyses along with 2023 yield and anticipated 2024 yields to plan your fall Boron, Potassium, and Zinc applications. 1,000 lbs of almond kernels harvested removes 80 lbs. of potassium from the field, so it's important to wait until after harvest to develop your fall nutrition plan. These fall applications have an outsized impact on the following year's yield. Nitrogen applied in the fall, however, does not benefit yield if an orchard is otherwise healthy. Read the [Postharvest Nutrition Review](#) for details on fall fertilizer applications.

**Cover Crops:** Cover crops or resident vegetation have numerous benefits including improving water infiltration and holding capacity, providing additional forage for bees in the spring, and providing easier access to the field when the soil is wet. It's important to monitor soil moisture and irrigate after planting a cover crop if we have a dry fall. This ensures good germination of your cover crop. Check out the [UC-Almond Board Cover Crop Best Management Practices Guide](#) for information on timing, cover crop species selection, equipment, and more.

**Weed Survey:** After the first rain, [scout for weeds](#) and develop your weed management strategy for the next year. Correct weed identification is critical for effective management plans, so utilize the [Weed Research and Information Center Weed ID Tool](#) if necessary.

**Winter Sanitation:** With reports of higher-than-average navel orangeworm damage in the 2023 harvest, winter sanitation will be necessary in most orchards. Count the mummies in 20 trees throughout each orchard. If more than 1 mummy nut per 5 trees is found, sanitize by shaking or poling nuts to the ground by Feb. 1 to reduce navel orangeworm pressure next year. Also note if mummy nuts are caused by hull rot, which may indicate a need to reevaluate your irrigation and nitrogen management practices next season. See the article on sanitation standards in this newsletter.

**Pruning:** Prune out dead or damaged branches, taking care to avoid pruning if rain is in the forecast within 14 days to minimize the risk of infection of fresh cuts by rain-spread pathogens. Applying Topsin-M after pruning also provides protection against canker pathogens like *Cytospora* and *Botryosphaeriaceae*.

**Apply Foliar Zinc if Deficient:** Recent research in stone fruit showed that lower rates of zinc sulfate (5 lbs./acre) applied earlier in October were as effective in getting Zn into the trees as later sprays at higher rates without damaging leaves. Zn applied at a

high rate (for example, 20+ lbs. zinc sulfate/acre) has the added benefit of defoliating trees, which may provide the advantage of reducing inoculum for the 2024 season in orchards where shot hole or rust were a problem. However, in a dry fall, heavy Zn applications will not defoliate trees.

**Dormant Spur Sampling:** [Sample dormant spurs](#) for scale and mite eggs and examine green shoots for scab lesions. Use this data to decide whether to apply a dormant spray to manage scale and mites and then watch for scab lesion sporulation in spring.

**Honeybee Planning:** Get your order in for 2-3 honeybee hives per acre for self-sterile varieties for the spring pollination season. Self-fertile varieties should have 0.5-1 hive per acre. See our article on [Honeybees, Colony Strength, and Beekeeper Challenges](#) for best practices for using honeybees in the orchard.

**Process Harvest Samples:** November is a great time to pull those harvest samples out of the freezer and [evaluate](#) them to identify specific pest damage.



## Be Careful with Almond Variety-Rootstock Selection

*Luke Milliron, UCCE Orchard Advisor Butte, Glenn, and Tehama Counties*

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

*Katherine Jarvis-Shean, UCCE Orchard Advisor; Sacramento, Solano, and Yolo Counties*

*Clarissa Reyes, UCCE Orchard Advisor Sutter-Yuba, Butte, and Placer Counties*

*Evie Smith, Former UCCE Staff Research Associate, Southern Sacramento Valley*

Almond variety and rootstock selection is a quarter-century investment. After choosing which crop type to plant, this is likely the most important decision you will make when planting a new orchard. The difference in results is massive. A poor selection could lead to the orchard failing to establish and needing to be removed or providing sub-standard yield for the life of the orchard. A successful selection could mean your trees are regularly yielding twice as much as a different variety-rootstock combination.

Variety and rootstock selections are typically thought of separately. Each [rootstock is bred or selected to have different strengths and adaptations](#) for different soil types, irrigation volumes, levels of anchorage, and ability to withstand adverse field conditions like nematodes, soil-borne pathogens, and toxic elements. [Varieties are selected](#) with self-fertility, pollen-compatibility and timing, marketing classification and price, quality and consistency, disease susceptibility, yield, and other factors in mind. However, evaluating the compatibility of different varieties and rootstocks together is critical to deciding whether a combination will be successful. A well-known nurseryman once said, “It takes 20 years to prove a rootstock”. We would add that it takes even longer to prove a variety, and a variety-rootstock combination. Why is the process as much as 30-40 years to provide growers with a winning variety-rootstock? Regional variety trials take the first 15-20 years but are only testing in three locations across the Central Valley and on only one rootstock per location. Once early adopters then plant the new variety-rootstock combination they become the researcher for another 20 plus years. If the grower decides to plant the same variety-rootstock combination for a second-generation orchard, we know we truly have a winner!

In the Sacramento Valley, Krymsk®86, a hybrid of peach and Myrobalan plum parentage, is enormously popular due to rock-solid anchorage and a relatively higher tolerance of “wet feet” (flooding or soil saturation) compared to peach seedling rootstocks such as Lovell and Nemaguard. Krymsk® 86 rootstock

has only been widely planted for about 15 years: while it consistently lives up to its promise of strong anchorage and strong production potential with many varieties, especially Nonpareil, we are still learning about how it performs with other varieties in different field conditions. In wet springs, Monterey and Butte on Krymsk® 86 rootstocks have demonstrated a higher tendency to have slow, yellow growth, a disorder termed ‘Yellow Curling Leaf’ (YCL). YCL symptoms have also been observed in Monterey on Rootpac®-R (almond x plum) rootstock. Trees with YCL express foliar symptoms similar to the Union Mild Etch (UME) disorder affecting those same varieties and others on the Marianna 2624 plum rootstock with typical symptoms including poor tree growth and yellowing leaves that roll and produce necrotic margins. YCL like UME, occurs mostly in second leaf orchards, although both disorders have been observed on older trees. UME was clearly linked to excess soil moisture in the root zone in wet springs or with over-irrigation resulting in excess soil moisture in late spring/early summer. Under those conditions weak pathogens attacked the small feeder roots, affecting growth, but rarely killing the trees. Affected Krymsk® 86 rooted trees, like those on Marianna 2624 usually recover over time when excessive soil moisture is corrected.

More recently, some new self-fertile varieties have performed very poorly in the Sacramento Valley when grafted to Krymsk® 86. YCL symptoms for example have shown up in multiple seasons in some orchards – leading to a stunted orchard and the decision by the grower to remove the orchard entirely. Other orchards were removed early in the 2023 season after suffering massive tree losses due to suspected bacterial canker. Our current thinking is that like the UME issues on Marianna rootstock – the problems we are now seeing with certain varieties on Krymsk® 86 may have to do with the plum parentage of Krymsk® 86. Without testing each new variety that breeders produce on Krymsk® 86 over many years, we won’t know which varieties are more likely to have severe problems.

**Figure 2. Low vigor and yellow curled leaf (YCL) symptoms on 2<sup>nd</sup> leaf Independence® on Krymsk® 86 rootstock. Photos taken July 2, 2021. Photo Credit: Franz Niederholzer.**



### Do you have a new variety struggling on Krymsk® 86?

- Use [the pressure chamber and soil moisture monitoring](#) to avoid over-irrigation, which can exacerbate YCL symptoms.
- Some growers have had success bypassing the rootstock and providing nutrition with foliar applications. However, this is very expensive, unsustainable, and doesn't correct the fundamental problem for providing long-term nutrition.
- Have ongoing discussions with your nurseryman, PCA, and farm advisor.

### For future orchards using a new variety:

- If you have historic almond orchard performance, start your variety selection process with what has performed best previously. Your local farm advisor is a great resource for these variety and rootstock selection conversations.
- Talk with your processor about what varieties the market wants now and what future trends could look like.
- Consider rootstocks other than Krymsk® 86 ([article and comparison tool](#) / [podcast](#)). Self-fertile trees planted on other standard rootstocks without significant plum parentage (e.g. Viking and Atlas) or the more vigorous peach-almond hybrid rootstocks (e.g. Hansen 536, Brights, Nickels, and Titan) have not exhibited the same symptoms as those seen on Krymsk® 86 in the Sacramento Valley.

Stay tuned for developments at the UC [Butte County almond variety trials](#) (all varieties on Krymsk® 86 rootstock, planted at the CSU Chico University Farm) to help inform your decisions about new almond varieties.



## Plant Cover Crops Now to Prepare for Another Wet Winter

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

*Clarissa Reyes, Orchard Systems Advisor, Sutter-Yuba, Butte & Placer Counties*

Weather forecasts for the upcoming winter months are leaning heavily toward another wet and cold winter due to the predicted *El Niño* conditions. Unlike last year, however, our reservoirs are already full, or close to full, going into this new water year. This is true for storage basins across the northern Sacramento Valley, due largely to the heavy mountain snowpack from last winter being ideally time-released over the summer months. Should *El Niño* bring heavy rainfall back to the region, any on-farm water capture that can be done should be done to keep as much water locally banked as possible. The weeks immediately following harvest present the best time of the year to plant cover crops to reap their various benefits in the months ahead.

So what are those potential benefits? Well, in the context of cold, winter rains, there are two primary components of orchard management that you should be considering:

### Infiltration

Last winter, we published the article [Vegetation for Infiltration](#) which offered guidance on how to best capture any winter rain that may fall after several consecutive years of drought. Of course, by the time the

article was published after the holidays, the rain had started to fall, and continued to fall, and it became clear just how large a role vegetation in the orchard can play during sustained rain events.

Standing water in an orchard indicates that the rate of precipitation (rainfall or irrigation) is exceeding the infiltration rate of the soil. Last year, orchards with vegetation in the middles typically had far less standing water than those with bare soil. Standing vegetation physically slows the flow of water across the orchard floor, and the roots of any native or cropped vegetation create downward channels, deep into the soil profile. These channels increase the rate at which water percolates through these soils when compared to soils left bare (Figure 1). The combined effect is overall increased infiltration and water storage in the soil profile and underlying aquifer due to reduced runoff from the soil surface.

### Frost Protection

Moisture in the soil profile helps to hold soil temperatures slightly higher than that of dry soil. However, if water has ponded on the soil surface, the sun's heat is reflected up and away so that it cannot further warm the soil. During nighttime hours, when the sun has set and temperatures drop, those few degrees of higher soil temperatures can make the difference in frost damage being sustained by your trees or not. With vegetation in the orchard, water from precipitation (or irrigation) can be more effectively introduced to the soil profile where it can aid in this warming effect. You will want to keep any vegetation in the orchard managed, though, as taller stands will block the sun's rays and keep them from warming the soil just as ponded water can. Aim to keep any vegetation from growing much over 2" or so by mowing as needed - hopefully when the orchard is dry to prevent any unnecessary compaction from equipment in the lanes.

Check out the [Cover Crop Best Management Practices](#) guide from the Almond Board of California for more detailed guidance and information.

*Figure 1. Photos: Curt Pierce, Jan 2023*



## Reality Check

*Franz Niederholzer, UCCE Farm Advisor, Colusa, Sutter, and Yuba Counties  
Sudan Gyawaly, UC IPM Area Advisor, Sacramento Valley*

Times change. Weather changes. Manage navel orangeworm accordingly.

For years, discussions about pest pressures in almond production in California have been separated by north/south differences, usually related to weather. The higher average rainfall in the Sacramento Valley means more disease pressure in that region. Generally hotter temperatures in the Central to Southern San Joaquin Valley drive higher navel orangeworm pressure “down there”.

The [UC IPM website for almond](#) pest management presents separate thresholds for orchard sanitation for navel orangeworm management – one for southern and central San Joaquin Valley and another for the northern San Joaquin and Sacramento Valleys. Based on mummy counts in 20 trees per block, the current northern threshold was the statewide industry standard beginning in the 1980s and established the target of 2 mummies or less per tree with no mention of number of mummies on the orchard floor. As quality standards and market concerns about *Aflatoxin* increased, [Kern County research produced a stricter southern region threshold](#) -- 1 mummy per 5 trees and 8 mummies on the ground under each tree, using data from 2003-06. The researchers developing the southern San Joaquin Valley threshold stated that “in order to meet a new threshold of 2% or less kernel damage in Kern County” the new threshold numbers were needed.

Winter sanitation will be critical to controlling NOW next year given the early reports of 200+% jump in NOW damage in Nonpareil in some counties in the Sacramento Valley this year and the expected high carry-over NOW populations. It could pay growers, here, to sanitize to the lower, tougher standards developed down south. The decision is yours. Activities on any farm are the decision of the grower. Lower yields and nut prices the last couple of years in the Sacramento Valley have made the decision to do proven practices difficult. However, not sanitizing at all invites potential disaster, for your operation and very possibly for your neighbors.

Also, remember that ‘Winter Sanitation’ is just the first, very effective, of the several lines of defense against NOW damage. Other defenses against NOW include timely harvest, well-timed in-season sprays, and mating disruption practices. Multiple NOW management practices are necessary to lower NOW damage to below 2%, the acceptable damage set for the industry. The foundation of NOW management is orchard sanitation, but many steps are needed to reduce crop damage, especially when NOW numbers are high.



## Planning for a Big Crop in Tight Times

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

Plans are a road map, helping direct focus and energy to get the job done as efficiently as possible. In times of high costs and low prices, planning helps growers and advisors (CCAs, PCA, etc.) find a path to as good a year as possible.

2024 could be a big crop in the state and, very possibly, keep almond prices low as the industry works to move a large inventory. How big could the 2024 crop be? With light crops (lb./acre) in the last two years,

the 2024 California almond crop could easily be in the 3-billion-pound range if bloom weather is good. (I get that number by taking the bearing crop acres from 2022 multiplied by the 10-year average yield/acre for the California almond crop. Both those numbers come from the USDA NASS CA almond acreage report released in April, 2023). I think it's better to budget for a big crop, as much as possible in this market, and go into next year aware of the possible situation.

Maintaining income in a low-price year will require growing a large, high-quality crop. Assuming that bloom and early spring weather is decent next year, a big crop per acre could set and will require significant amounts of potassium and nitrogen and pesticides to protect it. For your consideration and evaluation, the following are some net profit maximizing ideas (just examples of possible approaches) based on UC research results:

- One bloom spray if weather is good at bloom including a FRAC 3 material. Consider using [Gear Up, Throttle Down \(GUTD\)](#) approach to dormant and bloom spraying to save time and diesel. This spray program uses less tractor power and higher gear selection for faster tractor speed to save time and fuel when spraying lighter canopies early in the season. (GUTD does require rechecking sprayer calibration.) If bloom weather is wet, spray every-other-row at pink bud timing using GUTD, follow up with solid spray at full bloom using GUTD. Switch back to slow ground speed and full sprayer power after petal fall as the canopy fills out.
- Based on hull boron levels, apply 0.4 lbs. B/acre (equal to 2 lbs. Solubor®) in October to increase nut set next spring. Include a low rate of zinc sulfate (5 lbs./acre) if no summer spray was applied. Adjust pH to 5.0 to keep both materials in solution. Where needed, this spray delivers the best return on investment of any fertilizer application.
- Beginning at full leaf out and running into July, fertigate with nitrogen (N) using small weekly doses matching crop use through the season. Save 65 lb. N/acre by assuming 90% N use efficiency (N applied: N exported in crop) and budget to use only 225 lb. N/acre/year to deliver sufficient N to support a 3000 lb./acre crop (In 2015, a grower might have applied 290 lbs. N/acre in 4 applications through the year assuming 70% efficiency to supply a 3000 lb. crop). You will need a tank and venturi unit for passive delivery late in irrigation sets. Double check program with spring leaf analyses to keep July leaf N levels above 2.4%.
- In November, apply 3 tons/acre almond shells near the edge of the herbicide strip boundary (closer to the tree row) to deliver 100 lbs. K<sub>2</sub>O/acre. In season, apply 150 lbs. K<sub>2</sub>O in weekly increments from April through July. Double check program with last spring (May, June) leaf analyses to avoid falling below sufficient leaf K (1.4%) in July sample.
- Monitor for mites and predators weekly beginning in May. Avoid disruptive sprays (unless leaf footed bug or stinkbug spray needed). Delay or eliminate miticide if beneficials keep spider mites down. Avoid using pyrethroids (Asana®, Warrior®, Brigade®, etc.) and try to skip miticide in hull split. Apply miticide in second hull split spray if spider mite numbers build to a [“time to treat”](#) threshold.

Hopefully, the market will turn around and the price will come up. In the meantime, planning for tight times is needed.



## Bacterial Blast/Canker: What do we Know?

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

Diseases caused by *Pseudomonas syringae* can affect tissue throughout the entire tree, including bacterial blast of flowers, leaves, and shoots as well as bacterial cankers that develop under the bark in cambial and wood tissues of trunks, scaffolds, and branches. The pathogen commonly exists on plant surfaces in an orchard without causing disease, but cold, wet weather can trigger damaging infections. Bacterial canker/blast infections are most damaging, and potentially lethal, in stressed trees. Stress from ring nematodes or root-restricting hardpan predisposes almonds to blast and canker damage.

The wet, cold spring of 2023 promoted widespread *Pseudomonas* bacterial infections in almond. This pathogen is becoming a consistent problem in cold, wet springs as almond plantings increase across the state.

Currently, there are limited control options for bacterial canker/blast in almonds. The following list outlines factors influencing management practices and decisions.

1. *Pseudomonas syringae* is a damaging pathogen in cold, wet weather.
2. The pathogen is ubiquitous and occurs naturally on plant surfaces.
3. Infection risk varies with orchard site, rootstock, and variety selection.
  - a. Low spots (sites) are colder and thus, more prone to freeze damage.
  - b. Peach x almond hybrid rootstocks (Hansen, Nickels, Bright's) are more vulnerable to ring nematode and subsequently to bacterial canker damage than Viking, Lovell, or Guardian rootstocks.
  - c. All almond varieties are susceptible to bacterial canker/blast infection, but some are more so than others. New self-fertile varieties are very susceptible to bacterial blast/canker.
4. Antibiotics can significantly reduce bacterial blast at bloom in almond, but none are currently labeled for almond. An effective, research-proven antibiotic (kasugamycin; Kasumin®) was available under Section 18 exception but is not currently labeled for almond.
5. Copper resistance is widespread in *Pseudomonas syringae* bacteria, making copper sprays ineffective.
6. Frost protection can help reduce damage.

What can growers do to manage bacterial canker/blast?

- If approved for use, treat with labeled antibiotic (for example kasugamycin; Kasumin®) 1-6 days ahead of forecast freeze. Expect only a week of protection. Note that very cold weather will damage buds even if an antibiotic is applied. Greatest economic benefit should come from bloom treatment.
- If antibiotics are not labeled before bloom 2024, growers have limited options. Spraying copper to control bacterial canker/blast is generally ineffective. Adding mancozeb to copper may overcome resistance. Unfortunately, copper is phytotoxic and may cause leaf damage. Biologicals (Actinovate, Botector, etc) are not registered for blast control in almonds, but if applied for other bloom pathogens may reduce blast damage if applied multiple times (4, 3, 2, and 1 week before bloom).
- Run frost protection irrigation if water is available. This will help reduce both frost damage and blast risk.
- High rates (100 lbs urea/acre) of foliar lo-biuret urea in October reduced bacterial canker growth by more than 90% in UC studies in peach orchards. Lower rates of urea were not tested.

In the long run, recognize bacterial blast and canker risk when selecting rootstocks and varieties for a colder site (valley floor, etc.). Almond variety and rootstock selections in the Sacramento Valley have changed, trending from more tolerant to more sensitive combinations. The traditional almond planting in the Sacramento Valley was Nonpareil and pollinators on Lovell peach rootstock – combinations generally tolerant to bacterial canker/blast. Trees on Marianna 2624 plum rootstock were much more susceptible to bacterial blast than those on Lovell peach. Newer rootstocks with a plum genetic background and newer varieties may also be more vulnerable to damage. Solid plantings of self-fertile varieties on certain newer rootstocks increase the risk of economic loss under cold, wet conditions.

University of California researchers, funded by The Almond Board of California, continue to study *Pseudomonas syringae* bacterial infections of almond. Updates will be available at The Almond Conference ([almonds.com/about-us/programs-and-events/almond-conference](https://almonds.com/about-us/programs-and-events/almond-conference)) this December.

Figure 1. Bacterial canker damage



Figure 2. Bacterial blast on almond flowers (photo by Dani Lightle)



2024 Sacramento Valley Orchard Meeting Save the Dates!		
Th Jan 18, 12-2 PM	Third Thursday Things in the Field Lunch	Orland, CA
Tue Jan 30, AM	Colusa Winter Almond Meeting	Arbuckle Golf Club Arbuckle, CA
Wed Jan 31, 7 AM - Noon	North Valley Nut Conference	Silver Dollar Fairgrounds Chico, CA
Th Feb 1, 7:30 AM to Noon	Northern Sacramento Valley Prune Day	Elk's Lodge Red Bluff, CA
Tue Feb 20, 7:30 AM to Noon	North Sac Valley Olive Day	Orland, CA
Th Feb 22, 7:30 AM to Noon	Northern Sacramento Valley Walnut Day	Elk's Lodge Red Bluff, CA
Tue Feb 27, AM	South Sacramento Valley Prune Day	Sutter County Ag Yuba City, CA

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Almond Newsletter

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