Sacramento Valley Almond News
Preharvest, 2024

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In This Issue

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Pre- & Post-Harvest Almond Orchard Management Considerations

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ALL SUMMER

- **Valley smoke:** Wildfire smoke blocks sunlight from reaching the ground and increases relative humidity. Consult with your PCA/CCA to make a plan for 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. Given the high levels of NOW damage we saw last year, and the challenge many growers had in sanitizing orchards over the winter, this is a year to pay special attention to your NOW management. Consider an edge spray when the first sound nuts in the upper canopy of border 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 hull split spray timing.

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 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. Note: An informative YouTube video on six-spotted thrips (mite predator) monitoring is also available.
- **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 these articles on target boron levels and 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 to high, research indicates no further N application is needed. If leaf levels are low or 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. See the article in this newsletter on harvest timing.
- **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 guide 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 this 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.

Timing almond harvest in 2024

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Luke Milliron, UCCE Farm Advisor, Butte, Glenn and Tehama Counties
Franz Niederholzer, UCCE Farm Advisor, Colusa and Sutter/Yuba Counties

Almonds can be harvested as early as when 100% of the nuts on the tree reach hull split. 100% hull split occurs when the lowest nuts in the lower interior canopy reach stage 2C (Figure 1): there is a deep V at the suture and the nut splits open when hand pressure is applied to opposite ends of the hull. Historically, the recommendation from UC almond experts for the ideal time to shake was as soon as 100% hull split occurred, keeping in mind pest and disease management, nut removal/drying time, and nut quality. However, these considerations vary widely among varieties and locations, so we'd like to address potential challenges that growers should consider when timing harvest, with additional notes on this year's specific challenges.

Figure 1. Almond hull split stages (photographs by C. Reyes and L. Milliron)
1. No separation of suture
2A. Less than 50% of suture line separated.
2B. Deep V over 50% of suture line separated, hull cannot be squeezed open.
2C. Deep V over entire suture line, can be squeezed open by pressing opposite ends of the hull
3. Suture opening less than 1 cm in width, exposed shell; visible brown edge along split edge of hull when observed from beneath the canopy.
4. Suture opening more than 1 cm in width, fully exposed shell.
5. Hull edges begin to dry, shell changes from white to brown
6. Completely dry hull, brown shell

Pest and disease management:
Timely harvest with rapid removal of dried nuts from the orchard floor is an effective way to manage navel orangeworm (NOW) by reducing the amount of time a nut is vulnerable to infestation. NOW pressure is high this year due to increased overwintering populations, so a timely harvest may be especially valuable in

reducing NOW infestation risk this year. In general, further NOW infestation is much lower once nuts are shaken to the orchard floor.

Timely harvest can also reduce the incidence of hull rot in trees by reducing the amount of time a nut is open and vulnerable to infestation by fungi, and by reducing the amount of time an infected hull may transfer the toxin through the shoot.

Rapid removal of nuts from the ground can minimize ant infestation, and a new invasive beetle (*Carpophilus truncatus* - CT) where present. However, shaking at an earlier hull split stage (greener hulls) can mean longer drying times on the orchard floor and greater susceptibility to ant and CT damage. *(Note: at the time of this writing, in June 2024, CT has not been detected in the Sacramento Valley)*

Nut removal/drying time:
If shaken when hulls are still very green (stage 3 or earlier), nuts will require longer periods of drying time on the orchard floor. Conditioning windrows may accelerate drying on the ground, and potentially provide benefits of getting cleaner product from the field, speeding up the actual "pick-up" process, and reducing hulling/shelling costs (since hullers charge on incoming weight). It is necessary for nuts and hulls to be dry when delivered to the huller because stockpiling nuts with high moisture content is detrimental to nut quality.

For Nonpareil at stages 4-5, the abscission zone (the separation zone between the fruit and the peduncle) has formed, nuts are only attached to the tree by a few fibers, and removal is normally excellent. Nonpareil normally shakes very well with an early harvest timing of 100% hull split. Unfortunately, we don't know the ideal shake timing for each variety. The industry is still learning when to shake 'Independence' for maximum nut removal, with some growers swearing by an earlier shake, and others by a later shake.

A timely early harvest of Nonpareil typically requires an earlier water cutoff. Hulls dry more quickly on the ground than when nuts are attached to the tree, thus advancing harvest. However, a longer drying time on orchard floor, 7-14 days with early harvest vs. 4-7 days with later hull split stages, can prolong the time between irrigation and harvest for later-maturing varieties. To avoid water stress on later-maturing varieties, irrigation with drip or micro sprinklers can be applied between variety harvests. If this is not possible, severe water stress may result in sticktights (nuts stuck in the tree) and/or hulltights (green hulls shriveling and drying tight around the nut). 'Winters', 'Padre' and other mid- to late-harvesting varieties can be posterchildren for sticktights when water stress and a late shake combine. An excessively late harvest can also result in mite infestation, and defoliation on later-maturing varieties. Extreme defoliation robs the tree of carbohydrates and can reduce bloom the following spring.

In some areas of California, smoke from nearby wildfire events traps moisture in the air, extending overall drying time. This impacts hull moisture, harvest readiness, and drying time on the orchard floor. If smoke causes delayed drying and increased drought stress on trees, sticktights and/or hulltights can occur. If so, this may reduce nut removal and/or require shelling at the huller to remove the hulls, which can cause the grower to miss out on inshell premiums on a portion of the delivery.

Nut quality:
Stage 5 and 6 nuts have the highest chance of being cleanly hulled and receiving an inshell price premium. Harvesting too early can prevent color from developing on the pellicle, which reduces nut quality. Shaking too early can also result in nuts that form curled hulls from rapid drying on the orchard floor. These curled hulls are similarly sized to kernels, difficult to separate, and may contribute to increased foreign material.

Table 1. Pros and cons of a timely "early harvest" of Nonpareil	
Pro	**Con**
Reduces NOW infestation and hull rot strikes on Nonpareil– less time that nuts are open and vulnerable on tree	
	Maximum nut removal on Nonpareil at stage 3 or greater
Maintains kernel quality – no wrinkled kernels if water stress is avoided	Reduced kernel dry weight (component of yield) if harvested too early – it typically increases until approximately stage 3.
Hulls generally dry faster on the ground than they do on the tree.	Longer drying time on orchard floor (7-14 days vs. 4-7 with later hull split stages). Mold may develop in high moisture environments.
	More foreign material when harvested too early – curled hulls from rapid drying on the orchard floor or hulltights.
Spreads out equipment use to accommodate more acreage	Higher risk of barking damage if trees are shaken too early.

There are many factors that influence almond harvest time, including equipment scheduling, weather, irrigation timing, NOW pressure, and the potential of an inshell premium with shaking at a later hull split stage. With all these things in consideration, it is important for growers to prioritize their goals for the crop. Growers must account for site-specific challenges whereby subtle changes in the date of shaking help to mitigate costly problems with pests and diseases, nut removal, and nut quality.

First Hull Split Spray: Timing and Practice

Franz Niederholzer, UCCE Farm Advisor, Colusa and Sutter/Yuba Counties
Sudan Gyawaly, UC IPM Advisor, Sacramento Valley
David Haviland, UCCE Entomology Advisor, Kern County

Hull split for the 2024 almond crop is just ahead. Successful hull split spraying lowers NOW damage but requires accurate spray timing and careful spray practices. Good coverage, applied on time will be especially needed this year. Navel orangeworm (NOW) populations are extremely high in many almond districts. The following information is intended for growers planning to apply two hull split sprays before Nonpareil harvest.

First hull split spray timing:

Hull split sprays protect the nuts, targeting NOW eggs and just-hatched larvae. The most common products are the ovicides/larvicides Intrepid and Altacor. Pyrethroids are also used in some parts of the state where NOW has not become resistant, and where growers are willing to risk flare-ups of spider mites due to the loss of natural enemies. Regardless of the product chosen, the best management strategy is to achieve good/excellent insecticide coverage at the start of hull split so that 1) NOW eggs are laid on recently treated nuts, 2) newly laid eggs are sprayed, and/or 3) newly hatched larvae crawl over treated surfaces. NOW eggs hatch in four days under summer temperatures, and new larvae move quickly to feeding on the interior of the nut, so spraying must occur either before or within 4 days of the start of egg laying.

The UC IPM Pest Management Guidelines states, "Time the spray to the beginning of hullsplit (no later than 1% hullsplit) if eggs are being laid on egg traps or pheromone traps indicate that the second flight has

begun." This timing was chosen because NOW cannot successfully attack an almond until the hull is split, and because the volatiles coming from the first nuts to split are extremely attractive to females looking for places to lay eggs. The guideline of 1% split in Nonpareil provides a good balance between spraying too early (residues degrade before eggs are laid on split nuts) and too late (worms penetrate to the kernels before the spray is made).

Attaining the perfect spray timing can be tricky for large growers, especially when there are limitations on the amount of equipment. When faced with this situation, growers should begin making sprays at the initiation of hull split, or perhaps even a little before the initiation of hull split, to ensure that the last of the orchards is sprayed by the time that 1% of the nuts are split. In cases where equipment limitations force the first orchards to be sprayed earlier than ideal, growers should consider a bracket spray program by making a second application approximately two weeks after the first is made. This will help compensate for the less-than-ideal timing, while also ensuring that a spray is made during the peak (as compared to the beginning) of the second flight, at a time that Nonpareil nuts have mostly split, and when pollinators are starting to split.

In a year like 2024, growers should be preparing now for their hull split spray(s). This is a year where flight timing and crop phenology appear to be on schedule with long-term averages, but where pressure is very high, presumably due to reduced sanitation efforts by growers anticipating low prices. Growers should have their recommendations written, the sprayers ready, and the material in the shed. Then, the key is to use degree-day models (1050 dd from the egg biofix), current pheromone trap captures, and careful monitoring for the first splits to decide when to spray. Focus your attention on trees on the edge of the orchard because they tend to split first. However, don't assume that that this is always the case, as sometimes nuts in trees within the orchard can split first, especially in orchards with lower nutrient levels or less vigor (on rootstocks such as Lovell, Rootpac R, etc.). Nuts in the tree tops mature and split first, so use a pole pruner, ladder, binoculars, etc. to look for splitting nuts in the treetops. Spraying a few days early is better than spraying a few days too late.

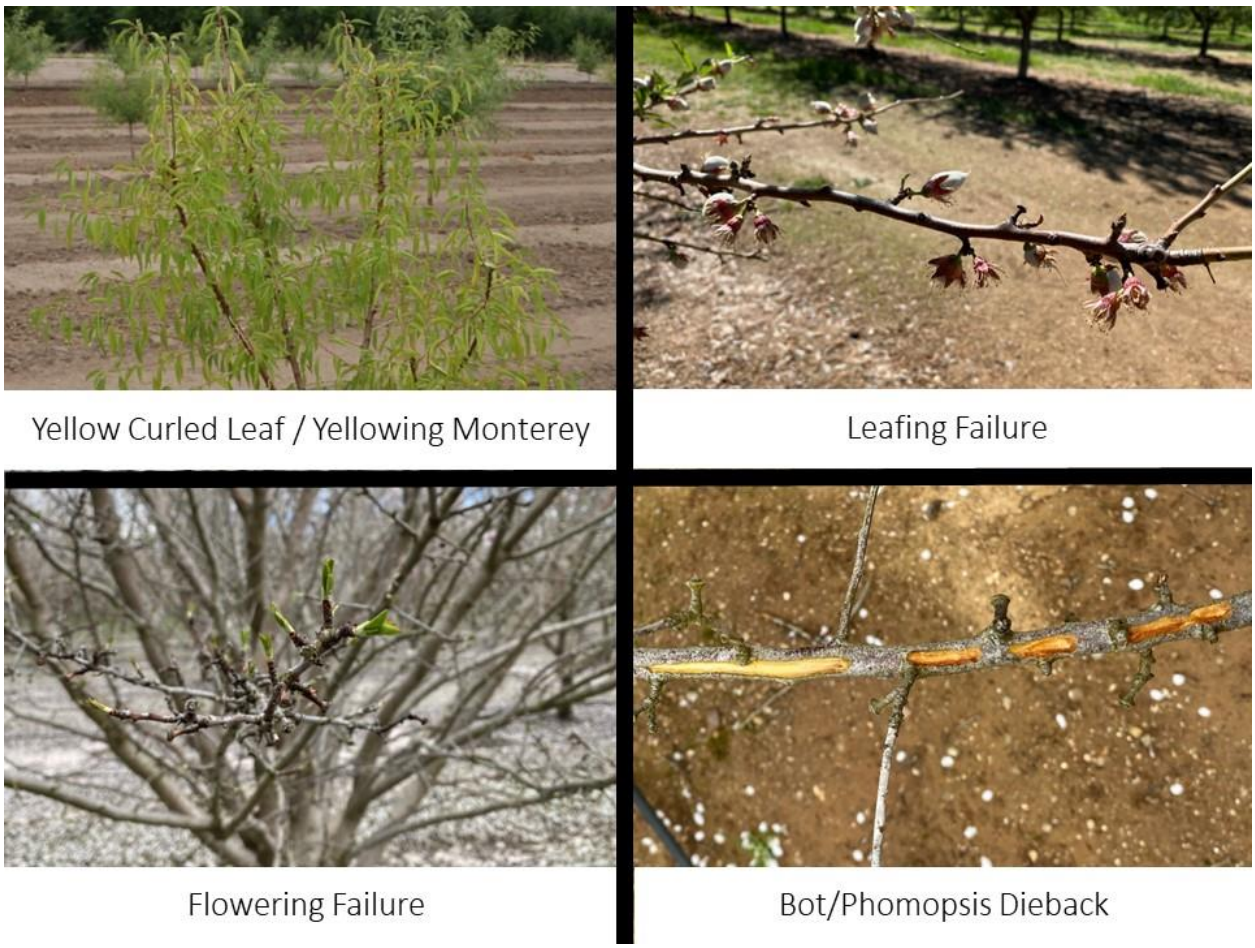
With relatively low almond prices there has been an increase in growers asking whether they should make their first hull split spray to the entire orchard, or only to the Nonpareils. The answer depends on what you're spraying and thus what you're targeting with your spray. *If a pyrethroid is being used,* the answer is definitively no, don't skip your pollinizers. Pyrethroids are relatively cheap compared to the cost of application and target highly mobile adults. Leaving gaps in the orchard makes little to no sense. However, *if Intrepid and Altacor are* used, where the target is eggs and newly hatching larvae, then there is some logic behind only spraying Nonpareil, assuming it is the only variety with splits. However, early pollinizers such as Sonora, Aldrich, or Winters may split soon after Nonpareil, so growers and PCAs must decide if the savings from just spraying the NP is worth the extra material cost compared to missing any early splits in those pollinizers. If all the pollinizers are later maturing varieties (Fritz, Carmel, or Monterey), the decision to spray just the Nonpareil in the first spray may be easier to make. If a second hull split spray is applied as a bracket spray (for example, 10-21 days after the first hull split spray), all varieties are usually sprayed, especially this year with the high NOW pressure.

Spray practices:

Good, uniform spray coverage is key to the best NOW control possible. More spray volume (150-200 gallons per acre) and slow sprayer speeds (2-2.5 MPH) using a powerful PTO or engine-drive sprayer deliver good spray coverage throughout vigorous, mature almond trees. Coverage in the treetops is most important; that's where most nuts are. Slow speeds ensure that the sprayer fan(s) have time to move the spray to the treetops. Driving too fast means good coverage low in the canopy, but poor coverage higher in the trees. Spraying at night reduces spray evaporation and improves coverage in the tops compared to spray applied when relative humidity (RH) drops below 40%; as early as 10-11 AM on a summer morning. As always when spraying, read and follow the label.

Monterey Maladies and the Need for Careful Irrigation Management

Luke Milliron, UCCE Orchard Systems Advisor: Butte, Glenn, Tehama Counties



From upper left to lower right, disorders with the Monterey almond variety: Yellow Curled Leaf (YCL)/Yellowing Monterey, Leafing Failure, Flowering Failure, and Bot/Phomopsis Dieback. Photos: YCL photo by Franz Niederholzer, other photos from Luke Milliron. Details on these four maladies can be found at: growingthevalleypodcast.com/podcastfeed/monterey

Over the past eight years, four new problems have arisen as major challenges for some Sacramento Valley growers as they work to establish and manage their Monterey almond trees. These four problems have not been studied in UCCE replicated and randomized field trials – instead we are relying on the establishment of patterns from individual grower experiences in the Sacramento Valley as well as anecdotes from Australian almond production. Over the past eight years with a growing list of Monterey maladies a single throughline has become well-ingrained: water.

Too little water:

Many growers accuse the Monterey variety of being a canary in the coal mine when it comes to water stress. One Glenn County grower who had a Ceres Imaging (remote sensing via airplane) flight over his orchard noted that the Monterey rows showed up bright red, indicating water stress. As we head towards harvest, keep in mind that extreme water stress has well known downsides – nut shrivel (reduced nut value), and the potential to reduce the flower buds for 2025 during bud differentiation (happens around the time of hull split). Water stress can be particularly challenging to avoid in the northern Sacramento Valley where many growers have full-coverage sprinkler irrigation that prevents them from watering their late harvesting

Montereys while other varieties are dried down for shaking or nuts are on the orchard floor. Given these well-known downsides of extreme water stress, do what you can this harvest season to quickly get water back on stressed Montereys. However, when it comes to this growing list of Monterey maladies, I don't yet have a consistent pattern from grower stories of previous water stress being linked to the various problems.

Too much water:
A history of excess water has been a consistent through-line in anecdotes about all four of the new Monterey maladies. Yellow curled leaf / yellowing Monterey has been found in our wettest springs (e.g. 2017) and trees have improved when excess soil moisture was corrected. Monterey leafing failure was previously induced by UC researchers in an over-irrigation experiment. In both California and Australia there is a weak link to seeing the problem following wet years (problem years in CA in 2018 and 2020 following wet 2017 and 2019 springs, respectively). Flowering failure has also been linked by UC researchers to excess water in the previous year, in particular because the problem appears low in the canopy where water status is wettest, and typically-smaller Monterey canopies can be over-irrigated season-long if you're irrigating for the larger Nonpareil trees. The newest problem - sudden branch dieback of Monterey canopies from Botryosphaeria and Phomopsis cankers in several Glenn County orchards in spring 2024 is the least well understood malady. However, one observant grower noted that his Montereys on heavier ground with nuts that stayed green through hull split (presumably wetter trees) are now the trees with severe dieback compared to trees that experienced more typical hull split and harvest water stress. Too much water for too long is associated with a growing list of Monterey maladies.

From too much to too little?
There is the potential for Montereys to be both too wet and too dry in the same season. Spring is the critical root growth period in almonds and too much water from rain or irrigation can kill the fine roots that are responsible for water uptake. Therefore, these trees go from too wet in spring to showing extreme stress late in the year during the hot harvest season, not necessarily because there isn't soil moisture, but because they don't have healthy roots to take up the water. Finding and maintaining the sweet spot in tree water status between too wet and too dry season-long is very difficult without a plant-based water status monitoring tool like the pressure chamber (pressure bomb), or an automated technology like FloraPulse that directly measures the water status of the tree. You can learn more about the pressure chamber at: sacvalleyorchards.com/manuals

Still learning:
We have lots more to learn – and the ideas for explaining the causes of these maladies are subject to change. We need additional details from grower and PCA experiences to continue our learning. If you have information you believe would be useful, please shoot me a text at: (530) 828-9666.

What Monterey maladies?
If you are surrounded by lush and productive Montereys and none of these problems are evident – be thankful. The northern Sacramento Valley where these problems are plaguing select orchards is a unique place – highest rainfall in the Central Valley, more full coverage sprinkler systems, and almost exclusive use of the Krymsk 86 rootstock. However, please take away that wherever you grow, too much water often leads to orchard maladies. Even in the depths of the two previous droughts, UCCE orchard advisors most often traced orchard maladies back to a history of too much water, not too little. Irrigation management is difficult, and grower stress about water stress is universal. However, it's a skillset that yields great benefits to orchard health with continual improvement.

Jocelyn Alvarez joins UCCE Orchard Team in the North Sacramento Valley

Jocelyn Alvarez joined UC ANR in 2024 as a Staff Research Associate serving the north Sacramento Valley with Curt Pierce and Becky Wheeler-Dykes in Glenn County, as well as the advisors in Butte and Tehama Counties. Jocelyn is a first-generation college student from Santa Maria, CA. She graduated with a B.S. in Wine and Viticulture in 2021 and a M.S. in Agriculture specializing in Crop Science from Cal Poly San Luis Obispo in 2023. She is focusing on research and learning more through new experiences to be able to contribute to future growing decisions and innovations. She enjoys hiking, traveling, spending time with family, and looking for new places to eat and explore. She will be based at the Glenn County Cooperative Extension office.