Sacramento Valley Almond News
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In This Issue

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Almond Management Considerations: Spring & Early Summer

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APRIL

- ✓ **Drought**: This will be a tough irrigation season for many growers. For a review of drought management strategies, download the free UC publication Drought Management for Almond Orchards (anrcatalog.ucanr.edu/pdf/8515.pdf).
- ✓ **Irrigation:** Monitor stem water potential using the pressure chamber and soil moisture sensors for irrigation timing (when and how long). Information on pressure chamber use is available at: sacvalleyorchards.com/manuals. Information on soil moisture monitoring at: ucanr.edu/sites/Tehama/files/20513.pdf. The pressure chamber is a more accurate measure of water status under saline soil/water conditions than soil moisture or ET.
- ✓ **Water Quality**: Do you know what is in your irrigation water? Overall salinity, chloride, sodium, and boron can change with source (canal vs. well) and time of the year. Consider taking a water quality sample (*see article in this issue*).
- ✓ **Spring Diseases:** For diseases such as rust, anthracnose, shot hole, scab and alternaria you can learn more about efficacy, timing, and mode of action (MOA) rotation options in the fungicide and bactericide efficacy and timing tables included in this newsletter. For the best disease control, spray before rain. Alternate fungicide chemistry (FRAC groups) to reduce resistance. You can learn more about these diseases at: www2.ipm.ucanr.edu/agriculture/almond/
- ✓ **Gophers** kill almond trees. Also, the combination of gopher mounds and close mowing produce more dust-induced spider mite pressure. Manage gophers early on, before their March through May reproductive pulse boosts populations. The best time to look for fresh mounding activity for implementing control measures is approximately 48-72 hours after rainfall or irrigation. See more on gopher control at sacvalleyorchards.com/blog/almonds-blog/options-for-gopher-management. Trapping is an excellent means of controlling gophers. Better trapping results have been measured when employees are trained to find tunnels and set traps. See video showing steps to gopher trapping with Dr. Roger Baldwin, UC Extension Specialist at youtube.com/watch?v=iDW0l6eeG0M.
- ✓ **NOW monitoring.** Continue monitoring traps, checking egg traps twice weekly to determine biofix. Many experienced practitioners in the Sacramento Valley use the first NOW eggs found in traps as the biofix. This differs from common

practices in the San Joaquin Valley because our population pressure is often lower. Pheromone and bait-bag traps can be used to track male and female flights and relative abundance. Additional details on NOW management at: www2.ipm.ucanr.edu/agriculture/almond/Navel-Orangeworm.

- ✓ We have been seeing lots of **shoot strikes caused by Peach twig borer or Oriental fruit moth**. These shoot strikes are primarily a problem in first leaf orchards, where you're encouraging shoot elongation to establish tree structure. Cut open shoots to see which pest is responsible. See pictures and management info at ipm.ucanr.edu/PMG/C003/m003fcshootstrik.html. Use pheromone traps to time control sprays, where needed.
- ✓ If you are worried your orchard may be nitrogen deficient, consider taking **early season leaf samples** once leaves have reached full size, which is roughly 35-50 days after full bloom. Careful following of leaf sampling protocol will provide a good estimate of how summer leaf levels will look. Sampling protocol on page 14 of almonds.com/sites/default/files/2020-12/ABC_Nitrogen_8.5x11_vmags.pdf. April is also a key time for assessing how large the crop is, and adjusting the nitrogen fertilizer budget according. Excess N in the tree (measured by leaf samples) contributes to increasing hull rot incidence.
- ✓ Monitor for **large bugs** (leaffooted bugs in March-April, stink bugs in May). Distinguish between the many causes of gummy nuts with the helpful guide at: sacvalleyorchards.com/almonds/insects-mites/possible-causes-of-gummy-nuts.

MAY

- ✓ **Navel orangeworm:** Track NOW populations and develop a hull split/harvest timing NOW plan. Egg traps can be used to project when egg laying is likely to begin for later generations once a biofix is obtained in spring. Pheromone traps (catch males, ineffective near mating disruption products) and bait-bag traps (catch females) can be used to track flights and relative pest levels.
- ✓ **Spider mites:** Monitor for spider mites and their predators (especially six-spotted thrips) at least weekly, watching hot spot areas that are often dusty or water-stressed. Be wary that a greater reliance on groundwater this year may result in increased irrigation salinity (EC) induced water stress, and therefore increased mite pressure. Early abamectin (AgriMek®, etc.) sprays provide excellent spider mite control for roughly 60 days if carefully applied but can create mite flaring going into harvest as the abamectin wears off, mites move in and if predators are absent. More information on the prophylactic vs. threshold approaches at: sacvalleyorchards.com/almonds/insects-mites/approaches-to-spider-mite-management-in-almonds.
- ✓ **Nitrogen (N):** Reassess your crop set and consider leaf sample results from last July and/or this spring and adjust the amount of nitrogen application needed before harvest – up or down depending on all information. Nuts use 80% of annual N budget by June.
- ✓ **Potassium (K):** Maintain leaf K levels in the adequate range (1.4%) through July to minimize spur death and reduced flower number (crop loss potential) next year. Almonds absorb K up to hull split, so the window for K fertilization is wider than N. Learn more at: sacvalleyorchards.com/almonds/horticulture/potassium-management-for-sustained-almond-yields
- ✓ **Diseases:** Monitor for **alternaria, rust, scab and anthracnose** and treat if needed. If orchard history and conditions indicate high vulnerability, consider a rust treatment *before* symptoms are visible. Rotate the material's site of action (FRAC Group) to avoid development of pesticide resistance (*see efficacy and timing tables in this newsletter*). Be aware of changes possibly affecting propiconazole (Tilt®, etc.) use for nuts exported to the EU. Consult with your processor/marketer regarding propiconazole use. See disease management details at: ipm.ucanr.edu/agriculture/almond.

- ✓ **Weeds:** Survey to see which weeds were not controlled by fall or winter treatment. The UC Weed ID Tool at wric.ucdavis.edu/information/weedid.htm can help with identification. This info will be very helpful in planning for next fall/winter weed management.
- ✓ **Bugs:** Monitor for leaffooted and stink bugs. Info at: ipm.ucanr.edu/agriculture/almond/Leaffooted-Bug and ipm.ucanr.edu/agriculture/almond/Stink-Bugs.

JUNE

- ✓ **Irrigation:** If you have been able to run full irrigations during these drought conditions, a strategic irrigation deficit at the onset of hullsplit offers mutliple benefits. For *Rhizopus* hull rot management and a shorter, cleaner shake at harvest, reduce irrigation set length as kernel fill completes. Deep, heavy soil with micro-sprinkler or solid set irrigation have more soil water available and so respond more slowly to reduced irrigation compared to lighter soil with drip irrigation. For two to three weeks, beginning at the onset of hull split (late June or early July), SWP levels of 4 to 8 bars drier than the baseline (generally -14 to -18 bars) will promote hull split and uniform nut maturity leading to timely harvest. Learn more at: sacvalleyorchards.com/manuals/stem-water-potential/advanced-swp-interpretation-in-almond
- ✓ **Spider mites:** Continue monitoring. Treat when populations reach thresholds. When spraying abamectin, use 1-2% (v/v) narrow range 415 oil (best leaf penetration) and spray at night (limits spray evaporation) to get the best mite control possible.
- ✓ **Navel orangeworm:** Continue monitoring NOW and preparing for hull split.
- ✓ **Hull rot:** Best control is from an integrated approach combining reduced irrigation between kernel fill and end of early hull split, moderate leaf N levels (no more than 2.6% N in summer leaf samples) and 1-2 fungicides in June or early July. See fungicide efficacy and timing tables in this newsletter**.**
  - ***Monilinia* hull rot:** For best control of *Monilinia* hull rot, which presents as a tan lesion on the outside of the hull, spray in early June as hull split timing does not effectively control this hull rot pathogen.
  - ***Rhizopus* hull rot*:*** For orchards with a history of *Rhizopus* hull rot (black spores), spray a fungicide at early hull split (first NOW timing).
- ✓ **Nitrogen:** Finish up N applications in June.
- ✓ **Potassium:** Continue K applications if needed.
- ✓ **Ants:** Ant feeding caused significant nut damage at harvest in 2020. Monitor for protein feeding ants in June. If they are found, decide on a treatment plan with your PCA. Depending on the material, applications can start as early as 10 weeks ahead of planned harvest. Use bait materials promptly after buying (product opened for 1-2 weeks no longer works) and apply to dry ground (at least one day after irrigation and two days before irrigation) for best results. Identification and key treatment details at: ipm.ucanr.edu/agriculture/almond/Ants.

Almond May Spray Considerations in a Tight Fiscal Year

David Haviland, UC Cooperative Extension, Kern Co.

Over the past month I have received numerous phone calls and texts asking different versions of the same question: When almond prices are low, how can a grower cut costs?

This question is often a tricky one to answer because in almond production, you have to spend money to make money. Trying to save money by reducing nitrogen or water costs can lead to yield losses and lower returns, just as skipping a fungicide spray can lead to losses from disease. The same can be true for the management of arthropod pests such as navel orangeworm, spider mites, peach twig borer, and leaffooted bug.

However, in the case of arthropod pest management, not all insects and mites need to be treated every year, and there are cases where almond growers have a history of spraying more than is necessary, especially at the timing referred to as 'May sprays'.

Peach Twig Borer

In the Sacramento Valley, the term 'May spray' had its origins with peach twig borer (PTB). "May" sprays referred to the timing at which insecticide applications should be made, based on degree-day models, to control PTB if they had not already been controlled during the dormant season or at bloom. However, despite its historical significance as an almond pest, damage by PTB has become almost irrelevant throughout California for trees that are bearing fruit. Most growers, including those who capture hundreds of PTB in traps, typically report very low to negligible levels of PTB damage in their official USDA kernel quality assessments. These assessments, of course, are what counts.

There are currently two main theories for why PTB is not the problem it used to be. The first is that modern-day precision irrigation practices allow for uniform shell expansion, leading to a good shell seal. When there is a good shell seal, PTB tends to feed outside the shell on the inside of the hull. This is in comparison to the historic use of flood irrigation, where wet-dry cycles during shell expansion caused cracks and splits in the shell that facilitated PTB access into the marketable kernel. The second theory relates to improved biological control. Historically, dormant and in-season applications of organophosphates reduced populations of all ant species. However, modern-day use of selective ant baits allows for control of pestiferous ant species, such as southern fire ant, while allowing the survival of the beneficial native gray ant. This species of ant feeds on PTB larvae, especially while they overwinter inside hibernacula on the trunk. Reductions in the use of organophosphates (Lorsban®, diazinon, etc.) and pyrethroids (Brigade®, Warrior®, Asana®, etc.) have likely also benefited species of parasitoids that attack PTB.

For growers that are unsure about whether or not they need a "May" spray for PTB, the UC Statewide IPM Program recommends evaluating shoot strikes in late April. If it is easy to find four strikes per tree on a mature tree, a treatment may be warranted, though my personal opinion is that threshold should be increased for reasons previously described. Non-bearing trees, of course, are a completely different story because unlike bearing trees, where the primary economic damage is feeding on the kernels, in nonbearing trees the primary concern is the impact of shoot strikes on scaffold and shoot development.

Spider Mites

Another common target for "May" sprays in the Sacramento Valley is the two-spotted (and possible Pacific) spider mite. May sprays for spider mites were invented in the early 2000s by almond growers in the lower San Joaquin Valley. At that time in Kern County, it was common for almond orchards to become defoliated by June in the absence of intervention, and it was quickly determined that newly-registered abamectin (Agri-Mek®, etc.) was most effective through its translaminar activity if applied in May before leaves hardened. Ten years later, as generic abamectin products became available and active ingredient prices dropped, May sprays became adopted more widely throughout the entire San Joaquin Valley. Adoption eventually reached a point that 'preventative' mite sprays in May became the industry standard practice.

Fast forward to 2020 and things have totally changed. It is nearly impossible to find mite-induced defoliation in a bearing almond orchard until after hullsplit, and biological control of spider mites is at an all-time high, thanks primarily to 'greener' production practices that promote sixspotted thrips. Recent research projects in the lower San Joaquin, upper San Joaquin, and Sacramento Valleys have all shown that

this natural enemy is present and important. In the Sacramento Valley, sixspotted thrips in some locations have displaced predatory mites as the most important mite predator. Overwintering adult sixspotted thrips have been shown to become active in the Sacramento Valley in the beginning of May, at the same time that spider mite populations sometimes increase.

In an effort to maximize biological control, miticides should only be applied in the spring if a treatment threshold of 40% of leaves infested has been reached, and there are less than 2 sixspotted thrips in two Pherocon predator traps (Trécé, Inc) within a week, or less than 3 sixspotted thrips in four traps. Surveys have shown that in most orchards most years, sixspotted thrips density far exceeds this threshold at the time May sprays are needed. The exceptions are typically cases where the grower has done something that disruptions biological control, such as a pyrethroid spray for leaffooted bugs. It is time for almond growers to make 'preventative' miticide sprays obsolete. Abandoning this practice will also help save on costs in a tight year.

Navel Orangeworm

May sprays for NOW have always been problematic. The most common insecticides for lepidopteran worms, including methoxyfenozide (Intrepid®) and chlorantraniliprole (Altacor®), do not kill overwintering larvae and pupae that are still in the mummy, do not kill adults that fly in the spring, and can only provide control from the time eggs are laid until the new larva passes below the mummy surface. Unfortunately, the first NOW flight occurs over a long period of time such that even a perfectly timed spray will only kill a small segment of the first-generation eggs and larvae. This also assumes that coverage is excellent, as eggs laid into cracks and crevices without insecticide residue have a good chance for survival. May sprays also do not directly protect kernels of the current year's crop, including from moths immigrating into the orchard from neighboring tree crops as hull split begins.

Cost-wary growers who plan to make one spray for navel orangeworm should apply it at the beginning of the hullsplit. If a second spray is needed, it should be applied towards the end of July as residues from the first spray break down, pollinizers are splitting, and the third flight is approaching. In the Sacramento Valley, especially in locations and years where NOW only has three flights (compared to four flights each year in the San Joaquin Valley), the need for a "May" spray is extremely rare.

Leaffooted Bug

Insecticide applications for leaffooted bugs in the spring are only needed sporadically. Cases where treatments are warranted most commonly follow mild winters in orchards near excellent overwintering sites. Key examples include areas that contain plants with foliage, such as urban landscapes, Cyprus trees or citrus orchards; or lots of debris, such as riparian areas along streams or rivers. From March to May, monitor almond orchards for the presence of leaffooted bugs, gummosis associated with a puncture mark on the almond hull, and aborted nuts. If found at levels that are not acceptable, consider a treatment. Otherwise, save your money.

Interactions

After monitoring individually for PTB, NOW, leaffooted bug, and spider mites, the verdict in most cases will be that no insecticide applications are needed in April or May. However, when exceptions for one of these pests occur, growers should make sure they get the best bang for their buck. If spraying for PTB, choose a product that is also effective against NOW. If spraying for NOW, consider applying it at a timing that is optimal for PTB. If spraying for leaffooted bug, consider the relative merits of different options: pyrethroids are inexpensive and effective but kill natural enemies, abamectin has short-lived effectiveness but is safe on most natural enemies other than sixspotted thrips, and clothianidin (Belay®) is more

expensive and has short effectiveness but preserves natural enemies. If applying a miticide, weigh your options between using abamectin (least expensive but toxic to sixspotted thrips) or a more expensive miticide not known to impact natural enemies that may help reduce the risk that another miticide treatment is needed later in the season.

When all things are considered, limiting "May" sprays have great potential to serve as a low-hanging fruit for cost-wary almond growers in 2021. For more information about making 'May spray' decisions, consult the UCIPM Pest Management guidelines for Almonds (https://www2.ipm.ucanr.edu/agriculture/almond/) or contact your local UC Cooperative Extension office.

Irrigating with lower quality water? What to consider first.

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Given low precipitation this past winter and low surface water allocations, many growers may be faced with the difficult prospect of using lower quality water for irrigation this season, either using more groundwater than usual or using groundwater that may have decreased in quality. What should be considered before irrigating with lower quality water?

What do we mean by "lower quality" water? And why does it matter?
Water can be low quality in a number of ways – high salinity, high sodicity, high in specific toxic ions, and/or high in bicarbonates.

Saline irrigation water can interfere with water uptake in the roots. Water moves into roots through osmosis. A high concentration of ions (dissolved salts) in the roots draws water into the roots, but if ion concentrations are also high in the soil-water solution, this root draw won't be as powerful. The end result is decreased growth due to reduced water uptake by the tree. Electrical conductivity of the water (ECw) is a measure of the potential for this osmotic effect.

Does EC_w pose a potential problem (osmotic effects)?

Unit	Degree of Growth or Yield Reduction		
	None	Increasing	Severe
dS/m	< 1.1	1.1 - 3.2	> 3.2

Sodicity is specific to the influence of sodium relative to other positive ions. High sodium relative to calcium and magnesium can lead to structural soil crusting. Water with a high sodium adsorption ratio (SAR) is dominated by sodium that elbows calcium off clay soil particles, destabilizing soil aggregates and causing problems with water infiltration. If the SAR/EC ratio is greater than 10, amendments are beneficial to avoid soil dispersion and sealing, either by directly adding calcium (e.g. gypsum) to the water or soil, or driving off bicarbonate and freeing up more calcium (i.e. acidifiers) to increase EC of the irrigation water and soil-water solution. Between 5-10 SAR/EC, amendments may be beneficial. If magnesium is high relative to calcium and sodium is low, magnesium may also act as a dispersant, destabilizing soil

aggregates and causing slow water infiltration. If the Ca/Mg ratio is less than 1 (i.e. more Mg than Ca), this could be a red flag.

Could the water chemistry reduce soil tilth, porosity, and cause slower water infiltration rates?

		Potential of Water Infiltration Problems Developing		
Lab Information	Unit	Unlikely	Increasing Likelihood	Likely
Ratio of SAR/ECw	ratio	<5.0	5.0- 10.0	>10
Ratio Ca/Mg	ratio	< 4.0	2.0- 1.0	<1.0

Toxicity from specific ions occurs when these ions move into the plant with water and accumulate in plant tissue to a level that kills the tissue. Depending on your region, sodium (Na), boron (B), and chloride (Cl) could be at toxic levels in some water sources.

Could specific elements (B, Cl, and Na) accumulate in the tree or soil to potentially toxic levels?

Element	Unit	Degree of Growth or Yield Reduction		
		None	Increasing	Severe
B (boron)	mg/l (ppm)	<0.5	0.5 - 3.0	>3.0
Cl (chloride)	meq/l	<4.0	4.0 - 10	>10.0
Na (sodium)	SAR (none)	<3.0	3.0 - 9.0	>9.0
Na (sodium)	meq/l	<4.0	4.0 - 7.0	>7.0

Irrigation water high in bicarbonates (HCO_3), greater than 2 meq/l, precipitates Ca with HCO_3, forming lime which can clog drip emitters, microsprinklers and filters, leading to issues with irrigation distribution uniformity, with some trees getting over- or under-irrigated, or a mix of both across an orchard. High bicarbonates may also influence balances between Ca, Na, Mg, and K but there is much to still be learned on this subject.

Could the water chemistry be prone to plugging emitters or filters and reduce distribution uniformity?

		Potential for Plugging Problems Developing		
Lab Information	Unit	Unlikely	Increasing Likelihood	Likely
ECw	dS/m	<0.8	0.8 to 3.0	>3.0
HCO3+CO3	meq/l	<2.0	2.0 - 4.0	>4.0
Mn (manganese)	mg/l	<0.1	0.1 - 1.5	>1.5
Fe (iron)	mg/l	<0.2	0.1 - 1.5	>1.5

See similar tables for other orchard crops at sacvalleyorchards.com/walnuts/irrigation-walnuts/evaluating-water-supply-for-irrigating-nut-crops.

What to watch for this year?

Before you make any decisions, get a sense of where you're starting from. Without a large amount of heavy, drenching rain this year, there was not much leaching of specific ions from the root zone. With each irrigation, sodium, boron and chloride can build up over the growing season. If you are concerned about toxic ions and considering using lower quality water this year, it would be prudent to test your soils around the root zone to see the baseline specific ion levels with which you are coming into the season. Make sure you test different depths in the root zone, ideally to at least three feet. It's important to understand the distribution of salts in the root zone. They may have moved down the soil profile but not all the way out of the root zone. Also consider reviewing leaf (Cl and Na) and hull (B) analysis results from last year.

As you consider the short- and long-term potential impacts of using lower quality water this year, think through what tools are at your disposal to mitigate those potential impacts. If you are worried about increased SAR or low Ca/Mg ratio leading to soil crusting, what are your options for adding calcium to the water or soil? What options do you have to add acidic amendments to lower bicarbonates or lower soil pH to liberate calcium from lime when it's present in the alkaline soils? Running these amendments in your irrigation water is generally the most efficient, direct approach, especially with drip systems. Even though these amendments may be more expensive, they will be going directly to the point of the problem, rather than cheaper broadcasted products that may improve infiltration in the middles, far from where your irrigation water touches. See fruitsandnuts.ucdavis.edu/files/73695.pdf for more on product purity and calculating amendment rates.

If you are concerned about lower quality water leading to salt build up in the root zone and reducing yield, how easy or difficult will it be to leach those salts this fall/winter? Do you have a clay layer or other soil profile issues that would make leaching difficult? Whereas soil crusting can happen with just a few irrigations and be easily perceived with the eye, root zone salinity build up may happen slowly over time. This is why having a beginning of season soil baseline that you can compare against at the end of the season is valuable, to know if leaching intervention after the end of the season is warranted.

When you have two sources of irrigation water, one better quality than the other, you have the options to irrigate with them separately or blend them into one source. If you choose to use them separately, keep in mind that early stages of growth are more likely vulnerable to stress related to water quality, particularly the osmotic root zone salinity stress that can result in plant tissue being water stressed even though there

is ample water in the root zone. If you are more interested in blending the two sources of water into one supply, you can find some help with blending water calculations here: fao.org/3/T0234E/T0234E03.htm#ch2.4.7.

As we go through the season, if pumping depths change, water quality from the same well can change. Rather than paying for multiple water tests throughout the season to know if you have a problem, you can keep an eye on the EC levels with a portable EC meter (~$50). Use this to monitor the total salinity of the well water every 4 to 8 weeks. If total salinity (ECw) increases by 20 percent or more, submit a new sample for lab analysis to include SAR and specific ions.

If your water samples indicate specific ion levels that may eventually exceed healthy levels in your trees, be sure to take leaf samples to monitor impact mid-season for sodium and chloride and hull samples for boron. Compare your values with previous years and hold onto them in case the next couple of years are lean water years, too. It is important to compare your tissue samples against critical values (sacvalleyorchards.com/almonds/horticulture/july-leaf-analysis). But it is also valuable to watch how management changes like changing water sources influence these levels over time, and if additional adjustments are needed. A similar approach is prudent for soil sampling, especially if you continue to rely on lower quality water for many years. How frequently you should sample soil depends on your starting baseline and how marginal your water quality is, but generally sampling every three years should be adequate.

Summary

We're going into the season with the water we have, not necessarily the water we want. Water quality may not be ideal, but with careful planning and consideration many of the risks associated with low quality water can be managed in the short-term: one year to a few years.

Lean Price Year Nutrient Management

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With prices down, growers and managers may be looking at their inputs and considering where they may be able to cut back this year. When it comes to nutrient management, there are some inputs you may be able to save, and some needs that still require attention where it's advisable not to scrimp. Every orchard is different, but here are some questions to consider when evaluating an orchard's nutrient management plan this year.

What nutrients that are heavily drawn down and need to be attended to every year?

Every year in bearing trees a crop will be removing nitrogen and potassium from the field, roughly equivalent to 68 pounds for every 1,000 pounds of kernel yield for nitrogen and up to 80 pounds for every 1,000 pounds of kernel yield for potassium (96 lbs K_20). These nutrients will have to be replaced every year if you are to maintain long-term productivity, so these are definitely not nutrients you can neglect. That said, if you have been applying nitrogen and potassium in excess of the minimum needs, there may be nitrogen or potassium reserves in your system to draw on, especially in a winter with limited leaching potential. Soil or leaf sample results (see below) can help assess if nitrogen or potassium may still be present in the soil or perennial tissue and available for uptake and use. At the very least, aim for replacement of removed nitrogen.

While there has been much talk about phosphorus in recent years, we still have not seen widespread phosphorus deficiency in California. Given the low expected price for almonds this year this might not be the best year to experiment with phosphorus.

Are there cheaper sources of nitrogen to consider this year?

If you're looking for a cheap source of nitrogen there is none cheaper than the nitrogen that might be present in your irrigation water, so get that tested at a reputable lab and use that nitrogen to offset against any fertilizer costs.

NO_3-N (mg/l, ppm) x 2.7 = lbs N per acre-foot of water

NO_3 (mg/l, ppm) x 0.6 = lbs N per acre-foot of water

Nitrogen that remains in the soil from previous year's fertilizations can also be utilized, so consider taking a soil nitrogen test to estimate how much nitrogen is in the root zone and you can save that amount of nitrogen from your fertilizer bill. The most expensive nitrogen is the nitrogen that never benefits the tree because it's leached down out of the root zone, so manage timing and water to minimize leaching.

What are the trends in each orchard's leaf tissue samples in recent years, and where were leaf tissue levels last year?

Consider your previous leaf tissue sample results relative to critical value thresholds (Table 1 and sacvalleyorchards.com/almonds/horticulture/july-leaf-analysis) to see if you could stay in the adequate range with a less aggressive nutrient plan than previous years. While it's true that almond trees certainly utilize a lot of potassium, if you've been doing routine tissue analysis and your 2020 tissues show that you were greater than 2% potassium you can probably save on potassium fertilization this year. In general, it takes a number of years for trees to respond to a potassium deficiency so if you've got to cut some corners this might be an opportunity. If, however, you're in a very sandy soil with low residual potassium and have had very high recent yields, you still may need to replace potassium taken away from the crop in last year's productivity.

Table 1. Critical nutrient levels for almond leaves sampled in **July**.

Nutrient	Deficient	Adequate	Excessive Over
Nitrogen (N)	< 2.0%	2.2-2.5%	>2.7%
Phosphorous (P)		0.1-0.3%	
Potassium (K)	< 1.0%	>1.4%	
Calcium (Ca)		>2.0%	
Zinc (Zn)	<15 ppm		
Manganese (Mn)		>20 ppm	
Copper (Cu)		>4 ppm	
Magnesium (Mg)		>0.25%	
Sodium (Na)			>0.25%
Chlorine (Cl)			>0.3%
Boron (Hulls at harvest)	<80 ppm	80-150 ppm	>200 ppm

Could potassium chloride be integrated into this year's potassium management program?

The question often arises about the potential to use potassium chloride for potassium management in almonds. Certainly it is a viable source, it is a cheap source and at least for some of the potassium demand of the crop, potassium chloride could be used. There is one caveat to this: if you have high levels of chloride in your water or soils, and it often shows in your leaf samples (table 1) then you should probably avoid potassium chloride as your potassium source. Make sure there are no soil layers that restrict leaching or a fluctuating water table that can move leached chloride back up into the root zone. If, however, your water is of good quality and chloride has not been an issue then it is quite safe to use potassium chloride for a portion of your total annual potassium demand. If you are applying potassium chloride it should be done in small amounts dissolved uniformly through the drip irrigation season if possible. Spreading potassium over a large area on heavier soils with sprinklers ties up potassium close to the surface and will reduce uptake.

What is in micronutrient blends and are they critical enough to add this year?

Micronutrients are, of course, essential for almond production; however, if you have not seen routine micronutrient deficiencies then this might be a year where you could skip the application of many of them. Two micronutrients not to skip are boron and zinc if previous leaf or hull samples showed you were on the marginal side of adequate leaf or hull levels (Table 1). As with nitrogen, consider what may be coming from your water. After this dry winter, if you're switching to more reliance on groundwater, check to see if that will provide more boron than your usual source, and potentially offset your traditional input program.

Does the return on investment of stimulating soil microbes pencil out this year?

There is a lot of uncertainty about the use of biostimulants or microbials and it is most likely that the response to these expensive applications is rare. Given tight margins and in the absence of extensive research, this might not be a year to experiment with these products.

Evie Smith, with Almond/Walnut/Pistachio industry support, joins Sacramento Valley UCCE Extension Team as a Staff Research Associate.

I am excited to be starting my position as a Staff Research Associate working under Dr. Katherine Jarvis-Shean and Dr. Franz Niederholzer in orchard crops in the Southern Sacramento Valley. I was born and raised in Georgia, and attended Auburn University in Alabama for my undergraduate studies in Horticulture and Agronomy. I moved to California in 2017 to do a master's in International Agricultural Development and subsequently a masters in Horticulture and Agronomy at UC Davis. My research experience and interests focus on connecting farmers with science-based strategies for climate change adaptation, water management, pest management, and other agricultural challenges through applied research and effective communication. In my free time, I enjoy gardening, cooking, hiking, camping, and drinking good coffee. I am grateful to the Almond Board of California, California Pistachio Research Board, and the California Walnut Board for funding my position with UC Cooperative Extension.

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Tree and Vine Crop Herbicide Chart – Updated (2021)

Please also find attached to this newsletter the updated tree and vine crop herbicide chart organized by Brad Hanson, UCCE Weed Science Specialist. Please remember that rotating and/or mixing herbicides with different modes of action (MOAs) is critical to good weed management, particularly with herbicide-resistant populations. Notes: R = registered, N = Not registered, NB = registered only for Non-Bearing. Always check the current specific herbicide label before use because labels change and there are occasionally differences among products with the same active ingredient.

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We are no longer mailing hard copy newsletters, unless you make a special request by calling the office at (530) 865-1107 (note: substantial delivery delay, limited content, and black and

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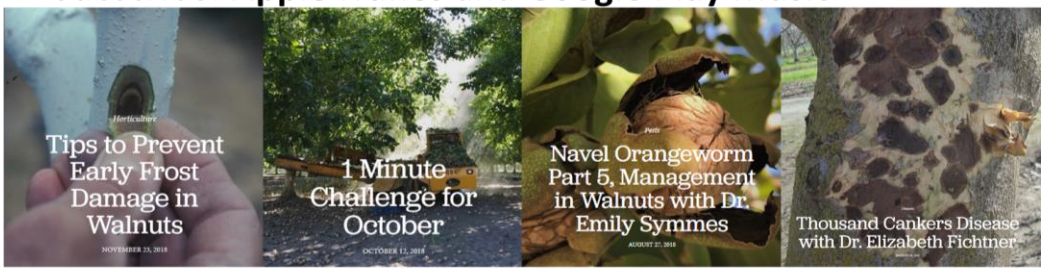

Website: SacValleyOrchards.com

Herbicide Registration on California Tree and Vine Crops - *(reviewed March 2021 - UC Weed Science)*

	Herbicide-Common Name *(example trade name)*	Site of Action Group[1]	Almond	Pecan	Pistachio	Walnut	Apple	Pear	Apricot	Cherry	Nectarine	Peach	Plum / Prune	Avocado	Citrus	Date	Fig	Grape	Kiwi	Olive	Pomegranate
			----- tree nut -------				- pome -		---------stone fruit ---------												
Preemergence	**dichlobenil** *(Casoron)*	L / 20	N	N	N	N	**R**	**R**	N	**R**	N	N	N	N	N	N	N	**R**	N	N	N
	diuron *(Karmex,Diurex)*	C2 / 7	N	**R**	N	**R**	**R**	**R**	N	N	N	**R**	N	N	**R**	N	N	**R**	N	**R**	N
	EPTC *(Eptam)*	N / 8	**R**	N	N	**R**	N	N	N	N	N	N	N	N	**R**	N	N	N	N	N	N
	flazasulfuron *(Mission)*	B / 2	**R**	N	**R**	**R**	N	N	N	N	N	N	N	N	**R**	N	N	**R**	N	N	N
	flumioxazin *(Chateau)*	E / 14	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	NB	NB	N	NB	**R**	N	**R**	**R**
	indaziflam *(Alion)*	L / 29	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	N	**R**	N
	isoxaben *(Trellis)*	L / 21	**R**	**R**	**R**	**R**	NB	NB	NB	NB	NB	NB	NB	NB	NB	N	NB	**R**	NB	NB	NB
	mesotrione *(Broadworks)*	F2/27	**R**	**R**	**R**	**R**	N	N	N	N	**R**	N	**R**	N	**R**	N	N	N	N	N	N
	napropamide *(Devrinol)*	K3 / 15	**R**	N	N	N	N	N	N	N	N	N	N	N	N	N	N	**R**	**R**	N	N
	norflurazon *(Solicam)*	F1 / 12	**R**	**R**	N	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	**R**	N	N	N
	oryzalin *(Surflan)*	K1 / 3	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	**R**	**R**	**R**	**R**
	oxyfluorfen *(Goal, GoalTender)*	E / 14	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	NB	**R**	**R**	**R**	**R**	**R**	**R**
	pendimethalin *(Prowl H2O)*	K1 / 3	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	**R**	**R**	**R**
	penoxsulam (*Pindar GT*)	B / 2	**R**	**R**	**R**	**R**	N	N	N	**R**	**R**	**R**	**R**	N	N	N	N	N	N	**R**	**R**
	pronamide *(Kerb)*	K1 / 3	N	N	N	N	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	N	N	**R**	N	N	N
	rimsulfuron (*Matrix*)	B / 2	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	N	N	N
	sulfentrazone *(Zeus)*	E / 14	N	N	**R**	**R**	N	N	N	N	N	N	N	N	**R**	N	N	**R**	N	N	N
	simazine *(Princep,Caliber 90)*	C1 / 5	**R**	**R**	N	**R**	**R**	**R**	N	**R**[2]	**R**	**R**	N	**R**	**R**	N	N	**R**	N	**R**	N
	trifluralin *(Treflan)*	K1 / 3	**R**	**R**	N	**R**	N	N	**R**	N	**R**	**R**	**R**	N	**R**	N	N	**R**	N	N	N
Postemergence	**carfentrazone** *(Shark EW)*	E / 14	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
	clethodim *(SelectMax)*	A / 1	**R**	**R**	**R**	**R**	NB	NB	NB	NB	NB	NB	NB	N	**R**	N	N	NB	N	NB	N
	2,4-D *(Clean-crop, Orchard Master)*	O / 4	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	N	N	**R**	N	N	N
	diquat (*Diquat*)	D / 22	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB
	fluazifop-p-butyl *(Fusilade)*	A / 1	NB	**R**	NB	NB	NB	NB	**R**	**R**	**R**	**R**	**R**	NB	**R**	NB	NB	**R**	N	NB	NB
	glyphosate *(Roundup)*	G / 9	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
	glufosinate *(Rely 280)*	H / 10	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	N	**R**	N
	halosulfuron *(Sandea)*	B / 2	N	**R**	**R**	**R**	**R**	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	paraquat *(Gramoxone)*	D / 22	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	**R**	**R**	**R**	**R**
	pelargonic acid (*Scythe*)	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N
	pyraflufen (*Venue*)	E / 14	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	**R**	**R**	**R**	**R**	**R**	**R**
	saflufenacil (*Treevix*)	E / 14	**R**	N	**R**	**R**	**R**	**R**	N	N	N	N	N	N	**R**	N	N	N	N	**R**	**R**
	sethoxydim *(Poast)*	A / 1	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	NB	NB	**R**	NB	NB	**R**	N	NB	NB
Organic	**ammonium nanoate** (*Axxe*)	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N
	ammoniated fatty acids (*Final-San-O*)	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
	caprilic/Capric acid (*Suppress*)	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	**R**	**R**	N	**R**
	d-limonene *(AvengerAG)*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	N	N	N
	eugenol *(Weed Slayer CA)*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**

Notes: R = Registered, N = Not registered, NB = nonbearing. This chart is intended as a general guide only. Always consult a current label before using any herbicide as labels change frequently and often contain special restrictions regarding use of a company's product.

[1] Herbicide site of action designations are according to the Herbicide Resistance Action Committee (letters) and the Weed Science Society of America (number) systems. NC = no accepted site of action classification; these contact herbicides are general membrane disruptors. [2]Simazine is registered on only tart cherry in CA. Weed susceptibility information and the most up to date version of this table can be found at the Weed Research and Information Center