Sacramento Valley Almond News
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University of California
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# Almond Management Considerations: Spring & Early Summer

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| April | May | June |
|---|---|---|
| • Set up water management tools<br>• Disease and pest control (if needed)<br>• Gopher population control | • N and K assessment<br>• NOW and spider mite monitoring<br>• Drought monitoring | • Taper N application<br>• Irrigation taper<br>• Hull rot management<br>• Continue pest monitoring |

**APRIL**

♦ **Irrigation**: Wherever possible, keep orchard water stress low (for example, 1-2 bars below baseline on pressure chamber readings) early in the season. Use plant and/or soil monitoring to know when and how long to irrigate. Pressure chambers are more accurate in measuring water status under saline soil/water conditions than soil moisture or ET. A free, UC drought management in almond publication is available on-line.

- **Water Quality:** Obtain water analysis for salinity, chloride, sodium and boron as all change with source (well to well) and time of year as drought conditions worsen. Add nitrate to the analysis to see if "free" nitrogen is available with irrigation water.

♦ **Disease**: Assess orchards for alternaria, rust, scab, and anthracnose symptoms and treat as needed. Consider a rust treatment *before* symptoms are visible if orchard history and conditions indicate high vulnerability. Rotate the material's site of action (FRAC Group) to avoid development of pesticide resistance. Check with your processor about status of different fungicides in the EU market.

♦ **Insects/mites**:

- Monitor for navel orangeworm (NOW) and peach twig borer (PTB). Hang mating disruption dispensers.
- In drought stressed orchards, spot check for spider mites.
- Monitor for leaffooted and stink bugs.

♦ **Gopher monitoring**: Severe gopher damage can kill trees. Also, a combination of gopher mounds and close mowing equates to more dust and increased spider mite pressure. Manage gophers before their reproductive pulse – usually between March and May. For best results, use multiple control strategies including trapping, fumigation or

baiting. See free video showing steps to gopher trapping with Dr. Roger Baldwin, UC Extension Specialist for great tips and review of trapping procedure.

- **Nitrogen:**

  This is a critical time for assessing crop size and **fertilizer budget adjustments**. See detailed information on nitrogen management in almonds is available, free from The Almond Board of California.

**MAY**

- **Irrigation:** Wherever possible, maintain adequate orchard moisture using plant and/or soil monitoring.
- **Nitrogen and Potassium** Keep up with orchard nitrogen (N) and potassium (K) demand. Nuts use 80% of annual N budget by June, May is a time of high N use in orchards with a good cropload. Maintain leaf K levels in an adequate range (>1.4%) to reduce spur death and crop loss potential next year.
- **Mites**: monitor orchards weekly and treat if pest and "friendly" mite numbers show a need.
- **Bugs:** Continue monitoring for leaffooted and stink bugs.
- **Disease:** Monitor for rust, scab, anthracnose and alternaria, treat as necessary.
- **Gophers:** Continue to monitor closely.
- Conduct a weed survey (UC Davis Weed ID) for those not controlled by fall or winter treatment.

**JUNE**

- **Irrigation:** If an orchard has been fully irrigated, a strategic irrigation deficit at the onset of hullsplit offers *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.
- **Fertilizer application:** Apply **potassium** as needed to maintain 1.4% range through July. Assess K fertilizer need using current crop set, last year's leaf analysis results, plus orchard observation. Finish **nitrogen** application in June
- **Continue pest monitoring:**
  - Ants**:** Contact your PCA, check for ants and find a treatment plan. Some application programs start 10 weeks ahead of planned harvest. Apply bait promptly after purchase to dry ground to increase efficiency- product opened for 1-2 weeks no longer works.
  - Continue scouting for spider mites **and** their predators.
  - NOW**:** Check for hull split in the upper southwest canopy of edge trees. Early is better than later for hull split sprays.
- **Hull rot**: Best control combines adequate N management (2.4-2.6% N in summer leaf samples), moderate water stress (-14 to -18 bars on the pressure chamber) between kernel fill and end of early hull split, and 1-2 fungicides in June or early July. In a drought year, reducing irrigation may not be needed/recommended.

- ***Monilinia*:** For best control of *Monilinia* hull rot, present 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*:** For orchards with a history of *Rhizopus* (black spores) hull rot, spray a fungicide at early hull split timing (tank mix with NOW insecticides).
- ***Aspergilus niger*:** Fungicides are more effective once the hulls have actually split.

- **Equipment preparation**: Time and money can be saved by checking harvest equipment before hull split and harvest. Plan for a low-dust harvest.

## Irrigating Freeze Damaged Almonds in a Drought

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Record low temperatures on February 24 severely reduced nut set and limited almond yield across thousands of acres of orchards in the Sacramento Valley. To bring the remaining crop to market, and to ensure good crop potential for next year, growers and CCAs must strive to maintain orchard health – likely with limited water availability. The following are our best suggestions for the season, given our experience and UC research results.

Water is one of the key inputs to maintain tree health and future production, even in orchards with major crop loss from frost damage. Crop loss does not reduce almond orchard water demand very much (trees will use roughly the same amount of water with or without a crop). UC research with peaches, a crop closely related to almonds, validated this. Low cropload only reduced tree water requirements by ~ 10%, a relatively small amount compared the precision expected when executing most irrigation plans. For many growers this year, the challenge will be how to optimize limited water supplies (compared to full irrigation) to support the current crop and/or allow the tree to grow and develop flowers on the new growth for next year.

Water stress during different times of the season shows up in different ways. Early season water reductions from March through early or mid-May that result in mild to moderate water stress may reduce shoot growth, reduce external hull and shell size, and may or may not impact root growth. In some instances, root growth may respond to better aeration if the water cutback is not severe. Generally, withholding water early in the season is likely to have less impact on production compared to higher and more sustained water stress later in the season and may prove particularly beneficial if the water saved can be used later in season during June through August and early September. Irrigation reductions made later, roughly between mid-May and harvest, may result in nuts that are smaller in size, weight and have more shrivel. If irrigation is not resumed after harvest, severe crop reductions can occur the following year as flower bud development is harmed by extreme water stress.

Extreme water stress can mean more than lost yield this season. Flower buds for next year's crop start forming around hull split (~July) and the process continues through September. Severe under irrigation, this season, will reduce flower bud initiation this year and crop next year, even if full irrigation is applied next year.

How and when does water drive nut growth? The shell (endocarp) is basically a water balloon that the water pressure in the tree inflates in April during nut sizing. The void within which the kernel eventually forms is another "water balloon" nested within the shell that water pressure inflates in May (nut fill). After nut sizing, the contents of the kernel "balloon" gets filled in with the endonuclease material that later solidifies to make the kernel. That solidification/dry weight accumulation occurs through the rest of the summer and is based on how much carbohydrates the leaves can photosynthesize – another process which is heavily influenced by water status.

What does the research tell us about the "best" irrigation practices with less water? One strategy is to apply only a proportion of crop ET estimates that reflects the limited amount of water available and apply it consistently throughout the season across all of the phases of tree and nut development. This is a research-proven strategy to maintain tree health and production as much as possible depending on water limits. The cutback can be made by either extending the days between irrigations and/or decreasing the run time for each irrigation. For example, if supplying full ET involved irrigating for 24 hours every six days but enough water is only available to supply 75 percent ET, then a couple of options would be to extend the days between irrigation from seven to nine or ten days or continue to irrigate weekly but reduce the run time from 24 to 18 hours per week. If the current crop is lost, then under-irrigations during the nut development period are less of a concern and larger reductions in applied water may be possible. Hopefully, there is enough water available to irrigate at least 60% of ET

Another approach to irrigation scheduling under limited water availability is using a pressure chamber to schedule irrigations, possibly allowing for even more effective utilization of limited water as this approach directly measures tree water status. An orchard may use less water through a season if irrigation is based on current water stress compared to some percentage of predicted water use under full irrigation conditions. See the tables below for general pressure chamber and irrigation volume targets by growth stage and stress-level tolerance. Note, however, that tree stress levels returning pressure chamber readings in the range of -14 to -18 bars will likely stop shoot growth and limit canopy growth of young blocks. Indeed, all our recommendations are made assuming mature orchards (>7$^{th}$ leaf or 70% canopy coverage). Younger orchards should be irrigated more conservatively to encourage sufficient establishment and continued development.

The irrigation strategy that works best for an operation may come down to where the water comes from. If district water is used and delivery timing and amount must be requested, then ET-based irrigation (using historical ET levels) maybe the best way to go. On the other hand, using plant stress measurements (pressure chamber) and on-demand (well water) irrigation maybe the best way to limit water use and maintain orchard health and productivity for 2023 and beyond.

Individual farming operations must decide the best course for the year depending on crop load, orchard age and water availability plus addition factors unique to that business. Excellent, free resources for dealing with drought conditions in almond production are available at:

- anrcatalog.ucanr.edu/pdf/8515.pdf
- ucmanagedrought.ucdavis.edu/Agriculture/Crop_Irrigation_Strategies/Almonds/

General target pressure chamber readings for different irrigation strategies.*

| Strategy | Up until mid-June | Mid-June thru 90% hull split | 90% hull split to leaf drop | Notes |
|---|---|---|---|---|
| Extreme drought (just keep the tree alive) | -14 bars | -25 bars | -25 bars | It may take 2 years to return to full crop |
| Moderate stress | -8 to -12 bars | -14 to -18 bars | -10 to -14 bars | Should not see significant crop loss |
| Full irrigation | -6 to -10 bars | -6 to -10 bars | -6 to -10 bars | May put the orchard at risk of disease (hull rot, etc.) |

*Sources: anrcatalog.ucanr.edu/pdf/8515.pdf ; anrcatalog.ucanr.edu/pdf/8503.pdf

Monthly mature almond orchard water use (acre-inches) ranges for the Sacramento Valley based on 30 year average data from CIMIS. These data show the average amount of water a mature almond orchard will use if water availability is unlimited (100% ET). Current year data will vary and are available at: sacvalleyorchards.com/et-reports.

| Month | Water Use (acre-inches) |
|---|---|
| March | 2.1-2.3” |
| April | 4.1” |
| May | 6.4” |
| June | 8.2” |
| July | 8.9-9.6” |
| August | 7.9-8.6” |
| September | 5.7-6.0” |
| October | 3.4-3.7” |
| November | 1.2” |

# Fertilizing Almonds after a Frost

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Crop load is the major driver in nitrogen (N) and potassium (K) and phosphorus (P) use in an orchard. Those nutrients also make up most of the fertilizer cost/acre. In a light crop year following frost, fertilizer savings are possible, but some fertilizer, especially N should be applied to maintain orchard health and crop potential for next year.

Where frost hit the crop, significant savings will be possible by reducing the nitrogen rate (lbs N/acre). The overall strategy is the same as for a good crop. Apply N from March to early June, following the pattern of tree and nut demand; some N early, peak demand in late April/May and easing off by June. The trees use 40 lbs N/acre regardless of the crop (see the table below for tree N needs per acre without crop), but the lighter crop means less N for the year. With less crop in the tree, less N is needed. The crop uses 68 lbs N/1000 lb kernel crop). For example, a tenth leaf orchard with a light crop (1000 lb kernel/acre) due to frost to should use 108 lbs N/acre instead of the 210 lbs N/acre used to feed a normal crop (2500 lbs kernel/acre). Check irrigation water nitrate levels for "free" N and subtract that from the gross orchard N need. Keeping up with N will maintain spur and shoot growth this year and flower production for next year.

What about nutrients other than N? Cropload is the major driver of orchard potassium (K) use, so a light cropload will lessen the need for this essential nutrient. If orchard leaf K level was adequate in 2021 and some K fertilizer applied last year or during the winter, little if any K will be needed this year in orchards with low set due to freeze. Phosphorus, too, should be a very low priority fertilizer unless the orchard has a history of low levels of this nutrient (<0.1% leaf P). [Crop K and P levels are roughly 90-100 lbs $K_2O$ and 23 lb $P_2O_5$ per 1000 lbs of kernel crop.] A May or June leaf analysis compared to July levels is a good way to check orchard K status with some time left in the season to add some K to avoid deficiency going into the fall. Micronutrients such as zinc and boron are most needed at bloom, so apply as needed this year, based on summer leaf and harvest hull tissue analysis, respectively, to prep the orchard for 2023.

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Tree (Leaves, shoots and wood) nitrogen (N) use at different ages presented as pounds N/acre or gallons UN32 (32-0-0) for an example orchard of 14' x 22' spacing; 145 trees/acre. Data do NOT include crop N demand. Crop demand is an additional 68 lbs N/1000 lbs kernel crop. Data is from Nitrogen Best Management Practices (almonds.com/almond-industry/orchard-management/soil-health-and-nutrients/nutrient-management)

| | Total Non-crop N demand (leaves + wood) | |
|---|---|---|
| Orchard Age (year) | Pounds nitrogen/acre | Gallons UN32/acre |
| 1 | **30** | **9** |
| 2 | **55** | **16** |
| 3 | **65** | **19** |
| 4 | **55** | **16** |
| 5 | **45** | **13** |
| 6-15 | **40** | **11** |
| 16-25 | **30** | **9** |

## Adela Contreras, with industry support, joins Sacramento Valley UCCE Extension Team as a Staff Research Associate.

Adela Contreras joined UC ANR in 2022 as a Staff Research Associate and serves Sacramento Valley with Katherine Jarvis-Shean and Franz Niederholzer across six counties. Adela is a first-generation college student from Salinas, CA, graduating with a B.S. from UC Davis in 2020. She previously worked on strawberries, tomatoes, fire regime in the boreal forest of Alaska, kernza grain, and walnuts. She plans to pursue a Ph.D. in Agronomy or Soils and Biogeochemistry and inform future grower decisions. She enjoys kayaking, hiking, visiting family, and adventuring with her dog.

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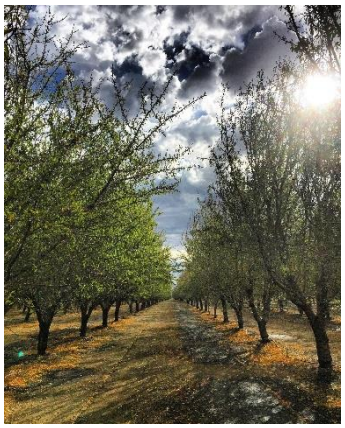
**Craig Ledbetter on the USDA breeding program**



**Irrigation Management with David Doll**

**Field Evaluation of Almond Varieties**

**The Dangers of Irrigation Leaks**

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