Sacramento Valley Almond Newsletter

UC CE UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources Cooperative Extension

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

## Almond Summer Management Considerations: July - September

*Ben Baldi, Staff Research Associate, Yolo, Solano, Sacramento, Colusa, Sutter, & Yuba Counties*

Please note that the following are general recommendations intended to help you keep track of regular practices in a busy time; the optimal timing for management practices may vary based on specific location and conditions. Some areas of the Sacramento Valley are already seeing the start of hull split.

July

- **Irrigation**: Maintain adequate soil moisture to ensure good nut weight gain going into harvest cut off. Sustained (weeks) of moderate to high orchard water stress in the weeks before harvest can reduce kernel weight at harvest. This can be an invisible yield loss and reduces grower income. Moderate to high water stress ranges from –14 to –20 bars; that is –6 to -11 bars below baseline, assuming baseline stem water potential is –9 bars (95°F and 30% RH).
- **Navel Orangeworm (NOW) & Peach Twig Borer (PTB):** Continue monitoring nut development and NOW and PTB trap counts to determine when and how to manage these pests in your orchard. Consider an edge spray when the first sound nuts in edge Nonpareil trees reach hull split Stage 2C (see picture below) and a full spray once nuts in the upper canopy of trees within the orchard reach that same stage. Depending on orchard conditions (age, rootstock, nutrition, water stress, etc.), nuts the interior of the orchard may split at the same time as edge trees.] Apply a second hull split spray prior to harvest as needed. See our article on Navel Orangeworm Considerations for more information. Consult with your PCA when making decisions about NOW and PTB management. Find 2025 Pest Reports for the Sacramento Valley here.

*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:** Significant leaf drop at harvest due to mite damage can lead to fewer flowers next year and slower drying this year. Continue monitoring mites and mite predators throughout your orchard on a weekly basis in July. For more monitoring and treatment information, see the UC IPM site for mites in almonds.
- **Ants:** Monitor for protein feeding ants and consult with your PCA about ant bait materials and application timing. Read more about ant control under category Insects & Mites here.
- **Leaf Samples:** Take July leaf samples and send them for analysis to check this season's nutrition program and help plan next season's program. For more articles about July leaf analysis interpretation, explore articles by the Almond Doctor here.

August

- **NOW Management in pollinizers:** After Nonpareil harvest you may want to spray pollinizer varieties for NOW management. The decision of whether to spray or not should be based on the amount of NOW damage observed in your Nonpareil almonds, progression of the third NOW generation, and when the fourth-generation egg laying will start. 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.
- **Hull Boron Samples:** Boron deficiency can cost almond growers hundreds of dollars/acre in lost crop. Hull analysis is the most accurate measure of orchard B status as, unlike many other nutrients, boron tends to accumulate in almond hulls. See this article by sacvalleyorchards.com for more information on hull boron sampling and analysis.
- **Nitrogen application:** Apply your last nitrogen of the year just before or after harvest to support next year's bud development. Use July leaf sample results to decide how much N to apply this year. If the July leaf levels are adequate to high, no further N application may be needed. If leaf levels are low, consider irrigation water nitrate levels when deciding on N fertilizer rates. For more information about N application in almonds see the publication "Nitrogen Best Management Practices" from the Almond Board and the CDFA's California Crop Fertilization Guidelines for Almonds.
- **Rust:** Look out for rust in young orchards. Rust can cause early defoliation, which can reduce flower counts next year. For more information on rust control in almond orchards, see UC IPM.

*Harvest*

- **Harvest when 100% of nuts are at Stage 2C of hull split or more** (see image above) and test trees shake clean. This will minimize NOW egg laying and feeding damage on the harvested nuts. (See article on harvest timing in this newsletter.)
- **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. For other recommendations, see this article from the Almond Board of California.
- **Shaker damage:** Limit shaker damage by making sure all trees in the orchard are ready to shake when starting harvest. Test-shake trees in areas that are historically the most vigorous and where nuts "stay green" the longest. Where scaffold heights allow, 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. In young (third and fourth leaf) orchards, be extra careful when shaking. Bark "tightens" as the season progresses, so later harvest timing should be the safest for young orchards.

- **Nut Damage Analysis:** Nut damage analysis (harvest samples) can help you understand the primary sources of nut damage in your orchard and plan for reducing damage next year. After shaking and before sweeping, collect 500 nuts throughout your orchard for analysis. Use the UC IPM Harvest Sample resource and our article on Harvest Damage Evaluation for Almonds to conduct your damage analysis. If you don't have time to crack out your nuts at harvest, you can freeze them at harvest and crack them out later or use a commercial for-fee harvest analysis. At least one company in the Sacramento Valley offers this service.
- **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 as nut quality could be reduced by mold and concealed 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.

*Post-harvest*

- **Post-harvest irrigation:** Return irrigation to your trees as quickly as possible after harvest to minimize water stress as much as possible. Water stress in August-October can lead to defoliation and interfere with next year's bud development. Dry trees after harvest = fewer flowers next spring = less crop.
- **Post-harvest disease and shaker damage assessments:** Check for hull rot strikes, leaf rust, red leaf blotch, and shaker (bark) damage on your trees after harvest. This information will help with planning for next year. More information about hull rot assessment and management can be found on the UC IPM website for hull rot management in almonds.

September

- **Plan fall Zn and B sprays:** Use orchard nutrient history, July leaf, and harvest hull analysis results to determine whether you need to apply foliar Zn and/or B this fall. See our Postharvest Nutrition Review article to learn more about when and how to apply these nutrients. Early season foliar sprays containing Zn, fertilizers or fungicides (phosphite, ziram, etc.) remain on the leaves and contaminate leaf samples. Under these conditions, growers and CCAs may consider leaf symptoms and orchard history when deciding to include Zn in a fall foliar application.
- **Plan for your fall potassium application.** Adequate orchard potassium (K) levels are important to spur health and orchard production. Almond production removes more K from the orchard than any other nutrients. 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 for more details (link above).
- **Prepare for cover crop planting:** Cover crops are a good tool if you're looking to improve soil health, provide pollen for bees, and/or increase winter water infiltration in your orchard. 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.

## Hull Split: 2025 Considerations

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

**Hull Split: High Stakes**

The start of hull split is a critical timing for navel orangeworm and hull rot control. How hull split proceeds is part of determining any water/energy savings, as well as your crop's susceptibility to NOW damage and how cleanly your trees will shake. Success or trouble during hull split is a big part of the orchard's financial success or disappointment. Every hull split season poses different challenges as you navigate a delicate dance between your trees, Mother Nature, and farming logistics.

**An Early Hull Split?**

Nonpareil hull split was underway early this year in parts of the Sacramento Valley. In late June many orchards on the west side of the valley had entered hull split, which is defined as 1% of the hulls in a tree reaching the 2C stage (Figure 1). Tree age, variety (older / newer varieties), rootstock, water stress and nitrogen status play important roles in timing the start of hull split. Nonpareil, on a low vigor rootstock like Rootpac-R, with low nitrogen, and moderate water stress will enter split very early. Conversely, Monterey or Fritz on a vigorous peach-almond hybrid like Hansen 536 and provided high nitrogen will be among the last trees to enter hull split.

**Hull Split Duration:**

The general rule is that hull split (1% to 100% 2C or greater, see figure 1) lasts 3 to 4 weeks but what determines exactly how long? Variety (older / newer varieties), rootstock, nitrogen, and water status all influence how fast hulls will split. From a NOW management perspective, you ideally want a fast, uniform hull split across the orchard leading to an earlier shake and minimizing the window for NOW egg laying on split nuts. However, from a marketable yield perspective, it is possible for hull split to be too short. Water stress between early June and the start of hull split means the hulls have the potential for a very fast split because they are entering the period with less water content. If hull split is too short a disruption of carbohydrates can increase shrivel. Conversely, excessive water stress during hull split can stall the split process by causing hull-tights. Excessive water stress during hull split can also increase mites, increase stick-tights, decrease kernel weight, and cause defoliation affecting next year's bloom. Excessive leaf nitrogen can also extend the duration of hull split. A recipe for a long, drawn-out hull split is high leaf nitrogen, and lots of water. High nitrogen and water conditions can also be a recipe for hull hot, uneven split across the orchard, and increased navel orangeworm susceptibility.

**Getting Specific about Water Stress during Hull Split:**

In the hull split duration discussion above we mention the need to avoid both extreme water stress and excess during hull split but how do you go about doing that? The oldest and most basic way of judging water stress is simply looking at the tree. A water stressed almond tree will have drooping leaves and after severe water stress in almond there is yellowing and drop of leaves in the interior canopy, particularly the smallest "guard" leaves (figure 2). Often by the time water stress is seen in the tree unwanted consequences have already occurred, making visual symptoms a poor irrigation management approach.

With visual symptoms often arriving too late to avoid unwanted consequences, irrigation management with stem water potential readings from the pressure chamber/pressure bomb is the way to dial in irrigation during this critical period. A carefully regulated deficit irrigation (RDI) guided by the pressure chamber can reduce hull rot, save water/pumping costs, make hull split more uniform, and increase harvestability. Once blanks begin to

split (1-2 weeks before 1% 2C and the official start of hull split on sound nuts) irrigation sets can be shortened to achieve moderate water stress, with stem water potential (SWP) readings with the goal of trees reaching -14 to -16 bars of stress before the next irrigation. The percentage irrigation sets are shortened by will depend on the water stress in the orchard ahead of hull split, with some orchards already at -14 bars and requiring no reduction in set length while others may require as much as a 1/3 reduction in set length. Full irrigation is resumed between 90% split and your irrigation cut off ahead of harvest. The increased irrigation improves split and reduces hull tights. RDI is NOT FOR EVERYONE. One reason to not do RDI is not owning a pressure chamber or an automated tree sensor that would allow you to measure tree water status and avoid excessive stress. A second reason to not do this deficit is because you are already behind on irrigation and trees are exhibiting stress. A final reason RDI isn't for you in 2025 is your main variety (e.g. Nonpareil or Independence) is already at or near the 90% split where full irrigation is resumed. Although there are significant advantages to RDI, and it's a crucial tool if hull rot is reducing your orchard's yield potential by killing spur wood, there is a small cost in the form of slightly reduced kernel weight (e.g. -2.5% dry mass), and increased severe shrivel (e.g. +4 %).

Whether you did RDI or not, provide full irrigation between 90% split and your irrigation cut off ahead of harvest. This imposed water stress ahead of shaking to help reduce barking can also be accomplished by shortening irrigation set length to achieve -15 to -18 bars water stress. After shaking irrigate as soon as possible. If wetting nuts is a concern, a single dripline can be a great investment in microsprinkler and solid set irrigation orchards to avoid unwanted consequences from severe water stress while hulls are drying on the orchard floor.


**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

**Figure 2.** Severe water stress in almond causes yellowing and drop of leaves in the interior canopy, particularly the smallest "guard" leaves. Often by the time water stress is seen in the tree unwanted consequences have already occurred, making visual symptoms a poor irrigation management approach (photo Luke Milliron).

## Harvest: 2025 Considerations

*Luke Milliron, UCCE Farm Advisor, Butte, Glenn and Tehama Counties*
*Franz Niederholzer, UCCE Farm Advisor, Colusa and Sutter/Yuba Counties*
*Clarissa Reyes, UCCE Farm Advisor, Sutter-Yuba, Butte, Placer*

### Harvest: Timing is Everything

The period from shaking until pick up is one of long days and high stakes in almond production. With the objective forecast for a three billion pound crop for the state, up almost 10% from last year, this year could be one where harvest timing decisions are even more critical to a successful season. The decision of when to shake will in-part determine nut removal, navel orangeworm (NOW) pressure, risk of trunk injury, and quality/grower income. In-short, the critical decisions in this final sprint can determine how financially successful this season will be. There are pros and cons of any harvest timing for Nonpareil, while specific shake times for certain other varieties improve nut removal and so may dictate harvest timing. At the end of the day, the decision to shake is a block-by-block grower call.

### When do you shake Nonpareil?

**Stage 2C-3:** Should it be a "timely harvest", one that begins once test shakes show virtually all nuts (96-99%) are removed? That depends on the orchard and the operation. Although you should get very good nut removal as soon as you have one-hundred percent hull split (all hulls are at least at 2C, figure 1 above), it might not make sense for your operation. The major advantage of this ASAP shake timing is a reduction in NOW pressure, with nuts being less vulnerable once they are on the orchard floor. Additional pros include fewer wrinkles on kernels if there is subsequent tree water stress, hulls generally dry faster on the ground,

and it spreads out equipment use if there's a lot of acreage to get to. However, shaking at an earlier hull split stage (greener hulls) means longer drying times on the orchard floor (7-14 days vs. 4-7 with later hull split stages), and greater susceptibility to ant and *Carpophilus truncatus* damage. Additionally, the best nut removal for Nonpareil and maximum kernel dry weight occurs as the nuts reach approximately stage 3, although most of the crop will be far past this stage when the last, lower nuts get to 2C and the trees are ready for timely shake. More foreign material can result when trees are harvested early, this comes in the form of curled hulls from rapid drying on the orchard floor or hull tights. Harvesting too early can prevent color from developing on the pellicle, which reduces nut quality. A final reason to not shake when hulls are on the green side is the earlier you shake, the higher the risk of barking.

If you see a lot of green (often Stage 2C or 3) in your windrows, conditioning can accelerate drying. Cleaning up windrows with conditioning can also speed up the actual "pick-up" process and potentially reduce hulling/shelling costs since many hullers now charge on incoming weight.

**Stage 4-6:** At these later hull split stages, 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. For Nonpareil, nuts at stage 5-6 have the highest chance of being cleanly hulled and receiving an inshell price premium. This stage also has the shortest possible drying time on the orchard floor (4-7 days). On the downside, shaking at stage 5-6 means that the nuts "hang" longer and face the risk of higher NOW damage compared to earlier harvest timings. Later hull split stage shaking also lowers the risk of harvester damage ("barking") as the bark tightens as the season progresses. In some cases, the long-term health of an orchard (no bark damage) could be the driving point in deciding to shake late.

**Other Varieties:**
While the ideal shake time is not known for all other varieties, shaking strategies for some varieties are clearer. For example, the industry is still learning when to shake 'Independence' for maximum nut removal. Some growers swear by an earlier shake (heavier nuts), lumping it in with the earlier shake strategy they would also pursue for 'Winters' or 'Padre'.

To avoid water stress on later-maturing pollinizers, irrigation with drip or micro sprinklers should be applied between harvests. If this is not possible, severe water stress may result in stick-tights (nuts stuck in the tree) and/or hull-tights (green hulls shriveling and drying tight around the nut). 'Winters', 'Padre' and other mid- to late-harvesting varieties can be posterchildren for stick-tights 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 and may reduce yield next harvest.

**Conclusion:** Harvest timing can be very important. It influences nut quality and grower returns. There are many factors that influence almond harvest timing, 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, harvest logistics, and nut quality.

Regardless of when you shake, 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. **Work with your processor on deciding pickup timing.**

## A July Nitrogen Leaf Result of 2.4% is the Goal

*Luke Milliron, UCCE Farm Advisor, Butte, Glenn and Tehama Counties*
*Franz Niederholzer, UCCE Farm Advisor, Colusa and Sutter/Yuba Counties*
*Sebastian Saa Silva, Associate Director, Agricultural Research at Almond Board of California*

Almond orchard nitrogen (N) deficiency, measured as July leaf N%, is linked to reduced crop yield compared to orchards with adequate leaf N levels. Excess leaf N increases the risk of hull rot infections that reduce yield and increase orchard sanitation costs. What July leaf N level is the target for best net grower return?

First, a quick review of how research and commercial practices differ and are used together may help explain what follows. Leaf nutrient levels vary from tree to tree in an orchard. Fertilizer trials are usually done using individual trees to eliminate this variability. Orchard or block leaf samples are taken from numerous trees and one value is presented after analysis.

UC recommends 2.2 – 2.5% as adequate July leaf N%. However, due to the natural nutrient variation across an orchard, potential yield might not be maximized at a lab reported 2.2 or 2.3% leaf N for the orchard. Specifically with an average of 2.2% on the lab result about half your trees could be experiencing a yield reducing nitrogen deficit (below 2.2%). Conversely if your samples are at 2.5%, most of the trees are likely being over-fertilized and are at an increased risk of hull rot and delayed nut maturity. The sweet spot in July is 2.4%, which ensures most trees are above the critical value of 2.2%.

This leaf Nitrogen report card is mainly useful in helping inform next year's program. However, it can inform your late season nitrogen timed either just before or just after harvest (or split between the two). This last shot(s) should account for no more than 20% of your total season's nitrogen application and can be reduced or skipped if July nitrogen levels are above 2.4% as research shows no increase in yield next year if late season N inputs are skipped in orchards with at least 2.4% July leaf N levels. Some growers elect for a small rate of late season N if July leaf N levels are on target. As an example, given a 2.4% July leaf N result, the Nickels Soil Lab will still add 10 lbs low biuret nitrogen per acre to their fall foliar spray along with boron and zinc, to "top off the tank". (*This is an example, NOT a fertilizer recommendation*)

Resources: More information on July leaf sampling / more information on nitrogen applications