Almond Newsletter

Cooperative Extension Glenn County

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In this issue:

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Pre- & Post-Harvest Almond Orchard Management Considerations

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JUNE

✓ *Regulated Deficit Irrigation (RDI)* induces, moderate water stress in the orchard to reduce *Rhizopus* hull rot and promote earlier, more even hull split. As my old high school driver ed teacher told us, slow down into turns. The orchard is turning towards harvest as hulls split. Ease off the "gas" of water and avoid nitrogen into this "turn" to manage hull rot and help hull split be more uniform. See the hull rot/ irrigation article in this issue.

✓ *Get ready for hull split.* Almonds become vulnerable to NOW feeding/damage once hull split begins. Closely monitor hull split in the upper SW side of Nonpareil (NP) trees on field edges as those exposed nuts usually split ahead of the rest of the orchard. Depending where you are in the Sacramento Valley and specific orchard conditions, hull split may start as early as late June or as late as mid-July. Consider an edge spray once sound nuts in the edge NP trees reach Stage 2C of hull split (see photo below). The rest of the NP in the orchard should follow in roughly a week. Depending on the pollinizer(s) used, growers and their PCAs should decide if the first hull split spray (at Stage 2C for NP) should be a full spray or just on the NP. See discussion in the NOW article in this newsletter.

✓ *Monitor for mites* weekly in the orchard's hot spots. Consider the presence of predators (sixspotted thrips and predator mites) in addition to the presence of spider mites when making treatment decisions. UC IPM guidelines use treatment thresholds of spider mite presence on 50% of leaves when predators are present, but only 30% of leaves if predators are absent. For more on monitoring and treatment options, visit: ipm.ucanr.edu/agriculture/almond/Webspinning-Spider-Mites.

✓ *Ants.* Timely harvest (100% hull split throughout the orchard) means less NOW risk. However, it also means longer drying times on the orchard floor and a higher chance for ant damage – if protein feeding ants are present. Survey ant colony concentration on the orchard floor 2 to 3 days after irrigation, counting active colonies in five 1,000 square foot areas (roughly a 5 x 6 tree rectangle). Confirm they are the undesirable (protein feeding) pavement or southern fire ants, not the harmless pyramid ants with the aid of helpful photos at sacvalleyorchards.com/photos-from-the-field/ant-mounds. Estimate potential harvest damage using the table in the ant management article in this issue and proceed based on your damage tolerance.

✓ *Ground squirrels* switch from eating green vegetation to seeds and grains in late May. This means that June is the beginning of the window in which they will eat baited rodenticides. Test bait acceptance before use of rodenticide to avoid toxin

To simplify information, trade names of products may be used. No endorsement of named products is intended, nor is criticism implied of similar products which are not mentioned.

shyness. For more on ground squirrel management, see groundsquirrelbmp.com.

- ✓ *Manage young tree irrigation carefully* as summer heats up, especially with potted trees, to make sure water is wetting the rootzone. For more on dealing with the challenge of irrigating potted trees, see sacvalleyorchards.com/blog/almonds-blog/why-you-should-irrigate-potted-trees-directly-onto-potting-media. Water sources (drippers and micro-sprinklers) should be moved away from the tree trunks after potted trees have been in the ground for a month.

JULY

- ✓ *Irrigation.* After 2 weeks of RDI beginning at early hull split, return the orchard to full ET irrigation until dry down for harvest.

- ✓ *Take leaf samples* in July to measure nutrient status. Pull leaves from non-bearing spurs on representative trees across a block from one variety per sample. With differing croploads between varieties, nutrient levels may vary by variety and sampling each variety in a block should provide important information. Adjust your nutrient management plan for the rest of the season based on July leaf sample results.

- ✓ *Keep tracking NOW and PTB populations.* If hull split didn't occur in June, consider an edge spray once sound nuts in the edge Nonpareil (NP) trees reach Stage 2C of hull split (see photo below). Hull split in the rest of NP in the orchard should follow in roughly a week. Depending on the pollenizer(s) used, growers and their PCAs should decide if the first hull split spray (when 1% of nuts are at Stage 2C for NP) should be a full spray or just targeting NP. See discussion in the NOW article in this newsletter.

- ✓ Spray a second hull split spray ahead of Nonpareil harvest if trap counts, current field checks, and/or past damage suggest a need.

- ✓ *Keep an eye on mites.* Late season flare ups are expensive to control and hard to schedule by ground. Defoliation of mite damaged leaves at harvest can mean reduced flower numbers next year and slower nut drying on the orchard floor this year.

- ✓ *PHI.* Preharvest interval (PHI) is based on shake date, not pickup date.

AUGUST

- ✓ *Harvest.* Shake your Nonpareil when all nuts in the tree are at least at Stage 2C hull split (see photo below). This will reduce NOW damage as the female moths lay virtually no eggs on nuts on the orchard floor. Train shaker operators to clamp closer to the scaffold crotch, where possible, versus lower on the trunk. This delivers the best shake to the canopy and limits root damage.

- ✓ *Watch for rust in young orchards.* Prevent early defoliation that can negatively affect flower bud formation for next year and delay nut drying. For more, see ipm.ucanr.edu/PMG/r3100711.html.

- ✓ *Plan ahead to minimize dust at harvest*. Consider steps like adjusting sweeper head heights, blower spout angles and fan speed. Find more suggestions at almonds.com/growers/in-the-orchard/harvest/harvest-dust.

- ✓ *If you're harvesting third or fourth leaf trees,* keep an extra close eye on the shaker and its operator (walk behind the machine for a few rows on a regular basis). Bark slips easily in young trees and is an entry point for canker infections, considerably shortening the productive life of an orchard.

- ✓ *At harvest, collect nut samples for damage analysis.* Gather at least 100 nuts per orchard after shaking, but before sweeping. Checking these samples immediately after Nonpareil harvest can inform NOW spray decisions for pollenizer varieties. If not checked immediately, freeze them for later. These samples will allow you to better understand damage results on your grade sheets and adapt IPM strategies for next year. Sampling and pest damage diagnosis help, including a handy damage comparison table with helpful photos, can be found at

sacvalleyorchards.com/almonds/insects-mites/harvest-samples-for-almond-crop.

✓ *Collect and submit hull samples at harvest* for B analysis. Pull dry hulls randomly from windrows across a block. For more information, see thealmonddoctor.com/2014/07/12/hull-sampling-for-boron/.

✓ *Manage post-harvest irrigation to minimize water stress.* Water stress in late August to early October can interfere with flower bud development for the following spring. This can mean fewer flowers next February and fewer nuts next harvest. Defoliation reduces tree vigor by reducing sugar production. This is particularly important for orchards with a long window between harvest of Nonpareil and late pollenizers.

✓ *Assess hull rot and shaker damage post-harvest.* Hull rot symptoms can be found at ipm.ucanr.edu/PMG/r3101811.html.

Hull Split Hull Rot Management

Franz Niederholzer, UCCE Farm Advisor Colusa, Sutter and Yuba Counties
Dani Lightle, former UCCE Farm Advisor Glenn, Butte and Tehama Counties

Hull rot is a general term for hull infection by one of several pathogens. Infected nuts don't shake off and must be removed by winter shaking and/or polling (winter sanitation), resulting in lost production plus increased management costs. In some varieties, especially Nonpareil, hull infections can spread to spurs and shoots, killing that wood and reducing future nut bearing sites.

There are two general types of hull rot infections, those that occur prior to hull split and those that occur after hull split. *Monilinia* and *Phomopsis* hull rot result from pre-hull split infection. Spray timings for both infections have passed. *Rhizopus stolonifera* and *Aspergillus niger* are wound pathogens that require an opening to enter and infect the hull. Hull split gives these pathogens an entry site to infect. *Rhizopus* hull rot is generally believed to be more widespread than *Aspergillus niger* hull rot and has been studied longer. Hence, we have a better understanding of what's needed to manage *Rhizopus stolonifera* than *Aspergillus niger* hull rot.

The best, current approach to managing *Rhizopus* hull rot management includes three parts. The first two steps help to manage the environment, with respect to the disease triangle, while the latter seeks to control the pathogen.

1. ***Moderate water stress in early hull split***: The target is -14 to -18 bars stem water potential (SWP) measured using the pressure chamber for two or three weeks beginning just before ANY hull split (late June). The goal is to gradually reach this goal by reducing the hours of each irrigation set, not the number of irrigations. After 2 or 3 weeks at that moderate stress level, return irrigation to full ET. To hit that target, growers must start reducing irrigation at different dates, depending on the effective root zone and soil water holding capacity (texture). Growers with deeper loam and clay loam soils may need to begin to back off on irrigation as early as June 1, up to 30 days before expected HS. Growers on lighter, sandier ground, or with a shallow rootzone due to a hard pan, may be able to wait closer to HS before easing up on the water. The key to successful hull rot management with irrigation is getting the orchard to -14 to -18 bars **just before the suture starts any separation and keeping it there for 2 weeks,** then return to full ET irrigation. This moderate stress in a short period does not reduce yield and helps save on the energy bill. Use a pressure chamber (pressure bomb) to make sure water stress reaches the target on time but doesn't exceed the target. If you don't reach the target water stress before hull split, you won't help control hull rot. If trees are severely stressed, next year's yield potential can suffer. Pressure chamber information at: sacvalleyorchards.com/manuals/stem-water-potential/

2. ***Careful nitrogen management.*** Adequate, but not excessive orchard N helps control hull rot. The target is <2.6% summer leaf N. Don't apply N between May 15 and harvest in orchards with hull rot history.

3. ***Spray application:***

Fungicides. To control *Rhizopus* hull rot with fungicides, the best spray timing is early hull split (Stage 2C) – the same as for first NOW spray. FRAC group fungicides 3 (not all), 11, and 19 provide "good and reliable" control when

carefully applied. Check UC Fungicide Efficacy and Timing publication for specific fungicide efficacy information (ipm.ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf)

Alkaline products. In several years of research trials by Dr. Jim Adaskaveg (UC Riverside), foliar sprays of some alkaline fertilizer/nutritional products reduced hull rot strikes per tree as much as many fungicides when sprayed at the same hull split timing. Effective materials in Dr. Adaskaveg's tests include K_2PO_4 fertilizer and Cinetis® (kelp extract plus mono-ammonium phosphate). There was no additive increase in hull rot control when fungicides were tank mixed with alkaline materials. Dr. Adaskaveg believes that the alkaline materials may neutralize the toxin produced by the hull rot infections responsible for spur and shoot death. Note: These fertilizer products are not registered as pesticides and so may not be specifically prescribed for hull rot control.

Stage 2C of hull split. When sound nuts in the SW corner of tree tops look like this, this is THE critical timing for insecticide for navel orangeworm and fungicide for *Rhizopus* hull rot. When all the trees in the orchard have all the nuts that look at least like this from top to bottom, the orchard should be ready to harvest.

Maintaining Quality with Pick Up & Stockpiling Best Practices

Luke Milliron, UCCE Orchards Advisor Butte, Glenn, and Tehama Counties
Bruce Lampinen, Tree Nut Extension Specialist, Planta Sciences Department, UC Davis

With a record statewide crop to be shaken, swept, and collected starting in August, will you and your handler be prepared? Research by Bruce Lampinen (UCCE Specialist, UC Davis) and others has shown that properly dried nuts are the key to maintaining quality and grower returns during stockpiling. Best practices help avoid *Aspergillus* growth and resulting aflatoxin contamination, and concealed damage to kernels. Aflatoxin and concealed damage reduce profits at a time when margins are critical. Maintaining a high quality product is also key to marketing and moving a record crop at the best possible prices to growers.

At Harvest:

Let hulls dry completely on the orchard floor before pick up. Do not pick up and stockpile nuts with a hull moisture above 12%, kernel moisture above 6%, or total fruit (hull and kernel) moisture above 9%. For reference, hulls snap at or below 11-12% moisture. When sampling for moisture level, it is critical to take a representative sample. For windrows, sample from both the top, as well as the bottom of the windrow, where moisture levels can be 2% greater. For almonds that have not been windrowed, sample both in row middles and adjacent to tree trunks on the north side of the canopy where moisture levels may again be 2% higher. Orchard floor drying is faster with north/south oriented rows and where canopy light interception does not exceed 80%.

If almonds are picked up at a total fruit moisture above 9%, do not stockpile. Instead spread out the crop in a dry area that allows for turning and spreading. If needed, take the crop to a dryer. For more information on rain at harvest, including a table of prescribed actions based on your harvest stage, see: almonds.com/sites/default/files/coping_with_rain_at_harvest%5B1%5D.pdf

Stockpile Management:

The record crop probably means that more crop than ever before will have to be stockpiled. If covered to fumigate for navel orangeworm control or because of a forecast rain, take steps at setup to avoid moisture accumulation. Ideally, stockpile locations are slightly raised to prevent puddling around the edges. Stockpiles should also be free of trash and placed away from equipment. The long axis of stockpiles should be oriented north/south to get sun on all sides. Piles should have smooth and flat tops, avoiding low spots that accumulate condensation. Finally, when needed, the use of white on black tarps is best, because they help avoid severe temperature fluctuations that increase condensation.

If a stockpile is built, monitor the relative humidity near the outer edge, where swings in temperature and the risk of condensation are greatest. If moisture levels are above the thresholds, open the tarps up during the day and close them at night, corresponding to low and high relative humidity, respectively. More details at: almonds.com/sites/default/files/grower_stockpile_management_best_practices_from_abc_2014%5B1%5D.pdf

Covered stockpiles: Designed to avoid moisture accumulation with N/S orientations, flat/smooth tops, and are ideally on a raised surface to avoid ponding (photo courtesy of Almond Board of California).

Navel Orangeworm Management Considerations

Franz Niederholzser, UCCE Farm Advisor, Colusa and Sutter/Yuba Counties

Hull split and the pesticide application timing for navel orangeworm control on new crop nuts are fast approaching. Timing, coverage and pesticide selection, in that order, are critical to getting the best possible results from spray applications. Growers, working with their PCA(s), will make the decisions that work best for each operation. The following are a few suggestions/points to consider as the hull split season approaches.

- Careful monitoring of NOW from the spring through harvest is key to knowing when the next generation of NOW will appear. This information helps time insecticide sprays and shaking for best NOW control. Harvest and spray timing decisions should be based on local conditions. Varieties in the orchard, variable terrain, irrigation status, off-farm sources of NOW and other local factors should be part of the decisions to deliver the best quality crop possible.

- Timing of the first application (when Stage 2C is showing in the upper canopy) of navel orangeworm pesticides is critical with materials that target eggs and small larvae, such as Intrepid®, Intrepid Edge® and Altacor®. [The suture pops when squeezed at Stage 2C of hull split. See the photo at the end of the first article in this newsletter]. From start to finish, hull split applications should take no more than a week.

- Consider NOW pesticides with limited to no harm on beneficial insects and mites. Spider mite control is expensive using knock down materials. A selective miticide can knock down spider mites as harvest approaches, leaving beneficials to help control spider mites. But, if the NOW insecticide tank mix damages the beneficial population, you are back to square one – hoping your miticide alone can get you through harvest without excessive leaf loss. The following is a partial list of materials registered for NOW control and their impact on some or all beneficials that help with mite control.

Easy on mite beneficials	Tough on mite beneficials
Altacor®	Pyrethroids (Warrior®, Brigade®, Asana®, & generics; Besiege®*)
Intrepid®	Intrepid® Edge; Delegate®
B.t. (Dipel®, Javelin®, etc.)	

*Jug mix containing lambda cyhalothrin, the active ingredient in Warrior®.

- NOW pesticide resistance management should be considered when selecting materials to help keep the materials active on the pest for as many years as possible. There are no new chemistries in the pipeline. Growers and PCAs should carefully steward the currently registered, effective materials. There are only two registered chemistries that offer effective, long term NOW control – methoxyfenozide (Intrepid®, Intrepid® Edge) and chlorantraniprole (Altacor®, Besiege®). Minecto®Pro contains cyantraniliprole, which is a different a.i. but is in the same IRAC group (28) as chlorantraniprole and should be lumped with it for resistance management considerations. The most careful resistance management program alternates chemistries for every spray. For example, Altacor® for the early hull split spray and Intrepid® for the second. Using the same chemistry for two consecutive generations is NOT resistance management. Two consecutive generations exposed to the same IRAC group, for example, Minecto®Pro for spring ("mummy") spray and Altacor® for early hull split spray, is not recommended.

- Pesticide control with egg/small larvae materials (Intrepid®, Altacor®) will only provide at best, roughly 50% control compared to unsprayed trees. Hull splitting of nuts is a moving target between start of hull split and shake. Research results reporting 90-100% NOW control with pesticide sprays from air or ground are from a specific test and are meant for comparison purposes, NOT to suggest that growers will get that kind of NOW control with pesticide spraying alone. Given the rising NOW pressure in the Sacramento Valley over the last decade and the tough quality standards the market demands, spraying is only one part of effective NOW management. Sanitation and timely harvest, along with mating disruption, are critical parts of NOW management. Research results reporting 90-100% NOW control with pesticide sprays from air or ground are from a specific test and meant for comparison purposes, NOT to suggest that growers will get that kind of NOW control from with pesticide spraying.

- Timely harvest, as soon as an orchard reaches 100% hull split, is a critical part of NOW control. Nuts on the orchard floor are virtually invisible to NOW females. Often, 100% hull split is reached before the start of the 3rd generation of NOW or just as it begins. Not every block can be harvested ahead of the 3rd flight, but those that are will have less damage than those harvested later, under equal NOW pressure. For example, in the high damage year of 2017, the organic block at Nickels Soil Lab, with no NOW spray applied, had 0.7% NOW damage in Nonpareil nuts, sampled from the nut cart. Harvest occurred as the 3rd flight of NOW was just beginning.

Ant Management is Especially Important in a Heavy Crop Year

Kris Tollerup, UCCE Area-wide IPM Advisor

USDA-NASS has estimated a three billion pound almond crop this year, with set so heavy that many trees are even breaking scaffolds. The size of this year's crop will likely translate into longer periods of almonds sitting on the orchard floor waiting for pick up – especially for growers that depend on contract harvesters. Because the percentage of ant damage is related to how long the nuts remain on the orchard floor (Table 1), planning for ant management this season is vital.

Table 1. Percent damage by Southern Fire Ants to almonds on the ground, shows the longer nuts are on the ground, the higher the ant damage.

Number of colony entrances per 5,000 sq. ft. in April to May	Days nuts are on the ground				
	4	7	10	14	21
15	0.9%	1.6%	2.1%	3.1%	4.9%
45	1.4%	2.3%	3.2%	4.7%	7.0%
185	2.0%	3.6%	5.0%	7.0%	11.1%

The paramount concern is direct feeding damage to the nut meat caused by the southern fire ant, *Solenopsis xyloni*, and pavement ant, *Tetramorium immigrans* (Fig. 1) while the crop is on the orchard floor during harvest. There are roughly 10 other ant species that often occur in almond orchards but pose no economic threat to the crop. Some very common species include the native gray ant, *Formica aerate*, pyramid ant, *Monomorium bicolor,* and California harvester ant, *Pogonomyrmex* californicus. The food sources of the native gray and pyramid ant consists of small insects and arthropods, and when available, honeydew. The harvester ant feeds exclusively on small seeds.

Because both pest and non-pest ant species so commonly exist in the same orchard, monitoring and proper identification play an important role in efficient ant management. The University of California Statewide Integrated Pest Management (IPM) Program *Almond Pest Management Guidelines* provides a procedure for monitoring pest ants in almond. The *Pest Management Guidelines* suggests that monitoring begins during April and May in the southern San Joaquin Valley and early June in the northern San Joaquin Valley and Sacramento Valley region. The mean number of pest ant nest openings is determined in five survey areas of ~1,000 ft^2 per survey area, per orchard. The guidelines provide a form and table to aid in recording sampling results and management decisions. (ipm.ucanr.edu/PMG/C003/almond-antcolony.pdf)

For instance, the table provided by the *Pest Management Guidelines* (Table 1.) indicate that if there are 15 nests per 5000 ft^2, and nuts remain on the ground for seven days, approximately 1.6% damage could result. Moreover, if nuts remain on the orchard floor for up to 10 days, 2.1% damage can occur.

So, what to do? Importantly, differentiate between pest and non-pest ant species. This is important since the insecticide baits effective against the pest species do not affect non-pests. In other words, do not assess a bait treatment as ineffective by misidentifying the target species. Next, monitor for pest ants and make sure there are enough to justify a treatment.

Four very effective bait management options exist for almond: insect growth regulator (IGR) baits, Estee (pyrproxyfen), and Extinguish (methoprene), and stomach poison baits, clinch (abamectin) and Altrevin (metaflumizone). Each of these baits use soybean oil as the attractant / toxicant carrier and preferentially attract lipid-feeding (protein-feeding)

ants. When deciding on a management strategy, make sure to consider the lag time between bait application and population reduction. IGR baits work slower, taking up to eight weeks before affecting a significant reduction in foraging activity. At this time in the season, an IGR ant bait may not be the best choice for the earlier-harvested cultivars. In contrast, the stomach toxicants, abamectin and metaflumizone work much faster, requiring just three and one week, respectively, before significantly reducing foraging activity.

Ant bait is relatively inexpensive and, when used properly, can save a grower a lot of money. Apply bait to dry soil that will not be irrigated for 48 hours by sprinkler. The bait can absorb moisture from soil or irrigation water and is then less attractive to ants. Don't use bait from bags open for more than a week. The soybean oil rapidly spoils and rancid soybean oil is not attractive to ants. Buy bait and use it quickly for best results.

Insecticide use should occur only if monitoring indicates the presence of ant pests. Apply bait insecticides only after considering the potential risks of the compound to water quality. For more information on this and other topics please consult the UC IPM Pest Management Guidelines for Almonds at: ipm.ucanr.edu/agriculture/almond .

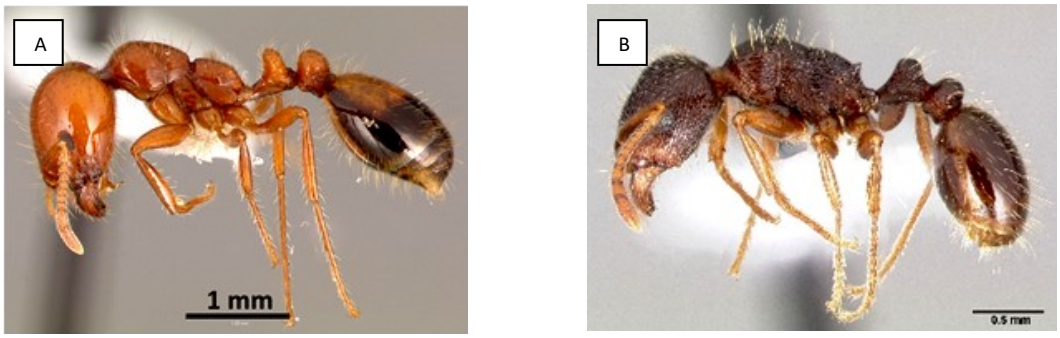

Fig. 1. Southern fire ant, *Solenopsis xyloni* (A) and Pavement ant, *Tetramorium immigrans.* Picture by April Nobile. AntWeb. Version 8.34. California Academy of Science, online at https://www.antweb.org. Accessed 12 June 2020.

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