Sacramento Valley Almond News
Pre Bloom, 2023

University of California
Agriculture and Natural Resources | Cooperative Extension

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

## Upcoming Meetings

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|---|---|
| January 18, 8am to 12pm | South Sacramento Valley Almond Grower Meeting, Arbuckle* |
| January 18, 1pm to 5pm | South Sacramento Valley Almond Grower Meeting, Woodland* |
| January 19, 7am to 1pm | North Valley Nut Conference, Chico*. Register at: www.myaglife.com/events |

*see agendas in this newsletter

# Almond Orchard Management Considerations – Bloom through Early April

*Franz Niederholzer, UCCE Farm Advisor, Colusa and Sutter/Yuba Counties*

## OVERVIEW

In business (and driving), there are curves and straightaways. The almond business in California has hit the first curves encountered in more than a decade. For growers in the financial position to stay the course, gently slowing down (cutting costs) in 2023 will be critical to minimize further net losses and hopefully return to profitability as soon as possible. Reevaluation of practices and the tradeoffs between input costs and returns on those investments will be critical to staying on the road to success. There is very little research on this topic, so growers and their advisors will need to proceed cautiously to match practices with conditions in different orchards.

## IRRIGATION

This will be another interesting irrigation season. Snowpack levels are good, so far, but the reservoirs are still low. Surface water deliveries look, at this point in the water year, to be light and/or expensive. The best way forward, as we see it, is to:

- Perform a thorough checkup of your well, pump and irrigation system components. A pump test will identify possible major problems such as substantial pressure reductions or water flow rates. Thoroughly check filters, pressure gauges, screens, and lines to make sure there are no plugs or leaks.
- Check out your irrigation system ahead of bud swell and frost risk. More information available at: sacvalleyorchards.com/almonds/irrigation/irrigation-system-maintenance.
  - If you farm in Tehama, Butte, Glenn or Shasta Counties free system evaluations are available from the Tehama Resource Conservation District Mobile Irrigation Lab. For more information contact Kevin Greer at (530) 727 – 1297 or kevin@tehamacountyrcd.org. For Yolo County, contact Conor Higgins, higgins@yolorcd.org. For Solano County, contact Kevin Young-Lai, kevin.young-lai@solanorcd.org. For Sutter-Yuba-Colusa, contact Karandave Kang, karandavek@gmail.com.
- Ready your soil or tree moisture monitoring tools. Have plant water status (pressure chamber, etc.) and soil moisture sensor equipment ready to go for the season.

- If the water availability for an orchard is limited, research results suggest the best approach is to limit irrigation from the first set and by the same relative amount through the season. For example, if you have 70-80% of normal water available, make your first irrigation just that amount (70-80% of what you would typically apply). The trees will adjust to reduction and be better prepared when the heat of the late spring/summer arrives.

## NOW SANITATION

*Orchard sanitation is a critical step in managing navel orangeworm.*

- Reduce mummy counts to no more than 2 mummies/tree on average (less if possible) by bud swell (end of January/early February). In high pressure sites, the target is an average of 0.2 mummies per tree and 8 mummies on the ground under a tree. Sanitation also removes overwintering sites for bacterial spot.
- Finish the job by mowing by March 1. Make sure to blow/sweep downed mummies into middles/windrows and flail mow (or disc or shred) to ensure destruction of mummy nuts. Do this by March 1 to make sure NOW are destroyed. When flail mowing mummies, make sure the mower speed is slow enough and your mower height setting low enough so that all nuts are shredded. Double-check the windrows after 1-2 passes to confirm all nuts are shredded. Slow the tractor speed if some nuts survive.
- Remove "wild" almonds along fence lines, etc. to reduce pressure from NOW overwintering there.
- Encourage all your neighbors to sanitize as well. The larger the contiguous area that's mummy free, the more effective winter sanitation becomes.

## WEED MANAGEMENT

- Talk with your PCA about a preemergence herbicide program for weed control in tree rows (strip sprays) before chances of rain pass completely. Consider a narrower weed-free strip spray to save costs, depending on the width of your mower. Prepare for sprays by removing leaves or dead weed cover from strips. Applications made to clean soil will last longer and be more effective.
- Weed management can be particularly difficult in newly planted and young orchards, as weeds get plenty of sun, water, and fertilizer. White paint alone does NOT protect young tree trunks from herbicide damage. Trunk cartons can provide protection from herbicide injury for young trees. Hear information on protecting young tree trunks at: growingthevalleypodcast.com/podcastfeed/trunkprotection

## DISEASE MANAGEMENT

- Get your sprayer(s) ready before needed. Check for worn or broken parts (nozzles, strainers, pressure gauge(s), etc.) and replace as needed. Calibrate the sprayer by measuring ground speed and spray flow (gallons per minute). Target most of the spray volume towards the upper canopy as rainfall will redistribute the spray materials downwards. The general rule is at least 2/3rd of the spray volume (gallons per minute) through the top half of open nozzles.
- Protect flowers during bloom with fungicides as needed, based on orchard history and weather conditions. The most current fungicide efficacy and treatment timings table for almond diseases are included in this newsletter.
  - Use bloom weather forecast to decide on one or two bloom sprays (see details on this important choice in the article on pest management in tight budget year in this newsletter).
  - Every-other-row spraying with a calibrated sprayer delivers effective disease control at pink bud. After pink bud, every-other-row spraying = every-other-row protection.
  - If the bloom forecast is for warm storms (temps in the low 60's), include at least one fungicide active on anthracnose in each application (see efficacy tables in this newsletter).
  - If the bloom forecast is for cold storms (temps 40-50's), include at least one fungicide active on jacket rot. FRAC 3 fungicides are largely ineffective on jacket rot.
  - Freezing/wet bloom weather = elevated risk for flower damage from bacterial blast. Frost protection helps reduce blast damage (see bullet on frost control). Kasumin®, a new bactericide, had a Section 18 label in the past several years, but is not labeled for use in almonds as of this writing (late December 2022). [Last year, the Kasumin® Sect 18 was approved in late January].

## HONEY BEE SAFETY

- Bee kind to bees in your orchard; you need them to be healthy! Start spraying in the afternoon after pollen is gone from the orchard for the day (stripped by the bees) and use only fungicide in the tank. (B.t. insecticide is bee safe and is the only exception to the "just fungicide" rule).
- If weather is dry, work with your beekeeper to make sure bees have access to fresh, clean water.
- Hive removal is recommended at petal fall for 90% of the latest blooming trees in the orchard.

## FROST PROTECTION

- Days before freezing conditions are predicted, close mow your orchard middles (vegetation should be < 2 inches tall). If a freeze is forecast during or after bloom, irrigate to wet the top foot of soil one to two days ahead of the event. Moist, firm, and bare/close mowed orchard floor releases more heat on cold nights than orchards with taller vegetation or recent cultivation. Check your irrigation system to make sure it can function at bloom in case freezing temperatures are forecast.
- If sprinkler irrigation is available and a freeze is forecast, turn on irrigation before wet bulb temperatures reach the critical crop temperature values; turn off water once the wet bulb temperature up wind from the orchard is above the critical temperature (or when all the ice melts). Click HERE to see critical temperatures for many varieties and flower stages.
- Drip irrigation provides no benefit when run during frost but irrigating a day or two ahead of cold (especially with the greater wetting surface of double line drip) gives time for wet soil to warm with sunlight and store more heat to release on a frosty night. A dry soil surface crust can prevent heat storage during the day and its release at night; re-irrigate the surface few inches of soil if the surface dries out.

## INSECT PESTS

- If peach twig borer (PTB) requires treatment, products containing only the active ingredient *Bacillus thuringiensis* (B.t.) can be used at bloom for minimal impact on honeybees. PTB can also be controlled with a delayed dormant spray or "May spray" (based on degree day timing), so bloom-timed B.t. applications, while effective, are not essential. More information on PTB management is available at UC IPM or SACVALLEY ORCHARDS.
- Hang San Jose scale and oriental fruit moth traps by mid- to late-February; navel orangeworm and peach twig borer traps by mid-March. Begin accumulating degree days once biofix has been established. Click HERE for more information on almond insect pests.
- If mating disruption is part of your IPM program for NOW, deploy dispensers by late March or early April. NOW pheromone traps should be shut down (catching no male moths) with good dispenser placement, so make sure your monitoring includes egg and bait bag traps to follow NOW activity. Click HERE for more information on navel orangeworm from UC IPM.
- The larger the area treated with mating disruption the more effective the technique will be. Multiple neighbors treating a larger area will help everyone. With NOW, the more effective your neighbors' management programs are, the better off you will be too.
- Tell your almond, walnut, and pistachio neighbors if you are using mating disruption, as NOW pheromone trap catches may be affected in areas outside of the treated orchard.

## NUTRIENTS

- Crop load determines big ticket (nitrogen and potassium) fertilizer need in mature orchards. Given the frost damage in 2022, there should be strong crop potential in many blocks if there is good bloom weather and adequate, good quality irrigation water. This means extra attention to nitrogen (N) and potassium (K) timing and rates. A potentially larger crop, uncertain nut prices, and higher fertilizer prices makes nutrient planning a challenge. Reducing fertilizer rates is a better option than eliminating them. To avoid deficient levels in summer (July) sampling, use early season leaf analysis as "early warning system". Click HERE to see information on that practice in the Almond Board of CA's publication on Nitrogen Best Management Practices in Almond based on Almond Board funded UC research. This publication contains a great deal of valuable information on N management in almond orchards.

- Apply approximately 20% of the year's predicted nitrogen (N) by late February or March (no later than full spur leaf out). Spur growth (see recommended amounts N/acre in Table 2 in the ABC Nitrogen BMP publication) is completed by April or early May.
- Start your K fertigation program in March or early April if dry fertilizer was not applied at all in the fall/winter. Despite high K fertilizer costs, some K (fertilizer, almond shells, etc.) should be applied in a heavy crop year to avoid K deficiency (and the resulting crop reduction the following year).
- In areas where high boron is not a problem and fall boron sprays were not applied, boron foliar sprays at 'pink' timing can improve yield significantly (100-200 kernel lbs/acre). The recommended rate is 1 to 2 lbs Solubor®/acre as a canopy s pray (equal to 0.2 to 0.4 lbs actual boron/acre). Even if hull B levels were up last year (but less than 200 ppm B), growers should consider a light rate (1 lb or 0.2 lb actual B/acre) if no fall B spray was applied. Full bloom application of B can reduce yield, while 'pink' bloom stage spraying improves set.

Links to online resources for almond orchard management:

- UC IPM Guidelines for Almond: ipm.ucanr.edu/agriculture/almond/
- UCCE Sacramento Valley Orchard Source: sacvalleyorchards.com/almonds/
- UC Davis LAWR Frost protection/Sprinkler on/off: biomet.ucdavis.edu/frostprotection/Start&StopSprinklers/FP001.htm
- Almond Board of CA Nitrogen Best Management Practice (BMPs): almonds.com/sites/default/files/2020-12/ABC_Nitrogen_8.5x11_vmags.pdf
- Almond Board of CA Bee BMPs: almonds.com/sites/default/files/ALM_189395_HBBrochure_8_5x11_Website_F.pdf

**Save the Date!**

**2023 Nickels Field Day**

**Thursday, May 18, 2023**

**Arbuckle, CA**

## Vegetation for Infiltration

*Curt Pierce, UCCE Irrigation and Water Resources Advisor for Glenn, Tehama, Colusa, and Shasta Counties*

Facing a fourth consecutive year of drought conditions across California, groundwater levels dropping throughout much of the Central Valley, and SIGMA policies coming into effect, more and more California growers are looking to incorporate some form of agriculturally managed recharge (AG-MAR) into their water management plans. During the off-season for orchards, AG-MAR looks to divert runoff from winter storms into groundwater basins where the water can be "banked" for future use.

Since the primary factor governing the suitability of an orchard to AG-MAR is soil type, an online tool called the Soil Agricultural Groundwater Banking Index (SAGBI) was developed by the California Soil Resource Lab at UC Davis. Using data including topography, percolation rates, and the root-zone residence time of applied water, the interface allows users to see suitability ratings for soils at most locations throughout the state. The website features tabs where users can quickly toggle between unmodified ground conditions and a theoretical model that accounts for the typically improved conditions that result from deep tillage, having occurred, such as ripping prior to orchard establishment. Growers with operations in areas rated "moderately good" to "very poor" can still benefit from using vegetation to help increase infiltration but need to take extra care to monitor soil moisture to avoid "wet feet" in their orchards, as the root-zone residence time of any water in the profile will be longer than in areas with higher SAGBI ratings.

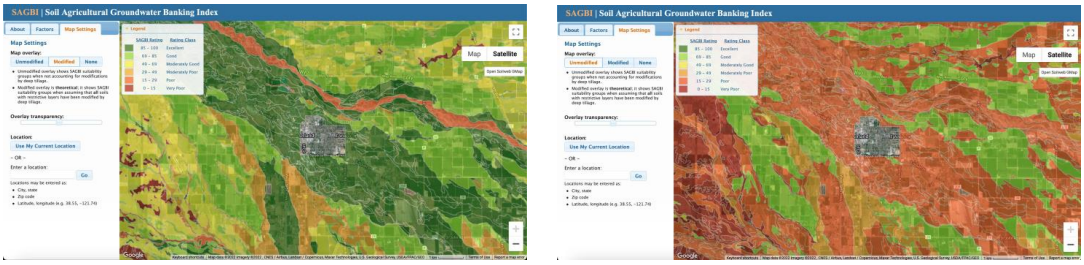


*Figure 1. Maps displaying data from the SAGBI website on soil suitability around the Orland, CA area. The map on the right displays theoretical data assuming significant improvement of AG-MAR suitability due to deep tillage.*

Once the soil suitability is determined, establish, or maintain vegetation in recharge areas. The presence of vegetation, whether resident vegetation or a cover crop will help "slow the flow" of water over the surface and increase infiltration into the soil profile. Grasses are relatively deep-rooted and withstand water flows well, but any cover crop or resident vegetation will aid the capture and infiltration of stormwater. Grasses may also help suppress the growth and spread of undesirable weed species.

Legumes, such as clover, provide extra nitrogen to the soil, in addition to slowing water flows. They have a lower carbon-to-nitrogen ratio than grasses, providing a quicker decomposition if they are mowed or incorporated into the soil during the growing season. They're a good choice for orchard middles, where grasses are likely better suited to channels, borders, and basins.

Brassicas (mustard, radish, and peas) can be useful in situations where a quick stand is needed but they become "woody" and are more challenging to reincorporate into the soil if left to grow to maturity. They are deep-rooted and very good for water infiltration, while being excellent forage for pollinators when in flower.

Of course, you may have many ever-changing priorities often conflicting with one another. Managing vegetation for infiltration is no different. Vegetation on orchard floors (two inches or taller) during the winter months shades the soil and makes passive frost protection less effective since soil is not warmed by the sun during the day.

For more information, please visit sacvalleyorchards.com for the recent article "Management Practices for Improved Water Capture" or consult the Cover Crop Best Management Practices guide, a joint project by the Almond Board of California, UC Davis, and the UC department of Agriculture and Natural Resources.

## Disease Management in Tight Budget Year

*Franz Niederholzer, UCCE Farm Advisor, Colusa, and Sutter/Yuba Counties*
*Sudan Gyawaly, Northern Sacramento Valley IPM Advisor*

In a tight budget year, getting the best results, affordably, is vital to delivering the crop this year and next year. The possibility of increased disease pressure this year (2023 is off to a wet start) compared to the last 3 years makes this even more important. The following are some considerations going into the 2023 crop year.

Overall strategy: Preventative treatment (i.e., spraying before rain or dew) with the right fungicide(s) should give better disease control compared to spraying after infection once symptoms appear. Why? 1) better spray coverage is possible early in the season (less canopy interference with spray movement) and 2) disease pressure is low, and control should be easier. Infection chances are often greater earlier in the season when more rain falls, on average, than later in the season. *

Brown rot: At least one, carefully applied, every row spray at 30-50% bloom if there is no to very little rain during bloom. Two sprays are recommended if it is a wet bloom, one at 'pink' (not dormant bud swell) and one at full bloom.

Green fruit rot: In a wet, cool bloom, target green fruit rot with full bloom fungicide spray. FRAC 3 fungicides (Tilt®, Indar®, Elite® and generics) are excellent brown rot fungicides, but largely ineffective on green fruit rot. There are many effective fungicides for green fruit rot (FRAC 2, 7, 9).

If bloom is warm (60°F plus) and wet, starting at pink bud, include a fungicide with good anthracnose activity (for example FRAC 3 materials) in the tank. The good news is that most fungicides used for brown rot (except FRAC 9 materials) have good efficacy on anthracnose.

Shot hole: is a significant concern from full bloom through 2 weeks after petal fall. FRAC 3 fungicides give only "moderate and variable" control of this disease that can cause nut drop in cool springs when heavy infections spread to nuts with rain. Many other fungicides deliver good control when applied ahead of rain once leaf infections begin sporulating.

Once petal fall occurs, keep an eye on the weather and consult with a PCA regarding materials and timings. Refer to the 'Fungicide Timing and Efficacy' table for key disease control timings. Click HERE to view a link (at the bottom of the page) to a pdf of the current UC IPM Fungicide Timing and Efficacy publication.

Severe infections producing early defoliation (scab, rust, alternaria) can reduce yield NEXT year (2024) as flower numbers/nut set can be dramatically reduced.

Careful sprayer calibration/set up is important for good pest control. Spray must reach all parts of the canopy to deliver effective disease control. Aim and select nozzles so that at least 2/3 of spray volume goes out of the top half of the open nozzles. Check with water sensitive paper to confirm coverage.

Final thought: Staying ahead of a problem is generally better than playing catch up!

*When spraying once high levels of the disease are present, UC recommends not using single site materials or pre-mixtures of single site materials. Broad spectrum products (sulfur, captan, ziram, etc.) are recommended when allowed by the label.

For spring arthropods/insect/mites pests management consideration during tight budget years, refer to the article previously published online at Sacramento Valley Orchard Source (Click here for the article).

## Rootstock Selection to Increase Tree Health, Longevity, and Yield in the Sacramento Valley

*Kat Jarvis-Shean, UCCE Sacramento, Solano and Yolo Counties*

Selecting a rootstock when developing an orchard is a decision that will impact tree health and yield for the rest of the life of the orchard. Rootstocks can help mitigate the impact of site-specific conditions, both abiotic stressors like toxic boron or chloride in the soil or water and biotic stresses like *Phytophthora* or nematodes in the soil. Rootstocks also impact horticultural characteristics of the tree, like anchorage and vigor. The University of California has spent decades testing rootstocks in greenhouses, lath houses and grower fields to understand their strengths and limitations. UC Cooperative Extension has recently compiled the lessons from those trials into one comprehensive ranking table (https://fruitsandnuts.ucdavis.edu/sites/g/files/dgvnsk12441/files/inline-files/Almond%20Rootstocks.pdf, Fig 1) and an online comparison tool (https://fruitsandnuts.ucdavis.edu/rootstocks/rootstock-comparison, Fig 2). The more time you invest early on in understanding the specific conditions of your site and selecting a rootstock based on those conditions, the less you'll have to invest in managing stressors later in the life of the orchard.

| Parentage | Rootstock | Genetic Background[1] | Comments | Compatibility | Anchorage |
|---|---|---|---|---|---|
| Peach | Guardian® | *P. persica* | Similar to Nemaguard but with good resistance to ring nematode and bacterial canker. | Good | Fair |
| | Lovell® | *P. persica* | Historical standard in Sacramento Valley heavier soils due to perceived better asphyxia tolerance than Nemaguard. Susceptible to rootknot nematode. | Good | Fair |
| | Nemaguard® | *P. persica* | Historical standard rootstock for the San Joaquin Valley in well-drained soil. Being replaced by newer, better-suited rootstocks. Prone to zinc deficiency. | Good | Good |
| Peach Hybrids | Cadaman® | *P. persica* × *P. davidiana* | Similar to Nemaguard but better tolerance of alkaline and saline conditions. | Good (limited experience) | Good |
| | Empyrean 1® (Barrier 1®) | *P. persica* × *P. davidiana* | High vigor and salt tolerance similar to peach × almond hybrids but less susceptible to ring nematode. Fair anchorage may limit use in windy areas. | Good (limited experience) | Fair |

Figure 1. Sample image showing a few of the rootstocks and traits ranked in the new UC Almond Rootstock guide.

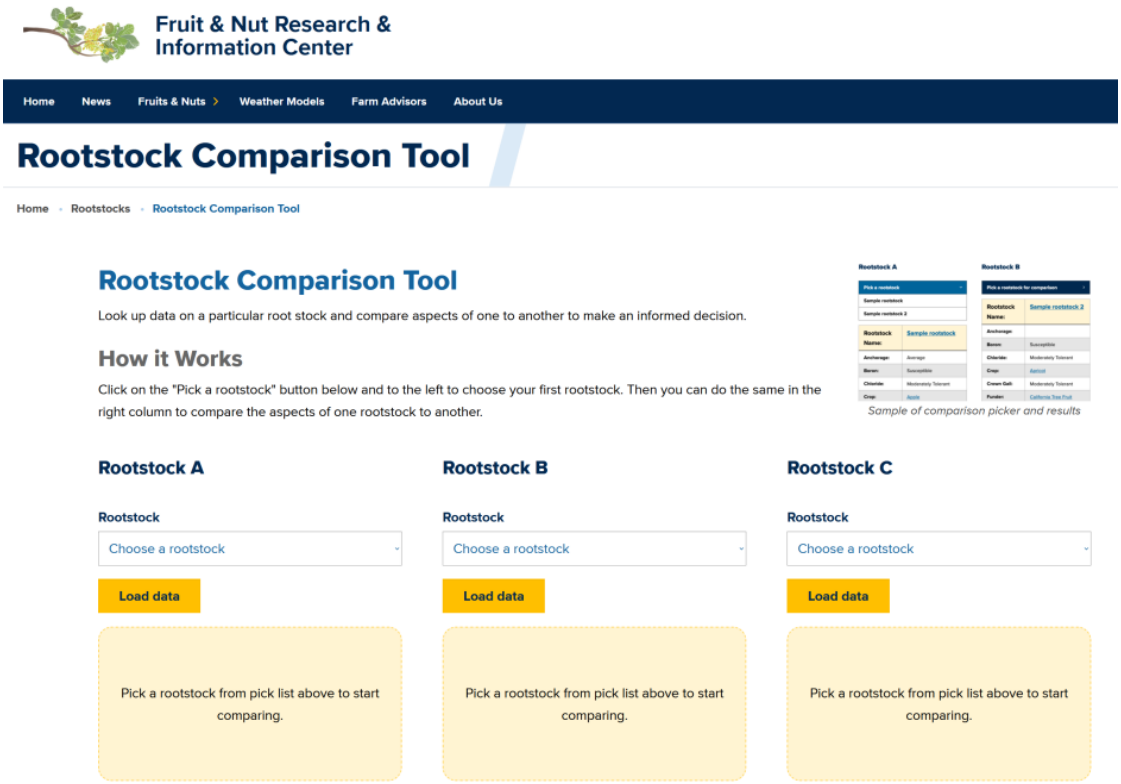


Figure 2. Sample image of the Fruit & Nut Research & Information Center Rootstock Comparison Tool.

Understandably, when selecting a rootstock, it's tempting to first look for the rootstock that will create the tree with the highest yield. But if there is particular challenges or stressors at your orchard site, picking based on yield results at an unchallenged site is putting the cart before the horse. The first focus should be a rootstock that will stay healthy under the conditions at your site. A sick tree won't live up to the maximum yields achieved at a pristine, unchallenged site, and will likely require significant additional inputs and management expenses to keep it yielding economically. Understand the one or two main challenges at your site, identify the rootstocks that can help manage those challenges, and then learn other aspects of those rootstocks so you can optimize the performance of trees in your orchard (e.g. plant at tighter spacing for a less vigorous rootstock).

When considering rootstock options, you'll encounter, roughly speaking, four groupings of different genetic heritage rootstock options: peach, peach-almond hybrids, Myro plum hybrids and complex hybrids (peach-almond-plum-apricot). Similar genetic heritage is often associated with common traits. These guidelines can help orient you to options; however, within categories, there are rankings and there are exceptions, so examine the merits of each specific rootstock. Below I'll review findings for common challenges in the Sacramento Valley, but for a complete ranking by trait and rootstock, check out the new publication or comparison tool. In the Sacramento Valley, frequent abiotic challenges include excessive chloride and boron, heavy soils that are susceptible to waterlogging, and strong winds leading to leaning trees or blow-overs.

In a decade-long trial in a grower field in western Stanislaus County, UCCE Farm Advisor Roger Duncan consistently found that leaves from cv. Nonpareil trees on the peach-almond hybrid rootstocks Paramount, Brights 5, BB 106, Hansen and FxA, as well as the plum-almond hybrid Rootpac R, remained below the chloride toxicity critical value threshold of 0.3%, while at the same site pure peach rootstocks Lovell and Nemaguard, along with peach-plum hybrid Krymsk 86, often had twice the critical value level in their leaves.

Similarly, at a decade long boron challenged rootstock trial that I led west of Woodland in an orchard with high boron in the soil and water, the peach-almond hybrids Nickels, FxA, Brights-5 and Titan SG1, always outperformed the pure peach rootstock Lovell in both yield and yield efficiency (yield adjusted for tree size, see below), as well as often having significantly lower hull boron values (Figure 3). Krymsk 86 was almost always significantly lower in yield and yield efficiency than the aforementioned peach-almond hybrids, as well.

Rootstocks with plum heritage often have good anchorage to withstand heavy winds. A trial in Kern County found the complex hybrid Viking had only 4% blow-overs following an 85 mph sustained wind coupled with rain. It's complex hybrid sibling, Atlas had 30% blow-overs. Other trials and anecdotal evidence have shown the plum hybrid Krymsk 86 and the peach-almond hybrids F x A and Hansen 536 to have excellent anchorage as well. Plum hybrids are generally considered to be the most tolerant to winter waterlogging, though it should be noted that wet soil in-season can worsen incompatibility symptoms we sometimes see with certain cultivars and plum heritage rootstocks.

Figure 3. Rootstocks Nickels, a peach-almond hybrid, alongside Lovell, a pure peach, both with cv. Nonpareil as scion.

When it comes to biotic challenges, we know more about disease and nematode susceptibility through researchers screening in greenhouses and small plots where they purposefully infect the plants than from large-scale grower-hosted trials. Frequent biotic challenges encountered in the Sacramento Valley include phytophthora, oak root fungus, verticillium wilt, and root lesion nematode. For phytophthora, the sources of resistance come from plum heritage. Plum hybrids such as Marianna 2624, Krymsk 86 and Rootpac R are the most resistant options, whereas peach-almond hybrids are highly susceptible. It's safest to assume any orchard that's been flooded or irrigated with surface water at some point in its history will have phytophthora inoculum present. Attentive irrigation management and site preparation (e.g. berms) may allow growers of even peach-almond hybrids to avoid infection, but on heavy ground with occasional drainage challenges, phytophthora risk should be strongly considered. Similar to phytophthora, for oak root fungus, the source of resistance is found in plum heritage, with plum hybrids Marianna 40 and Marianna 2624 providing the best resistance (though they'll require a cv. Padre interstem to be grafted below cv. Nonpareil) and Krymsk 86 providing moderate resistance. For verticillium wilt, which we often find in almonds following tomatoes, only Atlas has been found to be tolerant, whereas other rootstocks range from susceptible to highly susceptible. For root lesion nematode, our options are regrettably thin. Only Hansen 536 is moderately tolerant, but tolerance, as opposed to resistance, means it will still allow nematodes to infect, feed and breed on the roots; the tree just won't suffer as much stunting as a result of the infection. Research is ongoing to test and develop new and better options for these diseases, as well as crown gall and the major almond-infecting nematodes.

Once you understand what, if any, stressful conditions may be present at the site in question, and what rootstocks mitigate the stress of those conditions, then you can consider the vigor of your different options. If you're lucky enough to be planting a site without significant challenges, you can skip right to this step. Broadly speaking, peach-almond hybrids are highly vigorous, peach and complex hybrids have moderately high vigor and plum hybrids are moderately vigorous. Higher vigor frequently leads to higher yields since trees fill their space well. At Roger Duncan's westside trial, the trees on pure peach were about 20% smaller than the trees on peach-almond hybrids that were able to tolerate the site's high chloride and cumulatively over six harvests yielded about 30% less when they were planted at the same spacing. At my Yolo County high boron trial, trees on Lovell were about 20% smaller than the trees on the peach-almond hybrids and yielded only about half as much over the first nine harvests of the trial. At Joe Connell's northern Sacramento Valley trial, planted in Durham on a wide spacing (16 x 24 feet) in 2010 following an orchard that had been on Lovell, these same trends could be seen. The trees on peach rootstock Lovell, plum hybrid Krymsk 86 and complex hybrid Atlas were about 20% smaller than the peach-almond hybrid Nickels and the

peach-wild peach hybrid Empyrean 1, and cumulatively yielded about 25% less than trees on Nickels and Empyrean 1 that had better filled their space over the first eight harvests.

Though higher vigor often results in higher yields, there are some rootstocks that "punch above their weight" when it comes to size and yield. Thus, it also pays to examine 'yield efficiency', which is calculated by dividing yield by either the trunk circumference or canopy area, to essentially tell us how much trees are yielding compared to their size. On a yield efficiency basis, for example, Brights 5, a less vigorous peach-almond hybrid, and Viking, a complex hybrid, often yield as much as more vigorous peach-almond hybrids like Nickels. This tells us that at tighter spacings than used at the experimental sites, we would expect these rootstocks to have similar yield. For this level of data specificity, you can consult the results in the annual Almond Board rootstock research reports.

Picking a rootstock when planning an orchard is a tough decision that will impact how much yield an orchard pumps out, what inputs are required, and how much time and effort is needed to keep your orchard thriving. The first step is to know your site – test the soil and water, know the cropping history and any previous disease or nematode concerns. The next step is to select a rootstock that can thrive under the specific conditions of your site. Finally, appreciate the qualities of that rootstock beyond resistance or tolerance to site stressors, and integrate those qualities (e.g. moderate vigor, phytophthora susceptibility, etc.) into your orchard plan (e.g. tighter spacing, berms and attentive irrigation, etc.). New resources created by the University of California with support from the Almond Board can go a long way in helping in this process.

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For timely **almond, pistachio, prune, & walnut** orchard management reminders, pest and disease information, events, blog posts and more!

Use your phone to scan our QR code by opening your phone's camera app and hovering over the QR image below:

# 2023 UCCE Southern Sacramento Valley Almond Grower Meetings

## January 18, 2023

1.5 hours of PCA CE hours ("other") requested
3.5 hours of CCA CE hours **approved** (includes 0.5 hr Nutr Man + 0.5 hr Soil&Water Man,

- Arbuckle Golf Club, 5918 Hillgate Rd, Arbuckle, **8:00 am – 12:00 pm**
- Norton Hall, 70 Cottonwood St, Woodland, **1:00 pm – 5:00 pm**

*(Same presentations, different order)*

**Arbuckle 8:00 am – 12:00 pm**

**Thank you to Bayer Crop Science for their generous meeting sponsorship**

**8:00 AM** **Maximizing almond production profitability in a lean price year**
Brittney Goodrich, UC Davis

**8:30 AM** **Rootstock selection to avoid management costs and optimize yield**
Kat Jarvis-Shean, UCCE Sacramento-Solano-Yolo

**9:00 AM** **Monitoring almond tree irrigation and stress: How new tools stack up**
Ken Shackel, UC Davis

**9:30 AM** **Optimizing pesticide applications when every penny counts**
Franz Niederholzer, UCCE Sutter-Yuba-Colusa

**10:00 AM** **Break**

**10:30 AM** **Managing bacterial and fungal pathogens in almond leaves and nuts**
Jim Adaskaveg, UC Riverside

**11:00 AM** **Almond pest management in lean times**
Sudan Gyawaly, UCCE Sacramento Valley IPM Advisors

**11:30 AM** **Fertilizer management: Budgeting for your trees and your bottom line**
Franz Niederholzer, UCCE Sutter-Yuba-Colusa, Kat Jarvis-Shean, UCCE Sacramento-Solano-Yolo

**12:00 PM** **Adjourn**

**Woodland 1:00 pm – 5:00 pm**

**1:00 PM** **Maximizing almond production profitability in a lean price year**
Brittney Goodrich, UC Davis

**1:30 PM** **Monitoring almond tree irrigation and stress: How new tools stack up**
Ken Shackel, UC Davis

**2:00 PM** **Managing bacterial and fungal pathogens in almond leaves and nuts**
Jim Adaskaveg, UC Riverside

**2:30 PM** **Almond pest management in lean times**
Sudan Gyawaly, UCCE Sacramento Valley IPM Advisors

**3:00 PM** **Break**

**3:30 PM** **Optimizing pesticide applications when every penny counts**
Franz Niederholzer, UCCE Sutter-Yuba-Colusa

**4:00 PM** **Rootstock selection to avoid management costs and optimize yield**
Kat Jarvis-Shean, UCCE Sacramento-Solano-Yolo

**4:30 PM** **Fertilizer management: Budgeting for your trees and your bottom line**
Franz Niederholzer, UCCE Sutter-Yuba-Colusa, Kat Jarvis-Shean, UCCE Sacramento-Solano-Yolo

**5:00 PM** **Adjourn**

## 2023 North Valley Nut Conference

**January 19, 2023**

Silver Dollar Fairground, Chico
2 hours PCA CE, 4.5 hours CCA CE. **approved**

| | |
|---|---|
| 7:00 AM | **Registration** |
| 8:00 AM | **Butte and Glenn Co Ag Commissioners Update**<br>*Louis Mendoza, Butte Co Ag Commissioner*<br>*Marci Skelton, Glenn Co Ag Commissioner* |
| 8:30 AM | **Navel orangeworm management in nut crops**<br>*Sudan Gyawaly, UC IPM Advisor, Sacramento Valley* |
| 9:00 AM | **Irrigation strategies for north valley nut crops**<br>*Curt Pierce, UCCE Area Irrigation and Water Resources Advisor* |
| 9:30 AM | **Break** |
| 10:30 AM | **Walnut mold management**<br>*Themis Michailides, UC Davis Plant Pathologist* |
| 11:00 AM | **Phytophthora management updates in almond and walnut**<br>*Jamie Ott, UCCE Orchard Advisor* |
| 11:30 AM | **Key management lessons in almond and walnut**<br>*Luke Milliron, UCCE Orchard Advisor* |

**Hosted lunch**

**Lunch presentation:** **Pollinator Health Management**
*Rory Crowley and Patricia Stock, Seeds for Bees.*
*Cindy Daley, Dean, College of Agriculture, CSU Chico*

## FUNGICIDE EFFICACY - PHYTOPTHORA ROOT AND CROWN ROT (PRCR) USING CONVENTIONAL TREATMENTS

| Fungicide | Resistance risk (FRAC Code)[1] | PRCR |
|---|---|---|
| Orondis | high (49) | 5 |
| Revus** | high (40) | 5 |
| Presidio | high (43) | 4 |
| Ridomil, Metalaxyl | high (4) | 3 |
| Ridomil Gold, Mefenoxam | high (4) | 4 |
| Aliette, ProPhyt, Fungi-Phite, K-Phite | low-medium (P07, 33) | 4 |

**Rating:** 5 = excellent and consistent, 4 = good and reliable, 3 = moderate and variable, 2 = limited and/or erratic, 1 = minimal and often ineffective, 0 = ineffective, NL = not on label, and ND = no data.

****Not registered, label withdrawn or inactive in California.**

# ALMOND: TREATMENT TIMING

**Note: Not all indicated timings may be necessary for disease control.**

| Disease | Dormant | Bloom | | | Spring[1] | | Summer | |
|---|---|---|---|---|---|---|---|---|
| | | Pink bud | Full bloom | Petal fall | 2 wks | 5 wks | May | June/ July |
| Alternaria | ---- | ---- | ---- | ---- | ---- | ++ | +++ | +++ |
| Anthracnose[2] | ---- | ++ | +++ | +++ | +++ | +++ | +++ | ++ |
| Bacterial spot | + | ---- | ++ | +++ | +++ | ++ | + | ---- |
| Brown rot | ---- | ++ | +++ | + | ---- | ---- | ---- | ---- |
| Green fruit rot | ---- | ---- | +++ | ++ | ---- | ---- | ---- | ---- |
| Hull rot[7] | ---- | ---- | ---- | ---- | ---- | ---- | ---- | +++ |
| Leaf blight | ---- | ---- | +++ | ++ | + | ---- | ---- | ---- |
| Rust | ---- | ---- | ---- | ---- | ---- | +++ | +++ | +[6] |
| Scab[3] | ++ | ---- | ---- | ++ | +++ | +++ | + | ---- |
| Shot hole[4] | +[5] | + | ++ | +++ | +++ | ++ | ---- | ---- |

## ALMOND: FUNGICIDE EFFICACY - BIOCONTROLS AND NATURAL PRODUCTS

| Trade name | Biological or natural product (FRAC Code)[1] | Brown rot | Jacket rot | Anthrac -nose | Shot hole | Scab | Rust | ALS | Hull rot | PM-like | Silver leaf | Bac. Spot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Botector | *Aureobasidium pullulans* (BM 02) | 3 | 2 | NL | NL | NL | NL | NL | NL | NL | NL | NL |
| Double Nickel 55 | *Bacillus amyloliquefaciens* D747 (BM 02) | 2 | 2 | ND | 2 | NL | NL | NL | NL | NL | NL | 2 |
| Serifel | *B. amyloliquefaciens* MBI600 (BM 02) | 2 | 2 | NL | 2 | 2 | 1 | 1 | 1 | ND | ND | 2 |
| Taegro 2** | *B. amyloliquefaciens* FZB (BM 02) | NL | NL | NL | NL | NL | NL | NL | NL | NL | NL | NL |
| Sonata | *B. pumilis* QST2808 (BM 02) | 2 | NL | NL | NL | NL | NL | NL | NL | NL | NL | NL |
| Serenade | *B. subtilis* QST 713 (BM 02) | 3 | 3 | 2 | 2 | 1 | 1 | 1 | NL | ND | NL | 3 |
| Aviv | *B. subtilis* IAB/BS03 (BM 02) | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Dart* | capric and caprylic acids (BM 01) | 3 | 2 | ND | 2 | 1 | 1 | 2 | 2 | ND | 0 | 3 |
| Cinnacure | cinnamaldehyde (BM 01) | 1 | 1 | NL | NL | NL | NL | NL | NL | NL | NL | NL |
| EF400 | clove, rosemary, peppermint oils (BM 01) | 1 | 2 | 1 | NL | ND | NL | NL | NL | NL | NL | NL |
| BVT CR-7 | *Clonostachys rosea* CR-7 (experimental) | 4 | 2 | ND | 2 | ND | ND | ND | ND | ND | ND | ND |
| BacStop | essential oils (BM 01) | 1 | 1 | 1 | NL | ND | NL | NL | NL | NL | NL | 3 |
| Messenger** | harpin (P unspecified) | NL | 1 | NL | NL | NL | NL | NL | NL | NL | NL | NL |
| Kasumin | kasugamycin (24)[1] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| ProBLAD Verde* | *Lupinus albus* (BM 01) | 3 | 2 | NL | NL | NL | NL | NL | NL | NL | NL | NL |
| Timorex (Act, Gold) | natural oil (BM 01) | 1 | 1 | 2 | 1 | 2 | 2 | 1 | ND | 2 | NL | NL |
| Trilogy, Rango | neem oil (BM 01) | 1 | 1 | 1 | 1 | 1 | 2 | 1 | ND | 2 | NL | NL |
| Oxidate, Perasan | peroxyacetic acid (oxidizer) | 1 | 2 | 1 | 1 | NL | NL | 1 | ND | ND | NL | 2 |
| Armicarb**, Milstop | potassium bicarbonate (NC) | NL | NL | NL | NL | 1 | NL | NL | ND | 3 | NL | NL |
| All Phase | potassium sorbate/sodium lauryl sulfate (NC) | NL | NL | NL | NL | 2 | NL | NL | NL | NL | NL | NL |
| Howler | *Pseudomonas chlororaphis* strain AFS009 (BM 02) | 2 | 1 | NL | NL | NL | NL | NL | NL | NL | NL | 3 |
| Regalia | *Reynoutria sachalinensis* (P 05, BM 01) | 2 | 2 | 1 | 1 | 1 | 1 | 1 | ND | 2 | NL | 3 |
| Actinovate AG | *Streptomyces lydicus* (BM 02) | 1 | 1 | NL | NL | NL | NL | NL | NL | 1 | NL | 2 |
| EcoSwing | *Swinglea glutinosa* (BM 01) | 3 | 2 | NL | NL | 1 | NL | 1 | NL | ND | NL | ND |
| PlantShield | *Trichoderma harzianum* (BM 02) | NL | NL | NL | NL | NL | NL | NL | NL | NL | 4 | 0 |
| Vintec | *Trichoderma atroverde* (BM 02)[6] | NL | NL | NL | NL | NL | NL | NL | NL | NL | 4 | 0 |
| Procidic | citric acid | ND | ND | ND | NL | NL | NL | ND | NL | NL | NL | NL |

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## ALMOND: FUNGICIDE EFFICACY - CONVENTIONAL

| Fungicide | Resistance risk (FRAC)[1] | Brown rot | Jacket rot | Anthrac-nose | Shot hole | Scab[3] | Rust[3] | Leaf blight | Alternaria leaf spot[3] | PM-like[5] | Hull rot[16] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Adament | medium (3/11) | 5 | 4 | 5 | 5 | 5 | 5 | ND | 5 | 4 | 4 |
| Bumper, Tilt, Propicure, Propiconazole[4] | high (3) | 5 | 1 | 5 | 3 | 3 | 4 | ND | 3 | 4 | 3 |
| Cevya | high (3) | 5 | 1 | 5 | 5 | 3/4 | 4 | ND | 4 | ND | 4 |
| Fontelis[3] | high (7) | 5 | 5 | 3 | 5 | 3 | 3 | ND | 4 | ND | 0 |
| Kenja[4] | high (7) | 5 | 5 | 3 | 5 | 4 | 0 | ND | 4 | ND | 0 |
| Indar | high (3) | 5 | 1 | 4 | 3 | 3 | NL | ND | 2 | ND | 0 |
| Inspire | high (3) | 5 | 3 | 5 | 3 | 4 | 5 | ND | 5 | ND | 4 |
| Protocol[2] | med.-high (1/3) | 5 | 5 | ND | 4 | 4 | 5 | ND | 3 | ND | 2 |
| Inspire Super[4] | medium (3/9) | 5 | 5 | ND | 4 | 4 | 5 | ND | 5 | ND | 4 |
| Luna Experience[3] | medium (3/7) | 5 | 4 | 5 | 4 | 5 | 5 | ND | 5 | 4 | 4 |
| Fervent | medium (3/7) | 5 | 4 | 5 | 4 | 5 | 5 | ND | 5 | 4 | 4 |
| Luna Sensation[3,7] | medium (7/11) | 5 | 5 | 5 | 5 | 5 | 5 | ND | 5 | 4 | 4 |
| Miravis Duo | medium (3/7) | 5 | 4 | 5 | 4 | 5 | 5 | ND | 5 | 4 | 4 |
| Miravis Prime* | medium (7/12) | 5 | 4 | 5 | 5 | 5 | 5 | ND | 5 | 5 | 4 |
| Merivon[3,7] | medium (7/11) | 5 | 5 | 5 | 5 | 5 | 4 | ND | 5 | 5 | 4 |
| Pristine[3,7] | medium (7/11) | 5 | 5 | 5 | 5 | 5 | 4 | ND | 4 | 4 | 4 |
| Quadris Top[3] | medium (3/11) | 5 | 5 | 5 | 4 | 5 | 5 | ND | 4 | 4 | 4 |
| Quilt Xcel, Avaris 2XS[3] | medium (3/11) | 5 | 4 | 5 | 4 | 5 | 5 | ND | 4 | 4 | 4 |
| Quash[4] | high (3) | 5 | 3 | 5 | 4 | 4 | 5 | ND | 5 | 4 | 4 |
| Rovral oil[8, 9] | low (2) | 5 | 5 | 0 | 4 | 1 | 3 | ND | 4 | ND | 0 |
| Scala[3, 7, 10] | high (9) | 5 | 5 | ND | 3 | 0 | ND | ND | 2 | 0 | 0 |
| Tebucon,Toledo, Teb, Tebuconazole | high (3) | 5 | 1 | 4 | 3 | 3 | 4 | ND | 2 | ND | 3 |
| Viathon | medium (3/ P07,33) | 5 | 1 | 4 | 3 | 3 | 4 | ND | 2 | ND | 3 |
| Topsin-M, T-Methyl, Incognito, Cercobin[2,6,7,8] | high (1) | 5 | 5 | 0 | 0 | 4 | 2 | 4 | 0 | 3 | 0 |
| Vangard[3, 7,9, 10] | high (9) | 5 | 5 | ND | 3 | 0 | ND | ND | 2 | 0 | 0 |
| Abound | high (11) | 4 | 2 | 5 | 4 | 5 | 5 | 4 | 4 | 4 | 4 |
| Aproach[3,4,7] | high (11) | 4 | 2 | 5 | 4 | 5 | 5 | 4 | 4 | 4 | 4 |
| CaptEvate* | low (M4/17) | 4 | 4 | 4 | 4 | 4 | 0 | 4 | 2 | 0 | 0 |
| Elevate[7] | high (17) | 4 | 5 | 0 | 2 | ND | ND | ND | ND | ND | 0 |
| Gem[3,4, 7] | high (11) | 4 | 0 | 5 | 4 | 5 | 5 | 4 | 4 | 4 | 4 |
| Laredo, Rally[13] | high (3) | 4 | 0 | 3 | 3 | 0 | 2 | 4 | 0 | 4 | 0 |
| Luna Privilege | high (7) | 4 | 3 | 3 | 3 | 4 | 4 | ND | 4 | 3 | 3 |
| Rovral, Iprodione, Nevado[9] | low (2) | 4 | 4 | 0 | 4 | 0 | 0 | ND | 3 | 0 | 0 |
| Regev | high (3/BM 02) | 5 | 2 | 4 | 3 | 4 | 4 | ND | 4 | ND | 4 |
| Rhyme | high (3) | 4 | 1 | ND | 2 | 3 | ND | ND | 3 | ND | ND |
| Bravo, Chlorothalonil, Echo[11, 12, 15] (Equus**) | low (M5) | 3 | NL | 4 | 4 | 4 | 5 | NL | NL | 0 | 0 |
| Captan[4, 6, 12] | low (M4) | 3 | 3 | 4 | 4 | 3 | 0 | 4 | 2 | 0 | 0 |
| ProBLAD Verde | low (BM 01) | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mancozeb | low (M3) | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 2 | 0 | 0 |
| Ph-D | medium (19) | 3 | 4 | 0 | 3 | 4 | 4 | ND | 5 | ND | 4 |
| Ziram | low (M3) | 3 | 2 | 4 | 4 | 4 | 0 | 3 | 2 | 0 | 0 |
| Syllit | medium (U12) | 2 | 0 | ND | 4 | 5 | ND | ND | 2 | ND | 0 |
| Copper[14,15] | low (M1) | 1 | 1 | 0 | 2 | 2 | 0 | 0 | ND | 0 | 0 |
| Lime sulfur[12,15] | low (M2) | 1 | NL | 0 | 1 | 3 | 3 | NL | NL | 0 | 0 |
| Sulfur[4,12] | low (M2) | 1 | 1 | 0 | 0 | 3 | 3 | 0 | 0 | 4 | 0 |
| PlantShield[17] | low (BM 02) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Copper 2 oil[14,15] | low (M1) | ND | ND | 0 | 2 | 4 | 0 | 0 | ND | 0 | 0 |

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*Almond: Fungicide Efficacy, continued*

[1] Code numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see http://www.frac.info/). Fungicides with a different Code number are suitable to alternate in a resistance management program. In California, make no more than one application of fungicides with mode-of-actions (MOA) with high resistance risk before rotating to a fungicide with a different MOA (Code number); for other fungicides, make no more than two consecutive applications before rotating to fungicide with a different MOA (Code number).

[2] Strains of the brown rot fungi *Monilinia laxa* and *M. fructicola* resistant to Topsin-M and T-Methyl have been found in some California almond orchards. MBC-resistant strains of the jacket rot fungus, *Botrytis cinerea* and powdery mildew fungi, have been reported in California on crops other than almond and stone fruits and may have the potential to develop in almonds with overuse of fungicides with similar chemistry. MBC-resistant strains of the scab fungus, *Venturia* (*Fusicladium, Cladosporium*) *carpophila*, have been found in California.

[3] Field resistance of *Alternaria* sp. and *Fusicladium carpophilum* to QoI and SDHI fungicides has been detected in almond orchards. AP-resistant populations of *Monilinia* spp. have been found on other stone fruit crops in California.

[4] Of the materials listed, only sulfur, Abound, Gem, and some of the DMI fungicides (FRAC Code No. 3) are registered for use in late spring and earl summer when treatment is recommended.

[5] PM-like refers to a powdery mildew-like disease on almond fruit. Information suggests an *Acremonium* species is involved.

[6] Excellent control obtained when combinations of Topsin-M or T-Methyl and Captan are used.

[7] To reduce the risk of resistance development, start treatments with a fungicide with a multi-site mode of action; rotate or mix fungicides with different mode of action FRAC numbers for subsequent applications, use labeled rates (preferably the upper range), and limit the total number of applications per season.

[8] Oils recommended include "light" summer oil, 1-2% volume/volume.

[9] Not registered for use later than 5 weeks after petal fall.

[10] Efficacy reduced at high temperatures and relative humidity.

[11] Bravo Ultrex, Bravo WeatherStik, Echo, Echo Ultimate, and Chlorothalonil are currently registered.

[12] Dormant applications with oil are highly effective against scab, Do not use in-season combinations with oil or shortly before or after oil treatment.

[13] Efficacy is better in concentrate (80-100 gal/acre) than in dilute sprays.

[14] The low rates necessary to avoid phytotoxicity in spring reduce the efficacy of copper.

[15] "Burns out" scab twig lesions when applied at delayed dormant. (Chlorothalonil can be applied with dormant oil during tree dormancy).

[16] Hull rot ratings are for the disease caused by *Rhizopus stolonifer*. Ratings for the disease caused by *Monilinia* or *Aspergillus* spp. will be provided in the future.

[17] PlantShield is best used for wood-exposing wounds to prevent silverleaf and wood decay.