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Fruit and Nut Notes

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SACRAMENTO VALLEY REGIONAL

ALMOND NEWSLETTER

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The "SACARAMENTO VALLEY REGIONAL ALMOND NEWSLETTER" is a collaborative effort of almond research specialists working together to provide Sacramento Valley growers and industry leaders the latest research and information effecting almond production in today's changing environment. This newsletter will be published quarterly, be sure to look for upcoming issues!

Winter Sanitation for Navel Orangeworm Control

Richard P. Buchner, UC Cooperative Extension Orchard Advisor Tehama County

There are three season long components to a comprehensive navel orangeworm (NOW) control program. The first and most important is winter orchard sanitation followed by in season disease and insect control followed by timely harvest management to minimize the time that hull split nuts are exposed to NOW egg laying. NOW is usually a scavenger insect and favors nuts damaged by insects, disease, birds and possible environmental damage. So why is winter sanitation so important for successful NOW control? NOW overwinter as larvae in nuts remaining in the tree or laying on the orchard floor. These overwintering larvae emerge as adult moths in the spring. These adults are responsible for next year's first generation egg laying and subsequent damage from later generations. Winter sanitation is especially crucial where orchards have a history of NOW damage and NOW larvae are allowed to survive to infest the 2015 crop.

During 1981 and 1982, UC cooperative Extension Farm advisors throughout the Sacramento and San Joaquin Valleys participated in a study to evaluate the effectiveness of winter sanitation for NOW control. They found that NOW damage will occur where substantial numbers of overwintering nuts remain in the orchard regardless of in-season treatments. They observed that winter nut removal will significantly reduce the amount of NOW damage the following year. In the field, growers whose orchards had low numbers of nuts remaining in the canopy applied fewer sprays resulting in cost savings.

Use the following guidelines to accomplish winter sanitation:

1) Sample almond orchards for nuts remaining in the tree by early January. Randomly walk the orchard and count the number of nuts remaining in the tree canopy on 20 trees. If you count an average of more than 2 nuts per tree, additional nut removal is suggested. It is tempting to think that birds will do the clean up for free but birds don't always do as good of a job as we hope.

2) Use mechanical tree shaking or hand poling to remove almonds. Generally, trunk shaking is less expensive than hand poling and usually a better choice for trees over 12 feet tall assuming the orchard soil is dry enough to support shakers. Hand poling involves using long hand held poles to physically knock remaining nuts from the tree. Hand poling may be efficient for trees less than 20 feet tall with fewer than 50 nuts remaining per tree. Hand poling is often done prior to bud swell to reduce the possibility of removing flower buds. Wet or damp nuts are easier to remove because moisture softens the fibers holding nuts on the tree. Complete nut removal by February 1st with a target of cleaning to less than 2 nuts per tree as the objective. Early nut removal will give birds a better chance to finish the job. Stick-tights that won't come off are simply left behind and may contain live larvae and contribute to subsequent NOW damage.

3) Once on the ground, blow or sweep nuts into orchard row middles for shredding. Some nut decomposition and larval mortality will occur in wet years but that is not nearly as reliable as shredding.

4) Almonds must be shredded to destroy NOW larvae overwintering inside nuts. UC Integrated Pest Management Guidelines suggest shredding nuts by March 15 however, March 1 might be a better target to make sure nuts and larvae are destroyed sooner than later. First NOW egg laying often occurs about the first week in April in the Sacramento Valley so early March is a good conservative target date. A flail or rotary mower set at its lowest position does the best job.

Although easier said than done, if possible, shake and destroy almonds from backyard, roadside or abandoned trees. Clean up harvest equipment, hullers, and remove nuts and residue from beneath conveyers. Work with neighbors to clean up the entire neighborhood or district. The larger the area winter sanitized the more effective the program will be.

Winter & Bloom Almond Orchard Management Considerations

Dani Lightle, UCCE Farm Advisor, Glenn, Butte, & Tehama Cos.

Insect Pest Management:

- Mummy nut removal for navel orangeworm (NOW) sanitation should be completed by February 1. See the NOW article (*this newsletter*) for detailed sanitation guidelines. Egg traps for monitoring this season's populations should be hung by March 15.
- If not completed yet, conduct dormant spur sampling for scale and mite eggs before mid-January. Dormant spur sampling guidelines are here: http://www.ipm.ucdavis.edu/PMG/C003/m003dpdrmntpests.html
- If peach twig borer (PTB) was a problem in last years' harvest, B.t. sprays will provide control with minimal impact on honeybees. This is the only acceptable insecticide for bloom-time application for any insect pest. Thresholds and treatment timings are available here: http://www.ipm.ucdavis.edu/PMG/r3300211.html

Disease Management:

- For any disease control measures taken during bloom, be sure to consider honeybee health and safety. See the Honeybee safety article (*this newsletter*) for bee BMPs.
- Anthracnose may be initiated with warm, rainy weather during bloom, especially in orchards with a history of anthracnose. Symptoms include blossom blight, small nut infections followed by spur and limb dieback, marginal necrosis on leaves, and eventually orange lesions and gumming on larger nuts. Photos and management guidelines are here: http://www.ipm.ucdavis.edu/PMG/r3101111.html

- Brown rot occurs with warm rainy weather and may cause gumming at the base of infected flowers and cankers on infected twigs. Flowers are susceptible from pink bud until petal fall, but most susceptible when fully open. Management differs depending on whether there is rainfall during bloom. Guidelines are available here: http://www.ipm.ucdavis.edu/PMG/r3100111.html
- If scab or rust was a problem last season and inoculum is present in your orchard, control should be initiated about two weeks after petal fall. Control measures can be found at the following links.

  Scab: http://www.ipm.ucdavis.edu/PMG/r3100411.html;
  Rust: http://www.ipm.ucdavis.edu/PMG/r3100711.html

Weed Management:

- See the article in the previous Almond newsletter to develop a weed management program for the coming season, if you have not done so already. The newsletter is available at: http://ceglenn.ucanr.edu/newsletters/Orchard_Facts53036.pdf
- Remove or mow weeds and cover crops before bloom to aid in frost protection.

Nutrition:

- Now is the time to begin planning your nitrogen budget for the upcoming season. Nitrogen management tools, including a guidelines and a budget calculator, are available here: http://ucanr.edu/sites/scri/files/189631.pdf and through the Almond Board's California Almond Sustainability Program: sustainablealmondgrowing.org. At this time of year, water can be tested for nitrogen content and incorporated into the budget. Approximately 20% of the year's predicted nitrogen needs should be applied in February or March.

- Nutrient deficiencies will sometimes be most pronounced earlier in the season as trees first leaf out. Photos of some deficiencies and toxicities in almonds may be viewed at http://fruitsandnuts.ucdavis.edu/pages/almond/ - select "Almond Deficiencies & Toxicities" at the bottom to launch the photo gallery.

Honey Bee Safety During Bloom

Emily J. Symmes, UCCE Area IPM Advisor, Sacramento Valley

Honey bee safety is not a new concept in agriculture, particularly for almond growers, so be sure to follow best practices for honey bee health during almond pollination. A critical aspect is communication, which cannot be emphasized enough. All parties should be kept informed so beekeepers are aware of impending applications and applicators are aware of the requirements related to notification, materials, timing, location, and method of application. This includes growers, beekeepers, land owners-lessees, PCAs, pesticide applicators, and county agricultural commissioners.

General guidelines:

- Employ sound IPM practices. Apply pesticides only when absolutely necessary based on population monitoring and treatment thresholds, know all of the available treatments, treatment timings, and their impacts on pollinators and other non-target organisms.
- Always provide adequate clean water for bees. Cover or remove water sources prior to any application. Keep water clean and fresh ensuring bees spend more time pollinating the crop than searching for water. Bees can forage up to 5 miles away seeking food and water if not available in the orchard, increasing their risk of contact with harmful pesticides.
- Do not spray hives directly with any pesticide. Ensure the spray-rig driver turns off nozzles when near hives.
- Do not spray flying bees with any applications. Aside from toxicity concerns, bees will not be able to fly because of the weight of spray droplets on their wings.
- Avoid pesticide application or drift onto blooming weeds in or adjacent to the orchard.
- Avoid applying systemic pesticides or those with extended residual toxicities pre-bloom.
- Agree on proper hive removal timing. Bees should be removed from the orchard when 90 percent of flowers on the latest blooming cultivar are at petal fall. Past this point, no pollination is taking place.
- After removal of bees from an orchard, communication with neighbors remains important because other bees may still be foraging nearby.

Insecticide guidelines:

- Avoid applying insecticides during bloom until more is known. Much of the information and labeling related to honey bee toxicity is based on acute toxicity of foraging adults. In recent years, more research has indicated adverse effects of pesticides on developing brood, so even materials with "softer" reputations toward honey bees should be avoided. One exception is *Bacillus thuringiensis* (Bt), which may be used at petal fall and shortly after for control of peach twig borer. For more information on monitoring and treatment of PTB using Bt during bloom, refer to the UCIPM Pest Management Guidelines for PTB in almonds at: http://www.ipm.ucdavis.edu/PMG/r3300211.html
- Rely on other effective timing options (delayed dormant, post-bloom) for pest management. UCIPM Pest Management Guidelines for almonds provide monitoring information and insecticide and treatment timing options: http://www.ipm.ucdavis.edu/PMG/selectnewpest.almonds.html

Fungicide guidelines:

- If fungicide treatment is necessary, apply fungicide materials alone.
- Never tank mix with insecticides during bloom. Increasing evidence shows that synergistic effects of fungicides with insecticides can be more detrimental to both adult bees and the developing brood than either material alone.
- Addition of adjuvants for bloom fungicide applications are not necessary unless specified on the label, and may harm bees by increasing fungicide toxicity to the bee and/or impact their behavior directly. Limited canopy development should allow good spray coverage as long as the sprayer is well calibrated and properly set up, so addition of adjuvants should not be needed at bloom.

- Apply fungicides in the late afternoon or evening when bees and pollen are not present. Each morning new flowers and anthers open to release pollen. Pollen-collecting bees often collect all of this pollen and leave the almond blossoms by mid-afternoon. Pollen that will be collected the next day is still protected inside closed flowers or anthers, which will not open until morning. It is important to ensure that fungicides have time to dry before new flowers open, anthers shed pollen, and bees begin foraging the following day.
- Know the impacts of particular fungicides on honey bees and choose materials accordingly. The following fungicides have significant negative impacts on hive health and should be avoided during bloom: Rovral, Captan, and Ziram.

If you suspect pesticide-related damage to honey bees, immediately report this to your county agricultural commissioner. Preserving some adult bees, brood, pollen, honey, nectar, and/or wax by immediately collecting and freezing in clean, labeled containers may be helpful for follow-up on the incident. Signs to look for:

- Excessive numbers of dead or dying adult honey bees in front of hives
- Dead newly-emerged workers or brood (developing larvae) at the hive entrance
- Lack of foraging bees on a normally attractive blooming crop
- Adult bees exhibiting stupefaction (dazed, unconscious, etc.); paralysis; jerky, wobbly, or rapid movements; spinning on the back
- Disorientation and reduced efficiency of foraging bees
- Immobile or lethargic bees unable to leave flowers
- Bees unable to fly and crawling slowly as if chilled
- Queenless hives

Links to additional resources can be found at:

http://www.almonds.com/growers/pollination#tc-honey-bee-protection and links therein
http://www.almonds.com/growers/pollination#tc-BeeBMPs
http://entomology.ucdavis.edu/Faculty/Eric_C_Mussen/Apiculture_Newsletter/

Bacterial Spot of Almond in California -- *Update on the Disease and its Management*

J. E. Adaskaveg, University of California, Riverside,
B. Holtz, R. Duncan, and D. Doll, UCCE, San Joaquin, Stanislaus, and Merced Co., respectively

In the spring of 2013, we reported a high incidence of bacterial spot in some Sacramento and northern San Joaquin Valley almond orchards, especially on the 'Fritz' variety. It was also found on 'Nonpareil', 'Butte', 'Carmel', 'Monterey,' and 'Price' but at much lower levels. The disease has not been found in orchards in the southern San Joaquin valley.

Bacterial spot is caused by *Xanthomonas arboricola* pv. *pruni* and has also been referred to as bacteriosis, bacterial leaf spot, or bacterial shot hole. Bacterial spot occurs on leaves, twigs, and fruit of almost all *Prunus* spp. The pathogen commonly causes bacterial spot of peach in the eastern United States and is one of the major foliar diseases in high rainfall years. On almonds, it is a significant problem in Australia because of mid-season rain events. In 2014, we verified the presence of the disease at previous and additional locations in California, although at levels much lower than in 2013. *-continued-*

Bacterial spot on almond nut.
Photo by Jim Adaskaveg

Symptoms

Almond symptoms develop on leaves and shoots, but the most obvious symptoms are on fruit. Typically, almond hull lesions start as small, watery blemishes that produce light to dark amber gumming. Lesions are brown and slowly increase in size to 2/32 to 5/32 inches (2 to 4 mm, generally <5 mm) in diameter during the season as the infection extends into the hull. The amber color of the gumming is important because this helps distinguish bacterial spot from the clear gum of leaf footed bug feeding injury. Infections starting early in the season can cause fruit drop and infections that reach the kernel may cause off grades, or fruit may be un-marketable. Symptoms are usually first visible 7 to 21 days after infection with rapid expression dependent on warm temperatures. Small angular lesions may develop on leaves at the leaf tip, mid-rib, or along the leaf margin. Infected leaves may prematurely drop. As lesions age, centers may darken, become necrotic, and they may abscise. Leaves are most susceptible before becoming fully expanded. Twig lesions may develop on green shoots. These lesions are not obvious on almond but have been reported on almonds in Australia. On peach in the eastern US, they often turn into elliptical cankers.

Epidemiology

The pathogen is readily isolated from overwintering symptomatic fruit mummies well into the spring season, indicating their role as primary inoculum sources during infection periods. Twig lesions and bud death were not observed in our studies but have been reported on other *Prunus* spp. In the spring of 2014, wet and warm conditions did not occur until mid- to late March, and fruit symptoms were first observed in mid- April. Infections appear to initiate on developing fruit during or immediately after shuck split under favorable conditions. The bacterial pathogen needs splashing water to spread and wet conditions to infect. On other crops in the eastern United States, high winds during rain generally cause more severe infection periods.

Management

Strains of the pathogen collected and evaluated to date were all rated as copper-sensitive with growth occurring at 20 ppm copper, but not at 30 ppm. Field trials on the management of the disease were conducted that included dormant and in-season applications. Late-dormant treatments (late January) with copper, copper-mancozeb, or other combinations significantly reduced the incidence of disease, but not early dormant treatments that were applied in mid-November or mid-December 2013. In-season treatments were most effective when timed around rain events and before temperatures started to increase above 77ºF (25°C) in the springtime. Copper treatments were applied by halving the rate with each successive application (e.g., 1, 0.5, 0.25 lb MCE/A – metallic copper equivalent / acre). No copper phytotoxicity was observed after four applications when copper rates were successively reduced.

All copper products significantly reduced disease. Among products evaluated, however, Kocide 3000, Badge X2, Champ-Ion^{2+}, and Cuprofix were more effective than Cueva. A single delayed dormant (copper-mancozeb) and a single in-season treatment (copper alone or copper+mancozeb) in mid-March timed before rainfall and warm conditions provided excellent control and was equivalent to five applications (delayed dormant and four applications in 10- to 14-day intervals starting at full bloom) using the same chemicals.

Other experimental treatments with high efficacy included Kasumin-Manzate, Kasumin-Captan, Kocide-Tanos, Mycoshield/Fireline (oxytetracycline; federally registered on peach for this disease), Serenade Optiva, and the new bacterial membrane disruptor Ceragenin. Kasugamycin was accepted into the IR-4 program in 2014 for registration on almonds and peaches in the United States.

Summary

Bacterial spot is a new bacterial disease of almond in California that is caused by *Xanthomonas arboricola* pv. *pruni*. The disease mainly occurs on cultivar 'Fritz' in the mid- to northern almond production areas of California and commonly develops on fruit. Based on our first year of research, the pathogen primarily overwinters on diseased mummified fruit and infection periods are during warm, wet conditions during the spring as fruit and leaves develop. Our results from this past season indicate that the most effective management program for bacterial spot includes a delayed dormant (Jan.) bactericide (e.g., copper-mancozeb) application to reduce inoculum and at least one in-season application around rainfall events and rising temperatures (e.g., mid- to late March) to prevent new infections. In a wet spring, additional in-season applications may be needed to protect developing fruit. Most fixed-copper products and copper-mancozeb treatments are highly effective. To validate this, field trials will be conducted again in the coming season.

Rootstock trial for boron tolerance has Nickels with an early lead

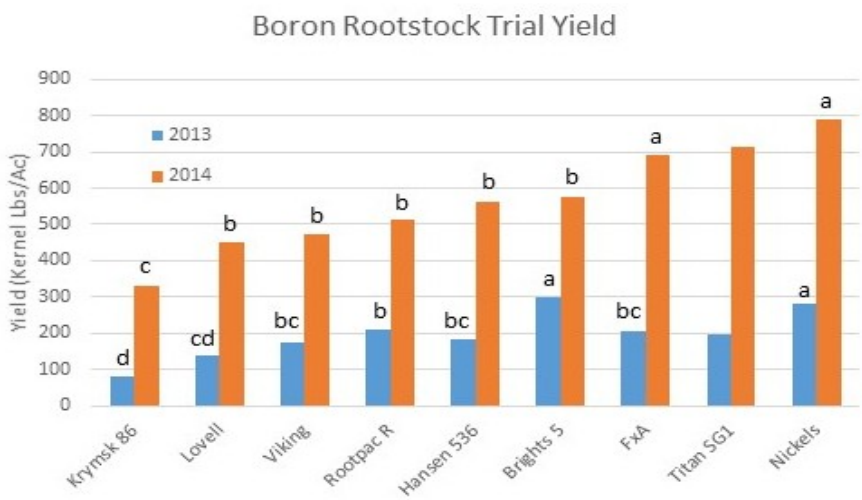
Katherine Pope, UCCE Orchard Advisor Yolo, Solano, & Sacramento Cos.

Excessive boron in soil or irrigation water is not widespread in the Central Valley, but where present, it can be a substantial obstacle to almond production. A rootstock trial in Yolo County was designed to find which almond rootstocks do better or worse under high boron conditions. So far Nickels has done best, and Krymsk 86 worst.

In 2011, Carolyn Debuse, former Yolo-Solano UCCE tree crop advisor, started a trial to measure the impact of heavy, clay soils and high boron water on different almond rootstocks with the support of grower Dave Scheuring. 'Nonpareil' nursery grafted trees on eight rootstocks were planted February 2011, at 18'x22' (110 trees per acre) – Brights-5, FxA, Hansen536, Krymsk86, Lovell, Nickels, Rootpac-R and Viking. Twenty Titan SG1s were added that April but not in the replicated trial. The trial is located in Yolo County north of Cache Creek. Boron in the irrigation water ranges from <1mg/l to 3.1 mg/l, depending on year and month.

The second year yield was measured this August. The yield ranking of all the rootstocks will require more years of data, but for both years there is a consistent leader and laggard. Both years, Nickels has produced significantly higher yields than most of the other rootstocks and Krymsk 86 had significantly lower yields, as can be seen in Figure 1.

Figure 1. Boron rootstock trial yield results for 3rd and 4th leaf (2013, 2014). Scaled from the 5 tree sample average to per acre yields based on the 110 trees per acre spacing.



Note: Different letters indicate groupings of statistically significantly different yields. Nickels is the only "a" rootstock both years, and Krymsk 86 is the only rootstock with the lowest ranking both years ("d" in 2013, "c" in 2014). Because there are not as many later planted Titan trees, we cannot make statistical comparisons with other rootstocks. However, based on limited yield data, Titan seem to be performing about the same as FxA.

More than 70% of the variability in yield can be explained by tree size. But, are the lower-yielding trees naturally smaller, or are the high levels of boron reducing size? The answer will hopefully become apparent with more years of data. However, comparison with a Butte County rootstock trial indicates lower yields are at least partly due to lower boron tolerance. At the Butte County trial in the 4th leaf, Krymsk 86 yielded 12% lower than Nickels. At the boron trial, Krymsk 86 yielded 58% lower than Nickels.

More years of data will give a clearer picture of how the 9 rootstocks in this trial compare in terms of boron tolerance. But for those who need to make decisions now, based on the results we have so far, it looks like Krymsk 86 is inadvisable for high boron conditions and Nickels is the safest bet for a productive orchard under high boron conditions.

ALMOND: FUNGICIDE EFFICACY

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]
Bumper/Tilt[4]	high (3)	++++	+/-	++++	++	++	+++	ND	++	+++	++
Indar	high (3)	++++	+/-	+++	++	++	NL	ND	+	ND	----
Inspire Super[4]	high (3/9)	++++	++++	ND	+++	+++	+++	ND	+++	ND	+++
Luna Sensation	medium (7/11)[3,7]	++++	++++	++++	++++	++++	++++	ND	++++	+++	+++
Pristine	medium (7/11)[3,7]	++++	++++	++++	++++	++++	+++	ND	+++	+++	+++
Merivon	medium (7/11)[3,7]	++++	++++	++++	++++	++++	+++	ND	++++	++++	+++
Quash[4]	high (3)	++++	++	++++	+++	+++	++++	ND	++++	+++	+++
Luna Experience	medium (3/7)[3]	++++	+++	++++	+++	++++	++++	ND	++++	+++	+++
Quadris Top	medium (3/11)[3]	++++	+++	++++	+++	++++	++++	ND	+++	+++	+++
Quilt Xcel	medium (3/11)[3]	++++	+++	++++	+++	++++	++++	ND	+++	+++	+++
Rovral + oil[8]	low (2)	++++	++++	----	+++	+/-	++	ND	+++[9]	ND	----
Scala[3]	high (9)[3, 7]	++++	++++	ND	++	----	ND	ND	+	----	----
Tebuzol (Elite**)	high (3)	++++	+/-	+++	++	++	+++	ND	+	ND	++
Topsin-M/T-Methyl/ Incognito[2]	high (1)[2, 7]	++++	++++	----	----	+++[8]	+	+++[6]	----	++	----
Vangard	high (9)[3, 7]	++++	++++	ND	++	----	ND	ND	+[9]	----	----
Fontelis	high (7)[4]	++++	++++	++	++++	+++	+++	ND	+++	ND	----
Abound[4]	high (11)[3, 7]	+++	----	++++	+++	++++	++++	+++	+++[10]	+++	+++
Elevate	high (17)[7]	+++	++++	----	+	ND	ND	ND	ND	ND	----
Protexio	high (17)[7]	+++	++++	----	+	ND	ND	ND	ND	ND	----
Gem[4]	high (11)[3, 7]	+++	----	++++	+++	++++	++++	+++	+++[10]	+++	+++
Laredo	high (3)	+++	----	++	++	----	+	+++	----	+++	----
Rovral/Iprodione /Nevado	low (2)	+++	+++	----	+++	----	----	ND	++[9]	----	----
Bravo/Chloro-thalonil/Echo /Equus[11,12]	low (M5)	++	NL	+++	+++	+++[15]	++++	NL	NL	----	----
Captan[4,12]	low (M4)	++	++	+++	+++	++	----	+++[6]	+	----	----
CaptEvate*	low (M4/17)	+++	+++	+++	+++	+++	----	+++	+	----	----
Ph-D	medium (19)	++	+++	----	++	+++	+++	ND	++++	ND	++
Syllit*	Medium (M7)	+	----	ND	+++	++++	ND	ND	+	ND	----
Rally[13]	high (3)	+++	----	++	+/-	----	+	+++	----	+++	----
Ziram	low (M3)	++	+	+++	+++	+++	----	++	+	----	----
Copper[14]	low (M1)	+/-	+/-	----	+	+[15]	----	----	ND	----	----
Copper + oil[14]	low (M1)	ND	ND	----	+	+++[15]	----	----	ND	----	----
Lime sulfur[12]	low (M2)	+/-	NL	----	+/-	++[15]	++	NL	NL	----	----
Sulfur[4,12]	low (M2)	+/-	+/-	----	----	++	++	----	----	+++	----
PlantShield***	low	----	----	----	----	----	----	----	----	----	----

Rating: ++++ = excellent and consistent, +++ = good and reliable, ++ = moderate and variable, + = limited and/or erratic, +/- = minimal and often ineffective, ---- = ineffective, NL = not on label, and ND = no data

*** Registration pending in California**

****Not registered, label withdrawn or inactive**

*** Section 24C (special local needs) registration approved in California for silver leaf disease of almond.

[1] Group 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 group number are suitable to alternate in a resistance management program. In California, make no more than one application of fungicides with mode of action Group numbers 1, 4, 9, 11, or 17 before rotating to a fungicide with a different mode of action Group number; for fungicides with other Group numbers, make no more than two consecutive applications before rotating to fungicide with a different mode of action Group number.

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, *Cladosporium carpophilum*, have been found in California.

[3] Field resistance of *Alternaria* sp. and *Cladosporium 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 Group No. 3) are registered for use in late spring and early summer when treatment is recommended.

[5] PM-like refers to a powdery mildew-like disease on almond fruit that is managed with fungicides. Recent information suggests an *Acremonium* species is involved.

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

Continued on next page

[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/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; experimental for Alternaria.
[11] Bravo Ultrex, Bravo WeatherStik, Echo, Echo Ultimate, and Chlorothalonil are currently registered.
[12] Do not use in combination with 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* spp. will be provided in the future.

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 weeks	5 weeks	May	June
Alternaria	----	----	----	----	----	++	+++	+++
Anthracnose[2]	----	++	+++	+++	+++	+++	+++	++
Brown rot	----	++	+++	+	----	----	----	----
Green fruit rot	----	----	+++	----	----	----	----	----
Hull rot[7]	—	—	—	—	—	—	—	+++
Leaf blight	----	----	+++	++	+	----	----	----
Scab[3]	++	---	---	++	+++	+++	+	---
Shot hole[4]	+[5]	+	++	+++	+++	++	----	----
Rust	----	----	----	----	----	+++	+++	+[6]

Rating: +++ = most effective, ++ = moderately effective, + = least effective, and ---- = ineffective

[1] Two and five weeks after petal fall are general timings to represent early postbloom and the latest time that most fungicides can be applied. The exact timing is not critical but depends on the occurrence of rainfall.

[2] If anthracnose was damaging in previous years and temperatures are moderate (63°F or higher) during bloom, make the first application at pink bud. Otherwise treatment can begin at or shortly after petal fall. In all cases, application should be repeated at 7- to 10-day intervals when rains occur during periods of moderate temperatures. Treatment should, if possible, precede any late spring and early summer rains. Rotate fungicides, using different fungicide classes, as a resistance management strategy.

[3] Early treatments (during bloom) have minimal effect on scab; the 5-week treatment usually is most effective. Treatments after 5 weeks are useful in northern areas where late spring and early summer rains occur. Dormant treatment with liquid lime sulfur improves efficacy of spring control programs.

[4] If pathogen spores were found during fall leaf monitoring, apply a shot hole fungicide during bloom, preferably at petal fall or when young leaves first appear. Re-apply when spores are found on new leaves or if heavy, persistent spring rains occur. If pathogen spores were not present the previous fall, shot hole control may be delayed until spores are seen on new leaves in spring.

[5] Dormant copper treatment seldom reduces shot hole infection but may be useful in severely affected orchards and must be followed by a good spring program.

[6] Treatment in June is important only if late spring and early summer rains occur.

[7] Make application at 1-5% hull split to manage hull rot caused by *Rhizopus stolonifer*.

ALMOND: SUGGESTED DISEASE MANAGEMENT PROGRAMS BY FUNGICIDE FRAC[1] GROUPS

Note: Not all indicated timings may be necessary for disease control (*see* Treatment Timing Table). If treatments are needed based on host phenology, weather monitoring, inoculum models, or environmental-disease forecasting models, suggested fungicide groups are listed for each timing.

How to use this table:

1) Identify disease(s) that need(s) to be managed. Know disease history of the orchard especially from the previous season.
2) Select one of the suggested fungicide groups. *Numbers separated by slashes are pre-mixtures, whereas numbers grouped by pluses are tank mixtures.* If several diseases need to be managed, select a group that is effective against all diseases. Refer to the fungicide efficacy table for fungicides belonging to each FRAC group. Group numbers are listed in numerical order within the suggested disease management program.

Continued on next page

3) Rotate groups for each application within a season and, if possible, use each group only once per season, except for multi-site mode of action materials (e.g., M2) or natural products/biological controls (NP/BC).

Disease	Dormant	Bloom			Spring		Summer	
		Pink bud	Full bloom	Petal fall	2 weeks	5 weeks	May	June
Alternaria	----	----	----	----	----	2	3, 7, 3/9, 3/7, 3/11, 7/11 11 19	3, 7, 3/7, 3/9, 3/11, 7/11 11, 19
Anthracnose	----	3, 7, 3/7, 3/9, 3/11	3, 7, 3/7, 3/9, 3/11 7/11 11	3, 3/9, 3/7, 3/11 11 M3 M4	3, 7, 3/9, 3/11, 3/7 7/11 11 M3 M4	3, 7, 3/7, 3/9, 3/11 7/11 11 M3 M4	3, 7, 3/7, 3/9, 3/11 7/11 11 M3 M4	3, 7, 3/7, 3/9, 3/11 7/11 11 M3 M4
Brown rot	----	1[2] 2 (+oil) 3, 3/7, 3/9, 3/11 9	1[2] 2 (+oil) 3, 7, 3/9, 3/11, 9 3/7, 7/11 11	1[2] 2 (+oil) 7, 9, 3/11 7/11	----	----	----	----
Green fruit rot	----	----	1[2] 2 (+oil) 3/7, 3/9, 7, 9 3/11, 7/11	----	----	----	----	----
Leaf blight	----	----	1[2] 2 3, 3/7, 3/9, 3/11 11	1[2] 2 3, 3/7, 3/9, 3/11 11 M3 M4	3, 3/7, 3/9, 3/11 11 M3 M4	----	----	----
Scab[4]	M1+oil, M2[3]	----	----	1[2], 3/7, 3/9, 7, 7/11[2] 3/11, 11[2] M3 M4, M5	1[2], 3/7, 3/9, 7, 7/11[2] 3/11, 11[2] M3 M4, M5	3, 3/7, 3/9, 3/11 7, 7/11[2], 3/11, 11[2] M2[3] M3, M4	M2[3] M4	----
Shot hole	M1	2 3, 3/7, 3/9, 3/11, 7, 9, 11	2 3, 3/7, 3/9, 3/11 7, 7/11 9, 11	2 3, 3/7, 3/9, 3/11 7, 7/11 9 11	7, 7/11 11 M3 M4 M5	7, 7/11 11 M3 M4 M5	----	----
Rust	----	----	----	----	----	3, 7, 3/7, 3/11 7/11 11, 19 M3	3, 7, 3/7, 3/11 7/11 11, 19	3, 7, 3/7, 3/11 7/11 11, 19

[1] Group numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see http://www.frac.info/). Group numbers are listed in numerical order within the suggested disease management program. Fungicides with a different group number are suitable to alternate in a resistance management program. Refer to the fungicide efficacy table for fungicides belonging to each FRAC group.

[2] Strains of *Monilinia fructicola* and *M. laxa* resistant to Topsin-M, and T-Methyl are present in some California almond orchards. 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 almond with overuse of fungicides with similar chemistry.

[3] Use liquid lime sulfur in dormant applications and wettable sulfur at and after pre-bloom.

[4] Apply petal fall treatments based on twig-infection sporulation model.

Upcoming Almond Meetings

Almond Institute -- Butte & Glenn Counties, Chico Masonic Family Life Center, 1110 W. East Ave. Chico,
January 27th, **8 to 12 Noon** Contact — Glenn Co Extension—Dani Lightle at 865-1107

South Sacramento Valley almond meeting, Stagehands Theater (Colusa Co Fairgrounds), Colusa,
February 5th , 8 to 12 Noon — Contact Yuba Sutter Extension - Franz Niederholzer at 822-7515

(Colusa Farm Show runs Feb 3-5 at the Colusa Co Fairgrounds.)

Yolo / Solano Young Almond & Walnut Orchards: Getting the First Five Years Right for Long Term Success, Woodland Community & Senior Center, 2001 East St.,
Friday, January 16, 2015, 8:30-Noon — Contact Yolo Co Extension - Katherine Pope at 666-8736

2015 Tehama Walnut Day
February 6, 2015

— See Enclosed Insert for Details —

Topics of interest to be covered are:

California Walnut Marketing & Research Update
Managing Botryosphaeria & Phomopsis in Walnut
Walnut Scale Management
Walnut Canopy Management
Walnut Husk Fly
Assembly Bill 109 in Tehama County
Tehama County Ag Commissioners Regulatory Updates

Register on-line at http://cetehama.ucanr.edu
Click on "Orchard Crops", click on "Upcoming Meetings"

2015 Tehama Prune Day
February 20, 2015

Watch for the meeting announcement in the next newsletter with meeting topics and details.

FRUIT & NUT NOTES

SACRAMENTO VALLEY REGIONAL
Almond Newsletter

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To simplify information, trade names of products may have been used but no endorsement of named product is intended, nor is criticism implied of similar products, which are not mentioned.

Tehama Walnut Day Meeting Announcement & Registration enclosed.
February 6, 2015

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