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Update on Yellow Monterey Almond Trees

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

Dani Lightle, UCCE Farm Advisor, Glenn, Butte and Tehama Counties

Katherine Pope, UCCE Farm Advisor, Sacramento, Solano and Yolo Counties

Farm Advisors and PCAs have fielded calls this season concerning Monterey on Krymsk 86 or Rootpac-R showing unique foliar symptoms – yellowing, rolling leaves with marginal necrosis and poor growth. Occasionally Nonpareil or Butte trees may be affected, but based on planting preferences and symptoms, Monterey generates the most concern. Most of the trees show these symptoms in the second leaf, but in some situations, first and third leaf trees are also affected.

Both Krymsk 86 (K86) and Rootpac-R are Myrobalan plum (*Prunus cerasifera*) hybrids – peach x Myrobalan plum (Krymsk 86) and almond x Myrobalan plum (Rootpac-R). The foliar symptoms are very similar to the condition called Union Mild Etch on some almond varieties (Butte, Monterey, etc.) grafted on Marianna 2624 plum (Myrobalan plum x wild goose plum) rootstock. Research on Union Mild Etch found symptoms occurred more often when soils were too wet either due to excessive rainfall or over-irrigation. Trees may look water stressed, but that does *not* mean more irrigation will help the problem. While there is no etching reported at the bud union on Monterey on K86 or Rootpac-R, the symptoms and recommended treatment have been the same: don't over irrigate, limit fertilizer, and let the trees recover naturally. While the most seriously affected trees may not recover – a few die – the majority appear to recover (see photos below of the same row of 2nd leaf Monterey on K86 taken at two times this summer).

For years, Butte and Monterey were listed in tables as partially incompatible on Marianna 2624 plum rootstock. Research by Jerry Uyemoto (USDA, retired) and Joe Connell (UCCE Butte Co, emeritus) conducted over 15 years, found the problem was more related to excess soil moisture than genetic incompatibility. When soils were too wet during the warmer part of the growing season, weak pathogens (*Fusarium*, *Cylindrocarpon*) in the soil would attack the fine feeder roots usually without harming the larger more permanent root structure. The

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.

problem occurred when wet winter/late spring rain kept the soil too wet or when growers over-irrigated young trees. These researchers produced the problem (yellowing, curled leaves with reduced growth) by over-irrigating previously healthy Butte/M2624. The problem is not a nitrogen deficiency; and, since the larger more permanent roots were healthy, when excessive soil moisture was corrected the trees would normally recover. By the time the orchard is 4-5 years old the problem seldom occurs since growers are less likely to over-irrigate at that age.

Bottom-line, the yellowing of Monterey on K86 or Rootpac R looks to be related to excess soil moisture, not incompatibility. The good news is that water can be managed, incompatibility can't be. True graft incompatibility usually manifests as gumming at the graft union, weak growth of the scion, and suckering from the root-stock.



The same row of Monterey on Krymsk 86 trees at two dates this summer. While the third tree in the row died by the second photo, the remainder appear to be healthier in September compared to July.

New Pesticide Labels Available to Help Control Pruning Wound Infections

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

Topsin® M WSP and Rally® 40WSP now have 2EE labels to protect pruning wounds on almonds (and other stone fruit trees and/or grapes) from canker disease infection. These products should be especially helpful in protecting young trees where disease infection of relatively large pruning cuts may cause extensive damage.

----Canker diseases listed on the Topsin® M and Rally® labels----

Topsin®M WSP	Rally® 40WSP
<i>Eutypa</i>	<i>Eutypa</i>
<i>Cytospora</i>	<i>Cytospora</i>
<i>Calosphaeria pulchella</i>	<i>Calosphaeria pulchella</i>
<i>Lasiodiplodia theobromae</i>	<i>Lasiodiplodia theobromae</i>
<i>Botryosphaeria</i>	<i>Botryosphaeria*</i>
<i>Phomopsis</i>	<i>Phomopsis*</i>

*suppression only

The labels are very similar in many regards. The following are recommended on both labels:

- Application within 24 hours of pruning is highly recommended.
- Assure complete coverage of all cut surfaces.
- Add a registered spray dye to better assess coverage.
- Additional application after about 2 weeks, especially if rain, irrigation, or high humidity occurs.
- Product combination (tank mixing) for best results and resistance management (Topsin M is a FRAC 1 fungicide, Rally a FRAC 3, and both have single site – high resistance risk – activity).
- Use of an organosilicone surfactant to improve pesticide penetration into pruning wound surfaces. (It is up to the grower to select and use a crop-safe organo-silicone with these products on pruning wounds).

There are some differences in the labels that limit how they can be used separately or combined. While the labels recommend tank mixing for best results and resistance management, consider the following:

- **The Rally label does not allow painting** the product on pruning wounds, while **the Topsin M label does allow painting** application.
- In addition, at the labeled rate (1.5 lb/acre), Topsin M is limited to 2 applications/year (max of 3 lbs/acre/year), while Rally is permitted a max of 3 applications/season (max of 1.5 lb/season).
- Therefore, if the two products are combined, painting is out and only 2 applications are allowed.

The similarities and differences on these two labels, intended for roughly the same purpose and target organisms, are a reminder of the importance of reading the label carefully and following it when applying the material. [It took an observant colleague to point out to me that painting was NOT on the Rally label...].

The 2EE labels (current as of September 2017) can be read online.

- Topsin M: <http://www.cdms.net/ldat/ld4EK010.pdf>
- Rally: <http://www.cdms.net/ldat/ld9M8019.pdf>

Gophers Kill Trees!

Joseph Connell, UCCE Farm Advisor Emeritus, Butte County

Gophers are insidious pests that chew on the roots of trees and girdle the crown by chewing off the bark usually about 6 inches below ground. **THEY KILL TREES.**

You're better off with the dead trees because the ones to remove and replant are obvious. Trees that just have root damage and a partially girdled crown limp along and may never reach their full productive potential. But, you keep them because they're not dead.

Subsequently, they may develop crown gall in the injuries that further compromise them over time. Wood rots enter dead galls, weaken the structural strength of the crown or main roots, and then the tree topples over prematurely.

Figure 1 shows the many ways gophers can compromise an otherwise beautiful, well-managed orchard. This 2nd leaf orchard will never be uniform again. Note the dead trees in a couple of rows in the background. The tree at the right front is pale and not growing...just limping along...compared to the healthy trees in the front left. This is all gopher damage!



Figure 1. A pale, weakened tree in the front right, dead trees in the background. Nothing here for gophers to eat but your trees!

It doesn't have to end like this. You can do something about it. When orchard ground is ripped before planting, new orchards essentially start gopher burrow-free. Don't let gophers get established in your orchard; the more "apartments" they establish, the easier it is for a new "squatter" to move back in, even if you kill the original inhabitant. If gophers are in the orchard and there are no weeds to eat, you can bet they're chewing on your trees.

Timing of control can have a huge impact on effort and success. Gophers breed any time of year but reproduction increases toward late winter through early spring. Control is more effective before this reproductive pulse since there are fewer individuals to remove. When soil moisture is high, new gopher mounds will help you easily identify active tunnel systems, reducing the time required for control.

Trapping studies have shown a 90% reduction in gophers after two trapping sessions separated by 1 to 2 weeks, to wait for fresh, active mounds to become apparent. A third trapping session has resulted in com-

plete removal of gophers from some fields. All growers should employ trapping to some extent, even if it is not the preferred primary approach since it allows you to target remaining individuals other tools have missed.

Fumigation with aluminum phosphide can provide around 90% control after two treatment periods. Find the gopher's main tunnel with a probe and drop the label designated number of tablets into the probe hole. Seal the opening to keep light from entering and toxic gases from escaping. Subsequently, treat active burrow systems that were initially missed to maximize efficacy. Only apply aluminum phosphide treatments when soil moisture is relatively high; the most effective timing is in late winter and early spring. Aluminum phosphide is a restricted-use material so applicators must be licensed and trained on its proper use.

Acute toxicant baits such as strychnine-treated grain bait kills after a single feeding and is available at a 0.5% concentration in California. Recent investigations have shown 0.5% strychnine is still highly effective, with 100% removal rates observed in trials. When repeatedly used over time, behavioral resistance to strychnine can develop. Supplement baiting with other management approaches to reduce this potential. Hand baiting with an all-in-one probe and bait dispenser can be effective if you have relatively few gophers in a field. Once the tunnel is located, deposit bait via a hand-crank or lever. Treat each burrow system twice to maximize efficacy. Proper application is essential for effective control.

Anticoagulants (e.g. chlophacinone, diphacinone) are often not very effective against gophers because they prefer eating green, vegetative tissue rather than the seeds or pellets used as baits with these materials. Unlike ground squirrels, they don't consume enough anticoagulant for the dose to be lethal.

To employ a burrow builder pulled behind a tractor, soil moisture must be just right to create and bait an artificial burrow. If too dry, the artificial burrow will cave in, if too wet, the burrow will not seal properly allowing light to filter in preventing gophers from travelling down the burrow. Efficacy varies greatly depending on how well you implement the method.

In summary, all techniques require multiple applications to maximize control. Recognize that re-invasion into orchards will occur. Regular long-term monitoring and removal of invaders before they multiply and re-establish is just part of good orchard management. For additional information, check out the UC IPM Pocket Gopher Pest Note at ipm.ucdavis.edu/PMG/PESTNOTES/pn7433.html

For those who are more visual learners, please check out this video of UCCE Vertebrate Specialist, Roger Baldwin, explaining how to effectively set traps for gophers: <https://youtu.be/iDW0l6eeG0M>

Bacterial Spot: A Dangerous Disease

Luke K. Milliron, UCCE Farm Advisor, Butte, Glenn and Tehama Counties

Bacterial spot is a relatively new and highly disturbing inhabitant of some Sacramento Valley orchards. In the spring of 2003, UC researchers in the San Joaquin Valley began receiving reports of almond hulls exuding amber-colored gum. Independent identifications by UC Plant Pathologists Themis Michailides and Jim Adaskaveg found the causal agent to be *Xanthomonas arboricola* pv. *pruni*. It was found in the Sacramento Valley in 2006 when Dr. Michailides confirmed the disease in Colusa County. Dr. Adaskaveg also confirmed bacterial spot in Butte County in 2016 and 2017.

Symptoms and Epidemiology:

As the Latin name implies, this bacterium infects trees of the *Prunus* genus, such as almond and peach. Under conditions of wind splashed rain/irrigation water, or even dripping dew, this vicious disease spreads to leaves and fruit (fruit most commonly present damage). Fruit infection results in multiple amber gum balls exuding from the hull. Gumming fruit may eventually result in a shriveled nut that falls from the tree or becomes a stick-tight mummy and serve as next year's inoculum (unless destroyed). The disease is most prolific on 'Fritz', although it has been documented on other varieties including 'Nonpareil', 'Monterey', 'Butte' and 'Price'. Heavy infections with symptoms consistent with bacterial spot were documented on farm calls in Butte County this summer, particularly on 'Fritz'.



Amber gum balls from bacterial spot (photo: LKM), as well as the gumming symptoms from anthracnose and leaf-footed bug (photos: UC IPM). To identify bacterial spot, rule out the sunken lesions and pink or orange spores of anthracnose, as well as the clear gum and punctures of leaf-footed bug.

Management:

As you likely have experienced, bacterial diseases are very difficult to control. The chemical toolbox is very limited, especially when faced with frequent spring rains as occurred in 2017. The bacterium is typically copper sensitive. A copper based management program can be effective (for details please see thealmonddoctor.com/2015/01/01/bacterial-spot-of-almond-management/). However, almond orchards in the northern Sacramento Valley that employ solid set irrigation for frost control may face a greater challenge. According to Dr. Jim Adaskaveg, any irrigation that hits a low scaffold may cause microdroplets to spray into the canopy and re-initiate the disease cycle. Growers with sprinkler irrigation that sprays lower branches should install splitters to keep water off the tree and can also look at lowering the sprinkler angle, and pruning out low branches as a last resort. All growers facing this disease should remove and destroy mummy nuts by shaking or polling and then mowing or discing.

The long-term solution is to plan future orchards with varietal susceptibility in mind. Growers may choose to follow the path of Australia, where many growers have chosen to avoid planting ‘Fritz’. For this disease, genetics may be the most effective long-term solution.

Acknowledgements: My thanks to the hard work of my fellow UC researchers Jim Adaskaveg, Themis Michailides, Roger Duncan, David Doll, and Brent Holtz who have documented and researched the epidemiology and management of this emerging disease.

Almond Orchard Management Checklist: Post-Harvest and Dormancy

Emily J. Symmes, Sacramento Valley Area IPM Advisor, UCCE and UC Statewide IPM Program

Luke Milliron, UCCE Orchard Systems Farm Advisor, Butte, Glenn, and Tehama Counties

With the 2017 harvest in the rearview mirror, time to relax, right? But not so fast! There are a number of post-harvest and dormant season activities that need to be considered. Incorporating these practices into your integrated orchard management program will help you apply the lessons of this past season and set your orchards up for a successful 2018 crop.

Diseases:

- **Rainfall and Disease:** With record rainfall, a number of diseases were more prevalent in 2017 than in recent years. This means more inoculum in the orchard environment, increasing carry-over potential for fungal and bacterial infections next year. Pruning out and removing dead wood and infected tissues should be done during the post-harvest and dormant periods to minimize inoculum sources and reduce infections next spring and summer. *Time your pruning carefully*, as spores are often spread by rain. Refer to the article in this newsletter for new pesticide labels to protect pruning wounds. Remember that no pesticide is fail-safe; properly timed pruning is crucial for effective infection prevention.
 - **Hull Rot:** Humidity during hull split may have increased the prevalence of hull rot this year. Monitor for incidence of hull rot post-harvest by looking for stick-tights and related twig death. If hull rot is indicated, consider revising irrigation and nitrogen management practices next year to discourage infection. Details on managing hull rot can be found at: sacvalleyorchards.com/almonds/diseases/almond-hull-rot-cultural-and-chemical-management/
 - **Shot Hole:** Monitor leaves for shot hole fruiting structures post-harvest. Detection of fruiting structures indicates a higher risk of disease development next spring, and petal fall treatments effective on shot hole should be planned.
 - **Rust:** If rust was a significant problem in the orchard this year, fall nutritional applications of zinc (late October or later) may hasten leaf drop, reducing inoculum carry-over (as well as storm wind resistance). For more details, see bullet and link below under “Nutrition.”
 - **Scab:** Monitor for scab while sampling spurs for mite eggs and scale; watch for scab twig lesions on green shoots. If scab has been a problem and/or there are lesions present, consider treating with oil plus either copper or chlorothalonil during the dormant period.
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Insects & Mites:

- **Harvest Sample:** Evaluate harvest samples to identify sources of damage. Detailed information available at: sacvalleyorchards.com/almonds/insects-mites/harvest-samples-for-almond-crop/
- **Navel orangeworm (NOW):** Sanitize. Sanitize! SANITIZE! This year is serving as a critical reminder that no amount of spraying can provide adequate control in a bad year if not paired with cultural practices (sanitation and timely harvest). Double digit NOW infestation and rejects have not been hard to come by this year.



Nonpareil infested with multiple NOW collected from a non-sanitized, late-harvested orchard. (Photo: E. J. Symmes).

Sanitation directly reduces overwintering populations AND limits development sites for next year's early generations!

- During the post-harvest and dormant periods, determine the density of mummy nuts in the orchard. The target for the Sacramento Valley is fewer than an average of two mummies per tree. Cracking out a subsample of mummy nuts to determine infestation by navel orangeworm (NOW) can provide even more information on the NOW carry-over potential for next year.
- Make sure mummy nuts are on the ground and destroyed by March 1 in the Sacramento Valley. It might be best to get an early start on sanitation this year. Once the rains start and orchard floor softens, it is difficult to use shakers for sanitation. Shakers are a lot cheaper and faster than hand crews (when you can find hand crews).
- **Spur Sample:** Conduct a dormant spur sample (paired with the observations for scab noted above) looking for San Jose scale, mite eggs (European red mite, brown almond mite), and European fruit lecanium. Consider treatment if any pest is detected at above 20% (live and unparasitized). More information on dormant sampling and treatments available at: ipm.ucanr.edu/PMG/r3900211.html.

Weeds:

- **Post-Harvest Weed Survey:** Conduct a weed survey after harvest to identify emerging winter species and summer species that escaped this year's weed management program. Remember that weeds growing in the row middles (except for problematic perennial species, such as Bermudagrass, Dallisgrass, Johnsongrass, little mallow, and field bindweed) can be beneficial in reducing soil erosion, compaction, and runoff.
 - **Pre-Emergence Herbicide:** Time pre-emergence herbicide applications for mid to late fall. Applying shortly before a rain or irrigation event will maximize movement into the soil subsurface before weed seeds germinate. If fall rains have already stimulated weed growth, consider including a post-emergence material.
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- Winter Weed Survey: Re-evaluate weed populations in winter to identify those not controlled by fall applications. In January, consider applying post-emergence herbicides in tree rows as needed, either alone or in combination with pre-emergence materials.

Vertebrates:

- Gophers: Effective gopher management requires year-round diligence (for details, see article in this newsletter).
- Ground Squirrels: Monitor ground squirrel activity. Fumigation is most effective once soil moisture is high. Trapping from post-harvest through late winter to early spring is moderately effective and works best when population numbers are low.

Nutrition:

- Zinc and Boron: Consider fall zinc and boron applications if foliar and hull analyses indicated deficiencies. A recent review of these practices can be found at: sacvalleyorchards.com/almonds/year-round-management/fall-zinc-and-boron/
- Potassium: Maintain an annual potassium (K) fertility program as almonds use a lot of K (70 to 80 lbs K/1000 lbs of kernel crop) and K deficiency this year means increased spur death this year and yield loss next year. Consider soil-banding potassium in the fall after leaf drop has progressed (typically late November) and at least six inches of rainfall or irrigation have wetted the soil profile. If applying K in the form of potassium chloride, ensure that adequate irrigation or rainfall (6 to 10 inches) that leaches harmful salts follows the application before trees emerge from dormancy (January).
- Nitrogen: Avoid N applications after mid-September. N uptake this late is minimal and leaching loss is likely. Plan for N application next spring. More details on recent research into post-harvest N applications can be found at: <http://thealmonddoctor.com/2017/09/19/almond-postharvest-management-nitrogen-considerations/>

Other Cultural Activities:

- Cover Crop/buffer strip/bee pasture: If considering planting a cover crop, bee pasture, or buffer strip, seed before the end of October for best stand establishment.
- Irrigation: Research has shown that avoiding severe water stress during the post-harvest period (defined as mid-August through November) is critical to maintaining orchard yield. Bear in mind that water use drops in the fall, so shorten irrigation sets or intervals accordingly. More detail can be found in a recent article at: thealmonddoctor.com/2017/09/09/almond-postharvest-water-management/
- Irrigation maintenance: Maintain/repair your system before spring frosts. For more information, contact a mobile irrigation lab such as tehamacountyrcd.org/services/lab2.html

More information on these practices is available at sacvalleyorchards.com and ipm.ucanr.edu.

UCCE Fall & Winter Almond Meetings

Sac Valley Post-Harvest Almond & Walnut IPM Meeting Chico Memorial Hall, 554 Rio Lindo Avenue	November 17 th , 2017 8am-12pm
Butte-Glenn-Tehama Almond & Walnut Meeting Silver Dollar Fairgrounds, Chico	January 31 st , 2018 Time TBA
Yolo-Solano-Sacramento Almond Meeting 70 Cottonwood Street, Woodland	February 6 th , 2018 8:00am-12:00pm
Sutter-Yuba-Colusa Almond Day Location TBD	February 7 th , 2018 Time TBA

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