Sacramento Valley Almond News

Fall, 2018

University of California
Agriculture and Natural Resources | Cooperative Extension

In This Issue

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Butte, Glenn, Tehama Counties

With special thanks to
Barbara Bechtel
Office Specialist Butte County

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Starting January of 2020, we will no longer be mailing hard copy newsletters, unless you make a special request by calling the office at (530) 538-7201 (note: substantial delivery delay, limited content, and no color).

ucanr.edu/ButteGoesOnline

3rd Annual Post-Harvest Almond and Walnut IPM Workshop

Join a panel of your Sacramento Valley Area IPM and Farm Advisors to hear about the latest research updates, 2018 field observations, and discuss key pest management issues in almonds and walnuts as we wrap up the season and look toward 2019!

Any and all orchard production topics will be on the table for discussion! To request topics or for more information, please contact UC IPM Advisor Emily Symmes at (530) 538-7201 or ejsymmes@ucanr.edu

Friday, November 16th, 2018
8:00 – 11:00am

Chico Veteran's Memorial Hall
554 Rio Lindo Avenue
Chico, CA 95926

Complete agenda and additional details will be available on the events page at sacvalleyorchards.com

DPR and CCA Continuing Education hours requested

Coffee and donuts provided by the Support Group of Butte County UCCE

2018 IPM BREAKFAST MEETINGS	Save the Dates! 2018-2019 Winter UCCE Almond Meetings	
Join Area IPM and Farm Advisors to discuss current pest management and production issues. We will largely focus on orchard crops (but everything is on the table for discussion!). These meetings are open to all interested growers, consultants, PCAs, CCAs, and related industry. Please contact Emily Symmes to request topics or bring your questions to the meeting! Upcoming meetings: • **Glenn County: October 19th (Berry Patch Restaurant, Orland), 7:30-9:00am** Full 2018 schedule is available on the events page at sacvalleyorchards.com or by contacting UC IPM Advisor Emily Symmes at (530) 538-7201 or ejsymmes@ucanr.edu. **Seating is limited – please RSVP to Emily prior to the meeting date** ****DPR and CCA Continuing Education hours requested**** **(No-host breakfast)**	**Post-Harvest Almond and Walnut UC IPM Workshop** *Chico Memorial Hall, 554 Rio Lindo Avenue* (details in this issue)	November 16th, 2018 8:00 AM - 11:00 AM
	Butte-Glenn-Tehama Almond & Walnut Meeting *Silver Dollar Fair Grounds, Chico*	January 30st, 2019 Time TBA
	Yolo-Solano-Sacramento Almond Meeting *70 Cottonwood Street, Woodland*	February 5th, 2019 8:00 AM - 12:00 PM
	Sutter-Yuba-Colusa Almond Day *Location TBD*	February 2019 Date & Time TBA

Post-Harvest Nutrition Review

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

In uncertain times, put your money on proven practices and materials. Certain postharvest fertilizer inputs (boron, potassium, and zinc) when needed, are proven to deliver increased yield. At least one nutrient, nitrogen, when fall applied does not deliver yield benefit at this timing in well managed orchards. Understanding effective delivery for each nutrient is key to the health and performance of your orchard.

Boron (B): A fall B spray can increase yield by hundreds of kernel pounds per acre when hull boron (B) analysis show low to adequate orchard B. This yield bump has been documented in multiple studies by UC researchers. Recommended rates are 0.2-0.4 lbs. B/acre – equivalent to 1-2 lbs. Solubor® - as a foliar spray applied at 100 gallons/acre spray volume targeting a full, healthy canopy. Lower rates of actual B may not deliver the expected results. Higher rates of B/acre can reduce yield. Note: fall soil-applied B fertilizer doesn't increase plant B levels until after petal fall the next year.

The key to effective fall B fertilization is getting B into the flowers by early bloom. Fall B foliar applications increase pollen viability the following spring and increase nut set compared to trees with low B levels. 'Pink' bud bloom stage is also an effective timing for foliar B to improve almond yield, while B sprayed at full bloom has been shown to actually reduce nut set. Since full bloom timing across an orchard can vary by variety, a fall spray at the right rate increases flower B with no risk to fruit set.

Finally, a fall B spray is at best a maintenance application. Don't expect to change orchard B status with a fall spray. A 2000 kernel lb./acre almond crop removes 0.4 lbs. of B from the orchard; that's equivalent to 2 lbs. Solubor®/acre as a foliar spray if somehow, all the B in the spray tank ends up in the tree*. If hull B levels are really low, work with your CCA to increase orchard B status with spring or summer soil applied B fertilizer.

Keep in mind, even when hull levels increase above the adequate threshold, a fall spray at the low end of the standard rate, may help yield.

Zinc (Zn) is critical for expanding shoot growth so adequate Zn must be present in deciduous tree crops at bud break. Since Zn is readily tied up in soils, a foliar treatment is often the most effective Zn fertilization method.

A fall Zn spray at a high rate (for example, 20+ lbs. zinc sulfate/acre) can defoliate trees while delivering needed Zn. This has been a standard late fall (November) practice for many years in California almonds. Recent research in stone fruit showed that lower rates of zinc sulfate (5 lbs./acre) applied earlier in October were as effective in getting Zn into the trees as later sprays at higher rates without damaging leaves.

Potassium (K) fertilization in the fall is based on using the soil as a "K bank" for the following years. This practice is a holdover from before micro-irrigation and solution-grade K fertilizers. Some growers continue to use fall application of banded dry potassium fertilizer since it works to get an essential nutrient into trees and it "frees up" the calendar the following year for injections of nitrogen and other nutrients and/or amendments. Orchards with very sandy or gravelly soils having a cation exchange capacity (CEC) of less than 15 meq/100 gm soil – should receive lower rates of dry K fertilizer in the fall than soils with more clay and so higher CECs. This avoids the expensive loss of fertilizer K by leaching with excessive winter rain or irrigation water.

Don't broadcast fertilizer K in orchards. Banding or applications concentrated in the micro-irrigation zones deliver effective results. Numerous UC potassium fertilization trials, all running for just 2-4 years, have shown that with micro-irrigation, annual rates of 200-250 lbs. K2O/acre, banded in fall, are as effective in increasing summer leaf K and yield in K deficient orchards as higher, more expensive K fertilizer rates. A final note; don't get behind in your K fertility program. When summer leaf K levels show the orchard is deficient, yield will suffer the following year even if you fertilize in the fall.

Nitrogen (N) is critical to sustained high yield in almonds. However, late fall (October) N applications have not increased yield in 2 years of replicated trials in Colusa County in a high yielding orchard with adequate summer leaf N levels. Leaves in these study trees were not removed by fall zinc sprays. The key timings for N applications are from early leaf out to early June and should not be missed when good to heavy crops are present.

Tank mixes: Improper mixing of Zn and B in the spray tank can reduce flower B levels the following bloom compared to just applying B in the spray. In UC research, when 0.4 lbs. of B as borate and 20 lbs. of zinc sulfate were tank mixed in 100 gallons of water, a beige cloud formed in the spray solution. This cloud didn't clog spray filters or nozzles, but reduced flower B levels compared to just B in the spray tank.

Lowering the solution to pH 5.0 with organic acid (not phosphoric acid) before adding Zn and B eliminated the haze and produced flower B levels the same as if B alone was applied. In that study, tank mixing B and Zn with the right tank chemistry defoliated trees and increased flower B the next year.

What about mixing phosphorous-acid (phosphite) materials (Phosgard®, Nutri-Phite®, etc.) along with Zn and B to get 3 materials on with one spray? In my experience, different phosphite materials behave

differently in the spray tank with Zn and B. A reputable phosphite manufacturer will have tech support who can give you a recipe for mixing Zn, B and their product. I called the chemist at one phosphite manufacturing company and got a careful recipe that he had tested to put all three ingredients into solution for their product. However, this recipe didn't work with a distributor's brand of phosphite. Since as Bill Olson, retired UCCE Farm Advisor in Butte Co. used to say, "the most expensive spray is the one that doesn't work", paying a little extra for a brand-name phosphite with a tested recipe for a Zn-B-phosphite tank mix from the manufacturer is most likely to deliver the best results. An experienced PCA/CCA will know who to call or may already have a recipe.

Time and/or money can be short in the fall, so spend those resources wisely. When tissue test results show low Zn, B, and/or K, fall application(s) should deliver results the following season. Fall foliar sprays get Zn and B into the tree ahead of the critical bloom timing, while fall, soil-applied dry K fertilizer can be effective and convenient compared to multiple in-season applications. Mid-October N applications to trees with adequate leaf N haven't shown benefit in recent trials.

*Well-calibrated, dialed-in sprayers deliver about 75% of the spray volume to the tree.

Post-Harvest Orchard Management Considerations

Katherine Jarvis-Shean, UCCE Orchard Advisor Yolo, Solano, & Sacramento Cos.

OCTOBER

- ✓ Survey for stick-tights/mummy nuts. Nuts stuck to the tree well after harvest may indicate hull rot. In certain areas, this could also be a result of high boron. If hull rot is indicated, consider revising irrigation and nitrogen management practices to help avoid hull rot next year. For more on hull rot, see http://ipm.ucanr.edu/PMG/r3101811.html. If more than 2 nuts per tree remain, plan to knock off and destroy mummies by February 1st to reduce navel orangeworm and brown rot.
- ✓ If rust infection was heavy this year, consider a foliar zinc sulfate nutritional spray to hasten leaf fall and reduce infected leaf carry over into next season. Wait until late October or early November to allow leaves time to continue making photosynthate and build up energy storage in the trees after harvest. See www.sacvalleyorchards.com/almonds/foliar-diseases/leaf-rust-of-almond/ for more details.
- ✓ Watch for shot hole fruiting structures in leaf lesions after fall rains begin. If fruiting structures producing spores are present in leaf lesions in the fall, there is a greater risk of shot hole development the following spring. If foliar zinc sulfate is applied in late October or early November and hastens leaf fall it may reduce shot hole inoculum. For more, see http://ipm.ucanr.edu/PMG/r3100211.html.
- ✓ Scout for weeds after the first fall rains. Look for late summer weeds that escaped this year's control and winter annual weeds that are just emerging. UC IPM has a late fall weed survey form that can help: http://ipm.ucanr.edu/PMG/C003/almond-fallweed.pdf. The UC Weed ID Tool may also help: http://weedid.wisc.edu/ca/weedid.php.

- ✓ Consider a fall nutrient spray. Check hull boron and leaf zinc analyses results to help determine if a foliar spray of either or both nutrients is needed. Boron is deficient if hull content is below 80 ppm. Zinc is deficient if July leaf samples read below 15 ppm. See product and rate considerations in the nutrition article in this newsletter.
- ✓ If planting a cover crop to improve soil, provide pollen to bees, and/or reduce runoff, get it in the ground by the end of October for best stand establishment. A good stand of resident vegetation provides many of the same benefits.

NOVEMBER

- ✓ Apply banded potassium to the soil if that is part of your fertility management plan. For more, see the nutrition article in this newsletter.

- ✓ If planning early pruning, watch the weather forecast. Especially in young orchards, avoid pruning ahead of forecast rain. Disease spores are spread in rain events, so pruning would increase the risk of pruning wound infections. Grower experience suggests the worst timing for infection may be November. Products are available to help protect pruning wounds against infection, when warranted. For more, see http://thealmonddoctor.com/2017/12/11/controlling-pruning-wound-infections/.
- ✓ Sample dormant spurs for scale and mite eggs and check green shoots for scab lesions sometime between mid-November and mid-January. Collect a total of 100 spurs from 35-50 trees, randomly selected from each orchard. Details for examining spurs and making treatment decisions can be found at http://ipm.ucanr.edu/PMG/r3900211.html.
- ✓ Evaluate stored harvest samples. Grab those harvest samples from your freezer or fridge, now that harvests have quieted down, and sort through to evaluate sources of damage and how your IPM program could be improved for next year. Try the handy chart here to differentiate causes of damage: http://www.sacvalleyorchards.com/almonds/insects-mites/harvest-samples-for-almond-crop/.

DECEMBER

- ✓ Look for Sac Valley farm advisors at the Almond Industry Conference, December 4th through 6th at the Sacramento Convention Center! For more, see https://www.almondconference.com/events.aspx.

Cover Crops in Almonds: Research Updates

Dani Lightle, UCCE Orchards Advisor, Glenn, Butte & Tehama Cos., Cynthia Creze, PhD Student, UC Davis, Amélie Gaudin, Department of Plant Sciences, UC Davis

Almond growers have indicated interest in the use of cover crops, but grower surveys indicate that lack of best management practices and concerns about expected returns continue to prevent wider adoption of cover cropping practices. Our current research aims to look at benefits and trade-offs of cover crops across almond production systems.

Research trials are replicated in producing almond orchards with micro-sprinkler irrigation across three production regions: Tehama, Merced & Kern counties.

Data are being collected on the performance of two cover crop mixes, different termination dates, weed population shifts, beneficial and plant parasitic nematodes, frost risk, impacts on navel orangeworm sanitation or honeybee pollination, water usage, soil health and tree nutrition, and yield.

Winter 2017-18 was the first year of this study and cover crops will be planted again in fall 2018. This article presents a brief overview of preliminary data on cover crop establishment and orchard frost risk.

Cover crop biomass and performance. All study sites planted four replicates of two different cover crop mixes: a soil mix, providing diverse root architectures and N-fixation to improve soil health, and a pollinator mix, designed to attract bees and provide pollinator habitat (Table 1). Both mixes contain radish to address compaction and water infiltration concerns, as well as white mustard for pollinators.

Table 1. Cover crop seed composition for 'soil mix' and 'pollinator mix' treatments.

Soil Mix		Pollinator Mix	
Species	**%**	**Species**	**%**
White mustard	10	Nemfix yellow mustard	15
Radish	10	Yellow mustard	15
Clover	20	White mustard	15
Ryegrass	30	Radish	20
Vetch	30	Canola	35

The biomass produced was proportional to the amount of precipitation received at each site: the Tehama site had the most rain and most biomass while the Kern county site had the least. However, the species composition varied widely among sites (Figures 1 & 2).

For example, in rows planted to the soil mix in Tehama county, 60% of the biomass was white mustard, while in Merced county, 59% of the biomass was ryegrass. These results show that the cover crop mix composition should be carefully considered, possibly by region or anticipated precipitation, especially if a certain cover species or purpose is desired.

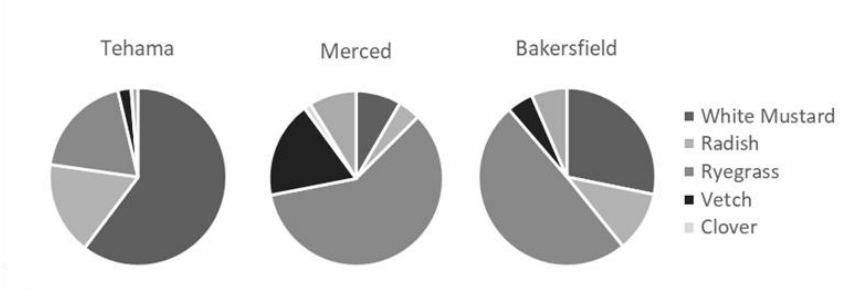


Figure 1. Soil mix species composition by dry-matter weight proportion at time of termination at each site. The species in the soil mix are listed in Table 1. Termination dates were March 30th (Tehama County), April 10th (Merced County), and April 2nd (Kern County).

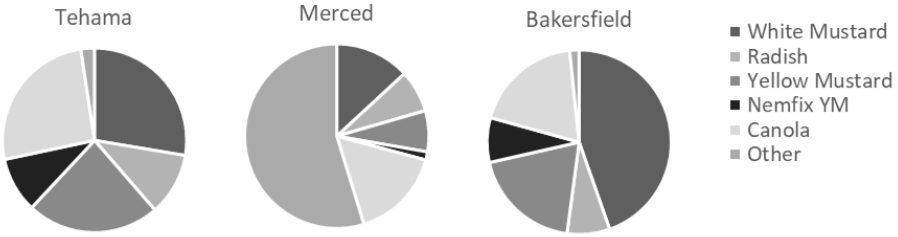


Figure 2. Pollinator mix species composition by dry-matter weight proportion at time of termination at each site. The species in the pollinator mix are listed in Table 1. Termination dates were March 30th (Tehama County), April 10th (Merced County), and April 2nd (Kern County).

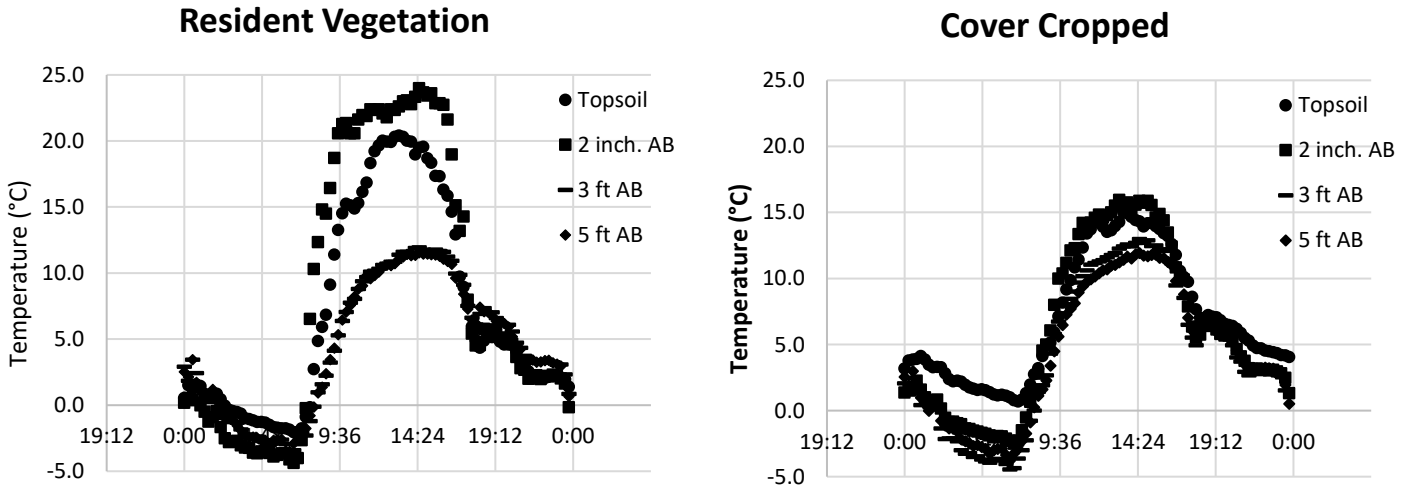
Frost risk (Tehama County). The goal was to monitor the microclimate above the cover crop compared to rows containing only resident vegetation to understand how orchard temperatures fluctuate and whether cover crops heighten frost risks. The most critical time period for frost damage was February 19-28, 2018.

During this time period, average biomass was 63% greater in cover cropped plots, though normalized difference vegetation index (NDVI, a measure of presence of vegetation) values showed roughly 25% greater ground coverage in resident vegetation plots, indicating that there was much more cover crop biomass that had grown up, but that native vegetative grew out to cover more soil area.

In row middles, sheltered temperature loggers were placed at 2 in., 3 ft. and 5 ft. height, and soil temperatures were measured at 2.5 in. depth. Frost protection irrigation was not utilized during this period. Figure 3 shows an example of the temperature fluctuations in the resident vegetation vs cover cropped plots. Topsoil temperatures were cooler in the cover cropped treatments than in the resident vegetation, which indicate that the cover crops act as a barrier to heat flow and storage in the soil. However, temperatures at 5 ft. during the critical frost periods were nearly identical between treatments.

We plan to directly measure bud temperature in 2019 to better understand whether conditions experienced by the buds are different in cover cropped or resident vegetation areas.

Figure 3. Average temperatures (degrees C) in the resident vegetation (left graph) and the cover cropped (right graph) treatments from the frost event occurring February 19, 2018. Temperatures were measured in the topsoil and at 2 inch, 3 feet, and 5 feet above ground (AB). Temperatures at 5 ft were nearly identical between cover cropped and resident vegetation treatments.



Cover Crop Survey

To gain a better understanding of current barriers and motivators of cover cropping, we are conducting a California-wide almond growers' survey. This will bring valuable insight into region-specific needs as well as operational challenges. Results will be used to develop regional best management practices, as well as guide further research and extension activities. If you are a California almond grower, we welcome you to take the 10-minute survey at the following link: https://almondcovercrop.faculty.ucdavis.edu/survey/

SoilWeb Workaround

Luke Milliron, UCCE Orchard Systems Farm Advisor, Butte, Tehama, and Glenn Cos., Dani Lightle, UCCE Orchard Systems Farm Advisor, Glenn, Butte, and Tehama Cos., Toby O'Geen, UCCE Soil Resource Specialist, UC Davis

Did you enjoy the popular UC Davis SoilWeb mobile application? Out in the field, this app enabled you to determine critical soil series information and mapping, based on your current location. Unfortunately, updates to the operating system (e.g. iOS on iPhone, or Android) on your phone can make apps created by small groups (like a UC research lab) un-workable.

Smart phone app code is written to run on smart phone operating systems. When operating systems are updated, old app code no longer matches with the new operating systems. Sometimes this just requires a few changes in code language. But if the operating system changes are extensive (like recent updates), it can mean essentially having to rewrite the code for a whole app.

The last major software update killed a couple of go-to University of California apps for many iPhone users. Essentially, the app makers would have to recode the entire tool to comply with the update. That is a large undertaking, similar to creating an entirely new app! Android users have reported the same problem.

Dr. Toby O'Geen at UC Davis, whose lab developed the app, created a workaround for both iPhone and Android users. The solution is an interactive online map https://casoilresource.lawr.ucdavis.edu/gmap/. For rapid access, you need to create a shortcut for the website on your phone and add it to your home screen (figure 1 and figure 2). The workaround creates an app-like icon that will take you straight to the online map's website.

Workaround for iPhone:

1. On your iPhone's Safari browser go to: casoilresource.lawr.ucdavis.edu/gmap/
2. Select the "Share, Print, and More" up-arrow button (see figure 1)
3. Scroll the lower ribbon to the right, and select "Add to Home Screen"

Workaround for Android:

1. On your Android Chrome browser go to: casoilresource.lawr.ucdavis.edu/gmap/
2. Select the "3 vertical dots" button (see figure 2)
3. Select the "Add to Home screen" button from the drop-down menu

This new icon shortcut linking you to the SoilWeb website functions similarly to or even better than the old app. For both iPhone and Android users, once you have created an icon on your home screen and clicked past the welcome screen, there are many ways to explore the immense database of soil information. One powerful option in both iPhone and Android is to select the grey bullseye target in the upper left-hand corner (not shown), this will direct the map to your current location. The bullseye allows you to you quickly gain access to critical soil information about your current location. In addition, Dr. O'Geen says that because a number of links to valuable outside information are available in this workaround, in some ways the workaround is an improvement over the old applications.

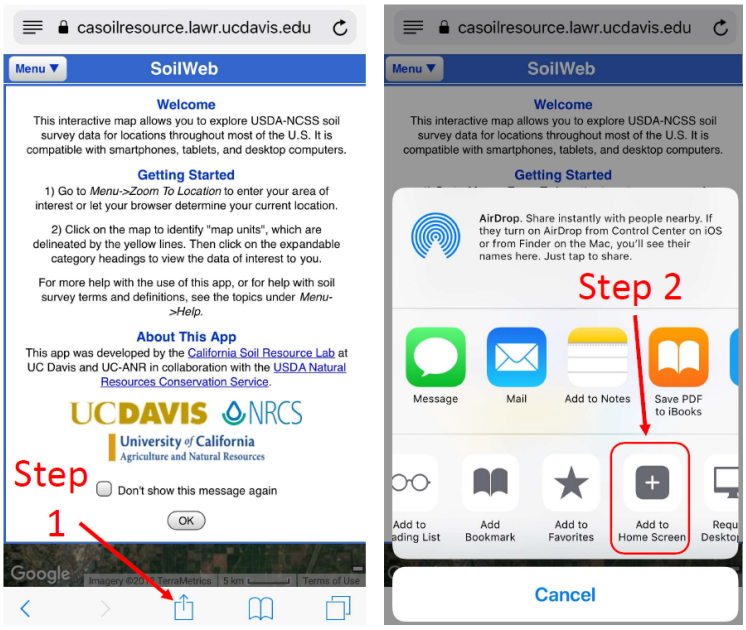


Figure 1. iPhone: Left screenshot: Select the "Share, Print, and More" up-arrow button. Right Screenshot: Scroll to the right and select the "Add to Home Screen" button to create an app-like shortcut.

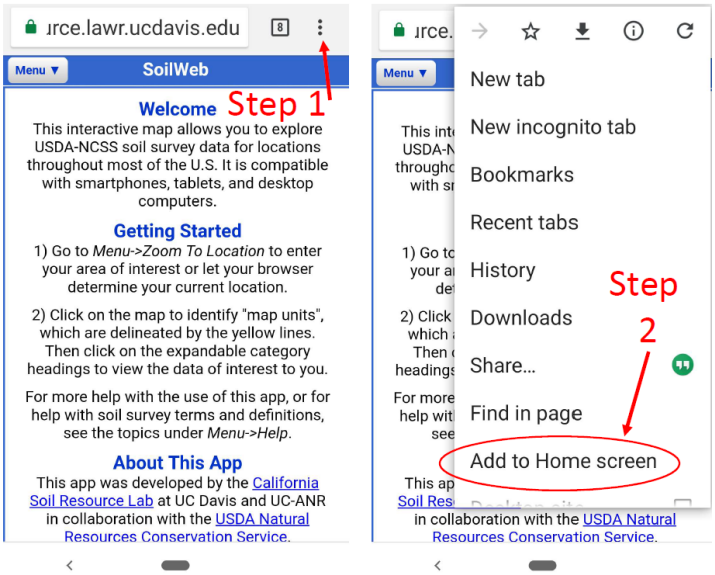


Figure 2. Android: Left screenshot: Select the "3 vertical dots" button. Right Screenshot: Select the "Add to Home screen" button to create an app-like shortcut.

SoilWeb Future for iPhone: Dr. O'Geen's lab is working on a new and improved iPhone app that complies with the latest software developments, however for the next several months the workaround is the way to go! You may like it better than the old app. For all available SoilWeb products, please see: casoilresource.lawr.ucdavis.edu/soilweb-apps

Keep an Eye Out for Potential Brown Marmorated Stink Bug Damage

Jhalendra Rijal, Ph.D., Area IPM Advisor-Northern San Joaquin Valley, UCCE Statewide IPM Program

There's a new pest to keep an eye out for in almond orchards: brown marmorated stink bug (BMSB), *Halyomorpha halys*. BMSB has been found in urban areas in 16 counties, but has only recently been documented in California orchards - Stanislaus County peaches in 2016, Stanislaus County almonds in 2017, and in several orchards in Stanislaus and Merced Counties 2018.

This pest has not yet seriously impacted many orchards and is still being studied. But it's worth being on the look-out. Damage from BMSB is similar to leaffooted bug damage. Below are some tips on identifying and trapping BMSB. For more on the history of the pest and on-going research, see StopBMSB.org.

Identifying the Bug: The BMSB is a marble-brown, 'shield' shaped stink bug about 3/4-inch-long with white bands on the antennae (it's most distinguishing characteristic) and legs, alternating black and white spots on the abdomen (Photo 1). BMSB attacks more than 170 plant species, including ornamental and landscape trees, apple, peaches, pears, cherries, and several field and vegetable crops.

Watching for Damage: BMSB feeding can begin as early as mid-March when they start to move to the orchard and may be present in the orchard throughout the season. However, early season feeding (from fruit set to before shell hardening) seems to be severely impacted as adult feeding causes nut abortion and drop. Feeding by BMSB on developing fruits leads to the gumming nuts with multiple feeding spots within the nut. The injury can be external (multiple gumming (Photo 2A), light brown speckles, yellowing) as well as internal (pinhole (Photo 2B), water-soaked lesion, cork tissue (Photo 2C), internal gumming). In 2018 season, we observed a substantial nut drop (with feeding injury) in a few orchards in the northern San Joaquin Valley during April this year. The presence of adults and the damage have been noticeably higher in the border tree rows next to the other host trees such as 'tree of heaven' and potential overwintering shelters (e.g., houses, barns, wood piles).

Some of the symptoms of BMSB damage resemble leaffooted and other stink bugs, but the severity and timing of damage seem to be different. BMSB damage occurs as early as mid-March and seems to continue for a few weeks to months, whereas leaffooted bug damage occurs in a point of time (around mid-April in general). Since BMSB is a landscape-based pest, BMSB can switch among different host crops within the season. BMSB are known to infest orchards in great numbers, and therefore, the degree of damage can be high compared to the leaffooted and other native stink bug damage. In terms of management, if the leaffooted bug is the problem, a one-time spray in spring is typically enough. Based on 2018 observations, management of BMSB infestations will probably require more than one sprays. We also observed multiple feeding sites (up to 13 pinholes) within the nut and multiple numbers of injured nuts in a cluster within the branch, and this BMSB feeding pattern is less common in the leaffooted bug infested nuts. Also, BMSB feeding to the nuts showed necrotic spots in the kernels (Photo 2D).

In harvested almonds, multiple feeding spots (in many cases, in the form of distinct necrotic spots) can be seen on the hull as well as in the shell (Photo 3A). Depending on the time and severity of the infestation, nutmeat (i.e., kernel) shows a several types of injury (shriveled to completely damaged kernel, light to severe gumming, presence of dark spots, dimpled and deformed kernel) (Photo 3B).

It is important for growers and PCAs to take harvest samples and evaluate for stink bug damage. Although taking sample nuts from the tree just before shaking can be a better strategy to see all injuries especially the external gumming, it is not necessary as regular harvest sample works just fine. Hand crack the sample nuts and carefully look for the feeding signs on the hull (external and internal), and the kernels for the potential BMSB damage.

Trapping: Commercial traps and lures which attract both nymphs and adults are available for BMSB monitoring. We recommend using the sticky panel (9 x12-inch double-sided sticky trap) that can be affixed to the top of a 5-ft long wooden stake, 1-ft of which is pounded into the ground. The traps should be placed in a border-tree row facing open field and/or other potential overwintering sites. In our monitoring, we captured the first BMSB in mid-March in 2017 and around the first week of April in 2018. Since BMSB damage symptoms can sometimes be confused with that related to the leaffooted bug and other stink bugs, a close orchard observation to locate alive insect is highly recommended. In addition, visual observations of the orchard for stink bug and damaged nuts is important as trap counts may not always represent the population density.

The visual observation should also be focused on border trees. There are several companies produce and see the BMSB traps and lures, but the one manufactured by the Trece, Inc. seems to be the most effective based on research from other states.

Photo 1 (left). BMSB adults: male (left), female (right) (Source: stopBMSB.org)

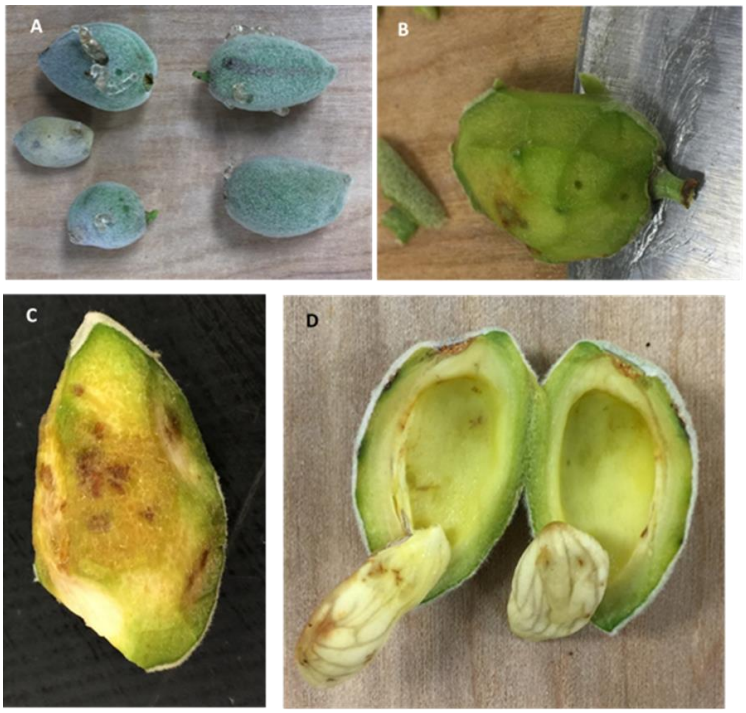


Photo 2 (right). BMSB feeding damage to developing almonds, A) External gumming, B) Pinhole damage, C) Necrotic spots on the fruit, D) Necrotic feeding spots on kernel

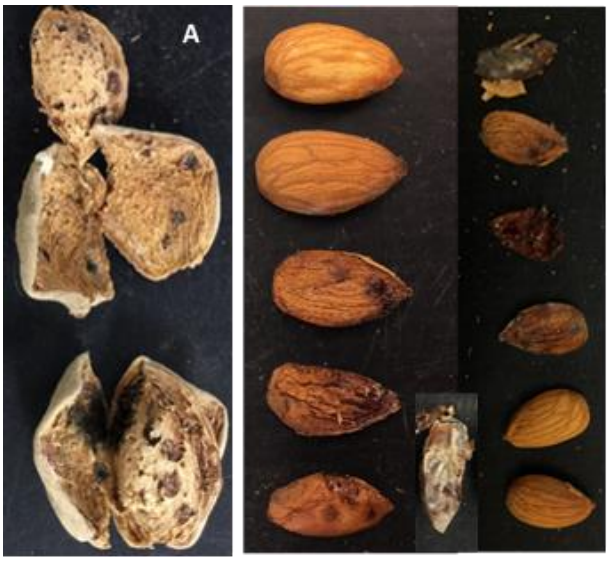


Photo 3 (left). BMSB feeding damage to almonds showed up at harvest, A) hull and shell, B) kernel

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