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WALNUT NEWS



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7/11/19 63rd Annual Weed Day—UC Davis

Contact Luke Milliron (530) 538-7201 or lkmilliron@ucanr

7/12/19 IPM Breakfast Meeting-Butte County

RSVPs required at (530) 538-7201 or ejsymmes@ucanr.edu

7/31/19 Prune Breeding Program & Research Tour 9am-3pm Winters

Additional details will be posted on the events page at sacvalleyorchards.com



Walnut Orchard Management – June through August 2019

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

Dani Lightle, UCCE Orchards Advisor, Glenn, Butte, & Tehama Counties

Luke Milliron, UCCE Orchards Advisor, Butte, Tehama, & Glenn Counties



JUNE

- ◆ Traps for walnut husk fly should already be out in the beginning of June. Yellow sticky traps with an ammonium carbonate lure work best and should be checked 2 to 3 times per week. Depending on treatment approach, treat based on first detection of husk fly, detection of eggs, or trends in trap catch numbers. For more details on treatment decision-making, see: sacvalleyorchards.com/walnuts/insects-mites-walnuts/walnut-husk-fly-biology-monitoring-and-spray-timing/. Refer to the insect and mite cost savings article in this issue for more detail on management strategies for WHF in lean price years.
- ◆ Look for the second codling moth biofix (an observed increase in trap numbers approximately 800 to 1300 DD after the first biofix). Refer to this recent article on approaches to codling moth management in lean price years: sacvalleyorchards.com/blog/walnuts-blog/revisiting-your-codling-moth-ipm-program/
- ◆ If Bot pressure is low, mid-June to early July is the best timing for a single fungicide treatment for Bot canker. More info at: sacvalleyorchards.com/walnuts/diseases/botryosphaeria-canker-blight/
- ◆ Monitor spider mites weekly through August. So far this season, we have observed substantial populations of predators in orchards throughout the spring (sixspotted thrips and predator mites). Maximizing biological control can save input costs – more on economic spider mite management in the insect and mite cost savings article in this issue.
- ◆ Research in Tehama County over the past several years has indicated that using the pressure chamber to delay the start of irrigation until -2 or -3 bars below the fully watered baseline saved water, largely retained crop value, and led to trees that were less water stressed late in the season. From 2015 to 2018 the average -2 bar irrigation trigger was reached in early to mid-June, and the -3 bar trigger in mid to late-June. At that trial site, those -2 and -3 bar irrigation triggers this year may be later following a wet spring. You can read more about these findings at: sacvalleyorchards.com/walnuts/irrigation-walnuts/pulling-the-trigger-start-of-spring-irrigation/

JULY

- ◆ Check codling moth traps to pinpoint the third flight biofix (on average 1100 DD after the second biofix). Codling moth third flight has typically occurred in late July to early August in the Sacramento Valley more recently. The prolonged rain and cooler temperatures well into May this year will likely result in later-than-typical flights, depending on how summer conditions progress. Refer to article referenced above and ipm.ucanr.edu/agriculture/walnut/codling-moth/ to assist with treatment decisions.
- ◆ Continue weekly monitoring for husk fly and spider mites.
- ◆ Take July leaf samples to assess nitrogen, potassium, and zinc, as well as chloride and boron toxicity, depending on your area. Sample four terminal leaflets from at least 29 trees, each at least 100 feet apart, on the same rootstock scattered throughout the orchard.
- ◆ Just as with pulling the trigger on the start of irrigation, waiting until the pressure chamber indicates -2 or -3 bars below the fully watered baseline to trigger irrigations in-season can lead to healthier orchards and avoid nut quality degradation from over- or under-irrigation. The details on interpreting pressure chamber readings and photos of disorders associated with over-irrigation can be found at: sacvalleyorchards.com/manuals/stem-water-potential/pressure-chamber-advanced-interpretation-in-walnut/

AUGUST

- ◆ Monitor for navel orangeworm. Healthy, intact walnuts are largely not susceptible to NOW damage until the hulls have begun to split. When considering treatment options, bear in mind pre-harvest intervals and duration of residual activity. Refer to the insect and mite cost savings article in this issue for more detail on management strategies for NOW in lean price years.
- ◆ Be careful when timing ethephon applications for advancing walnut harvest this year. Prolonged bloom and leaf-out may alter application timing. The most reliable way to time ethephon applications is to evaluate packing tissue brown (PTB) stage. Do not treat earlier than 100% PTB. For more detail, refer to the ethephon article in this issue and sacvalleyorchards.com/walnuts/ethephon-for-earlier-harvest/.



IPM on a Budget – Cost Saving Strategies for Insect & Mite Management

Emily J. Symmes, Sacramento Valley Area IPM Advisor
University of California Cooperative Extension and Statewide IPM Program

The good news is that a truly sound IPM program should already have you considering economic costs and returns when making pest management decisions. Economic treatment thresholds for pest management can be distilled into a formula that considers the following: cost of the management tactic, value of the crop, damage (crop loss in yield or quality per pest and unit area, e.g., lbs lost/acre or lbs downgraded/acre), and how effective the management tactic is. Simply put, a management tactic (whether chemical or otherwise) should be applied only when the benefits outweigh the costs (no major revelations here!). We can view this formulaic approach with the following equation, where the “economic injury level” represents the pest population density at or above which treating “pays”:

$$\text{Economic Injury Level} = \frac{\text{Cost of Management}}{\text{Crop Value} \times \text{Damage} \times \text{Effectiveness of Treatment}}$$

From this simplified approach, we see that when crop value decreases, as is the current situation for walnuts, the population level at which it “pays” to treat increases (in other words, we can tolerate more pests while maintaining our economic bottom line). The same is true when damage decreases, effectiveness of treatment decreases, or management costs increase (Table 1).

Economically-treatable Pest Population Density Higher (more pests tolerated)	Economically-treatable Pest Population Density Lower (fewer pests tolerated)
Management Cost <i>increases</i>	Management Cost <i>decreases</i>
Value <i>decreases</i>	Value <i>increases</i>
Damage <i>decreases</i>	Damage <i>increases</i>
Effectiveness of Treatment <i>decreases</i>	Effectiveness of Treatment <i>increases</i>

Table 1. Dynamics of economic pest population densities.

Keeping these basics in mind, what are the main insect and mite pests that can impact walnut yield and quality during the summer, and what is the best IPM strategy for each?

Codling moth:

Approaches to codling moth management considering current market conditions were addressed in our spring 2019 issue; article available at: sacvalleyorchards.com/blog/walnuts-blog/revisiting-your-codling-moth-ipm-program/.

Spider mites:

- Rely on biological control. We have observed significant numbers of natural enemies (sixspotted thrips and western predatory mites) in our spring monitoring this year. The basic tenets of conservation biocontrol are “don’t starve them & don’t kill them.” If predators are present in your orchard and have some food to eat (i.e., subeconomic populations of spider mites), they will stick around and the numbers of beneficials will increase. Avoid broad-spectrum pesticides (e.g., pyrethroids and organophosphates) at critical times of natural enemy population increase during the season (spring and early summer). Avoid applying prophylactic spider mite treatments before economic thresholds are reached.

Impacts of commonly-used insecticide and miticides on natural enemies can be found at: ipm.ucanr.edu/agriculture/walnut/Relative-Toxicities-of-Some-of-the-Pesticides-Used-in-Walnuts-to-Natural-Enemies-and-Honey-Bees/

Clean up populations *as needed* based on site-specific scouting of spider mites AND natural enemies according to published treatment threshold guidelines. Use materials that are less damaging to natural enemies where possible. Scout at least once weekly late May through August, noting percent presence/absence of spider mites and predators on leaf samples (5 low leaflets and 5 high leaflets from each of 10 randomly-selected trees in the block). A scouting form is available at: ipm.ucanr.edu/PMG/C881/walnut-mitemon.pdf. UC IPM guidelines suggest the following treatment thresholds based on whether pyrethroid or organophosphates applied to target other pests have been or will be used this season (Table 2).

- In orchards where pyrethroid or organophosphate applications **ARE NOT** used, consider treatment if your samples show:
 - * 30 to 40% spider-mite infested leaflets and predators on less than 10% of the leaflets.
 - * 40 to 50% spider-mite infested leaflets and predators on 20 to 50% of the leaflets.
 - * *No treatment warranted if predators are on 50% or more of the leaflets.*
- In orchards where pyrethroid or organophosphate applications **ARE** used, consider treatment if your samples show:
 - * 10% spider-mite infested leaflets and predator mites on less than 10% of the leaflets.
 - * 20% spider-mite infested leaflets and predators on more than 10% of the leaflets.

	Pyrethroids/OPs <u>NOT USED</u>			Pyrethroids/OPs <u>USED</u>	
Spider Mite Population Level (% of leaflets with ≥ 1 mites)	Predator Population Level (% of leaflets with ≥ 1 predators)				
	< 10%	20 - 50%	> 50%	< 10%	> 10%
0 - 9%	No treatment warranted			No treatment warranted	
10 - 19%				Consider treatment	
20 - 29%					
30 - 39%	Consider treatment		Consider treatment		
40 - 49%					
≥ 50%	Consider treatment				Consider treatment

Table 2. UC IPM spider mite and predator treatment threshold guidelines for walnuts.

Aphids:

- Rely on biological control (same basic tenets as above for conservation biological control of spider mite natural enemies). In addition to general predators, the more common aphid species encountered in walnut orchards (walnut aphid) has a very effective parasitoid natural enemy (if not disrupted).

Monitor aphid populations weekly beginning in May and continuing throughout shoot and nut growth, noting which aphid species are present and their abundance, along with signs of parasitism (aphid mummies). Each week, examine 5 first-subterminal leaves from each of 10 randomly-selected trees in the block (total of 50 leaflets). A monitoring form is available at: ipm.ucanr.edu/PMG/C881/walnut-aphidmon.pdf.

- Treat only *as needed* based on site-specific scouting for aphids and biocontrol evidence. UC IPM guidelines suggest the following treatment thresholds:

- o Walnut aphids (typically on lower leaflet surface): Consider treatment if average of 15 or more non-parasitized aphids per leaflet in sample.

Dusky-veined aphids (typically on upper leaflet surface): Consider treatment if average of 10% or more leaflets have live colonies of 6 or more aphids.

Walnut husk fly:

- Site-specific monitoring for walnut husk fly is critical, as orchard blocks even in very close proximity can differ in population abundance and treatment needs.

Best practices for monitoring and treatment decisions/timing are available at: sacvalleyorchards.com/walnuts/insects-mites-walnuts/walnut-husk-fly-biology-monitoring-and-spray-timing/.

- Traps for walnut husk fly are most effective when placed high in the tree canopy (north side, in shaded or damp areas). It may be tempting to place traps where they can be easily reached from the ground, but it is not advised to cut corners with trap placement. Checking traps suspended from durable rope (paracord is my favorite) high in the tree canopy takes little to no extra time at each trap check once the ropes are deployed to start the trapping season, and your time will be rewarded by increased trap efficacy.

- Monitor traps a few times per week until two to three weeks before harvest (at which time treatments should cease). WHF populations have been very spotty over the last two seasons, so make sure you are watching activity and treating only where needed.

Partial coverage and low volume spray applications have been shown to be effective in most situations (unless populations are very high), and can save costs relative to high volume, full coverage sprays. More detail at: sacvalleyorchards.com/walnuts/insects-mites-walnuts/walnut-husk-fly-trap-and-low-volume-spray-study/ and ipm.ucanr.edu/agriculture/walnut/Walnut-Husk-Fly/.

Navel orangeworm:

- Evaluate your risk potential for NOW damage this season. Factors to consider include:

- ◊Susceptibility of variety.

- ◊History of damage in the block.

- ◊Carry-over potential from last season (how well sanitation was completed).

- ◊In-season observations of population abundance (using traps or visual evidence of NOW infestation in mummies or damaged nuts).

- ◊Proximity to external sources of NOW (especially almond blocks as they are harvested).

- ◊Predictions of third and fourth flight overlap with husk split.

- ◊Anticipated harvest date, ethephon use, and single vs. double shake approach at harvest.

- With lower crop values, second shakes are not always economical. Remember that any nuts left behind in the orchard (in trees, on the orchard floor, in surrounding areas) will need to be cleaned up to minimize overwintering and early season NOW resources heading into next year.

- If you have a susceptible variety with a history of NOW damage or are in proximity to immigrating sources of NOW and late season flights are abundant and overlap with the peak window of susceptibility (husk split through harvest), consider a pesticide application during this period. With the prolonged spring, we will likely see staggered nut maturation and husk split, which will increase the susceptibility window for NOW infestation. This is likely to make timing applications for NOW even more challenging. Aim for getting the most residual on the greatest amount of susceptible plant tissue (i.e., opening husk and shell) and bear in mind pre-harvest interval restrictions.

A few final, general thoughts on cost saving strategies. Many of these have to do with the following statement: *the costliest application you will make is the one that didn't work or wasn't needed.*

Where “cutting costs” is likely to pay off:

- Performing pest management activities (whether a pesticide application or other method) based on validated economic thresholds (may reduce overall inputs).

- Eliminating unnecessary materials in the tank.

- Spot treating if possible (at minimum, block-specific treatments).

Prioritizing treatment locations and timing to achieve best results in the areas of greatest need.

Where “cutting costs” is unlikely to pay off:

- Skipping or reducing sprayer calibration efforts. Driving too fast or applying at volumes too low to achieve adequate coverage. If you are going to invest in materials and application, get the most bang for your buck!

- Applying at less-than-ideal timing, especially with many materials being more selective/less broad spectrum.

- Taking advantage of a “free ride” for an application if not the ideal time or necessitates use of less effective material.

- Not monitoring to determine pest populations, damage potential, need for management activities.

- Not rotating chemistries (especially where resistance development is a concern).

- Using below-label rates.

- Skipping proven cultural practices (e.g., sanitation for NOW).



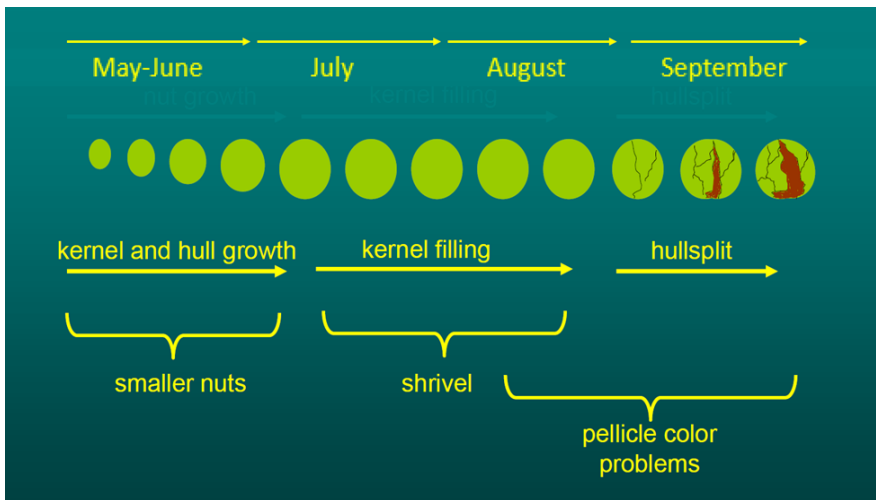
Maximizing walnut quality to improve value in a low-price year

Elizabeth Fichtner, UCCE Farm Advisor, Tulare County
 Carlos Cristosto, CE Specialist, Postharvest Physiology
 Bruce Lampinen, CE Specialist, Plant Sciences

The overall value of a walnut crop is based on yield and nut quality. Commodity prices are depressed, improving nut quality may be the determining factor influencing orchard profitability. Irrigation management is the single most important factor that can be adjusted for increasing kernel size and improving kernel color, two key components of quality. Nuts with a larger kernel size and lighter color pellicle (outer coating on the kernel) garner the highest prices in the market.

The most important irrigation management decision of the season is when to start irrigating in spring. Initiating irrigation too early in the season has been shown to predispose trees to stress at harvest. UC research trials have demonstrated that withholding irrigation until trees reach a midday stem water potential about 2 bars below the fully-watered baseline is best for maintaining overall tree health and higher edible kernel weights after crackout, which favors a higher price per pound. When irrigation was initiated earlier (at the baseline or 1 bar below), the trees exhibited more stress later in the season when irrigation was cut off in advance of harvest. The pressure chamber is the best tool for determining when to initiate irrigating in the spring and should be used throughout the season to schedule irrigation events based on plant stress. The pressure chamber can be used to directly measure midday stem water potential on a subset of trees in an orchard. A number of short articles detailing how to utilize the pressure chamber in walnuts, almonds, and prunes can be found at: sacvalleyorchards.com/manuals/stem-water-potential/.

UC research trials have shown that carbohydrate deprivation can cause darkening of the kernel pellicle. It can result from either excess or lack of water, as well as from shaded conditions in the inner canopy, which itself is exacerbated by either water deficiency or excess. The influence of carbohydrate deprivation on nut quality varies over the season; the diagram below characterizes the symptoms on Chandler at different phases of nut development and highlights the importance of irrigation management at all times during the season to maximize nut size, nut fill, and quality.



Nut quality problems can be associated with current year conditions or previous year conditions

Current season carbohydrate deprivation resulting from water stress (lack or excess) and/or shading related leaf loss

Symptom	Timing
thin shell	early June
severe shrivel	early July
slight shrivel	early August
yellow pellicle	early August
black pellicle	mid-August
bronze pellicle	late Aug/early Sept

Previous season insufficient carbohydrate storage during bud formation resulting in small leaves and small nuts in current season. Likely associated with buds that developed in shaded positions the previous year.

- Very weak bud = pee wee nut
- Relatively weak bud = brown adhering hull



Yellow



Bronze



Black

Historically, dark kernel color has been associated with water-stressed trees resulting from under-irrigation. However, more recent research has shown that it is now most often associated with trees maintained either close to or above the fully watered baseline (more wet) in mid to late summer. These studies indicate that optimal kernel color can be achieved by maintaining orchards at a midday stem water potential of approximately 2 bars below the baseline (more dry) during mid- to late summer.

Conclusions

Howard and Tulare are very sensitive to pellicle color problems resulting from carbohydrate deprivation derived from either poor irrigation management or shading. Chandler is relatively immune to these problems. Maximize your profits by paying attention to water management at all times during the season. Early-season stress can result in reduced nut size while stress later can result in kernel shrivel and pellicle color problems.



Should You Use Ethephon in a Lean Price Year?

Dani Lightle, UC Orchards Advisor, Glenn, Butte & Tehama Counties

Sure, you can harvest your walnuts this fall without application of any ethephon. Forgoing the ethephon application would save you material and spray costs. However, despite the costs of application, use of ethephon may wind up saving you money in the long run. Depending on your operational needs, ethephon can be used two ways: to increase kernel quality or to promote a one-shake harvest. Below are some factors to take into consideration while making your decision.

Cultivar considerations. You'll get the biggest bang for your buck if your cultivars respond well to ethephon application. Tulare is extremely sensitive to ethephon, while Howard and Vina respond well. Serr shows only a marginal response. Many growers have successfully used ethephon to stagger Chandler harvests.

Promoting one harvest. A well-timed application can help remove most nuts at the first shake, saving you the expense of sending the harvest crew through the block a second time. Apply at 5 to 7 days *after* 100% packing tissue brown (PTB), approximately 10 days prior to the normal harvest date. This spray timing should remove most nuts in the first shake and avoid an uneconomical second shake.

Kernel quality. Using ethephon to advance harvest may result in nuts with lighter kernel color or lower insect damage, should a NOW flight coincide with hull split. High quality kernels will net you the best pricing. Apply when nuts *first reach* 100% PTB. The first harvest will be approx. 7-10 days earlier than normal; the second shake should occur 2 weeks later.

Operational considerations. When needing to harvest across many blocks, strategically spacing out applications among some blocks but not others can ensure harvest timing will be staggered and that equipment will be available at optimal timing.

Weather. Ethephon is most effective when applied between 60 F to 90 F and with higher humidity conditions. If the weather is predicted to be rainy, hot, or windy, ethephon efficacy is decreased, and you may not get the results you are expecting. Also, avoid using ethephon on stressed orchards.

Need to brush up on your ethephon basics? See: sacvalleyorchards.com/walnuts/ethephon-for-earlier-harvest/



UC Advisor Janine Hasey Retiring

Janine Hasey, UCCE Advisor, Sutter, Yuba, Colusa Counties

I am retiring on July 1st after nearly 38 years working for UC Cooperative Extension and over 36 years as an Orchard and Environmental Horticulture (EH) Advisor in Sutter-Yuba Counties. What an honor to work with all of you growers, PCAs, and others in the Ag industry, and such a privilege to collaborate with so many talented UC colleagues solving challenging problems together. I can't think of a better career than working with so many fine individuals in orchards and vineyards throughout these counties diagnosing problems and researching methods to increase production, reduce labor costs, and manage pests and diseases with products safer to humans and the environment. We've persevered through droughts and floods, good times and bad - soaring crop prices only to come crashing down ...and then cycle back up. It's been quite an amazing experience and certainly an adventure.

It all started back in October 1981, when I was fortunate to become a Farm Advisor Intern. Dave Ramos, the UCCE Walnut Specialist at the time said I needed experience in tree crops and assigned me to Sutter-Yuba Counties where Dave Chaney mentored me for six months. My next assignment was in Napa County working with Dean Donaldson (weeds and EH) and Keith Bowers (viticulture). I'm so grateful for everything I learned from these experienced UCCE Advisors and many others as an intern. I returned to Sutter-Yuba in February 1983 to serve in my present position working mainly with walnuts, kiwifruit, and almonds. Over the years I added cling peaches (almonds went to another advisor), walnuts in Colusa County in 2011 and County Director in Sutter-Yuba Counties in 2014 to my responsibilities. I have seen walnut acreage in Sutter and Yuba Counties grow from 17,000 to 47,000 acres. UC released Chandler shortly before I began and now accounts for well over half of local and statewide walnut acreage. We went from two seedling walnut rootstocks to having three clonal Paradox rootstocks that now dominate our newer orchards. We had a paradigm shift when we realized that lateral bearing walnuts do not have to be headed to grow during the training stage. I am pleased to have played a role in these changes and really appreciate all the support from the growers and industries I have served over the years. A special thank you to those who cooperated on research projects and hosted extension meetings giving so much of your time and resources. Without you, we would not have made these advances.

Since I started, we have also seen UCCE Advisor and Specialist ranks decline from around 500 to 292 now. Within the current Advisor ranks most have 5 years or less of experience. Unfortunately, UC ANR continues to have budget issues so positions around the state are not being filled at this time. I do not see a replacement for my position in the foreseeable future. However, I will continue to work on certain research projects, follow-up on ongoing problems, be involved in industry advisory boards, mentor newer advisors, write long overdue publications, and continue to be involved in the Sacramento Valley Walnut Newsletter which you will continue to receive in Sutter, Yuba, and Colusa Counties. I am looking forward to travelling more but I'm not planning to "ride into the sunset" for a while.

2019 IPM Breakfast 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.

Meetings will be held the **second** Friday of each month (8:00-9:30am ***note new start time***) from March through October and will cover a wide range of timely pest and orchard management topics. Meeting locations will be rotated throughout the Sacramento Valley each month. Please contact Emily Symmes to request topics or bring your questions to the meeting!

2019 meeting dates:

- July 12th, 2019 (Butte County): Field Meeting, Location TBA
- August 9th, 2019 (Yuba-Sutter-Colusa Counties): Field Meeting, Location TBA
- September 13th, 2019 (Tehama County): Rockin' R Restaurant, Red Bluff
- October 11th, 2019 (Glenn County): Berry Patch Restaurant, Orland

Additional details will be posted on the events page at sacvalleyorchards.com

RSVPs required at (530) 538-7201 or ejsymmes@ucanr.edu

****DPR and CCA Continuing Education hours requested****

Industry Partners: Sponsorships for venue and refreshment costs are welcome and appreciated. If you would like to sponsor one or more of these meetings, please contact Emily Symmes to inquire.

Autumn Freeze Event and Spring Regrowth Update

Luke Milliron, UCCE Orchards Advisor, Butte, Tehama & Glenn Counties

Janine Hasey, UCCE Orchards Advisor, Sutter-Yuba & Colusa Counties

A sudden autumn freeze event last November is the likely cause of widespread dieback observed in both young and mature orchards in the Sacramento and northern San Joaquin Valleys this spring. Following reports in April of walnut orchards not leafing out, our initial diagnosis was freeze damage. We advisors, specialists, and faculty agree that this initial diagnosis has been further supported after examining additional orchards and weather station sites.

Why was the damage so severe in mature orchards?

The severe damage seen in young vigorous orchards is not unexpected with a sudden autumn freeze like we had last November. What we are still perplexed about is why we saw so much damage in mature orchards from this cold event. We also don't know all the contributing factors that led to the severity of cold injury damage in some orchards. We believe one orchard specific factor that in many cases helps explain why some orchards were affected and others were not is moisture at the top of the soil profile preceding the freezing conditions (photos 9 and 10 caption). Sharp swings in daily temperatures throughout the valley from relatively warm daytime temperatures to below freezing also helps explain the severe damage we are seeing.

The swing from daytime to nighttime temperature extremes may help explain the severe damage, according to UC Davis plant physiologist Dr. Maciej Zwieniecki. The daytime temperatures the week preceding the cold nights were in the mid 70°- 80° F range at the Verona CIMIS weather station. During these warm daytime temperatures, limbs contain starch, which does not provide protection from freezing. Slow cooling is needed to promote starch degradation into sugars, which protect against ice formation in cells. Our last November autumn freeze was a fast cooling event with temperatures at times dropping 5 degrees per hour that interfered with starch being degraded into sugars, leaving trees more susceptible to cold injury.

The daytime/nighttime temperature extremes likely contributed to the severity of cold injury seen. According to UCCE Walnut Specialist Dr. Bruce Lampinen, bud temperatures at night can run 5.4-10.8° F colder than air temperature when there are clear skies and about the same amount warmer than air temperature on warm, sunny winter days. Across much of the Central Valley, skies were not clear but smoky during this period due to the Camp Fire in Paradise, CA that coincided with the freeze event in November. Unlike cloud cover or fog however, smoke does not mitigate against the extreme temperature swings experienced by the buds. Most CIMIS weather stations were at or slightly below freezing with daytime highs above 60° F during the November 11-20 period, so bud temperatures were likely colder at night and warmer during the day than ambient air temperatures.

Damage in late April & Recovery as of late May:

In mid- to late- April, we began receiving calls about large swaths of walnut orchards that were only partially leafing out. The severity of partial leaf out was highly variable across these orchard blocks. While young orchards often showed the classic signs of sudden autumn freeze damage (characteristic brown freeze damaged tissue next to green healthy tissue), mature orchards had a more unusual pattern of twigs on the symptomatic wood with a shriveled and desiccated appearance although tissue was still green/living at the time. Although orchards with affected trees appeared to have dead limbs or canopies, we cautioned growers that adventitious buds (photo 7) were breaking dormancy and may allow for the development of new canopies.

For our full description and photos of damage in late April, see: sacvalleyorchards.com/photos-from-the-field/walnut-orchards-not-leafing-out/

In late May, we revisited many of the same orchards that we had been called out to a month before (photos 1, 3, and 5). The previously mentioned adventitious buds held in reserve on tree limbs and trunks allowed for regrowth following dieback from the cold injury as seen in late May in photos 2, 4, and 6. These adventitious buds are continuing to break (photo 8).



Photo 1 & 2. Very little leaf out in this part of a Gridley, CA Chandler orchard on April 22nd (photo 1). Significant canopy development in the same orchard by May 30th (photos: Luke Milliron).



Photo 3 & 4. Two trees with very little leaf out at the edge of a Chandler orchard northwest of Chico, CA on April 22nd (photo 3). Significant canopy development (photo 4) of the same two trees on May 31st (Photos: Luke Milliron).



Photos 5 & 6. Clusters of severely affected trees that did not leaf out on April 22nd (photo 5). Substantial canopy growth from the lower/central portion (photo 6) of most of the affected trees in this orchard on May 31st (photos: Luke Milliron).



Photo 7 & 8. On otherwise blank branches, some adventitious buds were beginning to push on this Howard tree on April 19 (photo 7, by Janine Hasey). These adventitious buds have continued to break (photo 8) much more recently (photo May 31st, by Luke Milliron).

The information below is what we have learned from previous freeze events and is provided if you conclude your walnut orchard has freeze damage.

How do you manage frost/freeze damage?

- With freeze damaged wood, budbreak can be quite delayed, but adventitious buds may continue to break (photo 8). Wait until mid-summer to prune out the dead wood that did not revive. New shoots that grow can be trained to replace the damaged wood. Although we recommend waiting until mid-summer to prune out wood that has not revived, the orchard in photos 9 and 10 was pruned on May 31 to have access to a shredder. Note that instead of an arbitrary topping or dehorning type cut, more selective chainsaw cuts were made to prune each scaffold back to where there was regrowth.
- Remove dead prunings from orchard as they may be infected with *Botryosphaeria* (Bot) or *Phomopsis* (photo 11); consider applying a Bot spray by early July, whether or not deadwood removal is completed, to prevent disease spread.
- Protect exposed areas where buds are breaking, but leaf cover is still minimal from sunburn. Protect by painting the southwest side of trunks or limbs with tree paint or diluted white latex paint 50:50.
- Reduce and delay fertilizer applications where cold damage is evident. Much of the nitrogen demand is from the crop, and therefore should be reduced in relation to the expected yield reduction.
- With less leaf surface, there is less transpiration. Delay the start of irrigation and monitor trees carefully using a pressure chamber and/or soil moisture measuring devices through the season.



Photos 9 & 10. Selective chainsaw cuts made to a 7th leaf Chandler orchard in Yuba County on May 31st. Photo 9 shows a partially pruned back tree, while photo 10 shows an unpruned row on the left and a pruned row on the right. This severely damaged area was ~13 acres within a 500-acre Chandler orchard on sandy loam soil. The area damaged received only 2 inches of water in mid-October, whereas the undamaged remainder of the orchard received 4 inches of water and later in October. The only exception was one other block which got 2 inches of water but later in October and had some freeze damage also (photos: Janine Hasey).



Photo 11. Freeze damaged limb from a Yuba City Howard orchard on June 6, 2019. Note raised “bumps” on bark and black pycnidia (see arrow) that produce spores below bark typical of Bot and Phomopsis (photo: Janine Hasey)

How can frost/freeze damage be prevented or reduced?

- Withdraw irrigation in September until a terminal bud is set on the trunk of young trees to harden the trees.
- If there has not been adequate rainfall by the end of October, irrigate young and mature orchards so the soil is moist going into November.
- If a freeze is predicted and the soil is dry, it should be wetted 3-5 days prior to a frost night to fill the air spaces so the soil will store more heat. Avoid water on the soil surface before a freeze since it will make the soil surface colder because of evaporative cooling.
- If frost damage is suspected in the fall or winter, check the tissue for drying or browning. Subsequent sunburn can further damage tissue on the southwest side of tree, but white paint shortly after a freeze can decrease this damage.





SACRAMENTO VALLEY REGIONAL Walnut Newsletter



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