



University of California

Agriculture and Natural Resources | Cooperative Extension

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Orchard Walnut Orchard Management-July & August 2021

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JULY

- **Drought Management Resources:** This year is shaping up to be one of the driest years on record in California. See our article in this newsletter to learn more about water management options for maintaining your orchard health this year. Using the pressure chamber and waiting to irrigate until trees are 2 to 3 bars drier than the fully watered baseline remains the gold standard for deciding when to irrigate. Learn more at sacvalleyorchards.com/manuals/stem-water-potential/pressure-chamber-advanced-interpretation-in-walnut/
- **Walnut Husk Fly (WHF):** Use yellow sticky traps to monitor weekly for WHF in your orchard. Begin treatment as soon as you detect eggs in trapped females or when the number of WHF in your traps increases significantly. See our article on Walnut Husk Fly Biology, Monitoring, and Spray Timing for more about monitoring strategies and treatment options and timing: sacvalleyorchards.com/walnuts/insects-mites-walnuts/walnut-husk-fly-biology-monitoring-and-spray-timing/
- **Spider Mites:** Monitor for spider mites and spider mite predators on a weekly basis throughout July and August. Check for spider mites on 10 leaflets (5 from higher branches), from 10 trees each time you monitor. If more than half of the leaflets with spider mites don't also have predators, consider treatment. Learn more about treatment options on the UC IPM site for spider mites in walnuts: ipm.ucanr.edu/agriculture/walnut/web-spinning-spider-mites/
- **Codling Moth:** The third codling moth biofix occurs in late July or early August (about 1100-1200 degree days after the second). Monitor your traps to decide when to treat. See UC IPM for Codling Moth in Walnuts to learn more about treatment decisions and options: ipm.ucanr.edu/agriculture/walnut/codling-moth/
- **Botryosphaeria (Bot) or Phomopsis:** Severe freeze last November may have left your orchard with more dead limbs than usual this time of year, making it vulnerable to Bot and Phomopsis infection. Begin pruning dead limbs and removing them from your orchard this month to avoid severe infection. Also consider spraying for Bot in early July if your orchard has a history of Bot infection. For more information on Bot control, see our article on Botryosphaeria Canker & Blight: sacvalleyorchards.com/walnuts/diseases/botryosphaeria-canker-blight/

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- **Lean Price Year Considerations:** When walnut prices are low, there are several management options that you can consider to improve your profit margins. Read our articles on walnut management during a lean price year on sacvalleyorchards.com:
 - IPM on a Budget: Cost Saving Strategies for Insect & Mite Management-
sacvalleyorchards.com/walnuts/cost-and-expense-considerations/cost-saving-strategies-for-insect-mite-management/
 - Maximizing walnut quality to improve value in a low-price year-
sacvalleyorchards.com/walnuts/cost-and-expense-considerations/maximizing-walnut-quality-to-improve-value-in-a-low-price-year/
 - Should You Use Ethephon in a Lean Price Year?- sacvalleyorchards.com/walnuts/cost-and-expense-considerations/should-you-use-ethephon-in-a-lean-price-year/

AUGUST

- **Navel Orangeworm:** Begin monitoring for NOW in your orchard. Healthy walnuts are only susceptible to NOW at and after hull split. Consider preharvest intervals and duration of residual activity when considering treatment options. See the above article on IPM on a Budget for NOW control considerations in a lean price year.
- **Mold:** Walnut mold was a challenge at harvest last year. While mold infections usually occur at hull split, steps can be taken throughout the growing season to reduce mold at harvest. See the article in this newsletter to learn how to control mold in your walnut orchard this season.
- **Packing Tissue Brown (PTB):** PTB will start developing in mid-August for early season varieties like Serr and Solano. Start monitoring for PTB in your orchard about two weeks before expected. Sample once or twice a week by cutting open 100 nuts collected throughout your orchard. Nuts with completely brown packing tissue are at full PTB. When 100% of the nuts that you sample are at full PTB, it is safe to apply ethephon to accelerate harvest timing.
- **Ethephon:** If you are applying ethephon in your orchard in August or September, use the following guidelines:
 - Apply 4-5 pints of product at a rate of 150-200 gallons per acre.
 - If you are applying from the ground, apply at a speed of 1.5-2.0 mph
 - Avoid applications at temperatures greater than 90° F or if there are drying winds or rain forecasted.

For more information on Ethephon use in walnuts, see “Ethephon for Earlier Harvest” (sacvalleyorchards.com/walnuts/ethephon-for-earlier-harvest/)



Drought Strategies for Walnut Orchards

Katherine Jarvis-Shean, UCCE Orchard Advisor, Sacramento, Solano and Yolo Counties

Allan Fulton, UCCE Irrigation & Water Resources Advisor Emeritus, Tehama, Shasta, Glenn, and Colusa Counties

With 41 California counties officially in a drought emergency and water allocations significantly reduced in many areas, many growers and managers are stuck with less water than walnuts use for prime production levels. In some crops (e.g. wine grapes, oil olives, almonds), water stress in certain developmental timeframes is not harmful, or may even be beneficial. Inducing this managed stress is called “regulated deficit irrigation” (RDI). Unfortunately, RDI is not an effective water saving strategy in walnuts. Sustained moderate to high water stress (stem water potential below -8 bars) at any growth stage will affect walnut crop productivity and quality.

Different factors of walnut productivity are vulnerable to water stress depending on the timing and extent of that stress. Figure 1 shows the generalized water use from walnut as measured by evapotranspiration over the course of a growing season and the different stages of nut and/or shoot growth occurring in the same timeframe. Because shoots are growing and walnuts are sizing in May and June, water stress during this timeframe decreases shoot growth, which can decrease bearing wood for nuts the following year, as well as decrease nut size in the year of the stress. Because shells harden in June and kernels are developing in July, August, and September, water stress in this time can impact kernel size and quality. Because this is also the time that buds are developing for the following season, severe stress in this period can also reduce flowers for nuts the following year.

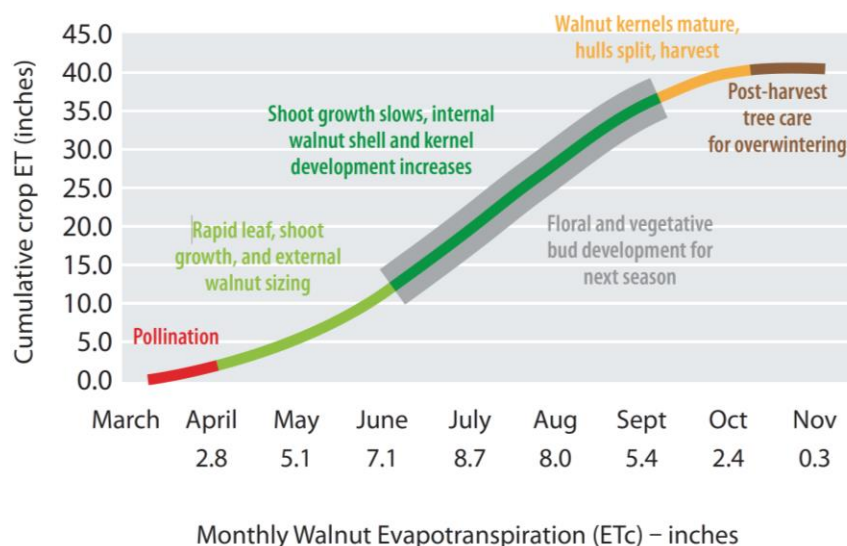


Figure 1. Cumulative and monthly average walnut evapotranspiration, tree growth and nut development over the growing season. ([Fulton & Buchner, 2015](#))

When faced with less water availability for irrigation, it is worth checking on system distribution uniformity to be sure the limited water that you do have is going exactly where you want it to go. An irrigation system that has not been maintained can apply twice as much water close to the pump as at the end of the system lines. Check out UC ANR's [maintenance of microirrigation systems site](#) and sacvalleyorchards.com/almonds/irrigation/irrigation-system-maintenance/ for guidance on how to check system pressure uniformity, flush irrigation lines and manage emitter clogging.

Once you are confident your system is applying water uniformly, the next water saving step is to be sure you're not applying more water than the trees need, and not moving that water below the rootzone where the trees can't access it. Irrigating based on evapotranspiration losses from the orchard is a relatively simple approach to manage this concern. Crop specific weekly ET totals can be found on the [Sac Valley Orchards ET page](#), where you can subscribe for weekly emails. Alternatively, you can contact your local UCCE office to sign up for weekly emails (Kat Jarvis-Shean for southern Sac Valley and Cindy McClain at clmccclain@ucanr.edu for northern Sac Valley). Numbers from ET reports give water use estimates for a generic, mature orchard based on local weather station data.

However, using a pressure chamber to directly measure tree stress via stem water potential is the most precise way to gauge the stress orchard trees are experiencing. Sac Valley Orchards has a [series of how-to guides](#) on measuring and interpreting stem water potential for everyone from beginners to long-time

users. Finally, [soil moisture sensors](#) at different depths can help monitor and prevent irrigation set lengths that push water past the bottom of the zone of concentrated roots, generally around three feet deep.

Even with a highly uniform system and precise irrigation accounting for the climate, soil, and tree measurements, reducing applied water to stressful levels may be unavoidable. During the last drought Allan Fulton and Rick Buchner, Farm Advisors Emeriti, created a drought strategies guidance document to explain different strategies and expected outcomes depending on the level of irrigation reduction (see: anrcatalog.ucanr.edu/pdf/8533.pdf). Since the 2015 document, we have learned that [pressure chamber use in spring can be used to safely delay the start of irrigation](#). Lessons learned from this new research have been integrated into the different strategies and expected outcomes depending on the level of irrigation reduction outlined below.

Percent Reduction	Percent of ET Applied	Water Shortfall	Strategy	Expected Outcome
20%	80%	4-8"	<p>Assess refill of soil water storage during the winter. Look for evidence that effective rainfall was sufficient to recharge root zone at least four or five feet deep. If winter rainfall has been too low, consider some winter irrigation to compensate.</p> <p>Delay the start of irrigation until -8 bars. Depending on the orchard and soil setting, the timing of the first irrigation may be delayed considerably.</p>	<p>Stored water can be relied upon to help manage limited water supply during the growing season.</p> <p>20 to 30 percent water/energy savings. Minimal impact on shoot growth and bud development. Slightly (10%) reduced external nut size and nut weight but edible kernel may actually be higher which positively affects nut value.</p>
21-50%	50-79%	8-21"	<p>Continue to save water early in the season by waiting until -8 bars to apply the first irrigation.</p> <p>Allow more stress prior to irrigation from kernel development through postharvest, up to -10 bars.</p> <p>Prioritize water to higher producing orchards over orchards that are near the end of their productive life.</p>	<p>Higher percent dark kernels in addition to smaller nuts. Lower edible kernel yields, decreased fruit bud development and thus lower yields next year.</p>
51-100%	0-49%	21-42"	<p>To the extent possible, apply stress uniformly throughout the season and try to maintain -8 to -12 bars stress. Save enough water for post-harvest irrigation to help guard against frost and cold injury in autumn.</p>	<p>Expect severe impacts to nut size and quality. In this range, the objective is tree survival. Expect at least severe impacts on shoot growth, bud development, and two years of normal irrigation before return to similar yields.</p>

2020 Walnut Freeze: Road to Recovery

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

Janine Hasey, UCCE Orchard Advisor Emerita

2020 brought yet another major autumn freeze. There were also sudden autumn freeze events in November of 2018 and 2019, however, observations in the northern Sacramento Valley indicate that the autumn 2020 freeze damage was more extensive than damage from either of the previous two years. Conversely, farm advisors as well as agricultural commissioners in central and southern Sacramento Valley counties received fewer freeze calls in the spring of 2021, than they had in spring 2019.

Our best guess for explaining the walnut freeze damage observed in 2021 are freeze events on the mornings of November 10th and 12th 2020. Temperatures had previously been unusually warm in the first two weeks of November with highs around 80 degrees during the first week and only one morning of temperatures near freezing, before temperatures dropped well below freezing on the 10th and 12th. Details on why severe damage may have occurred can be found at: sacvalleyorchards.com/blog/walnuts-blog/november-2020-freeze.

Below are descriptions of the freeze surveying and reporting being performed by County Agricultural Commissioners, the USDA Farm Service Agency, and UC Cooperative Extension.

Agricultural Commissioners in Butte, Glenn, and Tehama Counties initiated grower surveys in spring 2021 to assess if a crop disaster declaration was warranted. The Butte County Agricultural Commissioner's Office concluded that the county did not meet the 30% crop loss or tree loss needed to file a damage assessment report with the CDFA and CalOES. At the time of this writing, surveys in Glenn and Tehama Counties are ongoing. County Agricultural Commissioner's offices in Sutter, Yuba, Colusa, Yolo, Solano, and Sacramento Counties did not receive sufficient grower reports of freeze damage to warrant conducting surveys.

The USDA Farm Services Agency (FSA) encourages walnut growers who experienced losses from the 2020 autumn freeze to report losses to their local Farm Service Agency (FSA) office:

County	USDA Farm Services Agency (FSA) Phone Number
Tehama	(530) 691-5867
Glenn	(530) 934-4601
Butte	(530) 534-0112 ext. 2
Sutter & Yuba	(530) 671-0850 ext.2
Colusa	(530) 458-5131
Yolo	(530) 662-2037 ext. 2
Solano	(707) 448-0106 ext. 2
Sacramento	(916) 714.1104 ext.2
FSA Service Center Locator at: offices.sc.egov.usda.gov/locator/app	

These are the two USDA FSA programs you may qualify to apply for.

Disaster Assistance

Eligible orchardists, vineyardists, and nursery tree growers may be eligible for cost-share assistance through the [Tree Assistance Program](#) (TAP) to rehabilitate or replant and clean-up damage to orchards and vineyards that kill or damage the tree, vines or shrubs. For TAP, a program application must be filed 90 calendar days after the disaster event or the date when the loss is apparent.

Risk Management

Producers who have risk protection through [Federal Crop Insurance](#) or FSA's [Noninsured Crop Disaster Assistance Program](#) (NAP) should report crop damage to their crop insurance agent or FSA office. If they have crop insurance, producers should report crop damage to their agent within 72 hours of damage discovery and follow up in writing within 15 days. For NAP covered crops, a [Notice of Loss](#) (CCC-576) must be filed within 15 days of the loss becoming apparent, except for hand-harvested crops, which should be reported within 72 hours. NAP or Federal Crop Insurance often only covers the crop and not the plant.

Information courtesy of Brooke Raffaele, Public Affairs & Outreach Coordinator at the California Farm Service Agency USDA.

UC Cooperative Extension researchers will also be conducting a walnut freeze damage survey. This online survey will ask about the orchard characteristics and grower practices surrounding freeze damaged orchards, with the hope of refining best practices for preventing future freeze damage. Look out for this survey from your local orchard advisor as well as at sacvalleyorchards.com later this summer. Finally, save the date for a Zoom webinar tentatively scheduled for **Wednesday, September 1st from 4-5:30 PM** when Luke Milliron will be hosting a panel of UC researchers and walnut growers to share their experience and lessons learned in preventing sudden autumn freeze damage.

What to do now with freeze damaged orchards:

- **Sunburn:** Consider protecting exposed wood from sunburn by painting the southwest side of trunks or limbs with tree paint or white latex paint 50:50. We understand however, that this is likely a cost-prohibitive practice. Pay close attention to signs of sunburn on the nuts which can predispose walnuts to mold infection. See the article in this newsletter on mold in walnuts to learn more about managing the disease.
- **Water:** Use a pressure chamber and/or soil moisture to avoid over-irrigating. With less leaf surface (Photo 1 and 2), there is less transpiration. The pressure chamber is a direct measure of whether the trees need irrigation. Wait until pressure chamber readings are 2 to 3 bars below baseline before irrigating. Overwatering freeze affected trees will damage roots, likely leading to tree collapse, instead of recovery. You can learn more about using the pressure chamber in walnuts at: sacvalleyorchards.com/manuals/stem-water-potential/pressure-chamber-advanced-interpretation-in-walnut/
- **Nutrition:** Hopefully, you have been fertilizing appropriately. Much of the nitrogen demand is from the crop, and therefore nitrogen applications should be reduced in relation to any expected yield

reduction in freeze damaged orchards. Take a July leaf sample to check on your nutrition program for all nutrients (*see details in the July crop considerations*).

- **Botryosphaeria (Bot) or Phomopsis:** If you haven't already started doing so, remove dead limbs and prunings from the orchard as they may become infected with Botryosphaeria (Bot) or Phomopsis. Again, with some orchards experiencing tremendous dieback, the removal of small branches may be cost-prohibitive.

In orchards where there is a history of Bot infection, some growers reported plans to apply a Bot spray by early July, whether or not deadwood removal was completed. For both deciding what to do with prunings and how aggressively to treat for Bot, it's critical to assess what the infection level is in each orchard (table 1). Unsurprisingly the treatment regimen becomes more aggressive with increasing infection, however it becomes less critical for handling prunings at the highest infection rates because there is already such a high inoculum load present. You can learn more about Botryosphaeria and Phomopsis cankers at: sacvalleyorchards.com/walnuts/diseases/the-latest-on-managing-bot-canker-and-blight-in-walnut-2016-research-updates

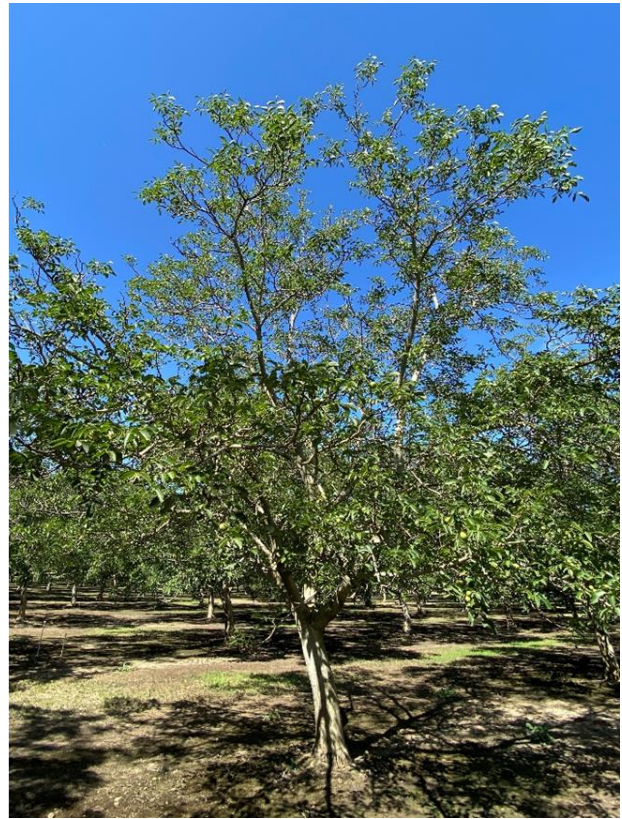


Photo 1 (L) and Photo 2 (R). Photo 1 (L) of a 9th leaf Howard orchard in Butte County shows the clear dieback, particularly higher in the canopy, that we typically associate with freeze damage symptoms (6/3/2021, photo by Luke Milliron). Photo 2 (R) shows a very thin canopy on June 10, 2020 in this Glenn County 15th leaf Chandler orchard is also likely due to freeze damage, specifically due to delayed budbreak (6/10/2021, photo by Luke Milliron).

Table 1. Walnut <i>Botryosphaeria</i> & <i>Phomopsis</i> (BOT) infections: Treatment and pruning considerations		
	Treatment/Risk Consideration*	Handling of prunings
No BOT yet	No spray	Chip prunings & leave in orchard
Light infection (1-20%)**	1 spray timing	Remove prunings*** – don't chip
Moderate infection (20-50%)	1+ spray/ or leaf-wetness model	Remove prunings – don't chip
Heavy infection (>50%)	Full fungicide program (May, June, July) or leaf-wetness model	Chip prunings & leave in orchard

*This table merely reflects research results and is not a treatment recommendation.

** Incidence of infection is determined by examining 20 to 30 blighted spurs/shoots from previous season crop for presence of pycnidia of *Botryosphaeria* and/or *Phomopsis*.

***Burn removed prunings if allowed, this provides the best reduction in inoculum.



Managing Mold in Walnut

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

Dr. Themis Michailides, UC Davis Plant Pathologist at the Kearney Ag Research and Extension Center



Photo 1. In the past five to six years there have been increased reports of walnut mold. Right photo: stained regions on the kernel are covered by loose mold mycelia. Photos courtesy of Dr. Themis Michailides.

What is walnut mold?

Growers and processors have reported elevated mold levels in harvested walnuts to farm advisors, which has resulted in pathology sample submissions to Dr. Themis Michailides, UC Davis Plant Pathologist (Photo 1). Although *Botryosphaeria* and *Phomopsis* (BOT) can cause walnut mold, most walnut mold develops from *Fusarium* and *Alternaria* species. Furthermore, walnut mold spray timing is later than BOT prevention spray applications and therefore your fungicide program for BOT will not control mold. Walnut mold does not begin to develop until the hull completes maturity and begins to split, long after most BOT-controlling

sprays have been applied. Before these alerts and ensuing research, not much was known about managing mold in walnut.

Because of increased mold reports, the California Walnut Board has funded Dr. Michailides to investigate the management of walnut mold. Although all possible predisposing factors have not yet been investigated, conditions that compromise the integrity of the hull, such as walnut blight, sunburn or insect-damage can serve as an entry point for mold fungi.

Secondary blight predisposes nuts to mold:

Secondary walnut blight (*Xanthomonas arboricola* pv. *juglandis*) infections that do not penetrate to the kernel nor result in nut drop, can create an entry for not only moth pests, but for the mold causing *Fusarium* and *Alternaria* species. These infections are a specific type of walnut mold called brown apical necrosis (BAN), named because the black blighted lesions at the apical end (aka: stylar – floral remnant) of the fruit, that turn brown following fungal colonization (Photo 2). As the fungal infection expands under the hull, the hull is decayed and the infection spreads to the kernel, most likely through the apical end. It stands to reason that improved walnut blight management, particularly of secondary infections, will lead to less BAN although this has not yet been studied. More on walnut blight best management practices at: sacvalleyorchards.com/walnuts/diseases/walnut-blight-management/



Photo 2. Brown Apical Necrosis (BAN) mold infections in Ivanhoe. Photo courtesy of Dr. Themis Michailides.

Predisposing factors and cultural controls for mold:

Practices that help maintain hull integrity are part of the pre-hull split management of walnut mold. One predisposing factor is sunburn, with mold commonly isolated from the sunburnt side of developing walnuts. Freeze damaged trees with less protective foliage are at high risk of sunburn and subsequent mold infection. Higher incidence of mold has also been found in insect infested nuts. Thus, controlling sunburn and insect damage will also help keep down mold infections. Finally, a critical management practice is timely shake and pick up. Bill Olson (UCCE Butte Advisor Emeritus) previously showed that mold and other quality problems increase the longer walnuts remain both on the tree and especially on the ground. Picking up the same day as shaking is a critical best practice for overall quality and grower returns, particularly for non-Chandler blocks.

Some varieties, such as Ivanhoe and Livermore are more susceptible to mold than others, and therefore more diligent attention to mold management may be required. In earlier research, higher incidence of mold was discovered in walnut varieties with larger openings at the stem end and larger sized nuts.

New findings in 2020. A very large number of walnuts with mold were examined at a stage when the fungal mycelia had not covered the entire kernel. Using a dissecting scope, it was determined that for nuts collected from the tree, mold initiated at higher levels (3.5 fold) from the stylar end than the stem end (Figure 1). This finding made us think that some infections by the mold fungi might start at bloom time. To determine if this could be a cause, bloom spray trials were initiated this year. Please stay tuned for further research findings.

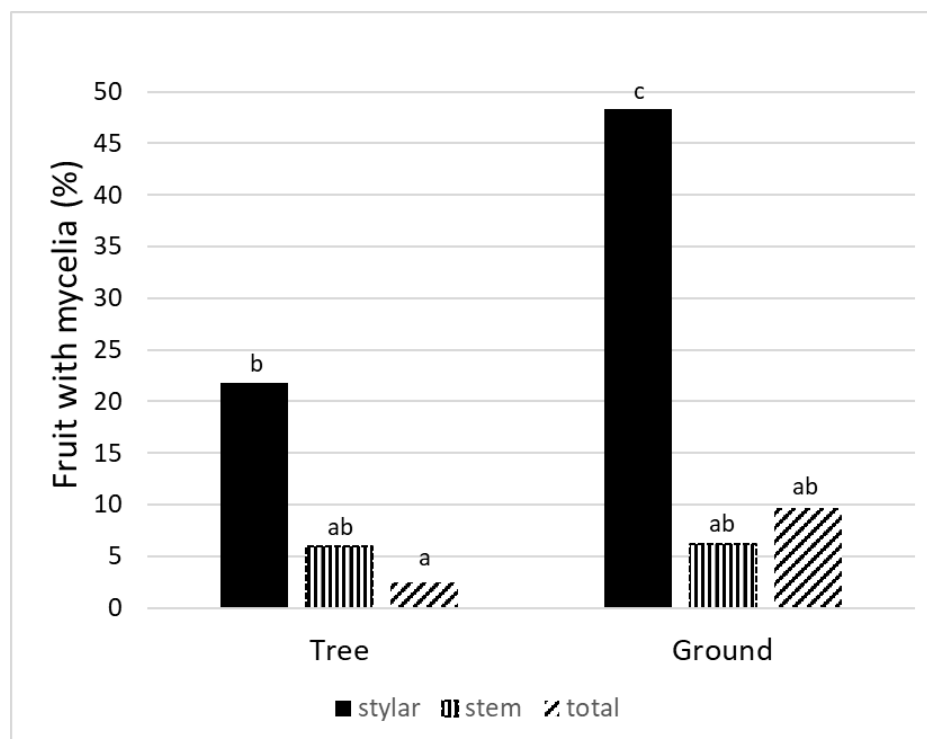


Figure 1. Walnut kernels of cv. Ivanhoe with mycelia initiating from stylar, or stem end of the fruit; “total” means that the entire kernel was covered with mycelia so that the origin of the mycelia could not be determined.

Fungicide¹ management for mold:

Results on fungicide trials to control walnut mold include those done in 2019 and 2020. In a 2019 trial in Chandler located in Butte County, the fungicide Rhyme (flutriafol) was tested because of its short preharvest interval (PHI). A single spray at either 30 or 60% hull split, reduced mold incidence by over 73%. In 2020, in the same orchard, two sprays with Rhyme, one at 3 weeks before hull split and the second at 20-30% hull split, resulted in 7% mold while the untreated control had 13% mold. However, this difference was not statistically significant. More efficacy testing of various chemical controls for walnut mold are planned and these results will be reported at: ipm.ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf

¹Mention of pesticides and spray timings do not constitute a pesticide recommendation; it is merely the sharing of research results. Always follow the pesticide label and consult with your PCA.

**New Staff Research Associate Introduction**

Clarissa Reyes (she/her), UCCE Staff Research Associate

I am pleased to join Luke Milliron, Dr. Franz Niederholzer, and Dr. Rich Rosecrance to work with orchard crops in the Sacramento Valley. I grew up in Sacramento, CA, then attended UC San Diego, where I earned a BS in General Biology. After graduating, I worked in the biotech industry in San Diego, developing bio-derived products as renewable resources for commercial use. As my sense of environmental stewardship evolved, I returned to Sacramento to pursue an interest in sustainable agriculture at UC Davis. There I worked in the McElrone Lab, first as a lab technician and then as a master's student in the Horticulture and Agronomy program. My research focused on applied water- and drought-related physiology in grapevine and woody species, with an emphasis on drought response in grapevine root systems. I recently moved to Chico for this position and am looking forward to exploring the surrounding areas for new places to hang out at the river, cycle, and camp. I am grateful to the Almond Board of California, California Walnut Board, California Pistachio Research Board and the California Prune Board for funding my position with UC Cooperative Extension.

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Weekly episodes from Growing the Valley podcast keep you up to date with the latest UC best practices in walnut, almond, prune, and pistachio production. Listen at: growingthevalleypodcast.com or wherever you listen to podcasts.

