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## Walnut Orchard Management: July & August 2022

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

*Evie Smith, Former UCCE Staff Research Associate, Southern Sacramento Valley*

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

*Janine Hasey, UCCE Farm Advisor Emerita, Sutter, Yuba, Colusa Counties*

### JULY

- **Drought Management Resources:** 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. How-to information at: [sacvalleyorchards.com/manuals/stem-water-potential/pressure-chamber-advanced-interpretation-in-walnut](http://sacvalleyorchards.com/manuals/stem-water-potential/pressure-chamber-advanced-interpretation-in-walnut). Additional considerations in the drought article in this newsletter.
- **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. Details at: [sacvalleyorchards.com/walnuts/insects-mites-walnuts/walnut-husk-fly-biology-monitoring-and-spray-timing](http://sacvalleyorchards.com/walnuts/insects-mites-walnuts/walnut-husk-fly-biology-monitoring-and-spray-timing).
- **Spider Mites:** Monitor weekly in July and August for spider mites and their predators. Check 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. Details at: [ipm.ucanr.edu/agriculture/walnut/web-spinning-spider-mites](http://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. Details at: [ipm.ucanr.edu/agriculture/walnut/codling-moth](http://ipm.ucanr.edu/agriculture/walnut/codling-moth).
- **Botryosphaeria (Bot) or Phomopsis:** 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. Fungicide efficacy on page 72: [ipm.ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf](http://ipm.ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf).
- **Lean Price Year Considerations:** There are several management options to improve your profit margins:
  - 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](http://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](http://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](http://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.

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- **Mold:** While the current recommended control timing for mold is 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. If you're considering using ethephon to remove more nuts at first shake or advance harvest timing, start monitoring for PTB in your orchard about two weeks before expected PTB. Sample once or twice a week by cutting open 100 nuts collected throughout your orchard. Application timing will vary depending on your goal. Apply at 100% PTB to advance harvest, but 5 to 7 days after 100% PTB to synch up maturity to remove more nuts at first shake. See "[Ethephon for Earlier Harvest](#)" for PTB photos and application guidelines.



### Mid to Late-season Drought Strategies for Walnut Orchards

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

*Curt Pierce, UCCE Irrigation & Water Resources Advisor, Glenn, Tehama, Colusa, and Shasta Counties*

With California in an enduring drought and water allocations significantly reduced or reduced to zero in many areas, many growers and managers are stuck with much less water than walnuts use for optimal production. In certain crops (e.g. wine grapes, oil olives, almonds), water stress in certain developmental timeframes ("regulated deficit irrigation" or RDI) is not harmful, or may even be beneficial. Unfortunately, an effective RDI strategy has not yet been identified for walnuts and sustained moderate to high water stress (stem water potential below -8 bars) at any growth stage has been shown to 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 throughout a growing season and the different stages of nut and shoot growth occurring in the same timeframe. With kernels developing in July, August, and September, water stress during this time can impact kernel size and quality. Perhaps more important, this is also the time that buds are developing, and severe stress in this period will typically reduce bloom counts and yield potential next season.



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

With less water available, and deficit irrigation infeasible, good system maintenance and precise irrigation application are the best approaches for walnut. For system maintenance tips, check out UC ANR's [maintenance of micro-irrigation systems](#) site, and [our article on irrigation system maintenance](#) for guidance on how to check system pressure uniformity, flush irrigation lines, and manage emitter clogging. For more precise irrigations, a good place to start is with weekly crop-water loss estimates, or evapotranspiration (ET). We supply weekly ET reports which can be found on the [Sac Valley Orchards ET page](#), and where you can subscribe for weekly emails to be sent directly to your inbox.

While ET replacement irrigation scheduling is a great start, 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. Waiting to irrigate until pressure chamber readings show that trees are 2 to 3 bars drier than the fully watered baseline (e.g. fully watered baseline is -4.5 bars, irrigating when trees near -6.5 to -7.5 bars). 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.

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. For more detailed information on drought mitigation irrigation strategies for walnut, please refer to that publication. More recently, Ken Shackel, professor of plant sciences at UC Davis, Allan Fulton, and others reported new [start-of-irrigation guidance for walnuts](#) not yet incorporated into the drought strategies document, but which offer additional opportunities for water savings heading into next season.

*Note: To see about scheduling a no-cost, irrigation system performance assessment, visit the [Mobile Irrigation Lab](#).*



### Managing Mold in Walnut, 2022 Update

*Clarissa Reyes, UCCE Orchards Staff Research Associate, Butte, Glenn, & Tehama*

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

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



Figure 1. Left photo: incident 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.

**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.

**Fungicide<sup>1</sup> management for mold, 2019-2021:**

In a 2019 trial using 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. In 2021, a spray 2 weeks before hull split (HS), 1 week before HS, a spray at 20-30% HS, and 3 sprays at all 3 dates, significantly reduced mold (by 57-72%) in comparison with the untreated control. There were no differences among the treatments, an indication that one spray should be sufficient in reducing mold significantly.

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](http://ipm.ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf).

<sup>1</sup>Mention 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.

**Spring Management to Control Mold****Secondary blight predisposes nuts to mold:**

Secondary walnut blight (*Xanthomonas arboricola* pv. *juglandis*) infections that do not penetrate to the kernel resulting 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 stylar end (aka: 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/](https://sacvalleyorchards.com/walnuts/diseases/walnut-blight-management/)



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

#### **New research on infection and control at bloom timing:**

A second year of data collection further bolstered the conclusion that most mold infections start at the styler end (aka: floral remnant) of the nut. These findings reinforce the contention 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 in 2021 and were repeated in 2022. In a trial using Tulare walnuts in Tulare County, a bloom spray gave similar control of mold as the 3 week and 1 week before hull split sprays and lead to significantly lower mold than the unsprayed control (evaluation by Diamond Foods). The same treatments applied using nearby Chandler showed no significant differences between the various spray timings and the unsprayed control trees. Please stay tuned for further information from the 2022 trial.



#### **Adela Contreras, with industry support, joins Sacramento Valley UCCE Extension Team as a Staff Research Associate**



Adela Contreras joined UC ANR in 2022 as a Staff Research Associate and serves the southern Sacramento Valley with Katherine Jarvis-Shean and Franz Niederholzer across six counties. Among other research projects, she works on prune and walnut rootstock experiments and safe and effective spray application strategies. Adela is a first-generation college student from Salinas, CA, graduating with a B.S. in Environmental Science and Management at UC Davis in 2020. She plans to pursue a Ph.D. in Agronomy or Soils and Biogeochemistry and inform future grower decisions. She enjoys kayaking, hiking, visiting family, eating, and adventuring with her dog Oakley.

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Walnut Newsletter

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