Sacramento Valley Almond Newsletter

UC CE UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources Cooperative Extension

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In This Issue

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Almond Management Considerations February and March

Ben Baldi, Staff Research Associate, Yolo, Solano, Sacramento, Colusa, Sutter, & Yuba Counties
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Weed management: Prepare your preemergent herbicide program with your PCA. In mature orchards, narrowing the weed-free strip and relying on mowing middles can reduce costs. Preemergent herbicides are more effective when applied to bare ground, so clean strips of leaves or weed cover as much as possible before application. Weed competition is especially damaging to young orchards, protect your trees from herbicide sprays and rodent damage by using cartons or sleeves. Click this link for currently registered herbicides. If you observe reduced herbicide efficacy or suspect resistance, contact UCCE Farm Advisors Becky Wheeler-Dykes at bawheeler@ucanr.edu or Ryan Hill at rjahill@ucanr.edu.

NOW sanitation: Winter sanitation is the most effective preventative action to reduce NOW populations in the coming season. Reduce mummy nuts to no more than 2 mummies/tree by the end of January. Blow/sweep nuts into middles and flail mow or otherwise destroy the downed nuts by March 1. Sanitation is more effective with community management – encourage your neighbors to sanitize as well. Do not overlook volunteer almonds along fence lines. View this article for more information, *"The case for orchard sanitation."*

Irrigation maintenance: A thorough checkup of your well, pump, and irrigation system components is critical ahead of bloom to ensure the ability to mitigate frost damage and be ready for an early irrigation season if the weather remains dry. Growers in Tehama, Butte, Glenn and Shasta Counties can utilize free irrigation evaluations through the Tehama Resource Conservation District (RCD) Mobile Irrigation Lab. Growers in Yolo, Colusa, Sutter and Yuba Counties should contact the Yolo-/Sutter Mobile Irrigation Lab. Growers in Solano County can contact the Solano RCD.

Disease management: Check spray equipment and calibrate to prepare for bloom sprays. A single bloom spray at 30-40% bloom using locally systemic fungicides (FRAC 3, 9, and/or 11) will protect the flowers if little to no rain occurred during bloom. Talk with your PCA about two sprays. One spray at pink bud and another at full (80%) bloom, as recommended in a rainy bloom. Click this link for most recent fungicide and timing tables to protect against bloom diseases. Check with your PCA regarding blast control options if frost is in the weather forecast especially for fields with a history of crop loss due to blast. See the latest information on Red Leaf Blotch disease of almond in this newsletter.

Frost protection: The warmest orchard temperatures are where vegetation is maintained at 2 inches or shorter, the ground is firm (NOT cultivated), and moist. Be sure sprinkler irrigation systems are ready for deployment. Turn on sprinklers when wet bulb temperature is above the critical temperature for the bloom stage in the orchard and turn off the sprinklers when the wet bulb temperature has recovered to above critical temperature. Frost not only damages delicate bloom and fruitlet tissue but also increases the risk of bacterial blast damage.

Bees: Talk with your beekeeper and use tools such as the BeeWhere system through CalAgPermits to check for beehive locations near your farm. Employ best practices to ensure honey bee safety. See the article in this newsletter for more information on 2025 bee losses.

Insect pests: Hang NOW traps by mid-March to determine biofix. If using mating disruption, deploy dispensers by late March or early April. Although expensive upfront, UC research has shown that mating disruption can passively work in the background all season long, and yield a positive return on investment. Biofix dates for other pests should also be established by trapping. San Jose Scale and Oriental Fruit Moth traps should be hung by mid- to late-February. Peach Twig Borer traps should be in place by mid-March.

Nutrition: Nitrogen and potassium used by the crop should be replaced each year to maintain yields and long-term health of trees, even in lean price years. Approximately 68 lb nitrogen and ~100 lb K_2O are required per 1,000 lb of kernel yield expected to be removed from the orchard in the current year crop. Make crop budget projections based on orchard yield history and bloom conditions (bloom strength, weather, and bee activity). Consult with your CCA and/or Farm Advisor as you consider the right time, place, material, and amount for all fertilizer applications. Stored nitrogen reserves are exhausted a month after the start of bud break. The first fertilizer N should be applied and plant available by that timing. See the Almond Board of California's free publication on Nitrogen Best Managment Practices for key details on nitrogen fertilization rates and timings.

Research updates on almond Red Leaf Blotch

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Background

In June 2024, a new foliar disease of almond, Red Leaf Blotch (RLB), was detected in Merced County. By the end of summer 2024, RLB presence was confirmed in six counties in the Northern San Joaquin Valley. Orchard surveys conducted in 2025 revealed a recent geographic spread of the disease to most almond-producing areas of the state. Cultivars affected by RLB included Aldrich, Butte, Carmel, Fritz, Independence, Monterey, Nonpareil, Padre, Shasta, and Wood Colony. The disease is caused by the invasive fungal pathogen *Polystigma amygdalinum* and is known as one of the most severe foliar diseases of almond in regions surrounding the Mediterranean Sea. The recent emergence of RLB in California is a serious new challenge for almond growers. The disease only affects leaves, causing obvious and severe symptoms. Severe infections in orchards result in reduced photosynthetic activity, premature tree defoliation during the summer, and depletion in carbohydrate storage, thus impacting tree productivity and orchard yield over several growing seasons. Yield reductions up to 30% have been reported in Spanish orchards.

After one season of field research, the Trouillas Lab at the University of California, Davis has developed knowledge of the disease epidemiology and biology and provided disease management guidelines. Of particular importance to growers and PCAs are an understanding of fungicidal products that can effectively prevent the disease and the best timings for fungicide applications were identified.

Disease symptoms and identification

Red Leaf Blotch affects almond leaves, causing leaf spots of different sizes and shapes. These leaf blotches are initially yellowish in color, turning orange to reddish-brown as the growing season progresses. The first symptoms can be noticeable in mid to late April, approximately five to six weeks after the initial leaf infections. New symptoms can appear through June on the leaves of actively growing shoots. At advanced stages of disease development, in June and July, leaves become necrotic, curl, and drop prematurely.

RLB is caused by *Polystigma amygdalinum*, an obligate biotrophic fungal pathogen, which is dependent on living plant tissue for growth, reproduction, and feeding and cannot be grown on culture medium. To facilitate diagnosis of RLB and identification of its causal agent, we tested and validated a polymerase chain reaction (PCR) assay (Zúñiga et al. 2018)

that uses species-specific primers following DNA extraction directly from leaves. Using similar tools, *P. amygdalinum* was formally confirmed in 2024 as being present in the state by both CDFA and the USDA.

Figure 1. Early symptoms of Red Leaf Blotch include small, pale yellowish spots or blotches (left: early-May). The leaf blotches turn orange to reddish-brown as the season progresses (center: mid-June; right: late July). [Photo credits: Renaud Travadon].

Disease cycle and infection dynamics

The fungus overwinters on fallen infected leaves in the orchard leaf litter. The sexual fruiting bodies of the fungus (perithecia) develop in these leaves during the winter season. These perithecia contain the infectious propagules (ascospores) of the fungus. In the spring, when it rains, ascospores get dispersed from perithecia present in the leaf litter into the air, causing primary infections on newly emerging almond leaves. Our spore trapping study in 2025 indicated that the first peak of ascospore release occurred following rain events in late February/early March in the San Joaquin Valley, which coincided with first leaf emergence soon after petal fall. We also observed additional peaks of sporulation during rainfall events in March and late April, confirming that ascospore release is mostly triggered by rain. Overall, our work indicates that infections of almond leaves can occur throughout the spring, primarily during and after rains starting late February/early March until late April/early May.

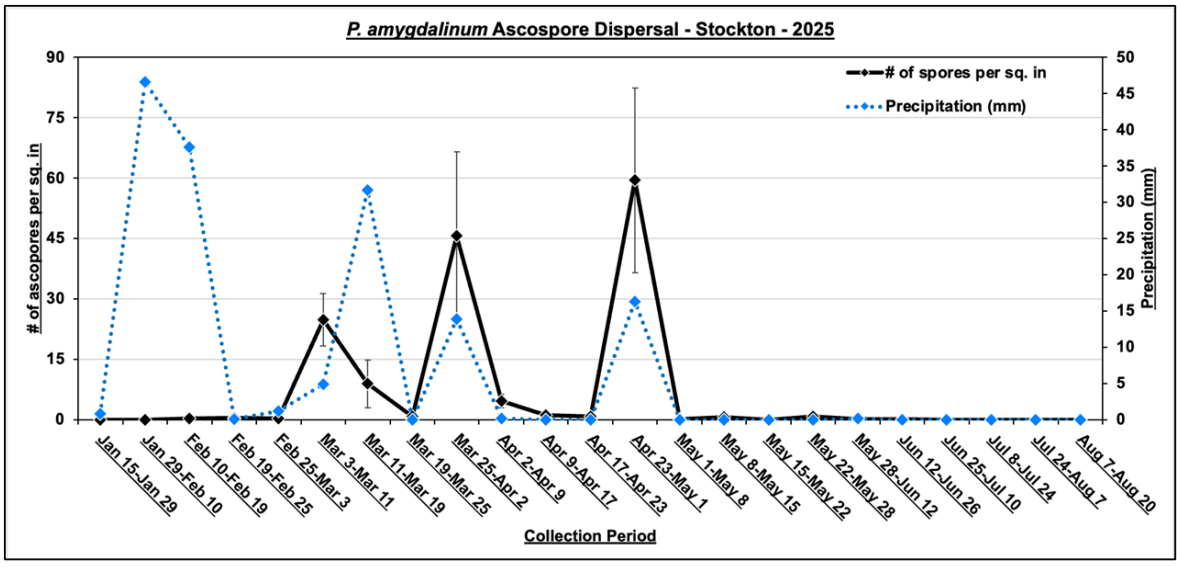


Figure 1. Sporulation dynamics and peaks of sporulation of *Polystigma amygdalinum* during the 2025 growing season in an almond orchard located in Stockton, California. Peaks of sporulation correlated with precipitation, indicating the optimal timings of fungicide applications prior to rain.

Disease Management

The disease has a long latent period of 35 to 40 days, so by the time symptoms are visible, the infection window has long passed. This makes early, preventive management the key to controlling the disease. Based on our 2025 field trials and growers' experience in Spain, a three-spray program is recommended for orchards at risk. The first spray should be applied at petal fall, followed by a second application two to three weeks later, and a third spray five to six weeks after petal fall if wet weather continues. These timings coincide with elevated inoculum levels of *Polystigma amygdalinum* in orchards and a period of high leaf susceptibility to RLB. Similar timings for fungicide applications are used to manage other spring diseases like scab, shot hole, rust and anthracnose, highlighting the need for an integrated approach to disease management in almond orchards.

Our research trials in 2025 indicated that the most effective products to control RLB included various mixed fungicides with FRAC groups 3 + 7 (e.g. difenoconazole + pydiflumetofen); 3 + 11 (e.g. difenoconazole + azoxystrobin or tebucnonazole + tryfloxystrobin); 7 + 11 (e.g. fluopyram + trifloxystrobin, fluxapyroxad + pyraclostrobin, or boscalid + pyraclostrobin); 7 + 12 (adepidyn + fludioxonil) and FRAC 3-triazoles (metconazole or flutriafol). Growers are advised to rotate modes of action and follow all resistance management and product label guidelines to prevent product failure over time. Cultural practices, focused on eliminating the primary inoculum of infected fallen leaves, also can help mitigate the disease. These consist of removing leaf litter or applying urea to accelerate its decomposition. However, such strategies are only effective when applied over a wide area. Fungicides applied during bloom and after symptoms are visible are not effective.

Disclaimer: Mention of any active ingredients or products is not an endorsement or recommendation. All chemicals must be applied according to the chemical label, local and federal regulations. Please check with your pest control adviser to confirm rates and site-specific restrictions. The authors are not liable for any damage from use or misuse.

Preventing Bacterial Blast Damage in 2026

Jaime Ott, UCCE Tehama, Shasta, Glenn, and Butte Counties

Though our weather outlook for the next couple of months is leaning toward warmer weather than usual, a cold snap during bloom and leaf-out could cause significant bacterial blast damage. Make a plan now in case of bad weather.

The Bottom Line:

- Bacterial blast can be a problem when cold, wet weather coincides with bloom or leaf-out.
- Copper resistance is common: spraying copper is ineffective for preventing blast.
- Frost protection is the most economical prevention option and will help prevent damage from both frost and bacterial blast.
- The antibiotic kasugamycin (Kasumin®) is effective for preventing blast when applied up to 6 days before cold, wet weather. It is available this year under Section 18 exemption (Feb 1- Apri 15), consult with your PCA regarding rates and timings.

The Details:

Pseudomonas syringae can infect all aboveground parts of an almond tree, causing bacterial blast of the leaves and flowers. *Pseudomonas* is everywhere, so weather conditions are the factor driving this disease. Freezing cold, wet weather favors this disease. *Pseudomonas* is spread by water hitting the tree. If this occurs during frost, *Pseudomonas* can enter the tree through cells broken by frost damage. Trees are especially susceptible to frost damage during bloom and leaf-out, when tender new growth is exposed to cold weather.

Preventing infection by *Pseudomonas* is the only way to control bacterial blast. Frost protection is the most inexpensive strategy: if the trees are not damaged by frost, *Pseudomonas* will not have a way in to cause disease. As a second line of defense, kasugamycin (Kasumin®) is effective to prevent bacterial blast when applied no more than 6 days before cold,

wet weather. For this spray, complete coverage is crucial: all the tender new growth must be covered in a protective layer of the antibiotic for it to be effective. Any tissue left uncovered will be unprotected. Kasugamycin recently received a Section 18 for use in almond between February 1 and April 15, 2026. If the weather warrants treatment, kasugamycin can be used as a preventative spray up to two times during the temporary use window. Current work by UC researchers shows that copper-resistance is common in *Pseudomonas* throughout the state. In some cases, mixing mancozeb with the copper may provide some level of control, but research shows that this mixture is not as effective as kasugamycin and can cause phytotoxicity.

For more information on bacterial blast, check out these articles at www.sacvalleyorchards.com

Bacterial blast/canker: What do we know?

Bacterial Blast and Canker

Independence on Viking (left), Independence on Hansen (right). Dead leaf bundles, spotted and misshapen leaves, dead flowers, and aborted nuts are symptoms of bacterial blast, caused by *Pseudomonas syringae*. These symptoms only become apparent after trees are infected and the damage is done.

Phytophthora sampling in the Stockton East Water District

Jaime Ott, UC Extension Tehama, Shasta, Glenn, and Butte Counties

This work was partially funded by the Stockton East Water District

Crown rot and root rot caused by *Phytophthora* species are diseases of great concern for almond growers. Many people believe that irrigating with surface water puts your trees at risk of *Phytophthora*, and that irrigating with groundwater is the best way to prevent these diseases. However, a recent study of *Phytophthora* in irrigation water and orchard soils tells a different story.

The Bottom Line:

Irrigation management is *Phytophthora* management. This study showed that *Phytophthora* is common in orchard soils. Regardless of whether they are irrigated with surface water or groundwater, over 30% of tested orchard soils were positive for *Phytophthora*. Since water (either standing water or saturated soil) allows *Phytophthora* to cause disease, good irrigation management is crucial to prevention, no matter what your water source.

- Reduce ponding: irrigation application rate should not exceed soil infiltration rate

- Reduce length of soil saturation: run shorter sets (24 hrs max) more frequently
- Avoid water on the trunk of the tree and avoid soil saturation at the trunk: plant on berms, use stream splitters, choose microsprinkler wetting patterns that avoid the trunk, move drip emitters away from the trunk

Using a resistant rootstock is an excellent tool to help limit Phytophthora disease if you are planting a new orchard (see this chart for rootstock info) or putting in replants. Even with a resistant rootstock, good irrigation management is crucial because no rootstock is immune.

The Details:

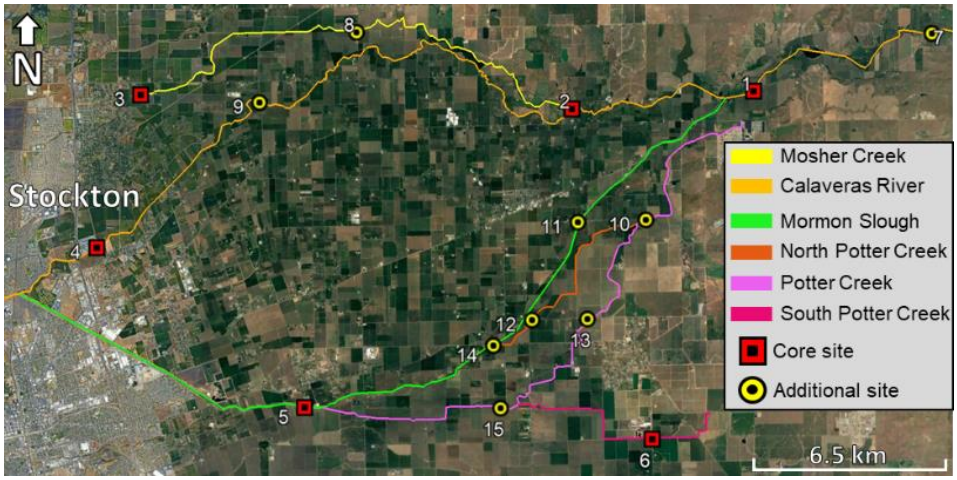
Phytophthora is a genus of fungus-like organisms which contains over 200 different species. Many of these species are important pathogens of orchards, causing root rot or crown rot (for example *Phytophthora cinnamomi*, *Phytophthora cactorum*, and *Phytophthora mediterranea*) or pruning wound cankers (mainly *Phytophthora syringae*). Many previous studies have shown that *Phytophthora* species are common in surface sources of irrigation water, such as rivers, canals, and sloughs. *Phytophthora* has not been found in groundwater from wells, unless that well has been contaminated with surface water. From this, people have assumed that irrigating with surface water puts an orchard at risk of Phytophthora root or crown rot, and that irrigating with groundwater is "safe." However, biology is rarely that simple: in my experience, orchards irrigated with groundwater can struggle with *Phytophthora*, and many orchards irrigated with surface water do not show symptoms of Phytophthora disease.

In 2021 and 2022, collaborators and I conducted a study to look at the effects of *Phytophthora* in irrigation water from a broader perspective. This study took place in the Stockton East Water District (SEWD), a local water agency that manages both groundwater and surface water use by agricultural producers east of Stockton, CA. The study had three objectives:

1. Test SEWD surface water for *Phytophthora* during the irrigation season
2. Test for live *Phytophthora* coming through irrigation emitters
3. Test orchard soils for *Phytophthora*, comparing orchards irrigated with surface water vs groundwater

Objective 1. Test SEWD surface water for *Phytophthora* during the irrigation season

During the 2021 irrigation season, we sampled water from surface water irrigation sources throughout the SEWD. Some locations (core sites) were sampled monthly from June through October, and some locations (additional sites) were sampled twice during the season, in July and October. Samples were taken back to the lab and tested for *Phytophthora* using DNA sequencing.



Overview of the Stockton East Water District (SEWD) with water sampling sites marked.

We found that *Phytophthora* species were common in SEWD waterways. Over the course of sampling, we found 39 *Phytophthora* species, 10 of which are known pathogens of orchards crops grown in the SEWD. Many of these species were found throughout the irrigation season. We did find that different waterways had different *Phytophthora* species, and some waterways had more orchard pathogens than others. However, every waterway, and nearly every site, had at

least one *Phytophthora* species of concern to orchards. These results are consistent with many previous studies, which have determined that *Phytophthora* species are common in surface sources of irrigation water.

Phytophthora species detected in Stockton East Water District waterways throughout the irrigation season

Species	Can cause disease on	Calaveras River	Mosher Creek	Mormon Slough	Potter Creek	South Potter Creek
P. cactorum	W, **C**, **A**	+	+	.	+	+
P. acerina	**A**	+	.	.	.	.
P. pini (formerly *P. citricola*)	**W**, A	+	+	+	+	.
P. rosacearum	C	+	.	.	.	.
P. chlamydospora	C, A	+	+	+	+	.
P. gonapodyides	W	+	+	+	+	.
P. taxon walnut	W, A, **P**	+	+	.	+	.
P. xcambivora	**C**, A	+	.	.	.	.
P. niederhauserii	**A**, **P**	+	+	.	.	.
P. mediterranea	**A**, **P**	+	+	+	+	.

The *Phytophthora* species listed in this table are reported to cause disease on walnut (W), cherry (C), almond (A), or pistachio (P). If the crop is **bold**, the *Phytophthora* species is particularly aggressive on that crop. A plus (+) indicates that the *Phytophthora* species was detected at least once in that waterway. A period (.) indicates that the species was not detected in that waterway. Nineteen other *Phytophthora* species (not listed) were detected, but these are not known to cause disease on orchard crops.

Objective 2. Test for live *Phytophthora* coming through irrigation emitters

In objective 1 we determined that *Phytophthora* is common in the SEWD waterways. However, very few studies have looked at whether *Phytophthora* in a waterway can get into an orchard through the irrigation system. This is especially true of drip irrigation systems, which require substantial filtration of surface water to keep emitters from plugging.

During the 2021 and 2022 irrigation seasons, we collected water directly from irrigation emitters during a normal irrigation and tested this water for the presence of live *Phytophthora*. This was done in three surface-water-irrigated orchards, two with drip emitters and one with sprinklers, as well as two groundwater-irrigated orchards, one with drip emitters and one with sprinklers.

Orchard sampling stations used to detect live *Phytophthora* in water from **A**, sprinklers and **B**, drip emitters.

We found that *Phytophthora* commonly survives the journey from surface water sources into the orchard, and that the irrigation system type did not seem to matter. Also, the presence of a sand media filter did not seem to affect how regularly we detected live *Phytophthora* coming through irrigation emitters.

Summary of *Phytophthora* detections in water collected from irrigation emitters

Site	Irrigation water type	Water source	Emitter type	Emitter specifications	Sampling date	Sand media filter	*Phytophthora* detected
1	Surface	Calaveras River	Sprinkler	Nelson R2000 5/64" nozzle	9/27/21	No	**Yes**
					7/6/22	Yes	**Yes**
					9/13/22	Yes	No
					10/3/22	Yes	No
3	Surface	Calaveras River	Drip	Toro 2GPH	9/13/22	Yes	**Yes**
					10/3/22	Yes	**Yes**
4	Surface	Potter Creek	Drip	Jain 0.5GPH	9/30/22	No	**Yes**
					10/5/22	No	**Yes**
5	Ground	Well	Drip	Jain 0.5GPH	10/11/22	Yes	No
2	Ground	Well	Sprinkler	Nelson R2000 5/64" nozzle	7/6/22	No	No
					9/17/22	No	No

Objective 3. Test orchard soils for *Phytophthora*, compare orchards irrigated with surface water vs groundwater

In objectives 1 and 2 we determined that *Phytophthora* is common in SEWD waterways and that it can survive the trip through an irrigation system and into the orchard. However, in most cases *Phytophthora* must survive in the soil to infect the orchard when conditions are right. Even though we knew that irrigation with surface water is bringing *Phytophthora* into orchards, we didn't know if this affects the incidence of *Phytophthora* in orchard soils.

In 2021, we collected soil from 20 SEWD orchards exclusively irrigated with groundwater for at least 60 years and from 20 SEWD orchards mainly or exclusively irrigated with surface water over the same timeframe. This soil was tested for the presence of *Phytophthora* species using both the DNA sequencing from objective 1 and the live detection methods from objective 2.

We found that *Phytophthora* is common in orchard soils, with 32.5% of sampled orchards (13 out of 40) testing positive. We also found that the source of irrigation water did not affect the chances of finding *Phytophthora* in the soil: groundwater irrigated orchards were as likely to have *Phytophthora* as orchards irrigated with surface water. This indicates that irrigation with surface water was not the main factor determining whether *Phytophthora* was present in orchard soils and that irrigation with surface water may not increase risk of Phytophthora disease in orchards.

Summary of total *Phytophthora* detections from orchard soils

	Groundwater	Surface Water
Number of orchards sampled:	20	20
Number of orchards positive for *Phytophthora*:	7	6
Phytophthora species found:	***P. cinnamomi***	***P. cinnamomi***
	P. pini	***P. pini***
	P. cactorum	***P. cactorum***
	P. rosacearum	
	P. nicotianae	

Phytophthora species in **bold** are particularly aggressive on orchard crops

The results from this study confirm that *Phytophthora* is common in surface water but show that irrigating with surface water was not the main factor determining whether *Phytophthora* was present in an orchard. Where is the *Phytophthora* coming from? It is hard to know, but historical flooding may play a role. We also know that *Phytophthora* can be moved into an orchard on planting material and in soil on equipment. Where does this leave us in terms of management? This study shows that *Phytophthora* is very common in orchard soils, regardless of the source of irrigation water. Since over 30% of tested orchards were positive for *Phytophthora*, it would be prudent to assume you have *Phytophthora* in your orchard. Saturated soil allows *Phytophthora* to infect and cause disease, so good irrigation management is crucial to prevention. By "good irrigation management", I mean that you want to reduce the length of time that orchard soils are fully saturated and avoid having standing water. This can be done by using irrigation emitters with output volumes suited for your soil infiltration rate and by irrigating more frequently for a shorter duration (24 hrs maximum). In addition, you want to apply irrigation water in the root zone but away from the trunk to reduce the opportunity for infection of the trunk or major roots. This can be done using stream splitters with sprinklers to protect the trunk, choosing a microsprinker wetting pattern that avoids the tree trunk, or moving drip emitters away from the trunk of the tree. At planting, consider using a resistant rootstock, and plant on berms. Note that even if you are using a resistant rootstock, good irrigation management is crucial because no rootstock is immune.

I want to leave you with this thought: **irrigating well is much more important for preventing *Phytophthora* than the source of your irrigation water**. I have been to many surface-water-irrigated orchards with no symptoms of *Phytophthora*. Some of the worst orchards I have seen, in terms of Phytophthora disease, were irrigated with groundwater with the driplines right against the trunk on 3rd leaf trees. Irrigation management is *Phytophthora* management.

Thank you to my collaborators on this project, Greg Browne (USDA-ARS) and Mohamed Nouri (UCCE San Joaquin County). Special thanks to Justin Hopkins with the SEWD for his help planning and executing this project. Thank you also to the SEWD growers who welcomed me into their orchards for sampling. This work was partially funded by the Stockton East Water District.

Save the Date!

2026 Nickels Field Day will be **Tuesday, May 19,** in Arbuckle on the Green Bay Road.

Talk topics will include both almonds and walnuts.

These newsletter articles, and the latest *orchard* announcements, events, and resources are available at our website

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