Sacramento Valley Walnut News

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In This Issue

Submitted by:

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Orchard Management Considerations: Budbreak through Early Summer

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APRIL

- ✓ Stay on top of your **blight sprays**, especially if we have rain around "prayer stage" of leaf out. More details on Walnut Blight at www.sacvalleyorchards.com/walnuts/diseases-walnuts/walnut-blight-management.
- ✓ The first flight of **codling moth** typically starts between mid-March and mid- April and will have two peaks (1A and 1B). Male biofix is the first day male moths are consistently found in traps and sunset temperatures reach 62°F. In orchards *not* using mating disruption *with* more than 3% damage last season, treating 1A *and* 1B flights may be warranted if pheromone traps (1X or L2) are catching more than an average of 2 moths/trap/night. Treat 1A larvae about 250 to 300 DD after biofix, depending on material. Some newer "reduced-risk" chemistries are more effective applied on the early end. If 1A treatment is not needed based on orchard history and/or trap catches, delaying treatment until 1B or second flight will minimize interference with walnut aphid parasitoids. For more information, see http://ipm.ucanr.edu/PMG/r881300211.html.
- ✓ Consider putting out **navel orangeworm (NOW)** pheromone traps (Biolure or L2), at least in more susceptible varieties and/or blocks with a history of NOW damage. See Winter 2016/17 NOW Update article for more information: http://cesutter.ucanr.edu/newsletters/Sacramento_Valley_Walnut_News66483.pdf
- ✓ Limbs that have been killed by **Bot canker** are easy to identify between budbreak and full leaf expansion. But wait to prune out infected limbs once rain is no longer forecasted, i.e. early summer. For more on Bot, see the article in this newsletter.
- ✓ If timing **Bot treatment** based on the Leaf Wetness Model, watch for storms that bring ≥¼" rain and temperatures ≥50° F. See the Bot article in this newsletter for more on treatment timing.
- ✓ For orchards with **standing water**, take pictures to document the flooding. This will help with diagnosing problems later in the season and is needed if applying for disaster relief programs. Photos taken on your phone will usually have a "created" file date that will help with record keeping. For more, see the article on flooded orchard damage in this newsletter.
- ✓ Apply **Foliar Zinc** (if needed, based on leaf sample analysis) when shoots are 6 to 10 inches long, when zinc can be easily absorbed through the leaf surface. If the deficiency is severe, additional sprays can be applied two more times every 2 to 3 weeks.
- ✓ Perform **irrigation system maintenance** now, before irrigation is necessary and system problems could cause tree stress. Check for broken or clogged filters and emitters. See http://micromaintain.ucanr.edu/ for more tips on maintaining micro-irrigation systems.

- ✓ Scout for **scale crawlers** by putting out double-sided sticky tape in late April, if scale has been a problem and you didn't treat for scale during the dormant season.

MAY

- ✓ Watch traps for the **codling moth** 1B peak about 600 to 700 DD after the first biofix. If a significant 1B flight peak occurs (and damage exceeded 3% last season), consider treating when residual effectiveness of the first treatment has elapsed. If a 1A spray was not applied, 1B treatment should be approximately 650 to 700 DD from first biofix (confirm with trap activity; ideal timing depends on material). More at http://ipm.ucanr.edu/PMG/r881300211.html.
- ✓ Apply the first round of **nitrogen fertilizer** in May, not before. Walnut trees only use stored nitrogen the first month after leaf-out, meaning N applied before May will likely be leached by rain and/or irrigation. Walnut tree nitrogen use is fairly steady over the growing season. Evenly dividing nitrogen application in 3-4 doses between May and the end of August will improve N uptake compared to 1-2 applications.
- ✓ Apply a fungicide spray for **Bot canker** and blight around mid-month in orchards with moderate to heavy infection.
- ✓ Survey **weeds** to see which weeds were not controlled by fall or winter treatment. The UC Weed ID Tool at http://weedid.wisc.edu/ca/weedid.php can help with identification.
- ✓ **Aphid** sampling should begin this month and continue throughout spring and summer. Collect 5 first sub-terminal leaflets (one back from the last leaflet) from 10 trees, checking the top surface for dusky-veined aphids and the underside for walnut aphids. Make treatment decisions following guidelines at http://ipm.ucanr.edu/PMG/r881300511.html.

JUNE

- ✓ Hang **Walnut Husk Fly** traps by June 1. Yellow sticky traps charged with an ammonium carbonate lure work best. Check traps 2 to 3 times per week and treat based on detection of eggs in trapped females or overall trap catch numbers. For more details on treatment decision-making, see http://www.sacvalleyorchards.com/walnuts/insects-mites-walnuts/walnut-husk-fly-biology-monitoring-and-spray-timing/.
- ✓ Keep monitoring **codling moth** traps, to determine when the second biofix occurs (an increase in trap catches between 800 to 1300 DD after first biofix). Gauge whether treatment is necessary by examining nuts in trees or dropped nuts, following the table at http://ipm.ucanr.edu/PMG/r881300211.html.
- ✓ Apply a fungicide spray for **Bot canker** and blight around mid-month in orchards with moderate to heavy infection. Mid-June is the timing if only applying one spray in orchards with light Bot infection.
- ✓ Look for **spider mites** and their predators on the leaflets already being examined for aphids. Examine an additional 5 leaflets from higher branches for a total of 10 leaflets from 10 trees. Monitor weekly through August. Treatment guidelines based on spider mite and predator presence, as well as organophosphate or pyrethroid use can be found at http://ipm.ucanr.edu/PMG/r881400111.html.

Walnut Blight Management

Richard P. Buchner – UCCE Farm Advisor Tehama, Glenn and Butte Counties

Symptoms and Damage

Walnut blight is the result of infection by the bacterium *Xanthomonas arboricola* pv *juglandis* (*Xaj*).All green tissue is susceptible to infection, including buds, flowers and leaves but nut infections are the most serious, usually resulting in economic damage. Early in the spring, infected walnuts develop a dark sunken lesion at the blossom end ("end blight") killing the developing kernel. As walnuts mature, blight lesions can develop elsewhere on the husk surface ("side blight"). Husk lesions begin as small water-soaked spots that later darken, enlarge, sink and often crack. Infections that do not invade the kernel may increase the possibility of secondary insect or disease damage. Drought years do not favor infection but years with extensive spring rainfall can be disastrous if management action is not taken.

Disease Cycle for Walnut Blight

The walnut blight pathogen, *Xaj*, survives the winter in the outer bud scales of dormant buds. As the new shoot elongates after bud break, *Xaj* are water transported from the outer bud scales to green tissue, flowers and developing nuts. Disease control requires applying spray materials to protect green tissue. A successful walnut blight control program focuses on protecting developing shoots and flowers and decreasing *Xaj* bacteria over-wintering in dormant buds.

Disease Control

The probability of infection depends upon how much pathogen exists on individual buds and environmental conditions favoring bacterial spread and infection. First blight sprays are timed to coincide with early shoot emergence. This places a protective layer of bactericide on emerging green tissue. Since all shoots do not emerge at the same time, a good compromise is to apply the first spray application when 40% of the shoots on the tree are at the "prayer stage" when unfolded leaves resemble hands held in prayer. A second spray is applied about 7 to 10 days later to protect the remaining opening buds. Additional sprays may be necessary depending upon the initial inoculum, disease history, weather conditions and variety. It is possible that half spray programs favor increasing populations of *Xaj* and the half spray-sub lethal exposure approach is an excellent way to select for resistance to the only effective spray program we have for walnut blight.

Material Choice

Copper formulations tank mixed with mancozeb are the best currently available spray materials for walnut blight management. Resistance to copper alone is very common in California and is thought to be responsible for poor walnut blight control in the early 1990's prior to EBDC tank mixes. Under heavy blight pressure, using maximum rates allowed by the label is suggested. In February, 2017 the Department of Pesticide Regulation approved requests by multiple County Ag Commissioners for emergency application of fungicides to orchards with standing water. The end date is June 1, 2017. Contact your County Agricultural Commissioner's office in Butte, Colusa, Glenn, Merced, San Joaquin, Stanislaus, Sutter, Tehama, Yolo and Yuba Counties for additional information.

Why Walnut Blight Management Sometimes Fails

1) First spray timing too late.

2) Walnut blight bacterial population increases in dormant buds resulting in high initial disease pressure.

3) Material rates too low.

4) Poor spray coverage by air or ground.

5) Using a weak bactericide in high blight potential orchards.

6) “Half sprays” due to every-other-row application.

7) Not tank mixing copper compounds with a Mancozeb formulation.

8) Dense tree canopies.

Monitoring Codling Moth In and Near Mating Disruption Orchards

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It is important to understand how mating disruption affects the ability to monitor codling moth in walnut orchards under mating disruption (MD) as well as in orchards in proximity to MD. Researchers are currently investigating just how far-reaching the impacts of mating disruption are to nearby non-MD blocks. Pheromone-only trapping methods will certainly be impacted in MD blocks, and can be affected in nearby non-MD environments (without the added benefit of substantial disruption, and thus population and damage reduction). Other monitoring methods are necessary in and near MD orchards to effectively manage codling moth populations.

Disruption of sexual communication in moths is thought to function by the following broad types of behavioral mechanisms, and combinations of the two mechanisms:

- Competitive attraction (false-plume-following), in which males are diverted from orienting to females because they are attracted to competing ‘false’ trails emitted by synthetic pheromone dispensers.
- Non-competitive mechanisms, whereby exposure to synthetic pheromone inhibits or blocks the ability of males to sense and/or respond normally to pheromone emitted from females. These include camouflage, desensitization (i.e., adaptation and habituation), and sensory imbalance.

In a practical sense, the presence of synthetic pheromone in and around the orchard environment, if effectively impacting mate location/mating success, will impact our ability to use pheromone lures to track population abundance and activity. Codling moth (CM) females emit sex pheromones which elicit responses from males of the species. Therefore, pheromone traps predominantly track only male activity. Successful MD will shut down pheromone traps to zero or very low male catches relative to non-MD environments. In a MD orchard, you will want to monitor pheromone-only traps to gauge this measure of MD effectiveness. However, it is also critical to be able to track flights and relative population abundance to determine if supplemental insecticide treatments are necessary, and to properly time the applications.

Fortunately, there are options available for monitoring CM in/near MD that can overcome trap shutdown by (1) incorporating non-pheromone based lures to trap males, females, or both sexes; and (2) employing additional surveillance methods (non-trap-based) to gauge pest pressure and inform treatment decisions.

- Combination lures:
  - Both female and male moths respond to pear ester. This is available in the CM-DA combo lure (contains codlemone, the codling moth pheromone, plus pear ester, a plant volatile-based kairomone). Traps baited with these lures should be used in orchards under MD in addition to pheromone only traps (baited with 1X or L2 lures), necessary to detect trap shutdown as a proxy for efficacy of the MD treatment. If you are concerned with the performance of pheromone-only CM traps in non-MD orchards, consider adding some CM-DA traps, particularly if you suspect you are in proximity to an MD block that is affecting your pheromone trap catches.
  - Another option is the three-way lure (CM-DA combo plus acetic acid, AA). Think of this as a 'super-charged' lure, which can provide more robust capture in terms of numbers of males and females (in both MD and non-MD orchards).
  - With both the CM-DA and CM-DA+AA lures, be cautious in your evaluation of trap numbers. Numbers may be higher or lower than pheromone trap catch numbers, depending on your particular environment (MD, non-MD, near MD), and may not directly correlate with the same moths/trap/night thresholds you are accustomed to.
- Non-trapping methods:
  - These surveillance methods involve in-season damage/population estimates via dropped nut counts and canopy counts looking for strikes (visible as small chimneys of frass at the CM entry point). These monitoring methods can and should be incorporated into your IPM program to aid in treatment decisions, regardless of presence of MD and the trap-lure combination you are using.

More information and details regarding these monitoring and treatment options for codling moth are available online in the UC IPM Guidelines (ipm.ucanr.edu/PMG/r881300211.html).

Some thoughts on best practices for lure-based trapping and monitoring in general.

- **Storage and handling.** Always follow manufacturer guidelines for storage and handling of lures. Most lures are best kept refrigerated or frozen (in non-cycling freezers). It is best to order fresh lures each year, as keeping lures for multiple years can impact performance. If lures are particularly 'hot' initially, pre-age lures (open packaging and let them sit out for a day or so) prior to deploying in the field to avoid misinterpretation of activity peaks. Use new traps every year and wear disposable rubber gloves when handling lures and traps to avoid cross-contamination (this will help prevent by-catch of non-target species).
- **Interpreting catches and perceived failures.** If you are encountering trap catch data that seems unusual, first consider any potential storage, handling, or contamination issues. Next consider other factors, such as new MD blocks in proximity to traps and unusual environmental conditions. Most manufacturers have strict quality control practices; if you have eliminated all other sources of a problem, contact your lure supplier.
- **Adopting new trapping techniques.** When possible, adopting new monitoring techniques should be a multi-year process, in which new trapping method(s) are introduced alongside those for which historical data is available to help you best understand new results.
- **Pesticide applications.** Ensure that you are accounting for all treatments and field activities when interpreting trap catches and population activity.
- **Interpreting data and making pest management decisions in the field is as much art as science.** Although researchers seek to provide the best decision-making guidelines, in reality, there are no exact thresholds and every situation is different. Individual pieces of information, while valuable, often do not provide robust enough evidence to support a "treat" vs. "don't treat" recommendation. Incorporating knowledge from trap data, other surveillance methods, orchard history, and environmental conditions is critical to developing effective pest management programs that you are confident in recommending.

The Latest on Managing Bot Canker and Blight in Walnut - 2016 Research Updates

Janine Hasey, UCCE Farm Advisor, Sutter/Yuba/Colusa Counties
Themis Michailides, Plant Pathologist, UC Davis/Kearney Research and Extension Center, Parlier

Bot background
Rainfall favors *Botryosphaeria* (Bot) and Phomopsis canker and blight of walnut when temperatures are over 50° F, so be alert to disease spread this spring and summer. Bot reduces yields by killing small fruit wood and large branches and directly infecting the nut. It is most obviously seen in walnut orchards as blighted shoots (dead branches with the leaves still stuck on), blighted twigs (dead, darkened and shriveled, Photo 1) and fruit with the entire hull blackened but still on the tree. Fruit can also have early season latent infections, but tissue death won't be visible until late summer/early fall. The focus of this article is on 2016 Bot research findings.

Spore types
Both pathogens (Botryosphaeria & Phomopsis) produce abundant water-splashed pycnidiospores and wind-borne ascospores. Practically-speaking, this means Bot can *spread* by spores dripping and splashing OR by blowing around in the orchard. Both spore types need water to trigger infection.

Conditions needed for disease
Bot infection requires susceptible tissue, presence of infective Bot spores, and the right environmental conditions - at least ¼" of rain (or irrigation water directly on susceptible tissue) and temperatures at or above 50°F.

Disease management practices

Management integrates cultural (pruning) and chemical control practices.

- Cultural control – reduce inoculum by pruning out dead branches, branch stubs, and blighted shoots in the summer or fall when not raining; disinfect pruning equipment; avoid sprinkler irrigation that wets the canopy.
- Chemical control – apply effective fungicides at proper timing adjusted for weather and Bot inoculum level in orchard. There are several fungicides that have reduced blighted spurs compared to the control in studies and their efficacy can be seen at http://www.ipm.ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf in the walnut section.

What's New - 2016

Fungicide spray timing
Timing sprays based on rain and temperature delivered the best control.

- **This may be the most important finding if we continue the have a wet spring**: In the Leaf Wetness Model (LWM), sprays were only applied when there were environmental conditions conducive to disease (≥¼" rain and temperatures ≥50° F). This resulted in three sprays in both 2015 and 2016. A fungicide is applied within 2-3 days of a rain event and estimate a 2 week residual.
- Use the LWM graph in Figure 1 during a rain event to pinpoint the BOT risk zone and determine whether a spray is needed.
- Figure 2 shows how rain events triggered three sprays in 2016. The only reason the high rainfall, high risk event on May 5-7 was not sprayed is because it was within the 2-week fungicide residual period of an earlier spray. Note that if a point falls on the line separating low and medium risk, i.e. during the rain event on May 21, a spray is also applied.
- The three spray dates triggered by the LWM in 2015 were April 9, April 26 and Sept 17.

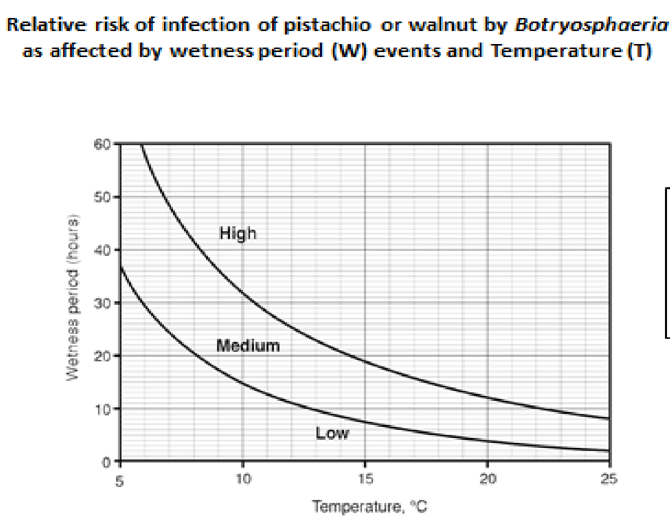
- The LWM was more economical than the 4 calendar sprays that gave equal control: April (bloom)+May+June+July or May+June+July+November (post-harvest).

If only applying ***one fungicide spray, the second part of June to first part of July*** *had the most effect, when tested in both a low (8% infection when unsprayed, 2015) and high (38% infection when unsprayed, 2016) disease year in the same orchard.*

- When sprayed just once at either bloom, mid-May, mid-June, mid-July, mid-August or post-harvest (October or early November), both the **mid-June** and **mid-July sprays** significantly decreased blighted shoots when compared with no spray treatment.

Bot inoculum and brush disposal/spray scenarios: *Chipping pruned wood reduces ability to cause infection by only two-thirds, so brush removal is still best option in light to moderate infected orchards. Always prune or hedge your more lightly infected orchards before moving to heavily infected ones. Watch for rains and spray according to leaf wetness model if possible.*

- Heavily infected orchards (>50%): Chip prunings and may leave in orchard since already high inoculum. Use a full spray fungicide program. (From experience, when inoculum on the trees is very high, there is a saturation point beyond which additional spore loads reaching the canopy do not cause more infection).
- Moderate (20-50%) infected orchards: Do not chip prunings but remove from the orchard and burn them if permitted. Some fungicide spraying.
- Light (1-20%) infected orchards: Do not chip prunings but remove from the orchard and burn them if permitted. Use one mid-June or early to mid-July spray.
- No Bot infection (mostly only applies to young orchards): Chip prunings and leave in orchard. No sprays are needed.



°C	°F
5	41
10	50
15	59
20	68
25	77

Figure 1. Based on rainfall amount and temperature, use this LWM graph during a rain event to pinpoint the BOT risk zone and determine whether a spray is needed. A spray is applied when points fall in medium and high risk. If a point falls on the line separating low and medium risk, a spray is also applied (see Figure 2).

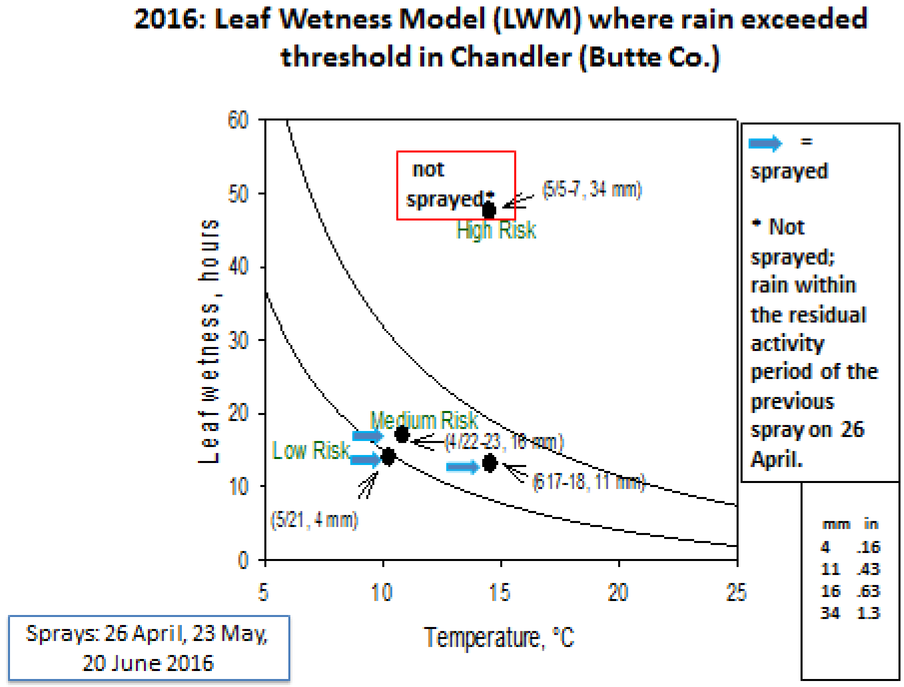


Figure 2. In 2016, the LWM triggered four risk events but only three sprays were needed. The high risk event fell in the period when there was residual fungicide activity.

Photo 1: Spurs killed by Bot or Phomopsis. These will be evident during leaf-out.
Photo by Themis Michailides

Flooded Orchards: Past Experiences and What to Do in 2017

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Greg Browne, USDA Plant Pathologist, UC Davis

Experiences with the 1986 and 1997 levee breaks in Yuba and Sutter Counties and other "high–water" events over the past thirty years afford us some expectations for the types and extents of tree damage that may result from orchard flooding in 2017. This article will first discuss some generalities of flooding damage and two key types of damage that tend to follow prolonged orchard flooding, i.e., waterlogging and Phytophthora diseases. Next, the article reflects on the floods in 1986 and 1997 and considers ways in which specific conditions associated with those floods seemed to affect orchard outcomes. Finally, we offer management steps to consider in dealing with orchard flooding in 2017.

Flood Damage Generalities

Tree damage from flooded soil is usually minimal if the flood occurs when the trees are dormant and the water continues to flow rather than remains standing in the orchard area. However, where water stands for extended periods in an orchard, two potential problems are of concern: 1) waterlogging of the root system, and 2) diseases caused by *Phytophthora*.

Waterlogging. Waterlogging can be viewed as an "oxygen starvation" effect of flooding. When an orchard soil is flooded or otherwise saturated with water, the air in its pore spaces is displaced, removing the supply of oxygen to the roots. The terminal portions of new walnut roots can be killed within one to four days in a saturated soil. As saturation is prolonged, damage to roots becomes greater and can lead to chlorosis, leaf wilting, and in extreme cases, entire root systems can be killed. As soil temperatures increase, the negative effects of waterlogging are accelerated. Walnut trees apparently survive waterlogging events during winter due to a combination of low soil temperature and a lack of active roots.

Waterlogging risk tends to be greater in "heavy" or compacted soils because of slower reentry of oxygen after saturation. Following floods in previous years, we observed less injury to trees growing in deep, permeable soils than to trees growing on soils with impaired vertical drainage caused by a claypan or hardpan.

Waterlogging damage to walnut trees can vary in severity, may not be immediately manifest, and can be difficult to discriminate from Phytophthora damage. For example, decline of walnut trees is sometimes not obvious until late spring or summer, when backhoe excavations can be used to confirm suspected waterlogging damage on walnut root systems. Boundaries between dead, waterlogged portions of major roots and crowns and living parts of the same roots tend to be poorly defined and occur in the absence of distinct cankers and lab diagnostics that indicate Phytophthora crown and root rot. Waterlogged tissues often have swollen lenticels (Photo 1).

Phytophthora diseases. Several species of the "water mold" *Phytophthora* are found in surface water sources such as our rivers and canals, as well as in infested soils. These fungal-like organisms can be carried along by the water and swim in it. After a levee break, the river water is a potential source of spreading *Phytophthora* inoculum throughout the flooded area. Flooding can bring active *Phytophthora* inoculum in contact with the aerial portions of trees, resulting in infections of the tree trunk, scaffolds and shoots. Flooding also increases the risk of root and crown infections by *Phytophthora*. Some Phytophthora species preferentially infect roots, but many preferentially infect the root, crown, or aerial tree parts.

When *Phytophthora* infects woody tissues of trees above or belowground, it typically causes cankers (i.e., continuous, often-elliptical areas of dead bark, ranging from less than an inch to more than a foot across). The cankers often "bleed". Removing the outer bark from the margin of a canker typically reveals a distinct, zonate (with concentric lines) margin, which is in contrast to the typically diffuse, non-zonate margin and vascular streaking evident at the edges of dead areas of waterlogged roots.

In general, cool to moderate temperatures and water-saturated conditions in or on soil favor tree infection by *Phytophthora* species. Some *Phytophthora* species are more virulent than others, and risk of disease also depends on genetic resistance of the rootstock or scion. Within a given rootstock or scion, susceptibility to *Phytophthora* can vary with time of year. For example, in experiments on seasonal variation in susceptibility of walnut, almond, and peach rootstocks to *Phytophthora citricola* (which can cause root and crown rot and trunk and branch cankers), the rootstocks were least susceptible to infection during wintertime and most susceptible during the growing season. In contrast, infection by *Phytophthora syringae* in almond and peach is most likely during the cool conditions of fall, winter, and early spring. These cankers cease development when summer temperatures become lethal to this "cool-temperature" pathogen.

Reflections on 1986 and 1997 flooding

1986. A subtropical storm brought heavy precipitation to northern CA and moderately high snow levels lasting for nearly 10 days, from February 11-20. Rainfall in the northern Sierra Nevada at 5,750 feet registered almost 56 inches. The water roared down the Yuba River where the levee broke February 20 in the evening flooding Linda and Olivehurst and acres of orchards. Walnut and prune orchards were flooded for 45 days from late February through mid-April.

1997. A polar system left several feet of snow in the Sierra on December 21-22, 1996. From December 26, 1996 through January 3, 1997, the weather pattern shifted to warmer and wetter storms of tropical origin that brought relentless precipitation, excessive runoff, and significantly melted the snow pack leading to widespread flooding. Oroville dam was spilling 160,000 cfs by January 1 and water was again roaring down the Yuba River. Late on January 2, a levee broke on the Feather River at Country Club Road in Yuba County flooding thousands of acres of orchards. Three weeks later, another levee gave way on the Bear River, causing more flooding in some of the same areas. In Sutter County, the west side of the Sutter Bypass levee broke in early January flooding the Meridian basin.

Based on what we learned from orchard responses to the widespread flooding in 1986 and 1997 and less-extensive flooding of river bottoms in several additional years, we have some expectations of the problems growers will face in orchards flooded this year. A major difference between the 1997 flood and that of 1986 was that the flood occurred in later February in 1986, when many tree crops were becoming active.

In 1997 by March, we observed waterlogging damage on collapsing peaches on heavier soil that had only been flooded a short time in January. Where trees are actively growing and then flooded, as in the river bottoms during our wet springs such as in 1995, most of the trees that died were in low areas where the water sat for prolonged periods. Those trees that were only in the fast-moving, cold water did fine, except for the submerged shoots.

After the 1986 levee break, water sat for several weeks in certain low lying areas. In these areas, as the water receded, symptoms of aerial infection by *Phytophthora* were apparent in some orchards. Aerial infections by *Phytophthora* were indicated by bleeding cankers in aboveground parts of trees, i.e., on trunks, scaffolds, branches, limbs, and hangers, as opposed to crown and root infections, which originate in soil. The aerial *Phytophthora* cankers on walnuts and prunes in 1986 tended to occur in orchards that had been flooded for about 45 days, from late February through mid-April (Photos 2A &2B).

After the 1997 levee breaks, we sampled flood waters in several orchards in the Arboga area (Yuba Co.) and Meridian (Sutter Co.) in early February. Using pear fruit to "bait" the *Phytophthora*, we found that every orchard location had species of the pathogen present. By mid-February 1997, we observed the first symptoms (amber colored gum) of aerial infections by *Phytophthora* on peaches, and soon afterwards the symptoms were seen on prunes. Cutting into the tissue below the gumming revealed reddish brown cankers. Many of these cankers, more on peach than on prune, continued to look active. With peaches in the flood zones and the river bottoms, there were multiple aerial *Phytophthora* infections on every tree in every orchard we surveyed, regardless of orchard age. Many of these orchards were flooded less than a week. By March 1997, we still had not seen aerial *Phytophthora* in flooded walnuts (bleeding in limbs and branches), suggesting that dormancy had offered them some protection from *Phytophthora*.

2017 flooding and management considerations

Flood overview. From a series of tropical storms, we have experienced record-breaking rainfall events in January and February which have resulted in very high river flows for many weeks. At this writing, orchards **outside the levees** along the rivers either are or have been flooded from river seepage due to high flows and/or overflowing ditches/canals. With the record-breaking snow pack, there is uncertainty as to how long the rivers will have high flows or if we have a flood event during springtime. It likely will take months before the extent of losses from waterlogging and/or disease can be assessed. As the trees become active and the weather warms up, we can expect to start seeing losses that could continue through the hot summer when trees with damaged root systems or crowns typically collapse. From recent research, substantial root growth in walnuts begins about a month after leaf-out and peaks in the summer. This should work in our favor for orchards that are flooded or saturated this spring.

Management guidelines to consider

- Drain or pump standing water out of orchards.
- Reduce vehicle/farm equipment traffic. Wet soils are easily compacted. Delay all operations that can wait until soil is dry enough to crumble at a depth of five to six inches rather than slick over or pack.
- Apply sprays by air. The Department of Pesticide Regulation issued the emergency application of several fungicides to orchards with **standing water only** including Butte, Colusa, Glenn, Sutter, Tehama, Yolo, and Yuba Counties This will be in effect until June 1, 2017. See your local Ag Commissioner for more information on allowable fungicides.
- Apply a phosphonate spray in May where *Phytophthora* is found or suspected. A summer and early fall application may also be needed.
- Ridomil application is another option but is considered by some to be less cost effective than phosphonates for some Phytophthora diseases.
- Remove deposited silt and debris around the root crowns when possible to decrease the chances of root/crown decay.
- Plants are effective in drying waterlogged soils. Encourage the growth of cover crops or even weeds that will help dry the soil after flooding.
- Fill in eroded areas in orchards if soil is available. Deposited materials in many instances are beneficial.
- Check for salts (chloride and sodium); a continued high water table saturating surface soil may result in these salts accumulating or alkalization of certain spots which have shown these troubles before. Neither leaching nor gypsum treatments will be effective until the water table is lowered and good drainage can be achieved.
- For new orchards or replants where seepage is problematic, consider using clonal Paradox RX1; it has high resistance to *Phytophthora*, but more observations are needed to determine how it performs under prolonged waterlogging.

Additional resources

For additional resources please see Hasey's blog at: http://www.sacvalleyorchards.com/blog/walnuts-blog/ The blog covers several flooding-related issues not covered here, including guidance on documenting and reporting damage and losses, and locating possible disaster relief resources for flooded orchards outside and inside the levees, including riverbank sloughing, such as occurred extensively along the Feather River.

Photo 1. Swollen lenticels (white raised areas) on clonal Paradox roots.
Photo by Janine Hasey

Photo 2A (taken March 1986). In 1986 flood, some walnuts were flooded for 45 days. Photo 2B (taken May 5, 1986) This resulted in aerial Phytophthora bleeding cankers (see arrow) and tissue damage (evident where bark removed).
Photos by Janine Hasey

Nickels Field Day (May 10) includes Three Walnut Talks

The annual Nickels Field Day will be Wednesday, May 10 beginning at 8:30. The location is Green Bay Rd, Arbuckle

Walnut Talk topics are in the early morning session (9-10:30) and include:

- Walnut pruning/hedging
- Bot management
- Thousand cankers research update

There will also be an almond topic in the morning session (irrigation) and four almond-related topics in the late morning session (10:30-noon) including canker diseases, variety selection, and disease management. A no-host lunch (tri-tip), benefiting the Pierce High School FFA program will follow the talks. More information/detailed agenda will be available at http://www.sacvalleyorchards.com/ by early April.

PCA/PA and CCA credit hours will be available.

Airblast Sprayer Calibration Field Day Set for Tuesday, April 25

A sprayer calibration workshop, co-sponsored by BASF and University of California Cooperative Extension will be held Tuesday, April 25 from 7:30 AM – 1:00 PM at the Nickels Soil Lab (Green Bay site) in Arbuckle. Light breakfast and coffee at 7:30, program starts at 8 and will end at noon with lunch provided. From 1-3 PM, the instructor (Matt Strmiska from ADAPTIV (adaptiv.us) will be available for questions and additional demo requests. Four hours of PCA/PA and CCA hours have been requested. The morning program will include:

- Overview of equipment and best spraying practices
- In-field calibration exercises
- In-field observations of airblast spraying

Upcoming 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 Tuesday of each month from February through November 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!

Upcoming meetings:

- Tehama: April 11th, 7:30-9:00am
  - Rockin R Restaurant, 201 Antelope Blvd, Red Bluff CA
  - Space is limited, please RSVP to Emily Symmes (contact information below) by April 9th.
  - No-host breakfast
- Glenn: May 9th (field meeting, time & location TBA)
- Butte: June 13th (field meeting, time & location TBA)
- Colusa: July 11th (field meeting, time & location TBA)

Remaining 2017 meetings will be held in August (Yuba-Sutter), September (Tehama), October (Glenn), and November (Butte). Stay tuned to upcoming newsletters and sacvalleyorchards.com for details.
Additional information for each meeting will be available on the events page at sacvalleyorchards.com or by contacting UC IPM Advisor Emily Symmes at (530) 538-7201 or ejsymmes@ucanr.edu.

DPR and CCA Continuing Education hours requested

Tree and Vine Crop Herbicide Chart – Updated (2017)

Rotating and/or mixing herbicides with different modes of action (MOAs) is critical to good weed management, particularly of herbicide-resistant populations. But MOAs and labeled crops are not always easy to keep track of. Brad Hanson, UCCE Weed Specialist, has organized a chart to help, with herbicide name, common trade name, the site of action group and the crops for which an herbicide has been labeled for use. This chart is intended as a general guide only. Notes: R = Registered, N = Not registered, NB = registered *only for* Non-Bearing. This chart is a helpful tool, but remember that labels change often. Always check the herbicide label before use.

Herbicide Registration on California Tree and Vine Crops -*(updated March 2017 - UC Weed Science)*

	Herbicide- Common Name *(example trade name)*	Site of Action Group[1]	Almond	Pecan	Pistachio	Walnut	Apple	Pear	Apricot	Cherry	Nectarine	Peach	Plum / Prune	Avocado	Citrus	Date	Fig	Grape	Kiwi	Olive	Pomegranate
			----- tree nut -------				- pome -		---------stone fruit---------												
Preemergence	**dichlobenil** (*Casoron)*	L / 20	N	N	N	N	R	R	N	R	N	N	N	N	N	N	N	R	N	N	N
	diuron *(Kamex,Diurex)*	C2 / 7	N	R	N	R	R	R	N	N	N	R	N	N	R	N	N	R	N	R	N
	EPTC *(Eptam)*	N / 8	R	N	N	R	N	N	N	N	N	N	N	N	R	N	N	N	N	N	N
	flazasulfuron *(Mission)*	B / 2	N	N	R	R	N	N	N	N	N	N	N	N	R	N	N	R	N	N	N
	flumioxazin *(Chateau)*	E/ 14	R	R	R	R	R	R	R	R	R	R	R	NB	NB	N	NB	R	N	R	R
	indaziflam *(Alion)*	L / 29	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	R	N
	isoxaben *(Trellis)*	L / 21	R	R	R	R	NB	NB	NB	NB	NB	NB	NB	NB	NB	N	NB	R	NB	NB	NB
	mesotrione (*Broadworks)*	F2/27	R	R	R	R	N	N	N	N	R	N	R	N	R	N	N	N	N	N	N
	napropamide *(Devrinol)*	K3 / 15	R	N	N	N	N	N	N	N	N	N	N	N	N	N	N	R	R	N	N
	norflurazon *(Solicam)*	F1/ 12	R	R	N	R	R	R	R	R	R	R	R	R	R	N	N	R	N	N	N
	oryzalin (*Surflan)*	K1/ 3	R	R	R	R	R	R	R	R	R	R	R	R	R	N	R	R	R	R	R
	oxyfluorfen (*Goal, GoalTender)*	E/ 14	R	R	R	R	R	R	R	R	R	R	R	R	NB	R	R	R	R	R	R
	pendimethalin *(Prowl H2O)*	K1/ 3	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	R	R
	penoxsulam *(Pindar GT)*	B / 2	R	R	R	R	N	N	N	R	R	R	R	N	N	N	N	N	N	R	R
	pronamide *(Kerb)*	K1/ 3	N	N	N	N	R	R	R	R	R	R	R	N	N	N	N	R	N	N	N
	rimsulfuron *(Matrix)*	B / 2	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	N	N
	sulfentrazone *(Zeus)*	E/ 14	N	R	R	R	N	N	N	N	N	N	N	N	R	N	N	R	N	N	N
	simazine *(Princep,Caliber 90)*	C1/ 5	R	R	N	R	R	R	N	R[2]	R	R	N	R	R	N	N	R	N	R	N
Postemergence	**carfentrazone** *(S hark)*	E/ 14	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
	clethodim (*SelectMax)*	A / 1	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	N	R	N	N	NB	N	NB	N
	2,4- D *(Clean- crop, Orchard Master)*	O / 4	R	R	R	R	R	R	R	R	R	R	R	N	N	N	N	R	N	N	N
	diquat *(Diquat)*	D / 22	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB
	fluazifop- p- butyl *(Fusilade)*	A / 1	NB	R	NB	NB	NB	NB	R	R	R	R	R	NB	R	NB	NB	R	N	NB	NB
	glyphosate *(Roundup)*	G / 9	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
	glufosinate *(Rely 280)*	H / 10	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	R	N
	halosulfuron *(Sandea)*	B / 2	N	R	R	R	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	paraquat (*Gramoxone)*	D / 22	R	R	R	R	R	R	R	R	R	R	R	R	R	N	R	R	R	R	R
	pelargonic acid *(Scythe)*	NC[3]	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	N
	pyraflufen *(Venue)*	E/ 14	R	R	R	R	R	R	R	R	R	R	R	N	N	R	R	R	R	R	R
	saflufenacil *(Treevix)*	E/ 14	R	N	R	R	R	R	N	N	N	N	N	N	R	N	N	N	N	N	N
	sethoxydim *(Poast)*	A / 1	R	R	R	R	R	R	R	R	R	R	NB	NB	R	NB	NB	R	N	NB	NB
Organic	**Caprilic/Capric acid** *(Suppress)*	NC[3]	R	R	R	R	R	R	R	R	R	R	R	R	R	N	N	R	R	N	R
	ammoniated fatty acids *(Final- San-*	NC[3]	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
	d- limionene *(AvengerAG)*	NC[3]	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	N	N
	Ammonium nanoate *(Axxe)*	NC[3]	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	N