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Submitted by:

John Edstrom
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Colusa County

Walnut Husk Fly Field Meeting

Monitoring, New Control Methods, Impact on Quality

Wednesday, June 9th, 2010

Time: 9:30am -11:00am

22122 Karnak Road, Knights Landing (see map)

Agenda

Introduction and Regulatory Update

Janine Hasey, UC Farm Advisor

Jan Kendel, Ag Biologist, Sutter County Agricultural Dept

Biology of Walnut Husk Fly

Carolyn DeBuse, UC Farm Advisor, Yolo/Solano Counties

Trapping/ Monitoring/ Decision Making

Janine Hasey, UC Farm Advisor, Sutter/Yuba Counties

New Chemical and Baiting Control Methods

Bill Coates, UC Farm Advisor, San Benito County

Impact and Damage

Bill Coates, UC Farm Advisor, San Benito County

Sponsored by: University of California Cooperative Extension,
Sutter/Yuba and Yolo/Solano Counties

Co-Sponsored by: Sutter County Agricultural Department

PCA and Private Applicator credit approved: 1.5 hours

For more information call the Cooperative Extension Sutter-Yuba Counties Office (530) 822-7515

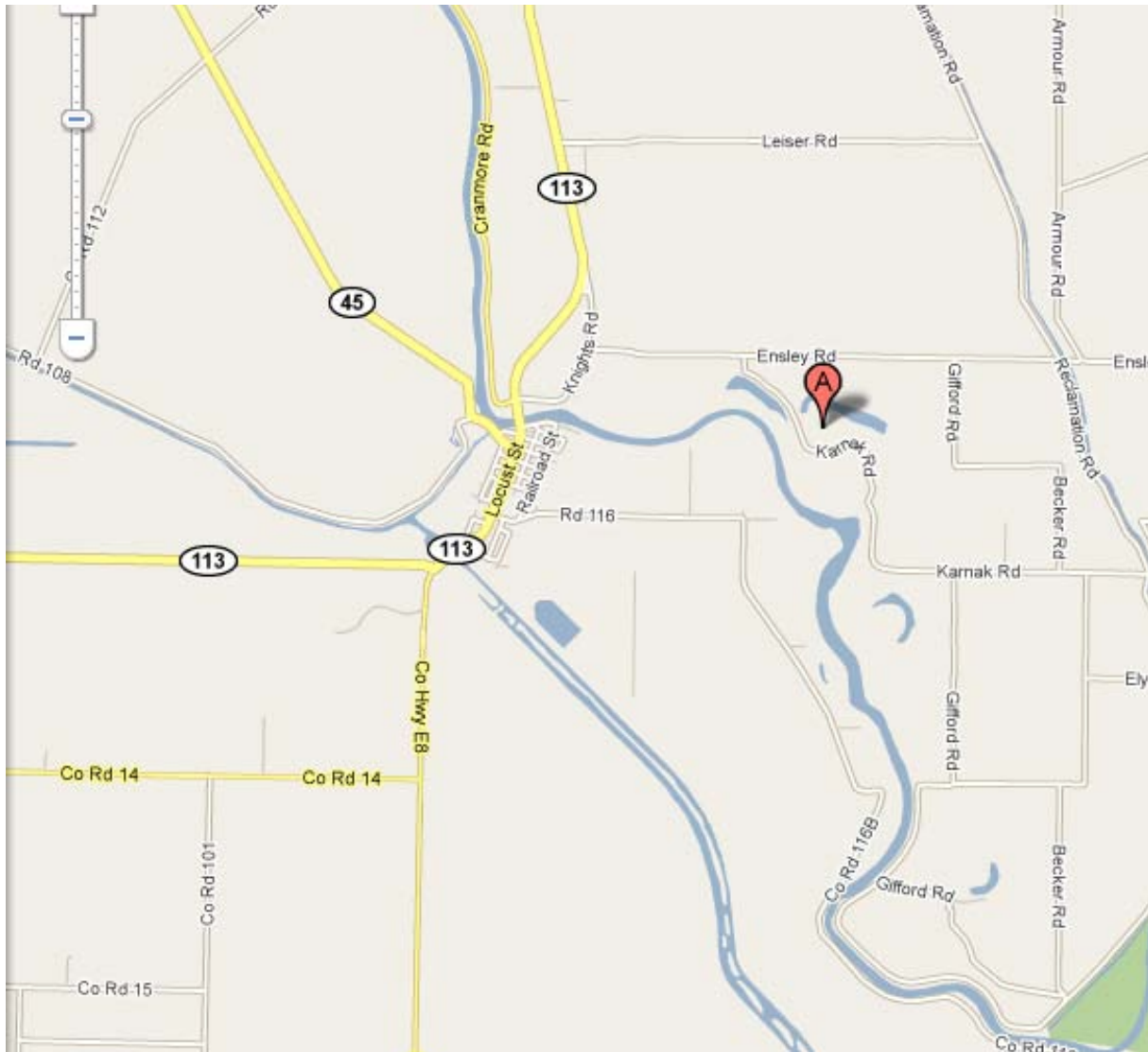
For those who are unable to attend and would like current information about the walnut husk fly and current control methods go to these two websites for articles.

http://cesutter.ucdavis.edu/newsletterfiles/Sacramento_Valley_Walnut_News14498.pdf

http://walnutresearch.ucdavis.edu/2009/2009_153.pdf

Walnut Husk Fly Field Meeting Monitoring, New Control Methods, Impact on Quality

Wednesday, June 9th, 2010
Time: 9:30am -11:00am
22122 Karnak Road, Knights Landing



Directions from north: Take 113 south from the 99hwy towards Nights Landing. Before the river turn left onto Knights rd. take a left on Ensley rd. and right on Karnak rd.

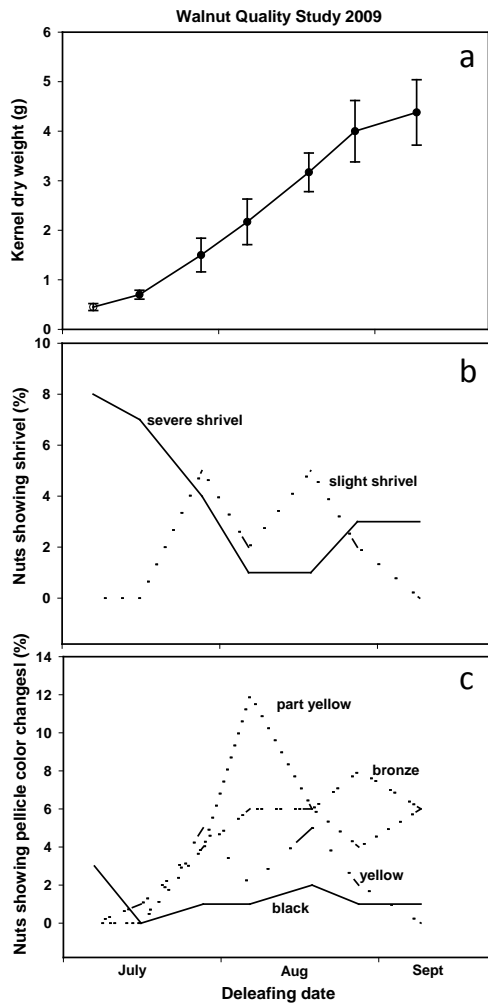
Directions from south: Take 102 or old 113 north from Woodland. Drive through Knights Landing and over the river. Take the first right onto Knights rd. Right onto Ensely rd. and a right on Karnak rd.

Orchard Management Impacts on Walnut Quality

Bruce Lampinen, Integrated Orchard Management/Walnut and Almond Specialist UC Davis, and Joe Grant, UCCE Farm Advisor San Joaquin County

Background- Walnut quality can be impacted by orchard management practices. Kernel shrivel and changes in pellicle (the covering on the kernel) color can be impacted by both water stress and shading. Monetary losses due to these problems can be substantial- we have seen cases where up to 70% of the nuts in an orchard had either shrivel or severely discolored pellicles as a result of severe water stress during late summer. Quality can also be impacted by sunburn which can also cause kernel darkening and/or various degrees of shrivel, depending on the nut exposure, but we will not discuss sunburn related problems in the present article.

Research trials- Research conducted in a Chandler walnut orchard in San Joaquin County in 2007-2009 showed that photosynthate reduction to the leaf was a likely contributing factor to undesirable pellicle color changes. The reduction in photosynthate to the leaf could be caused by leaf loss as a result of either water stress or shading, or by a combination of the two factors. The most common position on the tree to find these quality problems is low in the canopy, near the tree trunk. We also found problems with



pellicle color changes related to leaf loss in low canopy positions over the drive row where upper canopy branches had moved downward as the nut weight increased, eventually leading to shading of the lower branches and resultant leaf loss. In 2008, this was the most common position where nuts with yellow pellicles were found.

In 2009, a study was set up in the same San Joaquin County Chandler orchard described above. Spurs in lower canopy shaded positions were artificially defoliated on seven different dates starting in early July (Fig. 1a). The kernel dry weight accumulation for Chandler walnuts (on spurs that were not defoliated) on each of the defoliation dates is shown in Fig. 1a. It should be noted that the percentages are only for lower canopy shaded positions and percentages for the overall tree would be much lower.

Shrivel- As expected, defoliation during the time the kernel was increasing in dry weight resulted in various levels of shrivel. Severe shrivel was worst when defoliation occurred in early July when the kernel was just beginning to fill. Slight shrivel tended to occur with defoliation during late July through August (Fig. 1b). It is worth noting that even with total defoliation of the spurs in early July, only 8% of the nuts had severe shrivel suggesting that the tree was able to move photosynthate to the spur from other positions on the tree. This would agree with our earlier observations that the quality problems are much more severe if a stress event occurs during the July/August period when the tree is bearing a heavy crop as compared to a light crop.

Pellicle color changes- Pellicle color changes generally occurred after the hull became black and mushy as a result of lack of photosynthate.. This condition looks very much like husk fly damage but no husk fly larvae will be found in the husk if the damage is shading/stress related. Yellow pellicles tended to be worst when defoliation occurred in early August but occurred from about mid-July to early-September. (Fig. 1c). Black pellicles tended to increase with

defoliation from early July peaking with defoliation in mid-August and bronze pellicles peaking with defoliation in late August (Fig. 1c). Bronze pellicles tended to increase from the early July to late August defoliation dates (Fig. 1c). The condition known as oil-less nuts would be grouped within the bronze pellicle nut category. If you look at the period in early August in Fig. 1c, you can see that you could get varying levels of black, yellow, bronze or yellow nuts as a result of defoliation on that date. It is unclear what factors determine which of the pellicle colors occurs. There could possibly be an interaction with the proximity to other, functional leaves that can supply photosynthate to the defoliated spur.

Water management practices to minimize quality problems- In general good irrigation practices will help minimize quality problems. Avoid starting to irrigate too early in the season. Creating excessively wet conditions in the springtime leads to shallow rooting, poor tree growth and increased likelihood of water stress related problems later in the summer. Ideally, you should use a combination of soil and plant based measurements in the springtime to determine when to start irrigation. Later in the summer, during the kernel filling period, it is essential to minimize any irrigation related stress, either from too little or too much water.

Canopy management practices to minimize quality problems- Although light related quality problems in the lower canopy can be decreased by selective upper canopy pruning, it is likely that more crop would be lost due to the pruning than would be saved by the improved light in the lower canopy. In general, you should expect quality problems to increase in highly productive orchards (above 3 tons/acre) even with good water management. However, as discussed above, these problems can be minimized with proper orchard tree spacing and irrigation management.

Codling Moth Management

*Richard Buchner, Tehama County Farm Advisor and
Carolyn Pickel, Sacramento Valley Integrated Pest Management Advisor*

Codling Moth in walnut is difficult to control due to the long egg hatch period, the challenge of accurate spray timing and the necessity for good spray coverage. The most effective way to time codling moth sprays is to monitor traps and follow degree days to interpret trap data and predict egg hatch. The best chance for successful control is to monitor individual orchards and develop a feel for codling moth activity both during the season and historically. Each orchard has a different Codling moth dynamic. Area wide information is intended as guideline only and a “heads up” to activity in individual orchards.

Degree Days As with many organisms, temperature controls codling moth growth and development. Accumulated heat units are referred to as Degree Days (DD). One DD is one day (24 hours), with the temperature one degree above the lower developmental threshold. For example, if the minimum development threshold is 50° F and the temperature remains at 51° F for 24 hours, one DD is accumulated. As temperatures rise above the minimum threshold, more DD's are accumulated. In reality, 20 to 25 DD per day would be typical for a hot summer day in the Sacramento Valley. Codling moth thresholds are 50° F for the lower and 88° F for the upper threshold. Charts are available to calculate DD's using maximum and minimum temperatures. Inexpensive temperature sensors are available that directly output DD accumulations and local weather information and a DD calculator plus information on chemical mode of action are available at the UCIPM website <http://www.ipm.ucdavis.edu> . Click on pest management guidelines.

Codling Moth Traps and Lures The second component of a codling moth monitoring program includes traps. Traps are used to verify flight activity and monitor populations. Traps are hung high in the tree canopy and use pheromone, pear volatile, or a combination of the two as a lure. Pheromone lures (Codlemone) attract only male moths and work well in orchards that are not using a pheromone mating disruption (PMD) strategy or do not have neighboring orchards using PMD. So called “Combo” lures are

a combination of Codlemone and Pear volatile. These lures attract both male and female moths making it possible to follow both male and female flight activity. Combo lures are used in PMD orchards or where neighboring orchards are using PMD. PMD will “shut down” conventional pheromone traps making catch data unreliable. Pear volatile will continue to catch in a pheromone environment. High traps catch more moths so high placement is recommended particularly if moth populations are low. If possible, high traps are placed in the upper one third of the canopy. Delta traps catch more moths than the old wing style trap. Trap color doesn’t appear to affect trap catch. The orange color trap is less attractive to honey bees which keeps the bottoms cleaner and kills less honey bees. Unfortunately traps are not good indicators of damage probably because of the many factors that influence trap performance.

Codling Moth Activity Codling moth over-winter as fully grown larvae in bark cracks on tree trunks and limbs. Over-wintering larvae emerge as adult moths in the early spring. The monitoring season begins by hanging codling moth traps in orchards by mid-March before the first codling moths emerge. Get traps out early to record several dates with zero catch to confirm first moth catch. Bio-fix is the first date when moths are consistently found in traps. To predict egg hatch, begin accumulating DD’s from the biofix. If a spray is necessary, University of California Integrated Pest Management (UCIPM) suggests a treatment timing at 300 DD’s after the first male biofix (pheromone lure) and 250 DD’s after the first female biofix (pear volatile or combo lure). These spray timings are appropriate when using chemicals that are sprayed to control larvae as they hatch. New selective pesticides timed to control eggs may need to be applied earlier. Insect growth regulator materials are applied slightly earlier to target the beginning of egg hatch at 200 DD following first male biofix. DD’s are also used to predict the second peak of the first flight or "1B". Trap catch increases at 600-700 DD’s identify the "1B". The second flight (second biofix) usually occurs when trap catches increase at an average value of 1060 DD’s from the first biofix (800-1300 is the possible range). Well maintained traps checked frequently will confirm and fine tune DD’s at the second bio-fix. If a spray for the second flight is necessary, UCIPM suggests timing at 250 DD’s from the second bio-fix. Codling Moth typically has three generations in the upper Sacramento Valley. Third generation activity is monitored the same way as the second.

Codling Moth Historical Situation – First Biofix Dates

	2004	2005	2006	2007	2008	2009	2010
Male	3/22	3/31	4/27	3/26	3/24	3/30	4/26
Female	-	-	5/4	4/2	4/14	4/20	5/3

Figure 1 Male and female biofixes for Ashley walnut in Tehama County using pear volatile plus pheromone (combo) lures. Moths were not sexed until 2005 so female flight activity was not followed. The data was measured in a “conventional” orchard not using Pheromone Mating Disruption (PMD). The dates show the variation in activity through the years.

Codling Moth Current Situation For Ashley walnut in Tehama County, male biofix occurred on 4/26/10. First females were caught 5/3/10 with sunset temperatures suitable for egg laying. DD’s (figure 2) are at 289 as of 5/24/10 suggesting we are approaching the 300 DD target for non IGR insecticide treatment. Trap catches will confirm the second part of the first flight and identify the start of the second flight (second biofix). Remember, Codling moth activity data for Tehama County may or may not be representative for other orchards in the Sacramento Valley. Different biofix dates could significantly affect DD accumulation. Orchards must be monitored on an individual bases for accurate codling moth

management. Also, experience suggests later biofixes for orchards using Pheromone Mating Disruption (PMD). A consideration if you are using PMD. Temperature and codling moth information are available at the UC IPM web site <http://www.ipm.ucdavis.edu>.

<i>DATE</i>	<i>DEGREE DAYS</i>	<i>DATE</i>	<i>DEGREE DAYS</i>
4/26	0 (male biofix)	6/7	
5/3	56 (female biofix)	6/14	
5/10	136	6/21	
5/17	229	6/28	
5/24	289	7/5	
5/31		7/12	

Figure 2. Day Degree accumulations for a Tehama County orchard. Accumulations start at the 4/26/10 male biofix. Day Degrees are tabulated each Monday and are available at <http://ceteama.ucdavis.edu>

New Early Harvesting Cultivar ‘Ivanhoe’ Released

Gale McGranahan – Pomologist, Chuck Leslie – Specialist

UC Davis Walnut Improvement Program, Dept. of Plant Sciences

A new early harvesting cultivar, ‘Ivanhoe’, has been developed by the UC Davis Walnut Breeding Program and released earlier this year. Ivanhoe has a harvest date similar to Payne or Serr, harvesting about a month earlier than Chandler. It is precocious, 100% laterally fruitful, and protogynous (the female flowers open before the males). Ivanhoe leafs out with Payne or Serr but due to its reversed female and male bloom order Ivanhoe female bloom is a week earlier. Payne, Ashley or Serr would be suitable pollenizers.

Ivanhoe produces light-colored kernels and exhibits high yields. The nuts are oval with a smooth thin shell. Kernels average 7.7 g and comprise 57% of the nut weight. The tree is only moderately vigorous and is not resistant to walnut blight. The oldest field trials are now in their 10th year.

Ivanhoe, formerly known as UC 95-11-14, was named after a town near the first field trial in the southern San Joaquin Valley. It is an offspring of a cross made in 1995 between UC67-13 for quality and ‘Chico’ for yield.

Walnut nurseries have been notified of the release, licensed, and provided graftwood. Ivanhoe can be purchased from any licensed commercial nursery.

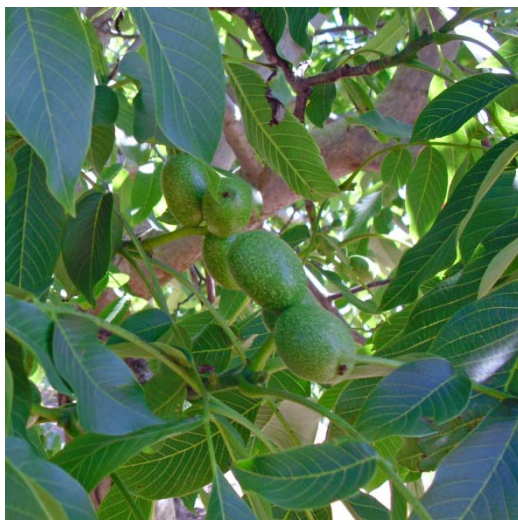


Nuts and kernel of Ivanhoe.

‘Ivanhoe’ Local Observations

Bill Olson, UC Farm Advisor Emeritus, Butte County

Ivanhoe was planted in an evaluation block of walnuts in Chico in 2002 amongst 58 other varieties or numbered walnut selections of various ages. I have been evaluating it for the past 9 seasons. It has moderate vigor and would be suited for 24' x 24' or similar spacing. I have collected nut samples from it for the past 5 years. The nuts are round to slightly oblong, medium sized with a good shell. The nut quality has been near 90 percent light - extra light kernels and over 54 percent edible kernel each year. For the last 4 springs, including this spring, it has set very heavy crops. This year it leafed out 2 days ahead of Payne (Ashley) and 13 days ahead of Vina. Last year it harvested 3 days ahead of Payne and 7 days ahead of Vina. What concerns me is its walnut blight susceptibility. For the past two springs, in this walnut blight sprayed block Ivanhoe was **the only** walnut variety of 58 walnut varieties/selections showing any walnut blight. So far in my evaluations, I think that Ivanhoe is too susceptible to walnut blight to be an acceptable variety for most growers in this area but would make an excellent choice in areas where walnut blight is not a major concern.



Ivanhoe showing a good crop at Chico 2010 (photo C. Debuse)



Ivanhoe showing walnut blight 2010 (photo B. Olsen)

Botryosphaeria and Phomopsis Cankers of Walnuts in California

Themis J. Michailides, Plant Pathologist, University of California, Davis /Kearney Ag Center, and Janine Hasey, UC Farm Advisor, Sutter and Yuba Counties

Some of the same species of fungi that cause panicle and shoot blight of pistachio and band canker of almond trees are the culprits of a canker disease of walnuts. In the early 1900s a branch wilt was described that was attributed to a fungus *Nattrassia mangiferae* (formerly called *Hendersonula toruloidea*). This branch wilt was shown to be the result of sunburned branches predisposing these sites to infection by this fungus. Starting in 2003, farm advisors in Yuba/Sutter and Stanislaus counties noticed that shoot blights and cankers in large dead branches did not correspond with the symptoms of what was called “branch wilt”; neither was the pathogen *N. mangiferae* present. Samples revealed that they were loaded with pycnidia of *Botryosphaeria* and *Phomopsis* fungi (Figure 1.). Isolations from the advancing cankers confirmed the presence and growth of these fungi into the healthy tissues. Although shading may predispose some twigs and branches to infection the dieback of larger branches, especially in the upper canopy, cannot be attributed to shading effects but to direct infection by these pathogens. Over the years, a large number of blighted shoots of Chandler, Tulare, and other walnut varieties were confirmed with *Botryosphaeria* and *Phomopsis* spp. from Sutter, Yuba, Stanislaus, Tulare, Kings, and Glenn counties and more recently Yolo County.

Symptoms: The initial conspicuous symptom of branch infection is often wilting and flagging of leaves on branches distal to the canker. The stems will generally have discolored areas on the bark. Cutting away the bark reveals the cortical and cambial tissues discolored brown to black. Peeling the bark, if the infection is old enough, will reveal well-developed embedded black pycnidia (fruiting bodies) mainly of two fungi, *Botryosphaeria* and *Phomopsis*.

Recently, both *Botryosphaeria* and *Phomopsis* fungi were found causing dieback of major scaffolds in a Howard hedgerow in Yuba County in the lower, middle, and upper tree canopy (Figure 2.) and *Botryosphaeria* was found causing dieback of lower major scaffolds in a Chandler orchard heavily infested with walnut and Italian pear scale under lichens.

Disease development:

Species of *Botryosphaeria* and *Phomopsis* develop and survive as saprophytic microorganisms on dead plant tissues such as tree bark and are commonly encountered in nature. Even dead tissue in otherwise healthy plants can be colonized. If the healthy plant subsequently is injured or stressed, the fungus can progress into healthy tissues. Symptoms caused by these fungi on walnut do not develop depressed tissues and the canker margins are dark and diffuse in younger shoots but have more definite margins in older age branches. These cankers are not contained by callus so they enlarge rapidly along the shoot. Beneath the bark the cambial and cortical tissues are brown with black margins. Fruiting structures form on dead tissues readily and can produce viable spores over a period of years. For example, *Botryosphaeria* pycnidia can produce viable spores for at least 6 years on pistachios. The fruiting structures are small measuring from 0.5 to 3 mm and protrude through the bark surface as small raised black spots (bumpy appearance; Figure 3.). They also can form in groups or singly. Pycnidia are most frequently found, although we sometimes find pseudothecia (another fruiting structure) of *B. dothidea* which contain ascospores, mainly on branches that have fallen on the ground. In a cross section, pycnidia are black with hyaline (glassy) contents while pseudothecia are black with white, dry contents. Older tissues of cankers develop a whitish bark with black pycnidia underneath.

For more photos, go to http://cesutter.ucdavis.edu/Orchard_Crops/Botryosphaeria_Blight.htm

The *Botryosphaeria* fungi can infect 45 different species of trees and vines in California, including those in riparian areas like willows, cottonwoods, elderberries, ash, and others. They provide the spore sources

for causing the disease on walnuts. These spores enter the tree through various types of wounds of large shoots and branches. The spores can easily develop in trees that have been stressed for water or have had freeze, sunburn, or herbicide damage, weakening of branches due to shading or scale infestations, and other causes. Once they get inside the bark of healthy trees, the spores remain dormant until conditions are right for them to expand and kill the branches. The Howard hedgerow mentioned above had limb dieback for a few years before being diagnosed with this disease. We think that infections in the canopy started from hedging wounds since we saw cankers developing in various cuts made by the saws. From limited research, there are at least five different species of *Botryosphaeria* that can infect walnut trees.

Control: Currently we don't know how to control *Botryosphaeria* and *Phomopsis* cankers in walnut orchards. Since chemical control is lacking at present, good sanitation and cultural practices are the best methods to prevent *Botryosphaeria* canker of walnuts.

Here are some questions and guidelines to prevent infection in your orchards:

- 1) *Do these fungi get in through pruning wounds or broken branches?* Yes they do, very effectively. Avoid wounding trees and remove broken branches quickly. Maintain trees in good health and avoid stressing them. When shoots are killed and covered with *Botryosphaeria* and *Phomopsis* spores, these tissues need to be removed to protect other trees from infection. The infected branches and prunings should be removed from the orchard and destroyed since the fungus can produce viable spores on pruned out branches for long period of time.
- 2) *What weather conditions favor disease development in walnut?* Rains during spring (late rains like the ones we have this year) can aggravate the problem. Hot weather during the growing season favors sunburn predisposition and *Botryosphaeria* development.
- 3) *When would be the best time to prune dead branches to reduce spread?* Dry weather, during summer for instance.
- 4) *When would be the best time to hedge prune to avoid potential spread?* When the weather is dry and we do not have rains predicted within 1 to 2 weeks after pruning. Although we do not know how long it takes for walnut pruning wounds to heal and no longer be susceptible, follow this guideline presently.



Figure 1. Black fungal fruiting bodies (pycnidia) of *Botryosphaeria*
Photo by Themis Michailides



Figure 2. Howard hedgerow with dead limbs to mid-canopy from *Phomopsis* and *Botryosphaeria*
Photo by Themis Michailides



Figure 3. *Phomopsis* fruiting structures
Photo by Themis Michailides

2010 Walnut Dehydrator Workshops

June 28 in Chico

(Masonic Family Center
1110 W. East Avenue, Chico)

June 29 in Modesto

(UC Cooperative Extension Office, Harvest Hall
3800 Cornucopia Way, Modesto)

Time: 10 a.m.— 3:30 p.m. (registration opens at 9:30 a.m.)

Cost: \$80 per person, includes lunch and instructional materials

Register: Online at <<http://postharvest.ucdavis.edu>> or call 530-752-6941

SCHEDULE

- **10 am Dryer Design Principles: Determining Equipment Capacity - Jim Thompson, Bio & Ag Engineering Dept. UC Davis**
- **10:45 am Dryer Design Principles: Burner Installation & Air Recirculation - Don Osias, Applied Instrumentation, Walnut Creek, CA**
- **12:00 pm Lunch (provided)**
- **12:45 pm Class Design of a 25 and 50 ton Dryer - Don Osias**
- **1:15 pm Huller/Dryer Cost Study - Jim Thompson**
- **2:00 pm Dryer Control Systems - Don Osias**
- **2:45 pm Designs of the Future - Jim Thompson**
- **3:30 pm Adjourn**