University of California Cooperative Extension Butte County

Walnut Notes

Agriculture & Natural Resources

Volume 41 ▪ July 10, 2012

In this Sacramento Valley Walnut News:

- 2012 walnut blight
- New walnut cost study for the Sacramento Valley
- Advisor retirement and new position proposals
- Anthracnose, *Botryosphaeria*, and *Phomopsis* in walnut -- updates
- Orchard management impacts on walnut quality

Joseph H. Connell
UC Farm Advisor

2012 walnut blight

Richard P. Buchner – UC Farm Advisor, Tehama Co.

Walnut blight counts (Table 1) illustrate an overview of blight damage for 30 selected orchards during the 2012 season. These orchards have been monitored for 2-3 years measuring disease trends and how much pathogen is over wintering in dormant buds. Notice that Chandler, Howard, Vina and Ashley all had orchards with excessive walnut blight damage. Also curious is the range in damage within varieties. Blight damage is 13.7% in Chandler #3 compared to none in Chandler #10 and #11 and 0.8 % in Vina #1 compared to 16.1% in Vina #3. What is not immediately apparent from the blight counts is that for about half of the surveyed orchards the amount of blight damage is increasing compared to last year.

Many variables influence walnut blight control. Weather, initial inoculum, spray material, spray rate, spray timing and coverage plus orchard architecture all affect disease control. 2012 was not a particularly wet spring (3/1/12 to 6/15/12) with 4.66 inches of rain over 10 rainfall events (CIMIS – Gerber). Storms were well predicted with good treatment opportunities. Heavy dews and leaf wetness could be an issue. We are measuring increased disease compared to last year. If spray programs are not sufficient for control, the initial inoculum levels will increase making disease control even more difficult next year. Dormant bud samples will verify the amount of disease present going into the next spring. Remember, it takes at least two years of a very good spray program to drive the disease back down.

Copper resistant walnut blight bacteria are typical for the Sacramento valley and have been here since about 1990. Copper alone will not provide adequate control against these bacteria. The copper/manzate tank mix is the best available material to control resistant blight bacteria. Farm advisors are currently surveying orchards with blight damage for resistance to copper/manzate mixes. Preliminary results suggest copper/manzate resistance is not responsible for elevated blight damage. More samples are being evaluated to verify preliminary information.

Spray rates vary by copper formulation. Any good quality copper will work equally well and under high blight pressure, high label rates are suggested.

2279-B Del Oro Ave., Oroville, CA 95965 (530) 538-7201 FAX: (530) 538-7140 Email: cebutte@ucdavis.edu Web Page: cebutte.ucdavis.edu

The manzate rate is set by the Section 18 and should be included with copper for optimum blight control. Since copper resistance is prevalent in the Sacramento valley, poor blight control would be expected without the addition of manzate. If blight control was questionable last year it is likely that populations are building making blight control more difficult this year.

First application at forty percent of the shoots at prayer stage and a second application 7-10 days later is the basis for good disease control. Additional sprays may be necessary with high inoculum levels and wet weather.

Good coverage is critical for disease control. Spray materials have to hit walnut tissue with an adequate amount of material to protect that tissue. It is very likely that half sprays are leaving the door wide open for walnut blight bacteria to prosper, increase populations and cause damage. In addition, the half spray sub-lethal exposure approach is an excellent way to continue to select for resistance to the only effective spray combination we have for walnut.

Percent Blighted Walnuts by Variety for 30 Orchards in Butte and Tehama Counties

	Orchard Number											
Variety	1	2	3	4	5	6	7	8	9	10	11	12
Chandler	2.5	10.2	13.7	2.6	6	0.3	0.03	0.9	0.03	0	0	0.3
Howard	1.3	1.4	1.4	1.4	5.4	0.1	0.07	0	0.07	0	0	
Vina	0.8	4.1	16.1									
Hartley	0.1	0.03										
Tulare	0.03											
Ashley	17.8											

Table 1. Walnut blight damage visually rated by counting over 3000 walnuts per orchard on June 19 and 20, 2012. Values represent the percent blight damage. The table represents 12 Chandler orchards, 11 Howard orchards, 3 Vina orchards, 2 Hartley orchards and 1 Ashley orchard.

New walnut cost study for the Sacramento Valley

Carolyn DeBuse, UC Farm Advisor, Solano & Yolo Counties

A new walnut cost study has been published by UC Davis. The cost study shows sample costs to establish a walnut orchard and produce walnuts in the Sacramento Valley, for the year 2012, under micro-sprinkler irrigation. This is a great resource and guide if you are thinking about growing walnuts for the first time, expanding your current orchards, or just need to determine potential returns. This cost study assumes a hypothetical farm of 105 acres with 100 acres planted in walnuts. In the first pages, the study goes over the farm's layout, orchard establishment and cultural practices assumed for the study trying to capture the current practices used to grow walnuts. The second part of the study is made up of tables which look at the average current cost of all these practices for the years of orchard establishment and for a mature orchard. Each tables finishes with estimated total cash cost and returns per acre grown. A sample table of cost per acre at varying yields is shown below.

This cost study is a great tool and should only be used as an estimate of current costs and returns. One way to use the cost study is to use it as an outline and create similar tables using your actual costs. Or another way is for new growers to use them to summarize what practices, machinery, custom hired work, and materials they should be planning to have when they establish their first orchard.

This cost study can be found at

http://coststudies.ucdavis.edu/files/WalnutSV2012.pdf

All current and past UC cost studies can be found at http://coststudies.ucdavis.edu

UC COOPERATIVE EXTENSION

Table 5. RANGING ANALYSIS

Sacramento Valley 2012

COST PER ACRE AT VARYING YIELDS TO PRODUCE WALNUTS

	YIELD (lbs/acre)						
	2,400	3,400	4,400	5,400	6,400	7,400	8,400
OPERATING COSTS:							
Cultural	1,052	1,052	1,052	1,052	1,052	1,052	1,052
Harvest	472	561	650	739	828	917	1,006
Interest on operating capital @ 5.75%	20	21	21	22	22	23	23
TOTAL OPERATING COSTS/ACRE	1,544	1,634	1,723	1,812	1,902	1,991	2,081
Total Operating Costs/lb	0.64	0.48	0.39	0.34	0.30	0.27	0.25
CASH OVERHEAD COSTS/ACRE	408	408	408	408	408	408	408
TOTAL CASH COSTS/ACRE	1,952	2,041	2,131	2,220	2,310	2,399	2,488
Total Cash Costs/lb	0.81	0.60	0.48	0.41	0.36	0.32	0.30
NON-CASH OVERHEAD COSTS/ACRE	1,277	1,277	1,277	1,277	1,277	1,277	1,277
TOTAL COSTS/ACRE	3,228	3,318	3,407	3,497	3,586	3,676	3,765
Total Costs/lb	1.35	0.98	0.77	0.65	0.56	0.50	0.45

Table showing the cost per acre at varying yields to produce walnuts taken from the new Walnut Cost Study for Sacramento Valley (micro-sprinklers) 2012.

Advisor retirement and new position proposals

Bill Krueger UCCE Farm Advisor Glenn County

On June 28th I retired after 32 years as a University of California Farm Advisor. I started as a Tree Crop Advisor in Glenn County in August of 1980. Over the years I added Olives in Tehama County and County Director in Glenn County to my responsibilities. I have seen tree crop acreage in Glenn County grow from 22,000 acres to more than 68,000 as many acres of row crops and, more recently, rangeland was converted to tree crop production. It has been great to be involved with this and I appreciate all of the support and cooperation I have received from growers, allied industry and my colleagues over the years.

During the same time we have also seen UC Advisor ranks decline from around 500 to less than 200 now. Within the current Advisor ranks two thirds are 55 or older so there are many more retirements eminent. While the consolidation of UCCE resources is likely to continue UCANR Administrators put the hiring of new Advisors and Specialists as a highest priority.

There are currently107 proposed positions being considered for recruitment. From this group of 56 Specialists and 51 Advisors a much smaller number will be selected for recruitment. Two of the proposed positions are a Walnut/Prune Advisor housed in Butte County covering Butte and Glenn Counties now and, potentially, adding Tehama County in the future when the current Advisor retires and an Almond/Olive Farm Advisor to be housed in Glenn County and covering Glenn and Tehama Counties now and adding Butte County when the current Advisor retires. If you are interested in learning more about these or the other positions being requested and / or commenting or making suggestions, they are posted online and open for comments through Aug. 7th. Following is the link.

http://ucanr.org/sites/anrstaff/Divisionwide_Planning/Program_Planning_and_Evaluation/2012_Call_for_Supplemental_Positions/

The positions mentioned above are numbers 079 and 235.

Anthracnose, *Botryosphaeria*, and *Phomopsis* in walnut – updates

Janine Hasey, UC Farm Advisor, Sutter and Yuba Counties; Themis Michailides, Plant Pathologist, UC Kearney Ag Center; Rick Buchner, UC Farm Advisor, Tehama County; Kathy Kelley Anderson, UC Farm Advisor, Stanislaus County

Wet springtime weather as in the previous two years, likely provided ideal conditions that led to us seeing some unusual walnut foliage and nut diseases in some counties. Three diseases - Anthracnose, Botryosphaeria, and Phomopsis blight, were seen in scattered locations in the Sacramento Valley.

Walnut Anthracnose is a fungal disease caused by *Marssonina californica*. Although we have had Anthracnose on black walnut in Butte, Sutter, Tehama, and Stanislaus Counties sporadically for several years, the reports on English walnut are rare in California - previously seen only in San Benito, Stanislaus, and Lake Counties. In late April/early May however, UC Plant Pathologist Themis Michailides identified Anthracnose on foliage samples from orchards in different locations in Sutter County and on different varieties such as 'Serr' and 'Chandler'. These orchards were not located near black walnut seed orchards that have had Anthracnose in the past.

Anthracnose symptoms include necrotic lesions on the leaves (Photo 1), shoots (Photo 2), and fruit. Also, there is leaf yellowing and drop. The anthracnose fungus can cause some leaflet loss, especially if the lesion (infection point) is located at the base of the leaflet and/or large necrotic lesions form when the infection point is on the mid rib. Infections on the mid rib result in breaking the blade and tearing the leaf tissues. Lesions develop acervuli (structures bearing characteristic spores of the anthracnose fungus). When there are multiple lesions per blade, they coalesce into large necrotic lesions. Sometimes when the leaf stem or petiole is infected, the leaflets above that point defoliate. We saw leaf drop but did not see lesions on the English nuts in Sutter County. In a black walnut (Sutter Co.) and an English walnut (San Benito Co.) orchard, leaves collected from the ground in spring had the ascosporic stage (*Gnomonia leptostyla*) of *Marssonina*. These kinds of spores are ejected forcibly when the perithecia (structures producing these spores) get wet by rains or other means, indicating that this fungus overwinters in infected leaves from the previous year dropped to the ground in the fall.

Photos of Anthracnose on English walnut are posted at our Sutter County website: http://cesutter.ucdavis.edu/Orchard_Crops_254/Anthracnose_on_English_Walnuts__Serr_/
Also, an anthracnose PowerPoint showing symptoms on black and English walnut (including the nuts) is on the Tehama County website at http://cetehama.ucdavis.edu (click on orchard crops, click on walnut, then, click on anthracnose BB 2005).

Botryosphaeria* and *Phomopsis fungi are mainly known in walnut to cause cankers resulting in fruitwood and branch dieback. An earlier issue of this newsletter at http://cesutter.ucdavis.edu/newsletters/Summer_2010_Sacramento_Valley_Walnut_News36485.pdf discusses this more common phase of this disease.

The focus of this article is on infection of spurs, foliage, and nuts by these fungi. In 2011 in Stanislaus County, there were orchards that suffered high nut loss from *Botryosphaeria* infection. In 2012, *Botryosphaeria* infections were found in some leaf samples from Sutter County and *Phomopsis* was identified in leaf lesions from Tehama County. In mid-September in a 'Tulare' orchard in Stanislaus County we observed large (1-2 cm) necrotic brown lesions (Photo 3) on leaves bearing pycnidia of *Botryosphaeria* and nuts that were totally affected with cankers moving down the peduncle (the stalk of the flower) to the spurs (Photo 4). Pycnidia of *Botryosphaeria* were abundant on all infected nuts, on peduncles and on spurs. In some cases, current growth shoots and leaves died back (Photo 5). Pycnidia were also found in these dying shoots. In May 2012, samples were collected from an orchard in San Benito Co. from a mixture of walnut cultivars. Hulls of the fruit were still hanging on the trees and there was a canker moving from the peduncle to the spurs; 80% of these spurs had pycnidia of *Botryosphaeria* and about 20% *Phomopsis*. The same results were obtained with a sample from an orchard in both Fresno and Stanislaus Counties. We are researching when these infections take place to help us understand why we can find so much *Botryosphaeria* and *Phomopsis* in walnut trees (small dead shoots and large limbs).

Photo 1. Anthracnose: Advanced leaf lesions on 'Serr'. (These lesions will have mature spores at this stage of development.) Photo by Janine Hasey.

Photo 2. Anthracnose: Shoot lesion showing active sporulation of the pathogen in 'Serr'. Photo by Janine Hasey.

Photo 3. Large necrotic lesions caused by *Botryosphaeria dothidea*. (Note infection extending into the petiole.) Photo by Themis Michailides.

Photo 4. Infection of fruit by *Botryosphaeria dothidea* moving through the peduncle to the spur (cv. Tulare). Photo by Themis Michailides.

Photo 5. Infection of current growth shoot by *Botryosphaeria* turn black and result in killing of affected leaves. Photo by Themis Michailides.

Photo 6. Phomopsis lesions on developing new growth. Photo by Rick Buchner.

Both these fungi produce pycnidia that need water to have their spores spread around. In fact, leaves with small (2 mm) red spots (Photo 6) from an orchard in Tehama County revealed infections by *Phomopsis.* However, one year old shoots with small (2-4 mm) black spots in Stanislaus County revealed quiescent infections of both *Botryosphaeria* and *Phomopsis.* When dormant buds of various walnut cultivars were collected from two different counties and cultured, infections of both *Botryosphaeria* and *Phomopsis* were very common, reaching 30-40% in both male and female buds. Growth of these fungi however, is favored by hot summer temperatures. Studies are in progress to understand the biology of these fungi on walnuts and to develop effective management tools to help California walnut growers.

Distinguishing between these diseases

Although the symptomology of initial lesions on leaves may be overlapping and confusing at this time, research may help us develop ways to distinguish symptoms early in the season for each of these diseases by just looking at macroscopic symptoms without using a microscope and/or waiting for results after culturing infected tissues.

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 (too dry or too wet) 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 sunburn severity, but we will not discuss sunburn related problems in the present article.

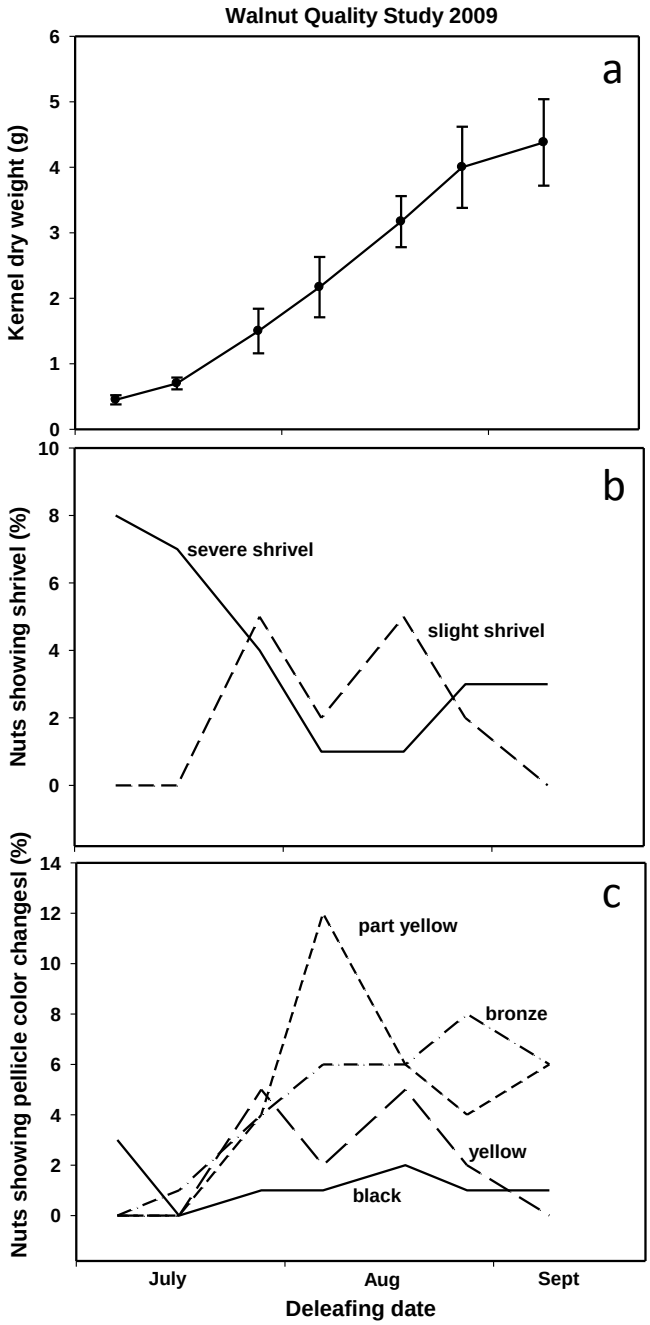

Figure 1. Kernel dry weight accumulation over the season (a), kernel shrivel as influenced by artificial de-leafing date (b) and kernel pellicle color characteristics as influenced by artificial de-leafing date.

Research trials- Research conducted in a mature Chandler walnut orchard in San Joaquin County in 2007-2009 showed that photosynthate (mobile carbohydrates) reduction from the leaf was a likely contributing factor to undesirable pellicle color changes. The reduction in photosynthate from 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 nut 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. 1). The kernel dry weight accumulation (Fig. 1a) is shown for Chandler walnuts on spurs that were not defoliated on each of the defoliation dates. It should be noted that the percentages (Fig. 1b & c) are only for lower canopy shaded positions. Percentages for the overall tree would be much lower since the positions tagged in the study emphasized the lower canopy positions where problems were likely to occur.

Shrivel- As expected, defoliation during the time kernel dry weight was increasing 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 supply. 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 to some degree (Fig. 1c). Black pellicles tended to increase with defoliation from early July with the black pellicles peaking with defoliation in mid-August and the bronze 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 at this point 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.

Pee wee nuts and brown adhering hulls- In 2011, we investigated the occurrence of pee wee nuts and brown adhering hulls in a mature Howard orchard in Colusa County. We found that pee wee nuts were on spurs that had a low number of much smaller than average leaves. These spurs may open later than the majority of buds on the tree so the small nut size may be associated with the late bud opening (and competition from other nuts that are already much larger) as well as the limited spur leaf area. Rows that had been mechanically hedged the previous winter tended to have more pee wee nuts but they occurred in unpruned, unhedged rows as well. The spurs with these characteristics (low number of small leaves) produced pee wee nuts even if the nut position was in well exposed location in the sun suggesting that the problem was related to the condition of the bud as it was formed in the previous season rather than current year conditions. The bud was likely weak due to having formed in a shaded position the previous year. The pee wee nuts were generally good quality, light colored kernels but just small. Brown adhering hulls were associated with buds that had an intermediate number of leaves (less than buds associated with normal nuts but more than peewee nuts) and intermediate size of leaves (smaller than buds associated with normal nuts but larger than those associated with peewee nuts). Nuts with brown adhering hulls were smaller than normal nuts and had variable quality (anywhere from good light color to darkened pellicle).

Water management practices to minimize quality problems- In general good irrigation practices will help to 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.

Nut quality problems can be associated with current year conditions or previous year conditions

Current season carbohydrate deprivation resulting from water stress (lack or excess) and/or shading related leaf loss:

Symptom	Timing
thin shell	early June
severe shrivel	early July
slight shrivel	early August
yellow pellicle	early August
black pellicle	mid August
bronze pellicle	late Aug/early Sept

Previous season problem due to insufficient carbohydrate storage in bud formed during the previous season resulting in small leaves and small nuts in current season. Likely associated with bud that developed in shaded position the previous year:

- Very weak bud = pee wee nut
- Relatively weak bud = brown adhering hull