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Agriculture and Natural Resources | Cooperative Extension

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Advances in Walnut Production Short Course

The Advances in Walnut Production short course will be held November 16 to November 19, 2015 at the University of California Davis. The course includes four days of instruction: lectures and field demonstrations to illustrate the relationship between walnut biology and orchard management. This University of California Cooperative Extension (UCCE) course is delivered by experienced Farm Advisors, Faculty and Specialists who represent decades of research and work experience in California walnut production.

The enrollment fee of \$1,500 will cover classroom instruction, all course materials, breakfast, coffee breaks, lunches, two evening socials, and one dinner. We are very close to full registration so if you've been considering attending, we recommend registering soon.

Please use online registration available on the UC Fruit & Nut Research & Information Center website: <http://fruitsandnuts.ucdavis.edu>.

For additional information, brochures are available at our UCCE office on Garden Highway. The registration coordinator is Penny Stockdale at pastockdale@ucdavis.edu or 530-752-7672. **Sign up Now!**

Late Summer and Fall Orchard Management Considerations

Luke Milliron, UCCE Horticulture Intern, Yuba, Sutter and San Joaquin Counties

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Water Management:

- ✓ Sufficient irrigation during hull split is needed to prevent hull tights and darkening kernels; reduced crop value can result from either excessive or a lack of water during this critical time. More information at: ucmanagedrought.ucdavis.edu/Agriculture/Crop_Irrigation_Strategies/Walnuts/

Nutrition Management:

- ✓ For bearing and non-bearing trees, the final nitrogen fertilizer application should be made by late August. Nitrogen applied late fall is unlikely to be taken up by the tree and is likely to leach out of the tree root zone.

- ✓ For bearing trees with borderline or deficient potassium, plan a fall application of potassium (K₂O) before winter rains. Information on calculating the fertilizer rate can be found at: apps.cdfa.ca.gov/frep/docs/Walnut.html

Insect Management:

- ✓ Monitor weekly for webspinning spider mites and predators through August. Examine 100 leaflets from 10 trees (5 leaflets each from high and low branches) for presence/absence of spider mites, predator mites, and sixspotted thrips. If predators are found on >50% of leaflets with mites, treatments are not warranted unless broad-spectrum pesticides (i.e., pyrethroids or organophosphates) have been applied. In orchards with broad-spectrum pesticide use, consider treating if ≥10% of leaflets have spider mites and less than 10% have predators OR ≥20% of leaflets have spider mites. If spider mites do not build up by mid-August, treatments are typically not warranted. Be aware of pre-harvest intervals for pesticides if applied late in the season. IPM Guidelines at: ipm.ucdavis.edu/PMG/r881400111.html
- ✓ Monitor twice a week for walnut husk fly until hull split. Consider treating if trap counts increase rapidly or after egg appearance. Treating for husk flies is not necessary within 3 weeks of harvest. Growers with previous severe late damage may want to use ethephon to hasten hull split (see article in this newsletter). IPM Guideline at: ipm.ucdavis.edu/PMG/r881301211.html
- ✓ Monitor for walnut aphid on leaflet undersides and dusky-veined aphid on the upper side leaflet midrib. Take 5 first-subterminal leaflets from 10 trees. Consider treating if, on average, non-parasitized walnut aphids per leaflet exceed 15 or if ≥10% of leaflets have 6 or more dusky-veined aphids. IPM Guideline at: ipm.ucdavis.edu/PMG/r881300511.html
- ✓ Manage navel orangeworm (NOW) and codling moth (CM) through harvest (see article in this newsletter for NOW management). Collect harvest samples to later identify source of ‘worm damage’ if it is noted on your grade sheets. IPM Guidelines at: ipm.ucdavis.edu/PMG/r881301111.html and ipm.ucdavis.edu/PMG/r881300211.html.

Harvest:

- ✓ Nuts that split early that have white kernels and very dark pellicles (skin) are oilless nuts. These nuts typically drop early and can be destroyed when preparing the orchard floor for harvest. See photos at: cesutter.ucanr.edu/Orchard_Crops_254/Walnuts_639/Walnut_Quality/Oilless_Nuts/
- ✓ Early harvest will maintain kernel color and reduce NOW and mold infestation.
- ✓ Shake only what can be picked up in the same day to preserve quality. The greatest loss of walnut quality occurs in the first 9 hours after harvest.
- ✓ Once harvest is completed, clear hullers and dryers of all trash nuts that may harbor moth larvae.

Pruning:

- ✓ Prune blighted branches and deadwood during summer or immediately after harvest to remove possible Botryosphaeria (Bot)/Phomopsis or branch wilt infected wood. It is easiest to tell dead, diseased from healthy wood when there are still leaves on the tree.
- ✓ Prune when it is dry and rain is not predicted to avoid spreading Bot spores to fresh pruning cuts. Remove diseased wood from the orchard floor if dead wood was minimal. In heavily infected orchards, wood can be chipped and left in the orchard.

Weed Management:

- ✓ A postharvest weed survey (ideally after first fall rains) allows you to identify weeds that have escaped your control program this season, as well as newly emerging winter weeds. The weed survey form and weed identification links are at: ipm.ucdavis.edu/PMG/C881/m881deweeds.html
- ✓ Apply pre-emergent herbicides for winter weed control mid- to late fall. Watch the weather and apply shortly before rainfall so that rain will move the herbicide into the soil before seedlings emerge.

Using Ethephon for Earlier Harvest

Janine Hasey, UCCE Farm Advisor, Sutter, Yuba and Colusa Counties

Bob Beede, UCCE Farm Advisor Emeritus, Kings County

Many walnut growers have successfully used ethephon, also known as Ethrel®, for several years as a harvest aid. Research shows improved nut value mainly due to lighter kernel color. If you have been on the fence about using this harvest aid or are newer to growing walnuts, here are the facts to help you decide if it's right for your orchard, and if so, how to use it properly for best results.

Ethephon is an ethylene-based plant growth regulator applied at walnut maturity indicated by packing tissue brown (PTB), or shortly thereafter, to accelerate hull split and harvest timing. By advancing walnut harvest by four to seven days, nut value is increased by lighter kernel color.

Walnuts are mature and kernels achieve maximum oil accumulation when the packing tissue surrounding the kernel has changed from a bright white to the color of oak (Photos 1 & 2). We call this packing tissue brown (PTB). This can occur 21 or more days ahead of unaided commercial harvest especially where the climate is warm. As the hull separates from the shell and cracks from tissue breakdown and moisture absorption during this period, the kernel also ages, resulting in darker, less valuable nuts. The risk of navel orangeworm damage also increases.

Timing treatment. Early walnut varieties such as Serr develop PTB sooner (mid-August) than late varieties such as Chandler (mid-September). Packing tissue brown occurs last in the bottom of the canopy. Orchards that are water stressed develop PTB sooner and those with shaded canopies have greater nut maturity variability than those with full sunlight.

Sampling. Begin sampling at least two weeks ahead of when PTB is expected; this year in particular, we will likely see earlier PTB because of earlier leafing. Plan to sample once or twice weekly for PTB. Walk diagonally across the orchard and collect at least 100 nuts. Cut each nut in half. Only nuts with complete browning of the packing tissue, including the area near the stem end, are considered at full PTB. Do not treat until 100% of sampled nuts are at PTB. It is better to apply late than early, since early ethephon application results in losses in weight, nut quality, and hullability. Applying ethephon five to seven days after PTB still improves percent nut removal and the chances of having to only harvest once.

Variety response. Walnut cultivars differ in their sensitivity to ethephon. Out of Serr, Payne, Tulare, and Chandler, Serr produces the least ethylene after treatment and shows a marginal response in the field. Tulare produces the most ethylene and nuts fall off the tree more quickly after treatment compared to other varieties. Chandler is responsive and many growers have found treating certain blocks can be a good way to spread the harvest and drying operations of this widely planted variety. Howard is also very responsive to ethephon, resulting in greatly enhanced quality and value.

Applying ethephon. Ethephon does not translocate and must hit the nut to create the desired response. In the Sacramento Valley, ethephon can be applied from the ground or aerially. For ground application, add four to five pints of ethephon to 150-200 gpa, with ground speeds between 1.5 and 2 mph, depending upon canopy size. For aerial application, rates of two to four pints in 40 gpa have been reported. Aerial application and ethephon concentrations greater than those recommended for ground treatment (900 ppm) are allowed by the label, but not supported by the manufacturers. High concentrations from aerial applications can result in significant defoliation. Rates higher than recommended may result in excessive defoliation, reduced catkin formation and twig dieback. Check with your crop consultant for a local recommendation. The benefits of

ethephon application are usually seen 14 to 23 days after application. Test shake a tree and evaluate hull adhesion before committing to harvest.

Environmental considerations. Experience shows greater response under higher humidity and lower temperatures. Never apply when temperatures exceed 90⁰ F. Applying the product at night or early morning helps avoid high temperatures. Performance improves with increased absorption time, so do not apply if there are drying winds or rain forecasted. Ethephon is rainfast within six hours of treatment.

Other Considerations when using ethephon:

- Do not treat orchards stressed by under or over irrigation, heavy mite infestation, heavy Botryosphaeria canker or blight (Bot), or the ‘yellow Howard problem’ which may result in more leaf drop.
- To take advantage of the accelerated maturity, your dehydrator must also be open and prepared to process your nuts promptly to further minimize quality losses.
- Nuts delivered to the huller/dryer without hulls will dry more quickly than nuts delivered in hull. Less drying time should be needed the earlier the hull cracks and separates from the shell.
- By harvesting early, the last flight of navel orangeworm may be avoided thus reducing insect damage; mold damage may also be decreased by avoiding early rains.
- Orchards with high navel orangeworm pressure may require the addition of an insecticide; consult your crop consultant on material selection and pre-harvest interval.
- Make sure ethephon sprays only hit the target walnut crop. Since ethephon is a plant growth regulator, drift onto nearby fruit crops such as kiwifruit can have unintended consequences, including fruit drop.



Photo 1. Immature walnuts
Photos by Bob Beede.



Photo 2. Mature and ready for ethephon treatment

Navel Orangeworm in Walnuts

Dani Lightle, UCCE Farm Advisor, Glenn, Butte, & Tehama Counties
Emily Symmes, UCCE Area IPM Advisor, Sacramento Valley

The economic impact of navel orangeworm (NOW) in walnuts has become an increasing concern for Sacramento Valley growers in recent years. In 2014, there were several reports of high worm damage attributed to NOW from growers and processors. Thus far in 2015, we have experienced higher than typical NOW pressure in other Sacramento Valley crops. That, combined with the fact that we are on track for a 4th generation of NOW, means that walnuts may be at high risk of infestation this year. Here we summarize what we currently know (and don't know) about NOW in walnuts.

Why is NOW pressure high in 2015? Historically, the worst years for NOW damage are those with at least a partial 4th generation. The dry winter may have contributed to better quality overwintering and spring development sites for NOW, which experienced first generation development time closer to 750 DD instead of the predicted 1050 DD. That, coupled with an earlier spring biofix, means that 4th generation NOW eggs are predicted as early as mid- to late August depending on temperatures.

When do walnuts become susceptible? Like almonds, the majority of walnuts become susceptible to NOW after hulls (husks) begin to split. Prior to hull split, NOW can infest codling moth-infested, blighted, sunburned, and mummy nuts in walnut orchards. Once inside the hull (via previous damage or hull split), worms access the stem end of the nut, where they enter through the softer tissue and feed on the kernel.

Where are NOW coming from? Are some orchards more at risk than others? NOW is a bit of a trash moth, laying eggs and developing in numerous fruit and nut hosts, both agricultural (walnut, almond, citrus, pistachio, fig, etc.) and native (oak, black walnut, etc.). Lab studies show NOW has a substantial flight capacity; this ability to migrate between hosts suggests that walnut orchards in proximity to another host may experience greater than normal NOW pressure this year based on the high populations observed. Anecdotal evidence indicates that NOW pressure is higher in walnut orchards neighboring or near alternate infestation sources, particularly those with high NOW populations. Keep in mind, however, NOW damage in walnuts is not solely due to migration in from external sources. Populations within walnut orchards can survive year-to-year and build up if adequate sanitation practices are not implemented.

What monitoring is useful for NOW in walnuts? We have very little information on whether monitoring traps are useful in walnut orchards. Traditionally, in almonds, NOW egg traps have been a good indicator of the presence of egg laying females in an orchard. Pheromone traps are very effective at trapping males but they give no indication of whether egg laying females are present and are not a good indicator of imminent crop risk. Eggs or worms in early split, damaged, or dropped nuts indicate NOW presence. NOW eggs are opaque white when first laid, turning pink to reddish-orange after a day (see identification chart); codling moth eggs are flatter, more disc-shaped and remain opaque white until hatching. NOW worms have a pair of brown, crescent-shaped marks behind the head, which are absent in codling moth larvae (see identification chart).

What treatment options are available for NOW control and when is the best time to apply? Intact walnuts (those not otherwise damaged) are not susceptible until after hull split, so control efforts should focus on providing protection from hull split through harvest. A number of insecticides are registered for NOW in walnuts, however at this time no specific UC recommendations are available. Consult with your Pest Control Adviser or crop consultant for options, bearing in mind pre-harvest intervals, duration of residual activity, and impacts of materials to your overall IPM program.

Will using ethephon reduce the risk of damage? The longer susceptible nuts are left on trees, the more likely they are to sustain damage as NOW populations continue to build or move into the orchard. Using ethephon to advance harvest should help to reduce the risk of damage. Regardless of whether ethephon is used, if NOW is present be sure to harvest promptly.

Do walnut growers need to sanitize like almond growers? YES! NOW will overwinter in nuts remaining in trees, waste materials around the field and hullers, etc. If NOW infestation is high based on harvest samples, sanitation should be done to reduce the pressure for next season. Remove mummy nuts from trees (additional shakes, hand poling), flail or mow any nuts remaining on the ground by March, and clean up all nut waste materials.

How do I properly identify the source of “worm” damage? Rather than relying on grade sheets, which do not identify the pest responsible for “worm” damage, take harvest samples to distinguish between NOW and codling moth damage. Collect any obviously damaged nuts to determine whether the cause is codling moth or NOW. If worms are present, NOW can be easily identified by the presence of dark crescent-shaped markings behind the head on either side (see identification chart). If no worms are present, nuts that were infested by NOW will have much more frass and webbing than nuts infested by codling moth alone (see identification chart).

Additionally, it’s important to get a picture of the overall percent damage – it is well worth the investment of time and resources. This will let you know what to expect on your grade sheets, inform on the success of this year’s control measures, and help you plan management strategies for next year. Collect and crack out a random sample of nuts to assess damage by NOW and codling moth, as well as other sources of damage (husk fly, sunburn, disease, etc.). UC IPM guidelines recommend a harvest sample of 1,000 nuts for best assessment of harvest damage; however, take as many nuts as is feasible based on block size and resource availability.

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Navel Orangeworm vs. Codling Moth Identification Sheet		
Stage	Navel Orangeworm	Codling Moth
Eggs	Opaque white when first laid, pink after approximately 1 day.	Flat, disc shaped. Remains opaque white.
		
Worms	Brown, crescent-shaped marks behind head. May find multiple worms feeding on a single kernel.	No marks behind head. Feed singly on kernels.
		
Damage	Copious frass and webbing.	Frass at point of entry; little webbing. (Note that codling moth damage does not necessarily result in darker kernels as shown).
		

Preparing Young Walnut Trees for Winter

Katherine Pope, UCCE Farm Advisor, Sacramento, Solano and Yolo Counties

You've spent all year pushing your new walnut trees to grow. September is the time to get them to stop growing and harden off before we experience freezing temperatures. It's tempting to push growth as long as possible, but that's risky. In severe cases of freeze damage, young trees can die back almost to the roots.

Vigorous young trees are more vulnerable to freeze damage than older trees. Fully dormant walnut trees can withstand temperatures well below freezing. The damage occurs when temperatures drop to 28° F or below before the trees have experienced a few nights near 32° F to become acclimated. Trees can be managed to encourage cold hardiness by following these key steps:

- 1) Don't apply nitrogen fertilizer past August. This avoids encouraging new, tender growth.
- 2) Withhold irrigation during September until a terminal vegetative bud sets on the trunk.
- 3) Consider painting with diluted white latex (50% water) if a frost occurs.
- 4) Delay pruning young trees until March after the threat of frosts have passed.

Water management is perhaps the most critical step. To encourage terminal bud set, avoid irrigating in September until growth at the tips of the branches has stopped. Hold off on water until you stop seeing new growth and red leaves. But don't stress trees to the point of yellowing leaves and defoliation. Once growth has stopped, resume irrigating in October if there is no rainfall. Make sure soil is moist before the possibility of a November freeze event.

In addition to water management, painting young trunks white can help minimize freeze damage, especially if applied as soon as possible after a freeze. Wilbur Reil, Farm Advisor Emeritus, found that when trees were painted a week after a freeze event 18% showed damage, compared with 46% damaged in the unpainted trees. Painting any parts that may be damaged should improve recovery; however, if time is limited focus on the south-west side. This side experiences the most day-to-night temperature fluctuations after sunny winter days and is most susceptible to sunburn, which worsens frost damage. To know if you have freeze damage, look for darkened cambial tissue below the bark (Figure 1). Symptoms resemble sunburn. It's most likely to be found on the south and west side of the tree, especially on horizontal branches.



Figure 1. Darkened cambial tissue damaged by frost.

Note, the damage occurred on this tree before the trunk was painted.

Photo, 4/94 by J. Hasey.