COOPERATIVE EXTENSION ... UNIVERSITY OF CALIFORNIA

FRUIT AND NUT NOTES

TEHAMA COUNTY **July 2009** Volume 2

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SACRAMENTO VALLEY REGIONAL WALNUT NEWSLETTER

IN THIS ISSUE:

FIELD MEETING ANNOUNCEMENT

Sutter/Yuba Counties Cooperative Extension

Managing Codling Moth in Walnuts Using Pheromone Mating Disruption

August 6, - 8:30 am

Gilbert Orchards, 4352 Wheatland Road, Wheatland

For more information contact Janine Hasay (530) 822-7515 or Mark Cady (530) 756-8518 ext. 20

The "SACARAMENTO VALLEY REGIONAL WALNUT NEWSLETTER" is a new collaborative effort of walnut research specialists working together to provide Sacramento Valley growers and industry leaders the latest research and information effecting walnut production in today's changing environment. This newsletter will be published quarterly, be sure to look for upcoming issues!

Crown Gall Treatment

Richard Buchner, UCCE Farm Advisor - Tehama County
Janine Hasey, UCCE Farm Advisor - Sutter/Yuba Counties

Due to superior vigor, more adaptability to marginal soils, and greater tolerance to *Phytophthora* crown and root rot and water logging conditions, English walnut varieties on Paradox hybrid rootstock are the preference of most California walnut growers. The major disadvantage of Paradox rootstock is its high susceptibility to crown gall caused by the bacterium *Agrobacterium tumefaciens.* Galls consist of soft, disorganized tissue that lack the rings found in healthy wood or callus.

Crown gall treatment is a costly and labor-intensive activity. It can easily take one to two hours to remove soil and effectively treat a single tree. The preferred time to treat is during the growing season when bark surrounding the gall can be easily removed and treated areas can callus rapidly. Avoid treating after an irrigation or rain since the bacterium spreads in water. Early detection and treating small galls is the preferred strategy. As galls enlarge and develop inside major roots they become increasingly difficult and time consuming to successfully treat. The majority of galls occur below ground so the first step is to remove soil and expose galls for treatment.

Shovels, pneumatic or hydraulic excavation are the most common techniques to expose galls prior to treatment. Shovels and other tools to remove soil work well if only a few trees need treatment. Be careful not to damage roots or crowns and encourage additional gall infection sites. If gall development is extensive and many trees need treatment, using air (pneumatic) or hydraulic (water) is more efficient. Galls can be treated immediately after air excavation whereas the area needs to dry before treatment after hydraulic excavation.

The following information on Pneumatic and hydraulic excavation is from Rob Gross, "Crown Gall in Tree Crops: Biology and Control", ANR Videotape No.: V00-B.

Pneumatic Excavation

For pneumatic excavation, we use commonly available air compressors and hoses, and attach precisely engineered nozzles which accelerate the air stream to twice the speed of sound (mach 2). This extreme speed is the source of power to drive the excavation process. It should be noted that air jets are slower than pressurized water and they are loud. However, the air is ubiquitous and essentially free. High ambient temperatures limit this system.

Method #1
90 psi at 150 cfm, 3/4 inch diameter hose with a mach 2 nozzle.

Method #2
90 psi at 330 cfm, 1 ½ inch diameter hose with a mach 2 nozzle.

For more information on pneumatic excavation including optimum soil conditions, visit *http://walnutresearch.ucdavis.edu/1999/1999_353.pdf*

Hydraulic Excavation

Water deliveries are of two basic types. Methods #3 and 4 use fire-suppression equipment. Method #5 uses a pressure washer-type delivery. For Methods #3 and #4 we have found 60-80 psi has tolerable root impacts at the flows specified. Nozz1e type and configuration are critical for excavation quality management. Water creates more waste with the soil excavate added to the water. Low temperatures limit water use. Water access, volume, flow rate, pressure and water costs are common concerns.

Method #3

One-inch diameter "forestry" hose with KK ThunderFog Nozzle (variable flow rate) or TFT Midmatic (automatic pressure regulating) nozzle. The variable flow rate is our choice as professionals because it is more adaptable to the variables commonly found in the delivery systems we use at different jobs. The automatic nozzles are simpler and easier for the operator to use.

Method #4

One and one-half inch diameter "attack line" hose with nozzles of the same style noted above in Method #3, only larger size. The variables are the same for 1 inch and the 1.5-inch diameter hose sizes.

Method #5

The pressure washer type. This is a convenient and commonly available delivery system, but it produces a slower excavation rate. The good news with this method is it uses less water than the other delivery systems. One point of concern with this delivery is when the nozzle is too close it will cut the roots. The nozzle must be held a foot or more from the roots or considerable damage will result. Over two feet away from the soil excavation, efficacy drops dramatically. Therefore, the nozzle proximity to the excavation is important.

As with any technology, care must be exercised to understand excavation method details in order to achieve predictable results.

Once crown galls are exposed, removing the gall and the bark tissue surrounding the gall is the most effective treatment currently available. Treatments that kill or remove the bark surrounding the gall result in very good control. Research has shown (Buchner, et. al. 1999, http://walnutresearch.ucdavis.edu) that careful surgery is very effective. Applying liquid treatments did not improve control and may have reduced control by not allowing cuts to dry. Every gall is different and requires innovation and tenacity to eliminate. The best strategy is to use a hatchet and chisel, a sharp knife and a propane torch. The hatchet and chisel are used to remove the bulk of the gall tissue. This does not help control but it makes it easier to perform surgery around the gall. Use the propane torch to heat and sterilize the knife then cut and remove a one inch ring of bark from around the gall. Finally, use the torch to heat, dry and sterilize the one inch ring around the gall. Leave the treatment area exposed for six months and look for new galls missed by the surgery and heat treatment. Any small galls at the margins can be quickly burned as they grow. Use caution in young trees as they are particularly sensitive to girdle damage from heat treatments. Photos can be found at *http://ipm.ucdavis.edu/PMG/r881100211.html*.

Continue Watching for Aphid and Spidermite Infestations

Bill Krueger, UCCE Farm Advisor - Glenn County

Aphids. There are two aphid species that damage walnuts, the walnut aphid (a small yellow aphid usually found on the lower surface of the leaf) and the dusky veined aphid (larger yellow aphid with dark banded spots that feeds near the mid vein on the upper surface of the leaf). In recent years, a white form (morph) of the walnut aphid has been found mostly in the lower Sacramento Valley. Populations of the white morph tend to build later in the season than the normal yellow aphids. Aphid feeding produces honeydew and a sooty mold growing on the honeydew turns the leaves black. Aphid feeding can reduce tree vigor, yield, nut size and quality. The honeydew is also attractive to walnut husk fly as a sugary food source.

Walnut aphid will usually be controlled by the introduced parasite, *Trioxys pallidus*, evidenced by the presence of brown mummified aphids with circular exit holes. *Trioxys* can be disrupted by sprays to control other pests or by hyperparasitism (parasitism of the parasites). In-season oil sprays have also been shown to disrupt *Trioxys.* Treatment materials that control other pests such as codling moth and walnut husk fly will normally control hyperparasites but may increase spider mite problems.

Sampling for aphids should begin in May and continue through shoot and nut growth. Collect 5 sub terminal leaflets from 20 trees. Treatment is recommended if there are more than 15 healthy walnut aphids per leaflet. Treatment of dusky veined aphid is recommended if 10% of the leaflets have colonies of 6 or more aphids.

Web spinning mites (spider mites) may develop high populations in the late spring through summer as temperatures rise. Light bronzing of the leaves is an indication of an increasing population. As the population develops, clusters of brown leaves are noticed. Heavy feeding results in webbing-over of the leaves and, ultimately, the defoliation of the infested leaves.

Spider mites are usually kept below damaging levels by natural enemies unless they are disrupted by broad spectrum pesticides or favored by dusty conditions or water stress. Use selective materials whenever possible when treating other pests and avoid the conditions mentioned above. The most dependable natural enemy is the western predatory mite which can be seen by using a hand lens. It is generally clear and pear-shaped and will be moving more rapidly than the spider mites. Six spotted thrips can also be an effective predator, but may come into the orchard too late to control the pest before economic damage occurs.

Monitoring. Starting in late May or early June and continuing through August at weekly intervals, randomly select ten trees in the orchard and check ten leaflets per tree (5 low and 5 high). Look for web spinning mites, predator mites and six spotted thrips.
Treatment thresholds where organophosphate or pyrethroid insecticides are **not** used.

- 30-40% infested leaflets if predators are on less than 10% of the leaflets.
- 40-50% infested leaflets if predators are on 40-50% of the leaflets.
- If predators are on 50% or more of the leaflets, a treatment should not be necessary.

Where organophosphates or pyrethroid insecticides **are** used.

- 10% infested leaflets if predator mites are on less than 10% of the leaflets.
- 20% infested leaflets if predators are on more than 20% of the leaflets.

There are a large number of materials available for controlling spider mites with different modes of action and characteristics. Select a material to fit your situation. Avoid using materials in the same mode of action group more than 2 times per year to reduce the risk of resistance development.

For more information on these and other pests, including pictures and treatment options, consult UC Pest Management Guidelines for walnuts available online at http://ucipm.ucdavis.edu or through your local Farm Advisors' office.

Fast Facts about Ethephone Use on Walnuts

Bob Beede, UCCE Farm Advisor—Kings County

What is Ethephon? Ethephon, also known as Ethrel®, is an ethylene-based plant growth regulator applied at walnut maturity, or shortly thereafter, which accelerates hull cracking and separation from the shell. In so doing, walnut harvest is advanced by four to seven days, depending on the season and variety, and nut value is increased by lighter kernel color and possibly less insect damage. Performance is improved with experience.

When are walnuts mature? Walnut kernels are physiologically mature well ahead of their natural drop from the tree. Kernels achieve maximum oil accumulation when the packing tissue surrounding the kernel has changed from a bright white to the color of oak. This is commonly referred to as Packing Tissue Brown (PTB). The packing tissue continues to darken to a mahogany color as the nut ages. Kernel maturity often occurs 21 or more days ahead of unaided commercial harvest (at least 80% removal with 10% or less stick-tights). During this period, the green hull tissue surrounding the nut undergoes separation of its vascular tissue from the nut, and the hull also cracks from tissue breakdown and moisture absorption. Unfortunately, the kernel also ages, resulting in darker, less valuable nuts. The risk of insect damage, principally from navel orangeworm, also increases due to longer exposure to the last generations of the season.

Is Ethephon right for me? Perhaps not. Users must commit to monitoring the orchard weekly for PTB, applying the product at night or early morning to avoid temperatures approaching 90^0 F, and then have control over harvest timing 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.

How do I time treatment? Three years research in Kings County shows PTB occurs last in the bottom of the canopy, and that fully shaded walnut canopies have greater maturity variability than those with full sunlight. Orchards deficit irrigated or stressed from low water infiltration also develop PTB sooner than well water orchards. Early walnut varieties such as Serr develop PTB sooner (mid-August) than late varieties such as Chandler (mid-September). Begin sampling at least two weeks ahead of when PTB is expected. Walk diagonally across the orchard and collect at least 100 nuts. Do not include nuts obviously advanced in maturity, since they are often oil-less and atypical. Cut each collected nut in half. This is often done by insertion of a knife blade into the stem end of the nut, followed by a twisting of the blade to split the nut down its suture. Care must be taken to prevent the sudden loss of resistance to the knife blade, with subsequent puncture of your hand palm! Wear leather gloves over latex ones to reduce the risk of injury and severe hand staining from the hull tissue. Place one half of each nut into either a "yes" or "no" group for PTB. **Only nuts with complete browning of the packing tissue, including the area near the stem end, qualify for the "yes" group**. It is better to be two days late in application than two days early, since losses in weight, nut quality, and hullability result from early ethephon application! Application delayed five to seven days after PTB improves percent nut removal and the chances of having to only harvest once. Consider crop load, weather, and variety susceptibility to darkening in electing this option.

Do all walnut varieties respond similarly? No, research in Kings County suggests walnut cultivars differ in their sensitivity to ethephon. Laboratory testing of Serr, Payne, Tulare, and Chandler suggests that Serr produces the least amount of ethylene after treatment of these four varieties, and Tulare the most. This agrees with field experience in the Southern San Joaquin Valley, where Serr is often marginal in response, and Tulare falls off the tree shortly after treatment. Growers report Howard is also very responsive to ethephon in Northern California, resulting in greatly enhanced quality and value. The responsiveness of Tulare in the South has now made it a standard cultural practice.

What about treating stressed orchards? Growers treat stressed orchards at their own risk. Walnut stress typically arises from under or over irrigation and heavy mite infestation. Ethephon applied to stressed orchards can experience more leaf drop prior to and after harvest. Excessive leaf drop can vastly complicate harvest, especially in the event of rain. Remember, quality does not begin at harvest, and ethephon is an aid, not a panacea for all the quality related problems experienced during the season.

How do I apply it? Only ground application with large self-propelled speed sprayers is recommended in the South. Four to five pints of product are added to 150-200 gpa, with ground speeds between 1.5 and 2 mph, depending upon canopy size. **Ethephon does not translocate! It must hit the nut to create the desired response!** Experience shows greater response under higher humidity and lower temperatures. Never apply when temperatures exceed 90^0 F. Do not apply when drying winds, typical in the North, prevail. Ethephon is rainfast within six hours of treatment. Like all plant growth regulators, application conditions which improve absorption time increase product performance. Reports from northern California growers suggest weather conditions are favorable for effective aerial applications on responsive varieties such as Howard, Hartley and Vina. Growers and northern California county Ag Commissioners report aerial use rates of two to four pints in 40 gpa. Aerial application and ethephon concentrations greater than those recommended for ground treatment (900 ppm) are allowed by the label, **BUT** they are not supported by the manufacturers. Rates higher than recommended may result in tree injury, such as excessive defoliation, reduced catkin formation and twig dieback. All risks for air application with higher concentrations are assumed by the grower. Check with your crop consultant for a local recommendation.

Does Ethephon pay? Research documents improved nut value of five cents per pound, principally due to lighter kernel color. However, greater value increases may be experienced commercially under heavy navel orangeworm pressure, or with varieties prone to rapid kernel darkening. Growers in the North report improved Howard value of nine to 12 cents. Control over harvest timing is also an advantage to which a price cannot be assigned.

Best Management of Replant Alternative Fumigants

Carolyn DeBuse, UCCE Orchard Systems Farm Advisor - Solano & Yolo Counties
Mike McKenry, Nematology Departtment, UC Riverside

Soil fumigation with methyl bromide or higher treatment rates of Telone II have historically been the standard practice when replanting walnut orchards. The gradual phase-out of methyl bromide, its increasing price and the California-imposed limitation of 332 lb/acre Telone II have forced growers into alternative replant approaches. Lesser application rates of alternative fumigants (< 350 lb/ac) have repeatedly been shown to be less effective than 400 lb/ac methyl bromide. Good management of their application can increase effectiveness. Walnut soils in the Sacramento Valley are almost always high in clay content. These finer- textured soils are harder to dry because their soil air spaces are more abundant and also smaller than those of the coarser-textured San Joaquin Valley soils. In finer-textured soils expect reduced overall fumigant movement particularly because molecules of the alternatives (Telone II and Chloropicrin) move slower through soil while degrading much faster than molecules of methyl bromide decreasing fumigant effectiveness.

The best recommendations when removing an orchard are to replant to a different crop or replant to a rootstock that has resistance and tolerance to pest presence. With walnuts we do not currently have enough rootstock choices available. A greater choice of rootstock selections will eventually help reduce nematode problems in replanted orchards but let's discuss what is available today. Seedling Paradox has higher vigor than black walnut but only a single clone of Paradox (VX211) is currently known to tolerate nematode feeding and this tolerance can be overcome if nematode populations are too high at planting time. The tolerance within VX211 derives from a resistance mechanism within its root tips that forces nematodes to avoid feeding within root tips. Black walnut roots support fewer nematodes than paradox but they do not develop as many roots. English walnut develops more roots than paradox but also supports a even higher nematode populations than most paradox roots and can receive notably greater nematode damage than either paradox or black walnut.

The terminal 12 inches of roots of English, Black or their hybrids commonly support thousands of *P. vulnus* per gram of root. Because of that, we refer to all three rootstock groupings, including the VX211 clone, as being highly susceptible (> 180 nematodes/gram of root). Meanwhile, further back on the root systems that support these root tips it is uncommon to find *P. vulnus* populations in numbers greater than 3 per gram of root. The take home message is that nematode damage to walnut trees is occurring due to damage caused while feeding at root tips. It follows that the long-lived *P. vulnus* located all along old walnut roots are constantly available in adequate numbers to immediately attack any new roots. Applications of Garlon herbicide can completely rid old walnut roots of *P. vulnus* within 6 months after its application. Be aware that five-years after killing walnut roots with Garlon one can expect 5% of the old root-lesion nematodes, *Pratylenchus vulnus*, to remain alive within soil without feeding.

Guidelines for replanting walnuts to walnuts

Nematode sampling: Send soil samples to a lab to determine if nematodes are present. Plan on a broadcast soil fumigation if *Pratylenchus vulnus* is present anywhere within the field at populations greater than 1 *P. vulnus* /250 cc of soil and the previous crop was a perennial.

October- mid-November: Kill and remove previous orchard roots- Roots left in the soil from the previous orchard will harbor nematodes and pathogens allowing them to quickly invade newly developing root systems. It is helpful to kill the old roots (easiest approach) or physically remove them (very difficult). To kill the old roots, first, irrigate the orchard. Second, cut down trees. Third, paint the cut tree stumps with 50ml Garlon 3A plus 50ml MorAct. This operation must be done by mid-November to be the most effective. Wait at least 60 days before removing stumps and ripping the ground. If the Garlon method is used you do not have to cross rip and hand-remove remaining roots. Within five months of this treatment nematode populations within roots can have been reduced by 99%. Now, any fumigant you might use does not need to penetrate and kill old roots. However, the fumigant does need to penetrate throughout as much of the soil volume as possible in order to adequately provide new roots enough growing space that is free of nematode feeding.

If you choose not to use Garlon to kill the roots, they should be removed in the traditional style of deep ripping to bring roots to the surface and then hand removing them from the orchard site. It will take over 2 ½ years for the nematode population to be reduced to the same level Garlon achieves in one.

March-May: Plant a covercrop or leave fallow- Plant safflower or true sudan grass rotation crops. These do not support nematode development and more importantly can serve to deep-dry the soil profile. Another option is to leave the site fallow for at least one year between removal of the old orchard and planting to help starve nematode and soil pathogen populations and to dry out the soil. Sudan grass can reduce the soil dwelling nematode population by 85% while fallowing the soil only reduces them by 50%. Unfortunately, any control level less than 98% is a failure and for comparison a good fumigation can kill 99.9% of nematodes within the surface 4.5 to 6 feet of soil.

September-November: Fumigation- Fumigation should take place after completion of soil preparation in the fallow year between September and November 15th, or before 2 inches of rainfall occurs. Soil moisture is critical for success and needs to be measured. True fumigants move 10,000 to 30,000 times faster in soil air spaces than they move in soil water; so it is important to treat dry soil. Soil moisture content on a dry-weight basis at the time of application should be at or below 12 percent throughout the surface five feet of soil to be successful with 332 lb/acre Telone II. Fallow soil should have been ripped and reworked through the summer to dry soils to the 5 foot depth. It is important to fumigate before soil temperature drops. It is recommended to fumigate before November 15th with soil temperatures still above 55°F. Soil temperatures should be taken at one foot depth.

Fumigation choices: To make a choice you need to consider soil texture, soil moisture and soil temperature.

- **Sandy or sandy loam soils**: The coarser-textured soils provide a higher potential for fumigants to be effective. These soils can be deeply-dried faster and easier and the natural movement of gases through such soils is greater. All true fumigants (Telone II, Telonce C-35, and chloropicrin) move best through coarser-textured soils. In addition, fumigants that must be moved with water, including In-line, Metam Sodium, and Metam Potassium will perform best in these soils. The latter three emulsified products can provide adequate nematode control in coarser textured soils if uniformly mixed with at least 6 acre inches of water; enough to move them down to the five-foot depth.

- **Silty loams or clay loams**: For best results (control to five foot depth) on finer-textured soils follow these steps for soils with: a) < 12% moisture, b) 12 to 15% soil moisture or c) 15 to 19% soil moisture.

  Pre-rip soil in one direction to 4 to 5 foot depth on 2 foot centers

  Disc and ring roller to close soil

  Fumigate using a shank mounted with 2 wings along its length just above the shank delivery points which are located 15-20 inches and 24-30 inches beneath the field surface. We call these Buessing shanks.

  Follow shank application with disc and roller

  At <12% moisture content apply 332 lb/ac Telone II equally mixed between the two delivery points.

  At 12 to 15% moisture content apply 332lb/ac Telone II at upper depth plus 150 lb/ac chloropicrin at deeper depth.

  At 15 to 19% moisture content apply 332 lb/ac Telone II at upper soil depth plus 250 lb/ac chloropicrin at deeper depth.

(Telone II and chloropicrin need a restricted materials permit that you can apply for at your County Ag Commissioner's office)

Nutritional considerations: Soil is depleted of many micro and macro nutrients by previous crop production and fumigation can lower available phosphorus (P) and zinc (Zn). It is important to consider these nutrients when replanting an orchard. Fertilization of the young trees may be needed. Leaf analysis should be done in July of the first year to confirm nutritional status.

For more information go to Dr. M. McKenry's website http://www.uckac.edu/nematode/ On this website pay particular attention to the one-hour interview of Dr McKenry by farm advisor Bob Beede of Kings County which shows fumigant movement as well as future directions for situations where no fumigants are available.

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