COOPERATIVE EXTENSION ... UNIVERSITY OF CALIFORNIA

FRUIT AND NUT NOTES

TEHAMA COUNTY **May 2009** Volume 1

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SACRAMENTO VALLEY REGIONAL WALNUT NEWSLETTER

IN THIS ISSUE:

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!

Kaolin Particle Film Application for Walnut

Kathy Kelley Anderson - UC Farm Advisor Stanislaus County
Richard P. Buchner - UC Farm advisor Tehama County

Kaolin, a naturally occurring clay mineral, is used in many consumer products including toothpaste and cosmetics. Kaolin is mined from the earth and processed into superfine particles. When mixed with water and sprayed on walnut trees, the particles link together to form a protective white film that reflects the suns heating infrared wavelengths, as well as the burning ultraviolet rays resulting in cooler trees and less sunburn. USDA apple researchers found that the material does not block the stomates and, in fact, increases photosynthesis. The material has also been shown to suppress codling moth and walnut husk fly and is OMRI approved for use in organic production.

Research conducted by UC Cooperative Extension Specialist Dr. Bruce Lampinen, showed that Surround^{Ò} was effective in lowering leaf and nut temperatures and preventing sunburn damage in walnuts. Tiny temperature sensors, called thermocouples, were taped on untreated and Surround^{Ò} sprayed sun-exposed leaves and nuts and temperatures were continuously recorded over a several day period in midsummer. Results indicated that exposed Surround^{Ò} treated walnuts were 4 to 8°F cooler than untreated nuts, enough to keep them below the estimated sunburn damage threshold of around 122 °F. Temperatures, of course, never get this high, but surprisingly, exposed walnuts were found to be up to 20°F warmer than the surrounding air.

Studies conducted over a four-year period in Stanislaus County compared untreated and Surround^{Ò} treated trees in well managed Vina, Howard, Tulare, and Chandler orchards. The quality of harvested nuts was evaluated by Diamond Foods Inc. and showed that Surround improved the percentage of large sound, external damage, mold, offgrade, and edible yield and increased relative value. Results varied among varieties and years. Quality and value increases were consistently seen in Vina. Improvements with Howard and Tulare were more variable while Chandler value was not increased in any of the years. However, the material and application costs of multiple full-canopy sprays can exceed the increase in crop value when calculated on a 60 cent per pound basis. Feasibility improves with increasing nut prices. In an effort to reduce costs, half-canopy sprays, applied to the south or west sides of the tree rows were evaluated. Results showed that Surround sprays applied only to the side of the canopy receiving afternoon sun were effective.

For optimum protection, thorough, uniform and complete coverage is required for best results. Label rates for ground applications currently range from 25 to 75 lbs. per acre in 100 to 200 gallons of water. In varying the amount of material and water, do not go under the effective dilution rate of 1 lb of Surround® in 2 to 4 gallons of water. Spray trees to wet. Three applications of Surround® at 50 lbs. per 200 gallons of water per acre gave good results in Stanislaus County trials. Improve coverage by changing the direction of travel on alternate applications. For example, if you start in the first row and move east on the first application, alternate directions and start on the west side of the first row for the second application.

The label says to make the initial application before a forecasted damaging heat event. Experiments in Stanislaus County indicate that in most years in the Central Valley, timing the initial application in early to mid-June works well. One application will not provide sufficient protection. Reapply Surround® as needed to maintain sufficient coating during hot weather. In trial work, the intervals were determined by the degree of material weathering and high temperature forecasts. The second application was typically made within 10 days to three weeks depending on conditions. Spray intervals between the second and third application ranged from three to four weeks. With larger trees, experience shows that shutting off lower nozzles and directing the spray to the upper canopy improves efficacy. On tall trees with exposed nuts only on the top of the canopy, three aerial applications at the rate of 30 pounds in 20 gallons of water per acre have given good results in non-trial situations. The label recommends aerial applications at the rate of 25 to 35 lbs. of Surround® WP in 25 to 35 gallons of water per acre. A real benefit of Surround® is that you can use it to evaluate spray coverage by assessing the evenness of the white coating on the trees.

Research conducted in Tehama County in 2003 studied the physiological effects of kaolin applications on low (-4 bars) versus high (-13 bars) stress Chandler walnut trees. Results suggested that kaolin applications improved whole canopy photosynthesis. Kaolin particle films altered light distribution within the canopy increasing incident radiation particularly on inner canopy leaves. From a trees stress perspective, evaluation of midday stem water potential showed no consistent difference due to Kaolin application. Midday stem water potentials were about the same for low and high stress trees treated with kaolin. Midday stem water potential indicates tree water stress measured with a pressure Chamber.

"Good Neighbor Program" Compatibility between Codling Moth Control Methods

Carolyn DeBuse, Orchard Systems Advisor, UCCE, Solano and Yolo Counties;Carolyn Pickel, Area IPM Advisor, UCCE, Sacrament Valley; Joe Grant, Farm Advisor, UCCE, San Joaquin County; Sara Goldman Smith, Staff Researcher, UCCE, Sut-

The use of pheromone mating disruption (PMD) is becoming more wide spread for controlling codling moth (CM) in walnuts. PMD floods the orchard with the female moth's pheromone so that the male cannot easily find the females to mate. With careful monitoring and supplemental codling moth insecticide sprays the first few years, UC demonstrations have shown that aerosal CheckMate Puffer CM-O ®manufactured by Suterra (figure 1) can provide good control in walnuts at rates as low as one unit per two acres in the orchard middles and more puffers on the edges. At this rate, along with the lower cost of labor and reduction in pesticide use over time, puffers are an affordable option for walnut growers. Other PMD options including hand applied dispensers and sprayable formulations are described in the UC Walnut Pest Management Guidelines (http://www.ipm.ucdavis.edu/PMG/r881300211.html#MONITORING1)

The puffers are programmed release pheromone at 15-minute intervals starting in the early evening and stop in the early morning. This means that during the night, air movement carries the pheromone throughout the puffer orchard and possibly into adjacent orchards. It is important to notify your neighbors that you are using puffers in your orchard because the pheromone used in PMD is the same pheromone used in the common 1X lure that is placed in the conventional CM monitoring traps. This makes 1X lures useless for monitoring codling moth in PMD orchards. It can also severely impair their usefulness in adjacent orchards. Making matters worse, the pheromone concentrations capable of causing trap "shut down" in nearby orchards are not high enough to provide control. The solution is for adjacent orchards to monitor using the same lure now recommended for monitoring codling moth in PMD orchards. This CM-DA Combo lure (from Trécé Inc.) attracts both male and female moths using a combination of codlemone, a male attractant, and a kairomone (pear essence), which attracts both males and females. CM-DA baited traps should be hung at the upper third height in the canopy to be the most effective.

In a 2008 orchard study in Yolo County, we looked at two neighboring walnut orchards, one using puffers and the other using conventional insecticide control for CM. To estimate the puffers pheromone influence, we hung 1X traps at progressively farther distances from the puffer orchard. It was found that puffers reduced the CM catches in 1X traps as far as 1000 feet away (figure 1). In other studies, in the direction of the prevailing wind the distance of influence has been up to 2000 ft.

We also wanted to compare combo traps hung in the top 1/3 of the canopy with combo traps hung low (6 feet). High hung combo traps caught a greater number of moths (Figure 2). Such differences in trap counts may be large enough to influence the grower's decision in choosing a control measure. A grower using only low-hung combo traps may not be getting a reliable reading of codling moth activity and population.

Proper monitoring using combo traps hung high in both the puffer and the neighboring orchard resulted in successful control of the codling moth populations. The puffer orchard treated one variety (Vina) with one insecticidal spray and the neighboring orchard used 3 applications of insecticides to control CM. Both orchards had less than 0.2% codling moth and 0% navel orangeworm damage. This study demonstrates that two very different approaches to controlling codling moth can be compatible when proper monitoring is used.

"Good Neighbor Program"

Using puffers for PMD is a useful method to control CM but you need to remember to be a good neighbor.

- Notify neighbors in a timely manner of your intentions to use puffers before the season starts, recognizing that each orchard location will have different prevailing wind.
- Educate neighbors on the influence the pheromone may have on their trapping and monitoring of CM in their orchards.
- Both orchards should monitor CM populations using CM-DA Combo traps hung high in the top 1/3 of the canopy.

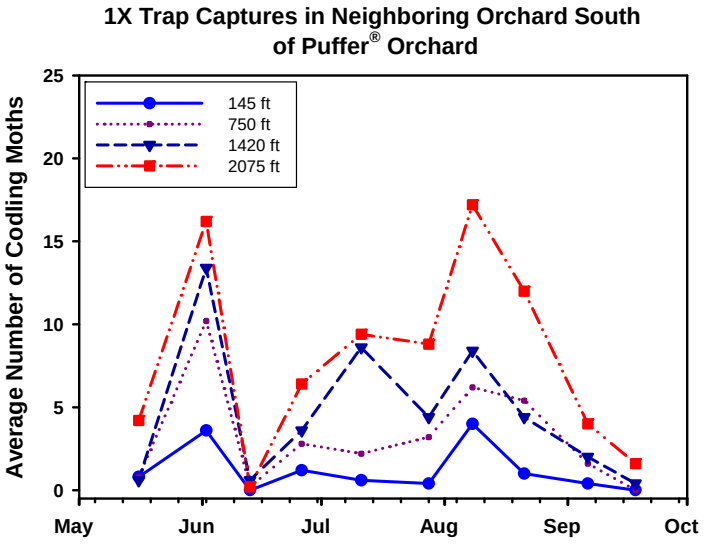


Figure 1. Average codling moth counts over the season in the 1X trap lines at 145, 750, 1,420, and 2,075 feet from puffer orchard.

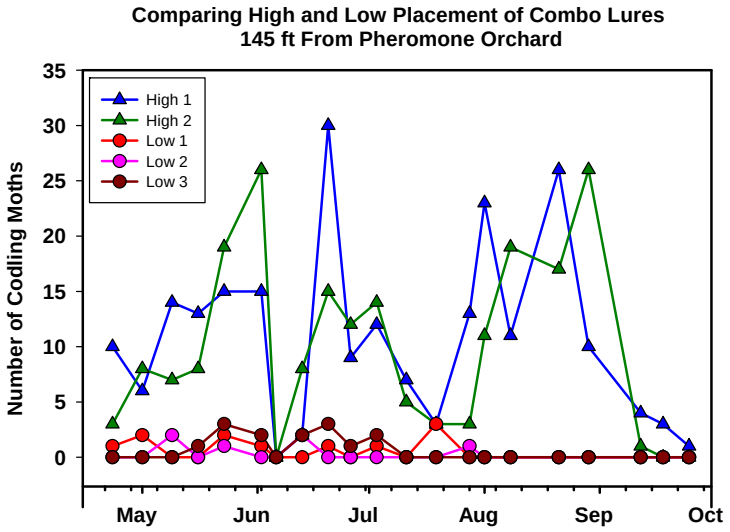


Figure 2. Number of codling moths caught at each date throughout the season comparing combo traps hung high in the top 1/3 of the canopy to traps hung low (~6 ft. from ground) within the pheromone influenced area of the neighboring orchard to the puffer orchard.

SOIL TESTING AND ANALYSIS: WHAT TO EXPECT IN THE REPORT

Allan Fulton, Farm Advisor, Tehama, Glenn, Colusa, and Shasta Counties and
Dirk Holstege, Director Analytical Laboratory, University of California Davis Agriculture and Natural Resources

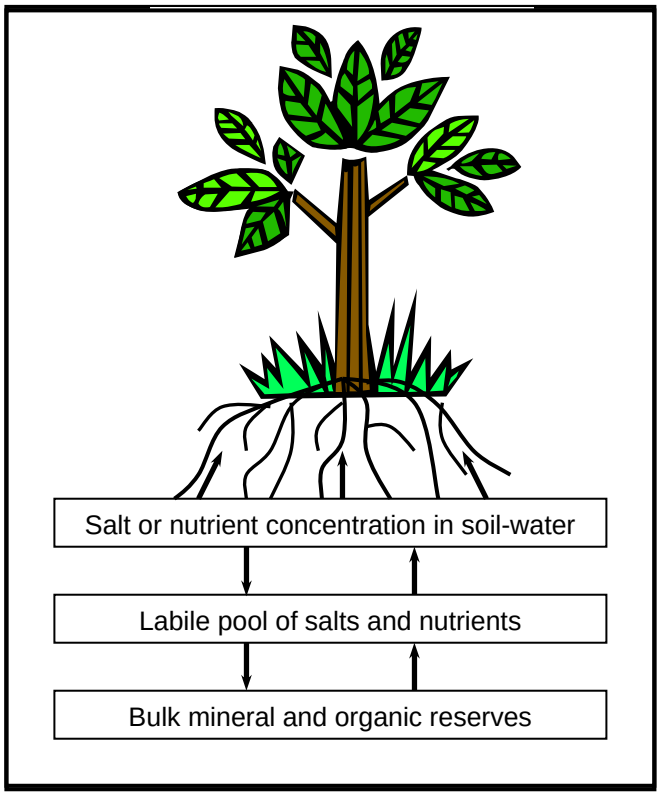
Agricultural laboratories usually analyze and report soil salinity and fertility levels in the same report. Saturation percentage, electrical conductivity, sodium, calcium, magnesium, chloride, bicarbonate and carbonate, sulfate, and boron are all factors related to salinity. Indices such as the Sodium Adsorption Ratio (SAR) and Exchangeable Sodium Percentage (ESP) are calculated from these basic measurements of soil salinity and included in the report. Soil testing for salinity is designed to diagnose osmotic effects, specific ion toxicities, and infiltration problems. When the salinity (electrical conductivity) of the soil-water surrounding the root exceeds the tolerance of a salt sensitive crop like walnut, the gradient between the solute concentration in the root cells and the soil-water around the root lessens, reducing water availability to trees. Trees influenced by osmotic effects will not grow as vigorously. Specific ion toxicity involves the accumulation of sodium, chloride, or boron in soils to high enough levels that the risk of these elements accumulating to toxic levels in leaf tissue of trees increases. Symptoms of ion toxicity may include death of leaf tissue along the margins or in the interveinal areas of leaves. Soils that develop slow water infiltration and permeability rates are sometimes related to low levels of electrical conductivity and calcium, and high levels of sodium or magnesium.

Fertility focuses on essential plant nutrients, which is evaluated based upon soil pH and proper quantities of nitrogen, phosphorus, potassium, zinc, iron, manganese, copper, and molybdenum in the soil to promote walnut tree growth and fruit development. While calcium, magnesium, boron, and chloride are important to diagnose salinity, they are also of interest from the standpoint of fertility in terms of deficiency, sufficiency, and balances.

Salts and nutrients exist in soils as three forms (see schematic) and this is reflected in soil test reports. Bulk minerals and organic reserves release salts and nutrients very slowly and contribute only in a minor way to the quantity or intensity of soil salinity or fertility affecting crops, so commonly used soil tests do not measure bulk minerals and organic reserves. Bulk minerals and organic reserves do play an important role in buffering soil salinity and fertility.

Labile forms of salts and nutrients are unstable and constantly seeking equilibrium with the salts and nutrients in the soil-water and to a lesser extent with the bulk mineral and organic reserves. It is widely accepted for laboratories to measure labile forms of nitrate-nitrogen, orthophosphates, and potassium in soils to determine the amount available to the plants. They can be recognized on the soil test report by measurement units in "milligrams per killogram soil (mg/kg)". Many, but not all, laboratories measure and report salts in the labile form. If measured, they can be recognized in a report by descriptive terms such as "exchangeable", "extractable", "cation exchange capacity" or reporting units in "milliequivalents per 100 grams of soil (meq/100 gm)". Some laboratories prefer to only measure and report salts in the saturated paste extract rather than exchangeable forms, unless specifically requested by the customer. Measuring exchangeable cations and the cation exchange capacity can be challenging because research has shown that commonly-used laboratory methods of extracting the cations adsorbed to the soil particles (the exchangeable cations) also dissolve lime and gypsum in the soil and as a result tend to overestimate the cation exchange capacity and exchangeable calcium.

Nearly all laboratories measure salinity (sodium, calcium, magnesium, chloride, bicarbonate and carbonate, sulfate, and boron) in a saturated paste extract. The extract represents the soil-water at a very high soil moisture content along with the dissolved salts and nutrients that are readily available to the tree. Decades of research on crop tolerance to salinity have been based upon correlations between crop development, yield and salinity levels in the extract. The extract is acquired for testing by following specific procedures to make a saturated soil paste or mud and then vacuum suctioning the water from the soil paste. The water content of the saturated paste (saturation percentage) is measured and reported to understand the dilution effect of the saturated soil and to enable the test results to be related to lower soil moisture levels that typically occur in orchard soils. Salinity measurements of the saturated soil extract are often labeled on reports as "water-soluble" and the reporting units are "milliequivalents per liter". The soil pH reported is commonly measured in the saturated paste prior to vacuum extracting the soil-water from the saturated paste. Nutrients such as nitrate-nitrogen, phosphorus, and potassium may not be reported in the water-soluble forms because determinations of these nutrients in labile forms are more meaningful to evaluate soil fertility.



For further information about soil testing and analysis and to acquire specific guidelines for interpreting soil salinity and fertility results in walnut, some suggested references include: 1) Chapter 23, *Mineral Nutrient Availability* and Chapter 24, *Nutritional Deficiencies and Toxicities in Walnut- Diagnosing and Correcting Imbalances* in UC Publication 3373 Walnut Production Manual, 1998; and 2) UC Publication 3375, *Agricultural Salinity and Drainage*, 2006. The North American Proficiency Testing Program website (http://www.naptprogram.org), which operates as an activity of the Soil Science Society of America, seeks to assist soil, plant, and water testing laboratories in their performance through inter-laboratory sample exchanges and statistical evaluation of laboratory results. The website provides information about participating laboratories in California and throughout the United States. Technical information is also available on laboratory methods specifically used on soils in the western United States including California conditions.

Walnut Scale

Bill Krueger and Janine Hasey UCCE Glenn and Sutter/Yuba Counties

Walnut scale can be found at significant levels throughout the walnut growing areas in California. Recent observations have indicated increasing populations in some parts of the Sacramento valley particularly on Chandler and Tulare varieties.
Walnut scale is a member of the armored scale family of insects which have a hard waxy covering that is separate from the body. Walnut scale has two generations per year in the Central Valley. The eggs of the first generation hatch in mid-may and the crawlers move around the branches for a short time before settling down to feed. The second generation hatches in mid-August and will molt once before overwintering.

The scales insert their mouth parts into twigs and branches, then suck sap from the tree. Unlike soft scales they do not secrete sticky honeydew. Infested trees may appear water stressed and inside fruiting wood encrusted with scale may die back **(fig 1)**. Heavy populations may cause the bark to split and twigs and limbs to dieback. Walnut trees can endure heavy populations without economic loss. The severity of these visual symptoms associated with heavy populations is used to determine if treatments are warranted.

It is important to be able to distinguish walnut scale from San Jose scale (SJS), another similar armored scale which can infest walnuts because SJS is more likely to cause dieback of branches and even scaffold limbs. Look for the characteristic "daisy" shape of the coverings of walnut scales that is formed as the elongated male crawlers settle under the margin of the female cover **(fig 2)** and deeply indented margins of the yellow female body that can be seen when the waxy covering is removed **(fig 3)**

Managing walnut scale

In many orchards, natural enemies will keep walnut scale below damaging levels. Predator beetles and small wasps such as *Aphytis* and *Encarsia* can be effective in controlling scales. This natural control can be disrupted in orchards using insecticides for codling moth and walnut husk fly. Even in orchards such as 'Chandler' where insecticides are rarely used, many orchards have developed high walnut scale populations over the last several years.
Determining treatable levels and spray timing-
, The dormant or delayed dormant period is the best time for monitoring scale, when scale on limbs and prunings can be easily examined. However, you can still examine the trunk and lower limbs for scale and apply an in season spray if needed directed at the crawler stage. To determine crawler emergence and population levels, encircle a few limbs where scale is evident with double sided sticky tape in early May. Check frequently for the yellow crawlers with a hand lens. Apply a spray once crawlers are detected. Previous research has shown that a spray directed at the crawler stage may have longer lasting effects than the delayed dormant application spray timing.
In season control options -
There are several control options available for orchards with heavy walnut scale populations, minimal parasitism, weakened or dying fruitwood, and crawlers detected on sticky tape:

- The insect growth regulator Seize 35 WP. Coverage is very important. Use rates are 4 to 5 oz product/acre and a nonionic surfactant may be used to increase efficacy. Because it is an insect growth regulator, it may take the summer for scale to cycle out.
- Supracide 25WP at 8 lbs product/acre. Do not combine with oil or use more than once per growing season.
- Lorsban 4 EC at 4 pts product/acre. Do not make more than two applications per season.
- Narrow range oils can suppress low to moderate populations during the summer. Do not apply to drought or diseased stressed trees or in temperatures over 90°F. This is the option for organic orchards.

Associated problems-

In some orchards where heavy walnut scale and extensive dieback has been observed, we've been finding the fungal disease Botryosphaeria that causes cankers in infected limbs. Another fungus, Phomopsis, has also been isolated from dying limbs where scale was a problem. The general thinking is that the scale weakens these limbs and predisposes them to these fungal diseases. Dead and dying wood should be pruned and removed and scale should be treated in these orchards.

Fig 1

Fig 2

Fig 3

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