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# ORCHARD NOTES

## SPRING, SUMMER, FALL 2006

MAY 2006

### SABBATICAL LEAVE

I will be taking a sabbatical leave from June 1, 2006 through May 31, 2007. During my absence, there are several Farm Advisors and Extension Specialists who will be answering questions. Our office staff will have a list of who you should contact depending on the crop and the question. Please call our office at (530) 822-7515 and tell them the crop and the general nature of question or problem (insect, disease, irrigation, economics, etc.) and they will refer you to the right person.

*What will continue?* John Edstrom, Colusa County Farm Advisor, will plan the 2007 Sutter/Yuba/Colusa Walnut Day and program announcements will be sent to those who checked walnuts on my "Orchard Notes" newsletter subscription form. I will occasionally visit my ongoing research plots and assist with collecting harvest and other data.

*What won't continue?* Sacramento Valley Cling Peach Day will not be held in January 2007 as there are no other peach farm advisors in northern California. My Pest Tracker will cease after May 31, 2006 and resume when I return in the summer of 2007. There will be no "Orchard Notes" newsletters except as noted above. However, this May issue includes information for spring, summer, and fall. Keep it for reference as the months go by.

*What will I be doing?* The first month I'll be traveling and meeting with researchers and growers of walnuts, peaches, and kiwifruit in Italy to learn of different practices, especially in the area of integrated and organic production systems and peach fruit ripening, to get ideas that could be researched locally. I'll be visiting the facility in Spain where cherry leaf roll virus (causes walnut blackline disease) tolerant clones and own-rooted walnuts that are micropropagated and also visit own-rooted walnut orchards.

In a 2002 walnut grower survey, Sutter and Yuba County growers listed crown gall disease as their number one walnut research need and statewide it was in the top three. I'll be conducting a crown gall study next spring at UC Davis with Dr. Dan Kluepfel of the USDA ARS comparing

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micropropagated (tissue culture) clonal Paradox rootstock, own-rooted walnut trees, and a new crown gall resistant walnut rootstock to seedling rootstocks for disease susceptibility. In conjunction with this study, I'll be doing a crown gall field survey in the fall. My plans also include writing several publications on completed research projects.

## SPRING TOPICS/ORCHARD ACTIVITIES

### NITROGEN FERTILIZER GUIDE IN WALNUT ORCHARDS

The 'hot off the press' UC publication "Guide to Efficient Nitrogen Fertilizer Use in Walnut Orchards" is included with your newsletter if you are a Sutter or Yuba County grower or PCA and checked walnuts on your newsletter subscription. This publication will provide in-depth information on nitrogen fertilization and management and provide tools to help you manage your orchard efficiently and economically. With the rising cost of fertilizer and fuel, it is just in time! You are receiving this free through funding provided by the Governor's Buy California Initiative, CDFR, and USDA. This publication will be available for purchase at a later date from our office.

### FINAL CHILLING and HISTORICAL BIOFIX

The crops leafed out about a month late and I too, am late in getting you a spring newsletter this year. Even though it may seem late, I always include my final chilling hours that I record at my office and historical biofixes in my spring issue so here they are. We certainly saw the straggled blooms that are characteristic in low chill years. The extended bloom was made worse with the continual cold and rainy weather in March and April. I must say I have never seen Peaches bloom for two months!

### FINAL CHILLING HOURS

Year	Nov 1-Feb 28 *(Yuba City) FINAL	Nov 1- Feb 28 (Nicolaus CIMIS) FINAL	Nov 1-Jan 3** *(Yuba City)	Nov 1-Jan 3 (Nicolaus CIMIS)
2005- 2006	780	837	466 (Jan 18)**	434
2004- 2005	994	985	466	524
2003- 2004	886	863	436	460
2002- 2003	779	920	388	492

\*Chilling hours recorded at our office in Yuba City on Garden Highway using the chilling hours below 45° F model. Included is a comparison of final chilling units to those accumulated in November and December, often considered as critical months for chilling.

**CURRENT AND HISTORICAL FIRST BIOFIX AND PEACH RUST DATA**

YEAR	OFM	PTB	CM	PEACH RUST
2006	Never set, too erratic & sporadic	5/15 (S)	4/19 (M) 5/5 (F)	4/5 - Twig Canker
2005	3/7 (S)	4/20 (S)	4/15 (S-M) 4/17 (Y-F)	None found where sampling
2004	2/29 (S)	4/12 (S)	3/20 (Y-M) 4/6 (Y-F)	4/15 - Twig Canker
2003	3/5 (S)	5/10 (S)	3/30 (Y)	5/6 - Twig Canker
2002	2/22 (S) 2/26 (Y)	5/7 (S)	3/27 (Y)	5/3 - Twig Canker
2001	2/26 (S) 2/28 (Y)	4/24 (S)	3/19 (S) 3/21 (Y)	5/4 - Twig Canker
2000	2/23 (S) 2/23 (Y)	5/3 (S) 4/24 (Y)	4/2 (S) 3/22 (Y)	None
1999	2/24 (S) 2/24 (Y)	5/3 (S) 5/17 (Y)	4/15 (S) 4/12 (Y)	4/21 - spores found (Twig Cankers)
1998	3/9 (S)	4/27 (S)	4/19 (S) 4/18 (Y)	4/6 - spores found (Twig Cankers)
1997	3/7 (S)	4/14 (S)	3/21 (S) 3/19 (Y)	
1996	3/7 (S)	4/25 (S) 4/25 (Y)	3/18 (S) 3/16 (Y)	4/11 - spores found 5/9 spores on leaves
1995	3/ 2 (S) 3/4 (Y)	5/2 (S) 5/5 (Y)	4/1 (S) 4/1 (Y)	Rust Epidemic
1994	2/28 (S)	4/11 (S)	4/4 (S) 3/26 (Y)	

(S) Sutter County, (Y) Yuba County  
(M) Male moth, (F) Female moth

**WATERLOGGING/PHTOPHTHORA**

Many orchards are showing the effects from the excessively wet spring and high water flows in our rivers and Sutter Bypass that caused saturated soils and water seepage as the tree crops were leafing and blooming. Flooded conditions are worse in the growing season especially as the weather warms up. In saturated situations, water replaces the oxygen in the soil and anaerobic processes take place. These include production of gases such as methane and decomposition of organic matter by anaerobic bacteria that can produce some very toxic materials such as hydrocarbons, phenolic acids, sulfur and cyanogenic compounds. Flooding also increases growth regulator levels of ethylene and abscisic acid while others such as cytokinins decrease resulting in poor leaf expansion and chlorosis, premature senescence and leaf abscission, and stem growth disruption. There is a reduction in root initiation and growth and many other physiological changes occur. Trees decline and may collapse rapidly or decline slowly over a few years before dying. When possible, drain the water from flooded orchards as quickly as possible and where soils are saturated, allow the vegetation to grow for an extended time before mowing to help dry down the soil.

Saturated soils also favor *Phytophthora* root or crown rot diseases. If *Phytophthora* is the problem in your orchard, there are treatments available that may help alleviate the problem. USDA Plant Pathologist Greg Browne from UC Davis, has researched the effects of phosphonate treatments on walnuts and almonds. Phosphonates (inorganic and organic salts of phosphonic acid, the active ingredient) can provide systemic activity against water mold fungi and have helped manage diseases caused by *Phytophthora*. They are

translocated both upward and downward in the plant; the mode of action is complex and not completely understood, but evidence suggests that phosphonic acid disrupts the growth of *Phytophthora* and increases the plant's defenses. There are several phosphonate products available on the market.

Dr. Brown found that using Fosphite® applied in late summer/early fall as either a foliar spray or foliar + phosphonate chemigation on walnut reduced the area of cankers caused by *P. citricola* compared to the untreated control trees. In another study on almonds, he found that using Nutri-Phite®P+K applied as a preventative foliar spray in the fall or spring suppressed development of *Phytophthora* cankers for up to 5 months. Many growers have already applied a phosphonate product on their orchards this spring. These treatments should perform better as the canopy fills in. For walnuts, that would be around mid to late May this year depending on the variety. You may want to consider the early fall timing also in severe situations. Make sure to check the label because tank mixing with copper may result in phytotoxicity. Not all these phosphonate materials are registered for controlling *Phytophthora*; some are only foliar nutrient sprays. Make sure to check label before using them for *Phytophthora* suppression.

### **THE PEACH CROP and PREDICTING HARVEST TIMING**

The crop this year is approximately 25 percent down. The bright side though is that thinning costs are down. Reference date for 2006 is May 26, 10 days later than the May 16 reference date in 2005. Full bloom was March 3, 2005 compared to March 14, 2006. The heat units accumulated driven by temperature the first 30 days after bloom are used to predict when a peach orchard will be ready to be harvested. Temperatures those first 30 days are critical and what happens after that has a much smaller effect on harvest date.

In the very warm spring of 2004, we accumulated 7,826 growing degree hours (GDH) at the Nicolaus CIMIS weather station. That was one of our earlier harvests with a very short growing season and fruit sizing problems. 2005 was a more normal harvest timing with 6,018 GDH 30 days after bloom. In 2006, we only accumulated 3,532 GDH 30 days after bloom. We have never experienced a year with temperatures as cold as these after bloom since the predictive model has been in existence. UC Davis Extension Pomologist Ted DeJong said it is possible that we may be picking Loadels in August. The main point is to be prepared for a later than usual peach harvest this year.

### **SCALE INSECTS and FUNGAL DISEASES IN WALNUTS**

Heavy infestations of walnut and/or San Jose scale can cause fruitwood to die in walnuts. I have seen several older Chandler orchards in particular with heavy scale infestations and extensive deadwood over the past few years. In conjunction with the scale, we've been finding the fungal disease *Botryosphaeria* that causes cankers in infected limbs. Recently another fungus, *Phomopsis*, was also isolated from dying limbs in a scale infested Chandler orchard where the scale was identified as Italian Pear Scale which is not as common. The general thinking is that the scale weakens these shoots and predisposes them to *Botryosphaeria* and *Phomopsis*. Dead and dying wood should be pruned and removed and scale should be treated in these orchards. For pictures go to our website at <http://cesutter.ucdavis.edu>.

## PEACH FRUIT FLY ALERT

By Margaret Stelmok, Agriculture and Standards Biologist,  
Sutter County Agriculture Department

Peach fruit fly, *Bactrocera zonata*, a little-known pest of a variety of commercially grown fruits and vegetables, was discovered in the Mayfair district of Fresno on May 15, 2006. County insect trappers discovered flies in residential areas on the western and southwestern edges of Fresno, and officials from the Fresno County Agriculture Department suspect that the pest was introduced from Asia into the United States by travelers illegally importing fruit. A single guava fruit fly was also trapped in the Fresno area. Peach fruit fly is native to parts of Asia including India, Egypt, Thailand, Pakistan, Vietnam, the Philippines, and Taiwan.



After the discovery of at least six flies, the California Department of Agriculture initiated a State Interior Quarantine, which established a 4.5 mile buffer zone surrounding the initial trap finds and restricts the movement of fruits and vegetables known to be fruit fly hosts, as well as soil and containers. Growers inside this area will be required to enter into compliance agreements with CDFA that specify how their commodities are to be treated with insecticides, harvested and shipped. The Fresno and Madera Agriculture Departments have increased trapping densities in the quarantined area. Since a large proportion of the area is non-agricultural, agricultural officials are urging residents not to move any fruit or vegetables from their properties, and to consume, preserve, or double bag and dispose of all backyard fruit.

Crop damage occurs when an adult female fly lays eggs in fruits and vegetables. The larvae feed on and contaminate produce, making it unfit for consumption. The implications for this find are serious. Fresno County was California's number one producer of all agricultural commodities in 2003 & 2004. Fresno and Madera Counties also lead in the production of several of the fly's favorite hosts, including peaches, almonds, apricots, nectarines, plums, prunes, citrus, melons, and tomatoes. As these are also principle crops in Yuba and Sutter Counties, this pest can pose a local threat as well.

To eradicate the flies already in the area, CDFA is conducting a "male annihilation" project within the quarantine area. This tactic uses bait stations stocked with a pheromone-Dibrom cocktail designed to attract and kill the male flies. According to A.G. Kawamura, CDFA Secretary, male annihilation projects have successfully eradicated several previous fruit fly infestations.

In Sutter County, we maintain McPhail insect traps, which are designed to attract a variety of fruit flies, including the olive fruit fly and peach fruit fly. Additionally, we participate in the statewide trapping program that targets Mediterranean fruit fly, Mexican fruit fly, melon fruit fly, Oriental fruit fly, gypsy moth, Japanese beetle, European pine shoot moth, and the Khapra beetle, a storage facility pest.

### SOURCES:

CDFA Press Release, Wednesday, May 24, 2006

USDA, National Agricultural Statistics Service, October 2005; Summary of County Agricultural Commissioners' Reports, 2003-2004

Text of California State Interior Quarantine 3424 against hosts and possible carriers of *Bactrocera zonata*.

[http://www.cdffa.ca.gov/phpps/pdep/peach\\_ff\\_profile.htm](http://www.cdffa.ca.gov/phpps/pdep/peach_ff_profile.htm)

CDFA Pest Detection and Emergency Projects Branch

Fresno Bee, May 18, 19, 2006 articles.

California Department of Food and Agriculture, Insect Trapping Guide, 2005

## **SUMMER TOPICS/ORCHARD ACTIVITIES**

### **RIPE FRUIT ROT IN PEACHES**

Ripe fruit rot caused by *Monilinia* or *Botrytis* could reduce an already low peach crop if there are unseasonable rains this summer. Many extra early and early peach orchards in particular have high disease pressure because of high fruit brown rot inoculum levels from last summer. The persistent rainfall during the extended bloom and jacket stage also could have increased inoculum levels of these fungi and predisposed young fruit to incipient infections.

There are management steps you can take to control this disease:

*Reduce disease pressure by:*

- Removing mummy fruit in the winter
- Controlling blossom and twig blight and jacket rot in the spring
- Removing blighted twigs when possible
- Removing, mowing or disking thinned fruit
- Making preharvest fungicide treatments when necessary

*Avoid orchard conditions that promote infections by:*

- Using appropriate levels of nitrogen fertilizer and water
- Controlling peach twig borer and oriental fruit moth that injure fruit
- Avoiding clustered fruit
- Avoiding split pits (Do not thin, fertilize and irrigate at the same time. Because of a light fruit load, split pits could be more of a problem this year, do not over thin).

If there are rains this summer and you decide to use preharvest fungicide treatments for fruit brown rot prevention in peaches, keep in mind that fungicides are preventive, not eradicated, and must be applied to uninjured fruit before infections occur. Preharvest sprays cannot protect injured fruit from *Monilinia* or *Botrytis* rot. UC Plant Pathologist Jim Adaskaveg recommends the following spray timing: for extra early (EE) varieties where there is a history of brown rot, preharvest treatments can begin one month before harvest. Typically preventative treatments would begin 21 days and/or 14 days before anticipated harvest. An additional preventative treatment at 7 days before harvest would be recommended in EE blocks with brown rot last year.

Please refer to the updated Peach Pest Management Guidelines and the Fungicide Efficacy and Timing for Tree Crops on the UCIPM website at <http://ipm.ucdavis.edu/PMG/> for information on fungicides.

*Remember the principles of resistance management every time you use fungicides:*

- Limit the total number of applications
- Use full coverage sprays
- Switch chemistries every time you spray
- Keep overall disease level low – it is a numbers game

### **PEACH YEAR-ROUND IPM PROGRAM**

In early March, the updated Peach Pest Management Guidelines and the new Peach Year-Round IPM Program Annual Checklist became available online through the IPM website at <http://ipm.ucdavis.edu>. Many people were shown how to use the checklist at my annual Cling Peach Day meeting last January and found it to be very helpful. This checklist is a great reference as it takes you through all the insect, disease, weed, and vertebrate considerations and activities for the dormant/delayed dormant season, bloom season, fruit development period, harvest, and postharvest seasons and has a pesticide application checklist. It has links to the Pest Management

Guidelines, monitoring forms, photographs and the UC IPM WaterTox which lets you evaluate the risk that a pesticide will move with water and eroded soil or organic matter and affect nontarget organisms. Pesticide users can consider the long-term hazard to fish and humans from leaching and runoff when making pest management decisions that involve pesticides.

There are two monitoring forms you can access through links on this checklist. We developed faster monitoring methods for webspinning mites and shoot strikes over a two year period a few years ago.

1) The **mite monitoring form** outlines the 5-minute timed search and lets you easily record your findings and determine whether a spray is needed. We recommend two 5-minute timed searches in most orchards because of variability of mite “hot spots”. The timed search method substantially reduces monitoring time over the presence-absence mite monitoring method and is quite accurate.

2) The **shoot strike monitoring form** outlines the Count Method for quickly assessing threshold levels of shoot strikes caused from either oriental fruit moth or peach twig borer. By monitoring shoot strikes, you can determine whether a supplemental spray is needed for the next generation in pheromone mating disruption orchards. The Count Method has substantial time savings over the usual Cut and Inspect Method where every shoot strike was examined for the presence of a larva.

This Year-Round IPM Program Annual Checklist Form is what you use if you cost share on your pest management program with the Natural Resources Conservation Service. We have hard copies available from our office if you do not have internet access.

## IRRIGATION MANAGEMENT PAYS

How do you decide when to irrigate your orchard? Do you wait until your neighbor is irrigating? Do you irrigate because the top of the soil is dry? Do you use your shovel or auger and check the soil moisture before irrigating? Are you taking advantage of the weather based, soil based, and plant based options available to help you optimally manage your irrigation to avoid tree stress and economic losses?

In weather based monitoring, we use evapotranspiration information presented as water use per day and/or week to determine how fast the water is being depleted. This information is available as long term, average estimates that can be helpful in developing an irrigation schedule or as tracking real-time estimates that can be used to assist with determining when and how long to irrigate. These values are particularly useful for low volume systems where the goal is to run the system long enough to replace daily water use. A mature walnut tree with no cover crop in mid-July can use over 100 gal/tree/day of water.

There are many choices available for soil based monitoring tools that either detect and indicate soil water content or the degree of tension that soil-water is held by the soil and available for uptake. Although these tools can be used alone, we have found it most useful to use in conjunction with plant based monitoring. Locally, we have found both methods critical for timing irrigations, especially in those orchards with a soil limitation and/or high water table. The soil moisture monitoring has helped to determine how deep water penetrates after irrigation and to determine seasonal water extraction trends in the root zone.

What is plant based monitoring? Over several years now, UC specialists and farm advisors have been researching plant based irrigation and demonstrating how pressure chambers measure stem water potential and what these numbers mean regarding tree stress and irrigation needs. The sum of four environmental influences determine plant water stress: soil moisture, wind, humidity, and direct sunlight. A plant based monitoring system allows you to measure what the plant is experiencing not just one of the environmental stresses. We use a pressure chamber device (better known as the pressure bomb) for measuring the degree of water stress within

the plant. Water is under tension within the plant and as water evaporates from the leaves, replacement water must be pulled in from the soil. It becomes harder for the plant to extract water from the soil as it dries increasing the tension within the plant. The pressure chamber allows us to measure how much tension the leaf is experiencing and the degree of water stress.

Through research, we have developed stem water potential (SWP) values for walnuts and peaches that indicate when the tree is stressed and needs irrigating. I have used the pump-up pressure chamber for irrigation research and also found it an invaluable tool for helping diagnose and correct water stress or over irrigation problems in some local orchards. Many of you have seen this device at some of my meetings and more growers and PCAs are using them every year. If you want more information on the pressure chamber go to <http://fruitsandnuts.ucdavis.edu/crops/pressure-chamber.shtml>.

***What are the costs of water stress?*** Several UC researchers have worked on irrigation management and the effects on yield and quality in various tree crops. A draft publication, “The Effect of Water Stress on Walnut Tree Growth, Productivity, and Economics” by Allan Fulton and Rick Buchner, UC Farm Advisors in Tehama County, addresses what happens to walnut trees when water stressed. They applied varying levels of water stress to Chandler walnut trees over a four year period. Essentially they found that shoot growth was uninhibited and yield was not reduced by maintaining midday SWP values at -4 to -7 bars. Where walnut trees averaged -8 bars and above over the season, fruitfulness (nut load) was reduced. Over four years, Chandler walnut on Paradox rootstock with the least water stress averaged over \$1400 per acre per year more due to higher in-shell yield and higher crop value due to lighter kernel color than trees with higher levels of water stress. Our research indicates that in many walnut orchards, SWP values at -7 bars indicate a need to irrigate. Growers should determine the SWP indicating a need to irrigate in their own orchards.

This publication also describes the various water management tools and lists websites and address of where to order them. This draft publication is available from our office and I recommend it for walnut growers.

Our plant based irrigation research on peach trees, although preliminary, indicated that we maximized fruit size by maintaining trees at -7 to -7.8 bars in a microsprinkler irrigated orchard. Peach trees should not be water stressed in August which can lead to more double fruit the following year.

## **USE OF SURROUND<sup>®</sup> WP CROP PROTECTANT ON WALNUTS**

*Kathy Kelley Anderson, UCCE Farm Advisor, Stanislaus County*

Research conducted in walnuts since 1999 has focused on the use of Surround<sup>®</sup> to improve walnut quality and grower return by reducing sunburn and heat stress. The material has also been shown to suppress codling moth and walnut husk fly.

Surround<sup>®</sup> is a naturally occurring mineral, kaolin, which is mined from the earth and processed into superfine particles. When mixed with water and sprayed on walnuts, the particles link together and form a protective film that appears as a white coating that reflects harmful infrared and ultraviolet radiation thus reducing sunburn and heat stress.

In addition to its agricultural uses, kaolin is used in toothpaste, baby powder, cosmetics, ceramics, paint, and paper coatings. Surround<sup>®</sup> WP is listed by the Organic Materials Review Institute (OMRI) for use in organic production.

Results have regularly shown increases of three to four cents per pound, but vary considerably among years and varieties. The most consistent results have been obtained with Vina, followed by Tulare and Howard.

Surround<sup>®</sup> applications have only improved Chandler quality where sunburn was severe. Economic feasibility varies depending on individual orchard site conditions and application economics. Growers using Surround<sup>®</sup> for the first time should consider comparing treated and untreated areas large enough to allow the processor to assess crop quality and returns separately.

Good coverage is essential for good results. Label rates for ground applications currently range from 25 to 75 lbs. per acre in 100 to 200 gallons of water. Surround<sup>®</sup> at 50 lbs. per 200 gallons of water per acre gave good results in our trials.

The label indicates the initial application should be made ahead of a forecasted damaging heat event or as walnuts reach about 1 inch in diameter. My trials indicate that in most years in the Central Valley, time the initial application in early to mid-June depending on the weather. One application will not provide adequate protection. Follow with a second application a week to 10 days later to build up sufficient protectant covering. A real advantage of Surround<sup>®</sup> is that you can evaluate coverage by the even, white appearance of the trees. 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.

Reapply Surround<sup>®</sup> as needed to maintain sufficient coating during hot weather. In trial work, the intervals were determined by the appearance of the trees and the amount of material weathering. The total applications were held to three per season with often little covering remaining on the trees in mid-to-late August when damaging temperatures often occur. The label recommends repeating applications on a 21-day schedule, which ensures good coverage through August. With larger trees, experience showed that shutting off lower nozzles and directing the spray to the upper canopy was effective. Last year trials were conducted that compared full coverage Surround<sup>®</sup> sprays with “half-canopy” sprays applied to the west side of the trees in N-S oriented orchards or to the south side of the trees in E-W oriented orchards. There were no significant differences between the two treatments.

Coverage by ground applications is always a problem on larger walnut trees. Make aerial applications at the rate of 25 to 35 lbs. of Surround<sup>®</sup> WP in 25 to 35 gallons of water per acre. Timing and application intervals are as indicated above. Seasonal rates are typically 100 to 125 lbs. per acre.

Surround can be tank-mixed with fungicides, insecticides and nutrients. When tank-mixing with other materials, always add Surround to the tank first. A pre-mix is suggested for sprayers without mechanical agitation. Consult the label for more detailed information. As with any material, read and follow all label instructions.

### **LEAF SAMPLING and ANALYSIS IN JULY**

A relatively inexpensive leaf analysis could potentially save on fertilizer costs. There are still a number of growers not using this test annually in their orchards and they are missing out on maximizing their production efficiency. You can determine if the nutrients are adequate, excessive or deficient by taking samples in July in all your orchard blocks. When sampling an orchard, keep in mind that trees with root problems may exhibit certain nutrient deficiencies because the tree is unable to extract some nutrients due to a limited root system. It is important to sample properly so the values you obtain can be compared to critical nutrient levels.

*Below are points to consider when sampling:*

- Sample in July (August for pistachio) when nutrient levels in leaves are relatively stable
- Test annually for nitrogen, potassium and zinc
- Check for any other suspected deficiencies or toxicities
- Each sample should be of the same variety, age, rootstock and soil
- Take comparison samples between poor vs. good trees

*Peach* ~ select 60-80 mid-shoot leaves from moderately vigorous fruiting shoots

*Walnuts* ~ select about 50 terminal leaflets from fully expanded spur leaves 6 to 8 feet above the ground

*Kiwifruit* ~ select 25-30 mature leaves, just past the fruit on the shoot

Put leaves in paper bags and keep them cool until they are delivered to the lab. We have a list of laboratories that do plant, soil and water testing in our office.

### Critical Nutrient Levels

*Based on July leaf samples*

	Cling Peach	Walnut	Kiwifruit
% Nitrogen (N)			
Deficient below	2.4	2.3	1.6
Adequate	2.6-3.5 <sup>1</sup>	2.4-3.2	2.2-2.8 <sup>2</sup>
% Potassium (K) <sup>3</sup>			
Deficient below	1.0	0.9	1.0
Adequate	1.2	1.2	1.5
% Magnesium (Mg)			
Adequate over	0.25	0.3	0.3
% Calcium (Ca)			
Adequate over	1.0	1.0	2.0
% PPM Zinc (Zn)			
Adequate over	20	18	15
% Chloride (Cl) <sup>4</sup>			
Excess over	0.3	0.3	1.1
% Sodium (Na) <sup>4</sup>			
Excess over	0.2	0.1	(?)

*Adequate levels for all orchard crops:*

*Phosphorus (P) 0.1-0.3%; Copper (Cu), over 4 PPM; Magnesium (Mn), over 20 ppm.*

<sup>1</sup>*Best to keep around 2.8-3.0%*

<sup>2</sup>*2.5% or lower is recommended to maximize storage potential*

<sup>3</sup>*K levels between deficient and adequate are considered 'low' and may cause reduced fruit sizes in some years.*

<sup>4</sup>*Excess Na or Cl cause reduced growth at the levels shown; leaf burn may or may not occur when levels are higher.*

## MANAGING INSECTS IN WALNUTS

 *Walnut Husk Fly* – In the past, we have recommend hanging husk fly traps by July 1. Instead, consider hanging traps in early to mid-June because of observing earlier and earlier flights in several local orchards. To properly control this pest, it is very important to know when the initial flies are present, especially if using the newer material GF-120 for control where sprays need to start when the first fly is found. If you want to know more about husk fly biology and control, there is a video in our office available on a 2 day checkout.

 *Walnut Aphids* - Early in the season, populations of over 15 aphids per leaflet reduce nut yield and quality and cause an increase in nuts with perforated shells. In a given orchard, walnut aphid outbreaks are not consistent from year to year. Walnut aphid is often controlled biologically by the parasitic wasp, *Trioxys pallidus*, unless disrupted by chemical spraying for other insects. More recently, the efficacy of

*Trioxys pallidus* was also found to be affected by hyperparasitoids (parasitoids that kill the *Trioxys*). In field studies conducted by Nick Mills, Entomologist from UC Berkeley, Success® appeared to be compatible with the biological control of walnut aphid by enhancing control by *Trioxys* by reducing hyperparasitoid populations. If walnut husk fly and walnut aphids are problems in your orchard, Success® is quite effective on husk fly and may improve biological control of walnut aphid by *Trioxys*. Monitor before applying treatments for walnut aphid. Treatments should be applied if the average number of non-parasitized healthy aphids found on the underside of subterminal leaflets of early varieties is over 15 per leaflet. As usual, consult the label and follow instructions before applying any material.

 *Dusky-veined Aphid* – These started appearing in some orchards in May. Treatments should be considered for this aphid whenever an average of 10 percent of the subterminal leaflets have colonies of six or more feeding on the upper surface along the midvein.

## MANAGING NEWLY PLANTED WALNUT ORCHARDS

 *Check trees frequently during the summer and tie trunk to stake as needed.* Keep competing shoots pruned back. They add carbohydrate for increasing caliper growth but don't let them slow the growth of your trunk. The goal is to attain over ten feet of trunk growth in a conventional orchard and about seven feet of growth in a hedgerow orchard.

 *Check soil moisture frequently with a soil tube or auger.* When walnut trees are stressed for water, they stop growing and it takes quite some time to get them moving again. The key to great growth is frequent and light irrigations; that is why young walnuts thrive under microsprinklers. Avoid saturated soil and do not irrigate over 18 hours per set time to avoid crown and root rot diseases (that is true for any tree crop). In mid to late May, we found stem water potentials in two new orchards already over -7 bars and in need of an irrigation. Monitor carefully all summer and into early fall.

## NEW TOOLS AVAILABLE FOR SPIDER MITE MANAGEMENT IN 2006

*David Haviland- Entomology Farm Advisor, UCCE Kern County*

During the past few years the number of miticides registered for California crops has increased dramatically. These products represent not only new formulations of existing products, but also completely new active ingredients and modes of action. These new miticides are also considered relatively reduced-risk with many offering shorter re-entry and pre-harvest intervals than most existing products. New miticide registrations also greatly enhance our ability to use rotation of materials as a viable strategy for the management of resistance.

Table 1 lists the predominant miticides used in California crops. Relatively new members of this list include Acramite, Desperado, Fujimite, Kanemite, Oberon, Onager and Zeal. Some of these products contain active ingredients that were previously available (i.e., Desperado is the active ingredient of Nexter plus sulfur whereas Onager is an EC formulation of the active ingredient of Savey) and others offer completely new active ingredients and modes of action.

Each of these new miticides has something to offer to mite management in California; the trick is to figuring out which miticide will work best under which situation, and to determine how to best fit them into resistance management plans and the economics of the crop. In some cases research is readily available to document the effects of these products, and in other cases our knowledge of the best fit of these products is still in its infancy.

## Despite new miticides, IPM is still the Key

While the new miticides offer new options in managing mites, the backbone of any integrated pest management program should always be monitoring, proper identification and rational action thresholds. Most species of spider mites thrive under hot, dry conditions, especially when leaves become dusty and cultural practices to mitigate these conditions should be the first line of defense. Dusty conditions can be avoided by managing road surfaces with water, oils or other dust-reducing products as well as by driving slower.

Plant stress is another common cause of mite flareups. This stress can be accidental as a the result of improper fertilization or inadequate irrigation, or can be a planned yearly phenomenon for crops like almonds, winegrapes, or early-harvested navel oranges where backing off of water is part of standard harvest preparations. The key to managing mites in these situations is to promote biological control early so that it is in place by the end of the season when temperatures rise and plant stress increases. If cultural and biological controls are insufficient, then miticides may be warranted.

In most California crops, predatory mites, thrips, small hemipterans (such as minute pirate bugs), and some ladybird beetles are the backbone of biological control. In most cases, however, information is not yet available on the effects of miticides on each of these predators. Until this has been developed, it would be beneficial for all growers using these products to keep track of the populations of these predators not only before applications (when determining the need to spray or not), but also afterwards to learn how they influence biocontrol as part of a comprehensive IPM program.

## Resistance Management

One of the biggest potential winners with the recent registration of so many miticides is resistance management. Tables 1 and 2 both list the mode of action number, as designated the Insecticide Resistance Action Committee (IRAC) for each of the most common miticides in California. In the tables, any two miticides with the same IRAC number are considered to have the same mode of action and should not be used back to back during the same season.

Table 2 also includes a brief description of how each miticide works. This is important because different miticides work in different ways and on different life stages. For example, a PCA needs to know that a mite growth regulator that inhibits molting will not immediately kill adults or eggs just as a product that causes adults to produce sterile eggs may have little effect on the juvenile mite stages. Additionally, one would expect that each of these products will work completely differently that a miticide with strictly contact activity. Because of details like these it is important to know the modes of action when deciding which miticide is needed (in cases where one is needed at all), as well as understanding observations made during follow-up visits to the field.

## Conclusion

The recent registration of several new reduced-risk miticides, some of which represent completely new modes of action, should be considered a great opportunity and challenge for anybody battling mites. It is now up to us as Growers, Pest Control Advisors, UC Extension and Chemical Company Representatives to become good stewards of the products. The trick will be to figure out how to use these products to enhance our IPM programs, and to avoid increased reliance on miticides at the expense of ever-important cultural and biological controls.

# Table of Some of the Most Common Miticides for Use Against Spider Mites<sup>1</sup> in California (Version 1, Nov. 2005)<sup>2</sup>

David Haviland; Entomology Farm Advisor, UCCE- Kern County

Miticide	Active Ingredient	Producer	Targeted life stages and mode of action	IRAC Number <sup>3</sup>
Acramite	bifenazate	Chemtura	contact toxin on all stages by unknown mechanism in nervous system	25
Agri-Mek	abamectin	Syngenta	contact or ingestion toxin that paralyzes juveniles and adults; death by starvation	6
Apollo	clofentezine	Makht.-Agan	growth regulator of mite eggs and some nymphs	10A
Carzol	formetanate	Gowan	contact toxin that inhibits acetylcholinesterase (carbamate)	1A
Comite	propargite	Chemtura	contact on juveniles and adults by inhibition of ATP synthesis	12C
Danitol	fenpropathrin	Valent	nerve toxin to juveniles and adults by modification of sodium channels (pyrethroid)	3
Desperado	pyridaben/sulfur	BASF	contact on juveniles and adults by inhibition of energy production, plus sulfur	21
Dicofol	dicofol	multiple	contact toxin of juveniles and adults with unknown mode of action	UNC
Envidor	spirodiclofen	Bayer	contact on all mite stages by inhibiting lipid biosynthesis; most effective on juveniles	23
Fujimite	fenpyroximate	Nichino	contact toxin to eggs, juveniles and adults; inhibits electron transport in the mitochondria	21
Kanemite	acequinocyl	Arysta	contact toxin to eggs, juveniles and adults; inhibits electron transport in the mitochondria	20B
Kelthane	dicofol	Dow	contact toxin of juveniles and adults with unknown mode of action	UNC
Nexter	pyridaben	BASF	contact on juveniles and adults by inhibition of energy production	21
Oberon	spiromesifen	Bayer	contact on all mite stages by inhibiting lipid biosynthesis; most effective on juveniles	23
Omite	propargite	Chemtura	contact on juveniles and adults by inhibition of ATP synthesis	12C
Onager	hexythiazox	Gowan	mite growth regulator; adult females lay sterile eggs; contact toxin on eggs and juveniles	10A
Savey	hexythiazox	Gowan	mite growth regulator; adult females lay sterile eggs; contact toxin on eggs and juveniles	10A
Vendex	fenbutin-oxide	Du Pont	contact toxin to juveniles and adults by inhibition of ATP synthesis	12B
Zeal	etoxazole	Valent	contact toxin on eggs; inhibits molting of juveniles; adult females produce sterile eggs	10B
Zephyr	abamectin	Syngenta	contact or ingestion toxin that paralyzes juveniles and adults; death by starvation	6

<sup>1</sup> Spider mite species include *Tetranychus* spp. (Pacific, two-spotted, strawberry, McDaniel, Carmine spider mites), *Panonychus* spp. (European, citrus red mites), *Eotetranychus* spp. (Willamette, Yuma spider mites), *Eutetranychus banksi* (Texas citrus mite)

<sup>2</sup> Pesticide-related information is always changing. To recommend changes to the table please contact David Haviland. [dhaviland@ucdavis.edu](mailto:dhaviland@ucdavis.edu), 661 868-6215

<sup>3</sup> Insecticide Resistance Action Committee (IRAC) numbers used to denote different modes of action. Same number indicates same mode of action

**Disclaimer:** Discussion of research findings necessitates using trade names. This does not constitute product endorsement, nor does it suggest products not listed would not be suitable for use. Some research results included involve use of chemicals which are currently registered for use, or may involve use which would be considered out of label. These results are reported but are not a recommendation from the University of California for use. Consult the label and use it as the basis of all recommendations.

**Registration Status of Selected Miticides for Use Against Spider Mites<sup>1</sup> in California. (Current as of January, 2006)**  
**David Haviland; Entomology Farm Advisor, UCCE- Kern County**

	IRAC Number <sup>2</sup>	Key: YES = fully registered for use			NB = registered for use on non-bearing crops only						No = not registered for use			
		Almond	Nut Crops Pistachio	Walnut	Apricot	Cherry	Stone Fruits Peach Plum Nectarine			Citrus Apple	Pome Fruits Pear	Grape		
Acramite	25	YES	YES	YES	NB	NB	YES	YES	YES	YES	NB	YES	YES	YES
Agri-Mek	6	YES	no	YES	no	no	YES	YES	no	no	YES	YES	YES	YES
Apollo	10A	YES	no	YES	YES	YES	no	no	YES	YES	no	YES	YES	YES
Carzol	1A	no	no	no	no	YES	no	YES	no	YES	No <sup>3</sup>	YES	no	no
Comite	12C	no	no	no	no	no	no	no	no	no	no	no	no	no
Danitol	3	no	no	no	no	no	no	no	no	no	YES	YES	No <sup>3</sup>	No <sup>3</sup>
Desperado	21	YES	YES	YES	no	no	YES	YES	YES	YES	no	YES	no	no
Dicofol	UNC	no	no	YES	no	no	no	no	no	no	YES	YES	YES	YES
Envidor	23	no	no	no	no	no	no	no	no	no	no	no	no	no
Fujimite	21	NB	NB	NB	NB	NB	NB	NB	NB	NB	no	YES	YES	YES
Kanemite	20B	YES	YES	no	no	no	no	no	no	no	YES	YES	YES	no
Kelthane	UNC	no	no	YES	no	no	no	no	no	no	YES	YES	YES	YES
Nexter	21	YES	YES	YES	no	no	YES	YES	YES	YES	YES	YES	YES	YES
Oberon	23	no	no	no	no	no	no	no	no	no	no	no	no	no
Omite	12C	YES	NB	YES	NB	YES <sup>4</sup>	NB	NB	YES	YES	YES <sup>5</sup>	NB	NB	YES
Onager	10A	YES	YES	YES	YES	YES	YES	YES	YES	YES	NB	no	no	NB
Savey	10A	YES	YES	YES	YES	YES	YES	YES	YES	YES	NB	YES	YES	NB
Vendex	12B	YES	no	YES	no	YES	YES	YES	YES	YES	YES	YES	YES	YES
Zeal	10B	YES	YES	YES	NB	NB	NB	NB	NB	NB	NB	YES	YES	YES
Zephyr	6	no	no	no	no	no	no	no	no	no	no	no	no	no

<sup>1</sup> Spider mite species include *Tetranychus* spp. (pacific, two-spotted, strawberry, McDaniel, Carmine spider mites), *Panonychus* spp. (European, citrus red mites), *Eotetranychus* spp. (Willamette, Yuma spider mites), *Eutetranychus banksi* (Texas citrus mite)

<sup>2</sup> Insecticide Resistance Action Committee (IRAC) numbers used to denote different modes of action. Same number indicates same mode of action

<sup>3</sup> Miticide is registered for the crop, but one or more spider mites are not listed on the label as target pests

<sup>4</sup> For use on non-bearing, or post-harvest on bearing

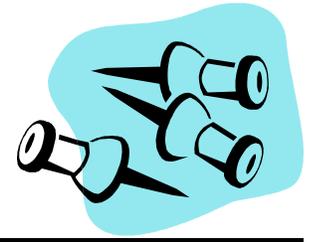
<sup>5</sup> For use on any non-bearing, or post-harvest on bearing navels or grapefruit

**Disclaimer:** Discussion of research findings necessitates using trade names. This does not constitute product endorsement, nor does it suggest products not listed would not be suitable for use. Some research results included involve use of chemicals which are currently registered for use, or may involve use which would be considered out of label. These results are reported but are not a recommendation from the University of California for use. Consult the label and use it as the basis of all recommendations.



# Safety Note

University of California  
Agriculture and Natural Resources  
Environmental Health and Safety



Safety Note #20

## HEAT STRESS AWARENESS

### Heat Stress Disorders and Symptoms

1. Heat Stroke – sweating stops and the body fails to regulate its temperature. Victims may die if they don't receive immediate medical treatment. Characterized by: mental confusion, fainting, or seizures; hot dry skin usually reddish in color; and high body temperature.
2. Heat Exhaustion – profuse sweating results in dehydration. Characterized by: fatigue, dizziness, and nausea; pale and moist skin; and possibly slightly elevated temperature.
3. Heat Cramps – cramping thought to be due to loss of salt through sweating. Characterized by muscle spasms in arms, legs, and abdomen during or following work activities.
4. Heat Syncope – dehydration while standing still causes blood pooling in lower portions of body. Characterized by fainting while standing still.
5. Heat Rash – occurs under hot and humid conditions where sweat does not evaporate readily. Characterized by irritated/itchy skin with prickly feeling and small red bumps on skin.

### Treatments for Heat Stress Disorders

1. Heat Stroke – call 911 immediately, soak victim's clothing with cool water, move victim to shaded and cool area, fan victim to increase cooling of their body.
2. Heat Exhaustion – have victim rest in shaded and cool place and drink fluids. Do not serve caffeinated fluids such as soft drinks, iced tea, or coffee.
3. Heat Cramps – have victim rest and drink non-caffeinated fluids.
4. Heat Syncope – have victim rest in a shaded and cool place, and drink non-caffeinated fluids.
5. Heat Rash – wash and dry skin. Wear loose clothing and keep skin dry.

### Precautions to Prevent Heat Stress Disorders

1. Acclimatize yourself to the prevailing weather conditions.
2. Always drink plenty of fluids such as water and sports drinks. Avoid caffeinated drinks.
3. Wear summer hat with a brim and loose-fitting, light-colored, and lightweight clothing like cotton.
4. Schedule vigorous work activities during coolest portions of the work day and take frequent breaks on hot days.

**If treated victims do not recover from heat exhaustion, heat cramps, or heat syncope in a reasonable amount of time, promptly seek medical help.**

## **FALL TOPICS/ORCHARD ACTIVITIES**

### **MANAGING WALNUT HARVEST FOR QUALITY**

▶ *Earlier harvest pays.* The most important fact to remember when harvesting walnuts is the earlier the harvest, the lighter the kernel color; the lighter the kernel color, the more money per pound. Kernels are mature when the packing tissue around the kernel has just turned brown, what we call packing tissue brown stage; kernels are the lightest and at the highest value. Before harvest can begin though, the hulls must split and separate from the shell. Hull split is favored by cooler weather, humidity, or rain. In the valley, our temperatures are usually hot especially at the beginning of the harvest season hastening the kernel maturity but delaying hull split, sometimes up to several weeks. This adversely affects kernel color. Walnut varieties also differ in their ability to produce light colored kernels with Chandler epitomizing the light kernel color. In addition to kernels darkening the longer the time period in the orchard after kernel maturity, kernel color will also darken after processing. The kernels of some varieties such as Howard, can become darker relatively quickly after processing whereas Chandler color doesn't change nearly as fast.

▶ *Optimizing light kernel color:* The trick in our hotter central valley, is getting packing tissue brown to more closely coincide with hull split. Consider using ethephon which contains ethylene to promote early harvest, especially on those varieties whose kernels tend to be dark or darken more quickly after processing. To hasten harvest about 7 to 10 days, ethephon is applied when the packing tissue of all nuts just turns brown. Typically, about 17 days later, nut removal will be about 90 percent. Application of ethephon before packing tissue brown will result in decreased kernel weight. What does this mean for this year? Since bloom was very late this year, it is likely that packing tissue brown will be delayed also. Start checking Ashley and Serr for packing tissue brown by mid-August but don't be surprised if the kernels are not mature until closer to September. Start checking later harvested varieties by the end of August. Ethephon can also be used to promote one shake harvest by applying it after packing tissue brown about ten days prior to normal harvest date. *What else can you do to keep walnut kernels light?* Once harvest begins, pick up, hull, and dry nuts as quickly as possible. Most quality loss occurs in the first 9 hours after harvest. The hotter the temperatures, the more quickly the loss of kernel color. Do not allow walnuts to become water stressed during the summer or before harvest. Cutting off water too early before harvest can result in hulls shriveling and darker kernel color in severe drought situations.

### **PREPARING AN ORCHARD FOR 2007 PLANTING**

Early fall is the time to prepare the ground if planning on planting an orchard in early 2007. The following are practices to do when the soil is relatively dry:

- ▶ If replanting after removing an orchard, remove as many of the old roots as possible. Rip soil where there is hardpan. (ripping in the fall also has an added benefit of increasing water infiltration, thereby decreasing runoff)
- ▶ Sample the roots and soil for nematodes. This will help determine the need for fumigation. If lesion nematodes (*Pratylenchus vulnus*) or Ring nematodes are found and you are planning on planting walnuts or peaches, fumigate in the fall while the soil is warm and dry. Letting the soil go fallow or planting to a grass for a year will also help reduce nematodes. With many cling peaches pulled in last years tree pull program, it would be better to fallow the land and research the economics of other crop options before making the transition.

- ▶ Ridge berms in the fall so they have time to settle over the winter. Planting trees on berms is an established practice in our area, especially on heavier soils. With berms, water moves away from the tree into the middles to help reduce crown and root rot and waterlogging during heavy rains, and to help avoid saturation in flood irrigated orchards. In the early 1980's when only a few orchards were on berms, there were large tree losses during El Nino heavy rainfall years. Now there are many more orchards on berms and I have not seen near the tree losses in heavy rainfall years in the 1990's and 2000's. A practice to be avoided though that is still common in our area, is ridging up berms after trees are planted, thereby burying the upper rootstock portion (above the roots) of the tree that should be totally exposed. Wet soil around the rootstock crown area creates a favorable condition for crown rot development and many trees have died needlessly because of this. Avoid planting trees too deeply on berms; soil should only be as high as the top most root. Dig the hole just deep enough for the root system or backfill and tamp in to ensure that trees do not settle more deeply after planting.
  
- ▶ Plan ahead before planting future walnut orchards. In conventional orchards, use **10 foot stakes with two feet in the ground.** We train walnut trees as a modified central leader. The first season, one vigorous shoot is tied up the stake to become the trunk and competing branches are pruned back. For conventional trees, our goal is 10 feet or more of growth by fall, a little less for hedgerow trees (see summer topics section). Because of north-south winds in our area, place stakes about 10 inches to the west of the tree in the hole at planting. This way the stake will not wound the tree with later placement. The west direction allows the tree to blow to the north or south without rubbing on the stake. Often growers use 8 foot stakes with 6 feet above ground and some growers new to walnut growing have stakes only 4 feet above the ground! These size stakes do not give enough height to train conventional trees without risking wind breakage. **Remember at planting to prune nursery grafted walnut trees to 3 to 5 buds above the graft union.** Keep the trees short to encourage the growth of one strong, dominate bud.

## COVER CROPS

Winter annual cover crops should be seeded in the fall. For walnuts, there is a short window of time right after harvest before significant leaf drop and rainfall to have equipment and seed ready to plant. Advantages to a cover crop include reduced soil erosion, better fall and winter access, increased water infiltration, soil protection and stabilization, weed suppression, extraction of atmospheric nitrogen by legume cover crops, and reduced run-off of pesticides. How can vegetation on the orchard floor reduce runoff to surface waters? There are several ways:

- Increasing water infiltration
- Decreasing pesticide movement carried by sediment
- Adsorbing pesticides to plant surfaces
- Reducing sheet erosion and runoff caused by rainfall falling on bare ground
- Pesticides are generally less persistent (breakdown faster) on vegetation than on soil

Allowing resident vegetation to grow and mowing in the spring has many of these same advantages but often will be sparser (produce less biomass) than a seeded cover crop. Sometime this year, a comprehensive UC publication on cover cropping in walnuts will become available. Call our office this fall at 822-7515 to see when it will be available.

Integrated into this new publication are the results of a local study that compared an annual reseeding cover crop to resident vegetation in a mature Vina orchard. In the walnut trial, a mix of legumes (clovers, vetch and subclover) plus a brome grass was seeded in fall of 1999 and evaluated for four years. The cover crop annually reseeded itself and over time, the subclover and brome grass increased while the other species remained the same or decreased.

In another local trial in organic peaches, subclover, brome grass and a combination of both were seeded in the fall of 2001 in a new peach orchard and evaluated until spring 2006. The subclover treatments were compared to resident vegetation with the addition of compost. The annual reseeding subclover and brome grass remained stable over four years. In the subclover treatments, adequate tree leaf nitrogen levels were maintained throughout the duration of the study. In both cover crop trials, the seeded cover crop middles had more biomass (i.e. higher plant density and better growth) than did the resident vegetation. To reduce the potential for frost damage, the cover crop plots were mowed by mid-March to decrease frost hazard and allowed to regrow and produce seed before mowing again around mid-June. The cover crop will reseed in the fall with this type of management. An advantage of subclovers is that they can be mowed more frequently if necessary since the seed is produced under the ground. A drawback in both studies was that gopher activity increased where cover crops were seeded. If considering planting a cover crop next fall, a helpful website is <http://www.sarep.ucdavis.edu>, University of California Sustainable Agriculture Research and Education Program.

## **PEACH DISEASE CONTROL**

The fungal disease Shothole can cause extensive damage to peach twigs and buds if there is heavy winter rainfall. Twig lesions can develop that produce spores and affected buds turn dark brown or black and are usually covered with a shiny layer of exuded gum. Spray at leaf fall in late November or early December before winter rains to protect against twig infections. The fungicides Ziram, Pristine, and copper are used to prevent Shothole. Although this late fall spray will give some protection against peach leaf curl, applying copper before bud swell is better timing for controlling this disease. The copper for peach leaf curl control is typically combined with dormant oil which controls scale and mite eggs and is applied in January or early February. Make sure not to apply any spray application preceding a forecasted rain event to avoid runoff. Consult the label for more detailed information on the above fungicides.

## **New Publication**

### **Fertigation with Microirrigation**

*Blaine Hanson, Neil O'Connell, Jan Hopmans, Jirka Simunek, Robert Beede*

This manual helps guide users through strategies and decision making for fertigation with nitrogen, phosphorus, potassium, and gypsum. The guide also covers the characteristics of selected fertilizers commonly used for fertigation, long and short duration strategies, how to calculate injection rates, frequency considerations, hour to apply fertilizers uniformly, mixed considerations, injection devices, and how to prevent backflow. Publication #21620, price \$25.00. This book is a retail only publication and is not available at our office. It can be ordered by calling 1-800-994-8849.

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