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University of California
Agriculture and Natural Resources
Making a Difference for California
Cooperative Extension Sutter-Yuba Counties

Pomology Notes

April 2010

ALMONDS

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Submitted by:

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Counties

Biofix for Oriental Fruit Moth, Peach Twig Borer, and Navel Orangeworm

Joe Connell & Rick Buchner, UC Farm Advisors, Butte and Tehama Counties

The biofix date or when you sustainably catch the first moth or trap the first eggs is used as the starting point to run degree day models for each of the following pests. These insect phenology models can improve spray timing if pressure is great enough to suggest that sprays are needed or they can provide a clue as to when pest pressure will occur as harvest approaches. Biofix dates will vary with location and the environment so it's best to have traps in *your* orchard if you wish to use this information most effectively. Today, degree day calculations can be made easily from the biofix in your orchard using the Degree Day calculator on the UCIPM web site at http://www.ipm.ucdavis.edu.

Oriental Fruit Moth (OFM). OFM is rarely a pest of almond kernels but can often be found feeding in shoots and in the soft tissue of newly splitting hulls. The 1st generation of OFM has been caught in pheromone traps and our Tehama biofix date was 3/15/2010 (figure 1). Egg hatch and new larvae are expected to arrive on the scene to start feeding in new shoots 500 to 600 Degree Days following biofix. OFM has multiple generations each year. Pheromone traps can verify subsequent biofixes and treatment timing can be calculated if needed. Watch for them in the hulls of pollenizers after hull split. OFM larvae are cream or pinkish colored while PTB larvae are brown banded.

Peach Twig Borer. First leaf trees can be set back and have their developing scaffolds deformed if the terminal growth is hit by PTB this spring. Second leaf trees are injured when over-wintering PTB larvae emerge and feed on many new shoot buds on the primary scaffolds. Sometimes this is confused with blast damage or possibly bud failure, but the tiny hollowed out shoots tell the tale. A dormant spray will prevent this damage. We do not have a 2010 biofix for PTB yet. The Historical biofixes are listed in figure 1. Pest updates are available from Tehama County if you wish to follow insect activity. To get on the list, email: mailto:rpbuchner@ucdavis.edu.

Spray timing for traditional control with a "May spray" is 400 to 500 day degrees after the first sustained moth catches in pheromone traps in your orchard. The time tested method of treating when first shoot strikes are seen has worked well over the years but requires regular monitoring and the ability to see the first few wilted leaves at the shoot tips. If you start watching closely you should be able to see new PTB shoot strikes beginning in May. Treat to protect your young trees before PTB stunts the developing scaffolds.

Navel orangeworm (NOW). Area wide sanitation of mummy almonds can really knock down the NOW overwintering population. Your winter sanitation efforts combined with storms in February and March should have helped greatly in reducing NOW pressure this year.

Place egg traps baited with almond press cake with 10% almond oil in your orchards to identify this year's biofix for the NOW day degree model. It should be in early May but is variable and not always clear in low population orchards (Figure 1). Using this date, the third generation NOW egg laying that usually begins around mid August can be predicted. If an early harvest can begin before or as close as possible to this date, worm damage from this pest in Nonpareil nuts can be largely avoided.

For more information on using biofixes for monitoring and for controlling these and other almond pests check out the almond page on the UC IPM website at:
http://www.ipm.ucdavis.edu/PMG/selectnewpest.almonds.html

Insect Pest	2004	2005	2006	2007	2008	2009	2010
Oriental Fruit Moth	2/23	2/21	3/20	3/5	3/5	3/16	3/15
Peach Twig Borer	3/29	4/11	5/11	4/2	4/10	4/20	?
Navel Orangeworm	-	-	5/26	4/30	-	-	?
San Jose Scale	3/31	-	4/24	3/19	4/25	-	?

Figure 1. Historical biofix dates for selected insects monitored in Tehama County almonds.

Commercial Almond Nutrition Program at Nickels Soils Lab

Franz Niederholzer, UC Farm Advisor, Sutter/Yuba Counties
John Edstrom, UC Farm Advisor and NSL Research/Field Activities Coordinator

Pesticides protect the crop, but the size of the almond crop is established by other factors such as tree size, irrigation and fertility – assuming proper variety selection, placement and bee activity. Adequate tree water and nutrient levels establish orchard crop potential for a given tree size. Availability of sufficient essential nutrients through the season help deliver that crop potential at harvest. So, getting reliable, third-party tested information on fertilizer practices should be a priority for almond growers in California. A great source of such information comes from the Nickels Soils Lab near Arbuckle.

The Nickels Soils Lab (NSL) is both a world-class research center and a commercial orchard. The 200 acre site, with 90 acres of almonds, is owned by the Leslie J. Nickels Estate, managed by court appointed trustees, and available as a site for cutting edge agricultural research. Much of the work is done by University of California researchers. NSL receives no state operating funds. Like all growers it must invest wisely to efficiently grow its own income source.

The Nickels Soils Lab (NSL) is located west of I-5 in near Arbuckle in Colusa County. Soils of the gently rolling site are Class 2-3. Irrigation is by micro-sprinkler or drip. Eight-year, all variety average nut meat production at NSL is roughly 2500 lbs nut meats/acre, representing a range of yields from 1900-3600 lbs/acre. A crop this size contains roughly 130 lbs N, 150 lbs K, 12 lbs P, 19 lbs Ca, 5 lbs S, and 0.25-50 lbs of micronutrients (B, Zn, Fe, Cu, etc.) per acre. Summer leaf analyses are taken every year at NSL. Tree vigor, crop size and lab results are used to evaluate and adjust the fertilizer program. Here's the current commercial nutrient management program at NSL.

Crop load drives annual nitrogen (N) use in mature trees. In season almond tree N demand follows nut growth. It is strongest between March and July. At NSL, N fertilizer is injected through irrigation system at five separate times through the season. Multiple applications are the best way to make sure what is applied gets into the tree. In March, 40 lbs of CAN-17 is delivered. In April, 40-70 lbs/acre of UN32 goes out, followed by 40-60 lbs/acre of UN32 in May. The amount applied is based on cropload and shoot growth evaluation. Light crop? Less N. Heavy crop? More N. Depending on the year, 40 lbs/acre N as UN32 may be applied in June/July and in the fall after harvest.

Mature tree K demand, like N demand, is driven by crop load. Almonds use more potassium (K) than N. At NSL, they use potassium chloride – muriate of potash – at low rates injected in three separate doses of 40 lbs K2O/acre in April, June, and July. Excess chloride can damage trees, but no build up of chloride has been observed in summer leaf levels probably due to winter rainfall (averaging 18") and the application of sufficient irrigation. Growers concerned with possible chloride damage can use potassium sulfate or another non-chloride K source.

The hull boron levels at NSL are in the range of 70-80 ppm. Hull B levels under 80 ppm are considered deficient by UC standards. While almond yields at NSL are generally good to great for the Sacramento Valley, the B fertilization program at NSL aims to improve hull B levels to 100 ppm – in the sufficient range. Since a 2500 pound nut meat/acre almond crop removes approximately a half pound of actual B/acre from an orchard, two foliar B sprays (3 pounds Solubor/acre each time) are applied annually at NSL. One application is included in the hull split spray. The other application goes on in the fall – after harvest and before leaf drop starts.

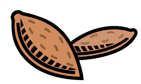
Zinc is applied twice in a season at NSL as foliar feeds. An April spray of Neutral 52% Zn is a safe and effective treatment. A fall application of 25 pounds of zinc sulfate 36% is an effective fertilizer application and speeds up leaf drop.

Gypsum is injected through the micro-irrigation system at an annual rate of 1000 pounds/acre throughout the summer to improve water penetration and provide calcium and sulfur.

The annual almond orchard nutrition program at Nickels Soils Lab -- Arbuckle, California.

Nutrient	Application	Annual Amount	Application timings	Target Tissue Analysis Level
Nitrogen (N)	Soil Injected	150-250 lbs N/acre	5 timings March -- fall	2.4-2.8 % N in summer leaves*
Potassium (K)	Soil Injected	120 lbs K_2O/acre	3 timings April - July	1.8 % K in summer leaves*
Zinc (Zn)	Foliar	4-6 lbs neutral zinc (52%) in April & 25 lb/acre $ZnSO_4$ in fall	April + Fall	>20 ppm Zn in summer leaves*
Boron (B)	Foliar	3 lbs Solubor® (0.205% B) /acre -- (2x)	Hull split + fall	>100 ppm in hulls at harvest

* non-bearing spur leaves.



Pacific Spider Mite Control at Hull Split in Almonds

David Haviland, Entomology Farm Advisor, UC Cooperative Extension, Kern Co.

Hull split is one of the most critical decision-making periods of the year for PCAs that manage spider mites in almonds. At this time, hot weather, dusty conditions, tree stress due to crop load, and reduced irrigation can all cause significant outbreaks of spider mites. Hull split is also often the last opportunity to utilize miticides in a spray program due to PHIs, as well as an opportunity to get a free ride through the field with a navel orangeworm spray. There are many new miticides available for mite control. However, not all fields require hull split miticide sprays. In many cases, beneficials are sufficient to keep spider mite populations in check.

Deciding if a treatment is needed

Monitoring and treatment guidelines can be found within the University of California Pest Management Guidelines for Almonds (www.ipm.ucdavis.edu). Treatment decisions are made based on the percentage of leaves with mites present on them. If no predators are present, treatments should be made if about 25% of the leaves have mites on them. If predators are present, treatments can be held off until about 50% of the leaves are infested. As with any monitoring program the sampling accuracy increases as the number of trees sampled and number of areas in the field sampled increase. The UC guidelines take this into account.

PCAs should also take into account additional information such as drought stress to the trees and mite history within the block. At hull split it is also wise to adapt the thresholds a little to consider that hull split may be the last opportunity to get into the field and spray before harvest begins.

Choosing a miticide

There are several miticides to choose from at hull split. The most commonly used include Envidor, Fujimite, Acramite, Zeal, and Omite. Each of these products can do well at hull split, depending on what you want to accomplish. It is also important to remember that 415 Oil is, by itself, a miticide. Use rates of 1% by volume with other miticides or insecticides will assist in mite control. Use rates of 2% can be very effective at suppressing mite populations while maintaining biological control organisms.

In three years of UC trials in Kern County, Fujimite and Envidor provided the best overall control at hull split (Table 1). Plots treated with these products either did not, or rarely had mite populations return to pretreatment levels for the duration of the trial. Pros and cons are that Fujimite acts very quickly and has long residual, but is highly toxic to predatory mites. Envidor has long residual and is safer on predatory mites, but takes longer to work. Acramite and Zeal also provided excellent knockdown of mites for a period of three to four weeks. Both products work quickly and are safe to predatory insects, though Zeal is highly toxic to predatory mites. Omite also continues to be an option, though its use decreases each year due to the availability of the reduced-risk miticides that were previously described.

Table 1. Affects of hull-split sprays on residual control of spider mites in large scale field trials in Kern County, 2006-2008.

Treatment[1]	Days after treatment to return to an average of 1 mite per leaf			Days after treatment to return to an average of 2 mites per leaf		
	2006	2007	2008	2006	2007	2008
Fujimite	28	30+	58+	34+	30+	58+
Envidor	29	30+	58	32	30+	58+
Acramite	15	30+	35	19	30+	45
Zeal	22	21	36	25	30	42
Kanemite	10	NT[2]	22	17	NT[2]	35
2% Oil	NT[2]	11	38	NT[2]	17	45

[1]Most treatments were made with the addition of 1% 415 oil at a water volume of 200 GPA.
[2]Not evaluated in that year.

A comparison of several methods for controlling pocket gophers.

Roger A. Baldwin, UC Wildlife Pest Management Advisor, Kearney Agricultural Center

Pocket gophers (*Thomomys* spp.) cause extensive damage to many crops throughout California. Many tools are available for controlling gophers including trapping, fumigation with aluminum phosphide, poison baits, and the use of a gas explosive device. Trapping gophers has been a common method for controlling gophers for many years. However, a new trap called the Gophinator (Trapline Products, Menlo Park, CA) is now available that may increase efficiency of trapping. Additionally, combining aluminum phosphide fumigation with trapping may increase effectiveness, as gophers will occasionally spring traps without getting captured. In these situations, gophers often become trap shy and are much more difficult to capture. Treating these tunnel systems with aluminum phosphide shortly after trapping could remove these individuals from the population thereby increasing gopher control in vineyards. Poison baiting with strychnine, zinc phosphide, and anticoagulant baits (e.g., chlorophacinone and diphacinone) has often been used to control gophers. Efficacy of these treatments has varied widely, although strychnine baits reportedly are most effective. Gas explosive devices have been used to control a number of burrowing animals, although no scientific studies on gophers have been reported. These devices combust a mixture of propane and oxygen within tunnel systems, thereby killing gophers through concussive force while also destroying the burrow system. All of these methods are currently allowable techniques for controlling gophers in California, although the efficacy and efficiency of these approaches, particularly in comparison to one another, remain unclear.

To better address these issues, I established a replicated trial at Laguna Ranch, Sebastopol, CA, from 6 April – 8 May, 2009, to estimate the efficacy and efficiency of these approaches. Three study blocks were established ranging from 21–31 acres in size. Plots of all three treatment types (trapping + aluminum phosphide, baiting with strychnine, gas explosive device [Rodenator®]) and a control were established within each block. Based on absolute indices (number of sites with any gopher sign after treatment/number of sites with any gopher sign before treatment), Rodenator® control ranged from 0–55%, baiting control ranged from 30–56%, and trapping + fumigation ranged from 74–90%. Relative index values (number of gopher mounds and feeder holes after treatment/number of gopher mounds and feeder holes before treatment) mirrored absolute indices, with substantial reductions in gopher sign for all trapping + fumigation plots (range = 91–96%); only 2 of 3 baiting (range = 22–81%) and Rodenator® (range = 0–86%) plots indicated substantially reduced gopher sign. Index values did not differ for control plots for either absolute or relative indices. Therefore, observed differences within and across treatments did not appear to be an artifact of natural variation in gopher populations over the sampling period.

The time required to apply each treatment was relatively similar between baiting, trapping, and Rodenator® treatments (90–106 seconds); fumigation treatments were substantially longer (260 seconds). Approximate costs per acre for each treatment were $420 for baiting, $396 for the Rodenator®, and $252 for trapping + fumigation. Please note these values are higher than what would typically be observed as densities were at the highest levels recorded for gophers (>60 gophers/acre).

To be effective, control measures need to result in a minimum of a 70% reduction in plots with gopher activity; values of 80–90% are preferable. Trapping + fumigation met this minimum criterion in all three plots, and met the more rigorous criterion in 2 of 3 plots. Even the one plot that fell short of an 80% reduction in plots with gopher activity yielded a 92% reduction in overall gopher activity. In addition to being more efficacious, trapping + fumigation was also more cost effective. Therefore, trapping + fumigation appears to be an effective method for controlling gophers. Baiting and Rodenator® treatments did somewhat reduce gopher activity in most plots, but these levels of control fell well below the minimum threshold for effectiveness (70%). As such, growers may realize short-term benefits from control, but will have to apply equal effort for control the following year. More effective control measures (80–90%) should reduce the cost of control in subsequent years.

Although absolute values were lower than desired for baiting and Rodenator® treatments, relative index values indicated a substantial reduction in gopher activity for 2 of 3 plots for both baiting and Rodenator® treatments. Therefore, an additional round of treatments could have resulted in greater absolute control values, although additional treatments would add additional costs to control efforts. This is of note, as baiting, and in particular, Rodenator®, treatments have the potential for slowing reinvasion rates due to the destruction of gopher burrow systems by the Rodenator®, and due to residual bait remaining in vacated gopher tunnel systems. However, given that these treatment types were already more costly than trapping + fumigation, a relatively high reduction in reinvasion rates would be required to offset these costs. These reinvasion rates are being assessed, although presently trapping + fumigation appears to be the most effective and efficient method for gopher control.

Understanding and applying information from a soil test: Part 1.

Allan Fulton, UC Farm Advisor Tehama, Glenn, Colusa, and Shasta Counties

This article is the first in a series of articles on understanding soil tests and making management decisions based on information provided in them. An article was written in the May 2009 issue of this newsletter and is available at http://cetehama.ucdavis.edu/newsletters.htm. The title was Soil Testing and Analysis: What to Expect in the Report and it discussed some basic principles of soil science that influence soil testing and the types of information reported. This article will focus on the role of soil testing in orchard management, describe steps to acquire informative soil testing information, and discuss two of the more familiar parameters in a soil test report: pH and saturation percentage (SP).

Soil testing helps understand the orchard soil environment and how to prevent or correct nutrient deficiencies, toxicities, or conditions that affect the availability of water to the trees in a cost effective manner. Soil testing may forewarn a problem before it actually affects growth and production. Therefore, it helps anticipate possible problems and offers the earliest opportunity to manage them. Soil testing is not a substitute for plant tissue testing, rather it is complementary. If soil and leaf tissue analyses both indicate a deficiency or toxicity, the diagnosis is obvious. If a soil analysis indicates a deficiency or toxicity but a leaf tissue test does not, it may only be a matter of time before the deficiency or toxicity develops in the trees. Conversely, if leaf tissue analysis indicates a deficiency or toxicity but soil testing does not, it may point out that either the soil testing does not represent how the trees' root system integrates the soil environment or that the soil environment has changed more rapidly than the nutritional status of the tree.

There are two basic philosophies for sampling soils. When marginal soil is known or suspected to exist**,** consider routine soil testing (at least every two or three years) to understand trends and guide long-term management. When confident that the soil is fertile, non-saline, and suitable orchard crops such as walnut, almond, and prune**,** sampling is only necessary to troubleshoot problems. Some situations do arise where a switch in sampling approach may be necessary. For example, when a change from a higher quality to lower quality irrigation water supply occurs, a change in approach from troubleshooting to routine testing may be necessary. Regardless of which approach is taken, soil sampling must represent the orchard for the test results to be of value. Within reason, sampling needs to be undertaken using methods that consider the type of irrigation system and cope with spatial and temporal variability in soils. Results from unrepresentative sampling may be misleading and costly. Sampling soils and analyzing for fertility and salinity status at multiple soil depths can give insight about irrigation and about using fertilizers and soil and water amendments.

The ***saturation percentage*** **(SP)** equals the weight of water required to saturate the pore space divided by the weight of the dry soil. Saturation percentage is useful for characterizing soil texture. Very sandy soils have SP values of less than 20 percent; sandy loam to loam soils have SP values between 20 and 35 percent; and silt loam, clay loam and clay soils have SP values from 35 to over 50 percent. Also, salinity measured in a saturated soil can be correlated to soil salinity at different soil-water contents measured in the field. As a general rule, the SP soil-water content is about two times higher than the soil-water content at field capacity. Therefore, the soil salinity in a saturation extract is about half of the actual concentration in the same soil at field capacity.

The *pH* of a soil measures hydrogen ion concentration (activity) and is sometimes referred to as soil reaction. Soil pH is closely related to bicarbonate concentration and can influence the availability of nutrients. It does not correlate with salinity in the root zone. The pH of soils in orchard production regions in the central valley of California commonly range from 5.5 to 8.4. Generally, fertility research and anecdotal experience has indicated that soil pH between 6.0 and 7.5 is ideal and attempts to change the pH within this range are unlikely to affect production. Soil pH below 5.5 and above 7.5 will begin to influence nutrient availability. Soil pH below 5.5 may result in calcium (Ca), magnesium (Mg), phosphorus (P), or molybdenum deficiency and perhaps excesses of manganese (Mn), iron (Fe), or aluminum (Al). Soil pH above 7.5 will begin to immobilize Mn, Fe, zinc (Zn), and copper (Cu) and deficiencies are more likely to occur when the soil pH is above 8.4.

Orchards with soil pH below 5.5 are more likely to benefit from liming. Table 1 outlines approximate rates of limestone for different soil textures to increase soil pH from 5.0 to 6.0. The lime requirement is dependent upon soil texture, the volume of soil amended, the initial soil pH and the desired change in soil pH. Costs to increase soil pH can be expensive. One method of reducing the cost is to apply the liming material in bands and control where the soil pH is increased. The liming material should pass a 60 mesh screen to react more efficiently and must contain carbonate (CO_3) or oxide (OH) to increase soil pH. Some other alternative liming materials include dolomite, sugarbeet lime, burnt lime, and hydrated lime.

Table 1. Approximate rate of limestone (100 percent $CaCO_3$ equivalent) needed to increase soil pH from 5.0 to 6.0 in an acre-foot of soil. [1]

Soil Texture	Lime Requirement from pH 5.0 to 6.0 (tons per acre-foot soil)
Sand and loamy sand	1.0
Sandy loam	1.8
Loam	2.5
Silt loam	3.0
Clay loam	3.6

[1] Table 1 is adapted from USDA Agricultural Handbook No. 18

Orchards with soil pH above 8.4 may benefit from applying acid forming amendments such as sulfuric acid or sulfur to lower the pH. When preparing land prior for planting, effective rates of sulfuric acid have ranged from 1 to 4 tons of acid per treated acre applied in a band to optimize cost and effectiveness. In established orchards, a single application of sulfuric acid in a band should not exceed 1,500 pounds per treated acre to avoid injuring the trees. Sulfuric acid may also be applied through irrigation systems as an alternative to banded soil applications. An equivalent rate of sulfur can also be applied in a treated band of soil. If sulfur is banded it needs to be incorporated into the soil to be most effective. Gypsum is neither a rapid reacting liming nor acidifying material. It is a pH neutral amendment.

Future articles will discuss additional soil test parameters related to diagnosing and managing soil salinity, infiltration problems, specific ion toxicity, and N, P, and K nutrient management.

33rd Annual Nickels Field Day

Thursday, May 6, 2010
Nickels Soil Lab, Marine Avenue, Arbuckle

8:30 am — **Registration**

Coffee and Danish provided by Farm Credit Services of Colusa-Glenn, ACA

9:00 am — **Field Topics:**

Getting the Most Out of Your Fertilizer, *Dr. Robert Mikkelsen, International Plant Nutrition Institute*
Control of Difficult Weeds, *Kurt Hembree, UC Farm Advisor, Fresno*
Severe Drought Trial in Nonpareil Almond, *Dr. Ken Shackel, Pomologist, UC Davis*
Navel Orangeworm Control using Mating Distruption, *Brad Higbee, Paramount Farming*
New Canker Diseases in Almond & Walnut, *Dr. Themis Michilliades, UC Plant Pathologist, Parlier*
Organic Almond Production, *Bill Krueger, UCCE Farm Advisor, Glenn County*
Water Runoff Issues in Orchards, *Parry Klassen, Coalition for Urban/Rural Environmental Stewardship*
Developments in Orchard Sprayer Technology, *Dr. Franz Niederholzer, UC Farm Advisor, Sutter/Yuba*

12:15 pm — **Lunch** by reservation, proceeds to benefit the Pierce FFA Program

Luncheon Speaker - Doug Youndahl, CEO, Blue Diamond Growers

Equipment Demo - Real-life look at Solar Power in Agriculture, *Mark Balken, Pres., Sun Valley Solar*

Organized by John Edstrom, Farm Advisor, University of California Cooperative Extension
PCA & CCA credits pending

Nickels Field Day Luncheon Reservation Form

Cost: ***$12.00/person (Prepaid Reservation), $15.00/person at the door***

Please return this form with your check by May 3rd to receive the discounted price.

Make checks payable to: *Arbuckle FFA*

Mail to: *Cooperative Extension*
P.O. Box 180, Colusa, CA 95932

Name:			
Address:			
City:	**State:**	**Zip:**	**Phone:**
Name(s) of Attendees(s):			
		Total Amount Enclosed: $	

33rd Annual Nickels Field Day

Thursday, May 6th 2010, 8:30 a.m. – 1:30 p.m.
Nickels Soils Lab, Marine Avenue – Arbuckle