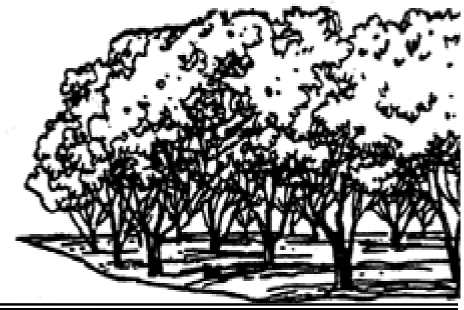
University of California **Cooperative Extension** **Butte County**

Almond Notes



Agriculture & Natural Resources

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February 13, 2013

Joseph H. Connell
UCCE Farm Advisor

Butte-Glenn Almond Institute & Walnut Day -- February 22nd

Joe Connell, UC Farm Advisor, Butte County

The Butte/Glenn Counties Almond Institute /Walnut Day will be held on Friday, February 22nd with presentations from 8:30 a.m. to 2:45 p.m. at a **NEW LOCATION** -- **Chico Elks Lodge, 1705 Manzanita Ave., Chico**. This seminar delivered by University of California farm advisors, specialists, research scientists, the Butte County Ag Commissioner, and industry experts from the California Walnut Board will feature the following topics:

- ♦Agricultural Commissioner's laws and regulations update
- ♦Your Assessment at Work: 2013 California Walnut State of the Industry
- ♦Site Selection, Soil Modification, and Replant Disease Management when Planting an Almond Orchard
- ♦Water Management in walnuts and almonds
- ♦Long Term Irrigated Lands Regulatory Program – A Sacramento Valley Perspective
- ♦Dynamics of Walnut Blight Management
- ♦Highlights of Hull Rot and Scab Control in Almonds
- ♦Update on New Walnut Varieties and New Variety Releases
- ♦What's new in Pest Management of Weeds and their Control
- ♦Root Physiology and Root Functions of Almond and Walnuts
- ♦Sprayer Calibration to meet Application Regulations and Save Money

This seminar is open to the public. Cost $15.00/person includes lunch and meeting expenses. For more information about the program, call (530) 538-7201 or visit our website: http://cebutte.ucanr.edu.

Groundwater Nitrogen Dilemma

Richard P. Buchner, UC Farm Advisor, Tehama Co.

Nitrogen is a key element for almond production. Economics plus a potential for leaching nitrogen (NO_3-N) below the root zone necessitates efficient use. Application estimates vary, but many almond farmers apply something like 200 pounds of nitrogen per acre per year. Hopefully all of that nitrogen is captured in the tree root zone. Under certain circumstances, losses can occur to volatilization, de-nitrification and possible leaching below the root zone. It's in everyone's interest to minimize those losses.

As interest in groundwater nitrogen increases, farm managers across California are going to be placed in the position of documenting efficient nitrogen application and where applied nitrogen goes. Fortunately for the almond industry, research on a "Nutrient Budget Approach and Optimization of Fertilizer Management in Almond" (Patrick Brown et al. at UCD) is underway and starting to offer answers for nitrogen management (Almond Board of California 2012 Research Update).

Just how serious ground water nitrate contamination from agricultural sources is for the Sacramento Valley is still to be determined. Recent studies focused on the southern San Joaquin Valley and the Salinas valley. Additional data will be needed from other regions of the state to sort out how serious of a problem actually exists and what sources contribute to the problem.

Work done by Cooperative Extension Farm Advisors in 1999 looked at NO_3-N groundwater levels across the Sacramento Valley. Analysis at fifteen locations from Yolo to Tehama County showed a range of 0 to 11.1 ppm NO_3-N in well water samples. 11.1 ppm NO_3-N would be 30.2 pounds of Nitrogen per acre-foot (NO_3-N (ppm) x 2.72 = pounds of nitrogen per acre-foot of water). Assuming 3 acre-feet of applied water, irrigating with that water could contribute 90.6 pounds of nitrogen per acre. This is a potentially valuable resource whose contribution you should know about in your wells when irrigating. Factoring in nitrogen contributions from irrigation water is an important part of making your farming operation efficient and cost effective. Depending upon location, ground water nitrogen is definitely worth looking at.

Bee Careful with Pesticides

Eric Mussen, Extension Apiculturist, UC Davis

Beekeeper complaints about the failure of their bees to emerge from the pupal stage, beginning 17 days after applications of the fungicide Pristine® to almonds, prompted a three-year investigation into the cause. Research showed that the fungicide, itself, harmed neither adult nor immature bees. The organosilicone adjuvant did not appear to be the problem, either, although a number of adjuvants can harm honey bees.

The unexpected discovery was that an insect growth regulator (IGR), diflubenzuron, had been added to the tank mix and applied with the fungicide at full bloom, apparently to assist in controlling peach twig borer. This type of growth regulator inhibits the production of chitin, the basic structural compound of an insect exoskeleton. Thus, the pupae could not develop into functional adults.

Insect growth regulators have been used on field and row crops, later in the season, with little harm to colonies. However, later in the season, other pollens are likely being consumed, in addition to the IGR-contaminated pollen. In the case of almonds, honey bees gather little else other than almond pollen, so they will be eating significant doses of whatever might be contaminating the pollen. In this particular situation, it appears that too much IGR made its way into the larval diet and caused brood loss. Usually, the addition of *Bacillus thuringiensis* (B.t.) to the tank mix would be a much more reasonable twig borer treatment from the standpoint of bee safety.

Despite the fact that no bee-toxicity warning may appear on the product label, or that the label might even state "safe for bees," the testing behind those statements usually relates to studies conducted on acute toxicity to adult worker bees. Obviously, adult bees are no longer producing chitin, so exposure to IGRs should not damage them. It is the immature stages that require protection, and current regulatory protocol does not mandate testing for negative effects of active ingredients, formulated products, adjuvants, or other "inert ingredients" on immature honey bees.

Probably no pesticide is totally benign to a honey bee colony. Pesticides are designed to kill ("-cides"). The best way to protect honey bees from poisoning is to reduce or eliminate the amount of pesticides that are returned to the hive in forager bees' pollen pellets. Many early-season tree crops shed their pollen in the morning and the bees are likely to collect nearly all of it by early in the afternoon.

By checking for pollen loads on foraging bees on the bloom, an applicator can determine when the pollen foragers have basically finished foraging for the day. At that time, pesticides that are not acutely toxic to honey bees can be applied to the crop. Nectar foragers that still may be visiting the contaminated bloom do little to contaminate the pollen stores. By avoiding contaminating pollen and pollen foragers, applicators can go a long way toward protecting the health of honey bee colonies.

Almond orchards with wild insects have higher fruit set

Claire Brittain[1,3], Claire Kremen[2], Neal Williams[3], Robbin Thorp[3], Stephen Hendrix[4], Alexandra-Maria Klein[1].
[1]Leuphana University of Lüneburg, Germany, [2]University of California, Berkeley, [3]University of California, Davis, [4]University of Iowa

Summary: Observations of flower visitors in almond orchards in Colusa and Yolo Counties found that flower visits by wild insects were positively related to the amount of natural habitat surrounding the orchard. Those orchards where there were lots of wild insects visiting flowers showed a higher percentage fruit set (percentage of flowers developing into nuts).

A team of researchers has been investigating the "free" pollination service that wild insects can provide to almonds in California. In 23 orchards across Colusa and Yolo Counties almond flower visitors were observed and fruit set monitored. The orchards varied in terms of their landscape context. Some orchards had high amounts of surrounding natural habitat (>30% within a 1km radius), some had low surrounding natural habitat (<5%) and a third group had low surrounding natural habitat but with a strip of semi-natural, often riparian habitat running along one edge of the orchard.

We found that almond orchards with high amounts of surrounding natural habitat received many more flower visits from wild insects, predominantly wild bees, than orchards with low surrounding natural habitat (Fig. 1a). The orchards with a semi-natural strip had more wild insect visits than the orchards with low surrounding natural habitat. We found the same pattern with fruit set. Those orchards that had high amounts of surrounding natural habitat and more wild insect visits had greater fruit set (Fig. 1b).

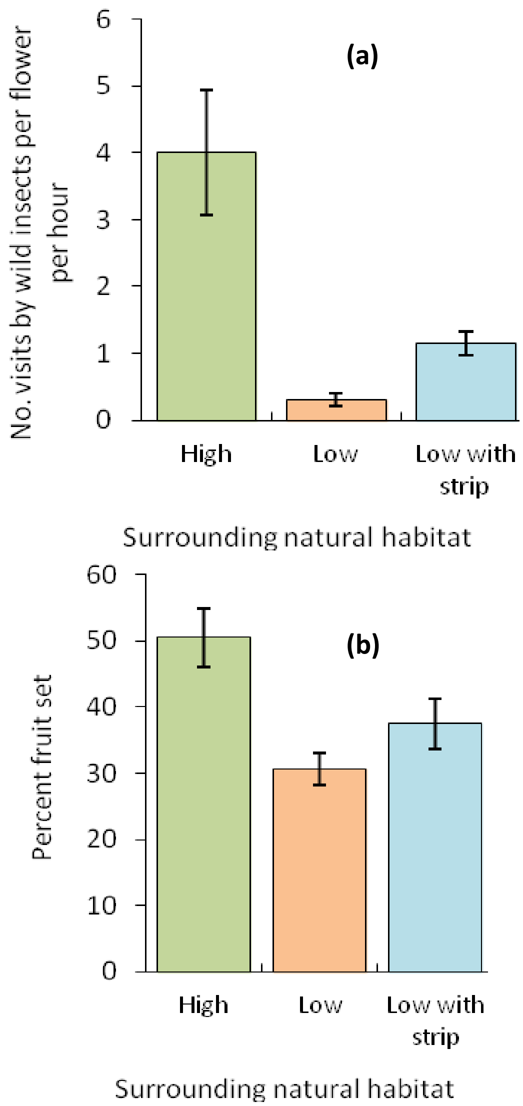

Figure 1. How the rate of almond flower visits by wild insects varied with the amount of natural habitat surrounding the orchard (a) and how this followed through to the percent fruit set (percentage of flowers developing into nuts – nuts were counted in July) (b). The colored columns represent the average per orchard and the black bars represent the variation between orchards.

Conclusions: Our results show that almond orchards can receive **"free" pollination** service from wild insects which can supplement honey bee pollination and result in greater fruit set. This highlights the importance of conserving the remaining **natural habitat** around almond orchards. In addition we found that where little natural habitat remains, lesser gains can be made by having a **semi-natural strip** of vegetation adjacent to the orchard. The degree of benefit these strips bring is likely to depend on how attractive the plants in the strip are to **wild bees**. *For further information please contact Claire Brittain at claire.brittain@uni.leuphana.de*

Nickels Field Day Set for May 15

Franz Niederholzer, UC Farm Advisor Sutter, Yuba, Colusa Counties

Save the date Wednesday, May 15th to attend the annual field day at the Nickels Soil Lab in Arbuckle. The final agenda is not yet set, but field topics will include bee health/availability in 2013, bee pastures to improve bee health, navel orangeworm monitoring/control, and other timely subjects. This event is free to the public. More detailed information (final agenda, lunch cost and registration, and lunch speaker) will be available in late March. In the meantime, please save the date for a valuable meeting with up-to-date, research-based information and discussion with ag professionals from around the region.

Springtime disease control

Joe Connell, UC Farm Advisor Butte County

Brown rot, jacket rot, shothole, scab, and anthracnose disease control efficacy is presented in the following tables showing relative fungicide effectiveness and appropriate timing for control of these diseases.

Full protection against **all** six diseases usually requires at least two fungicide applications during and shortly after bloom followed by continued treatments as needed if wet weather persists. Moisture from rain, fog, and dew favors all the diseases listed in the table.

Brown rot - This disease is favored by frequent rains accompanied by warm temperatures during bloom. Individual flowers from pink bud to the start of petal fall are susceptible. Flower parts including stigmas, anthers, and petals are all susceptible to infection.

Botrytis blossom blight, jacket rot, and green fruit rot Infections are usually initiated on senescing floral parts. The fungus progresses from the diseased flower jackets into the developing fruit causing them to rot or drop. This disease is sporadic and associated with moisture and cool conditions during bloom and early nut development. Green fruit rot most commonly affects nuts that are tightly packed together in clusters.

Shothole - Occasionally a few blossom infections are found on the jackets. The primary concern is leaf infections which can lead to defoliation and yield loss. Periods of 10 to 16 hours of continuous moisture are needed for shothole infection of leaves. Therefore, the primary objective of shothole sprays is protection of the foliage from bloom until five weeks after petal fall. Once spore producing sporodoccia form in leaf lesions the disease can become epidemic if subsequent rains occur.

Scab - The scab fungus begins its seasonal cycle by producing spores on old twig lesions from about late March to mid-April. If rain occurs after twig lesions sporulate, an epidemic scab outbreak can be present by June. Scab infections occur on both leaves and hulls ultimately producing oily greyish black spots on both. Severe infections cause premature defoliation. This disease is favored by protracted spring rains. Sprays after petal fall timed when twig lesions are beginning to sporulate have controlled scab. Later sprays have provided additional control in wet springs.

Leaf blight - With springtime moisture the leaf blight fungus attacks leaf petioles, and by June, infected leaves suddenly wither and die. During late autumn and winter the fungus grows from previously infected petioles into twigs to kill axillary buds. This disease can also be serious following summer rainfall. Sprays used from petal fall to five weeks after, have also controlled leaf blight in most seasons.

Anthracnose – This fungus overwinters as spores in infected mummies left on the tree or in dead twigs resulting from infections the previous year. New infections are initiated when spores are splashed by heavy continuous rains to the bloom or to the developing nuts. Infections can occur as long as rains continue thus requiring extended fungicide protection. Summer infections can occur if sprinkler irrigation contacts the tree canopy.

Spray materials must be **applied with good coverage** and **dried on** before rain to be effective and to reduce the chance of resistance developing. The "best" program for one orchard may not be the "best" for another. Different classes of materials should be rotated in a spray program to reduce the chances of resistance developing (and to reduce the loss of our currently effective materials).

See the UCIPM website, http://www.ipm.ucdavis.edu/PDF/PMG/fungicideefficacytiming.pdf for more information.

ALMOND: FUNGICIDE EFFICACY

Fungicide	Resistance risk (FRAC)[1]	Brown rot	Jacket rot	Anthrac -nose	Shot hole	Scab[3]	Rust[3]	Leaf blight	Alternaria leaf spot [3]	PM-like[5]	Silver leaf
Adament	high (3/11)[3]	++++	++	++++	+++	+++	+++	ND	++	+++	----
Bumper/Tilt[4]	high (3)	++++	+/-	++++	++	++	+++	ND	++	+++	----
Distinguish	high (9/11)	++++	++++	++++	++	ND	ND	ND	ND	ND	----
Indar	high (3)	++++	+/-	+++	++	++	NL	ND	+	ND	----
Inspire Super[4]	high (3/9)	++++	++++	ND	+++	+++	+++	ND	+++	ND	----
Luna Sensation	medium (7/11)[3,7]	++++	++++	++++	++++	++++	+++	ND	+++	+++	----
Pristine	medium (7/11)[3,7]	++++	++++	++++	++++	++++	+++	ND	+++	+++	----
Merivon*	medium (7/11)[3,7]	++++	++++	++++	++++	++++	+++	ND	++++	++++	----
Quash[4]	high (3)	++++	++	++++	+++	+++	++++	ND	++++	+++	----
Luna Experience	medium (3/7)[3]	++++	+++	++++	+++	++++	++++	ND	+++	+++	----
Quadris Top	medium (3/11)[3]	++++	+++	++++	+++	++++	++++	ND	+++	+++	----
Quilt Xcel	medium (3/11)[3]	++++	+++	++++	+++	++++	++++	ND	+++	+++	----
Rovral + oil[8]	low (2)	++++	++++	----	+++	+/-	++	ND	+++[9]	ND	----
Scala[3]	high (9)[3,7]	++++	++++	ND	++	----	ND	ND	+	----	----
Tebuzol (Elite**)	high (3)	++++	+/-	+++	++	++	+++	ND	+	ND	----
Topsin-M/T-Methyl/ Incognito[2]	high (1)[2,7]	++++	++++	----	----	+++[8]	+	+++[6]	----	++	----
Vangard	high (9)[3,7]	++++	++++	ND	++	----	ND	ND	+[9]	----	----
Fontelis*	high (7)[4]	++++	++++	++	++++	+++	+++	ND	+++	ND	----
Abound[4]	high (11)[3,7]	+++	----	++++	+++	++++	++++	+++	+++[10]	+++	----
Elevate	high (17)[7]	+++	++++	----	+	ND	ND	ND	ND	ND	----
Gem[4]	high (11)[3,7]	+++	----	++++	+++	++++	++++	+++	+++[10]	+++	----
Laredo	high (3)	+++	----	++	++	----	+	+++	----	+++	----
Rovral/Iprodione /Nevado	low (2)	+++	+++	----	+++	----	----	ND	++[9]	----	----
Bravo/Chloro-thalonil/Echo /Equus[11,12]	low (M5)	++	NL	+++	+++	+++[15]	++++	NL	NL	----	----
Captan[4,12]	low (M4)	++	++	+++	+++	++	----	+++[6]	+	----	----
CaptEvate*	low (M4/17)	+++	+++	+++	+++	+++	----	+++	+	----	----
Maneb**	low (M3)	++	+	++	++	++	+++	++	----	----	----
Ph-D	medium (19)	++	+++	----	++	+++	+++	ND	++++	ND	----
Syllit*	Medium (M7)	+	----	ND	+++	++++	ND	ND	+	ND	----
Rally[13]	high (3)	+++	----	++	+/-	----	+	+++	----	+++	----
Ziram	low (M3)	++	+	+++	+++	+++	----	++	+	----	----
Copper[14]	low (M1)	+/-	+/-	----	+	+[15]	----	----	ND	----	ND
Copper + oil[14]	low (M1)	ND	ND	----	+	+++[15]	----	----	ND	----	ND
Lime sulfur[12]	low (M2)	+/-	NL	----	+/-	++[15]	++	NL	NL	----	NL
Sulfur[4,12]	low (M2)	+/-	+/-	----	----	++	++	----	----	+++	----
PlantShield	low	----	----	----	----	----	----	----	----	----	+++***

Rating: ++++ = excellent and consistent, +++ = good and reliable, ++ = moderate and variable, + = limited and/or erratic, +/- = minimal and often ineffective, ---- = ineffective, NL = not on label, and ND = no data

*** Registration pending in California**

****Not registered, label withdrawn or inactive**

*** Section 24C (special local needs) registration approved in California.

[1] Group numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see http://www.frac.info/). Fungicides with a different group number are suitable to alternate in a resistance management program. In California, make no more than one application of fungicides with mode of action Group numbers 1, 4, 9, 11, or 17 before rotating to a fungicide with a different mode of action Group number; for fungicides with other Group numbers, make no more than two consecutive applications before rotating to fungicide with a different mode of action Group number.

[2] Strains of the brown rot fungi *Monilinia laxa* and *M. fructicola* resistant to Topsin-M and T-Methyl have been found in some California almond orchards. MBC-resistant strains of the jacket rot fungus, *Botrytis cinerea* and powdery mildew fungi, have been reported in California on crops, other than almond and stone fruits and may have the potential to develop in almonds with overuse of fungicides with similar chemistry. MBC-resistant strains of the scab fungus, *Cladosporium carpophilum*, have been found in California.
[3] Field resistance of *Alternaria* sp. and *Cladosporium carpophilum* to QoI and SDHI fungicides has been detected in almond orchards. AP-resistant populations of *Monilinia* spp. have been found on other stone fruit crops in California.
[4] Of the materials listed, only sulfur, Abound, Gem, and some of the DMI fungicides (FRAC Group No. 3) are registered for use in late spring and ea summer when treatment is recommended.
[5] PM-like refers to a powdery mildew-like disease on almond fruit that is managed with fungicides. Recent information suggests an *Acremonium* species is involved.
[6] Excellent control obtained when combinations of Topsin-M or T-Methyl and Captan are used.
[7] To reduce the risk of resistance development start treatments with a fungicide with a multi-site mode of action; rotate or mix fungicides with different mode of action FRAC numbers for subsequent applications, use labeled rates (preferably the upper range), and limit the total number of applications/season.
[8] Oils recommended include "light" summer oil, 1-2% volume/volume.
[9] Not registered for use later than 5 weeks after petal fall.
[10] Efficacy reduced at high temperatures and relative humidity; experimental for Alternaria.
[11] Bravo Ultrex, Bravo WeatherStik, Echo, Echo Ultimate, and Chlorothalonil are currently registered.
[12] Do not use in combination with or shortly before or after oil treatment.
[13] Efficacy is better in concentrate (80-100 gal/acre) than in dilute sprays.
[14] The low rates necessary to avoid phytotoxicity in spring reduce the efficacy of copper.
[15] "Burns out" scab twig lesions when applied at delayed dormant. (Chlorothalonil can be applied with dormant oil during tree dormancy).

ALMOND: TREATMENT TIMING

Note: Not all indicated timings may be necessary for disease control.

Disease	Dormant	Bloom			Spring[1]		Summer	
		Pink bud	Full bloom	Petal fall	2 weeks	5 weeks	May	June
Alternaria	----	----	----	----	----	++	+++	+++
Anthracnose[2]	----	++	+++	+++	+++	+++	+++	++
Brown rot	----	++	+++	+	----	----	----	----
Green fruit rot	----	----	+++	----	----	----	----	----
Hull rot[7]	—	—	—	—	—	—	—	+++
Leaf blight	----	----	+++	++	+	----	----	----
Scab[3]	++	---	---	++	+++	+++	+	---
Shot hole[4]	+[5]	+	++	+++	+++	++	----	----
Rust	----	----	----	----	----	+++	+++	+[6]

Rating: +++ = most effective, ++ = moderately effective, + = least effective, and ---- = ineffective

[1] Two and five weeks after petal fall are general timings to represent early postbloom and the latest time that most fungicides can be applied. The exact timing is not critical but depends on the occurrence of rainfall.
[2] If anthracnose was damaging in previous years and temperatures are moderate (63°F or higher) during bloom, make the first application at pink bud. Otherwise treatment can begin at or shortly after petal fall. In all cases, application should be repeated at 7- to 10-day intervals when rains occur during periods of moderate temperatures. Treatment should, if possible, precede any late spring and early summer rains. Rotate fungicides, using different fungicide classes, as a resistance management strategy.
[3] Early treatments (during bloom) have minimal effect on scab; the 5-week treatment usually is most effective. Treatments after 5 weeks are useful in northern areas where late spring and early summer rains occur. Dormant treatment with liquid lime sulfur improves efficacy of spring control programs.
[4] If pathogen spores were found during fall leaf monitoring, apply a shot hole fungicide during bloom, preferably at petal fall or when young leaves first appear. Re-apply when spores are found on new leaves or if heavy, persistent spring rains occur. If pathogen spores were not present the previous fall, shot hole control may be delayed until spores are seen on new leaves in spring.
[5] Dormant copper treatment seldom reduces shot hole infection but may be useful in severely affected orchards and must be followed by a good spring program.
[6] Treatment in June is important only if late spring and early summer rains occur.
[7] Make application at 20% hull split to manage hull rot caused by *Rhizopus stolonifer*.

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