University of California Cooperative Extension

The Pomology Post

Madera County

Volume 58, February 2009

Spring Control of Almond Diseases

by Brent Holtz, Ph.D., UCCE Madera County

Almond trees are susceptible to bloom and foliar diseases when it rains at bloom, and the decision of when to spray and what fungicides to use can be quite difficult. In the San Joaquin Valley we are usually in a low precipitation region and we cannot predict when and how much it is going to rain. We often receive rain during bloom which can result in favorable conditions for several plant pathogenic fungi to cause spring time diseases of almonds. The main diseases in almonds are Brown Rot Blossom Blight, Green Fruit Rot or Jacket Rot, and Shothole. Other less familiar diseases include Scab, Rust, Leaf Blight and Anthracnose. The fungi that cause these diseases are usually always present in almond orchards, sometimes in higher or lower amounts depending on the previous years disease levels and current environmental conditions.

Fungicide Control Programs

Generally, a good disease control program is based upon a wise choice of fungicides and good timing and coverage. Growers should assess the diseases present in their orchards and select materials carefully. Not all fungicides are equally effective on all diseases (fig. 1). It is a good idea to use more than one kind of fungicide for a broader spectrum of activity.

Usually two sprays are made for brown rot control. The first is usually done at 5-20 % bloom using a systemic fungicide such. Some of these fungicides may require a contact fungicide to reduce resistance. Resistance to these fungicides can develop over time and repeated use, thus try to rotate the fungicides you use. The second spray should be done at about 80% to full bloom or two weeks after the first spray. This is the most effective brown rot spray (fig. 2). Depending on the weather, a third spray may be necessary if rains persist and two weeks of protection have gone by. Since we cannot predict the weather at bloom time, we must at least take some initial action to protect our crop. Application techniques are also important. Usually ground application is better than air; but care must be taken that both are applied correctly. In general, use properly calibrated and directed nozzles and maintain a slow speed.

Brown Rot and Shot Hole

Most orchards are treated at least once during bloom for brown rot. The brown rot fungus (*Monilinia laxa*) attacks the tree by invading the anthers and pistils of the flower when it is open. From there the fungus can move into and kill the spur or shoot. Young fruit are also susceptible in early spring and infection of fruit may extend to and kill spurs and shoots. Although all cultivars of almond are susceptible to brown rot, they vary in their degree of susceptibility; Butte is the most susceptible variety followed by Carmel. Ne Plus Ultra and Mission are only moderately susceptible, while Nonpareil and Peerless are the least susceptible to brown rot. Varieties that are susceptible to Green Rot or Jacket Rot (caused by *Monilina laxa*, *Botrytis cinerea*, *Sclerotinia sclerotiorum*) are Butte, Ne Plus Ultra, Merced, Carmel, Price or any variety with tight clusters. Nonpareil can be affected by this disease if the right environmental conditions occur. The time of infection for Green Fruit Rot or Jacket Rot is from flower opening to petal fall. Brown Rot Blossom blight is usually controlled pink bud and full bloom treatments with the full bloom treatment the most important in my

opinion. A third petal fall spray may be necessary in years favorable to disease (rain). If bloom is strung out and the weather is wet and rainy, no more than ten days should elapse between treatments.

Shot Hole

The Shot Hole fungus (*Wilsonomyces carpophilus*) is notoriously more prevalent in wet years. This fungus requires water for all its activities, so periods of extended rainfall create a situation that favors Shot Hole disease epidemics. The fungus can cause lesions on leaves and fruit, but most of the time it infects the leaves as they emerge from the leaf bud. Leaf infections lead to defoliation, which usually occurs in early spring. Shot hole infection of young fruit, shortly after they emerge from the jacket, can cause the fruit to drop. As fruits enlarge, shot hole infection results in a lesion but the fruit no longer fall. About the first of May, when the embryo of the nut begins to grow, the hull becomes resistant to infection and no further lesions develop. Shot Hole is usually controlled by fungicide applications after bloom.

Scab

Until recently, scab (*Cladosporium carpophilum*) was considered more of a curiosity rather than a crop threatening disease. This has changed! In the last several years more and more orchards have developed scab problems and the disease is often serious. The fungus causes greasy black spots on fruit, leaves, and green shoots. The shoot lesions are the overwintering sites for the fungus and the source of new spores in the spring. No apparent damage is done to the fruit, but the leaves fall. Scab can completely defoliate a tree in a short time. Severe defoliation in early summer was even observed in several orchards in Madera County last year. All cultivars appear susceptible, but Carmel seems especially vulnerable. Scab is controlled by fungicide applications from 2 to 5 weeks after bloom. Earlier treatments are not effective alone, but increase the protection provided by the later treatment. Applications later than 5 weeks after bloom are less effective, especially in the southern part of the San Joaquin Valley. Not all fungicides are effective against scab, thus it is important to include scab-active materials in an overall treatment program.

Rust

Rust (*Tranzschelia discolor f. sp. dulcis*) can also cause defoliation. Both rust and scab are favored by high humidity and usually are worse in years when late spring rains occur. Orchard culture that produces humid conditions for long periods is ideal for both diseases. Like scab, rust usually appears in late spring or early summer. The fungus attack leaves but not fruit. On leaves, it produces small, bright yellow dots on the upper leaf surface, and reddish orange pustules on the lower leaf surface. The only material registered that has any efficacy is sulfur. One or two applications of sulfur in late spring can usually control rust.

Leaf Spot

Still another defoliating disease, Alternaria leaf spot, is also new to the San Joaquin Valley. Nothing is known about the disease except that it appears in early summer, causes large lesions on leaves, and can cause defoliation. Carmel, Nonpareil, Butte, Price, Sonora, Mission, and Peerless are affected. Sonora is somewhat more susceptible than the others. Leaf Spot has been around for several years, and only at a few locations has it caused enough damage to be of concern. But be on the alert! Rovral applied at 5 weeks after petal fall has some efficacy against Alternaria leaf spot, but does not prevent serious defoliation. The limitation of treatment no later than five weeks after petal fall may be partly responsible for the poor control.

Leaf Blight

The leaf blight fungus attacks the base of the leaf petiole and the bud that sits between the leaf and shoot. The leaf dies, turns a light tan color, and remains stuck to the tree. Later these leaves are then covered with the black growth of secondary fungi decomposing the infected leaves. Leaf death is of less importance, however, than the bud death that accompanies it. Leaf blight is more common in Northern California and fortunately we see it seldom here in Madera County. Generally, scab and shot hole programs control leaf blight.

Anthracnose

An extremely damaging fungal disease, Anthracnose (*Colletotrichum gloeosporioides*) was severe in some orchards in Northern California last year. Anthracnose has been in California for many years, but has become more severe recently, attacking leaves and fruit. Leaf lesions have a bleached appearance and can cause the leaves to drop, though defoliation is not usually very pronounced. On fruit, Anthracnoseauses deep crater-like lesions; the affected area turns a

rusty reddish brown, and older fruit often gum profusely. Inside, the nut meat is destroyed. The fungus is reported to invade the wood, and the branches upon which infected fruit reside weaken and die. Thus, in addition to destroying the crop, long term damage and weakening of the tree may occur. Varietal differences in susceptibility are not clear. It appears that good scab control programs appear to provide some control against this disease. Orchards which have a history of anthracnose should be treated during bloom, preferably at pink bud, to help reduce inoculum build-up as much as to protect blossoms. Trees should be protected before every rain, thus repeated applications may be necessary through spring.

Fungicide Control Programs

Generally, a good disease control program is based upon a wise choice of fungicides and good timing and coverage. Growers should assess the diseases present in their orchards and select materials carefully. Not all fungicides are equally effective on all diseases (fig. 1). It is a good idea to use more than one kind of fungicide for a broader spectrum of activity and to prevent pathogen populations from becoming resistant. This will be especially important with using Strobilurin fungicides (Abound, Cabrio, Flint, Sovran, and Pristine). Pristine is a Strobilurin fungicide that is combined with Carboxyanilide to slow resistance development.

Usually two sprays are made for brown rot control. The first is usually done at 5-20 % bloom using a systemic fungicide such. Some of these fungicides may require a contact fungicide to reduce resistance. Resistance to these fungicides can develop over time and repeated use, thus try to rotate the fungicides you use. The second spray should be done at about 80% to full bloom or two weeks after the first spray. This is the most effective brown rot spray. Depending on the weather, a third spray may be necessary if rains persist and two weeks of protection have gone by. Since we cannot predict the weather at bloom time, we must at least take some initial action to protect our crop. Application techniques are also important. Usually ground application is better than air; but care must be taken that both are applied correctly. In general, use properly calibrated and directed nozzles and maintain a slow speed. The fungicide efficacy and timing for deciduous tree fruit and nut crops and grapevines 2008 can be found at http://www.ipm.ucdavis.edu
Good Luck!!!

For special assistance regarding our programs, please contact us.

Sincerely,

Brent A. Holtz, Ph.D.
Pomology Farm Advisor

ALMOND—FUNGICIDE EFFICACY

Fungicide	Resistance risk (FRAC)[1]	Brown rot	Jacket rot	Anthrac-nose	Shot hole	Scab[2]	Rust[3]	Leaf blight	Alternaria leaf spot [2]	PM-like[4]	Silver leaf
Adament	high (3/11)	++++	++	++++	++	+++	+++	ND	++	ND	----
Benlate[5]	high (1)	++++	++++	----	----	+++	+	++++[6]	----	----	----
Distinguish	high (9/11)	++++	+++	++++	++	ND	ND	ND	ND	ND	----
Indar	high (3)	++++	+/-	+++	++	++	+++	ND	+	ND	----
Inspire*	high (3)	++++	+	ND	++	+++	ND	ND	+++	ND	----
Inspire Super[16]	high (3/9)	++++	++	ND	++	+++	ND	ND	+++	ND	----
Orbit	high (3)	++++	+/-	++++	++	++	+++	ND	++	ND	----
Pristine[3]	medium (7/11)[7]	++++	++++	++++	++++	++++	+++	ND	+++	+++	----
Quash	high (3)	++++	++	++++	+++	ND	ND	ND	++	ND	----
Rovral + oil[8]	low (2)	++++	++++	----	+++	+/-	++	ND	+++[9]	ND	----
Scala	high (9)[7]	++++	++++	ND	++	----	ND	ND	NR	----	----
Topsin-M/T-Methyl[5]	high (1)[7]	++++	++++	----	----	+++[8]	+	+++[6]	----	++	----
Vangard	high (9)[7]	++++	++++	ND	++	----	ND	ND	+[9]	----	----
Abound	high (11)[7]	+++	----	++++	+++	++++	+++	+++	+++[10]	+++	----
Elevate	high (17)[7]	+++	++++	----	+	ND	ND	ND	ND	ND	----
Gem	high (11)[7]	+++	----	++++	+++	++++	+++	+++	+++[10]	+++	----
Laredo	high (3)	+++	----	++	++	----	+	+++	----	+++	----
Rovral/Iprodione	low (2)	+++	+++	----	+++	----	----	ND	++[9]	----	----
Bravo/Chloro-thalonil/Echo[11,12]	low (M5)	++	NR	+++	+++	+++	NR	NR	NR	----	----
Captan[12]	low (M4)	++	++	+++	+++	++	----	+++	+	----	----
Captevate	low (M4/17)	+++	+++	+++	+++	+++	----	+++	+	----	----
Maneb	low (M3)	++	+	++	++	++	+++	++	----	----	----
Ph-D	medium (19)	++	++	----	++	----	ND	ND	+++	----	----
Rally[13]	high (3)	++	----	++	+/-	----	+	+++	----	+++	----

Ziram	low (M3)	++	+	+++	+++	+++	----	++	+	----	----
Copper[14]	low (M1)	+/-	+/-	----	+[6]	----	----	----	ND	----	ND
Lime sulfur[12]	low (M2)	+/-	NR	----	+/-	++[15]	NR	NR	NR	----	NR
Sulfur[12]	low (M2)	+/-	+/-	----	----	++	++	----	----	+++	----
PlantShield**	low	----	----	----	----	----	----	----	----	----	++++ ++[16]

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

* Not registered 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] Field resistance of *Alternaria* sp. and *Cladosporium carpophilum* to strobilurin and carboxamide fungicides has been detected in almond orchards.

[3] Of the materials listed, only sulfur, Abound, and Flint are registered for use in late spring and early summer when treatment is recommended.

[4] PM-like refers to a powdery mildew-like disease on almond fruit that is managed with fungicides with activity against powdery mildew fungi.

[5] Benlate label withdrawn. Strains of the brown rot fungi *Monilinia laxa* and *M. fructicola* resistant to Benlate, Topsin-M, and T-Methyl have been found in some California almond orchards. 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. Resistant strains of the scab fungus, *Cladosporium carpophilum*, have been found in California.

[6] Excellent control obtained with combination of Benlate and Captan; activity of Topsin-M and T-Methyl should be similar to that of Benlate.

[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] Oil is a "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.

[16] Registration pending

ALMOND—TREATMENT TIMING

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

		Bloom			Spring[1]		Summer	
Disease	Dormant	Pink bud	Full bloom	Petal fall	2 weeks	5 weeks	May	June
Alternaria	----	----	----	----	----	+++	+++	+++
Anthracnose[2]	----	++	+++	+++	+++	+++	+++	++
Brown rot	----	++	+++	+	----	----	----	----
Green fruit rot	----	----	+++	----	----	----	----	----
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.

ALMOND: SUGGESTED DISEASE MANAGEMENT PROGRAMS WITH FUNGICIDE FRAC[1] GROUPS

Note: Not all indicated timings may be necessary for disease control (*see* Treatment Timing Table). If treatments are needed based on host phenology, weather monitoring, inoculum models, or environmental-disease forecasting models, suggested fungicide groups are listed for each timing.

How to use this table:

1) Identify the disease(s) that need(s) to be managed. Know the disease history of the orchard especially from the previous season.
2) Select one of the suggested fungicide groups. *Numbers separated by slashes are pre-mixtures, whereas numbers grouped by pluses are tank mixtures.* If several diseases need to be managed, select a group that is effective against all diseases. Refer to fungicide efficacy table for fungicides belonging to each FRAC group. Group numbers are listed in numerical order within the suggested disease management program.
3) Rotate groups for each application within a season and, if possible, use each group only once per season, except for multi-site mode of action materials or natural products/biological controls (e.g., M2, NP/BC).

Disease	**Dormant**	**Bloom**			**Spring**		**Summer**	
		Pink bud	**Full bloom**	**Petal fall**	**2 weeks**	**5 weeks**	**May**	**June**
Alternaria	----	----	----	----	----	2	3 7/11 11 19	3 7/11 11 19
Anthracnose	----	3	3 7/11 11	3 11 M3 M4	3 7/11 11 M3 M	3 7/11 11 M3 M4	3 7/11 11 M3 M4	3 7/11 11 M3 M4
Brown rot	----	1₂ 2 (+oil) 3 9	1₂ 2 (+oil) 3 9 7/11 11	1₂ 2 (+oil) 9 7/11	----	----	----	----
Green fruit rot	----	----	1₂ 2 (+oil) 9 7/11	----	----	----	----	----
Leaf blight	----	----	1₂ 2 3 11	1₂ 2 3 11 M3 M4	3 11 M3 M4	----	----	----
Scab[4]	M2[3]	----	----	1[2] 7/11₂ 11₂ M3 M4 M5	1₂ 7/11[2] 11₂ M3 M4 M5	3 7/11[2] 11₂ M2₃ M3 M4	M2₃ M4	----
Shot hole	M1	2 3 9	2 3 7/11 9 11	2 3 7/11 9 11	7/11 11 M3 M4 M5	7/11 11 M3 M4 M5	----	----
Rust	----	----	----	----	----	3 7/11 11 M3	3 7/11 11 M3	3 7/11 11 M3

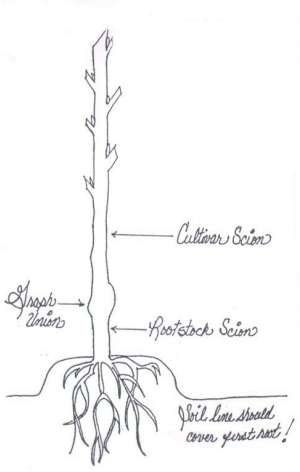
[1] Group numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see http://www.frac.info/). Groups numbers are listed in numerical order within the suggested disease management program. Fungicides with a different group number are suitable to alternate in a resistance management program. Refer to the fungicide efficacy table for fungicides belonging to each FRAC group.

[2] Benlate label withdrawn. Strains of *Monilinia fructicola* and *M. laxa* resistant to Benlate, Topsin-M, and T-Methyl are present in some California almond orchards. 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 almond with overuse of fungicides with similar chemistry.

[3] Use liquid lime sulfur in dormant applications and wettable sulfur at and after pre-bloom.

[4] Apply petal fall treatments based on twig-infection sporulation model.

Plant New Trees High, By: Brent A. Holtz



One of the worst things that can happen to young trees from nurseries is that they are often planted to deep. Sometimes though they are initially planted at the right height, but then a berm is thrown up around the trees and their crown (the graft union between the scion and rootstock) is covered with the soil from the berm. I saw many diseased trees last spring that had *Phytophthora* root and crown infections and every one of them had their graft union below the soil line; sometimes the union was more than six inches below. If you are planting or replanting, trees should be planted high on small mounds as shallowly as possible. Planting depth after settling should be no deeper than in the nursery, and the graft union should always be well above the soil line.

Try to follow some of these planting tips:

1. dig a hole deep enough so the roots are spread out and not cramped,
2. plant the trees so that the nursery soil line is above the current soil line,
3. plant the highest root a little above the soil line and then cover it with extra dirt, and
4. when planting allow for 3-6 inches of settling in the planting hole. I have never seen trees die from being planted too high, but I have seen many trees killed by being planted too low.

Most soils in Madera County are heavy with a high clay content. These soils have slow water percolation, drain slowly, and remain saturated longer than well drained sandy soils. The mound around the tree trunk forces excess water to drain away from the tree, thus reducing the length of time the crown is exposed to excess surface moisture. Saturated soil conditions can occur at plating if the trees are irrigated too heavily, or when a high rainfall winter and spring occur. Some orchards survive years before a wet spring kills trees that settled too deep or had their crown covered with a berm. Plant the tree right the first time!

After making a strong case for planting the trees high, there is one exception. If you are planting on Marianna 2624 plum rootstock you should plant your trees the same depth they were planted in the nursery. With this rootstock, planting trees too high will cause them to sucker from the roots. Marianna 2624 is fairly resistant to *Phytophthora* and it can also tolerate excess soil moisture better than other rootstocks.

2009 Almond Pruning Field Day

Wednesday, February 11, 2009

2:00 PM

Westside Research and Extension Center

17353 West Oakland Avenue
Five Points, CA 93624-0158

2:00 p.m. **Registration, Welcome and Introduction**

Brent Holtz, UCCE Farm Advisor, Madera County

2:15 p.m. **Dormant pruning first year dormant almond trees**

Brent Holtz, UCCE Farm Advisor, Madera County
Bill Seaman, Seaman Nursery, Chowchilla
Tim Gertz, Burchell Nursery Inc.

3:00 p.m. **Discussion of summer pruning almonds in their second season**

Brent Holtz, UCCE Farm Advisor, Madera County
Bill Seaman, Seaman Nursery, Chowchilla
Tim Gertz, Burchell Nursery Inc.

Sponsored by the University of California
Please RSVP at 559-675-7879 ext 201 by February 6, 2009

Southern San Joaquin Valley Almond Day
Thursday, February 12, 2009
Kearney Agricultural Center
9240 S. Riverbend Ave., Parlier, CA 93648, 559-646-6500
8:00 AM - 12:00 PM

8:00 a.m. **Introduction, PCA and continuing education credits sign-up**
Brent Holtz, PhD, Farm Advisor, UCCE Madera County

8:30 a.m. **Insect pest management in almond orchards**
Walter Bentley, Area wide UCIPM Advisor, Kearney Ag Center

9:00 a.m. **Replant disease management for almond and peach**
David Doll, Farm Advisor, UCCE Merced County

9:30 a.m. **Kaolin-processed clay on almond bud failure and yield**
Brent Holtz, PhD, Farm Advisor, UCCE Madera County

10:00 a.m. **Break**

10:30 p.m. **Almond canopy management with regard to pruning and spacing**
Roger Duncan, Farm Advisor, UCCE Stanislaus County

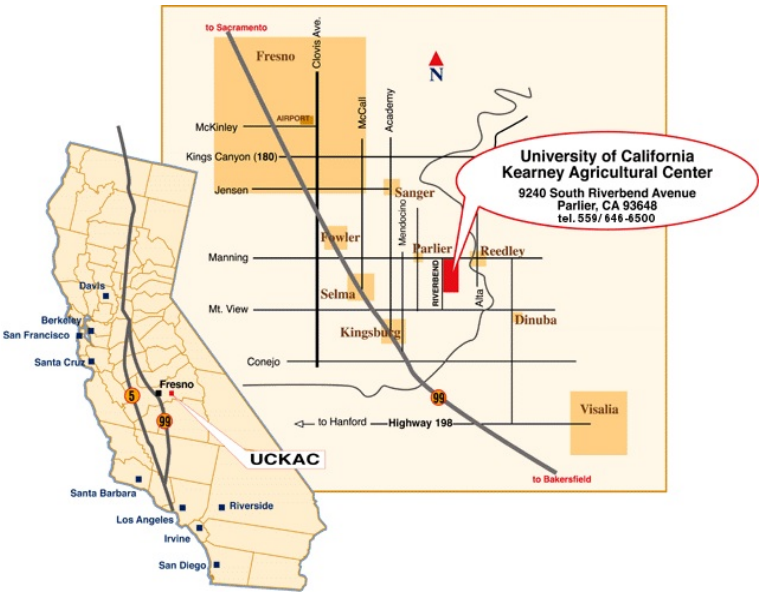
11:00 p.m. **Lower limb dieback, band canker, stigmatomycosis, and association of NOW with aflatoxin**
Themis Michailides, PhD, Plant Pathologist, UC Davis/KAC

11:30 p.m. **Matrix, tree and vine herbicide: performance and crop safety update**
Ron Vargas, UCCE Advisor Emeritus, Ron Vargas Consulting LLC

12:00 p.m. **A free lunch will be served thanks to meeting sponsors**

2.0 hours of PCA, CCA and Private Applicators Credit have been requested
Sponsors include The Almond Board of California, The University of California, Dow AgroSciences, Tessenderlo Kerley, Syngenta, Bayer Crop Science

Reservations: Please RSVP Brent Holtz's Office by February 9, 2009 at 559-675-7879



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PUBLICATIONS OF INTEREST:

Almond Production Manual - provides information on all stages of almond production, from planting and developing new orchards to managing bearing orchards and harvesting and handling the crop. Written by more than 50 UC experts, the manual's information is practical and suite to field application. More than 80 color photos. UC Pub # 3364 $30.00

IPM for Almonds, 2nd Edition - Covers 120 different pest problems including diseases, insects and mites, nematodes, vertebrate pests, and weeds including Anthracnose, Alternaria leaf blight, rust, tenlined June beetle, and leafhoppers. The second edition contains revised and expanded chapters on vertebrate pest management and vegetation management including recommendations for control techniques where endangered species occur and detailed information on cover crops. You'll also find revised sections on navel orangeworm and peach twig borer along with revised and updated tables on susceptibility of rootstocks and scion cultivars to major pests. Illustrated with 259 photos, 69 line drawings and tables, and a detailed index. UC Pub #3308 $32.00

New! Seasonal Guide to Environmentally Responsible Pest Management Practices in Almonds - This handy full-color guide takes you through the year based on the stages of growth with an easy to understand approach to environmentally friendly pest management. Easy to read format and printed on sturdy coated paper for durability in the field. This handy decision guide is packed with information to help growers make environmentally responsible pest management decisions year-round without decreasing their yields or increasing their reject levels. This guide indicates the best times to monitor specific pests and, when available, gives treatment thresholds and appropriate methods to use. UC Pub #21619 $7.00

Walnut Production Manual, 3rd Edition - This is the only comprehensive guide available covering all aspects of English walnut culture. Applicable worldwide, the book provides growers and researchers with basic understanding of the growth and development of the walnut tree and its fruit, practical considerations on harvesting and handling, and pest management. Over 50 detailed color photos. UC Pub 3373 $35.00

NEW! Cover Crops for Walnut Orchards - A cover crop is a noncash crop grown in the middles between tree rows and, in some situations, between trees within rows. Cover crops can provide many benefits in orchards and vineyards and have seen increasing use in recent years. This new handbook outlines a step-by-step process for success including suggested cover crops, orchard factors to consider when choosing a cover crop, how and when to plant, and how to manage the cover crop. UC Pub #21627 $7.00

Weeds of the West - This easy-to-use, encyclopedia guide includes 900 color photographs that illustrate and describe more than 350 weed species found in the West. Ninth edition. UC Pub #3350 $35.00

All of the above listed publications and many more, can be purchased from the University of California Cooperative Extension Office at 328 S. Madera Avenue, Madera, CA 93637. Cash or check only.