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THE SCOOP

on fruits and nuts in Stanislaus County

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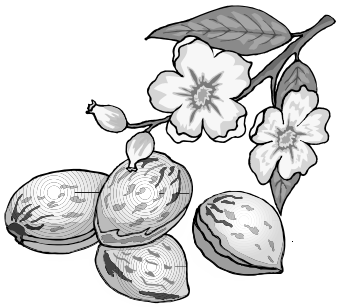
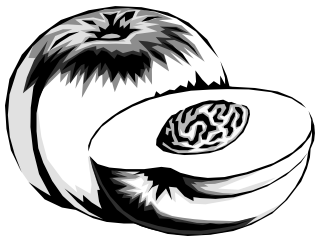
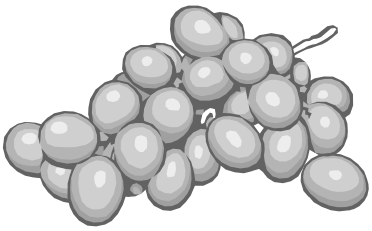
by Roger Duncan

Pomology and Viticuture Advisor







Fungicide Resistance Increases in Almond and Other Stone Fruits

By Roger Duncan and Jim Adaskaveg

Several important diseases of almond and other stone fruits are developing resistance to our fungicides. Almond scab began showing widespread resistance to strobilurin fungicides (e.g., Abound®, Flint®, Gem®) in 2006. Scab is also resistant to the strobilurin component of Pristine®. The second component of Pristine®, boscalid, was never very active against the scab pathogen. Alternaria leaf spot, a real problem in certain areas of Kern, Butte, Glenn and Tehama counties, developed resistance to the strobilurin class of fungicides beginning in 2003. This disease is now also showing resistance to carboxamide fungicides (e.g., boscalid) in many locations. Pristine® is a mixture of pyraclostrobin (a strobilurin) and boscalid. Initially, both materials were active against the pathogen, but now the Alternaria pathogen is becoming resistant to Pristine®. In 2007 we had our first confirmation that brown rot is becoming resistant to anilinopyrimidine fungicides (Scala®, Vangard®) in prunes. Resistance most likely developed due to overuse and/or improper use of these materials.

How does resistance to a fungicide (or insecticide, or antibiotic, etc.) develop? Whenever you have a population of living organisms, there are always a few individuals within the population that are tolerant to a particular chemical. If a grower continually uses the same chemical or another chemical of the same class, he will kill most of the susceptible individuals within the population, but the resistant ones will survive and multiply. Pretty soon the whole population is resistant to this chemical class. Poor spray coverage will increase the rate of resistance development.

Growers need to follow the important resistance management strategies listed below.

- If possible, begin the season with a multi-site mode of action fungicide. Many popular fungicides control a fungus by acting only on one site of a particular biochemical pathway. The potential for resistance development to these types of fungicides is high. Multiple-site mode of action fungicides kill an organism in more than one way. Resistance potential is low for these fungicides.

- Use fungicides from the same "class" only once per season if possible, especially fungicides with a single-site mode of action. Fungicides within the same class have the same mode of action. If an organism becomes resistant to a fungicide, it is also resistant to all other fungicides in the same class (example: Rally/Laredo and Elite). Fungicide classes are identified by a FRAC (Fungicide Resistance Action Committee) number. Do not use fungicides with the same FRAC number more than once in the same season (see table on page 3).

- Use label rates (not below label rates). Always use upper label rates for strobilurins (examples include Abound®, Flint® and Gem®).

- Make sure you have good spray coverage.
  This includes:
  - Do not use alternate row spray applications
  - Use enough spray volume to achieve good coverage
  - Drive slowly enough to achieve good spray coverage
  - Do not use airplane applications, especially at full canopy

The table on the next page lists the fungicides labeled for use on almonds, other stone fruits, and grapes, their modes of action, their FRAC number and resistance potential. Please study this list, as well as the table on the next page, before planning your fungicide program this year. Almond growers may choose to hold off on using materials like Pristine® and Abound® at bloom so they can be used later in the season for diseases like scab, anthracnose, and Alternaria leaf spot if necessary. Also, please note that rotating between Pristine® and Abound® is not a good resistance strategy (they both share FRAC number 11).

We are fortunate to have several very effective fungicides registered for use in almonds, other stone fruits, and grapes. There is no need to use the same fungicide more than once in the same season. If resistance develops against a fungicide class, this class may be lost indefinitely as a management tool. Generally, it takes the chemical industry and researchers years to develop new products with unique modes of action. If we all follow the resistance management guidelines, we will be able to maintain the effectiveness of the currently registered fungicides for many seasons to come.

For a complete list of fungicide efficacy tables, check our website at cestanislaus.ucdavis.edu and look under "new publications."

Chilling

So far, chilling hour accumulation this winter is slightly higher than last year in most locations. This means that we should have ample chilling to properly break dormancy of our fruit and nut trees. Not only is the total number of hours a little above recent average, but the quality and timing of chill accumulation has been excellent. As usual, the west side has accumulated significantly fewer chill hours than the east side, but this should not be a problem this year. Adequate chilling means that we should see good bloom overlap between varieties like Carmel and Nonpareil and a strong, compact peach bloom. Hopefully the weather will cooperate during bloom. To keep up to date on chilling hours, go to our UC Davis pomology website at http://fruitsandnuts.ucdavis.edu and click on weather services.

Number of Hours Below 45^{0}F between November 1, 2007 and February 12, 2008, according to four CIMIS weather stations in Stanislaus County.

	Denair	Modesto	Patterson	Oakdale
07-08	1237	1123	850	1050
06-07	1084	1092	858	1033
05-06	808	822	556	753
04-05	997	1022	945	--
03-04	899	867	787	--
02-03	924	957	750	--
01-02	--	953	899	--
00-01	--	1409	1188	--

IPM Breakfast Meetings & Pest Hotline

Our **integrated pest management (IPM) breakfast meetings for tree and vine crops** will be held every first and third Wednesday, from March 5-June 18, 7:00-8:00 am at the Peach Tree Restaurant, 2535 E. Whitmore Ave. in Ceres. They're open to any growers or PCAs of tree and vine crops in the area. We will have casual discussions of current pest management issues occurring in the field. Bring your insect or disease infested samples for show and tell if you like! One hour of continuing education units (CEU's) will be offered at each meeting. If your company would like to sponsor the $45 cost for a meeting, call Marie at 525-6800. UC Riverside plant pathologist, Jim Adaskaveg, will be our guest speaker on March 5.

The Tree and Vine IPM Pest Hotline for the 2008 season will begin March 18. Information on degree-days, flight activity and treatment timing for codling moth, peach twig borer, Oriental fruit moth and omnivorous leafroller is available 24 hours a day by calling 525-6841. Information is based on monitoring by farm advisors in local orchards. The information will be updated every Tuesday through July.

Boron Sprays at Bloom?

Boron is important for pollen tube growth and thus fertilization of fruit blossoms. Studies conducted a few years ago in Stanislaus County demonstrated that post-harvest foliar sprays of boron can significantly increase fruit set in almonds that have hull levels of 120 ppm or less. It was also shown that bud swell / pink bud sprays work almost as well as a post-harvest spray. However, boron included in full bloom sprays actually showed a reduction in yield compared to unsprayed trees. Boron sprayed in-season (petal fall through harvest) has little effect on tree boron status or fruit set the following year because developing hulls are such strong sinks for boron. If your almond trees are deficient in boron (as many orchards and vineyards east of the San Joaquin River are), consider applying 10-20 pounds of boron per acre to the soil in a broadcast application or injected through an irrigation system. Many growers find that adding boron in their herbicide strip sprays works well. However, spray mixes containing glyphosate need to be buffered or herbicidal activity will be reduced.

General Properties and Efficacy of Registered and Experimental Fungicides Used on Deciduous Tree Fruit, Nut, Strawberry, and Vine Crops in California

Trade name	Active Ingredient	Class	Systemic action	Mode of action (FRAC number)[1]	Resistance potential
various	copper	inorganic	No	Multi-site (M1)	Low
various	sulfur	inorganic	No	Multi-site (M2)	Low
Aliette	fosetyl-aluminum	phosphonate	Yes	Multi-site (33)	Low
Dithane/Manzate	mancozeb	carbamate (EBDC)	No	Multi-site (M3)	Low
Maneb/Manex	maneb	carbamate (EBDC)	No	Multi-site (M3)	Low
Thiram	thiram	carbamate (DMDC)	No	Multi-site (M3)	Low
Ziram	ziram	carbamate (DMDC)	No	Multi-site (M3)	Low
Rovral/Iprodione	iprodione	dicarboximide	Yes	Multi-site (2)	Low
Scala/Penbotec	pyrimethanil	anilinopyrimidine (AP)	Slight	Single-site (9)	High
Vangard	cyprodinil	AP	Slight	Single-site (9)	High
Botran/Allisan	dichloran	aromatic hydrocarbon	Slight	Single-site (14)	Medium
Bravo/Echo/Chlorothalonil	chlorothalonil	chloronitrile	No	Multi-site (M5)	Low
Benlate	benomyl	benzimidazole	Yes	Single-site (1)	Very high
Mertect	thiabendazole	benzimidazole	Yes	Single-site (1)	Very high
Topsin-M/T-Methyl	thiophanate-methyl	benzimidazole	Yes	Single-site (1)	Very high
Endura	boscalid	carboxamide	Yes?	Single-site (7)	High
Syllit	dodine	guanidine	Yes	Few - multi-site (M7)	Medium/High
Elevate/Judge	fenhexamid	hydroxyanilide	No	Single-site (17)	High
Ridomil Gold	mefenoxam	phenylamide	Yes	Single-site (4)	High
Captan	captan	phthalamide	No	Multi-site (M4)	Low
Captevate	captan/fenhexamid	phthalimide/ hydroxyanilide	No	Multi-site (M4)/ Single-site (17)	Low
Quintec	quinoxyfen	quinoline	No	Single-site (13)	Medium
Scholar	fludioxonil	phenylpyrrole	No	Few - multi-site (12)	Medium
Bayleton	triadimefon	DMI-triazole	Yes?	Single-site (3)	High
Elite	tebuconazole	DMI-triazole	Yes?	Single-site (3)	High
Eminent	tetraconazole	DMI-triazole	Yes?	Single-site (3)	High
Funginex	triforine	DMI-piperazine	Yes?	Single-site (3)	High
Indar/Enable	fenbuconazole	DMI-triazole	Yes?	Single-site (3)	High
Orbit/Bumper/ Mentor	propiconazole	DMI-triazole	Yes?	Single-site (3)	High
Procure	triflumizole	DMI-imidazole	Yes?	Single-site (3)	High
Rally/Laredo	myclobutanil	DMI-triazole	Yes?	Single-site (3)	High
Rubigan	fenarimol	DMI-pyrimidine	Yes?	Single-site (3)	High
Inspire	difenoconazole	DMI-triazole	Yes?	Single-site (3)	High
Abound	azoxystrobin	QoI	Yes?	Single-site (11)	High
Cabrio	pyraclostrobin	QoI	Yes?	Single-site (11)	High
Flint/Gem	trifloxystrobin	QoI	Yes?	Single-site (11)	High
Sovran	kresoxim-methyl	QoI	Yes?	Single-site (11)	High
Pristine	pyraclostrobin / boscalid	QoI/ carboxamide	Yes? Yes?	Single-site (11)/ Single-Site (7)	Medium
Switch	fludioxonil / cyprodinil	phenylpyrrole/ AP	No /Slight	Single-site (12)/ Single-site (9)	Medium

[1]Group numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions. Fungicides with a different group number are suitable to alternate in a resistance management program. For more information, see http://www.frac.info/.

ALMOND—FUNGICIDE EFFICACY

Fungicide	Resistance risk (FRAC#)	Brown Rot	Jacket rot	Anthracnose	Shot hole	Scab	Rust	Leaf blight	Alternaria leaf spot	PM-like	Silver leaf
Adament	high (3+11)	++++	++	++++	++	+++	+++	ND	++	ND	----
Benlate	high (1)	++++	++++	----	----	+++	+	++++	----	----	----
Distinguish	high (9+11)	++++	+++	++++	++	ND	ND	ND	ND	ND	----
Indar	high (3)	++++	-	+++	++	++	+++	ND	+	ND	----
Inspire	high (3)	++++	+	ND	++	+++	ND	ND	+++	ND	----
Inspire Super	high (3+9)	++++	++	ND	++	+++	ND	ND	+++	ND	----
Orbit	high (3)	++++	-	++++	++	++	+++	ND	++	ND	----
Pristine	medium (7/11)	++++	++++	++++	++++	++++	+++	ND	+++	+++	----
Quash	high (3)	++++	++	++++	+++	ND	ND	ND	++	ND	----
Rovral + oil	low (2)	++++	++++	----	+++	+/-	++	ND	+++	ND	----
Scala	high (9)	++++	++++	ND	++	----	ND	ND	NR	----	----
Topsin-M/T-Methyl	high (1)	++++	++++	----	----	+++	+	+++	----	++	----
Vangard	high (9)	++++	++++	ND	++	----	ND	ND	+	----	----
Abound	high (11)	+++	----	++++	+++	++++	+++	+++	+++	+++	----
Elevate	high (17)	+++	++++	----	+	ND	ND	ND	ND	ND	----
Gem	high (11)	+++	----	++++	+++	++++	+++	+++	+++	+++	----
Laredo	high (3)	+++	----	++	++	----	+	+++	----	+++	----
Rovral/Iprodione	low (2)	+++	+++	----	+++	----	----	ND	++	----	----
Bravo/Echo/ Chlorothalonil	low (M5)	++	NR	+++	+++	+++	NR	NR	NR	----	----
Captan	low (M4)	++	++	+++	+++	+++	----	+++	+	----	----
Maneb	low (M3)	++	+	++	++	++	+++	++	----	----	----
Ph-D	medium (19)	++	++	----	++	----	ND	ND	+++	----	----
Rally	high (3)	++	----	++	+/-	----	+	+++	----	+++	----
Ziram	low (M3)	++	+	+++	+++	+++	----	++	+	----	----
Copper	low (M1)	+/-	+/-	----	+	----	----	----	ND	----	ND
Lime sulfur	low (M2)	+/-	NR	----	+/-	++	NR	NR	NR	----	NR
Sulfur	low (M2)	+/-	+/-	----	----	++	++	----	----	+++	----
PlantShield	low	----	----	----	----	----	----	----	----	----	+++

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

ALMOND—TREATMENT TIMING

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

Disease	Dormant	Bloom			Spring		Summer	
		Pink bud	Full bloom	Petal fall	2 weeks	5 weeks	May	June
Alternaria	----	----	----	----	----	+++	+++	+++
Anthracnose	----	++	+++	+++	+++	+++	+++	++
Brown rot	----	++	+++	+	----	----	----	----
Green fruit rot	----	----	+++	----	----	----	----	----
Leaf blight	----	----	+++	++	+	----	----	----
Sca+b	+	---	---	++	+++	+++	++	---
Shot hole	+	+	++	+++	+++	++	----	----
Rust	----	----	----	----	----	+++	+++	+

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

PEACH AND NECTARINE—FUNGICIDE EFFICACY

Fungicide	Resistance risk (FRAC#)	Brown rot		Powdery mildew	Scab	Rust	Leaf curl	Shot hole
		Blossom	Fruit					
Adament	med. (3/11)	++++	++++	+++	+++	+++	----	++
Benlate	high (1)	++++	++++	+++	+++	+	----	----
Distinguish	med. (9/11)	++++	+++	++	+++	+++	----	++
Elite	high (3)	++++	++++	+++	++	+++	----	+/-
Indar/Enable	high (3)	++++	++++	+++	+++	ND	----	+/-
Orbit (Bumper)	high (3)	++++	++++	+++	----	+++	----	+/-
Pristine	medium (7/11)	++++	++++	+++	+++	ND	ND	++++
Rovral+ oil	low (2)	++++	NR	+	+	++	----	++
Scala	high (9)	++++	+++	ND	ND	ND	----	+
Topsin-M	high (1)	++++	++++	+++	+++	+	----	----
Vangard	high (9)	++++	+++	ND	ND	ND	----	+
Elevate	high (17)	+++	+++	ND	ND	ND	ND	ND
Rally	high (3)	+++	+++	++++	----	----	----	----
Rovral	low (2)	+++	NR	----	----	----	----	----
Abound	high (11)	++	+	++	++++	+++	----	++
Botran	medium (14)	++	+	ND	ND	ND	ND	ND
Bravo/Echo	low (M5)	++	----	----	+++	+	+++	+++
Captan	low (M4)	++	++	----	+++	----	----	+++
Gem	high (11)	++	+	++	++++	+++	----	++
Copper	low (M1)	+/-	----	----	----	----	+++	+++
Sulfur	low (M2)	+/-	+/-	+++	+++	+++	----	----
Ziram	low (M3)	+/-	----	----	+++	----	++++	+++

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

PEACH AND NECTARINE—TREATMENT TIMING

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

Disease	Dormant	Bloom		3-6 weeks	Preharvest	
		20-40%	80-100%	postbloom	3 weeks	1 week
Brown rot	----	++	+++	+	++	+++
Powdery mildew	----/ND	++	+++	+++	----	----
Leaf curl	+++	+	----	----	----	----
Rust	+	----	----	+++	++	----
Scab	----	+	++	+++	----	----
Shot hole	+++	+	+	++	----	----

Rating: +++ = most effective, ++ = moderately effective, + = least effective, ---- = ineffective, and ND = no data but needs to be evaluated.

THE SCOOP on fruits and nuts

NSJV Almond Day Slide Shows Available Online

If you missed the NSJV Almond Day, you can view the slide shows on our webpage at http://cestanislaus.ucdavis.edu. Click on the agriculture link, then on the almond link and scroll down the page. The talks included:

Almond Irrigation, Water Stress & Productivity
Dr. Ken Shackel, Dept. of Plant Sciences, UC Davis

Almond Pruning by the Numbers
Roger Duncan, Pomology Advisor, UCCE-Stanislaus County

Understanding the Role of the Soil Microbial Community in Replant Disease

Weed Control and Label Updates in Almonds
Kurt Hembree, Weed Advisor, UCCE-Fresno County

Predicting NOW Damage
Dr. Joel Siegel, Research Entomologist, USDA ARS, Parlier, CA

Organic Almond Disease Control
Dr. Brent Holtz, Pomology Advisor, UCCE-Madera County

To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products which are not mentioned.

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