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Powdery Mildew of Peach – Pathogens, Biology, and Management

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Powdery mildew of peach and nectarine occurs worldwide, but is most damaging in semi-arid growing areas. The disease can be caused by several different species of fungi that commonly occur on Rosaceous plants. Four species have been reported on peach: 1) the peach-rose powdery mildew fungus *Podosphaera pannosa* (formerly *Sphaerotheca pannosa*); 2) the apple powdery mildew fungus *P. leucotricha* that causes rusty spot of peach; 3) the cherry powdery mildew fungus *P. clandestina*; and 4) the late-season powdery mildew *P. tridactyla*. *P. clandestina* has not been reported on peach in California but has been found on peach seedlings in the eastern United States. The most common and important species on peach in California are *P. pannosa* and *P. leucotricha.* These species commonly cause fruit infections and significant economic damage, but leaf and twig infections are important sources of inoculum. In nurseries, powdery mildew leaf infections can cause significant damage to seedlings and small trees.

The susceptibility of peach and other stone fruit crops varies greatly among cultivars. The eglandular (without glands at the leaf base) peach cultivars are more susceptible than the glandular ones. Furthermore, in some cultivars, tissues also vary in their susceptibility with fruit being more or less susceptible than leaves, depending on the mildew species involved and maturity of host tissue. Leaves, buds, green shoots, and fruit are commonly attacked, but flower infections are rare. Fruit are susceptible to *P. pannosa* from the early stages of development until pit-hardening on peach and nectarine, but not other *Prunus* spp. (infection periods of other powdery mildew species are not known). White circular spots may enlarge, coalesce, and cover large areas of the fruit. Infections usually result in some deformation of the fruit surface with depressed or slightly raised areas. Infections on peach fruit become necrotic after pit-hardening, whereas on nectarine and occasionally also on peach the tissue remains green. Any fruit with blemishes caused by powdery mildew are generally unmarketable.

Management of powdery mildew is by cultural practices and by the use of protective fungicide treatments. Less susceptible cultivars should be planted in areas that commonly have favorable environments for high disease incidence. To reduce the relative humidity in the orchard, the frequency of irrigation periods should be minimized and low-angle sprinklers should be used to keep foliage dry. For managing powdery mildew, fungicide applications should be timed from full bloom until the pit hardening stage of fruit development. A guide to timing of fungicide applications for selected spring/summer diseases of peach and nectarine is shown in Table 1.

Table 1. Treatment timing of fungicides for spring and summer diseases of peach and nectarine.*

		Bloom		3-6 weeks	Preharvest[1]	
Disease	**Dormant**	**20-40%**	**80-100%**	**postbloom**	**3 weeks**	**1 week**
Brown rot	----	++**	+++	+	++	+++
Powdery mildew	----/ND	++	+++	+++[2]	----	----
Scab	----	+	++	+++	----	----
Rust	+[3]	----	----	+++	++	----

* - Visit the UCIPM program at www.ucipm.ucdavis.edu.

** Rating: +++ = most effective, ++ = moderately effective, + = least effective, ---- = ineffective, and ND = no data but needs to be evaluated. Note: Not all indicated timings may be necessary for disease control if environmental conditions are not favorable or the pathogen is not present.

[1] Timing not exact; weather conditions determine need for treatment.

[2] Apply until pit hardening.

[3] Fall application before winter rains begin is the most important; additional spring sprays are seldom required but may be needed to protect the fruit if heavy persistent spring rains occur.

Numerous fungicides are available and in 2010 several new materials will be registered for managing diseases of peach in California. Table 2 indicates selected fungicides registered in California for powdery mildew and other spring/summer diseases of peach. The products are grouped by their FRAC Group or mode of action.

Table 2. Fungicides registered or planned for registration for managing selected diseases of peach*.

New		Resistance	Brown rot[2]		Powdery		
Products	**Fungicide[1,3]**	**Risk (FRAC#)[1]**	**Blossom**	**Fruit**	**mildew[2]**	**Scab**	**Rust**
	Elite/Orius/Tebuzol	high (3)	++++	++++	+++	++	+++
	Indar/Enable[4]	high (3)	++++	++++	+++	++	ND
	Orbit/Tilt/Bumper	high (3)	++++	++++	+++	++	+++
Late 2009	Quash	high (3)	++++	++++	+++	ND	+++
	Rally	high (3)	+++	+++	++++	ND	ND
	Pristine	medium (7/11)[5]	++++	++++	+++	+++	+++
Late 2010	Luna Sensation	medium (7/11)[5]	++++	++++	+++	+++	+++
	Inspire Super	medium (3/9)	++++	++++	+++	++	+++
2009	Adament	medium (3/11)	++++	+++	+++	ND	+++
2010	Quadris Top*	medium (3/11)	++++	+++	+++	ND	+++
2010	Quilt Xcel*	medium (3/11)	++++	++++	+++	ND	+++
	Topsin-M /T-Methyl /Thiophanate-Methyl[3]	high (1)[5]	++++	++++	+++	+++	+
	Elevate	high (17)[5]	+++	+++	+	ND	ND
	Abound	high (11)[5]	++	+	++	++++	+++
	Gem	high (11)[5]	++	+	++	++++	+++
Late 2009	Quintec	high (13)	----	----	++++	----	----
	Sulfur[10]	low (M2)	+/-	+/-	+++	+++	+++

*** - Visit the UCIPM program at www.ucipm.ucdavis.edu.**

** - **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.

[1] Do not use fungicides with the same FRAC number and high resistance risk more than twice in one year.

[2] Strains of *Monilinia fructicola* resistant to Benlate (label withdrawn), Topsin-M, and T-Methyl are present in some peach and nectarine 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 peach and nectarine with overuse of fungicides with similar chemistry. Sub-populations of both *Monilinia* spp. have been shown to be resistant to AP (FRAC 9) fungicides in a few prune orchards in northern CA.

[3] 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.

New products include the single fungicides Quash (metconazole-FRAC Group 3) and Quintec (quinoxyfen-FRAC Group 13). Quash joins a number of other DMI fungicides previously registered on peach that are very good to excellent against mildew and other diseases like brown rot. Quintec has been registered on sweet cherry and grapes for several years but is a brand new mode of action on peach that is highly specific and highly effective against only powdery mildew fungi. The fungicide can be applied from full bloom to several weeks after petal fall based on host susceptibility, history of the disease in the orchard, and if favorable environments for mildew occur. Quintec should never be applied once symptoms have developed because of the high potential for resistance to develop in pathogen populations. It can be mixed with other fungicides and has two to three weeks of residual activity.

One of the latest trends in the development of fungicide products is the introduction of pre-mixtures. Registrants of fungicides have been able to increase the spectrum of activity and reduce the potential of selection for resistant populations of pathogens by mixing two single-site mode of action fungicides (provided that both active ingredients are effective against the pathogen). New products include: Adament (tebuconazole / trifloxystrobin), Quilt Xcel (azoxystrobin/propiconazole) and Quadris Top (azoxystrobin/propiconazole) that combine FRAC Groups 3/11; Luna Sensation (fluopyram/ trifloxystrobin), a new product that combines Groups 7/11; and Inspire Super (difenoconazole/ cyprodonil), a new product that combines Groups 3/9. All of these fungicides are highly active against powdery mildew, brown rot, and other diseases. Just as using single-site mode of action fungicides, when using pre-mixtures or tank mixtures rotate between the FRAC Groups, never apply more than two consecutive applications of the same FRAC Group number, and, ideally, rotate between the FRAC Groups with every application.

FINAL CHILLING HOURS:

2009-2010	854
2008-09	1116
2007-08	1108
2005-06	780
2004-05	994
2003-04	886
2002-03	779

Chilling hours recorded for hours below 45^{o} F model at our office in Yuba City on Garden Highway starting November 1 and ending on February 28.

Submitted by: Janine Hasey, UC Farm Advisor
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