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ORCHARD FACTS

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Sacramento Valley Prune Newsletter

What To Do If It's Hot At Bloom – 2008

Franz Niederholzer, UC Farm Advisor, Sutter/Yuba Counties

Summary:
- High temperatures (above 75°F) at bloom slow down or kill flower activity.
- To try to increase set if temperatures are above 75°F this year, growers might consider:
- Cooling their orchard with irrigation water. Soil should be kept moist (not saturated) when high temperatures occur.
  - Get bees in the orchard.

High temperatures at bloom present a huge economic challenge to California prune growers. Heat at bloom (>80°F) in 2004 resulted in the smallest California prune crop in almost a century. Temperatures over 80°F at full bloom in 2005, and 2007 produced prune crop failures in Sutter and Yuba Counties. Full bloom timing differences of only 24-48 hours in 2005 or 2007 resulted in crop load differences of 200-300%. If bloom temperatures head for 80°F in 2008, the crop may again be at risk.

What exactly is the relationship between heat at bloom and low crop set? Recent research by Dr. Vito Polito (Plant Sciences Department, UC Davis) showed that pollen germination and pollen tube growth decline rapidly above 75°F. At temperatures above 80°F, Dr. Polito believes that flower parts are severely damaged or killed. Researchers have not yet determined exactly what temperatures for how long will affect fruit set. However, experience shows that it doesn't take much heat at or above 80°F to damage flowers. The 2005 Sutter/Yuba prune crop was essentially destroyed when temperatures at full bloom were at or above 80°F for a total of 11 hours over a three day period (March 10-12).

What can growers do if the temperatures of 75+°F are predicted for bloom? While research has not yet developed rock solid recommendations for growers to follow, here's what has been learned over the past few years:

● **Cool the orchard with irrigation water.** Evaporative cooling may reduce temperatures enough to help set a crop. Impact sprinklers or micro-jet irrigation systems have an advantage over flood irrigation systems for orchard cooling. There are reports of good crops in 2005 after running water, while other growers ran water with no benefit. Soil should be moist (not saturated) when warm weather hits. If you can only irrigate part of the orchard per set, run water long enough to wet the soil and then shift flow to another part of the orchard. "Flash" water across irrigation checks and move on to others. If the soil surface dries and isn't rewet, the potential for evaporative cooling decreases significantly. Concentrate irrigation/cooling efforts where warm air is entering the orchard and let the wind move the cooled air down through the orchard. If water is applied to the trees for any length of time through overhead sprinklers, etc., a good systemic fungicide is advisable for control brown rot control.

● **Get bees in the orchard.** This means renting bees, as native bee populations have weakened due to bee mites and poor food availability. Experience suggests better fruit set in 2005 and 2007 on trees close to hives, and poor fruit set away from the hives. It may be beneficial to spread hives throughout the orchard. In almond orchards beehives are distributed at 1/10 to ¼ mile intervals for optimum pollination.

● **Leave grass long** in the orchard if heat at bloom is predicted. Tall, well irrigated grass should be 1-2°F cooler compared to short mowing . If frost is a threat at bloom, keep the orchard ground cover as short as possible. Delay the orchard floor management decision as long possible so that a better forecast of bloom weather is available and can be included in the final decision.

● **Spray oil at first flower to delay bloom:** this is a long shot, but 4 gallons of narrow range oil/acre oil (in 100 gallons/acre) at first flower may delay bloom a few days. This can be good or bad for fruit set, depending on when hot weather comes. If it does delay bloom in a particular block, it would only help if hot weather passed quickly.

Brown Rot Blossom and Twig Blight

Joseph Connell & Richard Buchner, UCCE Farm Advisors – Butte & Tehama Counties

Brown rot blossom/twig blight caused by *Monilinia* species is the most important blossom and pre-harvest disease of prune in California. In the main growing areas of the state, *M. laxa* is the primary pathogen on blossoms, whereas *M. fructicola* is the main pathogen on fruit. Properly timed fungicide treatments can most effectively protect your trees and prevent this disease.

The brown rot fungus produces ascospores from apothecia that develop on fruit mummies on the orchard floor and produces conidia from spore pads on mummified fruit left in the tree, twig/spur cankers, and on any remnants of infected flower parts. These old infections are the source of spores for spring infections and the spores can be both airborne or rain splashed. Good orchard sanitation including removing mummified fruit from trees, pruning out blighted shoots, and cultivating the orchard floor to bury fruit mummies are practices that reduce spore production.

All flower parts are susceptible to blossom infections from green bud through petal fall. Brown rot fungi grow and reproduce rapidly at temperatures ranging from 60° to 80°F. Infections do not develop below 50°F. Initially infected flowers turn brown, wither and remain attached to fruit spurs. Twig cankers form on the wood at the base of infected blossom spurs. Ultimately, as blossom infections extend into the twigs, shoot death is caused by girdling. Gumming occurs at infection sites and grey-brown spore masses may be visible under high humidity.

Orchards with a history of brown rot should be treated and all orchards are vulnerable in a severe brown rot year. The challenge is trying to anticipate or predict severe disease conditions. Sprays are preventive and do little if any good when applied after infection. Grower surveys following the severe brown rot year in 1993 suggested waiting to apply a single spray for brown rot at full bloom did not provide adequate control. A two-spray

program (green bud/white bud and full bloom) aimed at both brown rot (green bud and full bloom) and russet scab (full bloom, only) may be a good choice. Fungicide treatments are most effective when applied and allowed to dry thoroughly before rainfall occurs.

PRUNE (OR DRIED PLUM)—TREATMENT TIMING

Note: Timings listed are effective, but not all may be required for disease control. Timings used will depend upon orchard history of disease, length of bloom, and weather conditions each year.

Disease	Green bud	White bud	Full bloom	May	June	July
Brown rot[1]	+++	+++	+++	----	+	++
Russet scab[2]	----	----	+++	----	----	----
Rust[3]	----	----	----	+	++	+++

Rating: +++ = most effective, ++ = moderately effective, + = least effective, and ---- = ineffective
[1] Flowers are susceptible beginning with the emergence of the sepals (green bud) until the petals fall but are most susceptible when open.
[2] A physiological disorder; no pathogens involved.
[3] More severe when late spring rains occur.

Brown Rot Fungicide Resistance Management

Richard Buchner, UCCE Farm Advisor, Tehama County and
Jim Adaskaveg, Professor Plant Pathology, UC Riverside

New fungicides are very effective for brown rot management, however, a serious concern is the risk of resistant *Monilinia* species to these new materials. In 2007 Jim Adaskaveg, with the help from farm advisors, collected brown rotted fruit from orchards in the upper Sacramento Valley. Even though 2007 was a low disease pressure year, 51 isolates from 12 locations were collected. Resistance evaluations were performed for iprodione (FRAC Group 2) propiconazole (FRAC Group 3), and cyprodinil (FRAC Group 9). None of the isolates demonstrated any resistance to iprodione or propiconazole, however, one isolate showed resistance to cyprodinil. This is the first report of a FRAC Group 9-resistant field isolate of *M. fructicola*. These results emphasize the value of resistance management practices to avoid field resistance and loss of fungicide efficacy.

Each fungicide has a group number assigned by the Fungicide Resistance Action Committee (FRAC). Group numbers identify fungicides with different modes of action. The following is a review of selected FRAC groups important in California prune and stone fruit production: ***FRAC group 1*** is the Benzimidazole class with a single-site mode of action and very high resistance potential (e.g., Topsin-M/T-Methyl). *Monilinia* spp. have developed resistance to this fungicide class soon after its introduction and exclusive use. Furthermore, resistant isolates have remained stable in the pathogen population and are still widespread in California stone fruit production areas. ***FRAC group 2*** is the Dicarboximide class with a multi-site mode of action and low resistance potential (e.g., Rovral/Iprodione). This class remains important for brown rot blossom blight management, although labeled preharvest uses on fruit have been canceled since 2000. ***FRAC group 3*** is the DMI-Triazole class with a single site mode of action and high resistance potential (e.g., Orbit, Indar, Rally). This fungicide class is the current standard material for managing brown rot of stone fruit. Resistance has been reported in *M. fructicola*

populations in the southeastern United States. ***FRAC group 7*** is the Carboxyamide class with a single-site mode of action and high resistance potential (e.g., Boscalid - a component of Pristine). ***FRAC group 9*** is the Anilinopyrimidine class with a single-site action and high resistance potential (e.g., Vangard, Scala). These fungicides are highly effective for brown rot blossom blight control. They may be inconsistent in their performance in managing fruit brown rot especially in hot, humid environments. ***FRAC group 11*** is the Strobilurin class with a single-site action and high resistance potential (e.g., Abound, Gem, Pristine – a combination product of Groups 7 + 11). These materials are effective for managing brown rot blossom blight and fruit rot when used as protective treatments. Their late-season use after early-season rainfall conducive to brown rot infections is not an effective strategy. ***FRAC group 17*** is the Hydroxyanilide class with a single-site action and high resistance potential (e.g., Elevate). This fungicide class is highly effective for brown rot and jacket rot (mostly *Botrytis cinerea*) on blossoms and brown rot of fruit.

Later in 2008, new fungicide pre-mixtures that will be registered include Distinguish (a combination product of Groups 9 + 11), Adament (a combination product of Groups 3 + 11), and Inspire Super (a combination product of Groups 3 + 9). These products should prove effective in brown rot and other prune diseases such as rust (*Tranzschelia discolor*) and green fruit rot or jacket rot (*B. cinerea*).

Methods to Manage Fungicide Resistance:

1) Alternate fungicides with different modes of action. If a FRAC class 1 is used for the first application, choose a different fungicide class for the second application.

2) Make certain materials are applied at full label rates. Sub-lethal treatments increase the chance for resistant individuals of *Monilinia* spp. to survive.

3) Good tree coverage is essential for good disease control. If poor spray coverage results in a sub-lethal dose, resistant individuals of *Monilinia* spp. are favored.

4) Identify orchards with suspected resistance. The brown rot resistance survey will continue for 2008. If you suspect brown rot resistance, contact your local farm advisor so samples can be collected and analyzed.

PRUNE (OR DRIED PLUM)—FUNGICIDE EFFICACY 2008

Fungicide	Resistance risk (FRAC#)[1]	Brown rot Blossom	Fruit	Russet scab	Rust
Benlate[2] + oil[3]	high (1)	++++	++++	----	----
Distinguish*	medium (9/11)	++++	++	----	++
Indar	high (3)	++++	++++	----	+++
Orbit (Bumper)	high (3)	++++	++++	----	+++
Pristine	medium (7/11)[4]	++++	++++	ND	ND
Rovral[5] + oil[3]	low (2)	++++	NR	----	NR
Scala	high (9)[4]	++++	+++[6]	----	ND
Topsin-M2/T-Methyl + oil[3]	high (1)[4]	++++	++++	----	----
Vangard	high (9)[4]	++++	+++[6]	----	ND
Benlate[2]	high (1)	+++	+/-	----	----
Elevate	high (17)[4]	+++	+++	ND	----
Rovral[4]	low (2)	+++	NR	----	NR
Topsin-M/T-Methyl2 ----	high (1)[4]	+++	+/-	----	
Abound	high (11)[4]	++	+	----	+++
Botran	medium (14)	++	++	ND	ND
Bravo/Chlorothalonil/ Echo[7,8]	low (M5)	++	++	++	----[8]
Captan[7]	low (M4)	++	++	+++	----
Gem	high (11)[4]	++	+	----	+++
Rally	high (3)	++	++	----	----
Sulfur	low (M2)	+/-	+/-	----	++

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

* Registration pending.

[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.c.info/.

[2] Benlate label withdrawn. Strains of *Monilinia fructicola* and *M. laxa* resistant to Benlate, Topsin-M, and T-Methyl have been reported in some California prune orchards. No more than two applications of Benlate and Topsin should be made each year. 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 prune with overuse of fungicides with similar chemistry.

[3] The oil is "light" summer oil, 1-2% volume/volume. If applied in summer causes fruit to lose bloom and look red. They dry to normal color.

[4] 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.

[5] Blossom blight only; not registered for use after petal fall.

[6] High summer temperatures and relative humidity reduce efficacy.

[7] Do not use in combination with or shortly before or after oil treatment.

[8] Do not use after jacket (shuck) split.

Considerations For In-Season Nutrition of Prunes

Bill Krueger, UCCE Farm Advisor, Glenn County

Prune trees will not respond to fertilizer if they are not deficient in the particular element at the time of application. In this area, prune trees commonly need nitrogen (N), potassium (K) and zinc (Zn). Boron (B) may be deficient at certain times of the year in specific locations. A July leaf analysis is helpful for identifying nutrient deficiencies.

N application will normally be required every year in every location. A July leaf level of 2.3% or above is considered adequate while over 3.0% is excessive. As a general rule trees will utilize less than 50% of applied N. Losses can occur through volatization, leaching and denitrification. N uptake relies on actively transpiring leaves and is most efficient during the period of rapid shoot growth. Multiple applications during the growing season help reduce risks to losses such as volatilization or leaching. Applying N through low volume irrigation systems can improve efficiency compared to broadcasting or banding. N requirements are increased with larger crops. As a general rule, about 100 lbs. per acre per year of actual N is required for heavy production.

Ensuring adequate K is critical to producing large crops of high quality fruit since demand for K increases dramatically with larger crops. K deficiency results in smaller fruit, reduced drying ratio, and (in more severe cases) defoliation and limb dieback. K deficiency is generally corrected by fall or dormant applications to the soil. In season K management is generally limited to foliar sprays or fertigation for low volume irrigated orchards. Foliar application of potassium nitrate (KNO_3) can be used to correct deficiency in season or prevent deficiency under heavy crop loads. Four sprays of 20 to 30 lbs. per acre of KNO_3 are required to fully meet seasonal K requirements. Fertigation is efficient at getting K into the root zone of low volume irrigated trees and can give same season correction of deficiency. Rates of 250 to 500 lbs of potassium fertilizer per acre applied multiple times throughout the season through the low volume irrigation system is usually sufficient. Be careful if you use potassium chloride (a cheaper form of K) and check chloride levels in the July leaf analysis to monitor for chloride accumulation.

Concerns related to the potential for rapid development of K deficiency in heavy cropped trees and observations of higher K levels in productive orchards have led to questions about the adequacy of UC critical levels. Research conducted in 1996 in a single orchard found leaf levels higher than 1.3% did not correlate with higher yields or fruit quality. Results from survey sampling in 1998 and 1999 indicated no benefit from additional K application when leaf levels were greater than 2.0%.

Unfortunately, July leaf samples offer limited opportunity for adjusting fertilizer practices for that year. Research conducted under the Integrated Prune Farming Practices project in 2002 and 2003 evaluated early leaf sampling predictions but was unable to establish a significant correlation between N and K levels from May leaf samples and July samples. This is likely due to the influences of crop load, fertilizer application and residual N and K in the soil. Generally, orchards with May K levels above 2.3% did not develop deficiency symptoms during that year. Orchards below 1.3% in May with no K applied generally showed deficiency symptoms in July and August.

Zinc deficiency is common in California prune orchards. Check July leaf analysis for adequate levels of Zn (greater than 18 ppm) and look for deficiency symptoms (delayed bud break, small leaves with interveinal chlorosis). Foliar sprays are the most common way to correct zinc deficiency. Fall sprays with zinc sulfate or spring sprays with other Zn materials are both effective.

Boron (B) deficiency is not common in Sacramento Valley prune orchards. If B levels are marginal (below 25 ppm is considered deficient), bloom sprays may improve fruit set. Too much boron can actually reduce set. In UC research it has been difficult to show a benefit from boron sprays applied at bloom. One test showed a trend toward higher set but no significant differences between treatments. Other experiments have showed no benefit. If applied, boron is usually mixed at 1 to 2 lbs Solubor per 100 gallons and applied with a spray volume of 100 gpa no later than pink bud. Remember, higher rates can actually reduce set.

New Dried Plum/Prune Varieties Available for Planting

Carolyn DeBuse, UC Farm Advisor, Yolo/Solano Counties

The UC Dried Plum/Prune Cultivar Improvement Program has been working hard to create new varieties that will grow in California's climate and work well in the current prune industry. Currently there are two new dried plum cultivars and one new fresh market sweet plum available at nurseries for growers to choose from. 'Sutter' and 'Muir Beauty' are new high quality dried plums that harvest earlier than the commonly grown 'Improved French' cultivar. The new fresh market sweet plum, 'Tulare Giant', has been grown for the last 6-7 years with very good marketing results in the Pacific Rim market. The following table gives a comparison of many of the important key traits for the available prune varieties.

The new varieties may hold the solutions to some of the problems that the industry is facing today. The drive to increase the efficiency of harvest and drying has been a long time goal of the industry. If a grower was to plant acreage of all three dried plum varieties, then they would be able to begin harvest with 'Muir Beauty' followed by 'Sutter' and end with 'French' reducing the size of the harvest crew and using less machinery while maximizing the use of the drier. An additional problem faced by the industry in the last few years has been the high temperatures at bloom decreasing fruit set. 'Muir Beauty' blooms earlier than 'French' and this early timing of bloom has placed the 'Muir Beauty's' full bloom into a cooler temperature window. Due to this difference, 'Muir Beauty' has set a full crop at all location in the last six years. The idea is for the grower to use these new varieties in a way that spreads the risks associated with harvest and bloom while gaining an excellent quality product for the consumer.

Variety Comparison	Improved French	Sutter	Muir Beauty	Tulare Giant
Bloom date	mid-March	same as French	4-7 days before French	4-7 days before French
Harvest date	mid-August	7-10 days before French	10-15 days before French	early of July
Pollination requirement	self pollinating	self pollinating	self pollinating	needs pollinizer
Bloom susceptibility to heat	yes	yes	unknown	unknown
Dried plum market	yes	yes	yes	no
Fresh plum market	yes	yes	Unknown	yes
Average fresh weight	20-26 grams	24-30 grams	28-43 grams	43-60 grams
Skin color fresh	rose	rose/purple	purple/rose	purple
Flesh color fresh	light green	light amber	gold/orange	light green
Average soluble solids	20-25°Brix	21-28°Brix	20-24°Brix	18-23°Brix
Cracking	some years	less than French	slight	some tip cracking
Lacey Scab	susceptible	susceptible	slight	none
Fruit placement	on 2 yr old wood	on 2 yr old wood	on 1 & 2 yr old wood	on 1 & 2 yr old wood
Rootstocks	Peach, M40, M2624, Myro	M40, M2624, Myro	Peach, M40, M2624, Myro	M40, M2624, Myro

A full description of the new varieties can be found on the web at **http://fruitsandnuts.ucdavis.edu/crops/prune.shtml .**

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