COOPERATIVE EXTENSION ... UNIVERSITY OF CALIFORNIA

FRUIT AND NUT NOTES

TEHAMA COUNTY MARCH 2006 Volume 4

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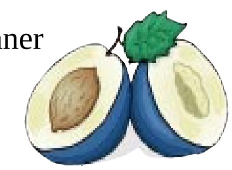
In This Issue:



- **Prune Bloom Diseases - Brown Rot and Russet Scab -** Richard Buchner
- **Prune Orchard Nutrition: Bloom to Harvest -** Franz Niederholzer
- **Crop Management -** Bill Krueger
- **Frost Protections -** Joseph Connell
- **Do High Temperatures During Bloom Reduce Prune Fruit Set? -** Vito Polito

Meeting Announcements

Statewide Prune Day

March 1, 2006 8:00 am - 11:30 am
U.C. Cooperative Extension - Sutter/Yuba Counties
Veterans Memorial Community Building, 1425 Veterans Circle Dr., Yuba City
Contact: Franz Niederholzer, U.C. Farm Advisor, (530) 822-7515

Tehama County Prune Day

March 9, 2006 8:00 am - 1:30 pm
U.C. Cooperative Extension - Tehama County
Red Bluff Elks Lodge - 355 Gilmore Road, Red Bluff
Contact: Richard Buchner, U. C. Farm Advisor, (530) 527-3101

Strawberry Nursery Meeting

March 14, 2006 9:00 am - 1:30 pm
U. C. Cooperative Extension - Tehama County
Curtis Wetter Hall, 1740 Walnut Street, Red Bluff
Contact: Richard Buchner, U.C. Farm Advisor, (530) 527-3101

PRUNE BLOOM DISEASES-Brown Rot & Russet Scab

by Richard Buchner - UCCE Tehama County

BROWN ROT

Depending upon weather conditions, brown rot fungi can be very destructive to flowers, shoots and green or maturing fruit. Summer sprays are typically applied for green fruit rot management and will be covered in the early summer newsletter. This discussion applies to the blossom/twig phase of the disease.

Blossom twig blight is caused by two species of Monilinia, M.laxa and M.fructicola. Survey results vary but most prune orchards contain both species and both species are most likely involved in the blossom/twig damage phase of the disease. The fungus survives within the orchard. Inoculum sources are ascospores produced from apothecia that develop on mummies on the orchard floor and conidia from mummified fruit, twig/spur cankers and any remnants of infected flower parts. Trees are most susceptible to blossom/twig infection from green tip through petal fall. All flower parts are susceptible. Disease development is primarily dependent upon temperature and moisture. Brown rot fungi grow and reproduce rapidly at temperatures ranging from 60° to 80°F. Infections do not develop below 50°F. Initial symptoms are flowers that turn brown, wither and remain attached to fruit spurs. Twig infections occur when blossom infections continue to develop and extend down to the stems, causing shoot death by girdling. Gumming occurs at infection sites and grey-brown spore masses may be visible under high humidity.

Not all orchards require protective sprays to manage brown rot. 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 tip/popcorn and full bloom) aimed at both brown rot and russet scab may be a good choice.

RUSSET SCAB

Severe russet scab usually occurs in years with excessive rainfall during or shortly after full bloom. Research by UC Plant Pathologist, Dr. Themis Michailides (Kearney Agricultural Center) showed that russet scab of French prune is an environmentally induced fruit disorder, which is most severe in years where rain occurs during full-bloom or within a week after full bloom. Newly emerging prunes are most susceptible during petal fall. Symptoms include superficial russeting on the stylar end of the fruit. Microorganisms such as fungi or bacteria have not been associated with russet scab on French prune. Affected areas have thin cuticles, lack epicuticular wax and have open, abnormal, probably non-functional stomata. Why certain fungicides applied at full bloom reduce russet scab remains a mystery.

Work by Farm Advisors Richard Buchner and Bill Olson showed russet scab severity did not increase as the fruit sized and matured. Although russet scab damage looks serious, many of the affected areas are not large enough to be scoreable on dried fruit and may not result in economic damage particularly when considering category tolerance. Sometimes, decay organisms (Monilinia, Cladosporium, Aspergillus and Phomopsis) can initiate from areas with russet scab. Russet scab could be more of an economic problem if it occurs with other defects and/or decays.

2005 PRUNE (DRIED PLUM)—FUNGICIDE EFFICACY

Adaskaveg, Holtz, Michailides and Gubler

Material	Resistance risk	Brown rot Blossom	Brown rot Fruit	Russet scab	Rust
Benlate[1] + oil[2]	high	++++	++++	----	----
Orbit (Bumper)	high	++++	NR	----	NR
Pristine	medium	++++	++++	ND	ND
Rovral[3] + oil[2]	low	++++	NR	----	NR
Topsin-M[1] + oil[2]	high	++++	++++	----	----
Vangard	high	++++	+++	----	ND
Benlate[1]	high	+++	+/-	----	----
Elevate	high	+++	+++	ND	----
Rovral[3]	low	+++	NR	----	NR
Topsin[1]	high	+++	+/-	----	----
Abound	high	++	+	----	+++
Botran	high	++	++	ND	ND
Bravo/Echo[4,5]	low	++	++	++	----
Captan[4]	low	++	++	+++	----
Rally	high	++	++	----	----
Sulfur	low	+/-	+/-	----	++

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

1. Benlate label withdrawn. Strains of *Monilinia fructicola* and *M. laxa* resistant to Benlate and Topsin-M have been reported in some California prune orchards. No more than two applications of Benlate and Topsin should be made each year.
2. 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.
3. Blossom blight only; not registered for use after petal fall.
4. Do not use in combination with or shortly before or after oil treatment.
5. Do not use after jacket (shuck) split.
6. High summer temperatures and relative humidity reduce efficacy.

2005 PRUNE (DRIED PLUM)—TREATMENT TIMING

Adaskaveg, Holtz, Michailides and Gubler

Note: Timings listed are effective but not all may be required for disease control.

Disease	Green bud	White bud	Full bloom	May	June	July
Brown rot[a]	+++	+++	+++	----	+	++
Russet scab[b]	----	----	+++	----	----	----
Rust[c]	----	----	----	+	++	+++

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

Timings used will depend upon orchard history of disease, length of bloom, and weather conditions each year.

a. Flowers are susceptible beginning with the emergence of the sepals (green bud) until the petals fall, but are most susceptible when open.

b. A physiological disorder, no pathogens involved.

c. More severe when late spring rains occur.

FROST PROTECTION

by Joseph Connell, Farm Advisor, Butte County

Mild, **radiation frosts** occur on still, clear nights, often with the development of a strong inversion. Under these conditions frost protection can be provided by running water. **Advection frosts** are more severe and usually result in more damage. They occur with wind present as cold air moves into a field from areas outside the orchard. Cold air accumulates in low spots or in areas where air drainage is blocked.

Soil and Groundcover Condition

Groundcover condition affects orchard minimums with any cover taller than 4 inches in height generally being colder. Soil heat storage is reduced because sunlight is reflected and water is evaporated. Keeping groundcovers cut short to 2 inches or less during frost season allows sunlight to reach the soil surface, and increases soil heat storage resulting in a warmer orchard through the night.

Bare, moist soil is warmest, but this is true only when the surface is moist. If pre-frost conditions are dry and windy and a dry crust forms on the surface, then, bare soil can be colder than a surface with a short (less than 2 inch) groundcover that tends to keep the surface moist with dew from the grasses and weeds. The ground surface must be moist for bare ground to be warmest.

Dry or recently cultivated soil has many air spaces, lower heat storage capacity, and low heat conductivity resulting in colder minimum temperatures. Moist soil stores more heat due to water content, has higher conductivity, and will have higher minimum temperatures. Irrigation should ideally wet the top foot over the entire orchard surface, soil moisture should be near field capacity, and these conditions should be achieved in advance to gain the most advantage. A light irrigation to moisten the soil before a frost will help obtain the greatest heat storage.

Frost Sensitivity

If water is used for frost protection, critical temperatures for frost damage determine when to turn irrigation systems on or off. At first white, buds are more resistant to cold compared to full bloom stage, which is more resistant than small fruits.

Critical Temperatures[1] for Frost Damage To Prune Buds, Flowers, or Fruit.

First White	26°F
First Bloom	27°F
Full Bloom	28°F
Post Bloom	30°F

[1] Temperature endured for 30 minutes or less.

Sprinklers and Micro-sprinklers

Under tree sprinklers provide protection because heat contained in water is released into the orchard system. As water cools and freezes, it releases a great deal of latent heat. This sensible heat is **radiated or convected** into the trees, thus providing protection. Sprinklers can be safely turned off when the wet bulb temperature upwind of the protected orchard is above the critical crop damage temperature or when all the ice melts.

In some orchards, frost protection is limited by the amount of water or available pipe. To learn more about moveable pipe placement we ran an experiment comparing protection with sprinkler lines in every middle, every other middle or every fourth middle. Air temperature in all sprinkled areas was 1 to 2 °F warmer than the unsprinkled control and there were no differences between these spacings. Soil surface temperatures were colder the further from the sprinklers with the dry centers between the lines in every fourth middle as cold as the unsprinkled control. Line spacing directly affects soil surface temperature but air movement evens out the benefits. Without air movement, protection may fail between widely spaced lines.

In our experiments with **micro-sprinklers** applying 15, 25, and 40 gallons per minute per acre resulted in little difference in observed air temperatures. However, exposed temperatures were 1 to 2 °F warmer at the higher water rates. Exposed temperature is what the buds themselves experience. The fact that the low water application gave a lower exposed temperature indicates that protection with under tree micro-sprinklers is coming mostly from radiation rather than convection. We found a greater separation in exposed temperatures between the low and medium/ high rates on the colder nights. Thus, micro-sprinkler application rate had little effect on air temperature but did affect temperature of exposed buds and flowers. The low application rate gave less protection than the higher rates and the higher soil surface temperatures from higher application rates led to more radiation heating. Under windy advective conditions this may be even more important since convection heating is negatively affected by wind but radiation is unaffected.

Drip irrigating in advance of a frost can help keep the orchard warmer by increasing soil heat storage particularly if the soil surface is dry. Running the system during a frost may provide slight benefits due to radiation heating from the wetted area beneath the trees. **Flood irrigation** for frost protection works in a similar fashion but due to larger water volumes it will provide more protection.

PRUNE ORCHARD NUTRITION Bloom to Harvest

by Franz Niederholzer-UCCE - Sutter / Yuba Counties

Excessive or deficient tree nutrient levels harm orchard health and the reduce grower income. Nutrient deficient orchards produce less fruit of poorer quality than blocks with adequate nutrition. Excessive fertilization wastes money and can harm the environment. An orchard that is nutritionally out of balance can also be more susceptible to infection by certain diseases.

Maintaining adequate, balanced orchard nutrition is not tricky or complicated, but requires attention every year. **Annual, mid-summer leaf sampling and analysis are the foundation of good orchard nutrition program.** In most prune orchards, adequate levels of three nutrients – potassium (K), nitrogen (N), and zinc (Zn) – are most important to maintaining healthy trees and good production. Other nutrients may be deficient. Leaf analyses can help determine if other nutrients are lacking.

Potassium is the most important nutrient in most prune blocks in most years. Prune fruit contains more K than any other nutrient, even more than nitrogen. The larger the crop, the more K the orchard needs. Excessive cropload and not enough K in any year can damage trees for years to come, through the domino effect of K deficiency à defoliation à, sunburn à *cytospora* infection à scaffold wood/tree death.

After bloom, options for effective K fertilization (getting enough K to the tree to avoid deficiency that year) are generally limited. Flood or full-coverage sprinkler irrigated are generally limited to foliar (potassium nitrate, etc.) sprays because soil applied (banded or shanked) fertilizers are not available in time to adequately supply the current crop. UC research has shown that a program of 4 potassium nitrate sprays of 20-25# material per acre per spray applied between April and August can be as effective as 600#/acre of soil-applied potassium chloride applied in the fall in maintaining good prune production. Fertigating with potassium sulfate is the most effective and efficient technique in micro or drip-irrigated orchards. General maintenance fertigation rates for injecting K generally run from 250-500 pounds of potassium sulfate/acre. While some growers have had good experiences with spring or summer soil applied K in flood irrigated orchards, UC research has not shown this to be as effective as fall soil-applied K or summer foliar sprays.

When injecting fertilizer into a microirrigation system, it is important to start adding the fertilizer no earlier than half-way through the irrigation set. The closer to the end of the set the better, but leave time for 2 hours of clean water flow after shutting off the fertilizer to make sure the nutrients get evenly distributed throughout the block. Adding the fertilizer too early in the irrigation set risks moving the nutrients below the root zone – especially when long sets are used.

Like potassium, prune tree N need is closely linked to cropload. The larger the crop, the more N the tree requires. However, since all trees store N over the winter in woody tissue and use these reserves to feed new growth in the spring, growers and PCA's can delay fertilizer N application until the cropload can be estimated, usually by late April. Fertilizer N in the root zone is readily absorbed by trees, so N "catch up" can be fast, even if the crop is large and leaf N is low. Excess tree N promotes excess shoot growth that must be pruned out and increases fruit N, which increases fruit susceptibility to brown rot. In contrast, N deficient prune trees have been shown to be more sensitive to bacterial canker infection. In a highly productive orchard, the general rule of thumb is 100 pounds actual N per acre is required to keep mid-summer leaf N levels at the adequate level (over 2.2%). Splitting N applications (for example, mid- to late April and June) improves the fertilizer use efficiency (amount of fertilizer N in the tree from the fertilizer). Nitrogen fertigation is more efficient that broadcasting/banding.

Zinc deficiency is common in California orchards. However, more is not better with zinc. Excessive Zn fertilizer use can causing gumming and leaf and/or shoot damage. Check summer leaf analysis reports or look for deficiency symptoms (delayed bud break, small, pale leaves, and/or yellowing between leaf veins) to determine if Zn is needed.

Foliar sprays are generally the best way to get zinc into the tree. Soil applied zinc fertilizers are usually locked up by the soil and not available to the tree. Zinc sulfate in the fall/dormant or foliar zinc materials in the spring before leaves "harden off" are good strategies to getting zinc into trees.

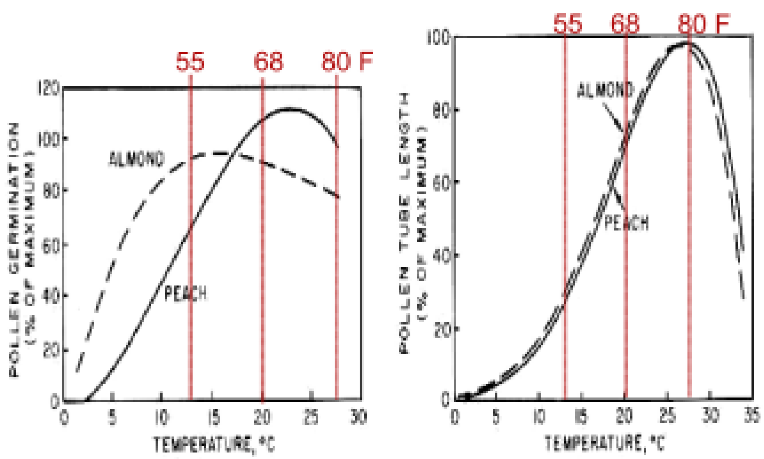
DO HIGH TEMPERATURES DURING BLOOM REDUCE PRUNE FRUIT SET?

by Vito Polito, Matthew DeCeault, Franz Niederholzer

Prune fruit set was poor for many growers in 2004 and 2005. Problems with fruit set for these years were correlated with high temperatures during the bloom period, which raises questions regarding how temperature affects prune fruit set.

In general, fruit set depends on three biological events: 1. Pollen germinates on the stigma. 2. Pollen tubes grow through the style. 3. Fertilization occurs when the pollen tube reaches a viable ovule. Each of these events is temperature dependent. Unfortunately, there is little in the literature on how temperature affects prune pollination and fruit set. The limited data suggest that high temperatures can adversely affect all three aspects of fruit set by reducing pollen germination, slowing pollen tube growth and accelerating ovule senescence. No research has been done on ‘French’, California’s important cultivar, however. It is clear from the literature that there can be great differences among cultivars, so research-based information is needed for our cultivars.

In our lab we have developed temperature response curves for pollen germination and pollen tube growth for several tree-crop species, including other *Prunus* species (see figure below). Note that almond and peach vary for the temperature optima for pollen germination despite the fact that they are closely related species. By contrast, the temperature responses for pollen tube growth are the same for both species. Pollen germination involves a series of complex biophysical events tied to rehydration of the desiccated pollen grain. Its temperature responses vary among and within species, and possibly for different environmental conditions. Pollen tube growth response to temperature remains constant between the two species, likely because it mimics whole plant growth responses. Thus, we consider it highly probable that the rapid fall-off in pollen tube growth at temperatures greater than 80ºF is likely to be more or less constant throughout *Prunus*, including ‘French’ prune.



Temperature response curves for pollen germination (l.) and pollen tube growth (r.) in almond and peach.

The third critical parameter is ovule viability. Following fertilization, the ovules develop into seeds. For fertilization to be successful, one ovule must retain receptivity at least until the first pollen tubes grow to it. Much less is known about how ovule viability is affected by temperature, but research from Oregon and Eastern Europe on other European plum cultivars suggests that ovule senescence is rapid above 80oF.

<u>Thus, inferences from these related species and cultivars, support the field observations that temperatures much greater than 80ºF adversely affect fruit set.</u> We are beginning a new research program this spring on temperature relationships for pollen germination, pollen tube growth and ovule viability in ‘French’ prune. Our results should define how prune pollination, fertilization and set are affected by temperature, and may be useful in suggesting management strategies for dealing with adverse temperature conditions during bloom.

CROP MANAGEMENT FOR DRIED PLUMS

by Bill Krueger, UCCE Glenn County

After two years of light crops (statewide), the potential for a large 2006 crop should be considered. Excessive crops are undesirable because they lead to small, less valuable fruit, higher drying ratios, potassium deficiency, tree damage (sunburn and limb breakage) and alternate bearing. The first line of defense against excess cropping is pruning. This was covered in the last issue of this newsletter. Pruning can help improve fruit size and drying ratio and help avoid all the negative things associated with excessive crops. However, because eventual crop set is dependant on conditions during bloom and early fruit growth, which are unpredictable, a moderate pruning level may be advisable. If conditions are good, this could result in excessive set.

Removing some of the fruit early in the season will allow the remaining fruit to grow larger and develop a higher sugar content and improved drying ratio. Mechanical thinning is done with the same machinery used for harvest. A representative sample taken at reference date, when the endosperm is visible at the flower end of the fruit (Figure 1) usually in early May, will allow for an estimation of fruit size at harvest (Table1). Unfortunately, this procedure will often over-estimate size especially if the crop load is high. To get a better idea, estimate the tonnage you can produce at the desired size and determine how many fruit per tree at harvest will result in this yield. For example, 4 tons (8,000 lbs.) x 70 dry fruit per pound divided by 150 trees per acre - 3,613 fruit/tree at harvest. Adjust this by the estimated pre-harvest drop to determine how many fruit should be left after thinning. Work done in the Sutter-Yuba area in the 1970's suggested that approximately 40% of the fruit would drop between reference date and harvest. More recent work in Glenn and Tehama Counties has suggested that fruit drop may be closer to 20%. Using 20% drop in our example, 3,613 divided by .8 = 4,516 fruit left per tree after shaking.

Figure 1. Extracting endosperm at reference date.

Dried Plum Reference Size Table

Reference size (count/lb)	Your Sizing Potential Harvest size (dry) (count/lb)		
	average	upper 25%	upper 12.5%
50	32	31	30
55	36	34	32
60	39	37	35
65	42	40	38
70	46	43	41
75	49	45	43
80	53	48	46
85	56	51	48
90	60	54	51
95	63	57	54
100	67	60	56
105	70	63	59
110	74	66	61
115	77	68	63
120	81	71	66
125	84	74	68
130	88	77	70
135	92	79	73
140	95	82	75
145	99	85	77

Estimate fruit per tree, at reference date, by removing and weighing all the fruit and multiplying by the count per pound determined from a representative sample (at least 100 fruit). Subtract the desired fruit per tree from the estimated fruit per tree to determine how much to remove. Shake a tree and calculate how much fruit was removed. Adjust the shaker and repeat the procedure until the desired amount of fruit is removed. Set the shaker and thin the block.l I recommend that a shake time and intensity be determined and then be applied uniformly to uniform blocks. I am not convinced that many people can accurately judge how much fruit is on a tree and how much it should be shaken from the ground or the shaker.

Concerns related to shake thinning include:

1. More valuable larger fruit in the top of the tree is removed is proportionally to the smaller less valuable fruit in the lower part of the tree. While this may be true to some extent, research has consistently shown improved average fruit size for thinned compared to unthinned trees.

2. Over-thinning. In reality, this is pretty difficult to do assuming the crop set is large and thinning is necessary. This is because a small crop of large fruit is worth more than a large crop of small fruit.

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