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ORCHARD FACTS

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Sacramento Valley Prune Newsletter

<u>Irrigation Management Pre and Post Harvest</u>

Richard P. Buchner and Allan E. Fulton, UC Farm Advisors, Tehama County

Over the years, there has been considerable interest in withholding irrigation water at certain times during crop development. The current concept is Regulated Deficit Irrigation or RDI. To be successful, an RDI strategy would need to identify specific stages of prune tree growth and crop development when moisture stress could be safely applied to achieve a beneficial effect or, at the very least, be tolerated by the tree. The benefits might include water/power savings, improved drying ratio, potential increases in return bloom and improved fruit quality.

Field research shows that prune trees can take some preharvest water stress without harming trees or grower returns. University of California Cooperative Extension Irrigation Specialist Dave Goldhammer (1989) experimented with cutting water off 44, 37, 30, 23, 16 and 9 days prior to harvest. Results showed soluble solids tended to be higher and dry ratios lower in the longer cutoff regimes with no differences between treatments in fruit drop or fruit size. Glenn County Farm Advisor Bill Krueger (1995) applied midseason water stress to prunes and found dry ratio was improved with mid season stress and fruit drop, count/lb., yield and fruit size were unaffected. University of California Cooperative Extension Orchard Specialist, Bruce Lampinen demonstrated MILD levels of mid season stress improved fruit set, sustained fruit size, avoided fruit cracking and increased fruit sugar content. These experimental results taken collectively have lead to a water management strategy for prunes, which gradually increases tree moisture stress as harvest approaches (Figure 1).

Accurately manipulating tree stress is easier to talk about than actually achieve. Moisture stress effects occur on an orchard-to-orchard basis depending upon orchard history, soil characteristics, climate and irrigation system to name a few. One approach would be to make pre-harvest irrigation cutoff decisions based upon experience from previous growing seasons. Every year is different so repeated success is not always good using this approach. Gradually reducing applied water based upon fractions of evapotranspiration estimates for an unstressed orchard is a possibility, but again levels of actual tree stress are unknown. Soil moisture measurements might work if monitoring sites accurately reflect the root zone, but again offers no direct reflection of prune tree water status. Recently, pressure chamber technology has become available to directly measure prune tree moisture stress using Midday Stem Water Potential (MSWP). Figure 1 suggests how MSWP might be utilized to make irrigation decisions. Pressure chambers used for plant based monitoring are available in various configurations and costs. If this technique interests you, check with your local Farm Advisor for more information.

When using an RDI strategy to gradually increase stress going into harvest, soil will be relatively dry after harvest. Consider a postharvest irrigation or irrigations, depending upon the system, to restore adequate soil moisture as trees approach dormancy.

Pressure Chamber Reading (- bars)	**DRIED PLUM**
0 to –2.0	
–2.0 to –4.0	
–4.0 to –6.0	Not commonly observed
–6.0 to –8.0	Low stress, common from March to mid April under fully irrigated conditions. Ideal for maximum shoot growth.
–8.0 to –10.0	Suggested levels in late April through mid June. Low stress levels enabling shoot growth and fruit sizing.
–10.0 to –12.0	Suggested mild levels of stress during late June and July. Shoot growth slowed but fruit sizing unaffected.
–12.0 to –14.0	Mild to moderate stress suggested for August to achieve desirable sugar content in fruit and to reduce “dry-away” (drying costs).
–14.0 to –18.0	Moderate stress acceptable in September.
–18.0 to –20.0 –20 to –30	Moderate to high stress levels. Most commonly observed after harvest. Generally undesirable during any stage of tree or fruit growth. Most appropriately managed with post-harvest irrigation.
Below – 30	High stress, extensive defoliation

Figure 1. A suggested strategy or game-plan for interpreting stem water potential measurements for prunes. These guidelines are tentative and subject to change as research and development with the pressure chamber and midday stem water potential progress.

<u>Prunes Need Honey Bees to Pollinate Flowers and Set Fruit</u>

Joe Connell, UC Farm Advisor, Butte County

French prune flowers have pistils that are elevated above the anthers that bear the pollen. Although self-fertile, they require honeybee pollinators to move the pollen around on the flowers for effective pollination and subsequent fertilization and fruit set. Prune flowers are not wind pollinated. Dr. Robin Thorpe, emeritus entomologist at UC Davis reported on prune pollination studies in the 1970's. In several experiments, exclusion of pollinators by caging French prune trees caused a lower percentage of fruit set, less than 1.3 percent, compared with 3.6 to 21.8 percent for open pollination (uncaged trees), and 15.5 to 19.4 percent fruit set for trees caged with honey bees. These experiments demonstrated how essential honey bee pollination was for setting a prune crop.

Honey Bee Populations. Supplemental pollination with honey bee colonies may be even more important today since the wild bee population has been decimated by *Varroa* mites. Eric Mussen, Extension Apiculturist, UC Davis, indicated that the varroa mite, *Varroa destructor*, was pretty well distributed throughout the country by 1992 and by 1995-96 there were very few feral colonies across the nation. An effective bee miticide granted a reprieve for about 10 years but around 2004 *Varroa* mites increased again as resistance developed and effective mite control was lost. Since infested colonies do not collect and store as much food as healthy colonies, colony losses rose fairly abruptly in 2004. The resurgence of *Varroa* mites in commercial beekeeping operations significantly increased costs of maintaining colonies and may have once again have largely eliminated the wild honey bee population.

Are Honey Bees Present? In some areas there just aren't many bees left. If you relied only on "natural" pollination to set a crop in your prunes are you disappointed? In some neighborhoods, competing blooms (mustard) or lack of bees may reduce prune pollination and result in poor fruit set. Fewer available bees may not be able to visit enough flowers to set a good crop during a short bloom. On the other hand, prunes surrounded by almonds may have lots of bees in the neighborhood and will likely do better in both good and bad pollination years. If you don't have honey bees in the area you may want to plan on having colonies brought into your prunes next year to be more certain of having a crop.

Foraging behavior. Bees can forage at least 3 miles from their colony but most tend to stay within a few hundred yards of the colony if there are adequate food rewards nearby. Prune blossoms are rewarding and will receive adequate visitation from nearby colonies depending on competition from other plants. Flight activity and foraging are proportionate to colony strength. At low temperatures bees from strong colonies are more likely to fly than are bees from weak colonies. Honey bees fly when temperatures are 55°F and higher. They do not fly in rain or in wind stronger than 15 mph. Cloudiness reduces flight activity, especially when temperatures are near the 55° threshold for flight. Honey bees often visit plants other than prunes if pollen and nectar rewards are sufficient. Thus, the density of bees and blooms within a mile or two of an orchard can greatly influence the number of bees available for prune pollination.

What's a good colony? For pollination purposes a good colony is one that has an active brood nest with uncapped worker brood at the start of prune bloom. Bees feed pollen to developing larvae so open brood cells indicate the hive has a demand for pollen. When pollen is in demand in the hive, more pollen foragers are sent into the field to collect pollen thus pollinating and setting your prune crop.

How much colony strength is needed? Use strong colonies with 8 or more frames of bees. This is not usually a problem for prune growers because colonies have just come from almonds where their populations have expanded rapidly.

How many colonies per acre? The usual recommendation for prunes is one colony per acre depending somewhat on local conditions. A large number of variables affect local needs including colony strength, the number of colonies in the neighborhood, plant competition within a 3-miles radius, and weather conditions during bloom.

<u>Cytospora</u> <u>Management</u>

Franz Niederholzer, UC Farm Advisor, Sutter/Yuba Counties

Branch and scaffold dieback was common in many blocks in the Sutter/Yuba region this spring, and whole trees died in areas of some orchards. Lab analysis by UC Davis plant pathologists found *Cytospora* fungus in all samples delivered to them. While all the dieback and tree death may not have been caused by *Cytospora*, in light of the lab results, a brief review of this damaging disease is in order.

- <u>*Cytospora* canker is a disease caused by the fungus *Cytospora leucostoma*</u>. It is a weak pathogen that shows maximum growth in hot temperatures around 90ºF, and is particularly active when prune tree activity is least (late summer/early fall). [Fall, 2006 was warm and dry, and trees were particularly stressed following a large crop. This may explain the large amount of dieback seen this spring.] *Cytospora* spores are spread from diseased wood by rain and wind to bark damaged by sunburn, old bacterial cankers, boring insects, etc.

- <u>Symptoms: Look for a dark, sunken canker (Figure 1) on the bark of limbs showing dieback and/or sudden wilting</u>. Pycnidia, black or white pimple-like structures on the damaged wood, (Figure 2) distinguish *Cytospora* canker from bacterial canker or other diseases. Some dark gumming can occur at the edges of the canker. When pycnidia can't be found, distinct zonate canker margins, looking a lot like bath-tub rings, help distinguish *Cytospora* canker from bacterial canker, which has non-distinct canker edges.

- <u>*Cytospora* cankers spread and grow in the bark of weak trees, but do not spread in healthy trees</u>. Water stress, potassium deficiency, and/or high ring nematode pressure increases tree susceptibility to the spread of infection (canker development). Trees planted on shallow and/or heavy textured (clay) soils are generally more likely to suffer economic damage from *Cytospora*.

- <u>There is no known chemical control for *Cytospora*. Manage infection and/or spread of the disease by 1) avoiding tree stress and 2) removing and destroying cankered wood from the orchard</u>. Avoid stress factors that specifically predispose prune trees to the spread of the disease such as potassium deficiency, sunburn, high ring nematode (*Criconemella xenoplax*) populations, trunk borers, and water stress. Prune to minimize sunburn potential, and paint exposed trunks and scaffold crotches with white interior latex paint to further protect them from sunburn. Maintain adequate orchard water status, especially after harvest. Avoid defoliation (sunburn potential) from spider mite or prune rust infections. Pruning cuts and leaf scars are not important infection sites.

- <u>When infection does occur, remove (cut out) cankers and destroy dead or damaged wood</u>. To ensure that all the disease is removed, cut into healthy wood several inches to one foot below any canker symptoms. Check the cut surface of damaged limbs to ensure that all the disease has been removed. In stressed orchards, where infected wood (cankers) are allowed to remain on the tree (Figure 3), canker growth continues and scaffold death can occur. Incomplete canker removal wastes time and money and doesn't control the disease. Remove from the orchard and destroy any dead wood containing *Cytospora* canker. Trees or limbs killed by *Cytospora* canker and left in the orchard or adjacent to living trees provide spores for further infection.

<u>Summary:</u>

- *Cytospora* canker can severely damage orchards, killing branches, scaffolds and, sometimes, trees. This bark disease infects trees weakened by sunburn, water stress, ring nematodes, and/or bacterial canker. This disease is most active in the warm summer months.

- There is no chemical control. To avoid tree damage, keep trees free of the stresses listed above. When found in the orchard, cut out and burn *Cytospora* damaged wood. Make sure cuts are made <u>below</u> all cankered wood. Cankers left in the tree will continue to grow, and may kill scaffolds or the entire tree.

Figure 1. Cytospora cankers are dark and depressed areas on the branch where the bark has been killed. In the first photo, arrow shows edge of canker revealed by knife cut in the second photo.

Figure 2. Pycnidia are initially black, but turn white.

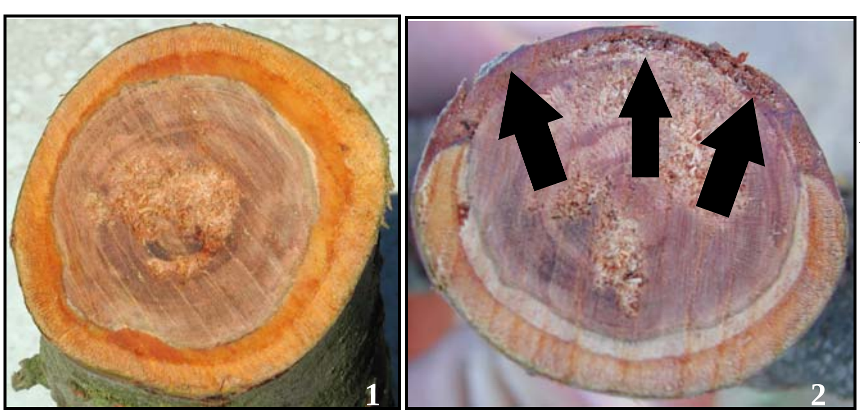

Figure 3. Good cut (1) showing only clean bark. Bad cut (2), showing diseased bark (shown by arrows) left on the tree.

Prune Harvest Timing

Bill Krueger, UC Farm Advisor, Glenn County

The goal of harvest timing should be a smooth, efficient harvest of high quality fruit which results in the maximum possible return. Ideally, prunes would be harvested when soluble solids (sugars) have accumulated to 24% and fruit pressure has dropped to 3 or 4 lbs. ("normal" harvest). Prunes will cease to accumulate dry weight at this point (Figure 1) and fruit drop will increase as the fruit softens. Any increase in soluble solids from this point on is due to dehydration of the fruit on the tree. Typically soluble solids will increase about 2% per week and fruit firmness will drop 1.5 to 2 lbs. per week prior to harvest (more rapidly with cool weather and more slowly with hot weather).

Dry fruit size increases with increasing soluble solids which result in lower drying ratios. Green tonnage peaks when the fruit reach 24% soluble solids and 4 lbs. pressure and begins to decline as fruit drop increases. Dry tonnage decreases to a lesser degree because it is partially offset by a improved drying ratio. Harvest costs are reduced with later harvest due to reduced green tonnage (assuming costs are per green ton and not per acre or per tree). Total return peaks at "normal" harvest and then declines slightly with later harvests. Reduced harvest cost associated with the later harvest offset reductions in total returns to some degree.

It will not be possible to harvest all fruit at the ideal maturity and it may be necessary to harvest some fruit before or after the ideal maturity is reached. Use fruit firmness, soluble solids and management to harvest as close to the ideal time as possible. Lighter cropped blocks may achieve good soluble solids while fruit is still greater than 4 lbs. and would be good candidates for earlier harvest. Later than ideal harvest would generally be better in terms of return than an early harvest -- especially for heavily cropped blocks. Risks of later harvest include weather events, such as high winds, which can increase drop, potential increased losses if Brown Rot is developing in the orchard and limited harvester and dryer capacities which can further delay harvest.

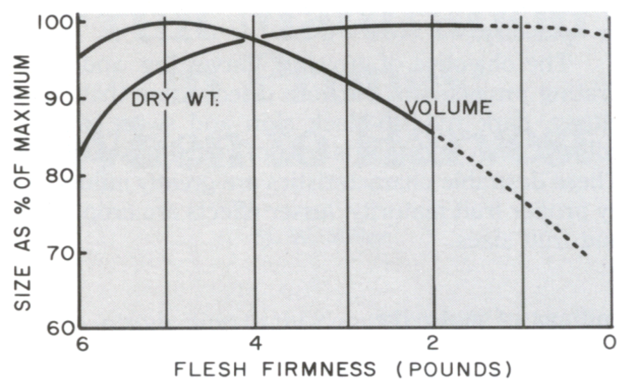

Figure 1. Dry weight and volume of fresh French Prunes in relation to flesh firmness. (Optimum) harvest would be done when flesh firmness is 3 to 4 pounds.

Harvest Prediction. The California prune crop is predicted to be light overall (95,000 tons). It is generally light in the southern part of the Sacramento Valley and moderate to heavy in the northern part of the valley.

Recent research conducted by Dr Ted DeJong at UC Davis has established a relationship between temperatures 30 days after full bloom and harvest date (see the last issue of this newsletter at http//ceglenn.ucdavis.edu or http://fruitsandnuts.ucdavis.edu/crops/estimating_prune_harvest_11_06.pdf). This model predicts that harvest would start around the 18th of August. It will probably be earlier in areas of lighter crop. It will be interesting to see how close this prediction is. Similar research on peaches also suggests that it is more difficult to size fruit when temperatures for the first 30 days following bloom are warm. This year it was significantly warmer than normal during this period. While there are many other things that can affect fruit size such as crop load and potassium status, this research would predict increased difficulty in sizing fruit.

Field Sizing. There are some large crops where fruit size will be an issue. While crop values have not been established, it is generally believed that fruit with a dry size of less than 100 count per pound will not be worth drying. While definitely the last resort, under the right conditions, field sizing at harvest can improve the bottom line. Field sizing is more likely to have a positive economic impact on large crops of small fruit or earlier in the season when sugars are low. In field sizing, it will be important to monitor characteristics of sorted fruit to be sure that valuable fruit is not being sorted out. It may also be necessary to adjust the bar opening or chain size depending on the results of the monitoring.

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