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ORCHARD FACTS

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Sacramento Valley Dried Plum Newsletter

Prune Orchard Irrigation

- Richard Buchner and Allan Fulton, UCCE, Tehama County

Excessive winter rainfall makes it difficult to think that orchards will ever dry out. However, expect healthy prune orchards at full leaf with resident vegetation/cover crops exposed to warm/hot weather to transpire water rapidly. Conditions vary; however, many orchards have the potential to extract one acre-inch (ac.-in.) of water or more every four days (.25 ac.-in./day) under spring weather conditions. During the heat of summer values can increase to one ac.-in. every 3 days or .33 ac.-in./day. In the spring and summer orchards can deplete available moisture very quickly.

This has been a unique spring, making it critical to carefully monitor soil and tree water status to avoid getting into a position where first irrigations are delayed, soil moisture is over depleted and fruit cracking becomes a concern when water is applied.

Growers have lots of options when it comes to water management. Soil based, weather based and plant based methods are all readily available and work very well if properly used. Usually one or more techniques are used together to improve confidence.

Soil based monitoring

There are dozens of different soil moisture monitoring devices commercially available. In general, there are two broad categories of tools or devices: 1) tools that detect and indicate soil water content and 2) devices that detect and indicate soil matric potential.

Soil water content is the amount of water in the soil while matric potential is the degree of tension or how tightly water is held by the soil. Complexity can range from using shovels or soil augers to visually evaluate soil moisture content to radioactive devices such as the neutron probe. Neutron probes must be operated by a licensed operator and are most often available through professional consultants. Capacitance probes are another tool to measure soil water content. Resistance blocks and tensiometers represent options for measuring soil matric potential. Each has its own pros and cons so it's up to individuals to decide which tool works best for them. Soil moisture monitoring is particularly useful to:

- understand water holding capacity of specific soils.
- determine how deep water penetrates after application.
- characterize the root zone and extraction depth.
- identify seasonal water extraction trends in the root zone.

The major challenge with orchard soil moisture monitoring is locating sensors at representative locations and depths.

Weather based monitoring

Orchard water use is primarily driven by canopy size and weather. In a mature healthy prune orchard, weather (solar radiation) provides the primary energy to evaporate water from leaf surfaces. That makes it possible to use weather measurements to predict water use. So called ET (evapotranspiration) information is presented as water use per day and/or weekly water use. If you know how much water is available in the soil and how fast that water is depleting, you can accurately predict when to irrigate and how much water to apply considering irrigation system efficiency. Mature healthy prunes in the Upper Sacramento Valley can have maximum summer water use rates of .30 ac-in per day. That's 8100 gals/day on a per acre basis. These values can be useful for drip irrigation where the goal is run the system long enough to replace daily water use.

Often local newspapers publish water use data. CIMIS weather data is available at no cost on the web at http://www.cimis.water.ca.gov.

Plant based monitoring

Plant based measurements most often utilize a pressure chamber (pressure bomb) to indirectly measure water potential of a plant or prune tree. In simplest terms, plant water potential is the "blood pressure" of the plant. However, for plants it's water not blood and water is not pumped by a heart but is rather pulled through the xylem network as water evaporates from leaf surfaces. This pull or tension can be measured using a pressure chamber and increases as soil moisture depletes. Using research and experience, these tension measurements (Midday Stem Water Potential) can be used to make water management decisions.

Prunes typically range from -6 to -8 bars when trees are under little water stress. Values in the -10 to -15 bar range represent increasing water stress and prunes under severe stress may show stem water potential levels of -20 to -30 bars.

Summer Nutrition/Leaf Sampling

- Bill Krueger, UC Farm Advisor, Glenn County

Nitrogen. Research has shown the most efficient time to apply nitrogen fertilizers is when leaves are on the tree and transpiration is occurring (spring and summer). A split application will allow for some adjustments in N levels as the crop develops. A typical split application would be ½ to 2/3 of the expected application in the spring and the remainder applied prior to harvest in Aug. Crop load and leaf analysis (described below) can be used to adjust application rates.

Potassium. Ensuring that trees are adequately supplied with potassium (K) is critical to producing large crops of high quality fruit. Tree demand for K increases dramatically with larger crops. Potassium deficiency results in smaller fruit reduced drying ratio and (in more severe cases) defoliation and limb dieback. After 2 years of lighter crops and this year's larger crop (hopefully) it will be important to ensure that K levels are adequate. Application of K fertilizers to the soil is usually done in the fall to allow for adequate time for uptake by the roots, especially for flood or drip irrigated orchards. With drip or micro sprinkler irrigated orchards the response to application through the irrigation water can be relatively quick and can be done during the growing season. Response to K application through drip irrigation has been measured through leaf analysis within 2 weeks of application. Trees under microsprinkler irrigation may take somewhat longer to respond but should still respond within the season.

Foliar application of materials such as potassium nitrate can be used to correct potassium deficiency during the season or to prevent development on K deficiency under heavy crop conditions. For season long correction a minimum of four sprays of 20 to 30 lbs. per acre of KNO_3 are recommended.

Prune Critical Nutrient Levels (Dry-Weight Basis) Leaves Sampled in July	
Nitrogen (N)	
deficient below	2.2%
adequate	2.3 to 2.8 %
Potassium (K)	
deficient	1.0%
adequate over	1.3%
Chlorine (Cl)	
excess over	0.3%
Boron (B)	
deficient below	25 ppm
adequate	30 to 80 ppm
excess over	100 ppm
Zinc (Zn)	
deficient below	18 ppm

Leaf analysis is used to detect or confirm nutrient deficiencies and evaluate and adjust fertilizer programs. To conduct a leaf analysis in July sample at least 25 randomly selected trees representing a block of trees up to 40 acres. Collect a total of at least 75 fully expanded leaves from non bearing spurs from the ground around the trees. Take separate samples for areas or sections that are not representative of the rest of the orchard. Collect into paper bags and submit for analyses as soon as possible. If delays are anticipated, keep the samples in a refrigerator until they can be submitted. Do not seal leaf-tissue samples in plastic bags. Submit the samples to a commercial agricultural laboratory. Have the samples analyzed for nitrogen (N), potassium (K), boron (B) and zinc (Zn). If zinc or boron has been applied foliarly, omit the analysis for these elements. If potassium chloride has been used as a fertilizer or is being contemplated, add a chloride (Cl) determination to establish a baseline level or detect a chloride build up. The following table gives deficient and adequate levels for these elements.

Concerns related to the potential for rapid development of K deficiency in heavy cropped trees and observations of higher K levels in productive orchards has led to questions about the adequacy of the above critical levels for potassium. 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 potassium levels were greater than 2.0 percent.

Unfortunately July leaf samples offer limited opportunity for adjusting fertilizer practices accordingly for that year. Research conducted under the Integrated Prune Farming Practices project in 2002 and 2003 was unable to establish a correlation between May 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 K levels above 2.3 percent in May did not develop deficiency symptoms that year. While orchards which were below 1.3 per cent in May and had no K applied generally showed deficiency symptoms in July and August.

Web-spinning Spider Mites

- Joseph H. Connell, UC Farm Advisor, Butte County

Web-spinning mites form abundant webs on both sides of leaves and can cause defoliation. In prunes, they include the two-spotted mite, Tetranychus urticae, and the Pacific mite, Tetranychus pacificus. Both of these mites have two black spots on their yellow green bodies and they are not easily distinguished from one another. The two-spotted mite is most common in the Sacramento Valley and the pacific mite is common in the San Joaquin valley. They over-winter as adult females under bark and on weeds. The mites move to the trees in spring and begin to feed on lower interior leaves. From there, they can spread throughout the tree. Eggs are laid in fine webbing on the undersurface of leaves and there are many overlapping generations each summer.

Spider mites feed by sucking the contents out of leaf cells. Leaf injury caused by spider mites begins as a mottling and browning of leaves. Such leaf damage reduces tree vitality and can adversely affect fruit size. If control measures are not initiated, defoliation can occur which may result in reduced bloom the following year as well as allowing the tree and fruit to become sunburned.

In many cases, biological control is effective at keeping spider mites below economically damaging levels. Predaceous mites and six-spotted thrips feed heavily on web-spinning mites and may give adequate control. Encourage predators by avoiding the use of disruptive insecticides. A narrow range oil spray will suppress low levels of mites without harming these predators. When predatory mites are present, low rates of selective miticides may be used to reduce spider mite populations and improve the predator/prey ratios. Minimizing sulfur sprays for rust control by treating only when monitoring indicates a need will also help preserve the natural enemies of mites.

Vigorously growing trees are much more tolerant to mite attack than trees under stress. Maintain trees with optimum irrigation and fertilization. Reduce dusty conditions in orchards by oiling or watering roads and by

maintaining a ground cover. Do not allow the ground cover to dry in mid-summer or mites will move up into the trees.

Assess web-spinning mite populations by conducting timed searches. Take weekly samples from June 1 to July 15 until the population either declines due to predator activity or until the treatment threshold has been reached and a treatment is applied. After July 15, or once a treatment is applied, monitoring is no longer necessary.

Conduct a 5-minute search in two separate areas of an orchard (up to 40 acres in size) for a total sampling time of 10 minutes. Examine about 2 to 3 leaves on 10 trees in dusty areas or known hot spots where mite infestations have occurred previously. For each 5-minute search, look for unthrifty-looking trees with leaf bronzing. Examine the leaves for fine webbing, curling, and defoliation. Use a hand lens to detect the presence of mites. Also, look for the following predators: predatory mites, six-spotted thrips, western flower thrips, and Stethorus beetles. Each week, select a dusty location or hot spot in the orchard for your search. Once mites have been found, observe the same trees weekly to track population development and the presence of predators.

Rate the population weekly as light, light/moderate, moderate, moderate/heavy, or heavy and record the presence of live predators as low, moderate, or high. Record these timed searches on a monitoring form. Miticide application may be necessary in some orchards if mite populations exceed threshold levels. Treat when the average rating from both 5-minute searches indicates either: a light/moderate mite rating with low predator rating, or, a moderate mite rating with a moderate to high predator rating.

Definitions of mite and predator rating levels and the monitoring form for tracking your mite population can be found in your Prune IPFP Pest management Binder. When populations exceed the treatment threshold, treatment is recommended. See the UC IPM Prune Pest Management Guidelines on the web (http://www.ipm.ucdavis.edu) for recommendations or to review great color photos of mites and predators. Some of these photos for identification of mites and predators can also be found in the "Tree Fruit Pest Identification Cards", UC ANR Publication 3426 that rides along easily in your pickup.

Summer Diseases: Rust and Fruit Brown Rot

- Franz Niederholzer, UC Farm Advisor, Sutter/Yuba County

Wet weather in spring and/or summer increases the risk of fruit brown rot or prune rust. These diseases can cost growers a lot of money. Brown rot infected fruit has no market value, and must be hand sorted from sound fruit at the grower's expense. Rust does not directly affect prune fruit, but can cause defoliation, that can lead to reduced fruit dry away and fruit or wood sunburn. The following are some factors to consider when planning for summer disease management.

Brown rot. While wet weather is a major (and unmanageable) factor affecting brown rot damage at harvest, there are some things growers can do to get the best production from a block while minimizing damaging losses:

==> Avoid, where possible, orchard conditions that promote fruit brown rot infections. These include:

" High nitrogen (N) levels. Avoid excess N fertilization. (see information on orchard nutrition in this newsletter.)

" Clustered fruit. Thinning can help reduce clustering of fruit and brown rot risk. [However, rain or irrigation immediately after thinning can increase the number of disease spores in an orchard.]

" Fruit damage (split fruit, hail damage, and/or insect damage).

" Late harvest. The longer the fruit hangs, the higher the chance of damage. Growers must balance the risk of the spread of brown rot infection in each block with the economic benefit (lower dry away) of harvesting at lower fruit pressures.

" High disease pressure. High inoculum levels in an orchard increase disease risk during the season. Reducing disease pressure is done by mummy removal during the winter, properly timed fungicides at bloom, and careful thinning (see above). Even with a good bloom spray program, fruit rot infections can occur at harvest.

==> Evaluate the economics of your operation. Determine what blocks are worth protecting with expensive fungicides. Where is the best crop? Do you want to spend the money to try to protect all blocks?

==> Where needed, chemical controls can be applied at the proper timing. Chemical fruit brown rot control is expensive and not always completely successful under the best of conditions. Registered fungicides can only protect uninjured fruit from brown rot infection. They must be applied before infection occurs, and

can not protect injured fruit.

Dr. Beth Teviotdale, recently retired UC Extension specialist in plant pathology, suggests that, when sprays are needed, growers approach chemical control of fruit brown rot in this way. If two sprays before harvest are affordable, then spray twice: once sometime between early June through mid July and then again two to three weeks before harvest. [Unfortunately, research data gives no clear picture of best spray timing during this 5-6 week period.] If only one spray is affordable, spray once 2-3 weeks before expected harvest.

Prune fruit is most sensitive to brown rot infection at two separate periods during the growing season - pit hardening and just before harvest. Research by Dr. Themis Michailides, UC plant pathologist, has identified these high risk periods, but development of management practices to using this information has not yet been done. Dr. Michailides hopes to have the funding to do this work in 2007.

Prune rust can cause extensive leaf drop and reduce fruit dry away and yield if defoliation occurs before harvest, but does not damage the fruit directly. Rust can be particularly harmful in a heavy crop year, when a healthy leaf canopy is essential to good quality fruit production.

Compared to fruit brown rot, rust can be easily managed with careful orchard scouting and use, where needed, of effective fungicides. To scout for rust, look for any rust symptoms on 40 trees per block beginning May 1. Replant trees are often the first trees to show symptoms and should be included in the sample. Spray sulfur as soon as possible after the first rust 'spot' is found and definitely before the next predicted rain. Orchards in the Sutter/Yuba region, showing some rust symptoms sprayed before summer rains in 2005, showed much less rust than those blocks that showed rust before the rain but were sprayed after it rained. [Note: Newly registered fungicides (Orbit®, Pristine®, and Abound®) provide good to excellent rust control when applied before infection occurs.]

A fungicide resistance management program should be used to delay or avoid the development of resistance to a certain fungicide or class of fungicides in a disease pest population. Dr. Jim Adaskaveg, UC Professor of Plant Pathology, recommends these steps for fungicide resistance management:

- Rotate between fungicide classes to avoid overuse of one or more classes. Just for example, use Orbit® then Pristine® if planning to use two sprays for fruit brown rot control this spring/summer. These two effective materials are from two different chemical classes.
- Use labeled rates and only spray when needed.
- Limit applications from one pesticide class to a maximum of 4/year
- Educate yourself about fungicide classes and modes of action.
- Start a resistance management program with the most effective material or one with multiple sites of action.

Excellent information on fungicide timings, efficacy, different fungicide classes and modes of action is available at: http://www.uckac.edu/plantpath/ or by calling your local UC Extension office.

Prune Fruit Cracking

-Franz Niederholzer, UC Farm Advisor, Sutter/Yuba Counties

2005 was a bad year for prune fruit cracking - at least in parts of the southern Sacramento Valley. Cracking can ruin fruit and provide an easy starting point for brown rot infection. There are two different types of fruit cracking in prunes: end cracking and side cracking. Each occurs under different situations, but both are related to fruit growth. This article gives a brief review of what is known about prune fruit cracking and how it can be managed to minimize crop damage.

End cracking occurs within days after dry trees are irrigated anytime before late July (when the fruit are essentially finished growing). The sudden increase in tree water status at least doubles fruit flesh pressure, especially in the tip, and cracking occurs soon afterwards.

Managing end cracking is simple. Don't let trees get water stressed in spring and summer-particularly May and June. In my experience, the worst end cracking years are those with wet, cool springs. Under those conditions, trees can use a lot more water than falls as rain, even though the soil surface might be moist, the skies often cloudy, and conditions not seem as though water might be limiting. There are several ways to keep track of orchard water

status: pressure bomb, Watermark sensors, ET estimates, etc. All work if used regularly. Contact your local UCCE farm advisor for information on any of these practices.

Side cracking usually happens when water forms (dew or rain) on the surface of exposed fruit during the final growth stage (when the fruit "cheeks" fill out). Large fruit, which expand and contract to a greater degree in a 24 hour period than smaller fruit, are usually most sensitive to side cracking. Side cracking potential is high during a three week period beginning a week after the cheek diameter of the fruit is greater than the suture diameter. (This is when the fruit "plump up"). This cracking window falls around July 4 in most years, but will probably be a least a week later this year due to the delayed bloom and cool March and April. During this "window", cooler weather can lead to dew forming on the fruit, an increase of pressure in the fruit, and cracking on the sunny-side of exposed fruit. (That portion of the fruit skin is sun-toughened, less elastic, and more likely to break under increased fruit flesh pressure.) Summer rain can also lead to this kind of cracking.

Managing side cracking is difficult, because the weather can't be managed. Some growers don't flood irrigate during the side cracking "window" hoping to keep orchard humidity low and reduce chances of dew forming on the fruit. Orchards irrigated with microjets or drip irrigation often have lower humidity than flood irrigated orchards and less side cracking than growers with flood irrigation. Side cracking varies more from year to year than from orchard to orchard, because it is generally related to regional weather, not conditions specific to a particular orchard.

Finally, in research by Dr. Nick Mills, professor of entomology at UC Berkeley, prune trees infested with mealy plum aphid showed a higher percentage of end cracking than trees without aphids. The aphids don't appear to directly cause the cracking, but they make the damage worse if cracking conditions occur in an orchard.

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