Irrigation with Reduced Water Supplies

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Reduced water supplies represent a real challenge for irrigation managers. The traditional methods of determining when to irrigate and how much water to apply are complicated by the impacts of water stress on tree and crop performance. Ideally, prune orchards are irrigated to meet evapotranspiration (ET). If adequate irrigation water is not available then additional management strategies are necessary. Exactly how to manage reduced water deliveries will depend upon orchard soils, root zone characteristics, canopy architecture, irrigation system and available irrigation water. Management decisions with a 10% water reduction would be drastically different than an 85 % reduction. Once all the constraints are identified, a best management plan can be designed.

When water supplies are in short supply, one of the first management steps is to make sure irrigation systems are working as designed and managed properly to apply water efficiently. Good system design and operation will minimize water losses to runoff and percolation below root zones. The second strategy is to schedule irrigations as accurately as possible. Many devices are available to monitor soil moisture. Soil augers are useful to visually evaluate soil moisture. Tensiometers and resistance blocks are available to measure soil moisture tension. Capacitance and neutron probes are available to measure soil moisture content. Capacitance and neutron probes are more technical to use and are usually supported by irrigation consultants. They may be cost prohibitive for smaller farms.

Since tree water use is largely driven by climatic conditions, weather measurements are used to calculate tree water use. Published values make it relatively easy to follow orchard water use. Plant based methods are also available with pressure chambers being the most typical technique. Pressure chambers are particularly useful if the intention is to regulate the soil moisture deficit. ET information and a discussion of monitoring devices are available at http://cetehama.ucdavis.edu. Click on Irrigation and water resources.

Other water saving strategies include:

- Winter irrigation to start the season with full soil moisture (the timeliness of this practice has passed for the 2009 season).
- Manage vegetation to conserve soil moisture.
- Avoid runoff, deep percolation and drift/evaporation from sprinklers.
- Apply water only to tree root systems (particularly important with developing orchards).
- Longer set times to infiltrate water deeper into the root zone and lessen surface evaporation. This practice needs to be balanced with preventing runoff.
- Use practices that favor water infiltration not evaporation (i.e. in some situations water amendments may improve water infiltration).

There is not a great deal of research experience to clearly understand the effects of water stress on prune production. The challenge is to allow moisture stress at a time when the tree and developing crop might tolerate water stress with the least negative impact.

Prune fruits continue to increase in size from bloom to about early August. Significant stress during that time period has been shown to reduce fruit size. If early season water stress is unavoidable, reducing the crop load might compensate for fruit size resulting from water stress. Moisture stress applied in early summer could impact flower bud development and may reduce shoot growth.

Prune trees probably have the best chance of tolerating moisture stress just prior to and after harvest. If there is not enough irrigation water available to avoid moisture stress, one option would be to manage irrigation so that prune tree stress gradually increases mid July to early August prior to harvest. After harvest, irrigate to recover the tree to modest stress level and then continue to withhold water until the end of the growing season. This approach might save several mid to late season irrigations and research suggests lower dry ratios while minimizing negative effects on the crop

If water availability is reduced drastically, acquiring additional water supplies by developing groundwater or by other means may become necessary. If an orchard is in a situation where acquiring reliable, sufficient supplies of water over the long term is questionable, the appropriateness of producing a permanent crop may need to be reconsidered.