

ESPS, 1998 report: Irrigation Management

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The ESPS recommended management of irrigation is based on research findings in prune, that: 1) stress can be accurately and reliably measured using the midday bagged leaf method (midday stem water potential), and 2) prune tree economic production appears to benefit from mild to moderate water stress later in the season, when dry yield is not affected but fruit hydration ratio is improved. Additional beneficial effects may also occur in prune (reduction in excess vegetative growth, increased return bloom), but these have been more difficult to clearly identify. Reduced water input is also one of the goals of ESPS, and so the objective of our irrigation management strategy are to minimize the applied water without causing detrimental effects on economic yield.

Midday stem water potential is measured by selecting an interior canopy leaf, attached near the trunk or main scaffold, and enclosing this leaf in a foil-covered black polyethylene envelope to stop leaf transpiration. After about 2 hours, at midday, the water potential of this nontranspiring leaf is measured with a pressure chamber. The relationship of this measurement to the midday conditions of temperature and humidity have been determined for fully irrigated prune trees (Table 1), and this value is used as a reference value for any particular date and site.

Table 1. Values of midday stem water potential (in **Bars**) to expect for fully irrigated prune and almond trees, under different conditions of air temperature and relative humidity.

Temperature (°F)	Air Relative Humidity (RH, %)						
	10	20	30	40	50	60	70
70	-6.8	-6.5	-6.2	-5.9	-5.6	-5.3	-5.0
75	-7.3	-7.0	-6.6	-6.2	-5.9	-5.5	-5.2
80	-7.9	-7.5	-7.0	-6.6	-6.2	-5.8	-5.4
85	-8.5	-8.1	-7.6	-7.1	-6.6	-6.1	-5.6
90	-9.3	-8.7	-8.2	-7.6	-7.0	-6.4	-5.8
95	-10.2	-9.5	-8.8	-8.2	-7.5	-6.8	-6.1
100	-11.2	-10.4	-9.6	-8.8	-8.0	-7.2	-6.5
105	-12.3	-11.4	-10.5	-9.6	-8.7	-7.8	-6.8
110	-13.6	-12.6	-11.5	-10.4	-9.4	-8.3	-7.3
115	-15.1	-13.9	-12.6	-11.4	-10.2	-9.0	-7.8

Based on: McCutchan and Shackel, 1992. Stem-water potential as a sensitive indicator of water stress in prune trees (*Prunus domestica* L. cv. French). Journal of the American Society for Horticultural Science 117(4):607-611 and Shackel et al. 1997. Plant water status as an index of irrigation need in deciduous fruit trees. HortTechnology 7(1):23-29.

Mature prune trees can be allowed to progressively decline through the growing season towards mild levels of stress (-15 bars on average) by harvest, with no effect on yield, and some improvement in fruit quality (lower fresh fruit moisture content). Rapid recovery from a stress of -15 bars or more should be avoided during the crack sensitive period (late June/early July), and substantial recoveries should probably also be avoided near harvest, since we have associated this with increased pre-harvest fruit drop.

Each site (Glenn, Butte, Tehama, Tulare) was monitored, and all sites showed the expected increases in stem water potential following irrigation, and declines as soil water was depleted (see individual figures). Tulare was the only site in which ESPS irrigation was directly compared to the growers normal practice, and at that site the grower applied 5 irrigations whereas the ESPS received 4 irrigations. ESPS sites in both Tehama and Butte county also only received 4 irrigations. We will continue to manage irrigation practices at these sites to conserve water, using midday stem water potential to indicate the need for irrigation, and the long term effects of this strategy will be determined.