



TENTATIVE GUIDELINES FOR INTERPRETING PRESSURE CHAMBER READINGS (MIDDAY STEM WATER POTENTIAL-SWP) IN WALNUT, ALMOND, AND DRIED PLUM, 2003 SEASON

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Pressure Chamber Reading (- bars)	WALNUT	ALMOND	DRIED PLUM
0 to -2.0	Not commonly observed		
-2.0 to -4.0	Fully irrigated, low stress, commonly observed when orchards are irrigated according to estimates of real-time evapotranspiration (ETc), long term root and tree health may be a concern		
-4.0 to -6.0	Low to mild stress, high rate of shoot growth visible, suggested level from leaf-out until mid June when nut sizing is completed	Not commonly observed.	Not commonly observed
-6.0 to -8.0	Mild to moderate stress, shoot growth in non-bearing and bearing trees has been observed to decline especially with Black Walnut Rootstock. These levels do not appear to affect kernel development and may be appropriate during kernel development	Low stress, indicator of fully irrigated conditions, ideal conditions for shoot growth. Suggest maintaining these levels from leaf-out through mid June.	Low stress, common from March to mid April under fully irrigated conditions. Ideal for maximum shoot growth.
-8.0 to -10.0	Moderate to high stress, shoot growth in non-bearing trees may stop, nut sizing may be reduced in bearing trees		Suggested levels in late April through mid June. Low stress levels enabling shoot growth and fruit sizing.
-10.0 to -12.0	High stress, temporary wilting of leaves has been observed. New shoot growth may be sparse or absent and some defoliation may be evident. Nut size likely to be reduced.	Mild to moderate stress, these levels of stress may be appropriate during the phase of growth just before the onset of hull split (late June).	Suggested mild levels of stress during late June and July. Shoot growth slowed but fruit sizing unaffected.
-12.0 to -14.0	Relative high levels of stress, moderate to severe defoliation, should be avoided		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	Severe defoliation, trees are likely dying	Moderate stress in almond. Suggested stress level during hull split, Help control diseases such as hull rot and alternaria, if diseases are present. Hull split occurs more rapidly	Moderate stress acceptable in September.
-18.0 to -20.0			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
-20 to -30		High stress, wilting observed, some defoliation	
Less than -30		Extensive defoliation has been observed	High stress, extensive defoliation

\* These guidelines are tentative and subject to change as research and development with the pressure chamber and midday stem water potential progress. This table should not be duplicated without prior consent by the authors.



## TIPS FOR USING PRESSURE CHAMBER AND MIDDAY STEM WATER POTENTIAL (SWP) MEASUREMENTS IN ORCHARD CROPS

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### **SAMPLING:**

Today, the pressure chamber can be used to measure midday stem water potential ideally between 1:00 and 3:00 p.m. with only one trip to the field. If necessary, the sampling time can be stretched to between 12:00 and 4:00 p.m. to allow growers with larger acreage more time for sampling. The foil bag needs to cover the leaf for only 10 minutes before removing the leaf from the tree and placing it, still inside the bag, in the chamber. Measure the SWP promptly (at least within one or two minutes after cutting a leaf from a tree). The SWP will decrease fairly rapidly after the leaf has been excised from the tree so prompt measurement is essential. Collecting more than one leaf at a time is not recommended.

Sample leaves from at least 5 trees per orchard block, although the actual number may depend upon the variability among soils, tree age, tree health, and other growing conditions. The sample trees should be representative of the orchard. If the orchard has drier and/or wetter areas, it is important to sample trees in these areas as well as those in more average areas in the orchard. Return to the same trees for repeated measurement during the season. In walnut, select a terminal (end) leaflet from the compound leaf. The terminal leaflet will have the longest stem and is easier to work with in the pressure chamber. Choose the leaf from among shaded leaves in the lower canopy near a scaffold branch or the trunk and cover it with a foil bag for at least 10 minutes. Weekly sampling is suggested but less frequent measurement may still be valuable. Measurements within a few days after irrigation and just before the next irrigation are most informative. For an experienced pressure chamber operator, it should take about 30 to 45 minutes per orchard block to complete about 10 measurements.

### **INTERPRETING MEASUREMENTS:**

Refer to the accompanying table of "Tentative Guidelines" for walnut, almond, and dried plum. These guidelines are tentative and will be updated as ongoing research and development is completed. However, these guidelines are believed to be reasonable to assist new users with the pressure chamber and midday stem water potential. Presently, two research trials are underway in Tehama and San Joaquin Counties to further develop SWP thresholds for mature walnut orchards. Development is also ongoing in almond and dried plum.

### **BASELINE ESTIMATE OF SWP FOR FULLY IRRIGATED ORCHARDS**

Since SWP is a plant-based indicator of orchard water status and integrates root health, soil moisture, and weather conditions into each measurement, it is possible to measure different levels (commonly -1 to -2 bars difference) of SWP on the same tree and under the similar soil moisture conditions when the weather conditions at the time of measurement are different. The novice user of the pressure chamber needs to be aware of the influence of weather at the time of measurement. The simplest way to minimize this variable is to measure SWP on clear days with near normal temperatures and avoid measuring SWP on overcast and unusually cool days or extremely hot and windy afternoons. For the advanced pressure chamber and SWP user, predictive models have been developed for walnut, almond, and dried plum to estimate the SWP level that would be expected for specific air temperatures and relative humidity conditions. Separate tables for predicting SWP for fully irrigated walnuts, almonds, and dried plum are available. Using representative sources of mid-afternoon air temperature and relative humidity for your location (i.e. CIMIS weather station, FieldWise Inc. weather, or NOAA), these tables can be used to predict SWP levels that could be expected when the orchard is fully irrigated (soil moisture is not limiting). Comparing the prediction for fully irrigated conditions to the field measurement helps clarify the orchard water status and extent of crop stress.