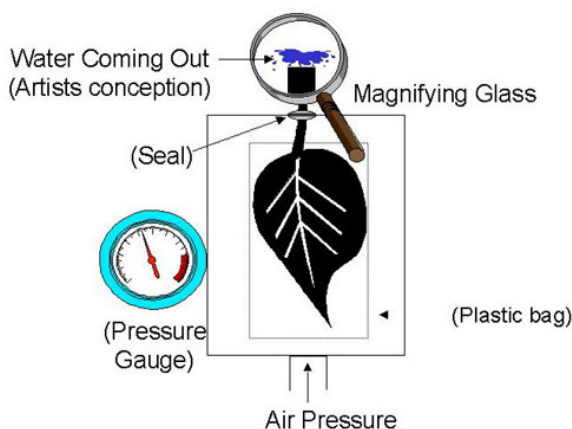


Using a Pressure Chamber in Winegrapes

The amount of pressure required to force water out of the cut end of the petiole equals the leaf's "water potential." This is equivalent to the amount of tension the leaf is holding on to the water it contains. Leaf water potential (LWP) is measured in units of negative bars. The more negative the number, the greater the water tension inside the leaf, thus the more stressed the vine is.



Important: when someone says that their pressure bomb readings were "higher" this week, ask if they mean more or less stress.

Factors that Influence Leaf Water Potential

The most important factors are:

- weather conditions at the time of sampling, and
- soil moisture content

For fully irrigated vines with a healthy root system, weather conditions can have a large impact on leaf water potential. Higher air temperature and lower relative humidity is reflected by more negative values. In all cases, hotter and dryer conditions cause more negative (more stress) water potential. For midsummer conditions in California, the values of water potential measured on a fully irrigated grapevine will typically be between -7.0 bars and -10.0 bars. To minimize the effect of temperature, measurements should be taken only when average conditions exist. For example, if average midday temperatures are 92°F, measurements can be made on days with midday temperatures of 90 to 95° with no need to make an adjustment for climate. Cloudy or foggy days or days with high winds should be avoided. LWP of water stressed vines is less affected by climatic conditions and more sensitive to soil moisture content.

Levels of winegrape water deficits measured by mid-day leaf water potential	
less than -10 Bars	no stress
-10 to -12 Bars	mild stress
-12 to -14 Bars	moderate stress
-14 to -16 Bars	high stress
above -16 Bars	severe stress

When to Sample

The loss of water from the leaf is not constant throughout the day and varies with a number of factors including the environmental demand. This factor can be minimized however by measuring when the leaf water potential is relative static. Before the sun reaches the leaf in the morning, the vine has had a chance to uptake water and translocates it to all parts of the plant. The leaf water potential is the least negative at this time. As the sun contacts the leaf and heats the surface, the rate of transpiration increases, causing a more negative leaf water status. During the midday (solar noon), the water potential is again static at the daily maximum deficit. An appropriate sample period is between 11:30 am and 1:30 pm. Mid-day measurements of leaf water potential are better related to the soil moisture content than predawn measurements.

Vine selection

- avoid vines with obvious nutritional, disease problems
- want vines in area that is in a soil type or depth that is typical for that block. If there is a lot of variability within the block, then optimally monitor more than one site.
- Flag the row and/or vines so that you can return to same area

Sample Number

The number of vines, which are measured depends somewhat on the variability of the vineyard; however it is necessary to measure enough leaves to closely approximate the average condition. For a 20-acre vineyard, selection of six vines located in all parts of the vineyard should be adequate. Select two leaves per vine for measurement.

Leaf selection

Select an undamaged fully expanded leaf from the “sun side” of the vine that has been in full sun for a few hours. This will be the south side of east-west rows and the west side of north-south rows. Leaves in the interior of the canopy, which are shaded, will not accurately represent the maximum leaf water potential and should not be sampled. Young leaves, which have not achieved full size, should also be avoided.

Sample collection

- place a plastic bag around the leaf and use a razor blade to cut the petiole off close to the shoot
- insert the petiole through the seal in the lid
- put bagged blade into the leaf chamber ASAP and lock lid
- typical time from the initial cut to when you begin to pressurize the chamber is 10 to 15 seconds

Measurement

- start the air flow into the chamber at a rate of about 0.3 bars per second
- watch the petiole’s cut end with a magnifying glass and stop pressurizing as soon water STARTS to appear
- QUICKLY read the pressure gauge. A leaf water potential reading of –10 bars should take 33 seconds. A higher rate of pressure increase followed by 0.3 bar rate near the endpoint causes a more stressed reading.

Problems

- OPERATOR ERROR
- crushing the petiole
- holes or torn leaf blade

Reproducibility

- If 2 leaves sampled per vine, they should be within 0.5 bars
- if 2 or more adjacent vines sampled, they should have values within 1.0 bar
- keep track of readings from each vine
- resample if necessary