

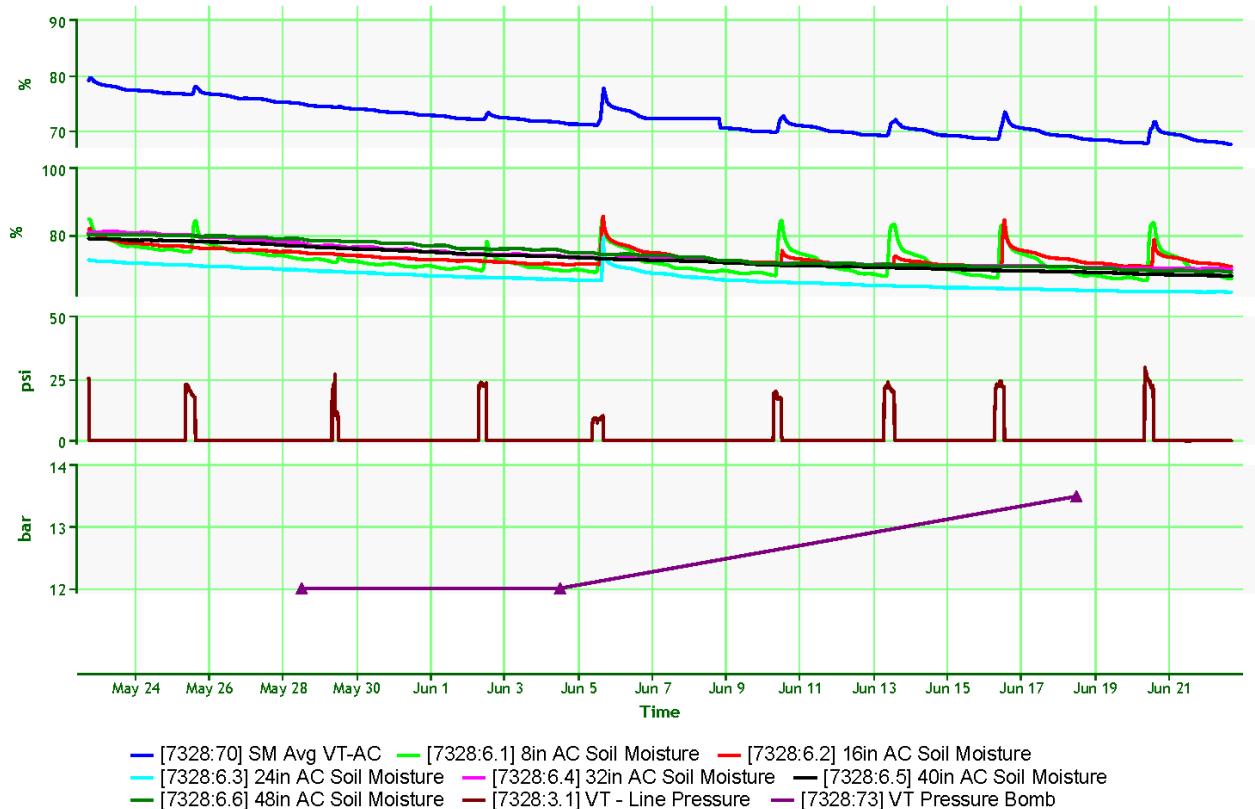
Vineyard Team Irrigation Demonstrations – June Observations

Soil moisture, plant stress, and temperature data are shared below from the last month of data collection at two vineyard demonstration sites in the Paso Robles area. This data is collected with support from the United States Department of Agriculture, Conservation Innovation Grant.

Key Observations

- Measuring relative soil moisture content may help a grower determine if a deficit irrigation is being achieved.
- Monitoring changes in soil water content may help a grower prevent premature shut down of shoot growth.
- Observing temperature and plant stress data along with soil moisture can provide a bigger picture for fine tuning the length and frequency of irrigation sets to achieve desired canopy size.

The figure below shows relative water content and plant stress data in relation to irrigation sets at a Cabernet Sauvignon vineyard block in Paso Robles. The top graph line in blue shows the percent average volumetric soil water content of 6 sensor depths from an AquaCheck soil moisture probe. Directly below we see the volumetric soil moisture for each of the probes at individual depths (8-48”). Irrigation sets are indicated in “psi” using an inline pressure transducer. The bottom graph shows vine water stress “bar” reading from mid-day leaf water potential using a pressure chamber (13 vines per 8 acre block).



The above figure is informative because it shows events leading up to the slowing (June 5th) and eventual stopping (June 19th) of shoot tip growth in the vineyard. The goal of the grower was to establish a shoot length of approximately 4 feet (17-20 leaves) per shoot before stopping shoot growth. Shoot tip growth began to slow down between May 28th and June 5th, with shoot tips stopping growth overall on June 19th.

The average of the 6 soil moisture sensors shows a decrease in soil moisture from May 24th through June 5th, continuing to decrease even as irrigation became more frequent from June 10-17th. When observing individual sensor readings at profile depths, it is apparent that the soil from 16-24 inch depth (red and light blue lines respectively) is no longer replenishing with routine irrigation (6 hour sets) after June 5th. Shallower depths showed an increased water volume with each irrigation set, and deeper soil showed a steady decrease throughout the season. Hence there appears to be a deficit irrigation applied, as the vine is drawing more moisture from the soil than is being applied as irrigation. The surface soil has the highest water holding capacity at this site (sandy clay loam) with decreasing water holding capacity at depth to 24 inches (clay loam) and deeper (loam). In this soil type, irrigation water may not be retained in the loamy depths of the soil, and increasing irrigation frequency rather than length of sets may be one strategy to adjust for deficits as desired.

Soil Horizons

pH 7.0



Sandy Clay Loam

Sand = 52%
Silt = 19%
Clay = 29%

pH 7.5



Clay Loam

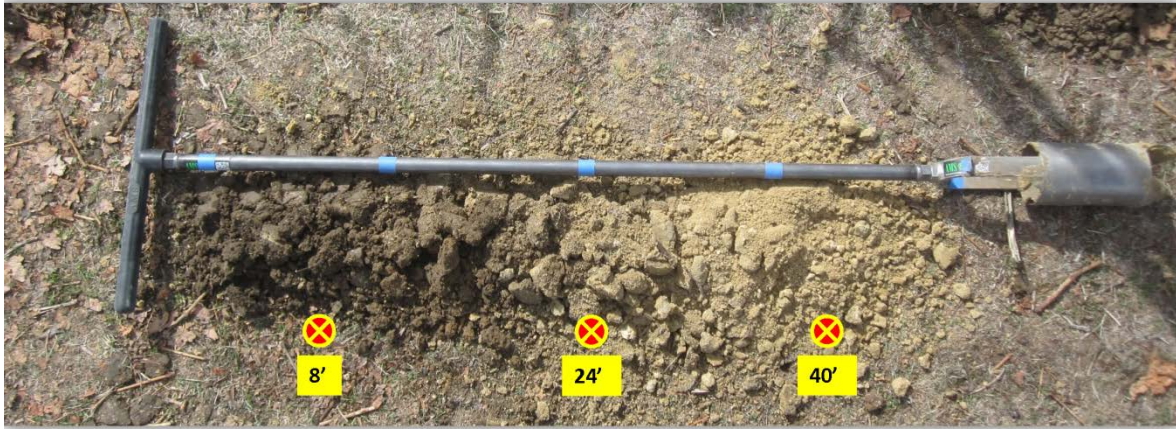
Sand = 42%
Silt = 27%
Clay = 31%

pH 7.6

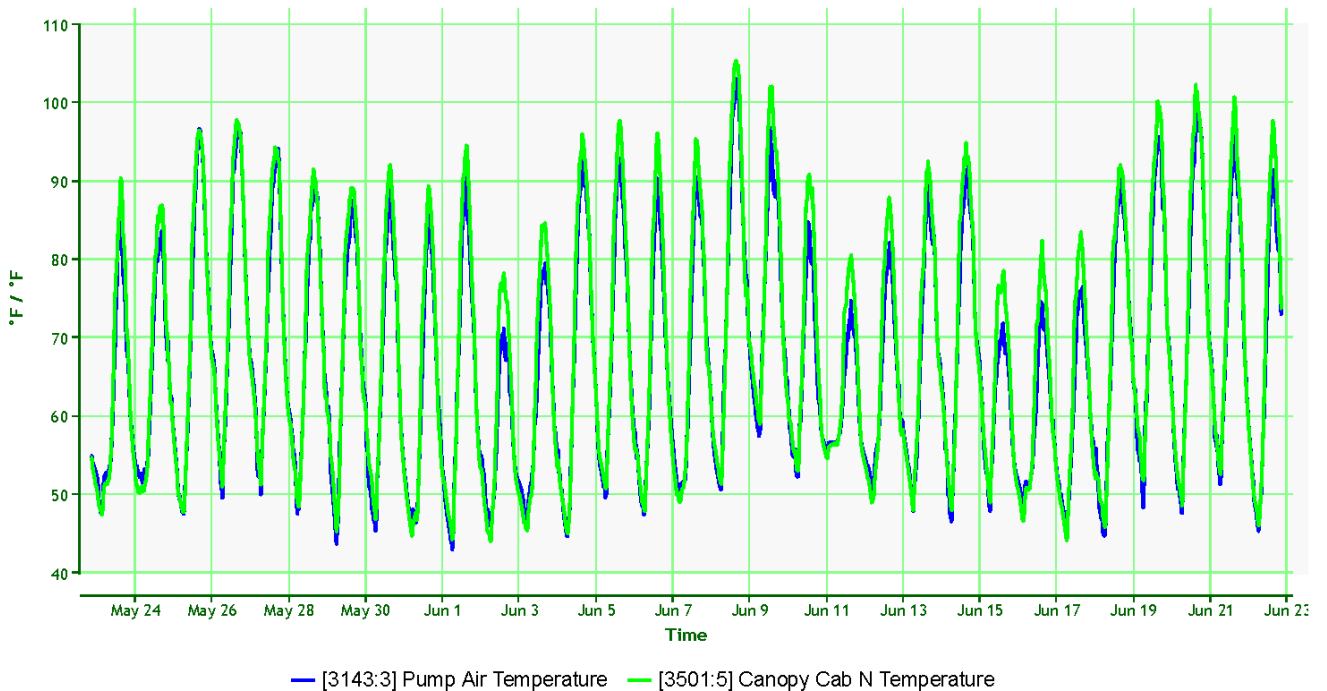


Loam

Sand = 47%
Silt = 34%
Clay = 19%



Temperature data (below) from the vineyard shows that highs in late May reached into the upper 90's, followed by a cool period from June 1-4th (shoot tips slowing), then another heat spike from June 5-10th with temperatures reaching over 100°F. In this example, we see that plant stress increased after heat spikes (average mid-day leaf water potential was 8.4 bar on May 21), and soil moisture was not replenished at the 16" depth with normal irrigation from June 5-17th. This may have occurred due to the increased draw of water at that depth by roots during a time of higher water demand.



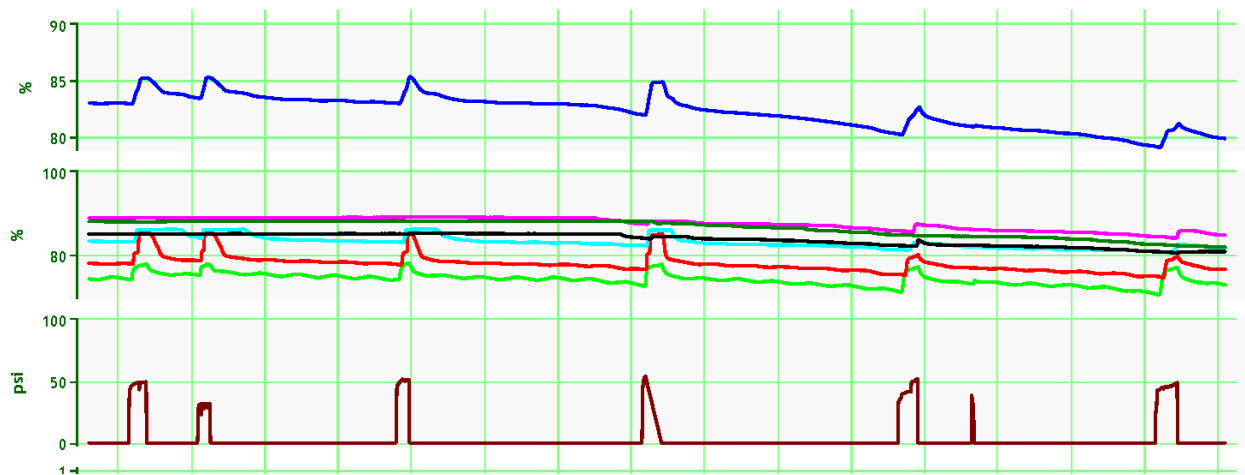


Shoot tip growth slowing – June 4th, 2014



Shoot tip growth stopping – June 18th, 2014

For comparison below we show the volumetric water content from a second Cabernet Sauvignon site with greater clay content in the deep soil profile (32-48"). Note how the volumetric water content is actually greater in the deeper profiles than those at 8" (red line) and 16" (green line). Shoot tips of Cabernet Sauvignon have yet to shut down at this site. The grower is also irrigating at night time to reduce water loss to evapotranspiration. Pressure chamber readings have remained under 10 bar at this site. If the grower has achieved the desired canopy length, they may want to consider lengthening irrigation intervals to develop more vine stress, and shut down shoot elongation. Plant stress could be carefully monitored during this process to prevent shut down of vines.



Second demonstration site showing percent average volumetric water content of the soil profile (8-48" top blue line), individual profile depths, and irrigation hours (psi).