

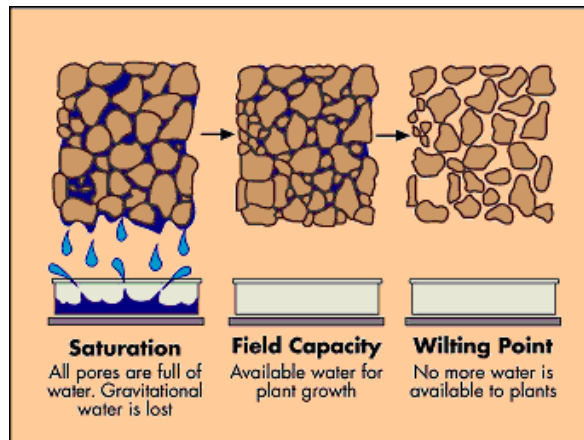
AquaSpy Full and Empty Point Interpretation

Overview

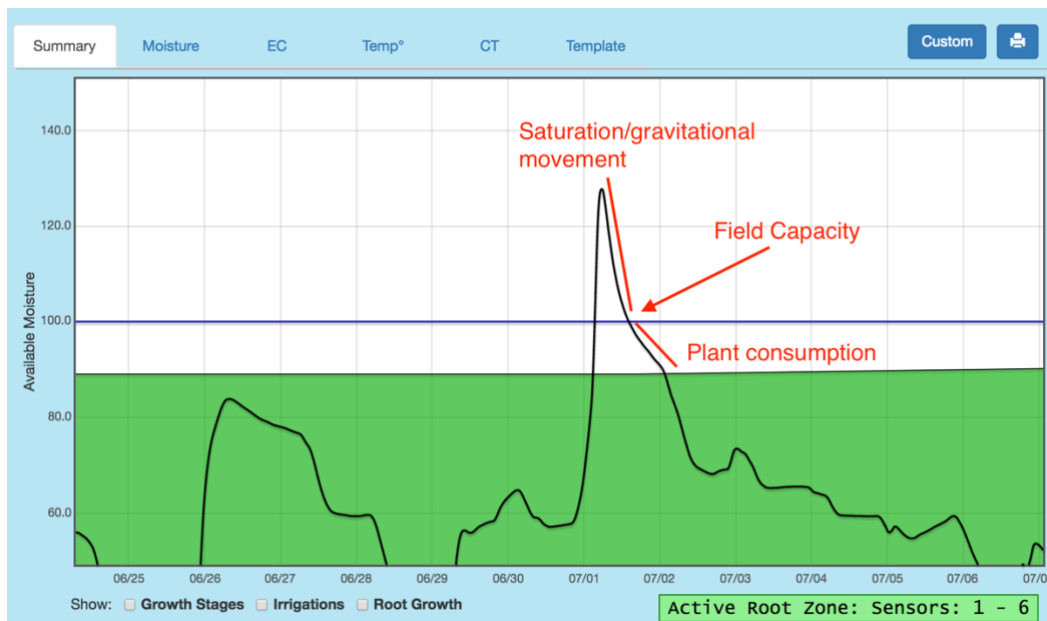
The AquaSpy soil moisture probe is an affective sensor for reading soil moisture, temperature, and Electrical Conductivity (EC). A audio signal is sent out from the probe, the speed and attenuation of the signal upon return is used to provide useable data. An algorithm is then used to calculate the full and refill points displayed within AgSpy. Below is a description of how the full and empty points are calculated and what they mean.

Full point-100%

- 100% on the AquaSpy Summary graph is Field capacity
- Field Capacity-is the amount of soil moisture or water content held in the soil after excess water has drained away and the rate of downward movement has decreased.

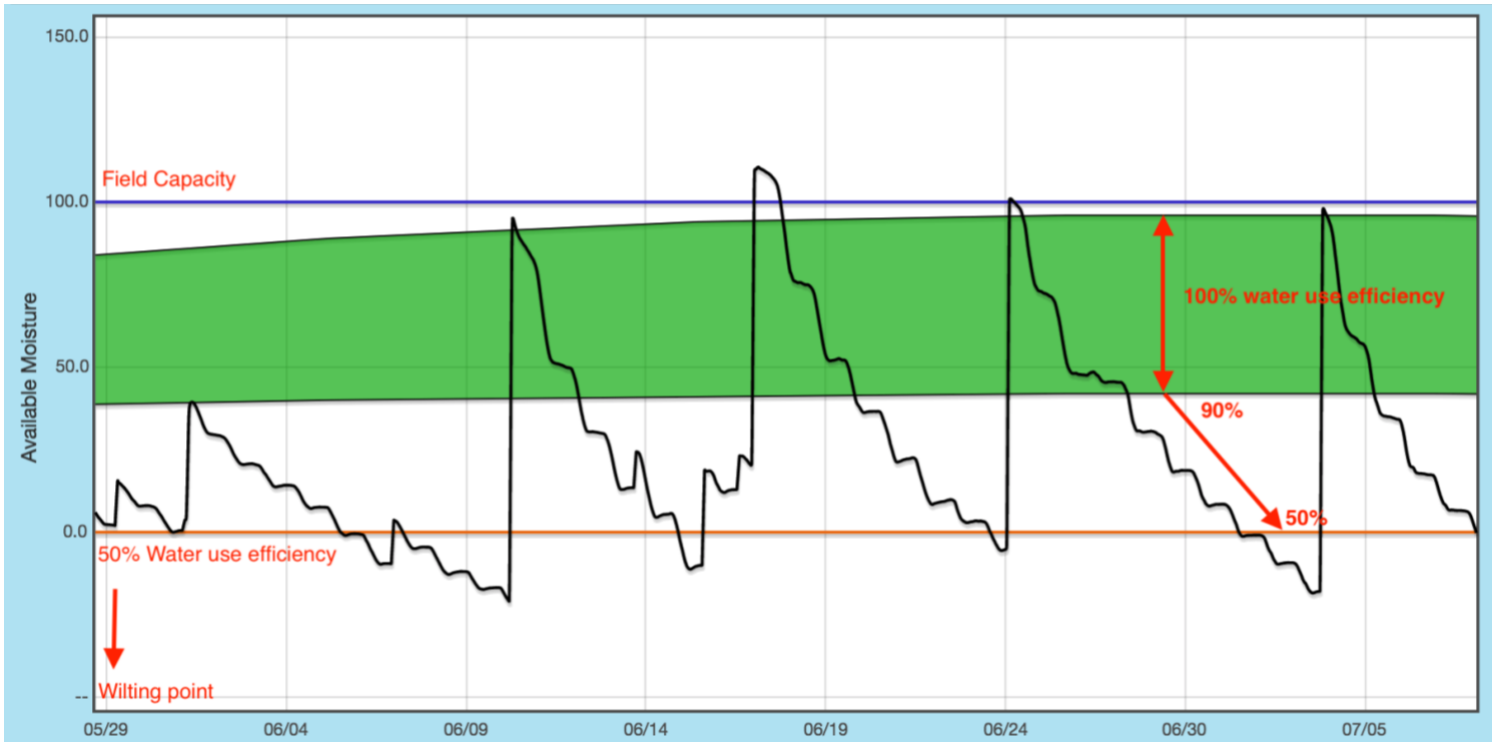


- Field capacity is detected within AquaSpy by looking for the inflection point, or change in slope, between free moving water and water being held in the pore space. This is best detected after a large rain or watering event where the soil is saturated.

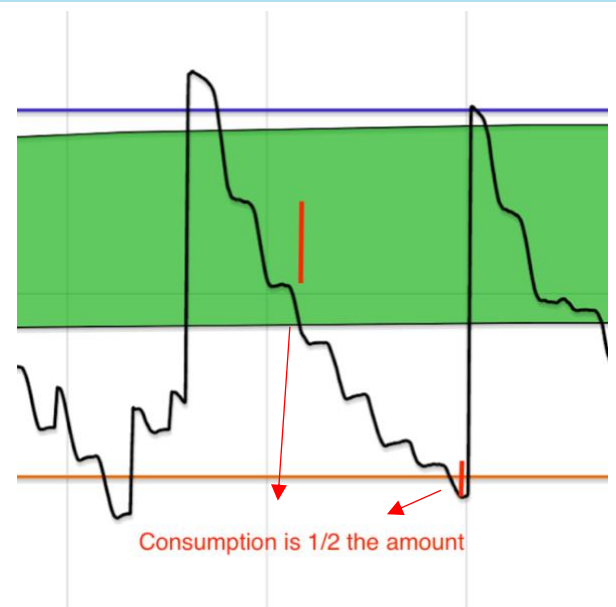


Refill point- 0%

- 0% on the AquaSpy graph represents 50% water use efficiency of any given crop. What this means is that the plant has significantly slowed down in the absorption of moisture and is getting half of the moisture that it wants to consume in ideal conditions.
 - Example- if a Potato plant is consuming .20 inches of water/day in the green band, it will be consuming .10 inches of water/day if the moisture decreases to the refill line (red line). The reduction in consumption will impact yields.
- Between the green band and the refill line the crop will continually decrease from 90% efficiency down to 50% efficiency (see below).



- The example to the right shows the reduction in consumption at the refill line versus the green band. This is assessed by observing the height of the daily water consumption patterns, or “stair steps”, in the two different areas. This is depicted by the two red vertical lines in the diagram.
- Notice that the lower red line is half the size of the upper red line, indicating 50% water use efficiency.
- The 50% water use efficiency line is crop specific and automatically adjust for different soil types.



Frequently used terms

Permanent Wilting Point (PWP)-is defined as the minimal point of soil moisture the plant requires not to wilt. If moisture decreases to this or any lower point a plant wilts and can no longer recover its turgidity when placed in a saturated atmosphere for 12 hours. PWP of soil is around 15% to 17% by volume

- PWP is not displayed on the AquaSpy summary graph. There are two reasons for this
 1. If soil reaches permanent wilting point the crop is at a critical state of survival where it is putting all growth efforts towards foliage/survival and not adding yield. AquaSpy alerts users before the soil every gets dry enough to be at a critical survival state. In doing so yield is maintained.
 2. Different crops respond differently to dry soil conditions. If PWP is used as the metric for all crops, the results will be highly variable. Meaning some crops may survive while others struggle to add yield.
 - For example: Rye/sorghum/sunflowers are more drought resistant than Corn, therefore the wilting point has less value as the effect of limited moisture will impact corn at a wetter level than sunflowers.
- These two reasons are why the refill line is based on water use efficiency and not wilting point specific. It is a more actionable metric and allows for a management strategy that maximizes yield for each crop.

Volumetric moisture readings- Volumetric soil moisture readings are a traditional way of measuring soil moisture. The calculation is done by comparing the volume of a soil sample before and after drying it.

- The AquaSpy soil moisture probe does not use volumetric soil measurements. The probe measures the rate of return of a 185 Mhz signal, from the return rate a scale is produced with field capacity representing the 100% line, and 50% water use efficiency representing the 0% line.
- The advantage of using the AquaSpy full and empty scale is that it is crop specific, allowing for tailored water management. AquaSpy has assessed probe data over many years on all crops within AgSpy. Through the assessment it was determined that 50% water use efficiency was reached at a different volumetric moisture value for each crop. However, for each crop the percentage decrease to 50% efficiency was consistent regardless of the soil type.
 - For example, Sunflowers reach 50% water use efficiency at a much drier overall soil moisture level than corn. This proves that these two crops should not be managed to the same volumetric moisture levels. The AquaSpy system takes out the guess work of managing different crops to different volumetric levels by using a crop specific scale.

Please contact FarmQA with further questions

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