Lab.2

Soil Water

water contained within or flowing through the soil profile. Surface water must infiltrate the soil profile to become soil water. classified into three categories:

1. Gravitational water (excess soil water)
2. Capillary water (available soil water)
3. Hygroscopic water (unavailable soil water)

Gravitational water (excess soil water):

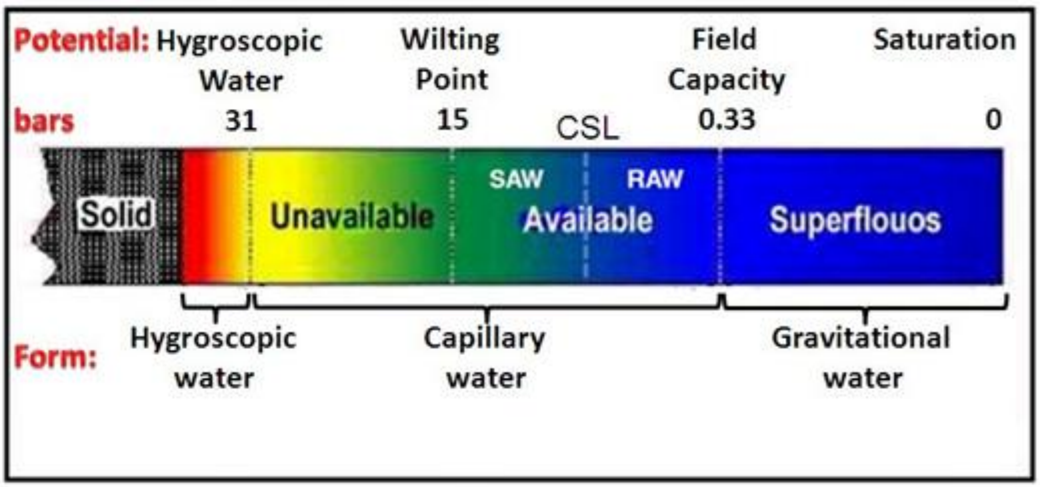
Gravitational water is free water moving through soil by the force of gravity. It is largely found in the macropores of soil and very little gravitational water is available to plants as it drains rapidly down the water.

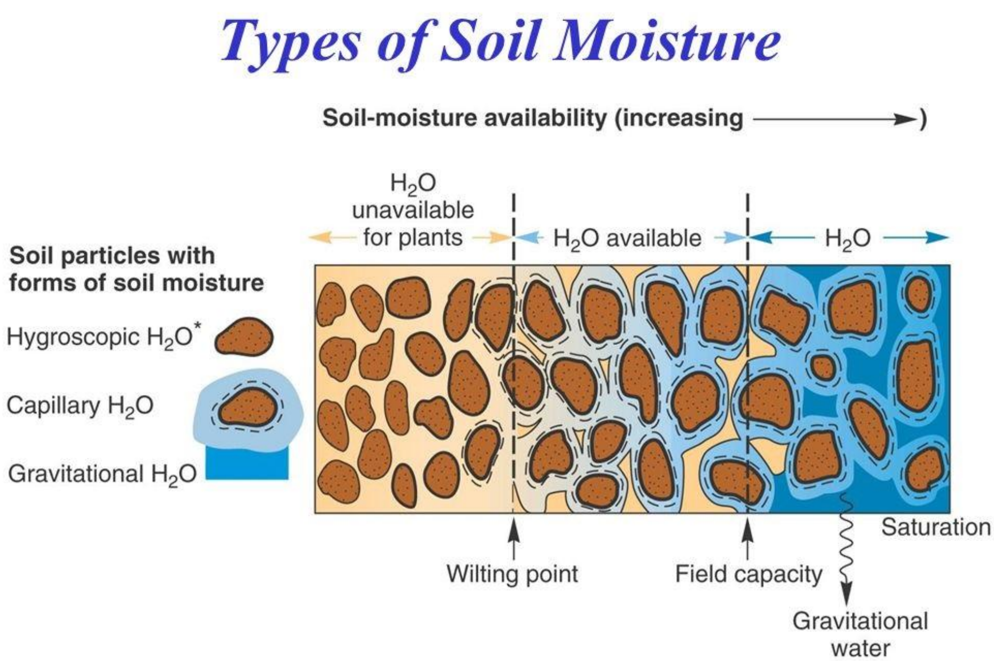
Capillary water (available soil water): water that is retained in the soil and can be extracted by the plant. The **available soil water** is most important for crop production. It is the water held by the soil between **field capacity** and **permanent wilting point**.

Capillary water is held in the soil because the surface tension properties (cohesion and adhesion) of the soil micropores are stronger than the force of gravity.

- **Field capacity:** the water content of a soil at the upper limit of the **available soil water** range. It is the amount of water remaining in a soil after the soil has been saturated and allowed to drain for approximately 24 hours.
- **Permanent wilting point:** the lower limit of the **available soil water** range. When plants have removed all of the available water from a given soil, they wilt and will not recover.

Hygroscopic water (unavailable soil water): Hygroscopic water forms as a very thin film surrounding soil particles and is generally not available to the plant. This type of soil water is bound so tightly to the soil by adhesion properties. Since hygroscopic water is found on the soil particles and not in the pores. These are tightly held in soil and cannot be eliminated except for over drying at 105 °C.





Hygroscopic Water Content

The hygroscopic water:

The water that held tightly on the surface of soil colloidal particle is known as hygroscopic water. It is essentially non-liquid and moves primarily in the vapor form. Hygroscopic water evaporates at temperatures above 100°C.

The pF is the term mostly used to express soil moisture, although other terms are also used, like atmosphere or bar. Water can exist in soil under a tension varying from pF = 0 (no tension) to pF = 7.0 (high tension).

1- The point at which water is held in soil after excess water has drained out by gravity is called field capacity (pF = 2.54).

2- The point at which water is held in soil at a force that plants cannot extract at a sufficient rate to maintain growth, is known as wilting point (pF = 4.2). At this point the plants start to wilt.

3- The amount of water between field capacity and wilting point is called available water. Water in air dry soil is held with a tension of pF 6.0.

Procedure

$$Moisture\%(Ovendrybase) = \frac{Mw}{Ms} * 100$$

1. Weigh accurately a metal can with lid (W1).

2. Place 50 g of soil in the can and weigh accurately along with the lid (W2).

3. Place the can in a drying oven at 105°C until constant weight.

4. Remove the can from the oven, cover it tightly with the lid, and place in a desiccator to cool.

5. After cooling, weigh the can accurately with the oven-dry soil in it. Record the weight (W3).

6. Compute percent moisture content on oven-dry basis.

Example1:

Wet weight of a soil sample with can is 210 g and dry soil with can is 180 g, weight of empty can is 40 g, calculated percent of water content for sample.

Solution:

Moisture content (%) = (Mw / Ms) * 100 = (30 / 140) * 100 = 21.4 %

Mw= (Wet weight of soil sample with can) – (dry weight of sample with can)

= (210 – 180) = = 30 g

Ms = (Dry weight of sample with can – weight of empty can)

=180 – 40 =140 g