CE - 422

Experiment 2
Soil Suction Measurement with Tensiometer

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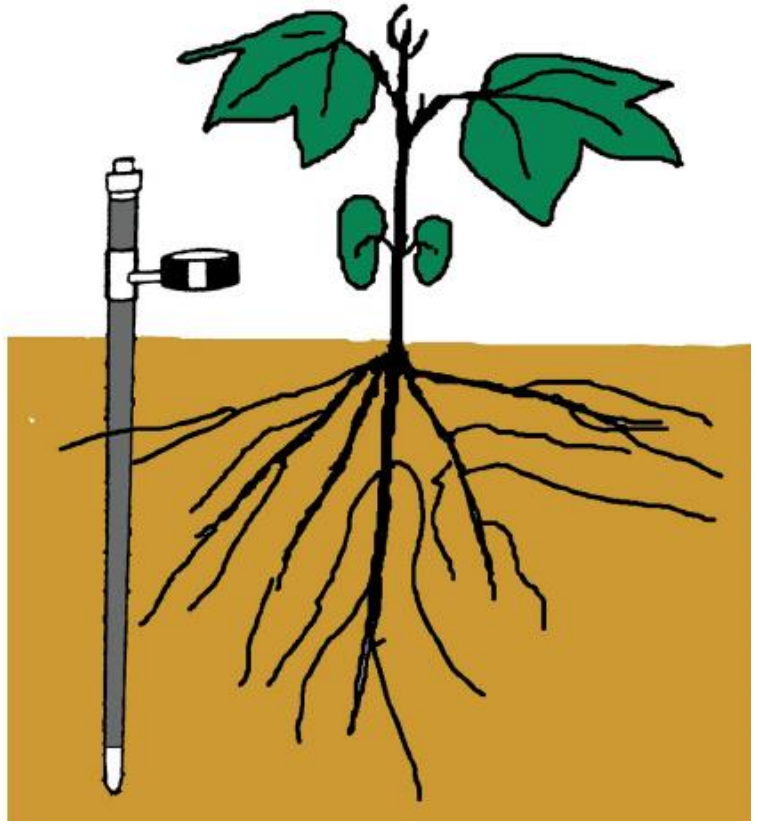
Experiment 2
Soil Suction Measurement with Tensiometer

Soil suction measurement with tensiometer at various time intervals is an indirect mean of measuring soil moisture in the soil.

O b j e c t i v e

1) Use of tensiometer to measure soil moisture tension.
2) Measure the moisture content of the soil by weight.
3) Plot the soil moisture characteristic curve (moisture content vs. suction).

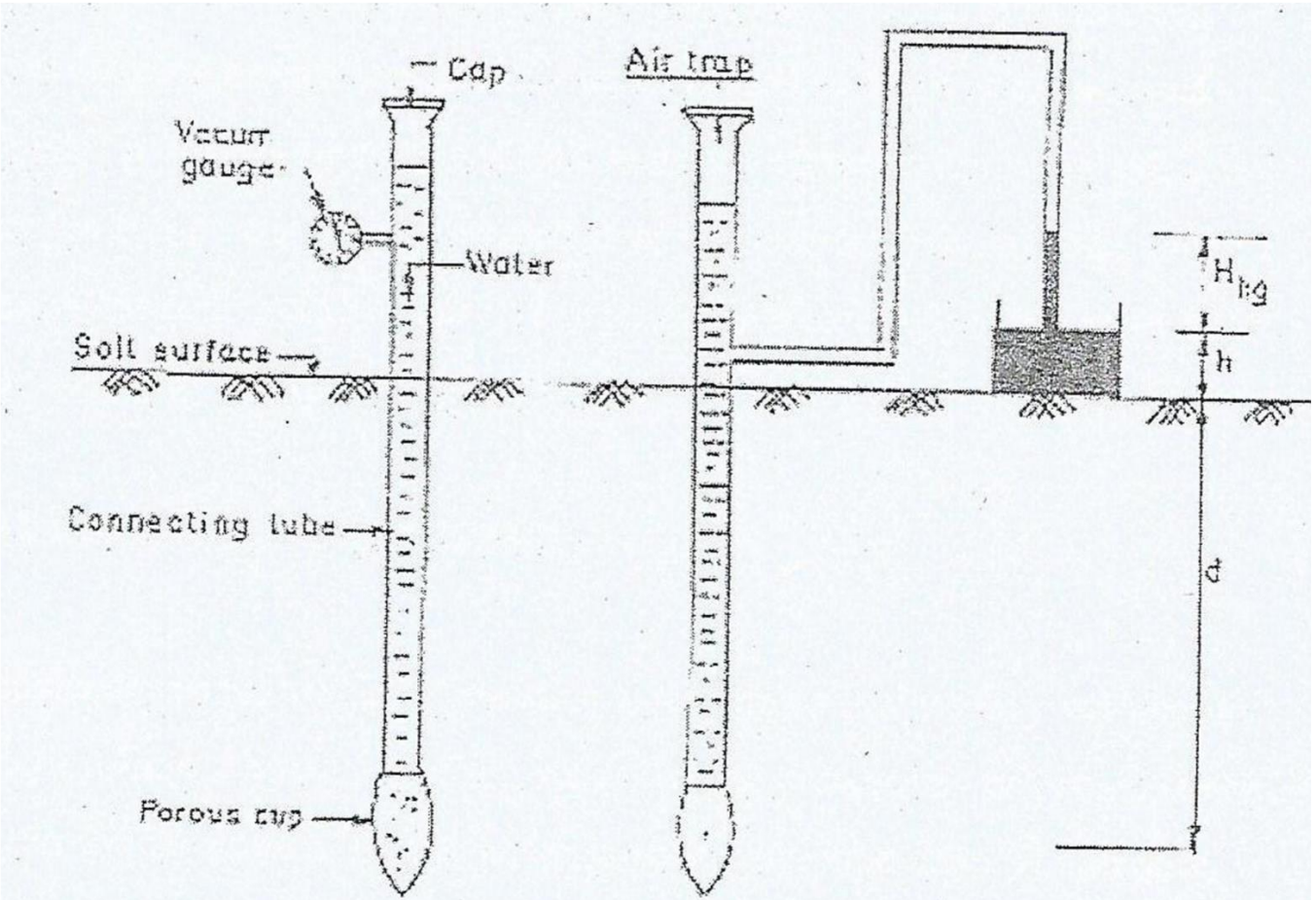


Soil Suction

In unsaturated soils, water is held in the soil matrix under negative pressure due to attraction of the soil matrix for water. Instead of referring to this negative pressure the water is said to be subjected to a tension exerted by the soil matrix. The tension with which the water is held in unsaturated soil is termed as soil-moisture suction or soil-moisture tension.

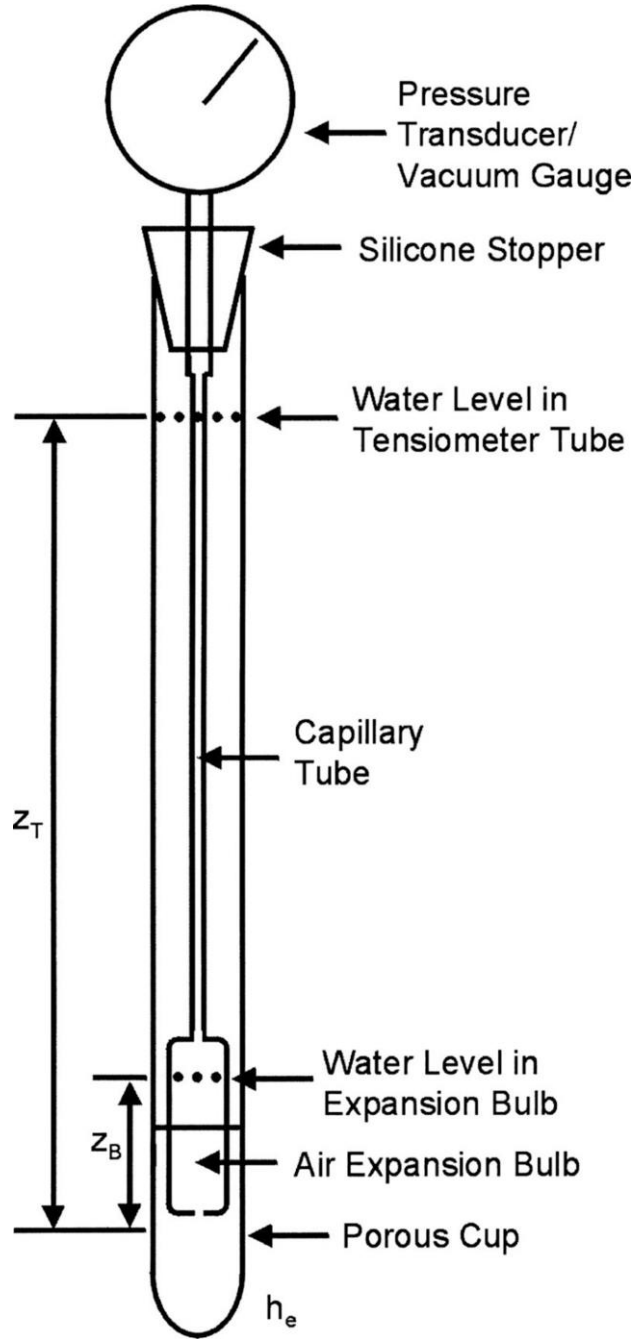
Tensiometer

The tensiometer is a mechanical device for measuring soil- water tension in the field. The essential parts of a tensiometer consist of the porous cup with a reservoir of water inside, the connecting tube, and the sensing element of a vacuum gauge or a mercury manometer. The figure below shows the essential parts of a tensiometer.



(a) Vacuum gauge type

(b) Mercury manometer type


Pressure
Transducer/
Vacuum Gauge
Silicone Stopper
Water Level in
Tensiometer Tube
Capillary
Tube
z_T
Water Level in
Expansion Bulb
z_B
Air Expansion Bulb
Porous Cup
h_e

Function of Tensiomete

- A porous ceramic cup is positioned in the soil where information regarding soil water is desired. The cup, the connecting tube, and the sensing element of a vacuum indicator are all filled with water. Water in the soil near the cup is in hydraulic contact with bulk water inside the cup through pores in the cup wall. Flow, in or out through the cup wall, tends to bring the cup water into hydraulic equilibrium with the soil water.

- As water moves out of the cup because of the suction in the soil water, the vacuum created in the cup is registered on the gauge. Conversely an increase of water will lower the tension, water will move into the cup, and the gauge will read less tension. Fluctuations of soil moisture are registered by the tensiometer, as long as tension does not exceed 0.8 atm. As soil water is depleted by root extraction, or replenished by rainfall or irrigation, corresponding changes in readings on the tensiometer gauges occur.

Limitation of Tensiometer

Tensiometer does have a definite limitation in the range of values they can measure. The practical limit is about 0.8 atm. At this pressure air enters the closed system through the pores of the cup and makes the unit inoperative. The air entry or bubbling pressure of the ceramic cup limits this range.

Scope of the test

Tensiometer readings plotted as a function of time provide a useful record of soil water conditions in the neighborhood of the cup. They do not provide direct information on the amount of water held in the soil. Tension measurements are useful in deciding when to irrigate, but they do not indicate how much water should be applied. A special curve named soil moisture characteristic curve (Moisture Content Vs. soil suction curve), plotted from tensiometer readings is an indirect measure of soil moisture content. The tensiometer readings are also very useful in determining the use rate of applied water.

Procedure

1) For field installation, a hole is made in the soil using an auger of diameter larger than the porous ceramic tube. Insert the porous ceramic tube part in the hole and refill the hole with the material excavated. The soil surrounding the tensiometer ceramic tube should be refilled and compacted well to ensure good contact.
2) When suction equilibrium has been reached, take the necessary measurements. For the laboratory set-up, take tensiometer reading 1 day after installation.
3) Take soil samples from the depth where tensiometer was installed. Determine the weight of the soil.
4) Put the soil sample in an oven at about 110°C and allow the water to evaporate. The evaporation process at least takes 24 hours. Determine the weight of the dry soil and the weight of water.

Stage 1 - Preparation

1 atm=76cm of Hg= 101.325 KPa

Serial No.	Weight of can (gm)	Weight of wet soil + can (gm)	Weight of dry soil+can (gm)	Moisture content (%)	Soil suction (cm of Hg)	Soil Suction (atm)	Soil Suction (centibar)

Qualitative Curves