

Indirect Methods of Soil Moisture Determination
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Indirect Methods: These methods not directly determined the soil moisture. On the basis of other properties, soil moisture is determined. These methods are relatively quick and accurate.

1. **Tensiometric method :** Tensiometer is also called irrometer, used in irrigation scheduling. It provide a direct measure of tenacity (tension) with which water is held by soil. It estimates the soil –water matric potential which includes adsorption and capillary effects. The working Principle of tensiometer is that when a sealed water-filled tube is placed in contact with the soil through a permeable and saturated porous material, the water (inside the tube) comes into equilibrium with the soil solution. Hence, the soil water matric potential is equivalent to the vacuum or suction created inside the tube. Tensiometer consists of a sealed water filled plastic tube with a ceramic cup at one end and a negative pressure gauge at the other. Typically measurement range is 0 to 0.80 bars. The vaccume gauge is graduated to indicate tension values upto one atm and is divided into 50 divisions each of 0.2 atm. It is calibrated in centibars or 1/100 of one bar. (Bar is an international unit of pressure in metric system = 14.5 Psi or 0.987 atm.). One centibar is equal to 1 kilopaskal (kPa).

Insert the tensiometer and gently push it down to the desired depth. Instrument is ready to use 24 hrs after installation. Readings should be taken early in the morning. A reading of zero corresponds to a completely saturated condition. A reading of 85 cb indicates a very dry condition.

Meaning of tensiometer reading

(1) 0-5 cb - Saturated soil (2) 10 cb - Field capacity (3) 10-25 cb - Ideal soil water and aeration (4) 25-85 cb - Decreased soil water availability

Irrigation scheduling for different soils

(1) Clay & Clay loam textured - 50 cb (2) Fine sand textured and sandy duplex - 30-40 cb (3) Coarse sand textured - 20-30 cb

2. Pressure plate technique : This is a laboratory method. The Pressure plate and Pressure membrane apparatus measures the uptake and release from soil samples over a wide range of suction values.

3. Electrical Resistance method : It works on the Principal based on the linear relationship between the electrical resistance and moisture content of soil. Electrical resistance increases with decrease in moisture content. The resistance blocks are made of gypsum. The electrodes in the blocks are connected to a conductance-meter for measuring the electrical resistance or conductance. The blocks are buried at an appropriate depth at a certain distance. After sometime equilibrium is reached. As the soil moisture increases or decreases, the water content of block also increases or decreases. Higher the water content, higher is the conductivity. Resistance blocks read low resistance (400 to 600 ohms) at field capacity (FC) and high resistance (50,000 to 75,000 ohms) at permanent wilting point (PWP). Associated soil water content must be obtained from a calibration curve.

4. Neutron Probe Moisture Meter:

A neutron probe moisture meter is a sophisticated and accurate equipment that measures the moisture content in soil. It requires calibration and operation by a licensed operator. The neutron probe comprises of (1) a nuclear unit, suspended on a cable, which is both a neutron source and detector (2) a housing containing the electronic receptors (3) a shield for safe transportation of the radioactive device.

The nuclear unit is lowered down a stopped aluminium access tube to set depth intervals. The neutron source starts scattering fast neutrons, which are deflected by hydrogen, most commonly water, and are slowed. The source also

detects and counts the returning slow neutrons. The amount of deflection is directly related to the soil moisture in the soil.

Limitations: Because of their high cost and the need for a licensed operator, neutron probes are usually only bought by large organisations or consultants running a service for smaller operators. The sphere of influence is related to the moisture content of the soil, with the neutron probe having a greater sphere of influence in drier soil. However, despite this, the neutron probe's sphere of influence is generally greater than other systems regardless of soil moisture content.

Advantages:

- (1) Accurate in determining soil moisture
- (2) Large sphere of influence
- (3) Not affected by temperature, soil type or pH
- (4) Measurements are interpreted by the contractor and provided to you
- (5) Access tubes installed with minimal soil disturbance
- (6) Trained consultant does readings for you
- (7) Reports and advice given by an irrigation consultant who is familiar with your property.

Disadvantages:

- (1) Costs of service and set-up on-farm
- (2) Licenses required to take readings (radioactive source), hence you are unable to take a reading at will
- (3) Clear access to property and sites required at all times
- (4) Access tubes may become compacted
- (5) Slight delay in receiving readings/reports.

Other Methods: Heat dissipation sensors, heat capacity sensors, soil psychrometers and remote sensing methods are also used to determine soil moisture.