SNS COLLEGE OF TECHNOLOGY

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DEPARTMENT OF AGRICULTURE ENGINEERING

COURSE CODE & NAME: 19AGT401 & POST HARVEST ENGINEERING

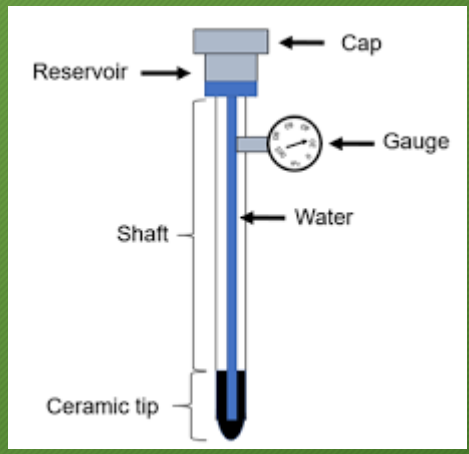
IV YEAR / VII SEMESTER

UNIT 1 : THRESHING, MOISTURE MEASUREMENT AND PHYSICAL PROPERTIES OF AGRICULTURAL PRODUCES

TOPIC 1 : TENSIOMETER

INTRODUCTION

- A tensiometer is a tool for monitoring soil moisture conditions in agriculture. Tensiometers can be easily read by irrigators in the field and operate without electricity.
- Tensiometers measure soil moisture in units of negative pressure, also known as tension.
- Tension is a measure of the force that plant roots must exert to pull water from soil pores.
- Large pores (macropores) hold water with less force than small pores (micropores).
- As plants extract moisture from the soil, water is first taken from the largest pores. As the soil dries, more force is required to pull water from smaller pores.
- High tension values mean that the soil is becoming dry, the plant experiences more water stress and growth slows.



WORKING PRINCIPLE

- Tensiometers are filled with water (preferably distilled) that has been de-gassed by boiling.
- A key component of the tensiometer is a porous ceramic tip which allows water in the shaft of the tensiometer to freely pass into the soil without air moving through the small pores in the tip.
- If the soil is not saturated, water will move from inside the tip to the unfilled soil pores. Because air cannot replace the space vacated by the exiting water, a vacuum (tension) develops in the tensiometer that can be measured with an accurate gauge.
- Water stops moving from inside the tensiometer to the soil when the internal vacuum pressure of the tensiometer equals the soil tension, or the force needed to pull water from the soil pores.

- The vacuum gauge measures tension in units of kilopascals (kPa) or centibars (cbars), which are equivalent (1kPa = 1 cbar).
- [A vacuum gauge may also display units of mmHg (millimeters of mercury). It is important to confirm which values are observed on the gauge (1 cbar = 7.5 mmHg).]
- Tensiometer readings are not affected by variations in soil texture, temperature or salinity.
- However, these factors can influence plants' ability to take up sufficient water and must be considered alongside the tensiometer reading. Note: Soil water tension indicates when to irrigate, but not how much water to apply.

WHERE TO INSTALL A TENSIOMETER

- Tensiometers should be placed in the field at several locations and preferably include the top, middle, and bottom regions of the field.
- A good thumb rule is to install the tensiometers in the plant row where roots are concentrated and taking up the most water.
- In drip-irrigated fields, place the tensiometer slightly inside the plant row, nearer to the wetting zone but not immediately beneath the drip tape.
- In sprinkler-irrigated fields, place the tensiometers within the sprinkler wetted pattern. At each location, install tensiometers at two or more depths.
- The shallowest depth should be a third to a half of the depth of the effective root zone. The second depth should be just below or at the effective rooting depth for the crop.
- For example, tensiometers installed at a 6- and 12-inch depth for strawberries allows for moisture monitoring in the active root zone and below the primary rooting zone.

PREPARATION BEFORE USE

1.Fill the tube and reservoir with clean water completely.

2.Place the tensiometer in a bucket of water for several hours to allow any air to rise to the surface. Then unscrew the reservoir cap to allow it to escape.

3.Alternatively, with a ceramic tip totally submerged, use a vacuum pump (service unit) to remove the air to ensure maximum accuracy.

4.Top up the reservoir with more water if needed.

5.Screw on the reservoir cap.

6. To prevent any air from entering the tensiometer,

keep the ceramic tip immersed in a bucket of water

or wrapped in a wet rag

PLACE SELECTION AND INSTALLATION

- It is important to find a suitable monitoring site before installation.
- The number of monitoring sites depends on the amount of variation in your orchard.
- There may be different types of soil, tree ages, irrigation delivery rates, and so on.
- Within each section, select the monitoring site that best represents the entire section.
- Mark the required depths on a solid bar and make a hole in the ground.
- The hole should be a similar diameter to the tensiometer. Otherwise, it will be time-consuming to fill the surrounding area with soil and your readings may not be accurate.

1. Add loose soil and water to the bottom of each hole.
2. Insert the tensiometer and ensure adequate contact between its tip and the soil.
3. Never push on the gauge. To insert the tensiometer into the hole, you can press on the reservoir cap.
4. Fill the hole with loose soil. Make a slight mound of soil around the tensiometer to prevent surface water from flowing down the outside of the tube to the tip which can lead to false readings.
5. The distance between tensiometers should be 25 cm.

- Wait 12 hours before taking initial readings.
- Use a tensiometer higher to the surface for irrigation triggering.
- A few days later the air may appear in the tube. Use a service unit (vacuum pump) to remove any air bubbles and refill with water if required.
- Once settled, the readings should rise with dry weather and fall again with irrigation or rainfall.
- If the tensiometer is always losing its vacuum and there's no end to the air bubbles when you use a vacuum pump, then it's possible that the soil is too dry or there are air gaps between the instrument and the soil.
- It may also mean that the soil is too sandy for the use of tensiometers.

THANK YOU

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