IN THE NAME OF GOD

Tensiometer: AB Bank model

ANDISHAB CO.
Register number: 10971
Made in Iran

A good irrigation program applies enough water to replenish the soil supply taken up by plant roots or lost by evaporation from the soil surface. A carefully planned program will also conserve water and reduce the potential for leaching of nitrates and pesticides into groundwater supplies. Tensiometers are a useful tool to schedule irrigation. Tensiometers are devices that sense soil moisture and allow us to measure the moisture that is available to plants. They provide useful information for planning irrigation and managing soil moisture levels to best advantage to maintain healthy turf and landscape plants. A tensiometer is basically a fluid filled plastic tube with a porous ceramic tip on one end with a vacuum gauge on the other. Tensiometers range in size from 30 cm for those used for shallow rooted crops to more than 60-90 cm for those utilized for large trees. Typically six or twelve inch tensiometers are used for vegetable production.

Tensiometer Components

A tensiometer consists of a porous cup connected through a rigid body tube to a vacuum gauge with all components filled with water. The porous cup is normally constructed of ceramic because of its structural strength as well as permeability to water flow. Figure 1 illustrates the components of one model of a commercially available tensiometer using a vacuum gauge. Figure 2 illustrates the dial face of a typical tensiometer vacuum gauge. Division are in units of centibars (cb), with a range 0-100 cb.

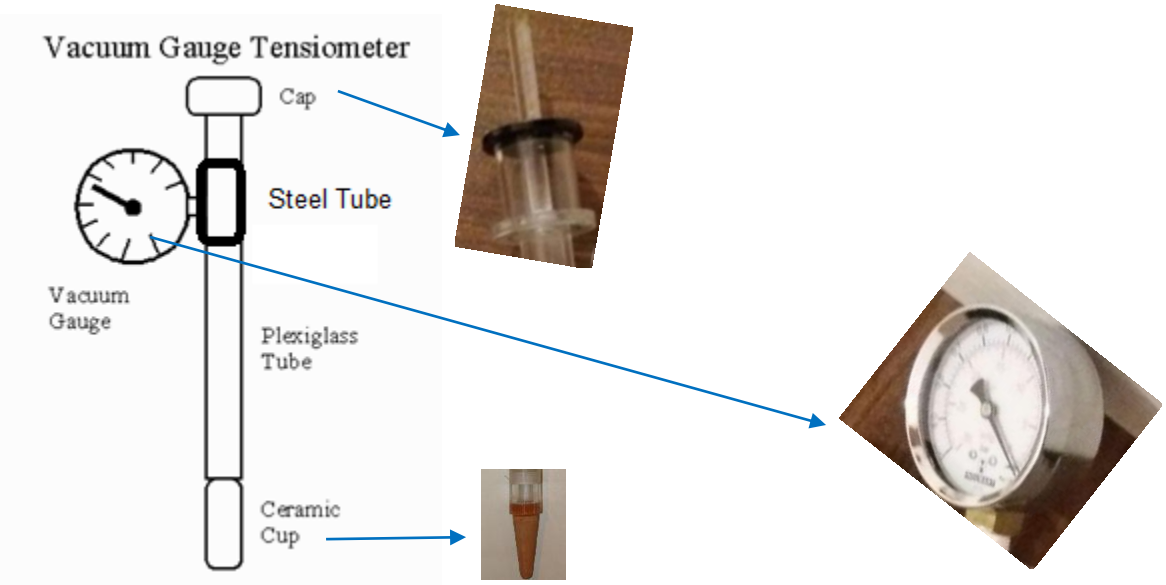


Fig 1. Tensiometer components.

Fig 2. Typically vacuum gauge dial face with graguations in centibars.

Cautions and Warning

1-Be sure to protect the porous ceramic cup from any oil, grease or other materials that will clog prores.

2-when tensiometer is not in use, empty all waters from tube body. Do not permit prolonged evaporation from the porous ceramic surface. Water solution deposits on the ceramic surface that can be removed by sanding with medium grade sandpaper.
3- Avoid exposing tensiometer to freezing conditions.
4-Befor using, besure to saturate the porous ceramic. Water can flow through the pores but the water film at each pore acts like a thin rubber diagram and will not let air pass, throughout the working range of the tensiometer.

Site selection and installation instructions

The instrument must be placed in the active root zone of the crop or plants for which irrigation is being scheduled. If the site contains more than one type of soil and the soils have different water-holding characteristics, several tensiometers may be necessary to adequately access the water status. For small sites or those with uniform soils, just one tensiometer may be adequate. The location selected for the tensiometer should be representative of the general condition. Place the tensiometer where it will receive the amount of rainfall or irrigation typical of the area. Tensiometer readings are not affected by salts in the soil or by irrigation with brackish or effluent water. For turf, groundcovers, or bedding plants, place the tensiometer in the center of the root zone but at least 4–6 inches below the surface.

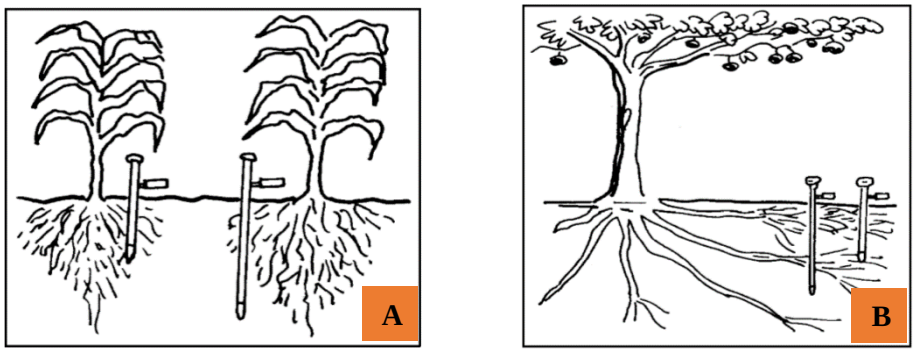


Fig1. Tensiometer placement in for row (A) and tree (B) crop productions.

Tensiometers must be installed correctly. The instrument must have good contact with the surrounding soil. Before field installation, test each tensiometer to verify that it is operating correctly. Fill the unit with clean water and allow it to stand in a vertical position for at least 30 minutes so the ceramic tip becomes saturated. Deionized water is preferred for use in tensiometers to help prevent growth of algae and bacteria in the tube. Water treatment compounds and dyes are also available from tensiometer manufacturers. The dyes make it easier to observe the water level in the tube. A plastic squeeze bottle with a small outlet tube is useful for filling tensiometers. When the tip is thoroughly wet, refill the tube and use the vacuum pump to remove air bubbles in the gauge. Refill again and cap the instrument for installation. After installation, several hours will be required for the tensiometer to come to equilibrium with soil moisture and provide accurate readings.

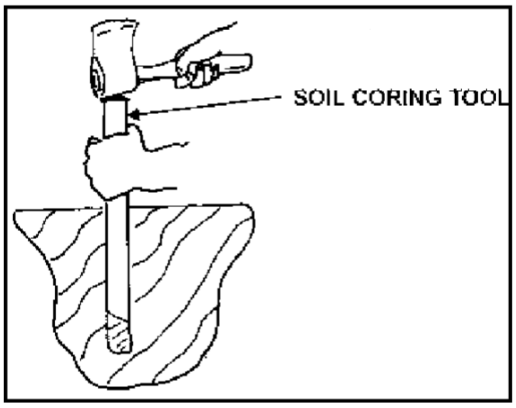


Fig 2. Installation procedure for heavy soils, using a commerically available soil coring tool.

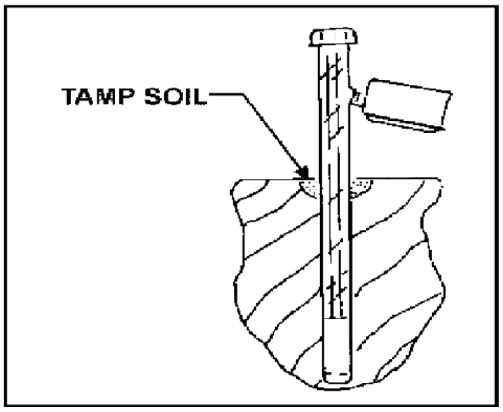
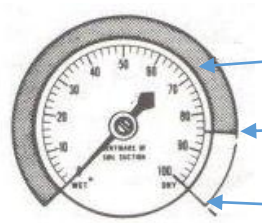


Fig 3. A properly placed tensiometer in field.

Effects of Altitude on Operation of Tensiometer

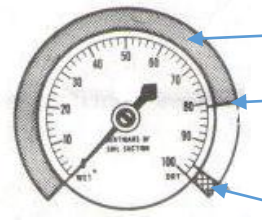


Practical reading range
0 to 85 centibar

In this range air coming out of solution makes reading inccurate

Theoretical limit of reading

At Sea Level

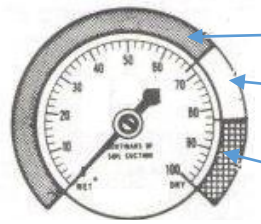


Practical reading range
0 to 81 centibar

In this range air coming out of solution makes reading inccurate

In this range water breaks into a vapor causing unit to lose all of its water

At 300 m above Sea Level



Practical reading range
0 to 68 centibar

In this range air coming out of solution makes reading inccurate

In this range water breaks into a vapor causing unit to lose all of its water

At 1500 m above Sea Level

Note: The reading range is reduced approximately 3.5 centibars for each 300 meter increase in elevation.

Scheduling irrigation with tensiometers

Tensiometers give a continuous indication of soil water status. This information must be calibrated to the landscape. Tensiometers do not indicate how much water should be applied. This decision must be made by the landscape manager.

The decision to irrigate is made when the average tensiometer reading exceeds a given critical value. The specific critical value depends on soil type, the plants involved, the plant quality desired, and the budget. To determine the critical value for the specific location, calibrate the tensiometer reading in relation to drought stress symptoms. Irrigate the site well, then shut off the irrigation system, disabling the automatic timers, and leave it off until the soil is dry enough that the plants show moisture stress. Look for drought symptoms on the turf or plants in the landscape where the tensiometers are located. Turfgrasses will show a dull green or grayish color. Footprints and tire marks will also be visible for some time after they are made, because the leaf blades are losing turgor. Note the reading on the tensiometer when the symptoms first become visible. The critical value for irrigation for the landscape is before the point when drought symptoms were observed. For instance, if the drought symptoms appear when the tensiometer reading is 60 centibars, water should be applied when the reading is 50 or 55 centibars. The amount of water to be applied must be determined by the manager based on the irrigation system and the soil's infiltration characteristics. The application rate and coverage of the irrigation system should be determined. Check water penetration by operating the system and observing the depth of water penetration by coring or digging a hole. The amount of irrigation water applied should be adequate to restore only the root zone to field capacity. Excess water will be lost as it percolates beyond the root zone, carrying plant nutrients with it.

Automating tensiometers

Tensiometers are available that can switch on an irrigation system when the gauge reaches a preset reading. The irrigation system will operate for a preset period of time. The tensiometer reading will change as the water from the irrigation cycle percolates into the root zone and moves into the tensiometer, reducing the pressure reading. The irrigation system will not run again until the gauge reaches the presetcritical value.

Summary

Tensiometers are delicate instruments that must be handled, installed, and maintained correctly. By using the information tensiometers provide about the soil water status and observing the plants under management, we can become more knowledgable about the water holding characteristics of the soil and the water needs of the plants. Used properly, tensiometers can help us avoid plant drought stress and meet plant water needs without wasting irrigation water supplies.

IN THE NAME OF GOD

Tensiometer: AB Bank model

Contact us:

eMail

info@andishab.com or ghorbani169@yahoo.com

Tel:

+98-17-33550891 Mobile: +98-912-622-9332