



## Tensiometer use in Pakistan

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### Introduction

Tensiometer is a device to measure the soil moisture content. Tensiometer is a sealed pipe filled with water. The Tensiometer has a ceramic tip on one end and a vacuum gauge on the other. As the soil dries it pulls the water out of the tensiometer through the ceramic tip. As it pulls out the water it creates a vacuum in the pipe. The vacuum is measured by the gauge. The dryer the soil the higher the vacuum gauge reading. During irrigation or rainfall the water from the soil enters into the tube and reduces the vacuum.

### Pre installation preparation

Fill the tensiometer with clean water, put it in a bucket with filled with a small amount of water that covers the tip, leave the cap off and allow it to drain overnight. This will saturate the tip.

Does not touch the tip as natural oil from the hands can block the tip; use a clean cloth or gloves when handling the tip. Make sure the tip is securely screwing into the tensiometer to avoid air leaks.

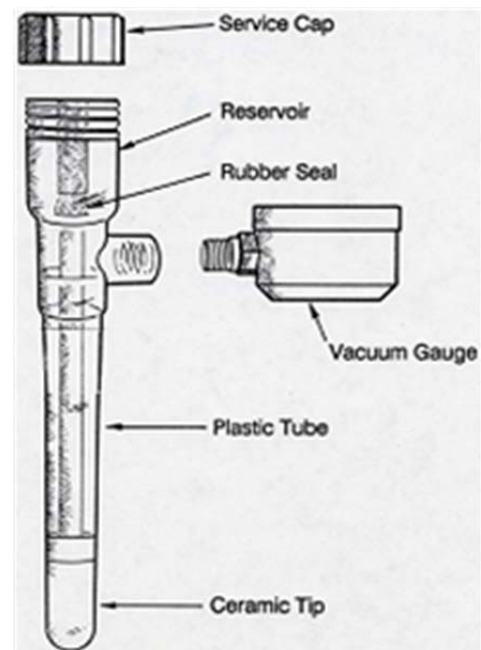
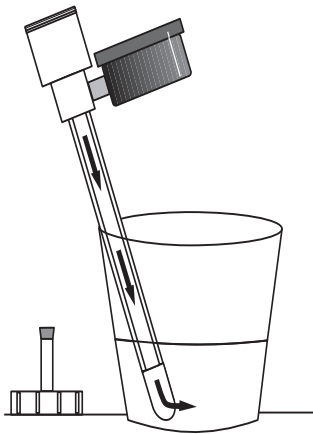


Figure 1: Components of a tensiometer



**Figure 2: Preparing a tensiometer in a bucket of water**

### **Prepare a solution made up of**

- 1 litre of water (clean rain or deionised water boiled and allowed to cool).
- A few drops of food dye, green is commonly used.
- Three to four drops of floor chlorine based bleach

Store this mixture in a labelled bottle. This mixture can be used to fill tensiometers, or top them up when required.

Whilst the ceramic tip is immersed in water use a vacuum pump to remove any trapped air in the gauge after the tensiometer has been filled. If you do not have a vacuum pump, place the tensiometer in an empty bucket of water and allow it to dry out to about 70 centibars.

### **Tensiometer testing**

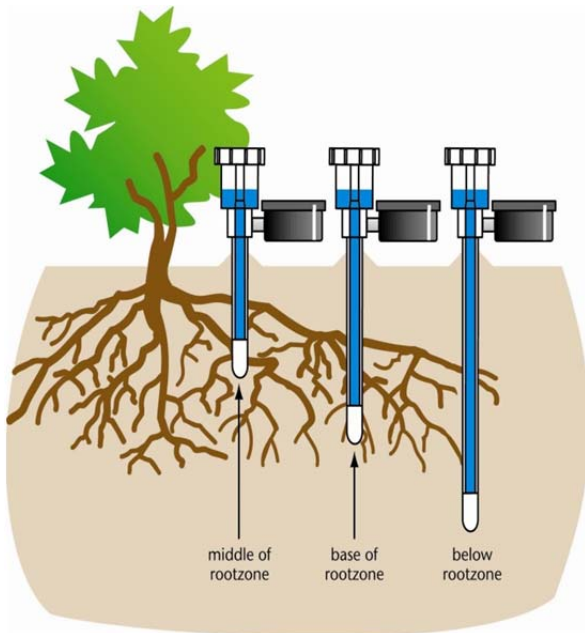
To test the tensiometer, leave it out of the water for a couple of hours. The reading on the gauge should rise. Place the tensiometer back into the bucket of water. The reading on the gauge should drop within 5 to 10 min.

### **Site selection and installation depth**

When locating the site to install tensiometers the following points need to be considered:

- Tensiometers should be installed in the active root zone. Active roots are located where water and fertiliser are applied to the soil. It is best to dig a number of pits about 80 to 100cm in depth around and under trees to identify where the majority of roots
- Common tensiometer sizes are 30, 60 and 90 cm and most are installed at those depths to indicate the middle of the root zone, base of the root zone and below the root zone. However if the soil pits indicate a shallower root system, then the tensiometer depths need to be adjusted accordingly.

- For furrow irrigation, locate the site about half to two thirds the way down the row and on the edge of the furrow on the tree side
- For drip irrigation place 5-10cm from the drip emitter.
- For low level sprinkler systems, place the tensiometer about half way between an emitter and the edge of the wetted area.
- Young trees - within the active root zone. A tensiometer installed on a slant can allow the tip to be placed in the active root zone of the tree.
- Covering Tensiometers helps to prevent frost and physical damage and reduces algal growth in them. An upturned bucket is a suitable cover.



**Figure 3: Install tensiometers at the top, middle and bottom of the rootzone**

## Installation

There are two options for installation. One is a tight fitting method and the other is a backfilling method

### Tight fitting method

Make a 25mm hole that is 10cm shorter than the tensiometer to be installed. Make a 19mm hole for the remaining 10cm. These holes can be made with an auger or hammering a pipe of the correct diameter (hammer pipe). Push the tensiometer firmly into the hole. There will be very narrow gap (1mm) between the tensiometer and soil. Disturb the top 5-10 cm of soil around the tensiometer and repack the loose soil by hand around the tensiometer to make a good seal. .

### Backfilling method

This method requires an auger at least 8cm wide. This auger might be more readily available than the 25mm and 19mm augers or hammer pipes used in the previous method. Auger the hole to the required depth. As you auger ensure you place the removed soil aside in a line so the soil can be placed back into the hole in the correct order (i.e. deep soil placed back first and top soil last). Put a few handfuls of soil back into the hole. If the soil is too dry place a small amount of water in the hole to moisten the soil, but not too much water to make it into slurry. Pat down the soil with a stick

about 20mm in diameter. Pat it down enough so it is firm, but not too hard. Pour more water in the hole and let it soak for a few minutes. Push the tensiometer ceramic tip into the packed down soil. If you packed down the soil too hard you will not be able to push the tensiometer into the soil. If the soil is not packed down enough the tensiometer tip will be loose. Both situations will require you to exhume the soil with the auger and pack it down again. Back fill the soil around the auger with the crumbled soil and after every couple of handfuls push the soil down with a narrow stick about 5-7mm in diameter (acacia stick or water sprout) pour a little.

## Maintenance

Every couple of weeks loosen or remove the cap to allow any air bubbles to escape and to allow water to fill the tensiometer tube. A length of 3mm tube (drinking straw) or a vacuum pump can be used to dislodge any air bubbles. Top up the reservoir if necessary.

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