HortFact--7003
UK COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY — COLLEGE OF AGRICULTURE
Horticulture Department

Tensiometer Installation

Timothy Coolong[1] and Susmitha Surendran[2]
[1]*Assistant Professor Vegetable Crops,* [2]*Post Doctoral Associate Horticulture*

Tensiometers are a useful tool to schedule irrigation. 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 just a few inches for those used for shallow rooted crops to more than two feet for those utilized for large trees. Typically six or twelve inch tensiometers are used for vegetable production.

(Left)Tensiometers ranging in size from six to eighteen inches, (Right) the vacuum gauge on a tensiometer reads in units of centibars

Tensiometers, though very effective on coarse textured soils, can experience cavitation when soil moisture tensions reach 85 centibars, rendering them ineffective on fine textured soils. Tensiometers are very accurate. Because they directly measure soil tension, unlike other soil moisture sensors, they do not require site specific calibration. However, the accuracy and utility of tensiometers are often compromised by improper installation. Many vegetables are shallow rooted, particularly when they are grown in raised beds with black plastic mulch. Tensiometers may be placed too deep, out of the effective root zones of crops. For most vegetables it is recommended that growers use at least one tensiometer placed at a depth of six inches about midway from the center of a bed. Do not place tensiometers right next to a drip irrigation line. When they are placed too close to an irrigation line they will read wet when only a small portion of the bed volume has actually been wetted leading to drought stressed plants. Also, do not place tensiometers right next to a plant. Plant roots will readily draw water from the tensiometer leading to artificially dry readings. It is preferred to use two tensiometers, one at six inches and another at twelve. Although irrigations are generally scheduled based off the tensiometer at a depth of six inches, the tensiometer at twelve inches can serve as a valuable indicator of when the soil moisture deficit is severe or when the ground has been over irrigated, evidenced by a consistently (low) wet reading.

Placement of a tensiometer in a raised bed

Tools for tensiometer preparation: Water with dye, suction device, and field flag

To prepare tensiometers first make sure they are clean and free of debris from the previous season. Then fill the tensiometer with water. Often a green dye is used with the water to make it easier to see in the field. Sometimes a used detergent bottle will make filling the tensiometer easier as you can decrease the presence of air bubbles. After filling, the air bubbles must be removed. You can purchase a small hand pump that can be used to pull any air bubbles out of the water in the tensiometer. Some growers use a metal flag to agitate the water in the tensiometer releasing air bubbles. Both methods work, though the suction method when used with a bucket of clean water seems to be faster. In addition, the suction pump has several other uses in tensiometer installation and may be a worthwhile investment. After air is removed allow the tensiometer to sit in water for a short period of time to ensure the ceramic tip is fully wetted.

Carry tensiometers out to the field in a bucket of water. If they are allowed to sit out in the air for extended periods of time they will begin to lose water through the ceramic tip. This can lead to cavitation or breaking the water column in the tensiometer, which will lead to the presence of bubbles and inaccurate readings. Once out in the field, make a hole in your desired location using a soil probe. Use a probe with a similar diameter as the tensiometer as it will allow for a tighter seal. Once a proper hole is made, fill it with water and then firmly push the tensiometer into place. Soil or mud can then be packed around the tensiometer. If the tensiometer does not form tight seal with the surrounding soil the

Making a hole with a soil probe, filling with water to form a slurry, and pulling suction on the inserted tensiometer make for a tight seal and accurate measurements.

readings will be incorrect. If the tensiometer is loose in the soil water can evaporate from the ceramic tip due to airspaces leading to a drier reading on the tensiometer that is not reflective of the greater soil environment. Once in place you can pull suction on the tensiometer to draw in water from the soil. This will also remove any additional bubbles in the tensiometer.

Tensiometers will not read accurately when air gaps are present.

During the growing season make sure the tensiometer is filled with water. Every two or three weeks add water to the filling cup, particularly if it has been dry. When a tensiometer loses water below the level of the gauge it will not read accurately. Also, if you notice your tensioimeter has been reading zero, despite being dry, it is likely that the soil dried enough to cause cavitation of the water column in the tensiometer. At tensions above 85 centibars the water column will typically snap. If this happens add more solution to the tensiometer, making sure to remove bubbles and reset it. Be sure to remove tensiometers in the fall prior to a hard freeze otherwise they will crack.

The readings from a tensiometer should not be the only factor taken into consideration when making irrigation decisions. The stage of crop development, need to fertigate, and weather conditions will all affect irrigation management decisions. However, as a general

rule irrigations can be initiated for plants such as tomatoes when tensiometers read about 15 centibars in sands and approximately 45 centibars for a loam soil. Typically irrigation is stopped when tensiometers read 0-5 centibars on a sandy soil or approximately10 centibars on a loam. Stopping irrigation before the tension reaches 0 will help prevent over watering. Tensiometers are not recommended for finer textrured soils such as clays because of the higher water holding capacities of these soils. A clay soil will bind water so effectively that tensions can often reach levels greater than 85 centibars with sufficient plant available water present. Though not without limitations, tensiometers can be a useful tool for growers trying to properly manage irrigation.

 Issued: 5/2011; Revised: