Tensiometer – *Job Sheet*

Natural Resources Conservation Service (NRCS) **September 2009**

GENERAL

Tensiometers are comprised of a water filled tube which is sealed at one end, with a porous ceramic filter at the other end. When buried in soil, tensiometers will allow water to flow freely through it, but not air. The suction of the water within the tube provides a direct measure of the suction at which water is being held in the surrounding soil and therefore the suction plant roots need to exert in order to extract water. Tensiometers measure the energy status (or potential) of soil water in centibars (cb). That measurement is very useful because it is directly related to the ability of plants to extract water from soil. The higher the reading, the dryer the soil. A reading of 0 cb indicates that the soil is saturated and plant roots may suffer from lack of oxygen.

In sandy soil, a desirable range for crop growth would be 10 cb to 20 cb. Extremely dry soil could have readings in excess of 60 cb.

LOCATION

The sites selected for installation should be representative of the surrounding field conditions. Isolated low, wet areas or high, dry areas should be avoided. Tensiometers should be placed within the plant canopy in positions where they will receive typical amounts of rainfall and irrigation. In a citrus grove, for example, locate the tensiometer under the tree canopy, in line with the tree row, in a location where it will be within the emitter's spray pattern, since water will not move horizontally very far in the soil. For patterns with individual streams, turn the emitter so that a stream hits the tensiometer.

Placement of tensiometers with depth is critical. For shallow-rooted (less than 12 inches) crops, only one tensiometer may be required. It should be centered in the crop root zone, but at least 4-6 inches below the surface.

For deeper rooted crops, such as a citrus, two tensiometers should be used. The shallower one should be placed in the zone of maximum root concentration. This is normally at 6 inches or about one-third of the active rooting depth. The deeper tensiometer, installed in the lower part of the active rooting depth, for example at 18 inches, can be an indicator of under or over irrigation. Other depth combinations may be used where appropriate.

If site conditions vary considerably, use more than one set of tensiometers.

PREPARATION AND INSTALLATION

The tensiometer can be a useful instrument for irrigation scheduling only if it is properly installed. In general, proper installation requires that the instruments be in good hydraulic contact with the surrounding soil so that water can move into and away from them as efficiently as possible.

Before field installation, each tensiometer should be tested to verify that it is operating properly.

Soak the ceramic tip over-night in distilled water that contains the proper amount of the chemical provided by the tensiometer manufacturer. Assemble the tensiometer, fill with the prepared water (distilled water is preferred to help prevent clogging of the ceramic tip) and use the vacuum pump to remove the air from the tensiometer gauge and test for air leaks. Completely fill the tensiometer and put on the reservoir or cap. With the tensiometer now completely sealed, let stand in a vertical position in the prepared water for 5 minutes or until the gauge needle stops moving. For gauges with a setscrew, calibrate the gauge to read 0 cb.

Test the tensiometer by taking it out of the water and drying off the tip with a paper towel. The gauge indicator should immediately begin to rise. Let it rise to 20 cb and check for air leaking in any point. This procedure will be necessary before installation as well as periodically (every 6-12 months) in the field.

Scrape away the dry, loose surface soil and hammer the insertion tool in to the proper depth. If the manufacturer's insertion tool is not available use a pipe or dowel that is the same diameter as the tensiometer tube. Carefully push the tensiometer into the soil and tamp the

soil for good contact between the soil and tensiometer. Cover the tensiometer with a can, tree wrap or other container. The container should be just large enough to fit over the tensiometer, so as to allow the irrigation water to reach the tensiometer.

After installation, several hours may be required before the tensiometer reads the correct soil water potential value. This is because of the disturbance to the soil caused by the installation procedure, and because of the need for water to move through the ceramic cup before equilibrium is reached. The correct reading will be reached more quickly in moist soils than in dry soils. After this initial equilibrium period, the tensiometer will accurately indicate the soil water tension, and it will closely follow changes in tension as they occur in the soil.

MAINTENANCE

Tensiometers are delicate instruments and should be protected from harm both before and after installation. They should be handled carefully and protected from impact by equipment or animals in the field. Also freezing conditions will damage tensiometers. They should not be left filled with water during freezing conditions.

Each time the tensiometers are read, check to make sure the water has not leaked out. Water should not have to be added for 3 months or more. If a leak is present, the gauge will always read low. Check the tensiometer for algae growth. The tensiometer should be removed and cleaned every 6 - 12 months to prevent clogging of the tip or gauge. Since roots will sometimes grow around the tip, the tensiometers should be reinstalled in a slightly different location under the tree or moved to an adjacent tree.

A leak in the tensiometer will cause it to lose water and read low or 0 cb. Water should not have to be added for several months of operation. A continually high tensiometer reading could mean a defective gauge, the irrigation water does not reach the tensiometer or the ceramic tip is clogged. A continually low reading without a leak in the tensiometer could mean could mean a high water table, over irrigation or a defective gauge.

IRRIGATION WATER MANAGEMENT

Tensiometers are only one tool for irrigation scheduling. Plant wilt, appearance of the soil, amount of irrigation water applied and rainfall should also be closely checked. Contact your local NRCS office or mobile irrigation lab for assistance in developing an irrigation water management plan. This plan may include an irrigation schedule and how long to irrigate.

Enter tensiometer readings in a notebook or diary with the rainfall and irrigation amounts and dates.

It is important to identify the location of tensiometers by recording a valve or site number, the depth of the tensiometer being read, and the date and time of taking the reading.

To demonstrate soil moisture over time, it is useful to plot tensiometer readings on a graph. A graph provides an excellent method to visualize changes in soil moisture levels. In addition to recording tensiometer readings, record the date of each irrigation with an arrow above the graph. Also record above the arrow the time in hours and the amount of water applied during each irrigation and/or the amount of rainfall.

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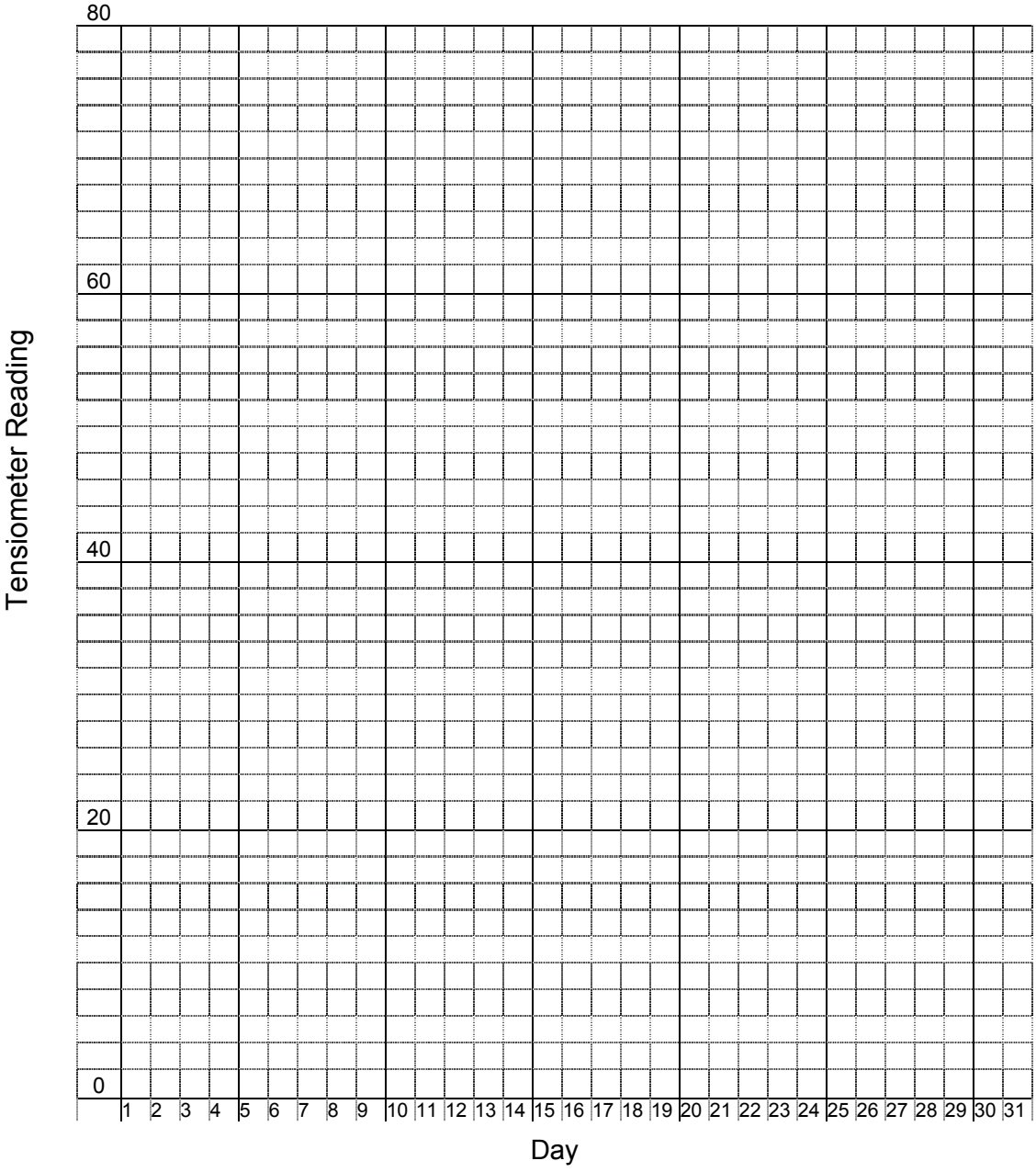
Show on the sketch below (or attach or refer to appropriate plan map) location of tensiometers.

Scale 1" = _____ ft. (NA indicates sketch not to scale: grid size = 1/2" by 1/2")

Tensiometers Sheet _ of _

Tensiometer Number or Location	Date (mm/dd/yy)	Hours Irrigated	Irrigation Water (inches)	Rainfall inches	Comments

Tensiometer Readings vs. Day of Month



Month: _____ Year: _____

Note: Use additional sheets for each month.