Soil Moisture Sensor Placement – Depth, Drip Emitter, and Vine Considerations

This is Grower Guide #3 in our ***Soil Moisture Sensor Series*** of guides. This guide covers the proper placement/installation of your soil moisture sensors in the vineyard, with respect to vines, irrigation, and soil type, including:

- Sensor Placement Relative to Emitters and Vines
- Depth of Sensor Placement
- Areas to Avoid

Related Guides:

- Guide #1 – Soil Moisture Sensor Types
- Guide #2 – Selecting the Location to Install Soil Moisture Sensors
- **Guide #3 – Soil Moisture Sensor Placement – Depth, Drip Emitter, and Vine Considerations**
- Guide #4 – Understanding Soil Moisture Monitoring

Once you have determined where to place soil moisture sensors in your vineyard (see *Guide #2 - Selecting the Location to Install Soil Moisture Sensors*), your next step is to correctly place the sensors in the vineyard row and within the soil column to ensure accurate readings.

Sensor Placement Relative to Emitters and Vines

The accuracy and, in turn, the usefulness of your soil moisture sensor data is directly tied to where they are installed in the vineyard row relative to the vine root system and drip emitters (in irrigated vineyards):

- Vine roots create a suction effect through transpiration in the leaves to draw up water, but this only extends a limited distance from active roots. Sensors placed too far from the roots could potentially show high levels of soil moisture that are not accessible to the vines, leading to under-irrigation.

- Sensors placed too far from the emitter can lead to excess watering of vines as the sensor is not within the desired wetting pattern of an irrigation set, leading to over-irrigation.

Soil moisture sensors are commonly positioned within 18 inches of a vine trunk and in line with trellis and irrigation wires to reduce damage from machinery (Figures 1 and 2).

Most growers (in irrigated vineyards) place sensors within 4-6 inches of a drip emitter but some trial and error may be necessary to find the best distance from an emitter in a particular soil.

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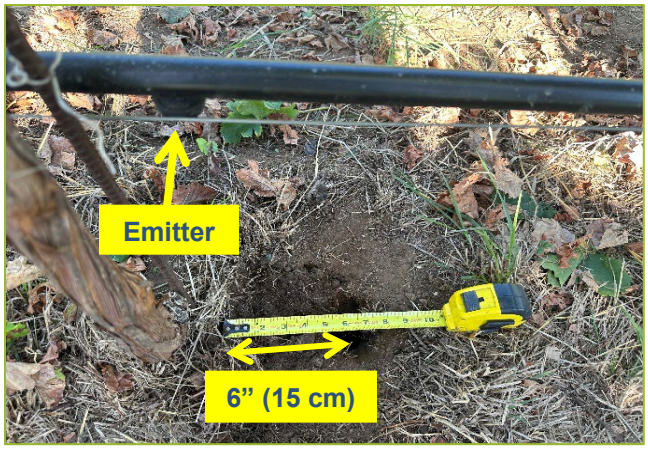

Figure 1: A typical soil moisture sensor installation showing the placement distance of about 4-6 inches from a drip emitter. Some trial and error may be needed to determine the ideal distance from the emitter to correlate soil moisture readings with plant water stress measurements.

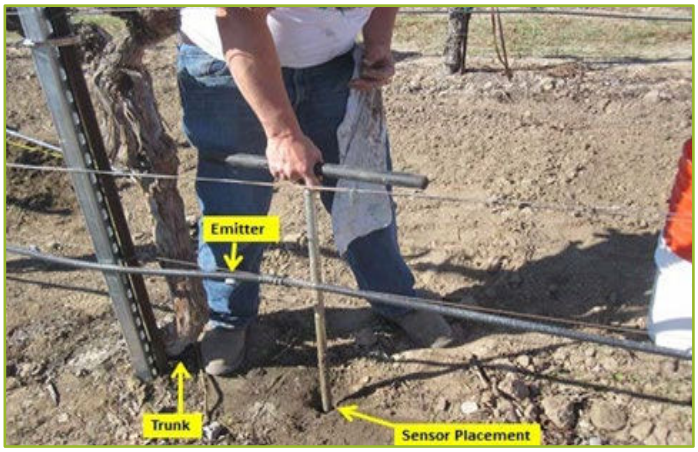

Figure 2: A typical soil moisture sensor installation showing the placement distance no more than 18 inches from the vine trunk, and 4-6 inches from a drip emitter.

Depth of Sensor Placement

After determining the best placement for your soil moisture sensor(s) relative to your vine trunk and drip emitter locations, the correct depth for sensor placement needs to be identified.

Choosing the depth to place an **individual soil moisture sensor** requires careful evaluation of the soil profile. If your soil texture or structure changes drastically as you dig down in a block it is best to purchase multiple sensors to place at different depths to get a comprehensive measurement.

Due to the deep rooting habit of grapevines, it is common to place sensors at multiple soil depths to capture the movement of water and the potential availability of water to roots (Figure 3).

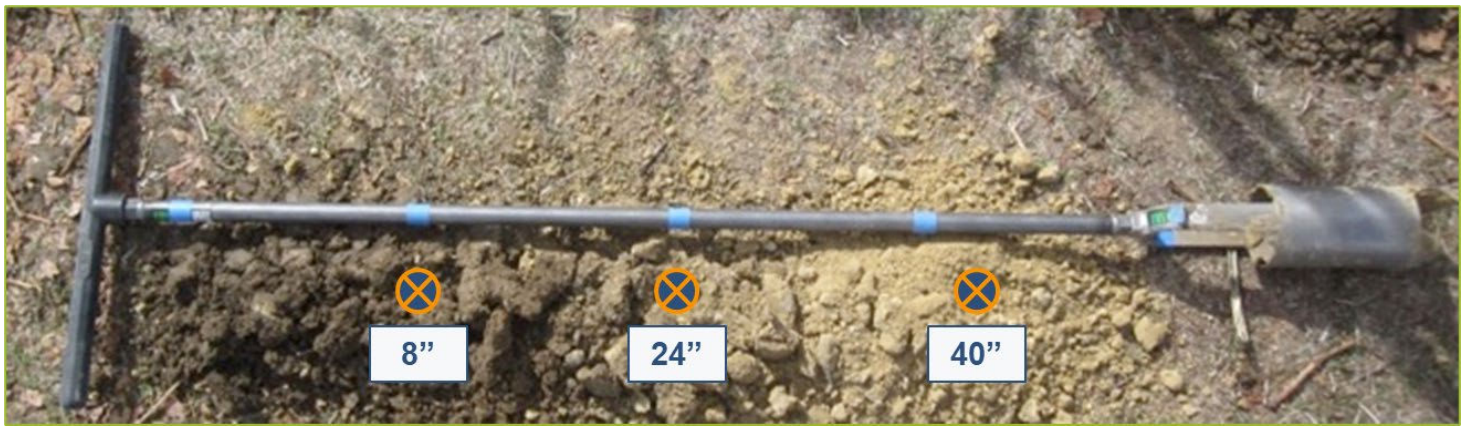

Figure 3: Sensor depth can be determined based on changes in soil texture, structure, or color in the profile. In this example, the top sensor is placed at 12 inches in the sandy clay loam topsoil, 24 inches in clay loam soil, and 40 inches in loam soil to measure the deep percolation of water. A soil moisture sensor that also measures electroconductivity could also be used at the 24 and 40-inch depths to evaluate the movement and accumulation of salts from irrigation water.

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When using **a probe-type sensor** with multiple sensor depths pre-set by the manufacturer (such as the capacitance probe used by **SensorInsight**), it is important to match the total length of the probe required to reach the desired soil depth. Be sure that the length matches the depth with which you wish to monitor water movement and that the soil depth is adequate for the full insertion of the probe. Placement of a sensor at or near the bottom of the root zone is suggested to identify deep percolation of water.

Before the final installation of soil sensors, observation points can be evaluated in the area immediately surrounding the sensor location (Figure 4). Evaluation of a soil profile within 2-3 feet of a proposed installation site is a helpful practice to make sure you do not install sensors in a disturbed spot and to confirm that the soil is representative of the block. Note that any observation hole dug within a few feet of a sensor site must be carefully backfilled and tamped to prevent rainfall or other surface water from influencing nearby sensor readings.

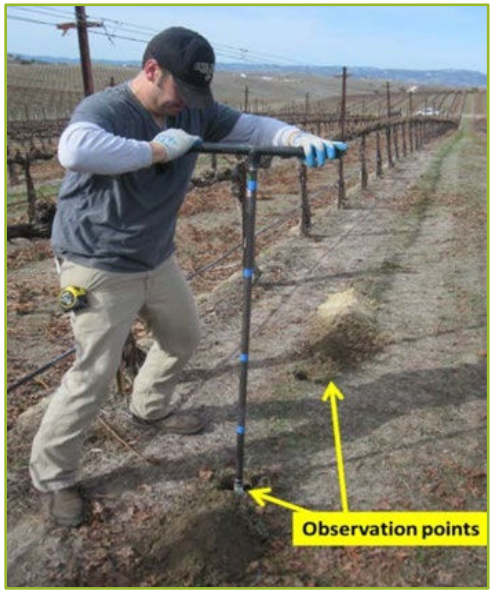

Figure 4: Before installing soil moisture sensors under the drip line, a series of observation points can be evaluated at a short distance from the desired sensor placement location. This extra step can verify that the soil is representative and identify abnormalities in soil that can influence water movements, such as hard pans, or pockets of rock or sand.

Areas to Avoid

In general, sensors should not be placed in the following areas of the vineyard:

- ❑ Areas of excessively high or excessively low vigor that do not represent the majority of the block
- ❑ Areas that do not drain well or hold water longer than the majority of the block
- ❑ Areas where soil depth is deeper or shallower than the majority of the block
- ❑ Pockets of soil that do not represent the majority of the block (e.g., random sand pockets, or hardpan)
- ❑ Areas in line with surface runoff (i.e., bottom of swales) or drainage channels in a block
- ❑ Areas on the border of the vineyard or areas near competing vegetation
- ❑ Areas that receive supplemental shade from structures other than vines or trellis
- ❑ Areas where natural soil structure has been disturbed in the past (e.g., backhoe pits, uprooted trees, backfill from erosion) (Figure 5)
- ❑ Areas that may receive significantly more or less irrigation water than the rest of the block (this may be based on the evaluation of irrigation distribution uniformity)
- ❑ Areas where vines are not representative of the block (e.g., weak vines, vines of different ages or rootstock)

Figure 5: Trees or other objects that may disturb soil during the removal process should be mapped and those areas avoided when installing soil moisture sensors. Sensors installed in disturbed areas such as these may not be representative of conditions in adjacent undisturbed areas.

Resources

1. United States Department of Agriculture, National Resource Conservation Service – Web Soil Survey (HTTP://WEBSOILSURVEY.SC.EGOV.USDA.GOV/APP/HOMEPAGE.HTM)

2. Peters, T. R., Desta, K., and Nelson, L. 2013. Practical Use of Soil Moisture Sensors and Their Data for Irrigation Scheduling. Washington State University Extension Fact Sheet – FS083E

Related Grower Guides

- ➢ Guide #1 - Soil Moisture Sensor Types
- ➢ Guide #2 - Selecting the Location to Install Soil Moisture Sensors
- ➢ Guide #4 – Understanding Soil Moisture Monitoring
- ➢ Installing a Capacitance Soil Moisture Probe in the Vineyard
- ➢ Installing Capacitance Soil Moisture Sensors in the Vineyard

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