Accuracy Of Soil Moisture Meters In Saline Soils

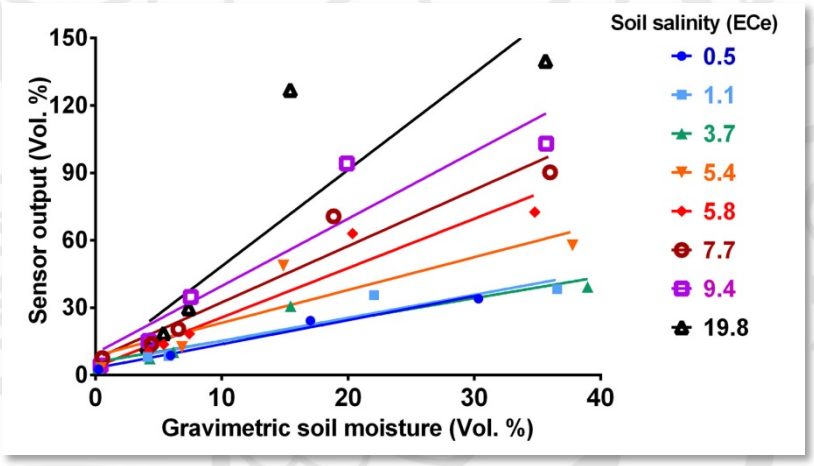
Measuring soil moisture with time-domain reflectometry (TDR) sensors can aid in turfgrass water conservation efforts and help improve playing conditions. However, information is lacking on the accuracy and reliability of newly introduced, hand-held, electromagnetic moisture sensors in saline soils. A laboratory study was conducted at New Mexico State University during 2015 to investigate the accuracy and reliability of TDR soil moisture sensors at different salinity levels, expressed as electrical conductivity of a saturated soil paste extract ECe.

Columns measuring 5 inches (14 cm) in height and 8 inches (20 cm) in diameter were filled with sand that met USGA specifications for particle size distribution. Columns were subsequently saturated for 24 hours with either distilled (ECw = 0 dS m-1), tap (ECw = 0.7 dS m-1), or saline water (ECw = 2, 4, 6, 8, 10 and 15.5 dS m-1). The treatments resulted in ECe of 0.46 (distilled water), 1.08 (tap water), and 3.68, 5.40, 5.78, 7.68, 9.38, and 19.84 dS m-1 (saline water), respectively.

Handheld TDR sensors can help guide irrigation decisions and improve playing conditions, but special calibration may be needed in saline soils.

Two TDR sensors with 3-inch (7.6 cm) probes were inserted into the soil columns. The columns were subsequently placed onto a pressure plate inside a pressure chamber to record sensor readings at different soil moisture levels. At the end of the dry-down period, columns were dried at 105 degrees Celsius. Volumetric soil moisture was subsequently determined for each moisture level. Data comparisons were based on fitting either linear or quadratic polynomial regressions to all salinities.

Overall, TDR sensor values increased with increasing soil moisture, as regression slopes significantly differ from 0 for every soil salinity level. Regression slopes for ECe ≥ 5 dS m-1 were greater than the regression slopes for salinities of ECe < 4 dS m-1. The regression slope at ECe = 19.8 dS m-1 was four times greater than the slope at ECe = 0.5 dS m-1. These results suggest that when using TDR sensors at different salinity levels, the sensors need separate calibration if the absolute soil moisture value is of interest.



Summary Points

- Soil moisture readings between two TDR sensors did not differ from one another across a wide range of soil salinities.
- Soil sensors accurately estimated soil moisture in a USGA sand at salinity levels of ECe < 5 dS m-1.
- When using TDR sensors at different salinity levels, special calibration is needed for soil with ECe > 5 dS m-1 if the absolute soil moisture value, rather than the relative difference in soil moisture, is of interest.