Use and abuse of soil moisture meters
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Easy availability and widespread adoption of soil moisture probes has increased irrigation accuracy and precision. With just the push of a button, a golf course superintendent can measure soil moisture content. This information allows superintendents to more precisely schedule irrigation cycles, direct hand watering efforts, improve playability, and ultimately conserve water and money. Unfortunately, these tools are frequently misunderstood and misused. Much like the Stimpmeter, which was transformed from a tool to measure green speed uniformity within a golf course to a device to compare golf courses, readings from moisture probes are sometimes used inappropriately. This is becoming especially true on social media where picture of soil moisture reading have become more common. To me, this has exposed a misunderstanding as to how to use this great tool.

Time domain reflectometry (TDR) is the method used by many modern soil moisture probes to calculate volumetric water content. Briefly, a wave of electric energy is sent down each metal conductor rod that is inserted into the soil. Depending on soil moisture, the wave will be transformed as it travels down each rod and part of it will bounce (be reflected) back to the meter much like radar. The meter then uses a calibration curve to relate the reflected signal to the volumetric soil water content. Having more metal probes on a meter increases the accuracy of the measurement but also reduce the battery's charge. Despite popular belief, electricity is not passed between the rods to measure soil moisture.

General knowledge of how a TDR moisture probe works is important to ensure your soil moisture readings are repeatable. First, be consistent with conductor rod length throughout a season and make sure you have selected the correct length on the meter if rods are exchangeable (i.e. Spectrum FieldScout 300). We prefer around a 3" rod for creeping bentgrass greens while others with predominately annual bluegrass greens prefer smaller probes. Second, ensure all conductor rods are pushed completely into the ground when taking a reading. Conductor rods pushed partly into the ground will cause the meter to 'think' the top of the rod is in a layer of very dry soil. This will display lower soil moisture content than if they were pushed all the way into the ground.

A TDR probe is a great tool because it provides rapid measurement of volumetric water content; the amount of water (in volume or depth) relative to the amount of soil (in volume or depth). A reading of 15% could also be thought of as 0.15" water depth of per one inch of soil depth. When a TDR probe is calibrated to a particular soil, it can provide very accurate and repeatable volumetric water content readings. Without specific soil calibration however, the numbers become less accurate but are still very repeatable. Factors such as soil texture, organic matter, and even the shape of the soil particles will affect the probe's calibration. Nevertheless, a TDR moisture probe doesn't need to be accurate to be useful; it just needs to be repeatable. For example, it's powerful when a superintendent knows a particular green consistently shows signs of wilt at an indicated water content of 12%. It does not matter if the green shows signs of wilt at a true, laboratory measured, volumetric soil water content of 9% as long as the signs of wilt show up whenever the TDR probe indicates 12%. The difference in accuracy between the true and indicated volumetric water content is arbitrary.

It should now be apparent why it's dumb to compare and compete for the title of the lowest soil moisture. There are simply too many variables involved to compare measurement (i.e. probe depth, meter brand, meter calibration, composition of the soil/root zone, soil organic matter composition). Lower soil moisture doesn't imply one course is more firm than another. For example, a new research green at the JSA Turf Research Center has very low organic matter content and will show wilt at soil moisture readings less than 4%. An adjacent green that's well established will show sign of wilt at 10%, but it is substantially more firm than the new green. Use TDR probes to improve turf management and not to compare to other facilities.

Keys to effectively use a TDR probe

1) Know the minimum soil moisture required to prevent wilt. This number will vary depending on factors such as turf age, soil composition, and management. Different greens on may have different minimum on the same course.
2) Measure areas before and after irrigation to dial in irrigation scheduling and monitor irrigation system performance. Write down pre- and post-irrigation moisture values on a scorecard and keep them as a record. Challenge yourself to set the exact amount of irrigation timing to appropriate soil moisture.
3) Compare the change in soil moisture reading with daily evapotranspiration to further refine irrigation scheduling.
4) Verify the usual dry spots are actually dry before handwatering. It can be easy to over-water high spots (and surrounding low spots) without a soil moisture probe.

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