

## Adapting Time Domain Reflectometry to Turfgrass Irrigation Studies

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Current soil moisture measuring devices used for irrigation scheduling and evaluation of plant use have several limitations. Gravimetric measurements are destructive to plots and time intensive. Tensiometer based scheduling data is not transferrable to other soil types. The neutron probe method is accurate and nondestructive but involves the use of radioactive materials.

Time Domain Reflectometry (TDR) provides for accurate, fast, nondestructive and safe volumetric soil moisture readings. Because of this we decided to evaluate this method for use in turfgrass irrigation studies. TDR readings involve the use of a cable tester that sends out pulses into the soil. The pulse is sent from the TDR through a rotary switch, wires and wave guides and reflected back to the TDR. From the slopes of the reflected wave the points of the initial peak and the lowest point are determined. The distance between these points is used to calculate time and propagation velocity. Propagation velocity is related to the dielectric constant of the soil. Dry soils have a dielectric constant of between 2 and 5. Water has a dielectric constant of approximately 80. As the water content increases the dielectric constant increases. This relationship is not linear and a polynomial curve equation has been developed for the relationship of dielectric constant and volumetric moisture content.

The system includes a TDR, shielded antenna wire, rotary switches, stainless steel wave guides and a portable computer to calculate and store the data. In our study we have a set of probes at 5 cm depth intervals from 5 cm down to 25 cm (10 inches) which allows for determinations of how much water turf roots are extracting from the soil at specific depths. The wave guides are horizontally placed 5 cm apart at each depth. The wave guides and switches are installed and verified in nine irrigation plots split by species. The two grasses maintained under fairway conditions are Poa annua and Agrostis plaustris. Three replications of each depth are installed in each species for a total of 198 wave guide pairs. Irrigation rates have been carefully determined by using 100 collection cups per plot on 4 foot spacings, repeated at least three times. It has been determined that the application rate is 2.5 centimeters per hour.

Irrigation treatments of .1 inch per day, maintained field capacity, and irrigation as needed to prevent wilt will be tested and any differences in quality and root water uptake by zone noted.

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