Stop #14

Time Domain Reflectometry use in Turfgrass Irrigation Scheduling

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The objectives of this study are to adapt time domain reflectometry techniques for volmetric soil moisture measurement for turfgrass irrigation scheduling and to observe the effects of different irrigation schedules on bentgrass and annual bluegrass fairway turf. Volume measurements provide information that can be directly used to schedule irrigation times.

Nine 36' X 36' irrigation blocks were split into two 18' X 36' plots, one seeded to bentgrass and the other to annual bluegrass. Plots are maintained at .5 inch height of cut. Soil moisture sensors were placed to measure volumetric soil moisture in the following zones: 0-2 inch, 2-4 inch, 4-6 inch and 6-10 inch. The 0-2, 2-4 and 4-6 zones were replicated three times per species and the 6-10 inch zone twice per species. A total of 198 moisture sensors were installed in the study.

Bulk density measurements were taken to facilitate correlation between physically removed samples and TDR readings. Correlation data has been collected from each depth and combined over all depths. Coefficients of determination for each depth and overall are as follows: 0-2 inch = .84, 2-4 inch = .80, 4-6 inch = .77, 6-10 = .68. This show a good relationship between soil samples and TDR measurements.

Irrigation rate was determined by measurements using 100 collection points located within the 36' X 36' irrigation block on 4' centers. Each plot was measured a minimum of 3 times. Application rates and uniformity were determined using a turfgrass irrigation system analysis program, TURFIMP, written by Dr. Richard Snyder of the University of California. Several different irrigation heads were tried until an acceptable head was found for this application. Average distribution of uniformity is 83% and average application rate is 1 inch per hour. The three irrigation philosophies being used are maintenance of field capacity, .1 inch per day and irrigation at stress. Moisture readings are taken daily and the amount of irrigation needed to return the plots to field capacity is calculated. The .1 inch per day plots receive .1 inch of water daily. Stress plots are watered back to field capacity after the onset of stress. The field capacity plots are irrigated back to field capacity each day water is needed.

In addition to soil moisture readings quality ratings, root weight, clipping weight, and species composition data is also collected. Annual bluegrass tends to have more soil moisture than creeping bentgrass regardless of irrigation treatment, however there is only a significant difference on a few dates. Quality was consistently higher for bentgrass under all irrigation treatments. Annual bluegrass quality ratings ranged from 8 in the field capacity treatment to a low of 3 in the stress treatments. Bentgrass quality ratings ranged from 8.5 in the field capacity plots to 6.5 on one date in the stress plots. Bentgrass quality was acceptable under all irrigation treatments on all dates whereas annual bluegrass was acceptable only in the field capacity plots for all dates. Bentgrass produces more clippings than annual bluegrass independent of irrigation treatment. Bentgrass also produced more roots than annual bluegrass at all 4 soil measurement depths under all irrigation treatments. At the beginning of the study the annual bluegrass plots were 100% annual bluegrass, over time the bentgrass has encroached into the annual bluegrass plots and presently accounts for up to 50% of the annual bluegrass plots.

Time domain reflectometry is proving a valuable tool for scheduling and monitoring soil moisture in turfgrass. The advantage of measuring volumetric soil moisture for irrigation scheduling is that this data can be easily converted to the number of minutes of irrigation needed to bring the soil back to any chosen soil moisture level. Annual bluegrass has not produced or performed as well as creeping bentgrass in any of the irrigation treatments described.