Turfgrass Irrigation With Municipal Effluent: Nitrogen Fate, Turf Kc Values and Water Requirements

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Two weighing lysimeters have been installed at the University of Arizona Karsten Turfgrass Research Center for researching the consumptive water use of turf, nitrogen fertilizer loss through leaching, and solute transport through a fine sand soil profile. Each tank is 4.0 m deep by 2.5 m in diameter, and has a filled weight of about 45,000 kg. Each tank has 90 sampling ports. Fifteen sampling ports are installed in three groups of five at 120° around the circumference of the tank. This occurs at each sampling depth which are every 50 cm beginning at 1.0 m and continuing down to 3.5 m. Three tensiometers with pressure transducers, three TDR probes, and three each of ceramic and stainless steel solution samplers have been installed at each sampling depth and at 120°. A single neutron probe access tube was installed in the center of each lysimeter. A Cardinal scale with a loadcell measures change in tank weight to ± 200 g (0.04 mm water loss). A Campbell CR-7 is used for Analog/digital conversion for the transducers and loadcell, and a single computer program has been written to import, analyze and manage the TDR, transducer and loadcell data. Data are available for viewing and retrieval in real time. Several experiments can be run in tandem to accommodate research in transport and plant-water processes.

Data collection has begun to monitor evaporative loss of water from the dry sand soil contained in each tank. This information is also being used for instrument calibration. Thus far the scales appear very accurate for each tank in the measurement of loss and gain of water from evaporation and rain.

Land preparation is beginning on the site in preparation for irrigation system installation. The land will be deep ripped to alleviate compaction due to construction. Rocks and stones will be removed. Mulch will be incorporated to a depth of 60 cm to enhance turf performance. Surface grading will take place to ensure that surface water does not accumulate around the lysimeters stairwell, evaporative cooler, and utility boxes. In addition a raised roadway has been constructed to prevent water from flowing into the study area.

A dual irrigation system has been designed for the site. Each lysimeter will have two irrigation systems either for delivering wastewater or potable water. Zero trajectory heads are to be installed to prevent drift from one tank to the other. A

wind speed shut-off switch has been purchased for installation onto the Rainbird Maxi-5 weather station to prevent the irrigation system from running should wind speed exceed 4.8 km/h. Multiple irrigation valves will also be installed to prevent over-irrigation due to a failed valve. In addition the lysimeter computer will also be able to shut the irrigation system off when the loadcell measures that a predetermined amount of water has been applied. The remainder of the irrigation system, i.e. that irrigating the surrounding turf, will also be controlled by the wind speed shut-off switch.

A M.S. graduate student has been hired for this project. Mr. Duane Otto has a B.A. in Agribusiness and a Mathematics minor from Mid-Nazarene College in Olathe, KS. His work experience with Turf Diagnostics and Design, also in Olathe, has given him experience in soil physical measurements. Duane is currently in his first semester of coursework at the UA.

Executive Summary

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Two weighing lysimeters have been installed at the University of Arizona Karsten Turfgrass Research Center for researching the consumptive water use of turf, nitrogen fertilizer loss through leaching, and solute transport through a fine sand soil profile. Each tank is 13.1 feet deep and 8.2 feet in diameter, and has a soil-filled weight of approximately 99,120 lb. Each tank has sampling ports in groups of five which are spaced at 120° around the tank. These ports begin at the 3.3 foot depth (level) and are then every 1.6 feet down to a depth of 11.5 feet. Tensiometers with pressure transducers, TDR probes, and ceramic and stainless steel solution samplers have been installed three each to a level. A single neutron probe access tube was installed in the center of each lysimeter. These devices are used for sampling soil water and monitoring soil moisture content. A Cardinal scale with an electronic loadcell measures changes in tank weight to ± 0.44 lbs (0.002 " water loss or gain). A Campbell CR-7 is used for Analog/Digital conversion for the transducers and loadcell, and a single computer program has been written to import, analyze and manage the data. Data are available for viewing and retrieval in real time.

Land preparation (deep ripping, mulch incorporation, rock removal, grading) is beginning on the site in preparation for irrigation system installation. A dual irrigation system has been designed for the site so that each lysimeter can receive either wastewater or potable water. A wind speed shut off switch and zero trajectory heads are to be installed to prevent drift. The lysimeter computer will also be able to shut the irrigation system off when a predetermined amount of water has been applied. The remainder of the irrigation system, i.e. that irrigating the surrounding turf, will also be controlled by the wind speed shut-off switch.

A M.S. graduate student was hired for this project in August, 1994. Mr. Duane Otto has a B.A. in Agribusiness and a Mathematics minor from Mid-Nazarene College in Olathe, KS. His work experience with Turf Diagnostics and Design has given him experience in soil physical measurements. He is currently in his first semester of coursework.