Assessing Nitrogen Losses during Grow-in of a Golf Putting Green under Two Irrigation Treatments

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The effects of irrigation intensity on nitrate and phosphate leaching, and on the emission of environmentally harmful nitrogen (N) trace gases are important considerations when evaluating irrigation practices. We measured nitrate and phosphate leaching during the grow-in of a USGA putting green with the use of lysimeters installed underneath the sand/peat layer. One of the two irrigation treatments followed general local irrigation practices for grow-ins, i.e. irrigation at a fixed daily rate of about 8mm (3/8") applied in 7 increments per day. In the other treatment, we irrigated to replace only as much moisture as was lost via evapotranspiration (ET) on the previous day. We hypothesized that this amount of water would be sufficient even for the turf establishment period. To estimate ET, we used the Penman-Monteith model and local climate data from the University of Minnesota weather station. Emissions of the N trace gases nitrous oxide and nitric oxide were measured by placing chambers on the soil surface and sampling of the air within the chambers.

In the fall 2003, creeping bentgrass was seeded in replicated USGA putting green plots (10 ft. x 10 ft.) at the TROE Center. The plots of both treatments were fertilized with 0.5 lbs N/1000 sq. ft. (10-4-16) every 10 days after an initial application of 1 lb N/1000 sq. ft. as 9-18-18 starter fertilizer.

After two months of grow-in, from end of August until the end of October, there were no differences in appearance of the newly established turf between the irrigation treatments. The amount of water applied in the treatment at a fixed daily rate was about four times greater than in the treatment to replace moisture lost through ET. In the fixed rate treatment, 33% of the amount of N applied as fertilizer was collected in the lysimeters (on a per area basis). In the ET replacement treatment, 19% of the amount of N applied as fertilizer was collected. This substantial amount of nitrate leaching even in the ET replacement treatment was probably due to rapid percolation of irrigation water through the sand medium during a time when root length density was low. In the fixed rate treatment, 9% of the phosphate applied as fertilizer versus 1 % in the ET replacement treatment was collected in the lysimeters.

Emissions of nitrous oxide gas in both treatments were never above background levels. In contrast, emissions of nitric oxide were highly elevated immediately after fertilizer applications. Nitric oxide is a reactant during the formation of ozone, which is a pollutant of the troposphere and a greenhouse gas. These nitric oxide emissions could also represent a significant loss of fertilizer N. In the current season, we plan to make frequent gas emission measurements to obtain better estimates of these gaseous N losses. We hypothesize that nitrate and phosphate leaching in 2004 will be lower since root systems will be more developed and fertilizer applications less frequent.