Nitrogen and Phosphorus Fate in a 10+ Year Old Kentucky Bluegrass Turf

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Objectives:

1. Determine nitrate-nitrogen and phosphorus leaching from a turfgrass stand that has been continually fertilized for 18 years.
2. Continue data collection from the Long Term Nutrient Fate Research Area at MSU; currently we have data collection for 10 years consecutively.

Start Date: 2003
Project Duration: five years
Total Funding: $68,886

USGA initially funded research at Michigan State University to determine nitrogen fate and leaching from a Kentucky bluegrass turf in 1991. Similar to previous research, the initial research at MSU conducted from 1991 through 1993 indicated that there was minimal risk of nitrate-nitrogen leaching from Kentucky bluegrass (*Poa pratensis* L.) turfgrass.

Since the summer of 1998, percolate samples have been collected from the same monolith lysimeters and analyzed for nitrate-nitrogen (NO_3-N). As of 2008, the turfgrass area has now been under continual fertilization practices for 18 years with percolate collection for the last 10 years consecutively.

From July 1998 through 2002, lysimeters were treated annually with urea at a low N rate 98 kg N ha^{-1} (4 applications) and a high N rate of 245 kg N ha^{-1} (4 applications). From 1998-2002 for the high N rate, there was a dramatic increase in NO_3-N leaching from 5 mg L^{-1} in 1998 to 25 mg L^{-1} in 2002. During the same time frame, there was a modest increase in NO_3-N leaching from 3 mg L^{-1} in 1998 to 5 mg L^{-1} in 2002. In 2003, the N rate was reduced to 196 kg N ha^{-1} for the high N rate, while the low N rate remained at 98 kg N ha^{-1}.

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Dr. Kevin Frank (above right) explains to members of USGA's Research Committee the efficiency of nitrogen use by mature Kentucky bluegrass when fertilized at a low (2 lb./1000 ft^2/year) and a high rate (5 lb./1000 ft^2/year). Results indicate that the high rate of nitrogen fertilization is much more than the turf needs and can result in unacceptable levels of nitrate-nitrogen in leachate.

Since 2003, phosphorus from triple superphosphate (20% P) has been applied at two rates, 49 and 98 kg P ha^{-1} split over two applications. The phosphorus application dates coincide with nitrogen application dates in the spring and autumn.

In 2003, the concentration of NO_3-N leaching from the high N rate treatment did not decline from the previous years. The average NO_3-N concentration leached from the low and high N rate treatments was 6.3 and 31.6 mg L^{-1}. In 2004, the concentration of NO_3-N leaching from the high N rate treatment declined drastically from previous years. The average concentration of NO_3-N in leachate for the high N rate was 8.5 mg L^{-1}. This was a decrease in NO_3-N concentration of 23.1 mg L^{-1} from 2003. For the low N rate the average concentration of NO_3-N in leachate for the low N rate was 1.2 mg L^{-1}. From 2004 through 2008, the mean NO_3-N concentration for the low and high N rates was 2.9 and 9.4 mg L^{-1}.

The concentration of phosphorus detected in leachate remains very low regardless of treatment. The mean concentration of phosphorus detected in leachate since initiating phosphorus treatments in 2003 has been less than 0.02 mg L^{-1}.

Summary Points

- The mean NO_3-N concentration from 2004 through 2008 is less than 10 mg L^{-1}.
- Results continue to indicate low amounts of phosphorus leaching.