

# Long-Term Nutrient Fate Research

Kevin W. Frank  
Michigan State University

## Objectives:

1. Determine nitrate-nitrogen and phosphorus leaching from a turfgrass stand that has been continually fertilized for 20 years.
2. Continue data collection from the Long-Term Nutrient Fate Research Area at MSU; currently we have data collection for 12 consecutive years.

**Start Date:** 2003

**Project Duration:** 11 years

**Total Funding:**

2008-2010: \$34,800

2003-2007: \$68,886

2000-2002: \$64,612

The USGA initially funded research at Michigan State University to determine nitrogen fate and leaching from a Kentucky bluegrass turf in 1991. Like previous research, the initial research at MSU conducted from 1991 through 1993 indicated that there was minimal risk of nitrate-nitrogen ( $\text{NO}_3\text{-N}$ ) 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  $\text{NO}_3\text{-N}$ . As of 2010, the turfgrass area has now been under continual fertilization practices for 20 years with percolate collection for the last 12 years consecutively.

From July, 1998 through 2002, lysimeters were treated annually with urea at a low N rate of 98 kg N/ha (24.5 kg N/

ha per application) and a high N rate of 245 kg N/ha (49 kg N/ha per application). From 1998 to 2002 for the high N rate, there was a dramatic increase in  $\text{NO}_3\text{-N}$  leaching from 5 mg/L in 1998 to 25 mg/L in 2002. During the same time frame, there was a modest increase in  $\text{NO}_3\text{-N}$  leaching from 3 mg/L in 1998 to 5 mg/L in 2002.

In 2003, the N rate was reduced to 196 kg N/ha for the high N rate, while the low N rate remained at 98 kg N/ha.

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

In 2003, the concentration of  $\text{NO}_3\text{-N}$  leaching from the high N rate treatment did not decline from the previous years. The average  $\text{NO}_3\text{-N}$  concentration leached from the low and high N rate treatments was 6.3 mg/L and 31.6 mg/L. In 2004, the concentration of  $\text{NO}_3\text{-N}$  leaching from the high N rate treatment declined drastically from previous years.

The average concentration of  $\text{NO}_3\text{-N}$  in leachate for the high N rate was 8.5 mg/L. This was a decrease in  $\text{NO}_3\text{-N}$  concentration of 23.1 mg/L from 2003. For the low N rate, the average concentration of  $\text{NO}_3\text{-N}$  in leachate was 1.2 mg/L.

The average concentration of  $\text{NO}_3\text{-N}$  in leachate for the high N rate from 2004 through 2009 was 8 mg/L. In 2009, the mean  $\text{NO}_3\text{-N}$  concentration in leachate for the high N rate was 3.2 mg/L. This was



Since the summer of 1998, percolate samples have been collected from the same monolith lysimeters and analyzed for nitrate-nitrogen ( $\text{NO}_3\text{-N}$ )



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<sup>-1</sup>.

the lowest mean  $\text{NO}_3\text{-N}$  concentration in leachate for the high N rate since data collection began in 1998. 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.

This research indicates that leaching potential from continually fertilized turfgrass sites changes due to the age of turfgrass and annual nitrogen rate.

## Summary Points

- From 2004 to 2009, for the high N rate, less than 4% of all samples had  $\text{NO}_3\text{-N}$  concentrations greater than 20 mg/L.
- For the high N rate, most of the sampling dates that had elevated  $\text{NO}_3\text{-N}$  concentrations were during late fall or winter when the turfgrass was dormant.
- For the low N rate, the mean  $\text{NO}_3\text{-N}$  concentration has been 5 mg/L or less for every year except one (2003).
- Results continue to indicate low amounts of phosphorus leaching.