

Long Term Nutrient Fate Research



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Objectives:

1. *Determine nitrate–nitrogen and phosphorus leaching from a turfgrass stand that has been continually fertilized for 22 years.*
2. *Continue data collection from the Long Term Nutrient Fate Research Area at MSU, currently we have data collection for 14 years consecutively.*

The 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 ($\text{NO}_3\text{-N}$). As of 2012, the turfgrass area has now been under continual fertilization practices for 22 years with percolate collection for the last 14 years consecutively.

From July 1998 through 2002, lysimeters were treated annually with urea at a low N rate 98 kg N ha^{-1} ($24.5 \text{ kg N ha}^{-1} \text{ application}^{-1}$) and a high N rate of 245 kg N ha^{-1} ($49 \text{ kg N ha}^{-1} \text{ app.}^{-1}$). From 1998–2002 for the high N rate there was a dramatic increase in $\text{NO}_3\text{-N}$ 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 $\text{NO}_3\text{-N}$ leaching from 3 mg L^{-1} in

Figure 1. The white circle in the foreground marks the top of a large lysimeter used to measure the amount of nitrogen and phosphorous that leaches through a 22-year old turf. The raised hatch allows researchers to collect samples at the base of the lysimeter.



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} .

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

Figure 2. Water leachate is collected on a regular basis to measure the amount of nitrogen and phosphorous that leaches through a Kentucky blue-grass turf maintained at rough height.



leached from the low and high N rate treatments was 6.3 and 31.6 mg L⁻¹. In 2004, the concentration of NO₃-N leaching from the high N rate treatment declined drastically from previous years. The average concentration of NO₃-N in leachate for the high N rate was 8.5 mg L⁻¹. This was a decrease in NO₃-N concentration of 23.1 mg L⁻¹ from 2003. For the low N rate the average concentration of NO₃-N in leachate for the low N rate was 1.2 mg L⁻¹.

Since 2004, there has been a steady decrease in the average concentration of NO₃-N in leachate for the high N rate. In the last 4 years (2009–2012) the mean NO₃-N concentration in leachate for the high N rate was 2.4 mg L⁻¹. Leaching from the low N rate has remained low and averaged less than 1 mg L⁻¹ in the last 4 years.

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

Summary Points

- For the high N rate, the annual mean NO₃-N concentration has been less than 10 mg L⁻¹ for 6 of 8 years since 2004.
- For the high N rate, NO₃-N concentrations have fallen in the last 4 years to levels less than 3 mg L⁻¹.
- For the low N rate, the mean NO₃-N concentration has been 5 mg L⁻¹ or less for every year except one (2003).