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Wetland Demonstration Project

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Abstract
Nitrate-nitrogen, as it relates to water quality in the Midwest, is tied to hypoxia in the Gulf of Mexico. Economic impacts due to loss of fishing in the Gulf along with environmental protection are a primary driver for reducing nitrate loads being delivered by the Mississippi River. Since a significant portion of nitrate-nitrogen export originates from subsurface drainage systems there is a need to implement practices that have the potential to reduce nitrate-nitrogen export. One way this can be done is through the use of constructed wetlands that denitrify the nitrate-nitrogen and release it to the atmosphere as nitrogen gas. The purpose of this project was to demonstrate the reductions in nitrate-nitrogen concentrations that can be achieved with a constructed wetland.

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Introduction

Nitrate-nitrogen, as it relates to water quality in the Midwest, is tied to hypoxia in the Gulf of Mexico. Economic impacts due to loss of fishing in the Gulf along with environmental protection are a primary driver for reducing nitrate loads being delivered by the Mississippi River. Since a significant portion of nitrate-nitrogen export originates from subsurface drainage systems there is a need to implement practices that have the potential to reduce nitrate-nitrogen export. One way this can be done is through the use of constructed wetlands that denitrify the nitrate-nitrogen and release it to the atmosphere as nitrogen gas. The purpose of this project was to demonstrate the reductions in nitrate-nitrogen concentrations that can be achieved with a constructed wetland.

Materials and Methods

The constructed wetland is located at the Southeast Research Farm near Crawfordsville, IA. It receives subsurface drainage from 30 acres of a drainage water management study. The wetland was constructed to have a water depth of 0 to 3 ft. Berms were constructed to force the water to follow a serpentine route as it flows through the wetland (Figure 1). The wetland was constructed to have a surface area of approximately one percent of the drained area. With 30 acres of subsurface coming into the wetland, it was sized with a surface area of 0.3 to 0.4 acres. Water levels in the wetland can be controlled with head control structure on the outlet of the wetland.

Because denitrification requires a growth of vegetation, cattail cuttings were planted in the spring of 2007. Good growth was achieved in 2007 with the cattails establishing well in 2008.

Water flow rates into and out of the wetland were monitored using V-notch weirs and pressure transducers and water samples were taken by grab sampling inflow and outflow on a weekly basis for assessment of nitrate-nitrogen levels.

Results and Discussion

Nitrate-nitrogen concentrations were slightly higher in 2008 than in 2009 (Figure 2). Averaged over the two years, influent nitrate-nitrogen concentrations were 9.8 mg/l and the effluent nitrate-nitrogen concentrations were 7.8 mg/l for a 20 percent reduction in concentration. It is anticipated that as more biomass accumulates in the wetland, nitrate-nitrogen removal may improve.

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Figure 1. Constructed wetland spring of 2009.

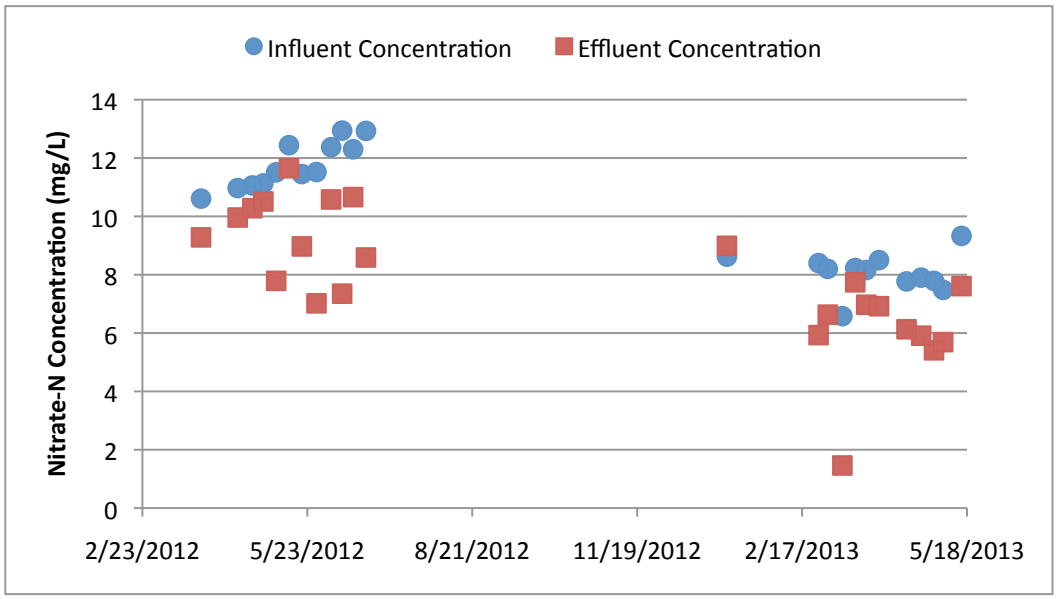

Figure 2. Wetland influent and effluent nitrate-N concentrations.