2009 CSREES National Water Conference; St. Louis, MO

Uptake and Degradation of Atrazine by Switchgrass

Jennifer A Anderson*, Joel R. Coats
Iowa State University
*Jen.humphries.anderson@gmail.com

Abstract:

Atrazine is widely used to control broadleaf weeds in row crop agriculture. Nonpoint source contamination (NPS) from agricultural surface water runoff has contributed to decreased water quality in rural watersheds throughout the Midwest. Plant-based remediation represents a cost-effective strategy for protecting valuable water resources from NPS. Switchgrass (Panicum virgatum L) is currently being investigated in the greenhouse and field to delineate the mechanisms driving the uptake and degradation of atrazine as well as to assess its potential for in situ phytoremediation. As part of the greenhouse study, twenty-four soil columns (30ft by 8ft) were seeded with switchgrass and grown under greenhouse conditions for 18 months prior to atrazine application. On days 0, 3, and 6, artificially-created agricultural runoff containing 4 ppm atrazine, was sprayed over the top 4ft of soil in each column. Columns were maintained under greenhouse conditions for the first six months and will be forced into senescence during the final two months of the study. Three columns are being sacrificed each month, and the concentration of atrazine and metabolites are being monitored in the soil and plant biomass by GC-NPD. As part of the three-year field study, two terraced agricultural fields in the clay-pan area of northeast Missouri are being remediated with switchgrass. Switchgrass was planted around tile inlets in terraces. The objectives of this study are to test the efficacy of using switchgrass buffers around tile inlets to reduce agricultural runoff and decrease the concentration of atrazine in tile drain effluent. Monitoring of atrazine concentrations in soil and tile drain effluent is ongoing in these fields. From these studies, a better understanding of the ability of a switchgrass-based phytomanagement strategy to decrease surface water runoff and enhance degradation of atrazine in situ will be achieved.

Impact Statement:

Switchgrass has the potential to provide a cost-effective management strategy for mitigating the environmental impacts associated with herbicide use in row-crop agriculture. We hypothesize that this switchgrass-based remediation technology will significantly reduce atrazine concentrations in surface water runoff, which will improve water quality in rural watersheds. The greenhouse study is specifically designed to delineate the mechanisms through which switchgrass can accumulate and degrade atrazine. The field study is designed to demonstrate the effectiveness of this green remediation technology. We have formed strong collaborations with the Vandalia Lake Watershed Group, which consists of farmers, city officials, and citizens, who each take an active interest in protecting the water quality in the Vandalia Lake Watershed. Short term outcomes of these studies include education and outreach for farmers and citizens living in rural watersheds. The remediated fields will be used for demonstration, where farmers and citizens can view the technology and learn how to best incorporate it into their fields. Long-term outcomes include improved water quality in rural watersheds throughout the Midwest.

Category: Agricultural BMPs
Type of Presentation: Poster Presentation