2012 Community IPM Grant Program Final Report

Project Title: Quantifying nitrogen leaching from an organic herbicide (corn gluten meal)

P.I.: Jenny Kao-Kniffin, Assistant Professor, Department of Horticulture

Cooperator: Marty Petrovic, Professor, Department of Horticulture

Mailing address: Cornell University, Department of Horticulture, 134A Plant Sciences Building, Ithaca, N.Y. 14853

Telephone: (607) 255-8886

Fax: (607) 255-0599

E-mail: jtk57@cornell.edu

Abstract: The recent NYS law banning conventional herbicides on school grounds (Child Safe Playing Fields Law) could create emerging problems for stormwater pollution management. We anticipate that corn gluten meal applications will increase as few allowable herbicides are available for weed control on school grounds. Lawns treated with corn gluten meal receive more than four times the level of nitrogen recommended by Cornell Turfgrass. We quantified the concentrations of nitrate leached from corn gluten meal, urea, and control plots over the 2012 growing season. We found that additions of urea and corn gluten meal resulted in high levels of nitrates in drainage water several months after the initial application. In contrast to what we expected, urea plots leached higher levels of nitrates compared to corn gluten meal despite starting with a nitrogen application 1/4th of the level found in corn gluten meal. For weed control, corn gluten meal did not show any difference in the suppression of annual crabgrass compared to the control. However, we found that adding low inputs of nitrogen in the form of urea increased the presence of weeds in comparison to the corn gluten meal and control plots. Although corn gluten meal showed no control of annual crabgrass, it can serve as an effective organic fertilizer that minimizes nitrate losses in drainage waters.

Background and Justification: Since May 2011, all public and private schools across NYS were required to change grounds management in adherence to the state mandated Child Safe Playing Fields Law. The law effectively bans the use of conventional herbicides for weed management on turf, with the exception of emergency applications that are approved by the school board. Additionally, organic landscaping is a growing trend in turf management that encompasses public spaces, home lawns, and institutional lands.

Corn gluten meal has been marketed as the only widely accepted preemergent herbicide for use in organic landscaping. The herbicidal properties of corn gluten meal consist of five peptides that inhibit the growth of seedlings. However, weed suppression through corn gluten meal additions may be a result of increased turf density and lower germination and survival of weed seedlings. Corn gluten meal is a product that contains high levels of leachable nitrogen, typically 10% of nitrogen by weight. We compared the effectiveness of corn gluten meal for

weed control in comparison to the Cornell recommended rate of nitrogen applications. The proposed project addresses the Community IPM priorities by:
1) Measuring potential impact of IPM practice and adoption on school grounds, and
2) Developing community IPM resources, such as website content, fact sheets, and manuals specific to school turf management.

Objectives: The proposed project is focused on the impacts of IPM adoption of corn gluten meal on school grounds and dissemination of IPM knowledge and resources to the stakeholder groups relevant to the NYS Community IPM program. The measurable outcomes are as follows:

Objective 1: Measure nitrogen losses and weed suppression levels across the corn gluten meal, nitrogen, and control treatment plots.
Procedures: We compared the efficacy of corn gluten meal as a preemergent herbicide on turf, in comparison to using nitrogen fertilizers as a weed suppressive technique. Researchers at Iowa State found that corn gluten meal contains peptides that inhibit seedling growth. However, turf scientists observed that adding corn gluten meal to lawns increases turf canopy cover and decreases weed emergence. We expected that the nitrogen found in corn gluten meal (10% nitrogen by weight) is providing weed control equivalent to using nitrogen fertilizers. In this proposed project, we hypothesized that nitrogen from corn gluten meal would be leached through the turf at high levels compared with the plots receiving the Cornell Turfgrass nitrogen recommendation rates.

Turfgrass plots at Cornell University's Bluegrass Lane Research Facility were fitted with lysimeter pools for the collection of leachate over a growing season. Three replicate circular plots per treatment measured 8 ft in diameter. Each plot received one of the following: 1) two applications of corn gluten meal at 20 lbs/1,000 sq. ft (equivalent to 2 lbs nitrogen/ 1,000 sq ft), 2) two applications of urea at 0.4 lbs. nitrogen/ 1,000 sq. ft, or 3) control plots with no additions. Leachate from each plot was collected in 18 liter collection buckets. A tipping bucket equipped with a HOBO pendant data logger (Onset Computer Corporation) logged the volume of leachate passing through the lysimeter. A portion of the leachate was collected after a rainfall for nitrate and ammonium analysis using an automated AQ2 Discrete Analyzer (SEAL Analytical). Suppression of annual smooth crabgrass (*Digitaria ischaemum*) and dandelion (*Taraxacum officinale)* was quantified in late summer using quadrant sampling devices measuring 0.25 m x 0.25 m.

Objective 2: Development and dissemination of IPM resources on school grounds weed management
Project Evaluation: We will analyze the results of the research project and summarize them as brochures, factsheets, and resource guides. The resources will be linked onto the Cornell Turfgrass website for free downloading. We will record the number of handouts disseminated at the presentation venues. Additionally, the research results will be shared with stakeholders through presentations at NYS turf and landscapes workshops and conferences. A select number of presentations will be followed with a reflective survey of audience members. We will ask the audience to evaluate the usefulness of the research findings to the management of landscapes they preside over, and the likelihood of adopting the various IPM methods discussed in the presentation.

Expected Outcomes/Impacts: The outcomes of the proposed project will serve school districts across NYS, in addition to the lawn care providers adhering to organic turf management. We plan to present the research results to school superintendents, groundskeepers, lawncare providers, and pesticide applicators through NYS turf and landscapes conferences and workshops. We estimate the following outcomes generated from this project:

· Number of contact hours = 1,000 hours (100 people x 1 hour presentation x 10 venues) generated through presentations at NYS turf and landscapes conferences and workshops featuring alternative weed management strategies

· Increase in knowledge or awareness of IPM = 1,500 copies of brochures, factsheets, and resource guides on allowable herbicides for school grounds and other alternative weed management strategies through the Cornell Turfgrass website and at the NYS turf and landscapes workshops and conferences.

Results and discussion

We found an increase in the percent cover of weeds in the plots treated with urea using the Cornell Turfgrass recommended rate of 0.4 lbs. nitrogen/ 1,000 sq. ft. (Fig. 1). There were no differences between the control and corn gluten meal treatments ($F= 7.72$ $p <0.05$). The other weeds in the study plots were comprised primarily of dandelions. We found lower percent cover of dandelions in the urea and corn gluten meal treatments compared to the control.

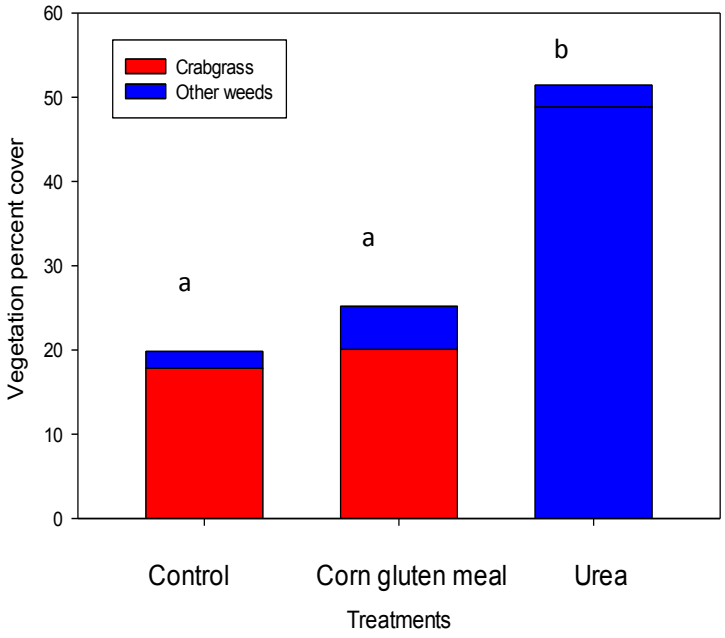

Figure 1. Weed percent cover in turfgrass plots treated with corn gluten meal or urea. Control plots did not receive any nitrogen additions.

Nitrogen losses were highest in the urea treated plots, followed by corn gluten meal, and the control (no nitrogen added) (Fig. 2). High nitrate levels were found in both urea and corn gluten meal drainage waters throughout the summer. We did not see a peak loss of nitrates in drainage water in the spring, when the urea and corn gluten meal treatments were added. Instead, nitrates were leached gradually throughout the growing season. The data show that corn gluten meal can be an effective alternative to synthetic fertilizer sources when nitrogen pollution is a concern to drainage waters. Turfgrass managed under organic land care standards primarily use manure-based organic fertilizers that contribute to high levels of phosphorus pollution, but corn gluten meal could be used as a viable option that minimizes nutrient losses.

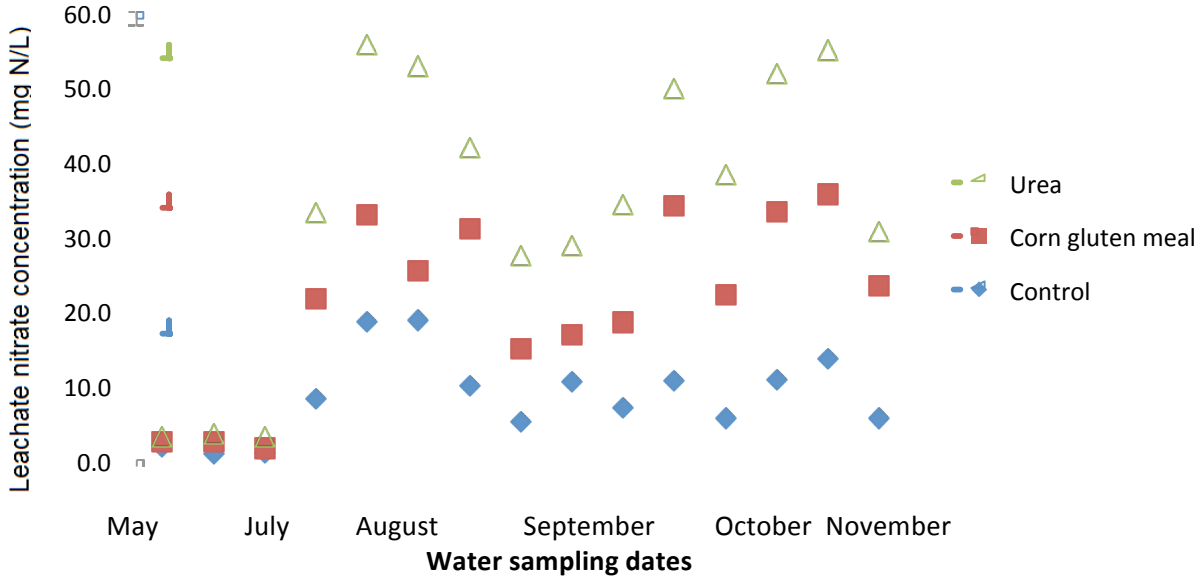

Figure 2. Levels of nitrate in water collected from lysimeters under the turfgrass plots. Applications of urea and corn gluten meal are compared with the control plots that received no nitrogen additions.

Significance of conclusions

The most significant findings from this study that will impact the NYS IPM community include the following:

1. Corn gluten meal does not provide any control of annual crabgrass weeds and urea worsened the infestation of annual crabgrass in turf by more than twice the level.
2. Urea leaches higher levels of nitrates into drainage waters, by more than four times the level of corn gluten meal.
3. Corn gluten meal is an effective organic alternative to synthetic nitrogen fertilizers by minimizing the losses of nitrates in drainage waters.

We will be including these significant findings in all extension materials concerning the 2010 Child Safe Playing Fields Law and organic lawn care strategies. Specifically, we anticipate:

1. 1,000 contact hours for 2013 in the form of extension presentations at workshops and conferences in NYS.
2. Inclusion of the findings in brochures, websites, and hand outs.
3. Citations of the study in extension publications summarizing corn gluten meal use in turf management.

Project Location

The findings from the research project are likely to be applied across all counties in NYS. The intended audience includes all school district superintendents, groundskeepers, and service contractors affected by the Child Safe Playing Fields Law.

Supplementary photos:

Photo 1: Researchers and a junior scientist collect water samples from the turfgrass plot lysimeters for nitrogen analysis

Photo 2: Chamber holding the lysimeter devices that collect drainage waters from the turf plots