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Understanding Pesticide and Nutrient Loss with Runoff From Fairway Turf and Evaluating the Ability Of Management Practices to Mitigate Their Loss

Principle Investigators

*Dr. Brian Horgan (U of MN) and Pamela Rice (USDA/ARS)
University of Minnesota*

This research project is part of a multi-state cooperative initiative to improve the current understanding of pesticide and nutrient runoff from turf. Two objectives of the study are 1) to quantify pesticide and nutrient transport with runoff from fairway turf as affected by regional variability, turf species variability, and test plot size, and 2) to evaluate the ability of turf management practices to mitigate pesticide and nutrient loss with rainfall and snowmelt runoff.

Effect of Regional Variability, Turf Species Variability, and Plot Size

A standardized protocol was used for the construction and maintenance of fairway turf plots in the North-Central, Mid-Atlantic, and Southeastern regions of the United States. Pesticide applications, rainfall simulation, runoff collection, and chemical analysis are similar for all locations (Minnesota, Maryland, and Mississippi), while plots size (small, medium, large) and turf species (bentgrass, Bermuda grass, tall fescue, Meyer Zoysia) vary according to location. Plots representing each treatment are replicated and hydrologically isolated from each other. Forty-eight hours prior to pesticide application the rainfall simulator will be used to pre-wet each plot to saturation to ensure uniform water distribution. Beginning this summer (2004), replicate samples of surface runoff water and turf/soil cores will be collected and analyzed to determine levels of nutrients and pesticides removed from the site of application with runoff water, leaching to the underlying soil, or remaining on the grass and thatch. We have selected medium size plots (20' x 80') planted with creeping bentgrass for the Minnesota location. Creeping bentgrass was also planted at the Maryland site while a number of different turf species are represented with the Mississippi plots. Data collected from this study will help fill the information gaps between former studies and what is required by the US EPA to more accurately



ly assess the non-point source pollution potential of pesticides and nutrients from turf runoff. Improved knowledge of pesticide transport will allow risk assessments to be made with quantitative data rather than conservative assumptions, which should reduce overestimation of risk and provide more accurate real-life estimates, resulting in more scientifically-based criteria for the registration and use of turf protection products

Ability of Management Practices to Mitigate Pesticide and Nutrient Loss

The off-site transport of pesticides and nutrients is both an agronomic and environmental concern resulting from reduced control of target pests in the area of application and contamination of non-target surrounding ecosystems. The primary objective of our research project, in Minnesota, is to evaluate the ability of management practices to mitigate pesticide and nutrient loss with rainfall and snowmelt runoff. Several management practices including tine aeration, vertical mowing, and sand topdressing can be utilized to control thatch accumulation. Hollow-tine aeration removes a small percentage of the thatch and introduces microbes responsible for organic matter degradation into the thatch layer. Vertical mowing has been successfully used as a substitute for core cultivation for thatch

control but does not have the same impact on reducing compaction. Regular sand topdressing of fairways is becoming more popular and has been shown to improve courses with heavy soils and poor drainage. Ultimately, this practice enhances playing conditions however it is not common on golf course fairways because of the resources required. Despite the widespread use of these turf management practices, their impact on runoff and potential to mitigate pesticide loss with runoff has not been studied. Our goal is to identify the management practice that maximizes pesticide and nutrient retention at the site of application, thereby improving desired results of pest control and turf maintenance while minimizing environmental contamination and adverse impacts associated with the off-site transport of these compounds. Assessment of management practices to reduce runoff volume and pesticide and nutrient loss with rainfall runoff will begin this summer (2004) followed by fall application of snow-mold fungicides and late-fall fertilizers, and the assessment of their transport with runoff during the following spring thaw. Results of this research will provide quantitative information to golf course superintendents that will allow for informed decisions on best management practices that are both environmentally-responsible and provide quality turf.

Corn Gluten—

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gathered included ratings for color and overall stand density. Percent weed invasion was added in 2003. Plots are rated about every 4 to 6 weeks during the growing season.

Some preliminary observations: Following are some preliminary observations of the plots to date:

+ Little to no annual grassy weed invasion in any of the plots;

+ Broadleaf control (esp. dandelion) is rather poor in mixture and KB; doesn't seem to vary by treatment; some white clover invasion;

+ Little to no dandelions in FF; FF weed free

+ Reaches peak green-up about 2 to 4 weeks following application;

+ Sustained dark green color for 6 - 8 weeks following applications;

+ As amount of CGM applied during the year increased, so did the consistency of color retention and density, and

+ Spring green-up characteristics are good to excellent from late season (late October) applications.

Data collection will be continuing on a monthly basis in 2004 and beyond. It will be interesting and informative to observe what if any of the current trends change over the next few years.

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Miscanthus, Ornamental and Invasive Grass

By Mary Hockenberry Meyer

Associate Professor, Department of Horticultural Science, University of Minnesota

Miscanthus is a beautiful ornamental grass, admired by many gardeners. It is often planted around water, and has good potential for use on golf courses and large landscape settings. Its tall, showy flowers are dramatic and stately, evoking images of the Orient and Japanese gardens. It has become a best seller as ornamental grasses and other new herbaceous perennials increase in popularity in American gardens.

Over the years, especially in the 1980s new cultivars of Miscanthus came on the market. Over 50 cultivars can be found today for sale, many of which originated from seedlings found in various nurseries. These new cultivars have been selected for earlier flowers, new flower colors and increased winter hardiness. Although these characteristics are desirable ornamental traits, they are also traits that are found in invasive plants.

Recently, I was able to spend a sabbatical study leave looking at the issue of Miscanthus as an invasive plant in the US.

The final result of this project, which was funded in part by the National Parks Service, is online:
<http://horticulture.coafes.umn.edu/miscanthus>.

I found a considerable amount of escaped Miscanthus in the US. In Eastern US, it's Miscanthus sinensis. In the Midwest, it's Miscanthus sacchariflorus. In Europe, there is much work on Miscanthus x giganteus, (a natural hybrid of the above two species) as a biomass fuel source. It is important to distinguish between these three kinds of Miscanthus.

Miscanthus sinensis is a bunch grass or clumper with many cultivars; Miscanthus sacchariflorus has aggressive rhizomes and little variation, and Miscanthus x giganteus is a huge plant, with broad leaves, slowly creeping rhizomes, and late flowers that set no seed. (For further details see:

<http://horticulture.coafes.umn.edu/miscanthus/identification.html>.)

Miscanthus Sinensis

As a grounds manager it's important to understand and to be aware of the potential invasiveness of Miscanthus. The biggest potential threat for invasiveness comes from Miscanthus sinensis.

Although few nurseries are growing or selling the species, the cultivars can be found at most retailers. When two or more of these cultivars are grown together, seedlings are possible, and almost always revert back to the "wild type" or species, which can become quite aggressive. Currently, the area where Miscanthus sinensis has self-seeded the most is the Middle Atlantic States.

Miscanthus is cross-pollinated, it requires two or more cultivars or species to set seed. Individual, isolated plants usually set little or no seed. Therefore, many gardeners who grow only one plant never see seedlings. In managed landscapes and typical home gardens any

(Continued on Page 27)



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Miscanthus—

(Continued from Page 25)

seedlings will be noticed, removed or enjoyed. When a large planting of Miscanthus including several cultivars or kinds is planted along a highway, natural area, or in landscapes where self-seeding can go unnoticed, potential problems exist.

Miscanthus Sacchariflorus

This rhizomatous species is very cold hardy, even in USDA Zone 2. Locally this species is often referred to as "pampas grass." Although large colonies of this grass are found along roadsides in many counties in Iowa, and to a limited extent in Minnesota, this species sets very little or no seed. Over the years, the diameter of the colony can increase, but it can be controlled with regular mowing during the growing season or glyphosate applied to 6-12" of green actively growing tissue. This species is not as ornamental due to the aggressive rhizomes, and because of this, many nurseries do not sell this plant.

Miscanthus x Giganteus

The giant Miscanthus has been researched extensively in Europe as a biomass fuel source. Flowers appear in October, however and the blooms may not form in colder, (USDA Zones 4 or 5) climates. These flowers are male sterile and even when grown with other species, this form has not been known to set any seed.

From an invasive standpoint, giant Miscanthus appears to be of little risk. This species is hardy in USDA Zone 3 in most winters. Because of its size, it makes a good screen, or a maze for children's gardens.

Recommendations

Should you continue to plant Miscanthus? DO NOT PLANT the species Miscanthus sinensis. Plant only vegetative propagated cultivars that have shown little evidence of self-seeding in your area. See <http://horticulture.coafes.umn.edu/miscanthus/recommendations.htm> for further recommendations.

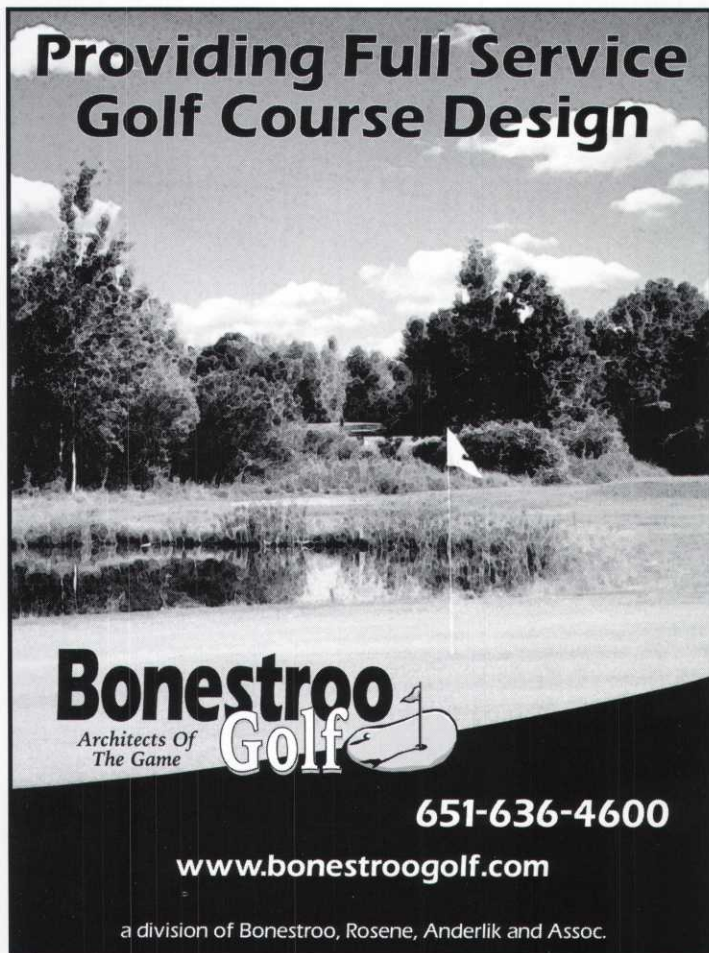
Watch for Seedlings!

If you have Miscanthus on your grounds or golf course, be on the lookout for seedlings in beds nearby or new plants appearing where you did not plant them. Remove all seedlings.

Will Miscanthus Be the Next Invasive Plant in Minnesota?

I doubt it. For one thing we are much more aware of invasive plant problems and on the lookout for potential self-seeding plants. Secondly, Miscanthus seeds still may not develop before a fall frost in our climate. Newer, early flowering cultivars pose the biggest threat and should be watched carefully.

In conclusion, Miscanthus sinensis cultivars should only be planted in managed landscapes where they can be watched and controlled for self-seeding. How quickly or much further Miscanthus will spread in the United States is difficult to predict. As responsible horticulturists, we must be aware of potentially invasive plants, open to communication about these issues, and play a role in the education of the gardening public.



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U OF M TURF AND GROUNDS FIELD DAY SET FOR JULY 29

The University of Minnesota Turf and Grounds Field Day will be held on July 29, 2004 at the TROE Center on the St. Paul campus. This is an excellent opportunity to see first hand the types of research projects being conducted by University faculty. The following are examples of research projects which will be showcased during the morning field day:

- + Pesticide runoff from bentgrass fairways
- + Use of colonial bentgrasses and fine fescues on golf course fairways
- + Nitrogen leaching and gas emissions from fertilizers applied to a USGA putting green as effected by irrigation inputs
- + National Turfgrass Evaluation Program
- + Perennial ryegrass and Kentucky bluegrass breeding nurseries
- + Using remote sensors to help conserve irrigation water
- + Fertilizer runoff from Kentucky bluegrass
- + No-mow grasses and alternative plant species

These are examples of the types of projects that you can see at field day on July 29, 2004. Following field day, we will offer a phosphorus fertilizer training program for golf personnel and other exciting educational opportunities.

— Brian Horgan
Extension Turfgrass Specialist, University of Minnesota

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Little Bluestem Research

By Mary H. Meyer

Associate Professor, Department of Horticultural Science, University of Minnesota

Schizachyrium scoparium, or little bluestem, is native to most of the United States, with the exception of the far western states and Florida. Typically an upland grass, little bluestem is known for its drought tolerance and ability to grow on sandy and poor soils. It is a dominant grass in the tall and short grass prairie and is found throughout Minnesota.

The USDA has released several varieties of *Schizachyrium scoparium*, or little bluestem beginning in the 1960's. 'Aldous', 'Blaze', 'Camper', 'Cimarron' and 'Pastura' were the result of breeding programs to improve grasses available for forage and range use in the central US. More recently, in 1997, the USDA Plant Materials Center in Bismarck, ND released 'Badlands', an ecotype selected from collections from North and South Dakota. 'Badlands' is adapted for range seeding, prairie restoration and prairie landscaping. None of these selections are from Minnesota native

little bluestem.

At the University of Minnesota, we have conducted research on little bluestem in the following projects.

- + Seeding Date & Establishment
- + Field Seedling ID
- + Minnesota Population & New Selections
- + Propagation Time & Aeration Porosity
- + Competition Study with *Miscanthus*

All of these projects, except the competition study, have been published in the references listed at the end of this article.

Seeding Date & Establishment

In this research, the best planting dates for little bluestem were May 1 through July 20. Dormant seedings were not successful for the two years, 1996 and 1997, of the project. As expected, rainfall influenced the success of most seedings.

Field Seedling ID

Identification of grasses without floral parts can be a challenge. In prairie restoration the ability to identify grass species in the seedling stage is necessary to determine if the planting has been successful. Little bluestem was one of 15 native and introduced grasses that were analyzed and described in a vegetative key to identify seedlings. Little bluestem seedlings have a flat sheath, are folded in the bud, have no auricles, the culm base is often tinged pink or maroon, and the first tillers fan out in a plane.

Minnesota Population & New Selections

A spaced planting of 35 Minnesota little bluestem populations was established in 1996 and 1997. Collections were made
(Continued on Page 31)

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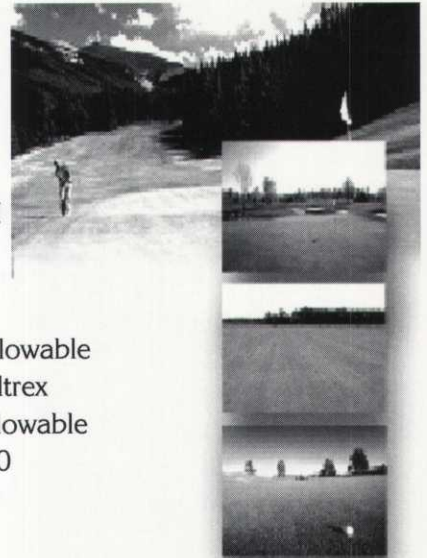


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