Reducing Pesticide and Nutrient Loads from Fairway Runoff Utilizing Management Practices

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Objectives:

1. To quantify pesticide transport with rainfall runoff and evaluate the ability of management practices to mitigate pesticide and nutrient loss with runoff.
2. To evaluate the mobility of snow mold fungicides and late-fall fertilizer with rainfall and snow melt runoff.
3. To determine the impact of location of chemical application to their transport with surface runoff.

Start Date: 2005
Project Duration: three years
Total Funding: $90,000

Water quality surveys have detected excess nutrients and multiple pesticides in surface waters of urban and rural areas. As a result, attempts are being made to identify the sources of these compounds and reduce their inputs.

The use of fertilizers and pesticides in highly managed turf systems has raised questions concerning the contribution of runoff from managed turf. To address these questions, we designed experiments to measure the quantity of fertilizers and pesticides transported with runoff from fairway turf, and to evaluate the ability of chemical application strategies and cultural practices to reduce the transport of applied chemicals with runoff.

Chemical application strategies were evaluated with conservative tracers, compounds historically utilized as hydrologic tools for characterizing water movement through soil. We applied potassium bromide (KBr) and three fluorobenzoic acids (FBAs) to selected areas of turf plots, representing a bentgrass fairway, to evaluate the influence of location of chemical application to their transport with surface runoff. Within 24 hours of the tracer application, precipitation was generated with a rainfall simulator and runoff samples were collected.

Co-application of FBAs and KBr demonstrated these tracers have similar transport patterns. Selective application of multiple FBAs enable identification of areas that contribute the most to chemical transport with runoff from turf and provide information to determine chemical application strategies to reduce off-site transport of applied compounds.

In 2005 and 2006, cultural practices were assessed to determine their capacity to reduce surface runoff and chemical transport with runoff. Turf plots were managed as a golf course fairway (1.25 cm height of cut) following a standardized protocol for chemical application, simulated precipitation, and collection of runoff and turf/soil samples.

Preliminary results of fertilizer transport show reduced runoff volume, nitrogen loss, and phosphorus loss with hollow-tine aeration compared to solid-tine aeration.

In 2005, half of the plots received solid-tine aeration while the remaining plots were managed with hollow-tine aeration. Fertilizer (18-3-18, N, P_2O_5, K_2O) and a commonly utilized herbicide (2,4-D), insecticide (chlorpyrifos), and fungicide (flutolanil) were applied to each plot 24 hours prior to the intiation of the simulated precipitation. Replicate samples of surface runoff water and turf/soil cores were collected for analysis to determine levels of fertilizer and pesticides removed from the site of application with runoff water or leaching to the underlying soil. Rainfall simulations and collection of resulting runoff were completed two days and 63 days following aeration (2d, 63d).

Preliminary results for fertilizer transport show reduced runoff volume (2d, 63d), nitrogen loss (2d) and phosphorus loss (2d, 63d) with hollow-tine aeration relative to solid-tine aeration. Completion of pesticide analysis and statistical analysis of fertilizer and pesticide data will determine the statistical relevance of the initial observed trends.

In 2006, an additional cultural practice was evaluated. All turf plots were initially managed with hollow-tine aeration and sand topdressing. Seven days prior to the second rainfall simulation, half of the plots also received vertical slicing to increase water infiltration and further manage the thatch. Chemical application, rainfall simulation, and sample collected followed the same protocol initiated in 2005.

Infiltration measurements revealed the implementation of vertical slicing enhanced water infiltration. Analysis of runoff water will determine the influence of enhanced infiltration on runoff volumes and chemical transported with the runoff. Chemical analysis and evaluation of pesticide and fertilizer data will continue through spring 2007 and will be utilized to determine management strategies evaluated during the summer of 2007.

Identifying practices that reduce off-site transport of applied chemicals will increase fertilizer and pesticide efficacy at the intended sites of application and minimize their potential adverse impacts to the surrounding surface water resources. Results of this research will provide information that will allow for informed decisions on best management practices that are both environmentally responsible and provide quality turf.

Summary Points

- Selective application of conservative tracers enable identification of areas that contribute the most to chemical transport with runoff from fairway turf.
- Hollow-tine aeration reduced runoff volume and nutrient transport with runoff compared to solid-tine aeration.
- Implementation of vertical slicing to turf managed with hollow-tine aeration and sand topdressing significantly enhanced water infiltration.