

Nutrient and Pesticide Runoff from Golf Course Fairways Caused by Simulated and Natural Rainfall

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Objectives:

1. The objective of this portion of the project is to investigate the amount of nutrient runoff that occurs from a bermudagrass golf course fairway under normal maintenance conditions.

Start Date: 2004

Project Duration: three years

Total Funding: \$90,000

Fairways comprise the largest portion of intensively managed turfgrass on golf courses and often border bodies of water. Fairways are fertilized throughout the growing season and surface runoff of nutrients can occur. The amount of nutrient runoff that is likely to occur under normal conditions is not known. The objective of this study is to investigate the amount of nutrient runoff that occurs from a bermudagrass golf course fairway under normal maintenance conditions and natural rainfall.

Collection troughs and automated samplers were positioned at the bottom of six 40 by 80 ft. plots (5% slope) for surface runoff collection. Fertilizer (1 lb./1000 sq. ft./month N and 0.5 lb./1000 sq. ft./month P) was applied to two of these plots (6,400 sq. ft.) at the beginning of each month during the growing season on a site specifically constructed and managed to simulate a bermudagrass (*Cynodon dactylon* L.) golf course fairway. A system of time domain reflectometers (18 total) were used to monitor antecedent soil moisture and irrigation was used to maintain the site at approximate field capacity throughout the study. Runoff samples were collected and tested for $\text{NO}_3\text{-N}$, $\text{NH}_4\text{-N}$, and dissolved reactive phosphorus (DRP) following two natural rainfall events that produced runoff in 2003. Runoff was also collected from three events in 2004 and three events in 2005.

An average of seven rainfall events occur each year that have sufficient intensity and duration to generate runoff from this particular site. The preliminary results from two events in 2003 and three events in 2004 and 2005 suggest that the loss of nutrients in runoff compared with the amount of nutrients applied is very



Future research will measure the difference in pesticide and nutrient runoff between a common method for producing simulated rainfall and a typical turfgrass irrigation system.

small under normal conditions. The proportion of nitrogen lost in runoff compared with the amount applied in a single month ranged from 0.01% to 5.77% during rainfall events. The mean loss during a rainfall event was 1.02%.

Phosphorus losses were also low. Phosphorus losses in runoff ranged from 0.02% to 5.06% and averaged 1.05% per event. Although nutrient losses were very low, the nutrient concentrations in runoff were high enough to potentially cause eutrophication of surface water. Eutrophication is the process that results in the so called "dead zones" at the Mississippi Delta, Chesapeake Bay, and other water bodies.

It has been stated that concentrations as low as 1 ppm nitrogen and as low as 50 ppb phosphorus in surface water are sufficient to cause eutrophication. The nitrogen concentrations collected during this study ranged from 0.00 to 6.84 ppm

and averaged 1.66 ppm. The phosphorus concentrations ranged from 0.00 to 6.88 ppm with a mean concentration of 1.93 ppm. The results of these eight events (preliminary data) suggest that nutrient concentrations are not particularly affected by runoff flow rate but are strongly related to cumulative volume loss.

Summary Points

- Nitrogen and phosphorus concentrations in runoff appear to be closely related to the cumulative runoff that occurs during natural rainfall.
- The percentage of applied fertilizer lost to surface water from a bermudagrass golf course fairway during normal rainfall appears to be extremely low (~1%).
- Although the percentage of fertilizer lost to runoff is very small, the concentrations of N and P in the runoff are high enough to potentially cause eutrophication of surface water.