Controlling Nutrient Runoff From Golf Course Fairways Using Vegetative Filter Strips

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Objectives:

1. The objective of this portion of the project was to investigate the influence of hollow-tine aerification and core removal on nutrient runoff from bermudagrass golf course fairways under natural rainfall conditions.

Start Date: 2000
Project Duration: 4 years
Total Funding: $75,000

Time domain reflectometers and irrigation were used to maintain soil moisture at field capacity throughout the study.

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. Golf course superintendents may aerate fairways two or more times during the growing season, but it is not known if aerification affects surface runoff during normal rainfall. The objective of this study was to investigate the influence of hollow-tine aerification and core removal on nutrient runoff from bermudagrass (*Cynodon dactylon* L.) golf course fairways under natural rainfall conditions.

Collection troughs and automated samplers were positioned at the bottom of six 12.3 x 24.4-m plots (5% slope) for surface runoff collection. Three plots received aerification and three plots served as controls in a randomized complete block design. No buffers or other deterrents were used to reduce runoff in this study. Aerification and fertilizer (49 kg N ha^{-1} and 24 kg P_2O_5 ha^{-1}) was applied at the beginning of each month during the growing season to a runoff site specifically constructed and managed to simulate a bermudagrass golf course fairway.

Collectors were programmed to collect runoff samples at 5-min intervals any time runoff occurred.

A system of time domain reflectometers (18 in all) 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 NO_3-N, NH_4-N, and dissolved reactive phosphorus (DRP) following seven natural rainfall events that produced runoff in 2003 and 2004.

Aerification delayed runoff by 4 minutes and reduced runoff volume by 47% compared to control plots. Aerification reduced the total amount of N and P lost to surface water during the first 70 minutes after rainfall began, but after prolonged, heavy periods (>70 min) of rainfall, nutrient runoff from the aerified plots did not differ significantly from the control plots. The total amount of applied fertilizer potentially lost to surface water was extremely low (<1%).

Although aerification reduced the total runoff volume and nutrient losses, nutrient concentrations in runoff did not differ between treatments. If undiluted, average DRP concentrations (1.5 mg L^{-1}) in runoff from both aerified and control plots were high enough to contribute to a degradation of surface water quality. Total N concentrations did not exceed the United States Environmental Protection Agency guidelines of 10 mg L^{-1}. This study implies that frequent aerification is likely to reduce nutrient runoff over the course of a growing season, but has no effect during a single heavy rainfall event.

Summary Points

- Aerification reduced the total amount of N and P lost to surface water during the first 70 minutes after rainfall began, but after prolonged, heavy periods (>70 min) of rainfall, nutrient runoff from the aerified plots did not differ significantly from the control plots.
- The total amount of applied fertilizer potentially lost to surface water was low (<1%).
- Although aerification reduced the total runoff volume and nutrient losses, nutrient concentrations in runoff did not differ between treatments.
- This study implies that frequent aerification is likely to reduce nutrient runoff over the course of a growing season, but has no effect during a single heavy rainfall event.