Controlling Nutrient Runoff From Golf Course Fairways Using Vegetative Filter Strips

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Objectives:

1. Investigate the influence of multiple vegetative filter strips for reduction of nutrient runoff.
2. Determine if irrigation and natural rainfall differ in propensity for nutrient runoff.
3. Study the impact of antecedent soil moisture and application timing prior to rainfall on nutrient runoff potential.
4. Investigate the potential use of the PRZM3 model for determing nitrogen fate under golf course conditions.

Start Date: 2000
Project Duration: 3 years
Total Funding: $75,000

Fairways comprise the majority of maintained grass on golf courses and often border creeks, streams, ponds, lakes, and oceans. Bermudagrass (*Cynodon dactylon*) is a commonly used turf for golf course fairways and is fertilized at rates as high as 1 lb nitrogen/1000 ft^2/ month and 0.5 lb P_2O_5/ 1000 ft^2 / month during the growing season. Consequently, nutrient runoff from golf course turf to surface water is an environmental concern.

Vegetative Filter Strips (VFS) are areas of permanent grassed vegetation that serve to prevent or reduce surface runoff of chemicals and nutrients from agricultural lands, golf courses, and residential landscapes. Little research has been done concerning VFS performance on golf course areas. The objective of this study was to investigate the influence of multiple VFS of increasing height for reduction of nutrient runoff from bermudagrass golf course fairways compared with VFS of uniform height, and with no VFS.

Runoff is collected from both natural and simulated rainfall. The irrgation system produces simulated events up to two inches per hour with an 80% coefficient of uniformity.

Simulated irrigation applied at a rate of 2.0 inches/hr for 1.5 hrs and natural rainfall events were observed for differences between single VFS and multiple VFS of increasing height as well as multiple VFS and no VFS in 2001 and 2002. Multiple VFS consisted of bermudagrass turf mowed at three heights increasing from 1 inch to 1.5 inches to 2 inches in 6-foot-wide strips perpendicular to a 5% slope. The single VFS were mowed at 2 inches and were 18 feet wide. The fairway was mowed at 0.5 inch.

After each simulated event, the site was fertilized again to await natural rainfall events. Three time domain reflectometry probes buried at the top, middle, and bottom of each fairway were used to monitor soil moisture content and irrigation was applied (with no resulting runoff) periodically to maintain field capacity between simulated and natural rainfall events. Time to initiation of runoff was monitored for each event. Runoff was tested for NO_3-N, NH_4-N, and PO_4-P. Flow rate was automatically recorded each time a sample was collected.

Multiple VFS significantly delayed the initiation of runoff compared with both single VFS and no VFS in both simulated and natural rainfall. There were no significant differences in NO_3-N, NH_4-N, or PO_4-P concentrations between single VFS and multiple VFS, but all three nutrient concentrations were significantly reduced in multiple VFS runoff compared with no VFS.

The concentration of NO_3-N never exceeded the recommended EPA limit for drinking water of 10 ppm, but PO_4-P consistently exceeded a commonly recommended allowance of approximately 50 parts per billion even though less than 4% of applied

Automatic samplers record flow rate and collect runoff at user-determined intervals after an ultrasonic detector sense the presence of runoff.

P was lost through runoff. During simulated rainfall events, multiple VFS delayed runoff for only about five minutes compared with single VFS, but prevented approximately 22 mg NO_3-N, 29 mg NH_4-N, and 165 mg PO_4-P from moving off-site. Multiple VFS significantly delayed runoff during natural rainfall events for an average of five minutes compared with single VFS.

Summary Points

- Multiple vegetative filter strips mowed at increasing height delayed runoff compared with a single vegetative filter strip of equal total width.
- Nutrient concentrations in runoff were not affected by the difference in multiple and single VFS, but multiple VFS did decrease nutrient loading by delaying runoff.
- Applications of granular N at 1 lb per 1000 ft^2 did not result in dangerous concentrations of NO_3-N in runoff even when subjected to severe rainfall.
- Applications of P at 0.5 lb per 1000 ft^2 produced excessive PO_4-P in runoff during severe rainfall and lighter, more frequent applications should be considered.