Optimization of Vegetative Filter Strips for Mitigation of Runoff from Golf Course Turf

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Objectives:

1. Use selected plant species in a field study to evaluate the efficacy of vegetative filter strips (VFS) and their most effective arrangement.
2. Determine the fate of pesticides retained in VFS and the major mechanisms of degradation.

Start Date: 2008
Project Duration: 3 years
Total Funding: $90,000

The loss of pesticides and nutrients into surrounding bodies of water and the resulting decreases in water quality has led to the use of best management practices on golf courses. One such practice is the use of vegetative filter strips (VFS) to intercept runoff water and thus prevent its loss and the loss of any associated pesticides and nutrients to surrounding water bodies.

Joint greenhouse and field studies have been implemented to evaluate selected plants for their effectiveness in removing pesticides and nutrients from turfgrass runoff waters that enter vegetative filter strips (VFS). A greenhouse pot study determined five species (big blue stem, blue flag iris, eastern gama grass, prairie cord grass, and woolgrass) most effectively removed the six selected pesticides (2 fungicides, 2 herbicides, and 2 insecticides) from a silt loam soil.

In 2008 a run-on plot, consisting of 12 VFS planted in replicates of three (unvegetated, random mixture of plants, succession of plants, and turfgrass cut to three heights), was established; and an overhead simulated rainfall system was constructed similar to those used in previous USGA-funded runoff studies in Minnesota.

During the 2009 growing season, we installed additional lysimeters 1' underground and conducted two studies using an estimated runoff volume generated during a 1-year storm event of 25.4 gallons over the course of 24 hours. The 25.4 gallons of run-on was applied to the top edge of each VFS as a water mixture with bromide (15.1 g/gal) via a solvent transfer pump, once using inground irrigation and once using an artificial rainfall system. Runoff water was continuously collected from the bottom of the VFS. There were little differences in runoff volumes from the VFS planted as turfgrass (0.5 gallons), mixture of plants (0.2 gallons), and succession of plants (0.3 gallons) compared to the bare strips (7.1 gallons).

Bromide was detected in the runoff from the unvegetated VFS only (average time to bromide detection was 6.5 minutes). An average of 32.4 mg of chlorothalonil, 10.9 mg chlorpyrifos, 6.3 mg pendimethalin, 11.3 mg propiconazole, and 68.6 µg of imidacloprid were detected in the runoff collected continuously from the unvegetated VFS. Chlorothalonil (0.7 mg), propiconazole (0.1 mg), and imidacloprid (2.0 µg) were detected in two of the three succession of plants VFS. Pesticides were not detected in the runoff from either the random mixture of plants or turfgrass VFS.

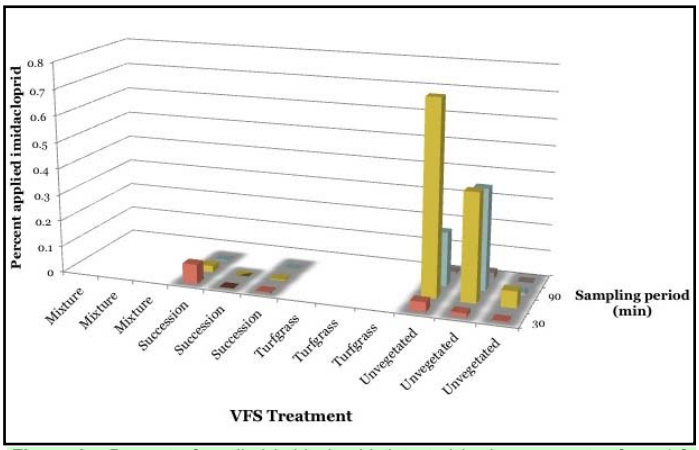

Figure 2. *Percent of applied imidacloprid detected in the pore water from 1-ft. lysimeters following pesticide application.*

As seen in Figure 1, imidacloprid was detected in all sampling intervals (30, 60, 90, and 120 minutes) in the runoff water from the three replicated unvegetative plots. It was also detected in the runoff from the succession VFS. It was not detected, however, in the runoff from the turfgrass and mixture VFS. Imidacloprid was detected in the pore water samples collected from the 1' lysimeters over time for all treatments. Nevertheless, the lysimeter samples from the turfgrass VFS were substantially less contaminated that the lysimeter samples from the other treatments.

These results are supportive of the contention that the thatch layer may be an efficient barrier to pesticide runoff and leaching, in that no imidacloprid was found in the runoff water from turfgrass VFS and less imidacloprid apparently was available for leaching in these plots.

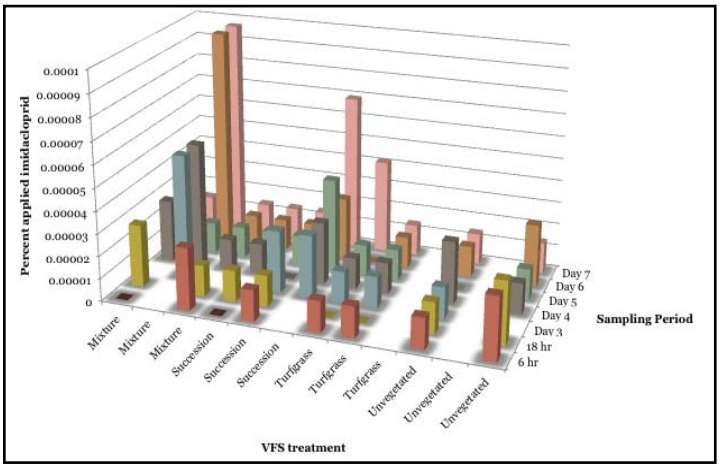

Figure 1. *Percent of applied imidacloprid detected on runoff water collected from VFS in 30-minute increments following run-on initiation.*

Summary Points

- Preliminary data suggests that all of the vegetative treatments work to retain runoff water and prevent pesticide loss.
- The turfgrass VFS works as well, if not better, as the other vegetative treatments.
- Mixtures of plants are unsustainable.