

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

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**Objective 1:** Use selected plant species in a field study to evaluate the efficacy of VFS and their most effective arrangement.

**Objective 2:** Determine the fate of pesticides retained in VFS and the major mechanisms of degradation.

Start Date: 2008

Project Duration: Three 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 runoff 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. This 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 hrs.

The purpose of the first application was to determine the runoff generated from VFS that had been planted in 2007. Soil presaturation was achieved prior to the initiation of the storm event by applying irrigation for 6 hrs (~2.4"). The 25.4 gal of runoff was applied to the top edge of each VFS as a water mixture with bromide (15.1 g/gal) via a solvent transfer pump. The runoff volume was applied over a 2 hr interval with the first hour in the presence of "rainfall" and the second hour without. Runoff water was continuously collected at the bottom of the VFS. Three-minute grab samples were collected in 30 mL bottles for the first 30 min after the initiation of runoff and analyzed for bromide. There were little differences in runoff volumes from the VFS planted as turfgrass (0.5 gal), mixture of plants (0.2 gal), and succession of plants (0.3 gal)

compared to the bare VFS (7.1 gal). Bromide was detected in the runoff from the bare VFS only (average time to bromide detection was 6.5 mins).

The second runoff application occurred in the presence of overhead simulated rainfall. Soil presaturation was achieved prior to the initiation of the storm event by applying 0.8 inches/hr of rainfall for 9 hrs, followed by 15 hrs without rainfall. Three hrs of overhead rainfall overlapped with the runoff (25.4 gal of water mixed with the six pesticides from the greenhouse study, at 5% their maximum application rate, and bromide at 1.5 g/gal as a tracer) for the last hr only. The overhead rainfall produced a four-fold increase in average runoff volumes and a greater distinction between treatments (1.2, 1.2, 4.6, and 27.3 gal over the course of 2 hrs for turfgrass, mixture of plants, succession of plants and bare VFS, respectively). We collected 60 runoff samples, 84 subsurface water samples from 1' lysimeters, 108 subsurface water samples from 5' lysimeters, and 648 soil core samples that will be analyzed for pesticides. We collected 132 30-mL samples to be analyzed for bromide. Bromide was detected after 3 min for the bare VFS.

Pesticides have been detected in the runoff water from the bare VFS at the highest concentrations. Preliminary data indicates pesticides were present in the runoff water from three of the eight mixture of plants and succession of plants VFS at levels eight times lower than the concentrations found in the runoff water from bare VFS. So far, no pesticides have been detected in the runoff water from the turfgrass VFS. In 2010, a 5-year storm event scenario will be tested.

### **Summary Points**

- A one-year rain event has been simulated twice on the VFS, once using irrigation and once using an artificial rainfall system.
- Preliminary data indicates that bromide and pesticides are being intercepted by the vegetative plots.
- 900 samples are currently being analyzed for pesticides.
- The pesticide application will be repeated next year using a 5-year storm scenario.

**Figure 1. Collecting runoff from the bottom of vegetative filter strips in the presence of overhead rainfall.**

