Assessment of Commercially Marketed Filter Materials for Tile Drainage Outlets on Golf Courses

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Objectives:

1. The overall objective of this research project is to assess the feasibility and effectiveness of commercially marketed filters designed to strip nutrients (NO_3-N, total nitrogen, PO_4-P, and total phosphorus) and pesticides (potentially chlorothalonil, metalaxyl, trinexapac-ethyl, azoxystrobin, and imidacloprid) from drainage waters exiting a golf course green.

Start Date: 2005
Project Duration: three years
Total Funding: $26,200

Tile drainage and other subsurface drainage features are considered essential by turfgrass managers to maintain water tables at depths necessary for healthy plant growth, maintain sufficient water and air in soil void space to stimulate essential microbial activity; avoid rutting and soil compaction by maintenance equipment, and to allow site use soon after heavy rains. Nutrient and pesticide transport through subsurface drainage systems may become a component of surface runoff if the drainage water discharges directly into surface water or onto the surface offsite or downslope. Subsurface drains conveying water directly into a stream or pond will bypass natural and managed filtering processes, including upland and riparian buffer zones. This research is designed to address the potential for commercially available filters to significantly reduce the transport of nutrients and pesticides from golf course tile drainage outlets to surface waters.

The project has two distinct components. The first component is a controlled laboratory experiment designed to evaluate the filter's effectiveness while operating at or near the design flow rate. The second component is a before-after field assessment of the filters. In addition to the primary objectives, the field study will provide unique hydrology data from a managed green.

The field site is located at Ridgewood Country Club in Waco, TX. The site is a chipping green constructed in a split design. Each half of the green is 4,000 ft^2 and has a distinct drainage network and unique construction. The green was originally designed to test alternative materials for the intermediate or gravel layer during green construction. The green was constructed by first establishing the desired subgrade and excavating for the drainage network. Second, an impermeable plastic layer was added followed by the subsurface tile lines. Next was the addition of the material designed to replace the gravel layer followed by a geotextile fabric and twelve inches of sand. The green was sodded with creeping bentgrass (*Agrostis stolonifera* L.).

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In late 2005, the field site was instrumented with two distinct commercial filters (one on each half of the green) and Isco automated water samplers. The samplers were positioned to collect simultaneous samples at the inflow and outflow of the filter, thus providing a before-after assessment. Samples are collected on a flow-proportional basis. Hydrology (discharge and rainfall) is collected on a 10-minute interval. Water quality data was collected for a two-month period and shared with industry representatives.

After reviewing the data, each of the filter industries expressed a desire to alter their designs. The filters were reinstalled in October of 2006, and we have been collecting data since that point. One of the filter materials is a mixture of activated carbon and zeolite; the other is a proprietary material.

Based on the currently available data (October 2006 to May 2007), the activated carbon and zeolite mixture significantly reduces the median pesticide and total nitrogen concentrations measured in the drainage water. The proprietary material had no significant impact on any measured concentrations. Based on these findings, data collection for the assessment of filter materials has been temporarily suspended. Once new filter materials are identified, we plan to install the filters and again assess the impacts of the materials.

We continue to collect hydrology data at the site. Data suggests that in order to initiate flushing a green approximately 1/2 inch of water is required. In March 2007, instrumentation was installed on an USGA specified green located at the same site. Hydrology data collected from the USGA-recommended green will provide comparison data for the alternative design. Additionally, the data collected will provide a clearer understanding of the subsurface hydrology of golf course green construction.

Summary Points

- Field and laboratory instrumentation is in place to assess different filter materials.
- Assessment of two different filter materials has been ongoing since October 2006.
- Preliminary data suggests that the activated carbon and zeolite-based filter has potential for significantly reducing the concentrations of certain pesticides and total nitrogen from the drainage waters.
- Preliminary hydrology findings suggest that the amount of water required to initiate flushing a green is approximately 1/2 inch.