

Comparison of Turf Chemical Runoff from Small- and Large-size Plots

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Objectives:

1. Develop and employ a standardized protocol to measure turf chemical runoff in different regions of the United States.
2. Determine the "scalability" of turf runoff events from field plot areas.
3. Examine the relationship between thatch age, thatch organic carbon content, and turf chemical runoff.

Start Date: 2003

Project Duration: three years

Total Funding: \$90,000

Most turf model validation and calibration efforts have relied on data collected from relatively small plots (i.e., < 1000 ft²). The practice of using small-plot data to evaluate model performance is currently being questioned. Several studies conducted on agricultural crops have demonstrated that chemical runoff from small plots is often substantially higher than from large plots on a unit land area basis. This suggests that models calibrated using small plot data may have an inherent bias that favors over prediction of chemical runoff losses from larger parcels of land.

Chemical runoff differences between small and large plots has been attributed to larger plots having more heterogeneous surface characteristics than smaller sized plots. Given the homogenous nature of a mature turf surface, concern about using small plot data to calibrate models may not be warranted, but data to support this hypothesis is lacking.

In the summer of 2003 a runoff facility consisting of three small (3.6m by 9.1 m) and three large plots (12.2 m by 38.1 m) was created at the University of Maryland turfgrass research facility. The



Trapezoidal flume and line from a bubble flow meter used to monitor discharge from a runoff event

site was laser graded to create plots having a 3.5% slope. Some soil settling occurred over the fall and winter months which resulted in the development of a 0.75% cross slope within one of large and small sized plots. No attempt was made to remove this cross slope in the plots where it was present. All plots were seeded with 'L-93' creeping bentgrass in May, 2004 and initial runoff investigations began in September.

Runoff investigations are being conducted in the following manner. The turf is fertilized with 49 kg N ha⁻¹ and 49 kg P₂O₅ ha⁻¹ using urea and triple super-



A rainfall simulator is being used to generate runoff events for this experiment.

phosphate as the N and P sources, respectively. Immediately after this, a tank mix of 2,4-D, flutoanil, and chlorpyrifos is applied. Approximately 24 hours later, a 3.5 cm hr⁻¹ simulated rainstorm is applied for the time needed to initiate runoff plus 90 additional minutes. Runoff from the lower end of the plot is directed to a flume where flow is continuously monitored by a bubble flow meter. Water samples are also collected from the flume every five minutes by an automated water sampler.

Initial hydrographs of the simulated rainfall events indicate that runoff from our plots commences within the first few minutes of the initiation of the rainfall



Bottles are pre-cooled with ice prior to sample collection to minimize chemical transformations that may occur prior to transport to the laboratory.

event when the surface antecedent moisture content is close to field capacity at the start of the event. Once the storm duration exceeds one hour, more than 75% of the precipitation applied after this is lost from the plot as runoff.

Initially this project was to examine nutrient runoff only. Additional funding support was received from The Environmental Institute of Golf (GCSAA) this past year that has allowed the runoff of pesticides to be included as part of the experiment. Pesticide analysis of the runoff samples will be conducted by USDA's Environmental Quality Laboratory in Beltsville, MD.

Summary Points

- Scale effects on turf chemical runoff need to be investigated to determine the applicability of earlier turfgrass model calibration efforts.
- Hydrographs of the initial simulated rainfall events indicate that once a storm having an intensity of 3.5 cm hr⁻¹ exceeds a duration of one hour, more than 75% of the precipitation that is applied after this time is lost from the plot as runoff.
- Additional funding has been obtained this past year that will allow pesticides to be included as part of this project.