

# 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 size 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/calibration efforts have relied on data collected from relatively small plots (i.e., < 1000 ft<sup>2</sup>). 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 2005, chemical runoff from three small plots (12 ft by 30 ft) and three large plots (40 ft by 125 ft) of 'L-93' creeping bentgrass was examined at the University of Maryland turfgrass research facility. The plots at this facility are located on hillside having a 3.5% slope and the turf is maintained using fairway management practices typical of the mid-Atlantic region of the US.

Prior to conducting the runoff event, cores were collected from the large plots to obtain soil hydraulic property data required to simulate runoff in process-based models. *In situ* measurements of the surface infiltrability of each plot were also obtained in 2005.

Chemical runoff was evaluated by applying a 3.5 cm hr<sup>-1</sup> simulated rainstorm one day after treating the turf with a



Soil hydraulic properties needed for model evaluation efforts were determined in 2005.

tank mix of 2,4-D, flutolanil, and chlorpyrifos. The turf was also fertilized with granular urea (49 kg N ha<sup>-1</sup>) and triple superphosphate (49 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>) one day before the simulated rainstorm. The rainstorm was applied for the time needed to initiate runoff plus 90 additional minutes. Runoff from the small plots was measured manually while runoff from the large plots was measured using a bubble flow meter. Water samples were collected every five minutes for first 90 minutes of the runoff event.

There were several interesting trends in variables that could be used to describe the hydrology of the small- and large-size plots, however none of these trends were statistically significant. For the two plot sizes, there was no difference in the time to runoff, the amount of runoff (when expressed as the depth of water lost from the plot), or in the portion of runoff that was lost after the simulator was turned off. In general, about two thirds of the applied rainfall was loss as runoff from the large and small plots.

Plot size had no effect on total N, total P, and flutolanil runoff losses when each was evaluated as a percentage of the amount material applied. Similarly, plot

size did not appear to affect the amount of suspended solids present in runoff. Analysis of the chlorpyrifos and 2,4-D concentrations in 2005 runoff samples is currently in progress.

Thatch was collected from the large plots prior to conducting the 2005 chemical runoff event. This will also be done in 2006. The sorption of flutolanil, chlorpyrifos, and 2,4-D to the thatch material collected in both years will be determined to evaluate the impact of thatch age on the runoff pesticides from turf. Our hypothesis is that as thatch ages, pesticide sorption to thatch increases. If this true, pesticide runoff losses from turf, for given set of experimental conditions, should decline as the turf ages.

## Summary Points

- Scale effects on turf chemical runoff need to be investigated to determine the applicability of earlier turfgrass model calibration efforts.
- Initial results indicate that plot size has little impact on turf chemical runoff.
- Thatch samples are being collected before each chemical runoff event so that event-specific pesticide sorption isotherms can be determined.