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

Mark Carroll
University of Maryland

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

Increased emphasis on obtaining computer model estimates of chemical losses from large land parcels has highlighted the need to better understand how the size of a study area may affect measured unit area chemical runoff losses. In 2003, cooperative projects in Maryland and Mississippi were initiated to evaluate the relationship between plot size and chemical runoff losses from turf.

Research in Maryland focused on examining nitrogen and phosphorus runoff losses from granular applied urea and triple superphosphate, and runoff losses of liquid applied 2,4-D, flutolanil, and chlorpyrifos. Chemical runoff losses from two size (3.6 by 9.1 m, and 12.2 by 38.1 m) creeping bentgrass plots are evaluated by simulating a 3.5 cm hr^{-1} rainstorm for time needed to initiate runoff plus 90 additional minutes. The simulated rainstorm occurs one day after chemicals have been applied to the turf.

Results obtained from single rainstorm events conducted in 2005 and 2006 indicate that turf plot size has little effect on unit area runoff losses of total nitrogen, 2,4-D, flutolanil and chlorpyrifos. Unit area runoff losses of total phosphorus, however, have been greater from large-size plots than from small-size plots. Total suspended sediment data collected during the runoff events suggest that the different phosphorus loss rates seen in the two size plots is not due to different amounts of sediment being lost from the two size plots.

When expressed as a percent of the chemical applied, average loss for the first 23 mm of runoff was 9.6% for total nitrogen, 8.2% for 2,4-D, 4.1% for flutolanil, and 0.33% for chlorpyrifos. Average total phosphorus loss was 20.1% from the large plots and 13.0% from the small plots. The relatively high nutrient lost rates seen in this investigation can be partially attributed to the fact that neither granular material was "watered in" immediately after being applied to the turf.

In general, total pesticide losses in runoff have mirrored pesticide washoff from foliage. Collection of pre- and post-rainfall event foliage samples in 2005 revealed that 66% of the 2,4-D, 39% of the flutolanil, and 14% of the chlorpyrifos present on bentgrass foliage was removed by the rainfall event. Concurrent determination of pesticide levels in thatch, before and after the rainfall event, suggest that thatch is more effective in intercepting and retaining "washed off" flutolanil, than in intercepting and retaining 2,4-D removed from the foliage by rainfall.

In 2005, post-rainfall levels of flutolanil in thatch were 4.5 times higher than pre-rainfall flutolanil levels. In contrast, post-rainfall thatch 2,4-D levels were not significantly different from pre-rainfall thatch 2,4-D levels. Foliage and thatch samples collected in 2006 will be analyzed in early 2007.

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

Chemical runoff losses from two size creeping bentgrass plots are evaluated by simulating a 3.5 cm hr^{-1} rainstorm for time needed to initiate runoff plus 90 additional minutes.

Summary Points

- Cooperative projects in Maryland and Mississippi are evaluating the relationship between plot size and chemical runoff losses from turf.
- Unit area losses of granular applied P are greater from large-size plots than from small-size plots
- Plot size has little effect on unit area runoff losses of total nitrogen, 2,4-D, flutolanil, and chlorpyrifos.
- Similar patterns were seen in pesticide foliar washoff losses and pesticide runoff losses.