Effect of Plot Size and Warm-season Grass Species on Turf Chemical Runoff

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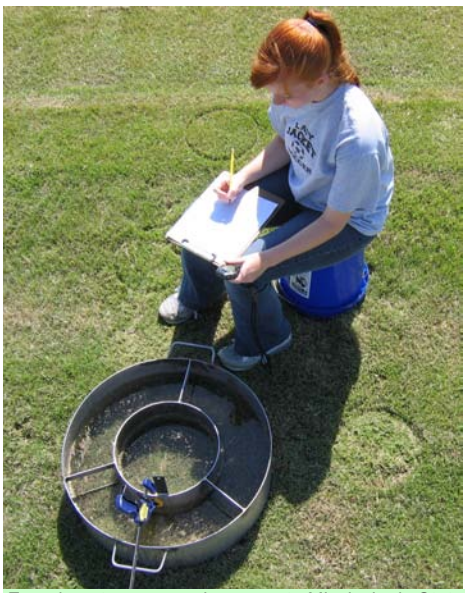
Objectives:

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 plots.
3. Determine if grass species impacts pesticide runoff for warm-season grasses.

Start Date: 2003
Project Duration: four years
Total Funding: $120,000

Knowledge of the impacts of management and scale are important for improved prediction of turf chemical runoff. This research is part of a national research effort that aims to better understand turf hydrology and pesticide runoff modeling.

Runoff studies were conducted on twelve 360 ft^2 plots growing either 'Mississippi Pride' bermudagrass and 'Meyer' zoysiagrass and four 1,600 ft^2 and four 5,000 ft^2 plots grown with only bermudagrass. These plots were mowed at 0.5 or 2 inches in a split-plot arrangement to simulate golf course fairways and residential lawns, respectively. A micro-plot (40 ft^2) was also temporarily constructed in each 5,000 ft^2 plot. Employing a standardize field protocol, 2, 4-D herbicide (1 lb./A), flutolanil fungicide (2 lb./A) and chlorpyrifos insecticide (2 lb./A) were co-applied to the plots 24 hours prior to rainfall simulation. Runoff was generated using simulated rainfall at 1.5 in/hr. Runoff samples were collected at approximately 5-minute intervals. Chemical concentrations in runoff were determined by HPLC-UV. The limit of quantification was ~ 10 ppb for each compound.



Experiments are underway at Mississippi State University to measure runoff losses of 2,4-D herbicide, flutolonil fungicide, and chlorpyrifos insecticide.

Results to date suggest that pesticide properties (e.g., sorption onto leaf cuticle or thatch) rather than hydrological differences between these grass treatments may be more important when determining pesticide runoff losses.

Averaging runoff results for the bermudgrass plots across all four plot sizes, 43.3 (+/- 12.7) % of applied 2, 4-D was lost in runoff compared to 6.8 (+/-1.0) % for flutolanil and 0.2 (+/-0.04) % for chlorpyrifos. Peak pesticide concentrations observed in runoff were 3.7 (+/-0.9) ppm for 2, 4-D, 0.8 (+/-0.3) ppm for flutolanil and 0.04 (+/-0.02) ppm for chlorpyrifos. Strong correlations ($r > 0.93$) between plot size and the mass of each pesticide in runoff indicated that pesticide runoff from 'Mississippi Pride' bermudagrass was scalable for compounds exhibiting a wide range of mobilities in grass. These results show that smaller turf plots (i.e., 360 ft^2) provide pesticide runoff results comparable to those obtained from larger plots (i.e., 1,600 ft^2 and 5,000 ft^2).

Studies comparing pesticide runoff for 'Mississippi Pride' bermudagrass and 'Meyer' zoysiagrass were conducted using data from the 360 ft^2 plots only. Here, neither the percent of applied 2, 4-D nor its peak concentration in runoff were affected by mowing height or turfgrass species. The percentage of applied flutolanil in runoff was affected by turf species ($p = 0.0124$) but not mowing height ($p = 0.2229$) while the peak concentrations of the fungicide were not affected by mowing height or turfgrass species.

The percentage of applied chlorpyrifos measured in runoff was affected by an interaction between mowing height and turf species ($p = 0.0178$), but peak concentrations of the insecticide were unaffected by these treatments. Depth of thatch in the two grass species were different ($p = 0.0018$). When various hydrological parameters were compared between the two grasses, no differences were observed. Findings suggest that pesticide retention mechanisms influenced by the physico-chemical properties of the pesticides played a more important role in determining chemical runoff than differences in the physical movement of water in these two warm-season grasses.

Summary Points

- The effects of plot size, mowing height and turfgrass species were compound-dependent.
- Runoff from 'Mississippi Pride' bermudagrass was scalable across a wide range of compounds and plot sizes.
- Pesticide runoff from 'Mississippi Pride' bermudagrass and 'Meyer' zoysiagrass was governed mainly by differences in pesticide retention and not differences in water flow.