

Mass Balance Assessment of Pesticides and Nutrients Applied to Golf Turf

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Goals:

- *To develop a better understanding of the factors and conditions important in the leaching of pesticides and fertilizers applied to an experimental golf fairway following establishment.*
- *Compare two ways of evaluating the fate of N by using a traditional N source and analytical methods compared to a heavy N isotope (N¹⁵) N fertilizer source and a ratio mass spectrophotometer for quantification.*

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The objective of this project was to develop a better understanding of the factors and conditions important in the leaching of pesticides and fertilizers applied to an experimental golf fairway following establishment. The ARESTS facility was utilized for this purpose where soil types (sand, silt loam and sandy loam) and post application precipitation factors could be studied.

An additional objective was to compare two ways of evaluating the fate of N by using a traditional N source and analytical methods compared to a heavy N isotope (N¹⁵) N fertilizer source and a ratio mass spectrophotometer for quantification.

The leaching of five pesticides (MCP, triadimefon, trichlorfon, isazofos and metalaxyl) and fertilizer elements (NO₃-N, NH₄-N and PO₄-P) were evaluated under well-maintained fairway conditions and three soils types (sand, Arkport sandy loam and Hudson silt loam). Normal and extremely wet precipitation conditions were also evaluated.

Under normal precipitation-irrigation conditions, in general, pesticide leaching was very limited or near zero (with exception of MCP applied to young-thin turf) even with highly leachable pesticides. When conditions were considered "worst case" (thin-immature turf, sandy soil; heavy rainfall shortly after application or excessively wet, over-irrigated turf), pesticide leaching was substantial. The leaching of phosphorus from fertilization was zero, even for the sand. Nitrate leaching

was limited and only influence by soil type (sand 9 %, silt loam 3% and sandy loam 1.5% of the amount applied) not precipitation or irrigation amount. From half (sandy loam) to over 90 percent of the applied N in the fertilizer was recovered in the clippings, while only 9 percent was recovered in the clipping from the sand lysimeters. Most of the remaining fertilizer N was found in the sod (as roots, organic

matter or fertilizer). The total estimated N recovery was slightly larger than the amount applied. Generally, there was good agreement in the data between the traditional N source and analytical method and the enriched N¹⁵ fertilizer and mass spec analysis. The use of the traditional methods is recommended because of a lower cost unless detailed soil and atmosphere N fate is needed.

Table 11. Total amount of Nitrogen (N) recovered in clippings, soil and leachate as a percent of applied nutrient on creeping bentgrass fairway turf.

Soil	Total N in Clippings	NO ₃ -N + NH ₄ -N in leachate	Range in total N in soil	Total N Recovered
	----- % of applied -----			
Arkport sandy loam	52*	1.5	<0	53.5
Hudson silt loam	91	3.1	<0	94.1
Sand	8	9.1	106.4 - 116.7	124 - 134

* Corrected for the amount of nitrogen recovered in unfertilized plots and amount in irrigation water.

Table 12. Total amount of phosphorous (P) recovered in clippings, soil and leachate as percent of applied nutrient on creeping bentgrass fairway turf.

Soil	Total P in clippings	Total PO-4 in leachate	Total P in soil	Total P recovered
	----- % of applied -----			
Arkport sandy loam	53	0 **	5.5	58.5
Hudson silt loam	65	0	<0	65
Sand	7.5	0	<0	7.5

** Adjusted for unfertilized plots and phosphorous in the irrigation water.