Further Evaluation and Modeling of Pesticide Partitioning Data From Putting Green Lysimeters

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Objectives:

1. Measure the site-specific critical water flow and pesticide transformation.
2. Simulate pesticide fate using the measured hydraulic properties and pesticide parameters as model inputs and compare the model outcomes with measured data.
3. Summarize the modeling predictions and measurements.

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The fate of pesticides and fertilizers applied to putting green and fairway soils were determined at University of California, Riverside.

Putting greens usually receive high inputs of fertilizers and pesticides due to the high visual quality and putting surface demand, as well as high stress factors created by close mowing and high traffic volume. In this research, two commonly used fungicides, metalaxyl (Subdue) and chlorothalonil (Daconil), were selected to evaluate their partitioning and persistence in a bentgrass putting green maintained under representative field management practices under the southern California climate in 1995.

The putting green site was constructed according to the US Golf Association (USGA) recommendations. Lysimeter assemblies were installed at the center of each plot to monitor the leachate volume and concentration of the two fungicides. Volatilization loss was monitored using flux chambers. Clippings were collected to determine the residues on grass, and soil core samples were collected to measure the fungicide residues in the constructed soil profile. A laboratory experiment was also carried out to determine the degradation rate of the two fungicides in thatch, mat, and underlying soil.

Results showed that cumulative volatilization loss accounted for 0.10% and 0.02%; clipping removal accounted for 0.11 % and 0.13%; and cumulative leaching was 0.71 % and 0.002% of the applied mass for metalaxyl and chlorothalonil, respectively.

The two fungicides were mainly found in the top 10 cm of the soil profile due to the high organic carbon content in the thatch and mat layers. The field dissipation half-life was 1.4 days for metalaxyl and 4.9 days for chlorothalonil, which were considerably shorter than those found in agricultural fields. This research showed that under normal turf management practices, only small fraction of the applied fungicides left the putting greens.

In 1996 and 1997, two more experiments were conducted at the same site to evaluate the environmental fate of two commonly used insecticides, trichlorfon (Dylox) and chlorpyrifos (Dursban). The two insecticides were chosen because of their difference in water solubility, persistence, adsorption, and vapor pressure. Volatilization, clipping removal, soil residues, and leaching of the two insecticides were intensively monitored in the putting green plots and by the *in situ* lysimeters.

Results showed that trichlorfon volatilization, clipping removal, and leaching loss were insignificant (in the range of 0.0001 to 0.06% of applied mass) both in 1996 and 1997. Clipping removal of chlorpyrifos was similar in both years (0. 15 and 0. 19% of applied mass, respectively), but lower cumulative leaching and soil concentration was observed in 1997 than in 1996, which was attributed to higher volatilization loss in 1997 (2.7 %) than that in 1996 (2.1%).

Two simulation models, CHAIN2D and PRZM-3, were also tested using the measured hydraulic properties and in situ measured potential evapotranspiration data from the California Irrigation Management Information System (CIMIS) data at Riverside. The simulation outputs, however, did not represent the field-measured pesticide partitioning well.

Summary Points

- Percent of applied fungicides and insecticides leaving the putting green via volatilization, clipping removal, and leaching was minimal.
- Neither CHAIN2D nor PRZM-3 simulated the field-measured data well, even when the measured hydraulic properties and ETo values were used.