Development and Testing of Indices and Models of Pesticide Volatilization from Turfgrass

Cornell University

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Start Date: 1998
Number of Years: 3
Total Funding: $27,724

Objectives:

1. *Develop and test concise indicators of volatilization hazard that can be used by turf managers to determine the likely degree of health hazards associated with pesticide applications.*
2. *Develop and test alternative models of turfgrass pesticide volatilization.*

Mathematical models can potentially be used to estimate volatilization of chemicals applied to turf. However, the complexity and limited testing of volatilization models restrict their general applicability. An alternative procedure estimates concentrations using simple *volatilization indicators* which are determined from basic chemical properties and the temperature and wind speed at the application site. Using data from field studies for eight different turf pesticides, three different indicators were evaluated for their ability to predict vapor concentrations. Chemical vapor pressure was the simplest indicator considered, and it was 70 percent effective in predicting variations in vapor concentrations. The effectiveness increases to 90 percent when factors related to solubility, adsorption and wind speed are added to produce the G/V indicator.

We further tested the use of volatilization indicators by using them to classify the inhalation hazards associated with 37 different applications of the eight pesticides to grass. Health hazards were determined by comparing inhaled dose to the EPA's reference doses. Inhaled doses were computed using both measured vapor concentrations and concentrations determined from the indicators. As shown in Table 11, the volatilization indicators produced the same rankings of health hazards that were obtained from the measured concentrations. Although further testing is necessary, the research suggests that with a chemical properties table and a weather forecast, it may be relatively easy to identify whether or not application of a pesticide to turf on a particular day may be hazardous to golfers or lawn users.

Table 11. Inhalation Hazard Quotients (HQ) Determined from Measured and Calculated Concentrations.

		HQ from Concentration Regressions on	
Chemical	HQ from Measured Concentration	Vapor Pressure	G/V
Bendiocarb	0.01	0.03	0.02
Carbaryl	0.00	0.01	0.00
Chlorpyrifos	0.09	0.04	0.11
Diazinon	2.80	2.70	1.50
Ethoprop	70.20	61.90	64.40
Isazophos	5.20	13.10	11.20
Isofenphos	0.12	0.17	0.15
Trichlorfon	0.04	0.04	0.03

Pesticide Runoff Model for Turfgrass: Development, Testing and Application

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Start Date: 1998
Number of Years: 3
Total Funding: $30,798

Objectives:

1. *Adapt a previously developed pesticide runoff model to turfgrass conditions and test the accuracy of model predictions by comparisons with data from field experiments.*
2. *Use the model to estimate pesticide runoff probabilities (return periods) for a range of chemicals and locations in the eastern United States.*

We are currently testing two pesticide runoff models, PRZM, and PESTRUN, to see if they are capable of predicting the quantities of water that may run off from turfgrass. Following testing of the water portion of these models, we will evaluate their abilities to predict the pesticide content of runoff water. Both models base runoff estimates on adaptations of the U.S. Soil Conservation Service Curve Number equation.

Comparisons of observed runoff data and results from calibrated runs of the two models are shown in Figure 12 for *classic* plots that were seeded to a mixture 50 percent Kentucky bluegrass, 20 percent fescue, and 30 percent ryegrass. The calibration process was subjective, i.e., curve numbers were adjusted until predicted runoff seemed to reasonably follow the observed values. The selected curve numbers (CN) are indicated on the figure legends. Best results were obtained for PESTRUN when different curve numbers were used for each year (39, 20, and 25 for 1986, 1987 and