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

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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..

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Project Duration: 3 years
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Dr. John Clark, University of Massachusetts, discusses the important weather information gathered during pesticide volatilization studies. This information was useful in creating a model to accurately predict the amount of pesticide volatilization expected on golf course turf.

A number of chemicals used for control of turfgrass pests have vapor pressures that suggest tendencies for volatilizaiton. Moreover, since applicaiton typically leaves the pesticides exposed to air on grass surfaces rather than incorporated into soil, opportunities for gaseous losses are often greater than with comparable applicaitons to agricultural crops.

Measurements have confirmed that volatilization of chemicals does indeed occur, resulting in possible health hazards to turf users. However, generalizations are difficult. Many of the pesticides which are used on turf may not volatilize significantly, or may not be particularly hazardous, or may only volatilize and threaten health under certain environmental conditions.

It would be useful to have concise indices of volatilization risk that could be used as site-specific means of classifying chemicals according to their degree of hazard. Similarly, mechanistic models of pesticide volatilization would be useful tools for exploring the relationship between water balance, volatilization, degradation, adsorption, wash-off and leaching within the turfgrass system. The indices and models could be tested and calibrated with data from previous and on-going experimental studies and thus provide means of extrapolating such data to a range of site conditions.

A high speed air sampler was used to measure the volatilization of several pesticides. This information has been translated into a model that accurately predicts pesticide volatilization under a range of environmental conditions.

The M2CM model was adapted to estimate volatilization losses from turf. The model assumes that pesticide vaporization is proportional to water vaporization (evapotranspiration, ET) and degradation is first order or exponential.

The primary difficulty in using the model is determination of the rate constant. Our approach was to estimate the rate constant from solar radiation and heat of vaporization. We also assume that the proportionality constant (b) is invariant within the chemical volatilization classes proposed by Clark.

Model testing was based on data from field turf experiments at the University of Massachusetts, Amherst. Testing data covered 20 week-long experiments during 1995-97.

For the high volatilization group, the proportionality constant was estimated by fitting the first week's model results for ethoprop to observations. The first week's data for chlorpyrifos was similarly used to determine the proportionality constant for the intermediate group.

Although individual weeks or experiments are not always well-fitted by the model, mean volatilization losses for each chemical are relatively accurate. More significantly, these means correctly reflect the relative differences in volatilization levels among chemicals.

Summary Points

- Researcher is fairly pleased with model to predict volatilization potential.
- Athough individual weeks were not well fitted by the M2CM model, the mean volatilization losses for each chemical were relatively accurate.