The Pesticide Matrix Project: Developing a Data Base Tool to Guide Environmentally Responsible Pesticide Selection

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Objectives:

1. To create a resource that is available electronically to help superintendents better understand the environmental characteristics of golf course pesticides and optimize their environmental stewardship.

Start Date: 2006
Project Duration: two years
Total Funding: $90,000

Golf course superintendents consider many factors when selecting a pesticide for a specific use, including cost, efficacy, and turf safety. However, it is currently much more difficult for a superintendent to assess environmental risk and its relevance to their golf course. What is the risk to groundwater supplies when a particular pesticide is applied? What is the risk to surface water, fish, or bees?

These are complex questions requiring not only data, but also a method to integrate the data into a form that allows meaningful conclusions. The first step of this project is to collect relevant data on environmental fate, toxicology, and environmental endpoints from publicly available databases. To date, we have collected the majority of the data needed.

The second part is to create a model or software program that calculates the relative risk to specific environmental features from the application of a specific pesticide active ingredient. Consider a golf course with a stream flowing through the property. The golf course superintendent may want to know the probability of a pesticide intended for use to reach the stream, and if it does, what is the likelihood that it will cause problems for fish in the stream? A rudimentary risk assessment determines the likely concentration of the pesticide in the stream and whether this concentration is high enough for concern.

Categories of risk factors included in the pesticide matrix model include risks to ground water, surface water, birds, and non-target invertebrates.

Integral to our process of building this resource has been the solicitation of feedback from the following groups:

- End-users of the resource, golf course superintendents;
- EPA staff with expertise in pesticide fate assessment and modeling, regulatory enforcement and economic impact;
- The scientific community via presentations at scientific meetings; and
- Scientists from pesticide manufacturers represented by Crop Life America and Responsible Industry for a Sound Environment.

The challenge of this project is to develop a tool that is easy to use, while retaining a sound scientific basis for estimating potential environmental risks of using a particular pesticide. At this point, several components of the final model have been selected. We expect the model to yield information on risk to ground water, surface water, birds, and non-target invertebrates for each of the over 100 pesticide active ingredients in our database. The risk determination will be based on risk ratios and presented in a format that is easy to interpret.

Recommendations for best management practices to minimize environmental risk of an application and maximize environmental stewardship will be provided. The resource will help superintendents make more informed environmental decisions on the pesticides they choose to use.

Data Obtained/to be Obtained		Numbers to be Calculated
Environmental Fate Properties	*Toxicological Endpoints*	*Toxicological Reference Points*
Koc	Ref. dose (RfD), cancer slope factor	HAL (drinking water Health Advisory Level) (calculated when MCLs or HALs unavailable)
Aerobic soil metabolism $t_{1/2}$	LC_{50} aquatic invertebrates	Acute MACs (.1 x LC_{50} or EC_{50}, or NOEC) for invertebrates
Turf dissipation $t_{1/2}$	LC_{50} aquatic vertebrates	Acute MACs (.1 x LC_{50} or NOEC) for vertebrates
Vapor pressure	LC_{50} and/or LD_{50} for birds	Avian exposure to "short rangegrass" (Pfleeger et al., 1996 modification of Kenaga approach)
Water solubility	LC_{50} earthworms	Amphibian MACs based on Lam & Cohen (2006).

The development of a pesticide matrix involves obtaining pesticide environmental fate and toxicological endpoints and calculating toxicological reference points when necessary.

Summary Points

- A database of pesticide properties needed for risk assessment is being compiled.
- The database will serve as the foundation to predict potential environmental risk of a pesticide's active ingredient.
- The end result of this research will be a resource that will help superintendents make more informed environmental decisions regarding the pesticides they apply.