Pesticide Runoff Model for Turfgrass: Development, Testing and Application

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Objectives:

1. A a previously developed pesticide runoff model to turfgrass conditions and test the accuracy of model predic tions 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.

Start Date: 1998
Project Duration: 3 years
Total Funding: $30,798

The dense vegetation of turfgrass and thatch minimizes possibilities for pesticide runoff. High water retention and infiltration constrain runoff opportunities, and extensive pesticide adsorption by surface organic matter reduce chemical mobility. However, field experiments have shown that conditions such as thin stands, repeated irrigation applications and extreme hydrologic events can produce significant pesticide runoff.

Exisisting pesticide runoff models were developed for agricultural crops and are difficult to apply directly to turfgrass. They are often predicated on runoff calculations for flood studies rather than the high detention and infiltration conditions associated with turf. Furthermore, the interaction between the enhanced leaching by infiltration and extensive adsorption to surface organic matter are much less important in an agricultural cropping situation.

Sufficient pesticide runoff data are now available from turfgrass experiments to permit extensive testing of runoff models for several different turf conditions, chemicals, and locations. Once an appropriate model has been validated, it may then be used to determine pesticide runoff frequencies for a wider range of situations and thus identify the chemicals and environmental conditions which enhance safe turfgrass pest control.

The TurfPQ model is a pesticide runoff model developed exclusively for turf. It has a runoff component based on the U.S. Soil Conservation Service Curve Number Equation. The chemical model is a mass balance of the pesticide in the turf foliage and thatch.

Runoff and leaching data from previous USGA-sponsored research is being used to evaluate existing pesticide fate models.

The model was tested using published plot runoff data for 52 runoff events in four states, three soil hydrologic groups, and four different turfgrasses: bermudagrass, creeping bentgrass, tall fescue and perennial ryegrass.

Estimated and observed pesticide runoff (yS and y, respectively) for each event were compared. Although events generally lie above the line yS = y, most are relatively close to the line. Mean predicted pesticide runoff is 3.2% of application, compared with an observed mean of 2.1%. TurfPQ captured the dynamics of the pesticide runoff events well with R^2 = 0.76.

To the best of our knowledge, TurfPQ is the first pesticide runoff model developed exclusively for turf. Other models such as EPIC, GLEAMS and OPUS which have been applied to turf were originally developed for agricultural crops, and are much more data intensive.

Although comparisons of accuracy are difficult because TurfPQ is the only model to have been tested with independent data sets for multiple chemicals and sites, it appears that the accuracy of TurfPQ meets or exceeds that of the more complex models.

Summary Points

- TurfPQ captured the dynamics of the pesticide runoff events well (R^2 = 0.76). The model is intended to be a practitioner's model.
- Model results were most accurate for dicamba and mecoprop, the least strongly adsorbed chemicals. For the most strongly adsorbed pesticides, chlorpyrifos and dithiopyr, the model overpredicts the actual values.