Managing Pesticide Exposure from Treated Turf

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Objectives:

1. Evaluate management practices that reduce the potential for golfer exposure to airborne and dislodgeable foliar residues of turfgrass pesticides.
2. Examine the relationship between dislodgeable foliar and airborne residues and actual golfer exposure, and develop an accurate exposure model using experimentally determined pesticide transfer and penetration factors.

Start Date: 2004
Project Duration: three years
Total Funding: $75,000

This study seeks the best management practices that reduce the potential for golfer exposure to turfgrass pesticides. Major routes of pesticide exposure for humans are primarily through inhalation and dermal penetration. Past research has determined that pesticides with high vapor pressures and inherently high toxicities result in Inhalation Hazard Quotients (IHQs) and Dermal Hazard Quotients (DHQs) greater than 1.0. This finding has established that there are volatile and dislodgeable residues, particularly from organophosphorous insecticides, available for golfer/bystander exposure, and not all of these exposures can be deemed "safe" using the USEPA Hazard Quotient (HQ) criteria.

Accurate assessment of golfer exposure to pesticides requires knowledge of the availability of pesticide residues following application, transfer and absorption

Collecting dislodgeable foliar residues (DFR) with the California roller (CA roller). The 32-lb roller is slowly rolled over a 6 ft^2 cloth 10 times. Pesticide residues transferred to the cloth are considered dislodgeable.

dynamics of these residues, as well as major routes of entry into the body. We are evaluating the optimal use of post-application irrigation, reentry intervals (e.g., evening pesticide applications), application of less toxic pesticides, and application strategies that result in less than full coverage (e.g., tees and greens only) to minimize exposure.

Dosimetry and biomonitoring, together with concurrently collected dislodgeable and airborne residue data, provides a novel and complete database on golfer exposure and has allowed us to develop a golfer exposure model. The transfer factor (TF) is derived from a comparison of the dislodgeable foliar residues with the residues determined from the whole body dosimeters. With this information, a simple California Roller wipe sample from the grass surface is sufficient to realistically predict exposure in most situations. By combining information previously collected on chlorpyrifos, cyfluthrin, and carbaryl with this seasons 2,4-D data and subsequent data sets for imidacloprid and chlorothalonil, we plan to validate this model and utilize it for a wide range of pesticides with varying physical and chemical properties.

In cooperation with the New England Regional Turfgrass Foundation, this season we have evaluated exposure in 24 rounds of golf following the application of three major phenoxy acid herbicides: 2,4-D, dicamba, and mecoprop-p (MCPP). This part of the project emphasizes dosimetry (measuring pesticide residues on full body cotton suits and personal air samplers) and biomonitoring (measuring urinary metabolites) to determine transfer and penetration factors.

Multipathway exposure is being evaluated by comparing pesticide residues on dosimetry media and/or 72-hr post-exposure urine (biomonitoring group) to airborne and dislodgeable foliar residues

Dosimetry involves measuring pesticide residues on full body cotton suits (shown above) and personal air samplers.

(DFR). The direct and simultaneous determination of dosimetry and biomonitoring data provides a novel and complete database on how much pesticide is transferred from the treated turf to the golfer during the play of a round of golf, and subsequently how much pesticide is actually absorbed.

Summary Points

- Researchers evaluated exposure in 24 rounds of golf following the application of three major phenoxy acid herbicides: 2,4-D, dicamba, and mecoprop-p (MCPP).
- Using the total pesticide dose derived from dosimetry and/or biomonitoring data, newly developed models can be used to accurately predict golfer exposure based solely on dislodgeable foliar residues (DFR) using a California Roller wipe sample.