

Best Management of Post-Application Irrigation on Turfgrass to Minimize Exposure to Volatile and Dislodgeable Foliar Pesticide Residues and Their Breakdown Products

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Objectives:

1. Evaluate the effect of post-application irrigation on the level and hazard of volatile and foliar dislodgeable pesticide residues and on the formation of environmental degradation products at full, half, and quarter labeled rates.
2. Conduct a concurrent determination of active and passive dosimetry and urinary biological monitoring of researchers simulating a 18-hole round of golf following application of chlorpyrifos to turfgrass maintained as a golf course fairway.

Start Date: 2000

Project Duration: 3 years

Total Funding: \$74,867

This ongoing 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.

Our past research has determined that pesticides with high vapor pressures and inherent high toxicities result in Inhalation Hazard Quotients (IHQs) and Dermal Hazard Quotients (DHQs) greater than 1.0. The research 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.

We have begun to evaluate the optimal use of post-application irrigation, reentry intervals, application of less toxic materials and application strategies that result in less than full coverage (e.g., tees and greens application only) to minimize human exposure to problematic pesticides and environmental impact of their breakdown products. This part of the project emphasizes concurrent dosimetry and biomonitoring studies of chlorpyrifos and cyfluthrin to determine transfer and penetration factors and whole body dose for golfers. These direct and realistic exposure measurements will allow us to predict the actual, if any, health implications to golfers and other recreational turfgrass users.

Dermal pesticide exposure is the most sig-



Research at the University of Massachusetts found that dermal exposure is the most significant route to golfers with currently used turfgrass products. However, risk analyses indicate a safe level of exposure.

nificant route to golfers with currently used turfgrass products. Following chlorpyrifos application at full rate and coverage, the Dermal Hazard Quotient (DHQ) from dislodgeable foliar residues was 0.4, which was 10-fold higher than the DHQ from the dosimetry group. Both DHQs, however, were substantially less than 1.0, indicating a safe exposure.

Inhalation Hazard Quotients (IHQs) from high volume versus personal air samplers were both 0.06 and indicate a large safety margin. Using the mean whole body dose of chlorpyrifos from urine biomonitoring (1.06 ug/kg/d, a value not significantly different than its ADI), a HQ value of 0.35 was obtained, indicating a safe exposure.

Overall, there was an 83-92 % reduction in the amount of chlorpyrifos absorbed following application to only tees and greens. Application of cyfluthrin, a pyrethroid of low toxicity, resulted in no detectible residues on either the dosimeters or in urine. Based on our detection limit, the estimated IHQ and DHQ for cyfluthrin

were 0.002 and 0.009 by dosimetry, respectively, and a HQ value of 0.002 by biomonitoring. These encouraging results show that operational practices, such as reentry intervals, reduced application areas, use of less toxic pesticides, do attenuate exposure and hazard.

Summary Points

- Dermal absorption is the most significant route of exposure to golfers following application of currently used turfgrass pesticides. Lower legs, arms and hands are most vulnerable.
- Post-application irrigation (1/4-1/2 inch) should always be applied when possible following pesticide application to turfgrass.
- A reentry interval of at least one-hour should be enforced following the application of any pesticide. If this delay is not possible, a pesticide of low volatility and low mammalian toxicity should be chosen.
- Total pesticide coverage of the playing area of the golf course should be minimized.