

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 study seeks the best management practices that reduce the potential for golfer exposure to volatile and dislodgeable foliar residues of turfgrass pesticides. Major routes of pesticide exposure for humans are primarily through inhalation and dermal penetration. Our past research 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.

This research has also established that there are volatile and dislodgeable residues, particularly from organophosphorous insecticides, available for golfer/bystander exposure. 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 of turfgrass to minimize human exposure to pesticides and environmental impact of their breakdown products. This part of the project emphasizes concurrent dosimetry and biomonitoring studies of chlorpyrifos to determine transfer and penetration factors and whole body dose for golfers.

To date, 140 volatile and foliar dislodgeable samples have been collected during two three-day monitoring experiments. These samples have been analyzed as described previously. Before, during and following these experiments, 25 soil cores have been collected, sectioned and stored for analysis of breakdown products of chlorpyrifos, trichlorfon and triadimefon.



Graduate students at the University of Massachusetts sample the amount of pesticide that dislodges from turfgrass leaves.

Methods for the analysis of chlorpyrifos in whole body dosimeters, hand rinses, urinary TCP, which were taken from Dow AgroSciences and the OSHA method of analysis for chlorpyrifos from personal air samplers, were validated in-house through chlorpyrifos recovery and storage, method linearity and detection limit evaluations. From dosimetry experiments following chlorpyrifos application, the lower leg consistently was the most available collector, followed by pants and torso.

A total of 320 and 303 micrograms of chlorpyrifos were collected during the dosimetry study at 0.65 and 13 cm post-application irrigation, respectively. Chlorpyrifos levels collected onto individual personal air samplers by the dosimetry group ranged from 8.8 to 14.8 micrograms for the four-hour exposure.

The actual whole body dose of absorbed chlorpyrifos from the biomonitoring group as judged by the urinary clearance of the metabolite (TCP) resulted in a

mean exposure of 1.15 ± 0.37 micrograms/kg/day, which is not significantly different from the current ADI value assigned. Using this actual dose, the USEPA hazard quotient for this exposure is estimated as 0.38. As expected, this actual value is well below the concern level of 1.0 and is six-fold less than the DHQ value estimated previously using dislodgeable foliar residues levels.

Summary Points

- Use of spray-tank adjuvants has not resulted in the reduced volatile and dislodgeable foliar pesticide residues following application to turfgrass. Adjuvants increase dermal hazard by apparently holding more dislodgeable residues on the turfgrass blades longer.
- Reducing post-application irrigation from 1.3 to 0.63 cm reduced volatile residues as determined by IHQ (inhalation hazard quotient) values in the presence and absence of adjuvant. This resulted in a substantial increase in dislodgeable residues.