Modeling Pesticide Transport in Turfgrass Thatch and Foliage

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Goals:

- *To quantify the washoff of pesticides from bentgrass foliage as a function of time after application and pesticide formulation.*
- *To determine the effect of solution residence time on the sorption of pesticides to turfgrass thatch.*
- *To determine if the linear equilibrium form of convection/dispersion equation is able to provide accurate estimates of pesticide transport in turf.*

Cooperator:

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Pesticides applied to mature turf move into the soil only after being washed off the foliage and moving through the turfgrass thatch. Any attempt to predict the movement of pesticides applied to turf requires that the retention characteristics of the pesticide to foliage and thatch be known.

In 1996 and 1997, a series of sorption and transport studies were conducted to characterize the movement of 2,4-D acid in soils containing a surface layer of turfgrass thatch. The sorption studies were conducted using a device called a mechanical vacuum extractor. This device precisely controls the rate at which a solution moves through a column of porous media.

The adsorption and desorption properties of a 3.5 year old, 2.3 cm thick *SOUTHSHORE* creeping bentgrass thatch, and a 6 year old, 3.4 cm thick *MEYER* zoysiagrass thatch were compared with the soil residing below each thatch layer.

The adsorption of 2,4-D to soil was nearly instantaneous. In contrast, 2,4-D adsorption to thatch was dependent on the residence time of the solution containing this pesticide. The adsorption kinetics for thatch of the two turfgrass species was similar. The quantity of 2,4-D adsorption to thatch increased 72 percent as the solution residence time increased from 15 minutes to 24 hours. However, even at a residence time as brief as 15 minutes, 2,4-D adsorption to thatch was three times greater than to soil.

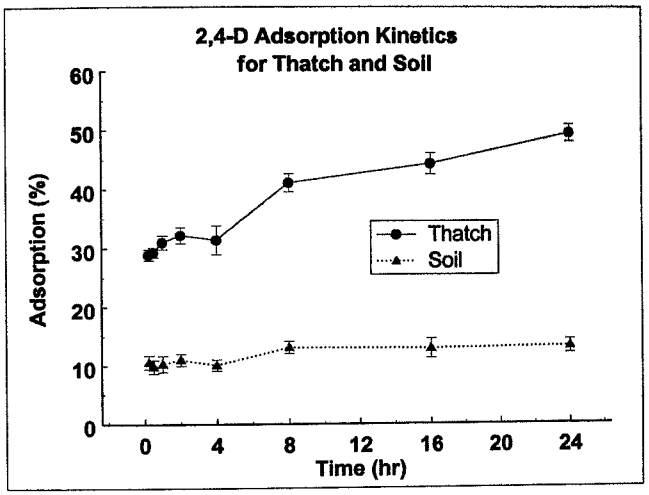

Figure 11. Adsorption kinetics of 2,4-D for thatch and soil.

Desorption losses were evaluated by subjecting columns of thatch or soil to three successive leaching events. The leaching events took place after allowing 2,4-D to adsorb to the thatch or soil for 24 hours. The quantity of 2,4-D detected in the leachate was used to determine the proportion of 2,4-D that was desorbed from the sample. The proportion of 2,4-D that was desorbed during the three leaching events was slightly less for thatch than for soil. The difference in proportional losses of 2,4-D, however, was small when compared to the total proportion of 2,4-D that was lost from each media. In a previously conducted desorption study, we found that desorption losses of dicamba were greater from soil than from thatch. Our earlier results suggest that some water-soluble pesticides may be more tightly bound to thatch than to soil.

Undisturbed cores of soil and soil plus a surface layer of thatch were used to determine the effect of thatch on the 2,4-D transport in soil. Cores having a surface layer of *SOUTHSHORE* creeping bentgrass thatch were more effective in reducing 2,4-D transport than cores having a surface layer of MEYER zoyisagrass thatch.

Bromide and 2,4-D breakthrough curves obtained from the transport study were used to evaluate the performance of linear equilibrium (LEM), two-site non-equilibrium (2SNE) and one-site kinetic non-equilibrium models to predict the transport of 2,4-D. The latter two models use non-equilibrium forms of the convection-dispersion equation to predict solute movement in porous media while the former model uses a linear equilibrium form of the equation to predict solute movement.

The bromide data did not present strong evidence of significant physical non-equilibrium or two domain flow in any core. In addition, all three models described 2,4-D transport fairly well with slightly improved fits resulting from the 2SNE model. Research in 1998 will focus on completing sorption and transport studies involving pesticides having low to moderate water solubilities.

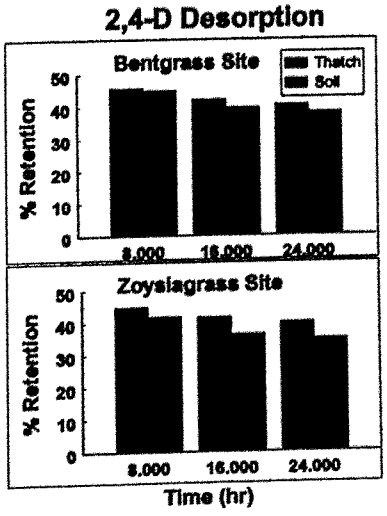

Figure 10. Cumulative proportion of 2,4-D retained to thatch following three successive 8 hour leaching events.