Title: **Effect of Soil Type on Atrazine and Alachlor Movement Through the Unsaturated Zone**

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Background/Need: Groundwater monitoring results have revealed numerous cases of contamination by agricultural chemicals in areas with sandy soils. The amount of this contamination, however, has varied greatly between areas with similar cropping practices and what were believed to be similar soil types. It appears that a particularly susceptible region was the intensively irrigated Lower Wisconsin River Valley (LWRV). Data from monitoring suggests that herbicide movement through the root zone of LWRV soils is much greater than through the similar soils from the Central Sands (CS) area of Wisconsin. A need exists to understand the link between groundwater contamination and field applied herbicides in the LWRV, as well as the differences between sandy soils from the LWRV and CS.

Objectives: 1) To compare the movement of atrazine and alachlor through exploratory soil columns representing the LWRV and CS regions. 2) To examine the influence of an experimental polymer additive on herbicide movement.

Methods: Five intact soil columns (two 80 cm, three 40 cm) were extracted from a Sparta sand from Arena Wisconsin and three columns (two 80 cm, one 40 cm) were extracted from the Plainfield sand of the Hancock Research Station. The columns were placed in a greenhouse and instrumented to simulate field temperature and moisture regimes. With the exception of a six-year storm on day 20, an average rainfall pattern was simulated for 110 days, while irrigations followed a pattern utilized by growers in the Lower Wisconsin River Valley (1.5 inches of precipitation and/or irrigation per week). All columns received the same amount of simulated rain and irrigation, totaling 53.4 cm. One corn plant was grown in each 8-inch diameter column. ^{14}C labeled atrazine applied to all columns at a rate of 1.3 kg/ha and alachlor was applied at 1.6 kg/ha. Two of the 40 cm Sparta columns received the polymer at the time of herbicide application.

Leachate was collected daily and analyzed for ^{14}C, parent atrazine and alachlor. At the completion of the experiment after 110 days each soil column was sectioned and the soil and plants were analyzed for the herbicides.

Results: There was less drainage from Plainfield columns compared to Sparta columns. Drainage differences may be due to a slightly greater water holding capacity of the Plainfield sand and in turn greater evapotranspiration.

There was a substantial difference in movement of the herbicides when comparing the two soil types. Over 45% of the applied atrazine leached through the 40 cm column of Sparta sand, while the Plainfield sand lost just over 3%. The 80 cm columns showed the Sparta and Plainfield losing 36% and 0.4% of the applied atrazine, respectively. Alachlor showed similar trends between soil types; however, concentrations were

significantly less, with the greatest loss being less than 2% from the Sparta 40 cm column.

The addition of the polymer to the herbicide application solutions showed a reduction in concentration and amount of herbicides leached through 40 cm columns. In 110 days the polymer columns lost 31% of the applied atrazine, compared to 45% leached from Sparta soil not receiving the polymer. In analyzing the soil remaining in the columns at the end of the experiment, data show that the columns receiving the polymer had a significant amount of the herbicide remaining at the surface of the soil, compared to those receiving regular application.

Conclusions/ Implications/ Recommendations: Significant differences in herbicide movement can exist on sandy soils previously considered to be characteristically similar. The Sparta soil has very little ability to retain atrazine in the top 80 cm compared to the Plainfield sand of the Central Sands. Alachlor is likely to be more mobile in Sparta sand than in Plainfield sand. The utilization of an experimental polymer in the herbicide application solution may be beneficial in reducing movement of herbicides through the soil profile.

This cursory study has led to a more comprehensive column study looking at atrazine, alachlor, and metolachlor movement in Sparta and Plainfield sand as well as a field study in the LWRV looking at herbicide movement under several irrigation and management schemes.

Related Publications:

Girard, B.D. 1991. Development of a modified flow-column technique for the determination of atrazine adsorption coefficients. M.S. thesis, Univ. of Wisconsin-Madison.

Wietersen, R.W. 1991. Effect of soil type, irrigation, and a tank-mix polymeron pesticide mobility through the root zone. M.S. thesis, UW-Madison.

Wietersen, R.C., T.C. Daniel, K.J. Fermanich, B.D. Girard, K. McSweeney, and B. Lowery. 1993. Atrazine, alachlor, and metolachlor mobility through two sandy Wisconsin soils. Journal of Environmental Quality. 22:811-818.

Key Words: atrazine, alachlor, Lower Wisconsin River Valley

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Project Report: A report on this project is available for loan from Wisconsin's Water Library, University of Wisconsin - Madison, 1975 Willow Drive, Madison, Wisconsin 53706.