Modeling the Interrelationship between Macropores and Subsurface Drainage for Pesticide Transport[1]

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Artificial subsurface drainage is successful at achieving the water quantity goals of agriculture management. However, concerns exist about the rapid transport of pesticides from the soil surface to ground water through macropores. Recent research indicates the potential for a direct hydraulic connection between macropores and subsurface drainage. This direct connection creates an exceedingly efficient transport mechanism currently not considered in environmental risk assessments. Exceedingly efficient transport results in immediate peaks in pesticide concentration in subsurface drains. A simplistic methodology has been proposed for incorporating direct macropore/subsurface drain connectivity into a pesticide transport model. The modification routes water from a percentage of the macropores near subsurface drains directly into the drains to simulate macropore/drain connectivity. Based on comparisons between field data and model simulations, the modified model more appropriately simulates the early concentration peaks for both conservative solutes and pesticides. Laboratory research will be performed to verify the hydraulic connectivity between macropores and subsurface drains. Water and conservative tracer infiltration studies will be conducted in two sets of experiments (with and without macropores) in two laboratory columns (with and without subsurface drainage). The two laboratory columns will be constructed to discriminate between matrix flow, macropore flow and mass transfer between the flow regimes and quantify the potential of drain-connected macropores influencing rapid transport to artificial drains. These laboratory experiments will provide an evaluation for the simplistic methodology for accounting for macropore/subsurface drainage connectivity.

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