2008 USDA-CSREES National Water Conference
Sparks, NV

Field and Laboratory Experiments on the Role of Directly Connected Macropores in Pathogen Transport to Subsurface Drainage

Garey Fox, Ramesh Kanwar, Rob Malone, Tom Moorman, Carl Pederson, Chi Kim Hoang and Jorge Guzman

Abstract Text:

The primary transport of pathogenic microorganisms in soils occurs through macropores that bypass the filtering and adsorptive effects of the soil matrix. Recent research indicates immediate breakthrough of solutes and contaminants in subsurface drainage by extraordinarily efficient transport through directly connected macropores. Other researchers have reported field experiments with no significant pathogen concentrations from subsurface drain flow, suggesting that pathogen transport to subsurface drainage systems is field specific. It is hypothesized that one of the primary reasons for field specific pathogen transport to subsurface drainage systems is related to the presence or absence of directly connected macropores that are “hydrologically” connected to subsurface drainage systems. Using a three-dimensional soil column, laboratory soil column experiments were performed using an innovative macropore design to investigate E. coli transport under controlled conditions with both surface connected and buried macropores. These laboratory experiments were performed on two soil types: a loamy sand and a field soil from Nashua, IA. Initial field experiments were also performed at the Nashua research site in Iowa with directly connected macropores to document E. coli transport to subsurface drainage. Initial experiments included a smoke test to identify directly connected macropores, infiltration tests on smoke emitting and non-smoke emitting macropores and bromide/pathogen transport experiments after application of liquid swine manure. Bromide and E. coli concentrations were measured in drain flow for a 24-hour period following rainfall application.

Impact Statement:

This research will determine the importance of directly connected macropores on pathogen (E. coli) transport to subsurface drains. Researchers have demonstrated hydrologic, nutrient, pathogen and pesticide connection, but have not sufficiently analyzed this direct connectivity.