Geophysical Research Abstracts, Vol. 7, 03731, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03731

Transport and retention of manure-borne *E. coli* in undisturbed soil columns

D. R. Shelton (1), A. K.Guber (2), E. V. Shein (3), L. M. Polyanskaya (3), B. A. Devin (3), Y. A. Pachepsky (1)

(1) USDA-ARS Environmental Microbial Safety Laboratory, Beltsville, MD, USA, (2) Department of Environmental Sciences, University of California, Riverside, USA, (3) Soil Science Department, Lomonosov Moscow State University, Moscow, Russian Federation (ypachepsky@anri.barc.usda.gov / Fax: 1-301-504-6608)

Animal manure is a source of several bacterial pathogens that can potentially contribute to surface and ground water contamination. Our objective was to test the hypothesis that manure colloids can enhance bacteria survival, compete for soil adsorption sites and serve as bacteria carriers. A pulse of 4% bovine manure suspension containing *E. coli* bacteria and KCl was passed through undisturbed 20-cm soil columns of a silt loam soil at 9 degrees C during 10 days. *E. coli* concentrations, chloride content and turbidity were measured in influent and in effluent. After the experiment, columns were cut into 2-cm layers to enumerate viable bacteria in pore solution and bacteria attached to the soil, and to measure bulk density and water content. Complementary batch experiments were carried out to measure attachment of *E. coli* to soil in presence of various amounts of manure colloids. Manure interfered with *E. coli* attachment to soil in batch experiments; increasing manure concentrations resulted in decreasing attachment. The attachment isotherm was linear without manure, and convex in presence of manure. In column experiments, maximum bacteria and Cl concentrations in leachate were observed before and after displacement of one pore volume, respectively. Individual columns had different average water flow velocities ranging from 2.3 to 9.3 cm/day. Variability in flow velocity and its effect on *E. coli* and manure transport were probably caused by different macroporosities in individual columns of the same soil. *E. coli* and manure colloid transport were similar in the slow-flow columns throughout the whole experiment. In the fast-flow columns, the *E. coli* transport was similar to the chloride transport until 0.5 volume of the pore so-

lution was replaced with the influent, but was subsequently retarded. . Bacteria and manure breakthrough curves had much longer tails compared with chloride. Manure transport in soil was affected by soil structure which manifested itself in differences in flow velocity. From 1% to 3% of the total applied bacteria were found in pore solution, and from 5% to 18% were attached to soil particles after the experiment. The *E. coli* attachment to soil in the fast-flow columns was similar to that in the batch experiment with 4% manure content. Attachment in the batch experiments with 0% and 2% manure bracketed the bacteria attachment observed in the slow-flow columns. Overall, high manure concentrations in pore solution and manure colloid transport reduced attachment to soil and increased breakthrough of *E. coli*. Variations in flow velocity among undisturbed samples of the same soil strongly affected attachment and entrapment of manure and bacteria in the pore space. The NATO Science Program supported this work via a Collaborative Linkage Grant.