RESEARCH ABSTRACT

PUBLIC HEALTH/WORKER SAFETY

Title: Effect of manure application rate and timing on the leaching and runoff potential of antibiotic resistant bacteria and their associated genes -**NPB#13-113**

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Date Submitted: December 30, 2016

Scientific Abstract

Antibiotics are used in swine production for therapeutic and for growth promotion purposes. It is well established that as much as 50 to 90% of antibiotics administered to animals are passed in the feces or urine in an unchanged form and this may lead to development of antibiotic-resistant strains of bacteria in the manure. Because land application is the most common method of disposing of swine lagoon effluent, there exists the potential threat of contaminating the underlying groundwater with antimicrobial-resistant bacteria (ARB) and their associated genes. Our study centered on improving our scientific understanding on the effect of liquid swine manure application rate and timing on soil leaching of ARB and associated genes. We hypothesized that two commonly used manure management practices – manure application rate and timing – will have significant effects on the leaching potential of ARB and associated genes through soil. Swine manure solutions were added to laboratory soil columns at rates of 5,000 or 30,000 gallons/acre. For both manure application rate, three columns were randomly selected to have rainfall applied (1.3 in/hr for 2 hours) at 1, 7, or 21 days after manure application. Column effluent and the top section of soil in the columns were sampled for cultivable bacteria and quantitative PCR (qPCR) was used to analyze and quantify tetracycline, methicillin, β-lactam and erythromycin resistance genetic determinants. Additionally, 16S rRNA and mobile genetic elements (class 1 integron) were measured. We also conducted similar experiments using swine lagoon effluent spiked with antibiotic resistant *E. coli* and *Salmonella*. We found that the amount of cultivable total bacteria recovered in the column effluent following application of the swine lagoon was similar in magnitude as control columns for both application rates and each rainfall timing interval indicating that the manure did not significantly elevate the risk of ARB transport in these columns. Moreover, we did not observe any significant increases in sediment-attached bacteria at the column inlet. In general, results were similar for the antibiotic resistant genetic determinants. In the experiments using swine manure spiked with *E. coli* and *Salmonella*, recovery of both microorganisms eluted from fine sand columns was similar for both manure application rates and time interval between manure application and rainfall event but differences were observed between application rates. In columns packed with loamy sand, no recovery was detected in the column effluent for either organism. Concentrations of sediment-attached bacteria showed a clear effect of manure application rate and rainfall timing. Results from the GU were similar. These findings show a clear effect of time interval between manure application and leaching event. This suggests the need to avoid manure application to fields when significant rainfall event is forecasted in the near future, even if the manure is not left on the soil surface but rather infiltrates into the soil.