RESEARCH ABSTRACT

PUBLIC HEALTH/WORKER SAFETY

Title: Quantifying Overland and Vertical Transport of Pathogens as Affected By Vegetated Buffer Strips - **NPB #01-148**

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II. Abstract:
Animal waste in the form of organic fertilizer is applied to agricultural land for crop production purposes. Pathogens in animal waste contain both beneficial as well as harmful bacteria such as Escherichia Coli O157:H7 and Salmonella. Such harmful bacteria pose human health risk if they reach to water and/or food supply. This study was designed to evaluate an effective vegetated buffer strip that can help prevent such harmful bacteria from reaching to water sources. Two sets of lysimeters one with 20% and the other with 5% were used to conduct the experiment. Both lysimeters were instrumented to monitor the surface and vertical transport of Pathogens. Soil on one side of the lysimeter with 20% slope is sandy loam, while on the other side it is clay loam. Each side of the two-sided lysimeter was divided into two sub-plots (6 m x 6.4 m), one with grass and the other with bare soil. Lysimeter with 5% slope contained clay loam soil and consisted of four sub-plots (4 m x 6.5 m), two with grass and the other two with bare soil. Plots were instrumented to collect runoff samples along the slope length (at three equidistant transects in 20% sub-plots and only at one location, 4.1 m from the edge of waste application area in sub-plots with 5% slope). Samples of runoff were also collected in a gutter at the edge of each plot for all sub-plots in both lysimeters. All plots with 20% slope were equipped with multi-sensor moisture probes to monitor real-time water content through the soil profile. No moisture sensors were installed in sub-plots with 5% slope. Bovine manure and Swine slurry, each at separate times was applied at the top of the slope of each plot in one-foot strips. Rainfall was simulated at 61 mm/hr and 81 mm/h, on 20% sub-plots and 5% sub-plots, respectively, using a portable rainfall simulator. Surface flow was measured and sampled at 2-5 minute intervals at three different transects in 20% sub-plots and one location in 5% sub-plots, and in the gutter for all sub-plots. Twenty four hours after simulations, soil samples were taken at incremental depths (0-50 cm).

Runoff and soil samples were analyzed for fecal coliforms (FC), E. Coli, and Salmonella. Results indicated that vegetated buffer strips retarded the flow, thus reducing the runoff of water and bacteria in both lysimeters and in all soil types examined in this study. Runoff from the bare

clay loam sub-plots contained virtually all the pathogens in both fresh manure and the swine slurry under both slopes, but runoff from the vegetated clay loam sub-plots had only 0.6 percent of the initial pathogen population in lysimeter with drastic slope of 20%. In comparison, runoff from bare sandy loam sub-plot with 20% slope contained 24 percent of the initial pathogen, but runoff from the vegetated sandy loam sub-plot had none. Similarly, vegetation seemed to filter both E.Coli and Salmonella in sub-plots with 5% slope, thus none or minor amounts of these pathogens were detected leaving the edge of the plot. This study concluded that even for drastic slopes such as the slope of 20% used in this study, grass buffer strip virtually stopped the movement of the pathogens. Results of this study has the real world implications in that such buffer strips may be implemented along the edges of the agricultural fields, especially in the regions of the country receiving animal waste, thus preventing the transport of pathogens to the surface bodies of water. Results also indicated that pathogens do not move much beyond 10 cm of the soil profile even in the vegetated sandy loam soil with the highest infiltration rate, thus indicating no threat to the groundwater. Results so far lead us to conclude that having a buffer strip of about 3-4 meters at the edge of the fields with sandy loam texture and about 4-5 meters at the edge of the fields with clay loam soil will prevent the delivery of pathogen from the fields receiving animal waste to the adjacent stream systems.