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MODELLING *ESCHERICHIA COLI* DENSITY ON LAND AND CONCENTRATION IN SURFACE RUNOFF

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ABSTRACT

Integrated farming of crop and animal enables resources from animal waste to be utilized. However, bacterial pollution is a concern. In this study, a bacterial model, ECOLI, was developed to simulate *E. coli* density on land daily and the concentration in surface runoff. Loss of *E. coli* was assumed to occur through decay, runoff, sediment, and percolation. *E. coli* decay was assumed to follow the first order decay affected by soil pH, soil temperature and soil moisture. In testing the model, the ECOLI model was interfaced with GLEAMS-SWT hydrologic and erosion model. Calibration and evaluation was performed with field-scale data from Franklinton, Louisiana. Fresh cow manure was applied on grassed plots and runoff was collected and analyzed. Predicted *E. coli* concentrations versus observed *E. coli* concentrations in surface runoff gave a regression line with coefficient of determination of 0.993, intercept of 0.011 and a slope of 0.995 indicating good agreement of model predicted concentrations with observed concentrations. The ECOLI model can be used to study the effects of various animal waste application practices such as waste loading rate, timing of application, and frequency of application. More research needs to be conducted to incorporate databases and also expand the capabilities of this model.

INTRODUCTION

Animal waste is known to contain nutrients for plants (Fontenot and Ross 1980). However, animal waste applied on land is subjected to hydrologic and other forces that can result in microbial pollution (Pell 1997; Hooda et al. 2000).

Models are useful in decision making. Reddy et al. (1981) proposed a conceptual model that was incorporated in ARMII (Overcash et al. 1983). Springer et al. (1983) used a continuity equation to describe faecal coliform movement. The model was partially tested for runoff on concrete surface. Moore et al. (1989) modified relationships proposed by Reddy et.al (1981) in estimating decay and proposed estimation bacteria movement during a rainfall event. Walker et al. (1990) proposed a combination of deterministic and statistical models to predict bacterial loss from the field and bacterial loss was assumed to be sediment bound. However, bacterial loss may not be adequately accounted for by binding to sediment as vegetative filter strip was found to be able to remove sediment but not faecal coliform (Chaubey et al. 1994). Different models have been proposed but none is available to farm managers. Therefore, the objective of this study was to develop a model capable of continuously simulating *E. coli* density in the soil and concentration in surface runoff from agricultural land where animal manure is applied.