



ESTIMATION OF NUTRIENT CONCENTRATIONS IN RUNOFF FROM BEEF CATTLE FEEDLOT USING ADAPTIVE NEURO-FUZZY INFERENCE SYSTEMS

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Abstract: Nutrient concentrations in runoff from beef cattle feedlots were estimated using two different adaptive network-based fuzzy inference systems (ANFIS), which were: (1) grid partition (ANFIS-GP) and (2) subtractive clustering based fuzzy inference system (ANFIS-SC). The input parameters were pH and electrical conductivity (EC); and the output parameters were total Kjeldahl nitrogen (TKN), ammonium-N ($\text{NH}_4\text{-N}$), orthophosphate (ortho-P), and potassium (K). Models performances were evaluated based on root mean square error, mean absolute error, mean bias error, and determination coefficient statistics. For the same dataset, the ANFIS model outputs were also compared with a previously published nutrient concentration predictability model for runoff using artificial neural network (ANN) outputs. Results showed that both ANFIS-GP and ANFIS-SC models successfully predicted the runoff nutrient concentration. The comparison results revealed that the ANFIS-GP model performed slightly better than ANFIS-SC model in estimating TKN, $\text{NH}_4\text{-N}$, ortho-P, and K. When compared with the ANN model for the same dataset, ANFIS outperformed ANN in nutrient concentration prediction in runoff.

Key words: *nutrient concentration, cattle feedlot, grid partition based fuzzy inference system (ANFIS-GP), subtractive clustering based fuzzy inference system (ANFIS-SC)*

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1. Introduction

With expanding livestock facilities, animal agriculture is facing increasing environmental concerns, i.e., water and air pollution due to increased manure volume. Although manure is an excellent source of nutrients for plants and a good soil conditioner, improper manure management, especially from feedlots, can negatively

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