

APEX Feedlot Water Quality Simulation

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Abstract: A manure erosion equation was developed and added to the APEX model for use in estimating nutrient losses from feedlots and manure application fields. The modified APEX was validated with data from feedlots near Bushland, TX and Carrington, ND. The model was used to investigate feedlot management options on a hypothetical feedlot with realistic data. Vegetative filter strip (VFS) characteristics including 10, 25, 50 and 100% FLRs (flow length ratios, i.e. filter flow length/feedlot flow length) and slopes of 1%, 5% and 10% were considered. Combinations of these VFS characteristics were compared on two soil types: clay loam and fine sandy loam. Management options included three stocking rates (10, 15, and 20 m² hd⁻¹) and two clean-out intervals (90 and 180 d). Additionally, two climatic conditions (precipitation of 440 and 825 mm yr⁻¹) were simulated. Results from 50 y simulations indicate that a VFS downslope of the feedlot can greatly reduce nutrient loads. All three VFS characteristics (FLR, slope, and soil) were important in controlling organic N and P losses. The best organic N and P control was obtained from a VFS with maximum FLR (100%), minimum slope (1%), and a sandy loam soil. Results were similar for soluble N and P control except that VFS slope had little effect. The simulated management options (clean-out interval and stocking rate) were also effective in controlling nutrient losses. The climatic variable (annual precipitation) gave higher nutrient losses from the feedlot and the VFS with 825 mm than with 440 mm. Nutrient control efficiencies, CEs, (1.0 - nutrient loss from VFS / nutrient loss from feedlot) were calculated for all scenarios considered. The VFSs on sandy loam soil with FLRs equal or greater than 50% gave the highest CEs for both soluble and organic nutrients. Other factors including VFS slope, clean-out interval, and stocking rate had marginal impacts on CE. For soluble nutrients CE is inversely related to annual precipitation. Thus, it is important to locate feedlots in areas with low precipitation and to provide a well designed VFS. The APEX model with the new manure erosion equation provides a tool for designing VFSs for controlling nutrient losses from feedlots.

The full paper is in press (Transactions of the ASAE)