

Watershed-level Benefits of Alabama P-Index: A Comparison of Predictability and Sensitivity of Two Phosphorus Models

Buildup of phosphorus (P) in the agricultural soils due to excessive, long term application of poultry litter is a major environmental concern in many poultry producing states. Even though P is an essential nutrient for plant growth, transport of P from litter applied areas cause severe impairment of water bodies. To reduce buildup and transport of P from poultry litter-applied areas, many states have developed P indices. A P-index recommends different poultry litter application rates, based on vulnerability of sites to transport P, to reduce potential risk of P transport to nearby surface waters. In Alabama also, a P-index has been developed to identify areas with high potential risk of P transport so that application rates can be adjusted to eliminate over-application of poultry litter to those areas. While a P-index can potentially reduce P transport at a field-scale, the watershed-level benefits of applying P-index have not been quantified. The objective of this study was to determine the effectiveness of the Alabama P-index at reducing P loads at the watershed-scale. This study used the Soil and Water Assessment Tool (SWAT) model and a newly-developed state-of-the-art manure P model to evaluate the effectiveness of the Alabama P-index in reducing P transport at a watershed-scale in a Randolph County, Alabama watershed. The SWAT model was calibrated with 2004 and 2005 flow data with Nash-Sutcliffe coefficient of 0.61, 0.43 and 0.69 for surface runoff, base flow and total streamflow, respectively. Results from the SWAT model suggest that Alabama P-index is effective at reducing P loads in the watershed. However, because of the SWAT P sub-model limitations, the true watershed-level benefits of applying the P-index cannot be quantified. Results from the SWAT and the newly-developed manure P model are being combined to quantify the true benefits of the P-index.

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