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Nutrient Loads in Ohio Headwater Streams

Published studies show that nutrient inputs to headwater streams in the Midwest result in degraded water quality in the Gulf of Mexico and the Great lakes. The majority of headwater streams in Ohio are incised, over-wide trapezoidal drainage ditches flowing through agricultural fields. An alternative design to mitigate nutrient export from agricultural watersheds is the two-stage ditch design. This design consists of reconfiguring the traditional trapezoidal ditch to include a small main channel with attached floodplains, within ditch confines. This study quantifies the nutrient load reduction in three constructed and two naturally developed two-stage ditches in Ohio and Michigan. An additional trapezoidal ditch was also monitored for control. ISCO automatic water samplers were installed upstream and downstream of the selected drainage ditch reaches; water samples were analyzed for nitrogen, phosphorus, and sediment. The study shows that nutrient reduction over the two-stage ditch reach was greater when compared to the trapezoidal reach. Nitrate loadings in a two-stage reach over a particular sampling interval reduced by 27 percent between upstream and downstream sampling stations; in the control trapezoidal ditch, nitrate loadings increased by 4 percent over a similar distance and sampling interval. The study shows there is a strong seasonal trend in nutrient inputs to the headwater system, as well as a significant relationship between nutrient reductions and flow regime. Average reductions, trends, and statistical analysis of nutrient data will be presented. The results of this study suggest that two-stage drainage ditches have a greater potential to decrease nutrient loadings when compared to traditional trapezoidal ditches. The modification of trapezoidal ditches to two-stage ditch design could improve water quality exported by agricultural watersheds in the Midwest.

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