Many Practices Can Reduce Nitrate Losses from Fields, but Social Constraints Make Implementation Difficult

Watersheds in the upper Midwest Corn Belt are flat and extensively tile-drained, producing high yields of corn and soybeans on greater than 90% of the land. Corn production requires large inputs of nitrogen fertilizer, and there are extensive periods with no plant roots to take up available nitrate. Therefore, precipitation events during late fall through early summer lead to large losses of nitrate, typically about 20 to 30 kg N⁻¹ ha⁻¹ yr⁻¹. This nitrate is transported down the Mississippi River system and contributes to the hypoxic zone that forms each summer in the Gulf of Mexico. These watersheds are the focus of many federal and state programs to reduce these tile nitrate losses, with little success to this point.

In an upcoming issue of the Journal of Environmental Quality, researchers report on multi-year studies from two watersheds in east-central Illinois (Upper Salt Fork and Embarras River) where a range of nitrate reduction practices were evaluated on tile-drained fields, along with social science perspectives of the landowners and farmers. The article is part of a special section of papers on “Improving Nitrogen Use Efficiency in Crop and Livestock Production Systems.” On-farm studies of fertilizer timing, cover crops, drainage water management, woodchip bioreactors, and constructed wetlands were used to evaluate the efficacy of reducing nitrate losses. All methods led to various levels of reductions in nitrate losses (30–80%), with the exception of drainage water management. The management fields were a retrofit of existing systems, and water flowed laterally from the managed drainage system nearby.

The biophysical and social studies conducted in the Upper Salt Fork and Embarras River watersheds demonstrated a disconnect between field and stream monitoring and water quality perspectives of farm operators as well as the complexity of reducing nitrate concentrations in the river systems. Various in-field and edge-of-field techniques that could help to reduce nitrate loadings and little social acceptance under our current policy and management systems. In addition, large-scale (nearly every field) adoption would be needed for substantial reductions in nitrate yields to occur. Interviews and surveys indicated that land owners and farmers had