

QUANTIFICATION OF NUTRIENT DYNAMICS IN AGRICULTURAL DRAINAGE DITCHES IN NORTHERN INDIANA

Dr. Indrajeet Chaubey, Project Leader

Cooperators: Srinivaulu Ale, Dr. Laura Bowling

Graduate Student: Katherine Merriman

Goals:

- Perform nutrient injections within three different ditches for spring, summer, and fall seasons
- Investigate sediment interactions with water through equilibrium phosphorus concentration (EPC_0), phosphorus sorption index (PSI), exchangeable nitrogen (Ex-N), and exchangeable phosphorus (Ex-P) extractions
- Quantify hydrologic parameters with the hydrologic transport model OTIS-P

Statement of Problem: Poorly drained soils are common in the Midwest and will leave water standing in low spots on the fields. This excess water leads to reduced crop production and health. In the Midwest, it is common to remove water in those areas via tile drains. Tile drains have piping installed under fields that outlet to surface waters, which are usually drainage ditches. This system has been shown to increase the speed of transport and loss of soluble pollutants like phosphate, nitrate, and ammonium. This expedited drainage is particularly important to nitrate loading since nitrate can be denitrified within the soil profile; tile drainage removes water from the soil profile quickly, reducing the possibility of denitrification. Hypoxia, levels of low dissolved oxygen, has appeared in the Gulf of Mexico and is threatening the aquatic life of the area. Shrimp, crab, snails, and bottom dwelling fish are suffocated every summer, while other fish leave the area in search of more oxygen rich zones. Nitrogen (N) and phosphorous (P) are needed to sustain a healthy aquatic environment, but excessive amounts of either will cause rapid algal growth, or eutrophication. Studies have shown that much of the hypoxia in the Gulf of Mexico is a result of polluted upstream waters draining into the Mississippi River Basin. A large source of the nutrients and sediment from in the Mississippi River basin are results of agriculture from the Midwest Corn Belt. Currently, many parameters are unknown on the attenuation of nutrients within the drainage ditches of the Midwest. This study will quantify the movement of nutrients within two drainage ditches in north central Indiana.

Current Activities: This study focuses on seasonal nutrient dynamics within three agricultural drainage ditches with different best management practices (BMPs) in the Hoagland Ditch watershed in Northern Indiana. The BMPs explored were dredged ditches and vegetated ditches, with the third ditch being both undredged and nonvegetated as a control. Short-term nutrient injections were performed in the ditches to determine nutrient uptake length (S_w) during spring and fall conditions. To determine sediment-nutrient interactions, sediment extractions including equilibrium phosphorus concentration (EPC_0), phosphorous sorption index (PSI), exchangeable nitrogen (Ex-N), and exchangeable phosphorous (Ex-P) were performed at all sites for each season. The results were analyzed to evaluate seasonal and BMP differences in nutrient transport and sediment nutrient interactions in agricultural drainage ditches.