Utt, N.J. M.S.E., Purdue University, 2010. Impacts of drainage water management on crop growth, soil quality, and nitrate loads. Major Professors: Jane R. Frankenberger and Eileen J. Kladivko.

Subsurface drainage, a common practice used in the Midwest to lower the seasonal water table and improve crop yield, increases the movement of nitrate into surface water and is one of the causes of a seasonal hypoxic zone in the Gulf of Mexico. Drainage water management uses a control structure to raise the subsurface drainage outlet and reduce water flow from the system, potentially reducing nitrate loads to the watershed. This study examined the effectiveness of drainage water management in Indiana by using a paired watershed approach to measure its impact on drain flow, nitrate concentration in the drain flow, nitrate loads, and agronomic impacts. Field conditions were monitored at four locations from 2005 through 2009. Annual flow reductions ranged from 12 - 22% and annual nitrate load reductions ranged from 17 - 29% at the site where flow measurements were most reliable. The nitrate concentration in the drain flow increased at three sites by 2 - 11% during the growing season and decreased by 3 - 32% during the dormant season. Plant samples collected throughout the growing season showed no significant impacts on nitrogen uptake. Differences in soil fertility and soil physical properties, including bulk density, aggregate stability, and penetration resistance, varied among test plots and years, but were largely attributed to differences in the soil characteristics and other confounding factors. Drainage water management was not observed to have a significant impact on any of the agronomic properties measured. These results indicate that drainage water management could be an effective and agronomically sustainable method for reducing nitrate loading to surface waters in Indiana.