Impact of Drainage Water Management on Crop Yield, Drainage Volume, and Nitrate Loss

RFR-A1474

Linda Schott, graduate student
Matt Helmers, professor
Carl Pederson, ag specialist
Department of Agricultural and Biosystems Engineering
Greg Brenneman, extension, ag engineering specialist
Myron Rees, farm superintendent

Introduction

The objectives of this study were to determine the impact of shallow, controlled, conventional, and no drainage on crop yields, subsurface drainage volumes, and nitrate loss through subsurface drainage. This research investigates whether drainage water management reduces nitrate loadings to downstream surface waters.

Materials and Methods

Research was conducted at the Iowa State University Southeast Research Farm, Crawfordsville, Iowa, from 2007-2014. There were eight research plots with two replications for each drainage treatment. Each plot was planted and rotated so half was in corn and half in soybeans for a typical rotation.

Conventional plot tile lines were installed at a depth of 4 ft and a spacing of 60 ft. Shallow and controlled drainage plots represent drainage water management. Controlled tile lines were the same design as the conventional. Shallow plot tile lines were installed at a depth of 2.5 ft with a spacing of 40 ft. All plots were designed to have a maximum drainage coefficient of 0.75 in./day. The controlled drainage boards are typically removed in mid-April prior to planting to allow free flow to reduce the height of the water table for improved trafficability. The boards are replaced after planting.

Results and Discussion

Crop yield. In general, no significant differences were observed in corn grain yields between treatments (Figure 1). However, in wet years, corn yields in the undrained plots were reduced. Soybeans had a significant reduction ($P < 0.05$) in undrained plot yields, but there was no difference between drainage types (Figure 2).

Drainage volume. Over the seven-year study period, the conventional plots drained more water than the controlled and shallow plots (Figure 3). The controlled and shallow drainage plots reduced drainage by 41 and 49 percent, respectively.

Nitrogen loss. The conventional plots lost, on average, 29 lbs-N/acre (Figure 4). The controlled and shallow drained plots lost 49 and 42 percent less N, respectively.

Acknowledgements

This research is part of a regional collaborative project supported by the USDA-NIFA, Award No. 2011-68002-30190: Cropping Systems Coordinated Agricultural Project: Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems.

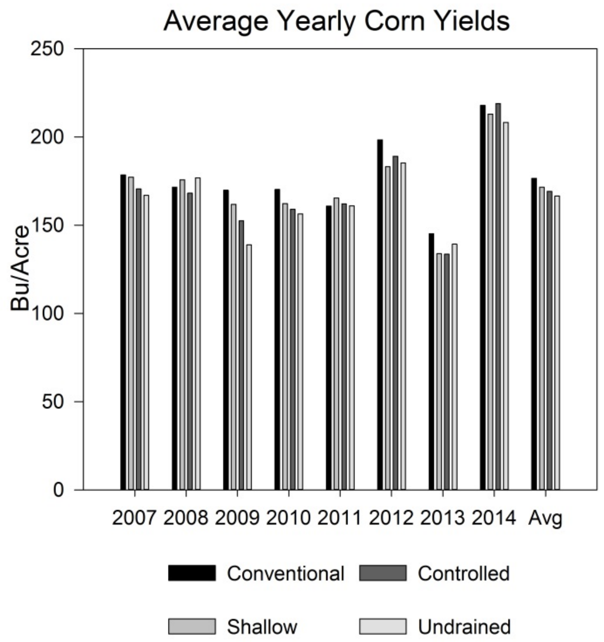

Figure 1. Average yearly corn yield for various tile drainage systems.

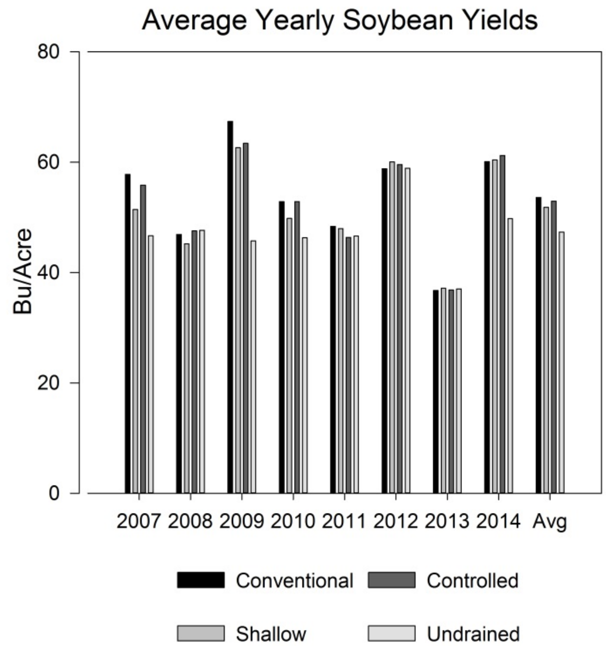

Figure 2. Average yearly soybean yield for various tile drainage systems.

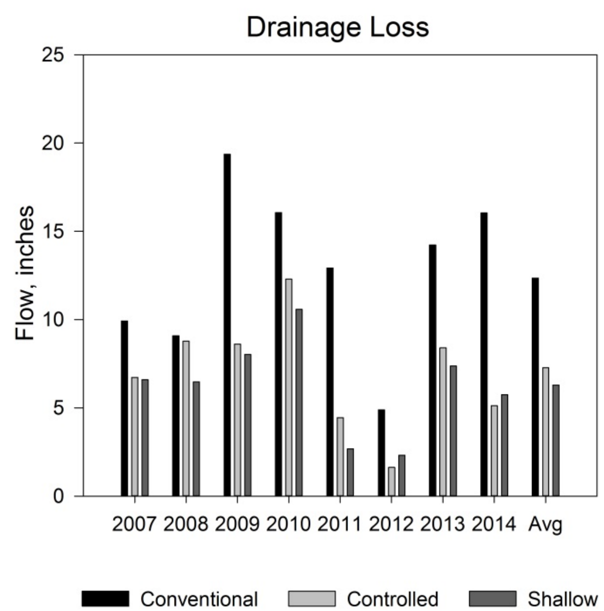

Figure 3. Average yearly drainage loss for various tile drainage systems.

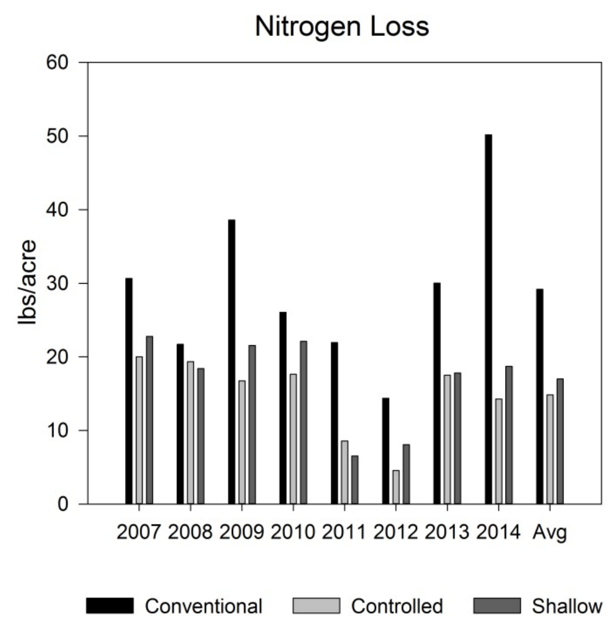

Figure 4. Average yearly nitrogen loss for various tile drainage systems.