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Impact of Drainage Water Management on Crop Yield

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Abstract
The objectives of this project were to study nitrate loading in subsurface drainage and corn-soybean yield response under various drainage water management practices. This experiment explores various drainage strategies to reduce nitrate loading to surface waters in southeast Iowa.

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Introduction

The objectives of this project were to study nitrate loading in subsurface drainage and corn-soybean yield response under various drainage water management practices. This experiment explores various drainage strategies to reduce nitrate loading to surface waters in southeast Iowa.

Materials and Methods

Research was conducted at the Southeast Research Farm in Crawfordsville, Iowa from 2007–2012. Monthly precipitation during the study period is shown in Table 1. The research site has eight plots with two replications for each treatment. Plots were split down the middle and cropped east to west with both corn and soybean each year, which alternate each year to replicate a typical Iowa corn-soybean rotation. The eight plots included two undrained plots, two plots with conventional drainage, two plots with shallow drainage, and two plots with controlled drainage. The conventional and controlled drainage plots had tiles installed to a 4 ft depth with a drain spacing of 60 ft. Shallow drainage plots had tiles installed to a 2.5-ft depth with a 40-ft spacing. All drained plots were designed to have a maximum drainage coefficient of 0.75 in./day.

The gates in the water table control structures were opened in mid- to late-April prior to planting and generally closed in late May to early June after planting was completed. Management in the fall was typically not required at this site due to low water table conditions.

Yield data was collected with a combine yield monitor and readings were constrained to the center 12 to 18 rows of corn and soybeans for each plot. The length monitored was 120 ft for each plot. The start and end locations were midway between tile lines in the center of the plots.

Results and Discussion

The effect of drainage water management on corn and soybean yields for 2007 through 2012 are shown in Figures 1 and 2. Overall, the six-year average corn and soybean yields were highest for conventional drainage plots and lowest for undrained plots. The shallow drainage and controlled drainage plots were intermediate. Corn yield shows little variation between years except the highest yield was recorded in 2012 in spite of drought conditions. Soybean yield varies widely over the years.

Table1. Monthly precipitation in 2007-2012. Unavailable data is indicated with "—".

	2007	2008	2009	2010	2011	2012
	---------- inches ----------					
Jan.	0.9	0.3	—	1.6	1.3	1.0
Feb.	1.8	0.1	—	0.3	2.4	1.7
Mar.	3.6	0.9	4.3	2.9	2.1	1.3
Apr.	5.0	5.4	2.2	4.4	3.4	2.9
May	3.3	5.4	5.9	5.9	4.4	6.3
June	7.5	6.3	8.6	12.6	7.6	4.0
July	4.2	3.3	4.8	5.1	1.4	0.7
Aug.	7.5	3.8	9.8	4.7	0.7	3.0
Sept.	2.0	8.1	1.4	7.4	2.5	2.3
Oct.	3.9	2.4	7.2	1.2	0.9	2.7
Nov.	0.6	0.2	2.7	1.3	3.6	1.2
Dec.	—	—	1.6	1.1	3.1	3.3
Year	40.3	36.1	48.5	48.6	33.4	30.3

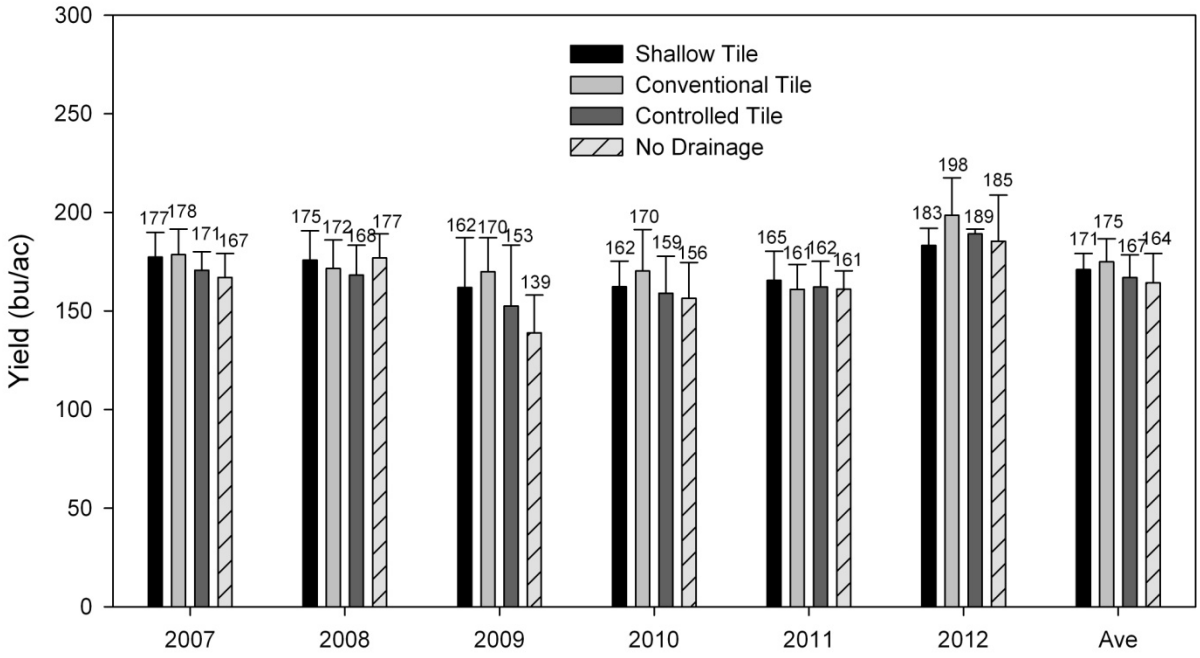

Figure 1. Corn grain yield for different drainage water management.

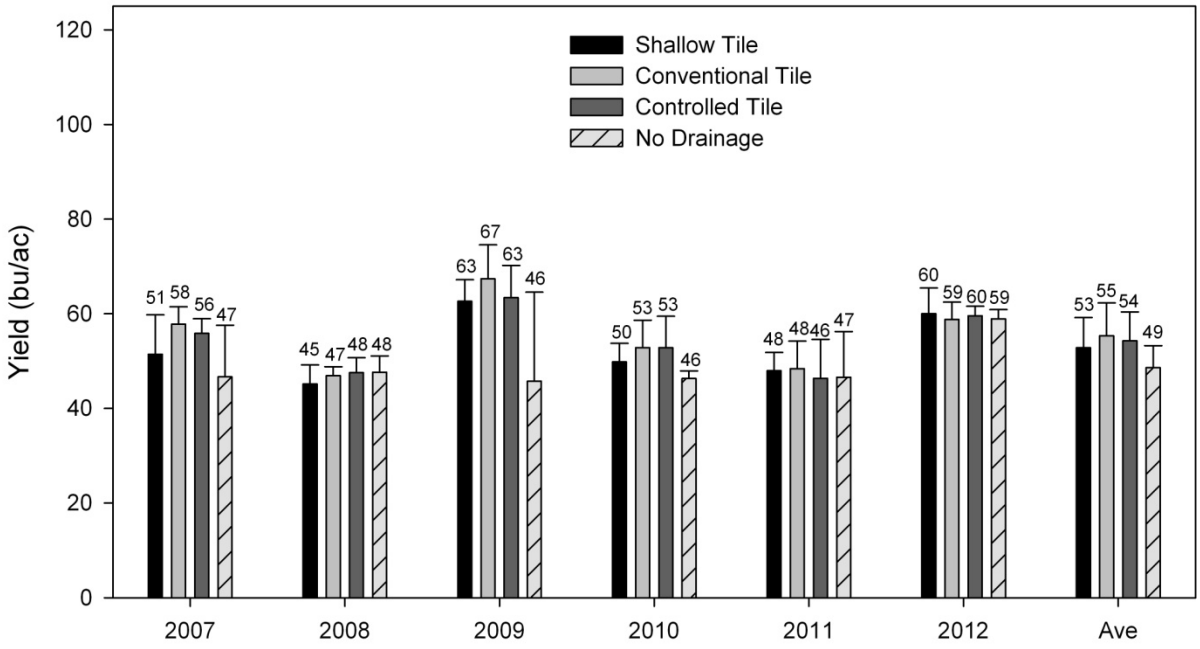

Figure 2. Soybean grain yield for different drainage water management.