Effect of Spring Application of N Fertilizer and a Nitrification Inhibitor on Corn Grain Yields

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Introduction

Nitrogen (N) fertilizer management for corn production continues to be a very important issue in Iowa. The goal of N management is to apply enough fertilizer to maximize profits for the crop producer and to limit the potential for environmental contamination from unused fertilizer. The ammonium (NH_4) form of N fertilizer doesn't leach or denitrify in soils. Eventually NH_4 is converted to nitrate (NO_3) in soils, and once this occurs the potential for N loss increases. Nitrification inhibitors (NI) maintain, for a time, ammonium (NH_4) in soils thus reducing the risk of N loss. Research on NIs in Iowa has not shown predictable corn yield increases due to their use, especially when applied in the spring in liquid N fertilizers. This may be because NIs are volatile and may be lost from the soil during application. The purpose of this study was to evaluate a reformulation of the NI nitrapyrin. This product is currently being sold as Stay N. The reformulated product is less volatile than the old material.

Materials and Methods

This study was conducted in 2000 and 2001. The experiment was arranged in a split-plot in a randomized, complete block design. Main plots were NI treatments (with or without). Sub-plots were seven nitrogen rates ranging from 0 lb/a N to 240 lb/a N (Table 1). The NI was mixed with urea-ammonium nitrate solutions (32% N) and broadcast over the appropriate plots in the spring using a small-plot fertilizer applicator. The fertilizer and NI were incorporated into the soil within 3 hours of application by disking the field. The experiments were planted in early May and harvested in October each year.

Results

The effects of treatments on corn grain yield are shown in Table 1. Grain yields were high in 2000, ranging from about 140 bushels/acre to 177 bushels/acre, and increased with the addition of N fertilizer in 2000 ($p>F=<0.01$). The yield of corn with the NI added, averaged over N rates, was 166 bushels/acre. Corn yields without the NI, averaged over N rates, was 172 bushels/acre but the difference was due to random variability rather than to the treatment ($p>F=0.61$). There was no significant interaction between N fertilizer rates and the NI in 2000 ($p>F=0.93$).

Grain yields were considerably lower in 2001 due primarily to a dry summer. Yields ranged from 85 bushels/acre to 138 bushels/acre and increased with N fertilizer rates ($p>F=<0.01$). Yields were variable, which was also a reflection of the dry growing season. The average grain yield where the NI was applied, averaged over N rates, was 114 bushels/acre, which was the same as the average yield where it wasn't applied. The interaction between N fertilizer rates and the NI was not significant in 2001 either ($p>F=0.70$).

The results of this study show that there was no economic benefit to application of the NI at this site in either year. Profits would be reduced by the cost of the NI in both years. We are currently analyzing soil samples taken after harvest each year to see if the NI had an effect on the amount of N remaining in the soil in the fall. This information will allow us to speculate about the potential environmental effects from using a nitrogen inhibitor at this site.

Table 1. Corn response to N fertilizer and a nitrification inhibitor at Sutherland in 2000 and 2001.

N Rate	Nitrification Inhibitor	2000 Grain yield	2001 Grain yield
lb/a		----------bushels/acre----------	
0	No	144	80
40		176	97
80		168	106
120		184	107
160		175	141
200		180	128
240		176	140
Average		172	114
0	Yes	136	89
40		174	93
80		167	117
120		167	118
160		178	135
200		172	134
240		167	113
Average		166	114
0	(Averages of	140	85
40	above yields)	175	95
80		168	112
120		175	113
160		177	138
200		176	131
240		172	127
Statistics			
		Prob> F	
N rate		<0.01	<0.01
NI		0.61	0.92
N rate × NI		0.93	0.70