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Sulfur Fertilizer Application to Corn and Soybean

Abstract

Historically, sulfur (S) application has not been recommended on Iowa soils for corn and soybean production. The soil supply or combination from sources such as manure or precipitation has met crop S needs. However, soil S levels or supply may become depleted with prolonged crop removal, sulfate leaching, low precipitation deposition, and reduced soil organic matter levels. The objectives of this study were to determine if corn and soybean yields would respond to S fertilizer application and rate at sites in central and northeast Iowa.

Keywords

Agronomy

Disciplines

Agricultural Science | Agriculture | Agronomy and Crop Sciences

Sulfur Fertilizer Application to Corn and Soybean

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Introduction

Historically, sulfur (S) application has not been recommended on Iowa soils for corn and soybean production. The soil supply or combination from sources such as manure or precipitation has met crop S needs. However, soil S levels or supply may become depleted with prolonged crop removal, sulfate leaching, low precipitation deposition, and reduced soil organic matter levels.

The objectives of this study were to determine if corn and soybean yields would respond to S fertilizer application and rate at sites in central and northeast Iowa.

Materials and Methods

This study was conducted at two Iowa State University Research and Demonstration Farms in 2008. The soils were a Canisteo silty clay loam and Clyde silty clay loam at Ames and Nashua, respectively. Calcium sulfate was broadcast and incorporated before corn and soybean planting at rates of 0, 10, 20, and 40 lb S/acre in the spring of 2008. Fertilizer N was applied to corn at a uniform rate of 120 lb N/acre at Ames and 140 lb N/acre at Nashua.

The study was a randomized complete block design with four replications. Cultural practices were those typically used for a corn-soybean rotation at each research farm.

Corn plant sensing to detect S deficiency was conducted at the V10 growth stage using the Crop Circle ACS-210 active canopy sensor. The normalized difference vegetative index (NDVI) provided by the sensor is a measure of plant biomass and greenness. Leaf S concentration was determined from 10 corn

ear leaves (opposite and below the primary ear, VT growth stage) and 10 uppermost trifoliolate soybean leaves (petioles removed, R2 growth stage). Grain was harvested with a plot combine and yields corrected to standard moisture.

Results and Discussion

The corn canopy NDVI values (Table 1) show no response to applied S at Ames but a small S rate response trend at Nashua. Using plant sensing to determine S stress could be practical in the future, but more research is needed to develop it as a diagnostic tool for identifying S deficiency.

Application of S fertilizer increased the S concentration of corn and soybean leaves (Table 2). However, the increase in plant S concentrations was not large and did not translate to grain yield response (Table 3). The corn leaf S concentrations were low with no S application, but apparently not at or below a critical concentration.

Due to wet conditions in 2008, grain yields were variable. Also, the N rate applied at Ames was likely not enough to maximize corn grain yield. Corn at the Ames and Nashua sites did not have a yield increase from S application. Corn at Nashua did have a small NDVI response early in the season (V10 stage) to S application, but that increase was small and did not result in a grain yield response. This is similar to the ear leaf S concentrations. Soybean yield increased linearly with increasing S rate at Ames. Low soybean yields at this site were due to late planting, hail, and grasshopper damage in July. Soybean yields at Nashua did not respond to S application.

Research is continuing to further study corn and soybean response to S application in the central and northeastern geographic areas of Iowa.

Acknowledgements

Appreciation is extended to the Iowa State University Research and Demonstration Farm superintendents and to all of the farm crews for their assistance with this study.

Table 1. Effect of S fertilizer application on corn NDVI at two ISU research and demonstration farms, 2008.

S Rate lb S/acre	Corn	
	Ames	Nashua
0	0.722	0.742
10	0.730	0.744
20	0.730	0.748
40	0.721	0.745
	NS	*
<u>Average response</u>		
No S	0.722	0.742
S fertilizer	0.727	0.746
	NS	*

Significant at the 0.10 probability level (*). Not significant (NS).

Table 2. Effect of S fertilizer application on corn and soybean leaf S concentration at two ISU research and demonstration farms, 2008.

S Rate lb S/acre	Corn		Soybean	
	Ames	Nashua	Ames	Nashua
0	0.14	0.16	-	0.29
10	0.16	0.18	-	0.31
20	0.16	0.18	-	0.31
40	0.16	0.18	-	0.31
	*	*		*
<u>Average response</u>				
No S	0.14	0.16	-	0.29
S fertilizer	0.16	0.18	-	0.31
	*	*	-	*

Significant at the 0.10 probability level (*). Not significant (NS).

Table 3. Effect of S fertilizer application on corn and soybean yield at two ISU research and demonstration farms, 2008.

S Rate lb S/acre	Corn		Soybean	
	Ames	Nashua	Ames	Nashua
0	159	241	32	62
10	171	246	31	65
20	172	247	34	58
40	161	252	35	60
	NS	NS	*	NS
<u>Average response</u>				
No S	159	241	32	62
S fertilizer	168	248	33	61
	NS	NS	NS	NS

Significant at the 0.10 probability level (*). Not significant (NS).