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Sulfur Fertilizer Application to Corn and Soybean

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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 will become depleted with prolonged crop removal, sulfate leaching, low precipitation deposition, and declining soil organic matter. The objective of this study was to determine the responsiveness of corn and soybean to S application (first year and residual second year) and S fertilizer material at multiple sites across Iowa soils and climatic conditions.

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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 will become depleted with prolonged crop removal, sulfate leaching, low precipitation deposition, and declining soil organic matter.

The objective of this study was to determine the responsiveness of corn and soybean to S application (first year and residual second year) and S fertilizer material at multiple sites across Iowa soils and climatic conditions.

Materials and Methods

This study was conducted at six Iowa State University Research and Demonstration farms in 2000. Calcium sulfate and elemental S fertilizers were broadcast applied to corn and soybean at rates of 0, 10, 20, and 40 lb S/acre in the spring of 2000. The sulfur fertilizers were either incorporated with spring tillage or were left on the soil surface if the site used no-till. Corn and soybean crops will be rotated and residual response to S fertilizers applied in 2000 will be measured in 2001.

A complete factorial arrangement of treatments was replicated four times in a randomized complete block design. Plot size was either 15 or 20 feet wide (6 or 8 rows) and 50 feet long. Cultural practices were those typically utilized for corn and soybean production at each research farm.

Corn leaf greenness (ear leaf) was measured with a SPAD chlorophyll meter at tassel (VT growth stage). The middle 3 to 6 rows (varied by farm) were harvested the length of the plots with plot combines. Grain yields were corrected to standard moisture. Soil samples were collected in the spring at 0-6, 6-12, 12-24, and 24-36 inch depths and analyzed for sulfate-S.

Results and Discussion

Sulfur applied in 2000 had no statistically significant effect on corn or soybean grain yield at any site (Tables 1 and 2). This response was the same for both S sources. Also, S application did not change the corn leaf greenness (Table 3).

Soil sulfur levels (extractable sulfate-S by the monocalcium phosphate method) were variable between sites and depths (Table 4). Despite the extractable levels in the 0-6 inch depth at several sites being lower than reported critical levels, there were no crop yield responses. This illustrates a commonly observed result in S research trials – high soil sulfate-S test levels correctly indicate expectation of no response to applied S, but low tests don’t reliably predict response to applied S.

The lack of grain yield increase to applied S in this study is consistent with results of previous studies conducted in Iowa.

Acknowledgments

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Table 1. Effect of sulfur source and rate on corn grain yield, 2000.

	Ames		Atlantic		Crawfordsville		Doon		Kanawha		Castana	
S Rate	CaS	S	CaS	S	CaS	S	CaS	S	CaS	S	CaS	S
lb S/acre	bu/acre											
0	175	180	150	150	172	158	154	147	159	159	159	163
10	180	174	146	150	157	167	143	149	161	156	160	161
20	174	176	152	152	170	164	142	143	156	160	155	156
40	177	175	147	149	151	161	146	147	163	161	163	163
	NS*		NS		NS		NS		NS		NS	

CaS = calcium sulfate; S = elemental sulfur; sulfur fertilizers applied spring 2000.
* Not significant at the 0.05 probability level.
Iowa State University, 2001.

Table 2. Effect of sulfur source and rate on soybean grain yield, 2000.

	Ames		Atlantic		Crawfordsville		Doon		Kanawha		Castana	
S Rate	CaS	S	CaS	S	CaS	S	CaS	S	CaS	S	CaS	S
lb S/acre	bu/acre											
0	53.8	54.2	47.4	46.6	51.4	52.3	43.5	43.1	52.5	52.7	---	---
10	53.9	53.4	46.3	48.4	51.2	49.7	42.4	42.6	51.7	52.6	---	---
20	52.8	55.0	46.3	45.5	50.0	50.2	39.9	44.3	53.1	53.1	---	---
40	50.4	54.4	46.4	47.4	51.0	49.5	42.3	43.8	53.1	51.7	---	---
	NS*		NS		NS		NS		NS		NS	

CaS = calcium sulfate; S = elemental sulfur; sulfur fertilizers applied spring 2000.
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Table 3. Effect of sulfur source and rate on corn ear leaf SPAD chlorophyll meter readings (VT stage), 2000.

	Ames		Atlantic		Crawfordsville		Doon		Kanawha		Castana	
S Rate	CaS	S	CaS	S	CaS	S	CaS	S	CaS	S	CaS	S
lb S/acre	SPAD Units											
0	61	63	60	62	55	54	59	59	61	62	---	---
10	62	60	61	62	55	55	60	60	61	61	---	---
20	62	61	62	62	56	55	60	60	63	61	---	---
40	62	61	62	61	55	56	60	60	61	62	---	---
	NS*		NS		NS		NS		NS		NS	

CaS = calcium sulfate; S = elemental sulfur; sulfur fertilizers applied spring 2000.
* Not significant at the 0.05 probability level.
Iowa State University, 2001.

Table 4. Extractable S concentration by the monocalcium phosphate sulfate-S soil test method, 2000.

Sample	Ames		Atlantic		Crawfordsville		Doon		Kanawha		Castana	
Depth	Crn	Sb	Crn	Sb	Crn	Sb	Crn	Sb	Crn	Sb	Crn	Sb
inches	ppm											
0-6	23	13	8	11	6	7	2	11	7	7	4	--
6-12	6	6	11	5	2	4	2	4	4	7	5	--
12-24	9	25	7	7	2	5	8	7	10	15	2	--
24-36	13	42	7	16	3	2	--	--	9	10	4	--

Crn = Corn; Sb = Soybean.
Soil samples collected spring 2000. Iowa State University, 2001.