1-1-2015

On-Farm Sulfur Fertilization of Corn and Soybean Trials

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Abstract
In the past several years, sulfur (S) deficiency has been showing up more frequently in Iowa fields. This has been especially true in corn and alfalfa fields of northeast Iowa. This is thought to be partially due to Iowa receiving less S in the rainfall due to more stringent air pollution regulations, less S fertilizer applications, and less widespread use of manure. Sulfur fertilizer applications can offer yield increases when S deficiencies are present. The objective of these trials was to evaluate potential for S deficiency and grain yield response in corn and soybean to S applications.

Keywords
Agronomy

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences | Inorganic Chemicals | Natural Resources and Conservation

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RFR-A1446

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Introduction

In the past several years, sulfur (S) deficiency has been showing up more frequently in Iowa fields. This has been especially true in corn and alfalfa fields of northeast Iowa. This is thought to be partially due to Iowa receiving less S in the rainfall due to more stringent air pollution regulations, less S fertilizer applications, and less widespread use of manure. Sulfur fertilizer applications can offer yield increases when S deficiencies are present. The objective of these trials was to evaluate potential for S deficiency and grain yield response in corn and soybean to S applications.

Materials and Methods

The response of soybean and corn to S application was investigated in five soybean fields and three cornfields in 2014 (Tables 1 and 2). Sulfur was applied to one cornfield with no manure history to test the response of corn to S in 2012, and the residual effect in the same field with soybean in 2013 and corn in 2014. Sulfur was applied to two cornfields and five soybean fields in 2014 to test the response of corn and soybean to S in the year of application. There was no recent manure history in Trial 1 in soybean and no manure history in the other trials in 2014. Corn was at the V6 growth stage at the time of application in 2014. In four trials, soybeans were at the V6-V7 growth stage at the time of application in 2014, and in the other soybean trial (Trial 1) the S was applied prior to planting. Calcium sulfate (gypsum) was the source of S in all trials. The rate of applied S ranged from 16 to 34 lb S/acre and was dribble applied to the soil surface in all trials. Strips receiving the S application were compared with untreated strips. All trials were in southwest Iowa except Trial 1 in soybean, which was in southeast Iowa and Trial 3 in corn, which was in west central Iowa.

All trials were conducted on-farm by farmer cooperators using the farmers' equipment. Strips were arranged in a randomized complete block design with at least three replications per treatment. Strip size varied from field to field depending on equipment size and size of field. All strips were machine harvested for grain yield.

Results and Discussion

There was no effect of S application on soybean yield in any of the trials (Table 3). There was a significant yield increase of 23 bushels/acre of corn in Trial 2 with the application of 17 lb S/acre when corn was at the V6 stage ($P = 0.07$), but no effect of S application on corn yield in Trial 1 (Table 4). Trial 3 investigated the effect of residual S on corn yields, however, no yield increase was measured in 2014 (three years after the S application). There was a significant yield increase of 32 bushels/acre of corn in that field in the year of application ($P < 0.01$), and also a yield increase in soybeans of 4 bushels/acre in the year after application ($P = 0.01$). These results indicate there are corn and soybean fields in Iowa that could benefit from S application.

Table 1. Variety, row spacing, planting date, planting population, previous crop, and tillage practices in the on–farm sulfur fertilization trials on soybeans in 2014.

Exp. no.	Trial	County	Variety	Row spacing (in.)	Planting date	Planting population (seeds/A)	Previous crop	Tillage
140707	1	Washington	Asgrow 2931	7.5	5/17/14	180,000	Corn	No-till
140632	2	Cass	Epply ESB254 NRR	30	6/7/14	160,000	Corn	Disked
140638	3	Cass	Pioneer P2Y83	30	5/17/14	155,000	Corn	No-till
140639	4	Pottawattamie	Stine 27L32	30	5/20/14	155,000	Corn	Field cultivate
140640	5	Cass	Epply ESB281 NRR	30	5/31/14	170,000	Corn	No-till

Table 2. Hybrid, row spacing, planting date, planting population, previous crop, and tillage practices in the on-farm sulfur fertilization trials on corn in 2014.

Exp. no.	Trial	County	Hybrid	Row spacing (in.)	Planting date	Planting population (seeds/A)	Previous crop	Tillage
140618	1	Pottawattamie	Wyffels 5786	30	6/15/14	34,000	Soybean	Field cultivate
140621	2	Cass	Pioneer P1215AM1	30	5/4/12	34,325	Soybean	No-till
140321	3	Crawford	Pioneer PO987	30	5/7/14	29,900	Soybean	No-till

Table 3. Yield response from the on-farm sulfur fertilization trials on soybeans in 2014.

				Yield (bushels/A)			
Exp. no.	Trial	Sulfur rate (lb/A)	Application timing	Sulfur	Control	Response	P-value[x]
140707	1	17	Pre-plant (4/11/14)	61	57	4	0.19
140632	2	17	V6-V7 (7/17/14)	63	61	2	0.18
140638	3	17	V6-V7 (6/20/14)	65	66	-1	0.38
140639	4	34	V6-V7 (6/15/14)	71	71	0	0.87
140640	5	17	V6-V7 (7/7/14)	67	71	-4	0.31

[x]P-Value = the calculated probability that the difference in yields can be attributed to the treatments and not other factors. For example, if a trial has a P-Value of 0.10, then we are 90 percent confident the yield differences are in response to treatments. For P = 0.05, we would be 95 percent confident.

Table 4. Yield response from the on-farm sulfur fertilization trials on corn in 2014.

				Yield (bushels/A)			
Exp. no.	Trial	Sulfur Rate (lb/acre)	Application timing	Sulfur	Control	Response	P-value[x]
140618	1	17	V6 (7/10/14)	178	176	2	0.63
140621	2	17	V6 (5/28/14)	212	189	23	0.07
140321	3	16	2012	185	186	-1	0.88

[x]P-Value = the calculated probability that the difference in yields can be attributed to the treatments and not other factors. For example, if a trial has a P-Value of 0.10, then we are 90 percent confident the yield differences are in response to treatments. For P = 0.05, we would be 95 percent confident.