On-Farm Ammonium Sulfate Fertilization of Soybean Demonstration Trials

RFR-A2055

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Introduction

Applying ammonium sulfate (AMS) to soybean is a practice that has the potential to add sulfur and nitrogen benefits for yield and agronomic potential. The goal of this study is to determine if there is a yield difference between strips applied with AMS and those without. This study is an initial design, which will determine if there is an impact of AMS. The trial is not designed to validate which component of the AMS (nitrogen or sulfur) could be causing the potential benefits. It is designed as a demonstration that could lead to potential research validation trials in the future.

Materials and Methods

The response of soybean yield to an AMS application was investigated in 12 trials in 2020 (Table 1). A granular Sulf-N® ammonium sulfate (21-0-0-24S) was provided in partnership with AdvanSix Corporation. Field sites for these trials were selected based on the criteria of mid-low organic matter, coarse textured soils, and lower clay content. Soil sampling analysis was taken at each site July 2020, after fertilization (Table 2). None of the fields had a manure history and this was the first year of AMS application in all trial sites. The treatment rate for AMS was 30 lb N/acre (142.8 lb. AMS/acre) and applied with a granular spreader. Application occurred between planting and soybean V2 growth stage. Strips with AMS were compared with untreated strips. Trials were conducted on ISU research farms and on farm cooperator fields. 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 field and equipment size. All strips were machine harvested for yield.

Results and Discussion

There was not a significant response to the AMS application in soybean yield in 9 of the 12 trials at a level of $P \leq 0.10$ (Table 3). In trials 200406 and 200603, there was a significant positive yield response to the AMS of 4 to 9 bushels/acre advantage. In trials 200303 and 200304, there was a significant loss of yield from applying AMS of 3 bushels. Both trials 200303 and 200304 had a field notation of increased lodging at harvest, which could possibly account for the yield loss.

These results indicate there are soybean fields in Iowa that could benefit from AMS application, however, as found in prior research, not all fields planted to soybean will have a yield increase from AMS application. This trial is not designed to evaluate if increased amounts of nitrogen or sulfur contributed to the yield changes in four trials. In prior research in Iowa, soybean yields both increased and decreased with a sulfur or nitrogen application. The variability in results makes it difficult to draw any conclusions from these trials.

For more information on sulfur management see ISU extension publication CROP 3072 (http://www.agronext.iastate.edu/soilfertility/info/CROP3072.pdf).

Acknowledgements
This project was a collaboration with ISU On-Farm Demonstration Trials and AdvanSix Corporation.

NOTE: The results presented are from replicated demonstration trials. Statistics are used to detect differences at a location and should not be interpreted beyond the single location.

Table 1. Variety, row spacing, planting date, planting population, previous crop, tillage practices, and soil type in the 2020 AMS trials on soybean.

Trial	County	Variety	Row spacing (in.)	Planting date	Planting population (seeds/ac)	Previous crop	Tillage	Soil type
200002	Lucas	Pioneer 33A53	18	5/2/20	140,000	Corn	Vertical	Edina-211, Haig-362, Grundy-364B
200009	Lucas	Pioneer 33A53	18	5/2/20	140,000	Corn	Vertical	Edina-211, Haig-362, Grundy-364B
200301	Monona	LG 2444RX	30	5/22/20	140,000	Corn	1 pass disc	Monona-510B
200302	Monona	LG 2580RX	30	6/6/20	140,000	Corn-Spring Rye	1 pass disc	Nishna-234
200303	Monona	LG 2898LL	30	5/21/20	140,000	Corn	No-till	Monona-10D2
200304	Monona	LG 2888	30	5/13/20	140,000	Corn	No-till	Ida-IE3
200406	Hancock	Pioneer 21A28X	30	5/4/20	140,000	Corn	Conven.	Canisteo-507
200502	Boone	Pioneer 2659LL	30	5/17/20	140,000	Corn	Fall ripped spring cultivate	Harps-95, Bemis Moraine
200505	Boone	Pioneer 25A96L	30	5/17/20	140,000	Corn	Fall ripped spring cultivate	Harps-95, Bemis Moraine
200603	Pottawattamie	BASF CZ 2830 GTLL	30	4/25/20	140,000	Corn	No-till	Exira-99D2
200609	Adair	BASF CZ2830 GTLL	30	5/6/20	140,000	Corn	No-till	Nira-570C
200802	Floyd	Pioneer 22A24X	30	5/1/20	189,000	Corn	No-till	Clyde-84, Floyd-198B

Table 2. Soil test results for the 2020 AMS trials on soybean.

Trial	Sample depth	% OM	N ppm	Bray 1 P ppm	K ppm	Mg ppm	Ca ppm	S ppm	Zn ppm	pH	Buffer pH	Na ppm	CEC
200002	0-6	3.3	10.2	7	75	295	3159	8	1.41	7	7.5	33	18.6
200002	6-12	2.6	3.7	2	59	279	2923	22	0.64	6.9	7.5	50	17.3
200009	0-6	3	9.7	18	88	289	3441	3	0.99	7	7.5	10	19.9
200009	6-12	2.2	4.2	5	57	321	2849	3	0.26	6.9	7.5	17	17.1
200301	0-6	2.4	8.9	3	75	316	2267	2	0.54	5.8	6.8	6	16.9
200301	6-12	2.2	18	14	165	269	1669	4	0.82	5.1	6.5	5	17
200302	0-6	2.7	17.4	24	101	436	2641	4	1.06	5.7	6.7	7	20.9
200302	6-12	1.9	5	12	70	436	2768	2	0.62	6.6	7.5	9	17.7
200303	0-6	2	21.1	15	171	239	4010	5	0.71	8	7.5	5	22.5
200303	6-12	1.3	11.7	16	86	225	4188	4	0.22	8.2	7.5	3	23
200304	0-6	3	17.1	21	153	275	1820	5	0.64	5.5	6.8	8	15.2
200304	6-12	2.4	7.4	6	74	281	1997	4	0.24	5.9	6.8	5	15.2
200406	0-6	3.7	15.3	27	181	556	4012	5	0.96	5.8	6.6	5	30.1
200406	6-12	3.1	6.3	14	51	564	4400	2	0.16	7.3	7.5	5	26.9
200502	0-6	5.1	13.5	43	168	572	5174	4	1.84	6.7	7.5	3	31.1
200502	6-12	4.6	11.4	27	63	462	6547	3	0.58	7.8	7.5	4	36.8
200505	0-6	4	9.6	15	108	544	4422	4	1.08	6.4	6.9	4	29.5
200505	6-12	3.2	5.5	18	86	593	5491	24	0.21	7.3	7.5	43	32.8
200603	0-6	2.8	14.5	7	126	383	3762	5	0.63	7.1	7.5	5	22.3
200603	6-12	2.5	5.1	2	86	391	3028	6	0.12	6.8	7.5	6	18.6
200609	0-6	3.3	17.2	23	174	423	3707	4	1.31	6.1	6.7	8	26.2
200609	6-12	3.2	4.8	5	116	490	3582	3	0.36	6.8	7.5	11	22.3
200802	0-6	2.1	7.2	19	239	214	1671	4	3.28	5.7	6.7	4	14.4
200802	6-12	2.1	6.8	5	73	283	1979	5	0.26	5.5	6.6	5	17.8

Table 3. Yield from corn and soybean AMS trials in 2020.

Trial	Treatment	Yield (bu/ac)[a]	P-value[b]
200002	AMS (21-0-0-24S) at 142.8 lb/ac	54 a	0.49
	Untreated	55 a	
200009	AMS (21-0-0-24S) at 142.8 lb/ac	59 a	0.57
	Untreated	60 a	
200301	AMS (21-0-0-24S) at 142.8 lb/ac	61 a	0.76
	Untreated	62 a	
200302	AMS (21-0-0-24S) at 142.8 lb/ac	61 a	0.42
	Untreated	62 a	
200303	AMS (21-0-0-24S) at 142.8 lb/ac	53 a	0.14
	Untreated	56 a	
200304	AMS (21-0-0-24S) at 142.8 lb/ac	66 a	0.01
	Untreated	69 b	
200406	AMS (21-0-0-24S) at 142.8 lb/ac	70 a	0.07
	Untreated	66 b	
200502	AMS (21-0-0-24S) at 142.8 lb/ac	55 a	0.54
	Untreated	55 a	
200505	AMS (21-0-0-24S) at 142.8 lb/ac	61 a	0.64
	Untreated	62 a	
200603	AMS (21-0-0-24S) at 142.8 lb/ac	69 a	0.02
	Untreated	60 b	
200609	AMS (21-0-0-24S) at 142.8 lb/ac	71 a	0.24
	Untreated	65 a	
200802	AMS (21-0-0-24S) at 142.8 lb/ac	62 a	0.78
	Untreated	61 a	

[a]Values denoted with the same letter within a trial are not statistically different at the significance level of 0.10.
[b]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. This is consistent with demonstration trials.