SULFUR FERTILIZATION EFFECTS ON CORN YIELD, ECONOMIC OPTIMUM NITROGEN RATE, AND RETURN TO NITROGEN

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ABSTRACT

Sulfur (S) has received renewed attention in corn fertility programs as atmospheric S deposition has declined and crop S demand has increased. Nitrogen (N) and S metabolism are closely linked through amino acid and protein synthesis. How S fertilization affects corn grain yield response to N, N use efficiency, and the economics of N fertilization remains unclear. We conducted 21 field trials in Illinois and Iowa in 2025 and 2026, including 14 in corn–soybean (CS) rotations and seven in continuous corn (CC). The trials included six N rates (0–250 lb N/ac, in 50 lb increments), applied as urea–ammonium nitrate (32% N). Sulfur treatments varied by site and included a no-S control, gypsum at 15, 20, or 30 lb S/ac, ammonium sulfate (AMS) at 30 lb S/ac, and ammonium thiosulfate at 20 or 40 lb S/ac. Corn yield responses to N were fitted using quadratic-plateau and linear-plateau models for each S treatment at each site-year. Across CS site-years, the mean economic optimum N rate (EONR) was 196 lb N/ac without S and 188 lb N/ac with S. Sulfur fertilization significantly increased mean yield at EONR (YEONR) from 224 to 228 bu/ac, with similar maximum returns to N (MRTN) of $358 and $362/ac, respectively. At two CS site-years, one with low soil organic matter (SOM) and the other with 3.9% SOM, the main effect of S on grain yield was significant ($P < 0.05$). Fitted curves for gypsum or AMS at these sites indicated EONR reductions of up to 14% (30 lb N/ac) and YEONR increases of 2.3–5.1% (5–11 bu/ac). The S main effect on grain yield was also significant at a third CS site-year with 4.9% SOM. There, fitted curves for gypsum or AMS indicated a 27% increase in EONR (29 lb N/ac) and an increase in YEONR of up to 5.8% (14.4 bu/ac). At five of the seven CC site-years, fitted curves indicated EONRs 3–30% (5–55 lb N/ac) lower with S at similar YEONRs. These preliminary results suggest that S fertilization can affect corn yield and the EONR beyond low SOM conditions. Identifying the soil and environmental conditions associated with these responses will help refine N and S fertilizer recommendations.

INTRODUCTION

Historically, routine sulfur (S) fertilization was rarely recommended across much of the north-central Corn Belt because yield responses were uncommon. In Illinois, corn yield positively responded to S in 5 of 81 trials conducted from 1977 to 1979 (Hoeft et al., 1985). In Iowa, over 40 years of field research up to 2005 documented a yield response to S in only 3 of approximately 200 trials with corn or soybean (Sawyer et al., 2015). At the time, soil sulfate, S released through soil organic matter (SOM) mineralization, and atmospheric deposition commonly met crop S needs (Hoeft et al.,

1985; Sawyer & Barker, 2000). Manure from integrated crop–livestock operations provided another source of S (Dick et al., 2008).

In recent decades, declining S inputs and increasing crop S demand have renewed interest in S fertilization. Average U.S. atmospheric S deposition declined by 71% over about 30 years, and deposition in the northern Corn Belt was estimated at less than 4.5 lb S/ac/year (NADP, 2025). As many Corn Belt farms shifted from mixed crop–livestock operations to specialized corn–soybean production (MacDonald et al., 2013), on-farm manure became less available as a source of S (MacDonald et al., 2009). In addition, greater use of high-analysis nitrogen (N) and phosphorus (P) fertilizers that contain little S have also reduced incidental S inputs (Dick et al., 2008), while subsurface drainage facilitates sulfate-S losses (David et al., 2016) . Over the past eight decades, Illinois corn yields have increased by an average of 1.97 bu/acre/year, reaching 217 bu/acre in 2025 (USDA-NASS, 2025). Higher corn yields are associated with greater total S uptake (Roa & Ruiz Diaz, 2026) and greater S removal in harvested grain (Preza Fontes et al., 2025). More recent field studies have reported variable corn yield responses to S fertilization across the region. Corn yield increased with S in 2 of 4 trials in Minnesota (Kim et al., 2013), and in 28 of 47 trials conducted in Iowa from 2007 to 2009 (Sawyer et al., 2015). However, in a statewide Illinois study conducted from 2009 to 2011, Preza Fontes et al. (2025) found a yield response in only 2 of 40 trials (5%).

Nitrogen and S are closely linked in corn nutrition. Both nutrients are required for protein synthesis, and S is needed to synthesize cysteine and methionine (Chen et al., 2008). Sulfur deficiency can reduce the concentrations of these amino acids and limit protein synthesis (Marschner, 1995). In Argentine corn field trials, Carciochi et al. (2020) found that applying either nutrient improved the use efficiency of the other. To our knowledge, relatively few studies across the north-central Corn Belt have tested how S response varies with N rate. In Michigan, Steinke et al. (2015) observed significant yield increases with S only at low N rates (≤ 50 lb N/ac). In Ohio, Chen et al. (2008) also found significant corn yield responses to S at about 120 lb N/ac in two of four years, with gains of 29 bu/ac (18%) in 2004 and 42 bu/ac (47%) in 2005 and suggesting that S fertilization could reduce the fertilizer N needed to achieve high yields in S-responsive soils. Approximately 15 years have passed since the most recent statewide field evaluation of corn yield response to S in Illinois, and whether S fertilization alters the economic optimum N rate (EONR), the yield at EONR, or N use efficiency across a broader range of Corn Belt environments remains unclear. The objective of this ongoing study is to evaluate the effects of S fertilization on (i) corn grain yield response to N, (ii) the economic optimum N rate (EONR), (iii) N use efficiency, and (iv) economic return to N.

MATERIALS AND METHODS

Sites Description and Experimental Design

Twenty-one field trials were conducted in Illinois and Iowa during the 2025 and 2026 growing seasons. Fourteen trials were in corn following soybean (CS), and seven were in continuous corn (CC). Before planting, composite soil samples were collected from each replicate at depths of 0–6 and 6–12 in. to assess soil fertility (Table 1). At

sites with low soil test phosphorus (P), triple superphosphate (0-46-0) was topdressed at rates intended to bring soil P to regional sufficiency levels (Bardeggia et al., 2025).

Trials used a randomized complete block design with three to six replicates. Plots were 10 ft wide and 40–100 ft long, and 30-in. row spacing. The six target nitrogen (N) rates were 0, 50, 100, 150, 200, and 250 lb N/ac. Urea-ammonium nitrate (UAN, 32-0-0) was applied either a few days before planting or as an early sidedress at V4-V6. Sulfur (S) treatments included a no-S control, 15 lb S/ac as gypsum (0-0-0-17S), and 30 lb S/ac as gypsum or ammonium sulfate (AMS, 21-0-0-24S). At sites where ammonium thiosulfate (ATS, 12-0-0-26S) was evaluated, S rates were 0, 20, and 40 lb S/ac. Gypsum and AMS were hand-broadcast immediately after planting and left on the soil surface. At one site, the UAN rate was adjusted to account for N supplied by AMS. At the other sites where AMS was used, it supplied N above the target rate. ATS was applied at planting, 2 in. to the side of the seed furrow. At each target N rate, the 0 and 20 lb S/ac treatments received additional UAN to match the total N applied in the 40 lb S/ac treatment. Thus, the lowest total N rate at the ATS sites was 19 lb N/ac across all three S treatments. Yield data were collected by harvesting the center two rows of each plot, and yields were adjusted to 15.5% moisture.

Statistics and Data Analysis

Corn yield response to N rate was modeled using linear-plateau and quadratic-plateau models. The best-fitting model was chosen for each S level based on adjusted R^2, root mean square error (RMSE), AIC, BIC, and residual diagnostics, as suggested by Archontoulis & Miguez (2015). The economic optimum nitrogen rates (EONR) were determined by setting the first derivative of the response model to an N price ($/lb N) to corn price ($/bu) ratio and solving for the N rate (Equation 1 and 2). Prices of $0.50 /lb N and $4.00/bushel were used for this purpose, resulting in a price ratio (PR) of 0.125 bu/lb N.

Equation 1: $QP\ EONR\ (lb\ N/ac) = \frac{PR-b}{2c}$

Equation 2: $LP\ EONR\ (lb\ N/ac) = \begin{cases} X_N, & b \geq PR \\ 0, & b < PR \end{cases}$

Where *c* [(bu/ac) / (lb N^2)] is the quadratic coefficient in Equation 1, *b* (bu/lb N) is the linear coefficient in Equation 1 and 2, and X_N is the joint point (linear-plateau model) of the best fit response models. Yield at the EONR (YEONR) was estimated from each best-fitting yield response function. The return to N (RTN) value is defined as the economic partial return received due to the increase in yield when applying N fertilizer at a certain rate (Y_N) as compared to a zero-nitrogen application (Y_0) minus the cost of the nitrogen fertilizer applied (Equation 3).

Equation 3: $RTN\ (\$/ac) = [(Y_N - Y_0) \times \$/bu\ corn] - (N \times \$/lb\ N)$

Grain yield responses were also evaluated at each site-year using analysis of variance (ANOVA), with N rate, S treatment, and their interaction considered fixed effects. At sites where AMS supplied additional N above the target rate, AMS treatments were excluded from the ANOVA to avoid confounding N and S effects.

Instead, AMS was evaluated separately using pairwise t-tests restricted to N-sufficient rates, where grain yield no longer differed significantly among the higher N rates. Statistical significance was assessed at $P \leq 0.05$. Additionally, an exploratory aggregated analysis was conducted by averaging fitted N-response curves across site-

Table 1. Pre-plant selected soil properties at 0-6 and 6-12 inches depths. Note: CS denotes corn-soybean rotation, and CC denotes continuous corn. Preplant soil test data were unavailable for 25-Claremont CS, 25-Tipton CS, and 25-Roseville CS.

State	Location	County	Depth	SOM	CEC	pH	P	K	S
				%	meq 100g^{-1}	1:1	-----ppm ----		
IL	25-Altamont CS	Effingham	0-6"	1.9	8	6.5	15	59	8
			6-12"	1.8	14	5.6	6	76	15
IL	25-Belleville CS	St. Clair	0-6"	1.8	7	6.5	40	118	6
			6-12"	1.2	6	6.7	18	77	5
IL	25-Oglesby CS	LaSalle	0-6"	3.4	14	6.7	41	234	11
			6-12"	2.7	15	6.8	13	108	7
IL	25-Urbana CS	Champaign	0-6"	4.1	18	6.2	16	113	9
			6-12"	4.0	18	6.1	8	77	8
IL	25-Urbana CC	Champaign	0-6"	4.5	19	6.5	21	114	7
			6-12"	4.1	21	6.1	9	82	6
IL	25-Perry CS	Pike	0-6"	1.9	-	5.7	21	232	-
			6-12"	-	-	-	-	-	-
IL	25-Perry CC	Pike	0-6"	1.9	-	6.5	26	114	-
			6-12"	-	-	-	-	-	-
IL	26-Altamont CS	Effingham	0-6"	2.0	7	6.1	23	108	6
			6-12"	1.5	8	6.4	6	49	6
IL	26-Belleville CS	St. Clair	0-6"	1.5	5	6.2	25	138	6
			6-12"	1.2	6	6.4	15	119	5
IL	26-Belleville CC	St. Clair	0-6"	2.3	10	6.2	26	152	7
			6-12"	1.8	12	6.1	14	91	6
IL	26-Monmouth CS	Warren	0-6"	4.9	19	6.1	24	134	9
			6-12"	4.4	19	6.0	16	87	8
IL	26-Monmouth CC	Warren	0-6"	4.1	14	6.5	31	128	8
			6-12"	4.0	14	6.6	18	68	8
IL	26-Oglesby CS	LaSalle	0-6"	4.2	15	6.5	24	151	8
			6-12"	3.3	18	6.5	5	81	7
IL	26-Perry CC	Pike	0-6"	2.4	9	5.4	32	182	6
			6-12"	1.8	9	6.2	14	70	6
IL	26-Urbana CS	Champaign	0-6"	3.7	16	6.5	14	93	8
			6-12"	3.4	17	6.3	6	76	7
IL	26-Urbana CC	Champaign	0-6"	3.7	15	6.1	13	100	8
			6-12"	3.6	17	6.0	7	87	8
IL	26-Roseville CS	Warren	0-6"	3.4	12	6.5	17	154	8
			6-12"	3.0	15	6.1	12	89	7
IA	26-Mt. Pleasant CC	Henry	0-6"	4.0	18	7.0	49	138	9
			6-12"	3.4	17	6.8	11	99	8

[1]Mehlich-3 extraction, quantified by inductively coupled plasma optical emission spectroscopy (ICP)

years, separately for corn–soybean and continuous-corn rotations. Within each site-year, S-fertilized treatments (S+) were combined into a single average response curve across available S sources and rates and compared with the no-S control (0S). EONR, YEONR, and maximum RTN (MRTN) were calculated from the resulting mean curves. Paired t-tests were used to compare site-year-specific estimates between 0S and S+.

RESULTS AND DISCUSSION

Figure 1 shows the modeled corn yield response to N rate for each S treatment at each site-year, and Table 2 lists the best-fitting models. Of the 60 yield responses evaluated, 45 were best described by quadratic-plateau models (adjusted R^2 = 0.45–0.96) and 15 by linear-plateau models (adjusted R^2 = 0.68–0.94). The yield response to N rate was statistically significant for all 60 selected models ($P \leq 0.05$).

Across 14 corn–soybean site-years, EONR ranged from 82 to 269 lb N/ac, YEONR from 155 to 262 bu/ac, and MRTN from $159 to $541/ac. Across seven continuous corn site-years, the corresponding ranges were 92–207 lb N/ac, 160–284 bu/ac, and $85–$492/ac.

Sulfur Fertilization Effects on EONR, YEONR and MRTN

Across 14 corn–soybean (CS) site-years, YEONR averaged 228 bu/ac with S+ and 224 bu/ac without S (0S), a difference of 4 bu/ac (paired t-test, $P \leq 0.05$) (Table 3). Mean EONRs were equivalent with S+ and 0S (188 vs. 196 lb N/ac, respectively), and MRTN did not differ significantly ($362/ac with S+ vs. $358/ac with 0S).

Responses varied among CS site-years. While some sites remained unresponsive to S fertilization, 25-Claremont CS showed a significant S main effect in the ANOVA ($P \leq 0.05$). There, the fitted curves indicated a 14% lower EONR with S (188 vs. 219 lb N/ac) and a higher YEONR (216 vs. 210 bu/ac). Although S responses have often been associated with low soil organic matter (SOM) (Kim et al., 2013), the ANOVA also showed significant S main effects at 26-Urbana CS (Champaign County, 3.7% SOM) and 26-Monmouth CS (Warren County, 4.9% SOM). At Urbana, the fitted curves indicated that YEONR was 3.5-5.1% (8–11 bu/ac) higher with 15 lb S/ac applied as gypsum and 30 lb S/ac as AMS compared to the 0S control, with similar EONRs (187–191 lb N/ac). Gypsum at 30 lb S/ac increased YEONR by 3 bu/ac and lowered EONR by 9% (17 lb N/ac). At Monmouth, fitted EONRs were 15-27% (16-29 lb N/ac) higher with S (either gypsum treatments or AMS) than with 0S, while YEONR was 3–6% higher (7–14 bu/ac).

At 25-Altamont CS, 25-Oglesby CS, and 25-Perry CS, the ANOVA showed no significant S effects. Yet, the fitted curves indicated 10–29% lower EONRs with 30 lb S/ac as gypsum (21–34 lb N/ac) at similar YEONRs relative to 0S.

Across seven CC site-years, paired t-tests showed no significant differences between 0S and S+ in EONR, YEONR, or MRTN. Mean EONR was 196 lb N/ac with 0S and 183 lb N/ac with S+. Mean YEONR was 201 bu/ac for both treatments, and mean MRTN was $264/ac with 0S and $277/ac with S+. Consistent with the aggregated analysis, site-year ANOVAs showed no significant S main effects or

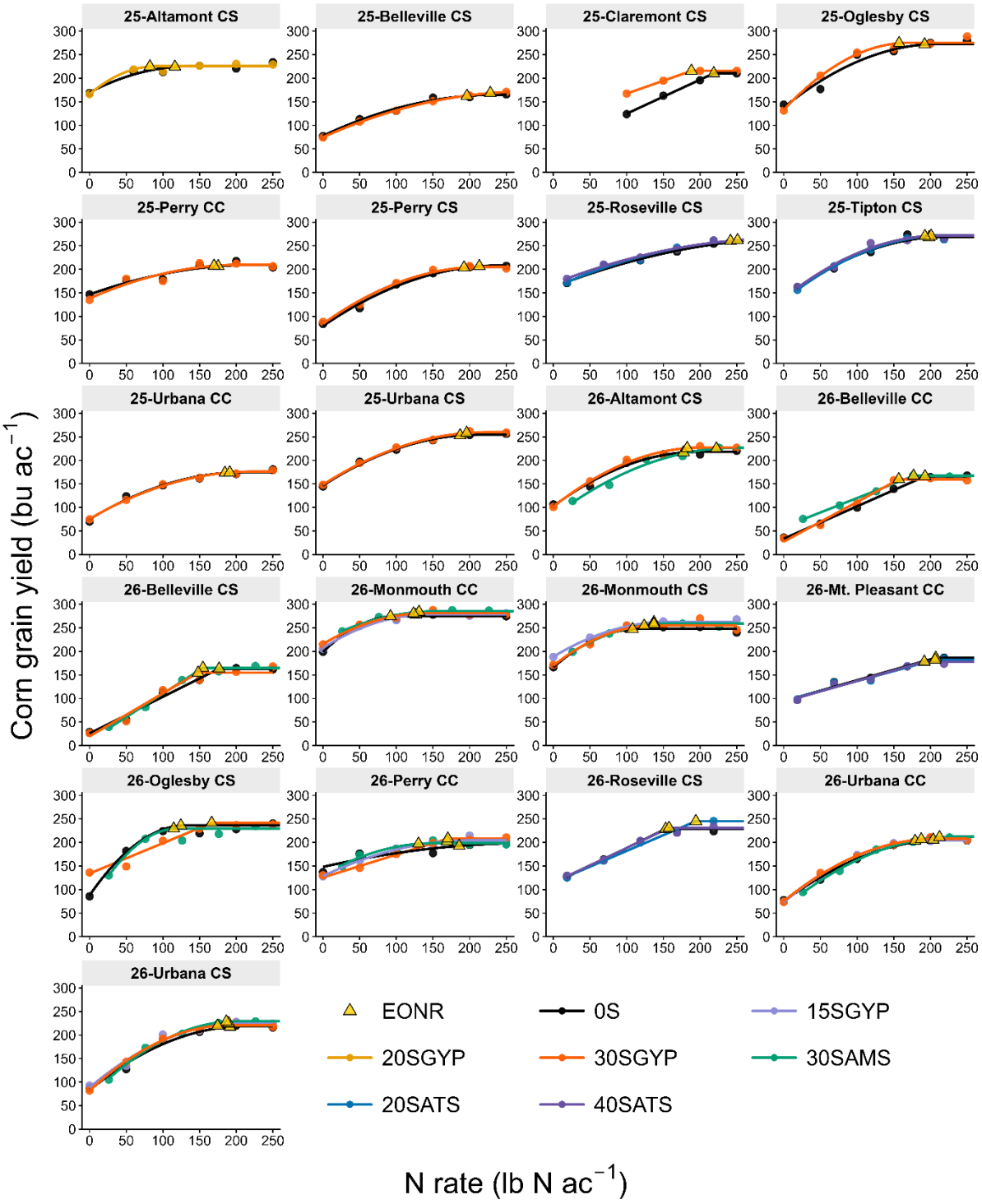


Figure 1. Relationship between N fertilizer rate and corn yield for each S treatment at each site-year. CS denotes corn-soybean, while CC denotes continuous corn. 0S = no sulfur applied; SGYP = gypsum; SAMS = ammonium sulfate; SATS = ammonium thiosulfate. Numbers preceding each abbreviation indicate the S application rate (lb S/ac). Yellow triangles indicate the economic optimum N rate (EONR).

Table 2. Equations describing relationships between nitrogen rates across sulfur levels and yield for each site-year, EONRs, and associated YEONR and MRTN for selected sites.

			Equation Coefficients and Statistics							
Site-year	**S level**	**Model**	**Y_0**	**b**	**c**	**RMSE**	**R^2**	**EONR**	**YEONR**	**MRTN**
								lb N/ac	**bu/ac**	**$/ac**
25-Altamont CS	0S	QP	169.9	0.808	-0.0029	10.53	0.78	116	224.2	159
	20SGYP	QP	166.4	1.301	-0.0071	11.09	0.78	82	225.0	194
25-Belleville CS	0S	QP	77.7	0.738	-0.0016	10.80	0.88	196	162.4	241
	30SGYP	QP	74.7	0.697	-0.0013	7.05	0.95	228	168.4	261
25-Claremont CS	0S	LP	52.7	0.720		12.75	0.85	219	210.3	521
	30SGYP	LP	112.5	0.548		7.69	0.83	188	215.7	319
25-Oglesby CS	0S	QP	137.9	1.268	-0.0030	15.78	0.89	192	271.7	439
	30SGYP	QP	132.6	1.677	-0.0049	10.45	0.95	157	274.4	488
25-Perry CC	0S	QP	146.5	0.560	-0.0012	14.93	0.64	175	206.5	152
	30SGYP	QP	138.0	0.692	-0.0017	14.70	0.74	170	207.4	193
25-Perry CS	0S	QP	79.5	1.066	-0.0022	8.99	0.96	213	206.4	401
	30SGYP	QP	84.2	1.118	-0.0026	8.10	0.96	192	203.7	382
25-Roseville CS	0S	QP	162.2	0.608	-0.0009	12.81	0.84	269	261.8	264
	20SATS	QP	160.4	0.699	-0.0012	12.56	0.85	242	260.0	278
	40SATS	QP	169.6	0.608	-0.0010	8.51	0.92	251	261.7	243
25-Tipton CS	0S	QP	138.7	1.176	-0.0027	15.76	0.86	198	267.6	416
	20SATS	QP	134.5	1.235	-0.0028	16.54	0.86	201	271.1	446
	40SATS	QP	138.4	1.247	-0.0029	16.50	0.83	193	270.4	432
25-Urbana CC	0S	QP	75.0	0.941	-0.0022	9.85	0.92	185	173.4	301
	30SGYP	QP	75.6	0.906	-0.0020	9.90	0.92	191	174.2	299
25-Urbana CS	0S	QP	146.6	1.013	-0.0024	13.27	0.89	187	253.0	332
	30SGYP	QP	148.4	0.995	-0.0022	13.38	0.90	196	258.2	341
26-Altamont CS	0S	QP	102.7	1.161	-0.0029	13.39	0.90	177	216.8	368
	30SAMS	QP	81.6	1.166	-0.0023	11.38	0.93	222	225.0	463
	30SGYP	QP	101.6	1.239	-0.0031	10.40	0.95	182	226.0	406
26-Belleville CC	0S	LP	33.5	0.688		14.28	0.91	193	166.1	434
	30SAMS	LP	58.6	0.613		14.84	0.84	177	167.1	345
	30SGYP	LP	27.3	0.843		11.99	0.94	157	159.6	451
26-Belleville CS	0S	LP	25.8	0.778		12.74	0.94	177	163.2	462
	30SAMS	LP	10.6	0.998		12.39	0.93	155	164.9	540
	30SGYP	LP	19.7	0.912		17.62	0.89	148	154.8	466
26-Monmouth CC	0S	QP	198.9	1.516	-0.0076	12.54	0.81	92	274.4	256
	15SGYP	QP	207.5	0.985	-0.0034	12.16	0.81	127	277.8	218
	30SAMS	QP	224.9	0.776	-0.0025	9.88	0.68	131	283.9	170
	30SGYP	QP	215.9	0.917	-0.0032	13.10	0.75	123	280.2	196

Table 2. Continued.

Site-year	S level	Model	Equation Coefficients and Statistics					EONR	YEONR	MRTN
			Y_0	b	c	RMSE	R^2	lb N/ac	bu/ac	$/ac
26-Monmouth CS	0S	QP	166.2	1.380	-0.0058	13.13	0.83	108	247.4	271
	15SGYP	QP	188.7	0.941	-0.0030	17.03	0.69	137	261.8	224
	30SAMS	QP	172.1	1.128	-0.0037	14.16	0.68	137	257.9	275
	30SGYP	QP	169.7	1.241	-0.0045	15.34	0.79	124	254.3	276
26-Mt. Pleasant CC	0S	LP	94.4	0.444		18.45	0.72	207	186.4	264
	20SATS	LP	94.3	0.427		19.26	0.68	206	182.3	249
	40SATS	LP	92.8	0.444		17.66	0.69	192	178.0	245
26-Oglesby CS	0S	QP	87.6	2.257	-0.0086	18.65	0.81	125	235.9	531
	30SAMS	QP	66.6	2.710	-0.0113	26.04	0.60	115	229.3	593
	30SGYP	LP	134.1	0.645		17.52	0.78	167	241.5	346
26-Perry CC	0S	QP	148.1	0.355	-0.0006	15.62	0.45	186	192.6	85
	15SGYP	QP	128.5	0.750	-0.0018	15.53	0.74	169	202.6	212
	30SAMS	QP	130.8	0.896	-0.0030	10.42	0.73	130	197.2	201
	30SGYP	LP	125.6	0.484		14.41	0.78	170	208.1	245
26-Roseville CS	0S	LP	112.4	0.760		19.76	0.78	153	228.7	389
	20SATS	LP	115.2	0.669		14.84	0.89	194	245.2	423
	40SATS	LP	114.6	0.738		17.18	0.83	158	231.0	387
26-Urbana CC	0S	QP	74.6	1.162	-0.0025	18.70	0.85	204	205.7	423
	15SGYP	QP	72.6	1.332	-0.0034	23.10	0.79	179	203.2	433
	30SAMS	QP	61.4	1.284	-0.0027	24.51	0.73	212	211.1	492
	30SGYP	QP	75.3	1.274	-0.0031	19.94	0.84	188	206.5	431
26-Urbana CS	0S	QP	82.8	1.281	-0.0030	25.11	0.77	191	217.4	442
	15SGYP	QP	88.7	1.309	-0.0031	21.37	0.83	190	224.9	450
	30SAMS	QP	68.4	1.592	-0.0039	27.20	0.70	187	228.5	547
	30SGYP	QP	81.7	1.456	-0.0038	21.92	0.83	175	219.7	465

Table 3. Economic optimum nitrogen rate (EONR), yield at EONR (YEONR), and maximum return to nitrogen (MRTN) estimated from N-response curves averaged across 14 site-years for corn–soybean and seven continuous-corn rotations, with and without sulfur fertilization. Values shown are model-derived aggregated estimates; P-values are from paired t-tests using site-years as replicates (0S vs. S+ within rotation).

Rotation	S level	EONR lb N/ac	YEONR bu/ac	MRTN $/ac
Corn-soybean	0S	196	224	358
	S+	188	228	362
Difference		-8	4	4
P-value		*0.973*	*0.010*	*0.925*
Continuous corn	0S	196	201	264
	S+	183	201	277
Difference		-13	0	13
P-value		*0.859*	*0.533*	*0.694*

N rate × S interactions. Still, at five of the seven site-years, the fitted curves showed a strong trend, indicating 3–30% lower EONRs (5–55 lb N/ac) with S at similar YEONRs.

Preliminary results from 21 site-years suggest that S fertilization can affect corn yield and the economic optimum N rate (EONR), even in soils with relatively high organic matter. These responses may occur when crop S demand exceeds the supply from soil mineralization. When a response to S fertilization occurs, the return on investment can be substantial, driven by either increased grain yield and/or reduced N fertilizer requirements.

Greater accumulation of corn residue with a high carbon-to-sulfur ratio can limit S availability in continuous corn (Kaur et al., 2018; Quinn, 2026). However, in this study, site-specific yield responses to S were more evident in CS, although fewer site-years were evaluated in CC (7 vs. 14). One possible explanation for the yield response to S fertilization in corn following soybean is that higher yield potential increased crop S demand.

Relationship Between Preplant Soil Sulfur and Relative Corn Yield

Weak relationships between pre-plant soil sulfate and relative yield were found in this study (Figure 2). Quadratic-plateau models were fit ($P \leq 0.1$) to response relationships; however, goodness of fit was poor (adjusted R^2 0.11 to 0.14). For this reason, no models or critical soil-test S levels are shown until additional site-years are collected. Soil testing has been used successfully to establish critical levels for P and K. For S, previous studies have found little or no relationship between extractable sulfate-S in the standard 0–6 in. sampling depth and corn yield response to S fertilization (Kim et al., 2013; Preza Fontes et al., 2025). In our trials, the relationship between relative corn yield and preplant Mehlich-3 extractable S was also nonsignificant in both the 0-6 in. and 6–12 in. layers, and the combined 0–12 in. profile. These results suggest that preplant soil S had limited value for predicting corn yield response to S fertilization across the sites evaluated.

Sulfate-S represents only a small fraction of total soil S, while 95–98% of total S is present in organic forms (Tabatabai & Bremner, 1972). Microbial mineralization releases sulfate-S from organic S, and its rate depends on soil temperature and moisture (Schoenau & Malhi, 2008). As a result, a preplant soil test may capture only part of the S supply available to corn during the growing season.

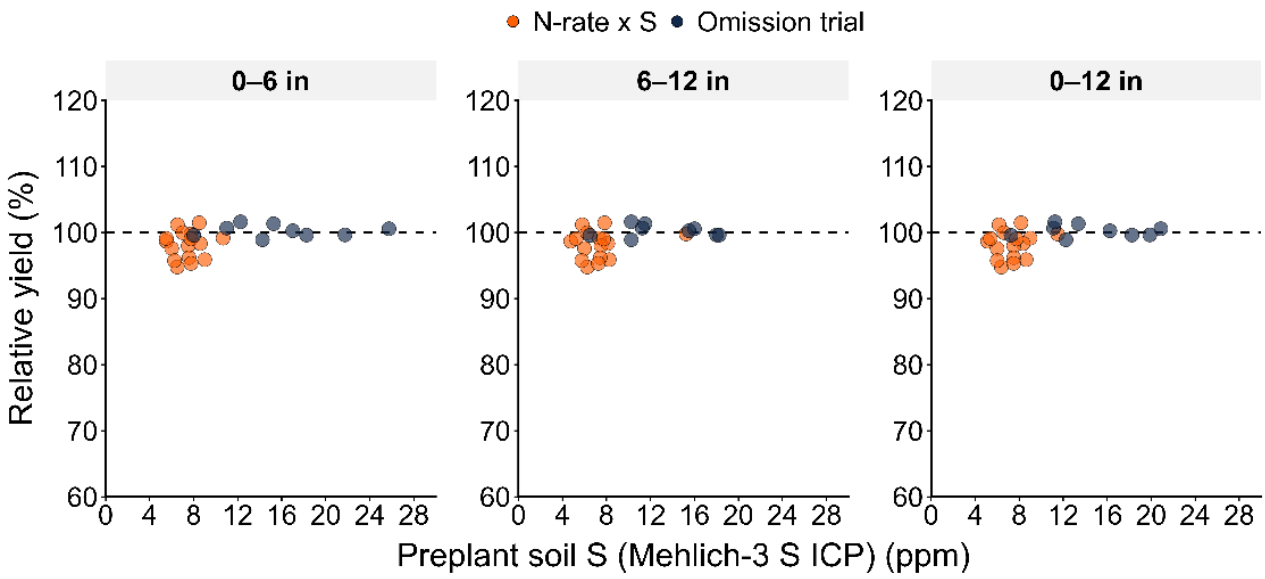


Figure 2. Relationship between relative corn grain yield and preplant soil S concentration at three sampling depths (0–6, 6–12, and 0–12 in.). Data were obtained from the present study (N-rate × S) and a separate statewide omission trial evaluating corn yield response to S fertilization (with and without S). Relative yield was calculated following the STATMAX procedure described by Pearce et al. (2022).

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