

**Research Report of Progress
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Sulfur Research on Corn

**Agronomy Department
Kansas Agricultural Experiment Station
Kansas State University
Manhattan, Kansas 66506**

SULPHUR FERTILIZATION OF IRRIGATED CORN
David A. Whitney, Agronomy Department
Kansas State University

Sulphur fertilization research was continued in 1980 on irrigated corn with support from the Kansas Fertilizer and Chemical Institute. With the excellent response to sulphur on irrigated corn in Kiowa County in 1979, it seemed reasonable to followup with more research in the area. The sulphur rate study on the Ron Taylor farm which gave the good sulphur response in 1979 was continued without sulphur application in 1980 to evaluate the residual effect in the second year after the gypsum application. In addition a new study was initiated at this location and a second location in the same area to compare sulphur sources and rates of application. Three sulphur sources were included - gypsum, potassium-magnesium sulphate and ammonium thiosulphate. Potassium as muriate of potash and nitrogen as ammonium nitrate were added to equal the rate of K and N supplied by the highest rate of potassium-magnesium sulphate and thiosulphate, respectively, to plots not receiving these treatments. The cultural fertilization, and irrigation practices of the cooperator was utilized in growing the crop. Both of these locations had irrigation water with 3 ppm S as sulphate or less in the water.

An excellent visual response to sulphur was evident at the 6 to 8 leaf stage on the residual sulphur rate study on the Taylor farm. This was also true on the rate and source study initiated in 1980 along side the residual study. Although the extremely hot-dry summer hurt yields, there was a significant yield response to the residual sulphur, Table 1. The 60 lb/A of S rate gave the highest yield with a 19 bu/A increase above the control (no sulphur). Leaf samples collected at the 8-leaf and tassel stages of maturity showed similar responses to the residual sulphur. The 30 lb/A of S residual was not adequate to effect a change in the leaf sulphur content compared to the no sulphur plots. The sulphur level in the plants was much greater at the 8-leaf compared to the tassel stage. These results suggest that gypsum application at 60 lb/A or more of sulphur can be expected to last at least two seasons.

Grain yields were only obtained at the Taylor location on the sulphur rate and source studies initiated in 1980 due to the unusually hot-dry summer making it impossible to avoid severe stress on these sprinkler irrigated sandy soils. The severe stress resulted in poor yields and considerable within experiment variation and no significant yield response to sulphur rate or source was found, Table 2.

Leaf samples were collected at two stages of plant growth (8-leaf and tassel) at both locations, Table 2. The application of sulphur increased the leaf sulphur content at both locations at the 8-leaf stage. There was little increase in leaf sulphur content with the 60 over the 30 lb/A S rate. No difference was found among sources. At tassel, the Bevan's location was under severe moisture stress and this stress may be reflected in no significant treatment effect on leaf sulphur. At the Taylor location only the higher rates of gypsum (preplant and sidedress) significantly increased leaf sulphur over the control. The ammonium thiosulphate and potassium-magnesium sulphate being more soluble may have been leached by the early season irrigation from the preplant applications. This source difference in leaf sulphur levels at tassel needs additional study before any firm conclusion can be made as there is research in other areas to show good response from all sources tested.

Table 1. Residual Effect of Sulphur Applied on Irrigated Corn on Yield and Leaf Sulphur Content.

Ron Taylor Farm, Kiowa County

Sulphur ¹ Rate	Grain Yield		Leaf Sulphur Content	
	1979	1980	8-leaf	Tassel
lb/a	-bu/a-		-%-	
0	97	63	.21	.12
30	120	70	.20	.12
60	121	82	.30	.14
120	130	78	.22	.15
LSD (.05)	20	16	.06	.03

¹ Sulphur applied in spring of 1979 as gypsum
Irrigation water contains 1.5 ppm S or SO₄

Table 2. Effect of Sulphur Rate, Source and Time of Application on Irrigated Corn Yield and Plant Sulphur Content.

Kiowa County, Kansas

Sulphur Rate	Source	Time of application	Taylor Farm			Bevan Farms	
			Grain yield	Leaf S 8-leaf	Content Tassel	Leaf S 8-leaf	Content Tassel
lb/a							
0	--	--	72	.19	.16	.22	.19
15	Gypsum	Preplant	96	.32	.20	.31	.20
30			88	.41	.24	.38	.21
60			88	.44	.30	.37	.19
15	Potassium	Preplant	82	.34	.17	.25	.19
30	Magnesium		84	.40	.20	.30	.21
60	Sulphate		96	.36	.22	.32	.22
15	Ammonium	Preplant	86	.24	.15	.28	.20
30	Thiosulphate		93	.31	.16	.42	.19
60			88	.35	.21	.28	.21
15	Gypsum	Sidedress ¹	82	.16	.21	.20	.19
30			80	.17	.26	.24	.21
60			78	.19	.34	.20	.24
30		½ Pre + ½ SD	88	.26	.20	.34	.21
LSD (.05)			NS	.13	.07	.07	NS

¹ Sidedress S applied at time of first leaf sampling - 6/10 on Taylor, 6/2 on Bevan.
Irrigation water contains 1.5 and 3.0 ppm S or SO₄, respectively.

A sulphur and nitrogen rate study was continued for the third year on the Rossville unit of the Kansas River Valley Field. This study has shown a yield decrease to sulphur application when less than adequate nitrogen is used, but sulphur application has had no effect on yield when adequate nitrogen is applied. Although yields were poor in 1980 a similar yield trend was observed in 1980, Table 3. The reason for this yield reduction is not clear and is of limited importance to farmers as most will be supplying adequate nitrogen before applying sulphur. However, this does point out the need to be aware of interaction effects among nutrients and the need for caution in indiscriminate use of fertilizer. Leaf samples taken at the 8-leaf stage showed a marked increase in sulphur content with increasing sulphur rate. At tassel sulphur application had no effect on leaf sulphur. The sidedress nitrogen application increased the leaf nitrogen at tassel.

Sulphur research on irrigated corn over the past three years has resulted in a positive response to sulphur on sandy, low organic matter soils irrigated with water low in sulphur. These factors appear to be good predictor of potential sulphur need.

Table 3. Effect of Nitrogen and Sulphur Application on Irrigated Corn Yield and Leaf Nutrient Content.

Kansas River Valley Field, Rossville

Treatment ¹		Grain Yield			8-leaf		Tassel	
N	S	1978	1979	1980	N	S	N	S
lb/a		bu/a			-%-		-%-	
0	0	64	121	94	2.45	.12	1.97	.23
0	30	67	105	89	2.68	.20	1.99	.27
0	60	41	89	59	2.78	.37	1.76	.23
75	0	87	150	88	2.40	.13	2.25	.23
75	30	76	150	74	2.76	.27	2.30	.25
75	60	73	139	74	2.67	.28	2.20	.30
150	0	96	158	80	2.74	.14	2.32	.25
150	30	92	151	81	2.78	.27	2.43	.23
150	60	89	157	76	2.73	.36	2.45	.30
LSD (.05)		31	16	NS	NS	.08	.26	NS

¹75 lb/a blanket application of nitrogen applied to all plots prior to planting.
 N rate shown applied at time of first leaf sample.
 Irrigation water contains -17.4 ppm S as SO₄⁻