Impact of Sulfur and Nitrogen on Strip-tilled Corn in Southeast North Dakota

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Objective: Determine The impact of sulfur on corn yields

Materials and Methods

This trial was conducted in the 2016 growing season on a long-term strip-tilled field at Forman, ND. The soil unit was an Aastad-Forman loam. Plots were 15 feet wide and 30 feet long. The fertilizer treatments consisted of a control (0 lbs N and 0 lbs S), and two N fertilizer rates at 105 and 210 lbs N/acre applied as urea. On each of the N fertilizer level treatments (105 and 210 lbs N), four rates of S treatments were imposed at 0, 10, 20, 30, and 40 lbs S/ac in a randomized complete block design with four replicates. Ammonium sulfate and urea were the sources of S and N, applied by surface broadcasting when corn plants were at V2 (on May 20) one day before the site received about 0.2 inches of rain. Yields and test weight were determined, pending grain analysis. Agronomic efficiency was also determined (the ratio of the difference in yield between S fertilizer treatments and the S-control to the rate of S applied). The corn variety planted was Croplan 3337, at 30,000 live seeds/acre, 2.5 inches deep. Previous crop was spring wheat. Plots were managed against weeds by applying 32 oz. of Round Up, 8 oz. of Diflex, and 2 pints of Harness on May 24. Another weed control was effectuated (that contained Round Up, Laudis, Interlock, Preference NIS, and AMS) on 23 June. The crop was harvested on October 14 from the two middle rows of each plot. Data was analyzed using the mixed model in SAS, and means compared using Tukey's method at 95 and 90% confidence limits.

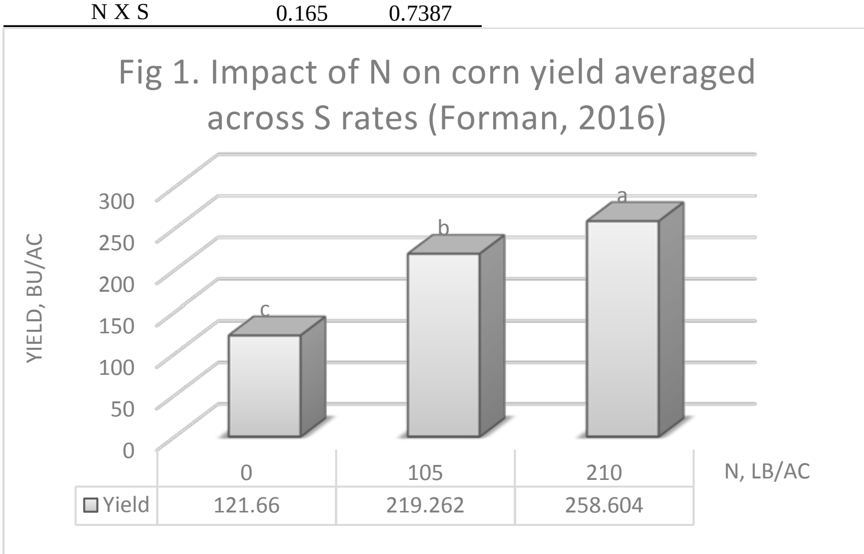
Results

There was significant yield response of corn to sulfur ($p<0.0276$) and to nitrogen ($p<0.0001$). The highest yield (276 bushels) was recorded when 210 lbs of N was applied at an S rate of 20 lbs (Table 1). Across S rates, yield increased significantly by almost 100 bushels, by applying 105 lbs N compared to the N control (0 lbs N and S applied), and by 137 bushels compared to 210 lb N treatment. Averaged across N fertilizer rates, the strongest yield impact of S on yield, of statistical significance at the 95% confidence, was observed at 20 lbs S, with a 26-bushel yield increase over the S control. Yield differences were not significant between the control and the rest of the S treatments except at 90% confidence level (figure 2). At 40 lbs S, yield was lowest among S fertilized plots, and not different from the control. It appears that as S rates increased above 20 lbs, it began having a negative impact on yield. The response curves for S at 105 and 210 lbs showed predicted maximum yield at S rate of 27 lbs and 25 lbs, respectively. However, at S rates above 10 lbs, the agronomic efficiency declined, as determined from the unit increase in yield with application of 10 lbs or more of S (Figure 3). While yield increased by 23 bushels with 10 lbs S application, only three more bushels were gained by adding 10 more lbs of S (20 lbs S). These results suggest that, in 2016 (at this research site), for yields obtained at N rate of 210 lbs N (i.e., above a mean of 240 bushels), it was more efficient to apply 26 lbs or less of S, to produce yields above the control at same N rate (dotted line, figure 3). Above this line, > 1 bushel of corn was produced for every unit of S applied, implying that fertilizer efficiency was above 100%. Meanwhile, at 105 lbs N, which produced lower yields but relatively higher than average for the region, less than 15 lbs of S was needed for each unit of S to increase yield by at least a bushel. These results suggest that a farmer would likely have gained fertilizer efficiency and better return for their expense, by applying rates that are close to the S recommended rate for corn of about 10 lbs S (depending on their soil type). The result however, does not suggest that the efficiency of S use above the reference (100% yield) line means profit. These have to be assessed against fertilizer prices and grain yields. Because of inconsistency of crop response to S, application of S at, or just below the state recommended rate for corn, may be advised in view of current grain prices.

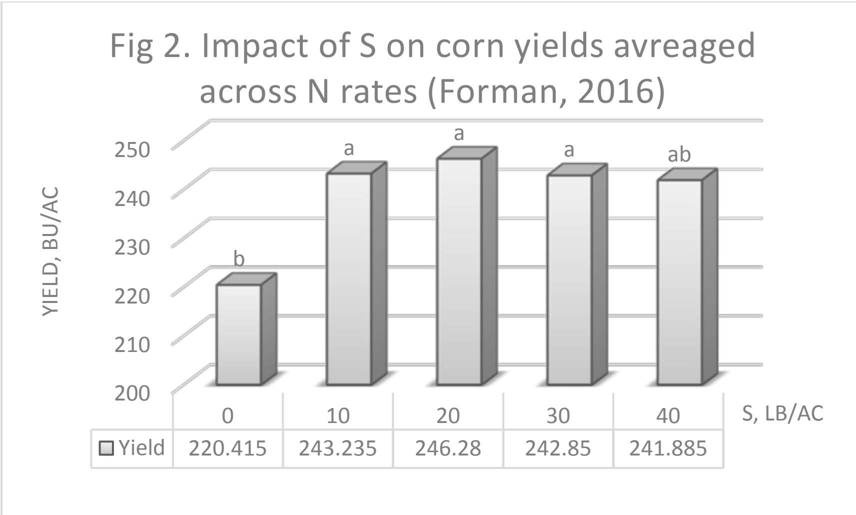
Table 1. Effect of S and N on corn yield at Forman.

Nrate	S-rate	Yield	TWT
lb/ac		bu/ac	lb/bu
105	0	207	58.0
	10	221	57.8
	20	217	59.1
	30	233	59.0
	40	219	58.8
Mean		219	58.5
Tukey (0.05)		ns	ns
Tukey (0.1)		ns	*
SED		11.074	0.472
210	0	234	57.9
	10	266	58.7
	20	276	58.8
	30	253	59.2
	40	265	58.1
Mean		259	58.5
Tukey (0.05)		ns	ns
Tukey (0.1)		*	ns
SED		13.635	0.745
0	0	122	58.0

Analysis of Variance	---- *P* value ----	
Nrate (N)	<.0001	0.7934
Srate (S)	0.0276	0.0653
N X S	0.165	0.7387



Means with different letters are significantly different (p<0.1)



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