The Effect of Sulfur Application on Yield and Protein of Spring Wheat

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Rationale: Sulfur deficiency is a growing problem for wheat and many crops in North Dakota, yet minimal studies have been conducted in recent years to provide updates on the economic impact of sulfur application to wheat. Prolonged cool springs and soil residue in no-till are some factors that affect S mineralization and availability to wheat. Soil S analysis is not very reliable for predicting crop yield and protein response because unlike N, over 90 percent of soil S is in the organic matter form, which must be broken down before S is released in soil. The trial was established to determine if sulfur application improves wheat yields. And if so, would wheat response depend on available S.

Materials and Methods

The trial was planted by a 7-row planter at 7-in. row spacing in a randomized split-plot design with four replicates. Nitrogen was the main plot factor at four N levels (60, 120, 180, 240 lbs/ac) plus a control, and sulfur was the sub-plots applied at 0, 10, 20, and 30 lbs. Sulfur was applied as ammonium sulfate.

Results

There was no apparent effect of N on wheat yield even with the addition of sulfur. However, grain protein increased significantly with N addition, as well as with S rates (Table 1). There were no significant differences between 0 and 10, and 0 and 20 lbs S except at the 30 lb. rate, where S significantly increased grain protein over the check. The lack of significant N and S treatment effects on yield may have to do with availability at the time needed to significantly enhance grain yields. The highest mean yield (60 bu/ac) and mean protein (16.24%) by treatment was observed at 200 lbs N averaged across S rates. Averaged across N rates, 20 lbs S produced the highest yield (58 bu/ac), and 30 lbs S produced the most grain protein (15.7%). From this study we can observe that sulfur application enhanced protein content (Fig. 1) in the grain, as did N (Fig. 2).

Table 1. Analysis of variance for yield and protein by location.

		Yield		Protein	
Effect	DF	F	*P*-value	F	*P*-value
N Rate	4	0.79	0.552	30.15	<0.001
S Rate	3	0.32	0.809	2.95	<0.0428
N x S Rate	12	1.7	0.099	0.36	0.722

P- values < 0.05 indicate that the treatment had significant effect on the response variable (e.g. yield).

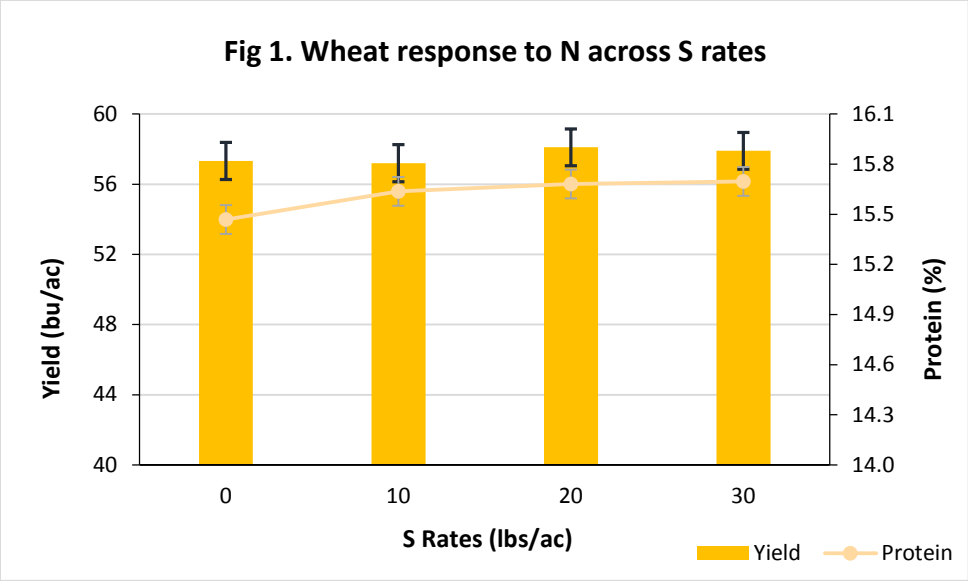
Fig 1. Wheat response to N across S rates
60
56
52
48
44
40
16.1
15.8
15.5
15.2
14.9
14.6
14.3
14.0
Yield (bu/ac)
Protein (%)
0
10
20
30
S Rates (lbs/ac)
Yield
Protein

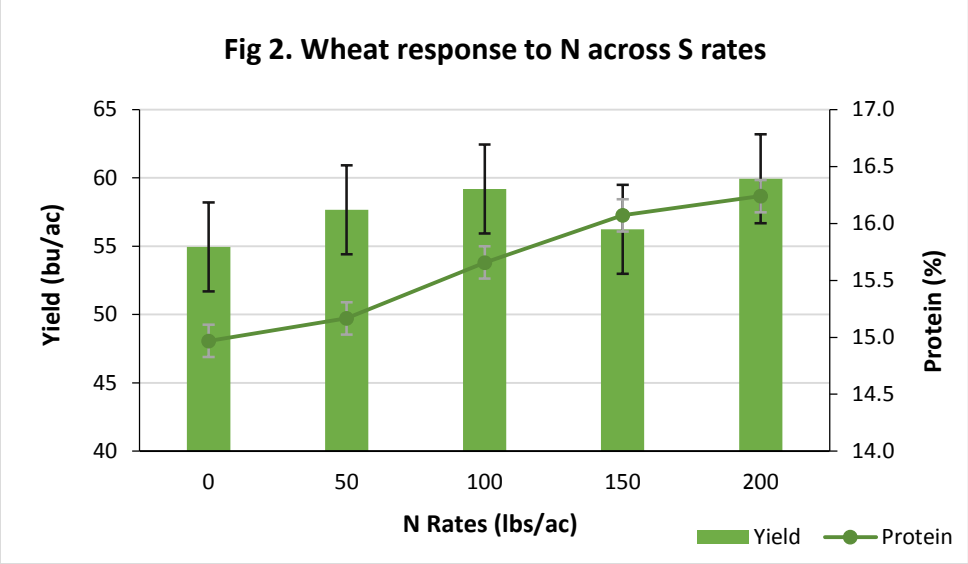
Fig 2. Wheat response to N across S rates
65
60
55
50
45
40
17.0
16.5
16.0
15.5
15.0
14.5
14.0
Yield (bu/ac)
Protein (%)
0
50
100
150
200
N Rates (lbs/ac)
Yield
Protein