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Corn Responds To Sulfur Fertilization On Eroded Soils

Studies conducted in 2000 on no-till, rolling South Dakota landscape show yield variances on different slope positions.

Summary: *Liquid sulfur (S) increased mean corn grain yields at the shoulders (severely eroded) and backslopes (moderately eroded) by at least 17 and 29 bu/A, respectively, when compared to control plots. In these experiments conducted in the year 2000, ammonium thiosulfate (ATS) was applied during planting at the rate of 25 lbs/A of S, along with the UAN application.*

Landscapes in southeastern South Dakota, southwestern Minnesota, northwestern Iowa, and northeastern Nebraska are gently to moderately rolling. Soils in the region were formed from loess deposited during post-glacial events. The shoulders and hilltops of these landscapes are often eroded and soil organic matter content is often lower. Soil pH is often higher from free $CaCO_3$ in the exposed subsoil than pH in the footslopes. The predominant soil association in the region is the Moody-Nora-Crofton series.

Corn and soybeans are grown in rotation on either no- or conventional-till. In the eroded areas, crop yields are depressed in relation to the footslope positions and strong leaf striping (interveinal chlorosis) in corn has been observed at these locations. This leaf coloration pattern is similar to that observed for micronutrient metal (Fe or Mn) deficiencies. However, in previous studies ATS ameliorated the leaf striping and increased grain yield, compared to controls. The need for supplemental S in these eroded areas was indicated.

Generally, crop S requirements are supplied by the mineralization of soil organic matter and crop residues. It is suspected that levels of available SO_4-S released during the growing season on eroded soils were inadequate because the soils had lower organic matter which, when mineralized, could not supply adequate S levels to meet the potential yield goal. No-till practices probably contributed to this condition since organic matter mineralization generally is less under no-till than in conventionally tilled fields, and the SO_4-S released would be less.

The objective of our study was to determine how growth and yield parameters of corn will be enhanced by S fertilization across various organic matter levels as determined by landscape position.

Soil test

Soil organic matter, extractable soil orthophosphate-P and soil Zn increased significantly as sampling position progressed from the shoulder (severe erosion) to the footslope (no erosion). Erosion removed much of the topsoil and subsequently reduced favorable chemical and physical soil properties on these slopes. There was a 1.2 percent organic matter mean decrease and a 1.0 pH unit mean increase as sampling progressed from the footslope to the shoulder. Interestingly enough, the level of extractable SO_4-S was very high at the shoulder landscape positions. Available SO_4-S can react with free calcium carbonate and form gypsum, which may not solubilize to release SO_4-S at the same rate as mineralization of organic matter. Some of this SO_4-S is likely to be released from the gypsum by the soil grinding procedure and/or extracted by lab procedure during soil testing that would not necessarily be available to the crop during the growing season. In

Table 1. Summary of treatments for corn, Woodard and Bly, Garretson, SD, 2000.

Parameters	Rates	N	P	K
	lbs/A			
Control	0	130	30	10
ATS	25	122	30	10

addition, the analytical procedure (turbidimetric method) may not be appropriate for these soils for SO_4-S determination. More work on this aspect of soil- available SO_4-S is forthcoming.

Corn response

To sulfur. Grain yield increased significantly for the S treatment compared to control (146.5 bu/A vs. 127.3 bu/A) when pooling landscape positions (Figure 1).

To landscape position. Overall grain yield increased substantially from the shoulder to the footslope from a mean of 113.4 to 160.8 bu/A. Soils at the footslope provide a favorable growing environment because of more favorable chemical and physical properties and soil water status compared to the eroded soils at the shoulder positions. There were many agronomic factors contributing to yield decreases as yield sampling progressed upslope.

If S is a limiting nutrient to corn grain production due to landscape position, then an S application should be more effective when applied to soils at the shoulder position. Comparing the control to the single S application to landscape position (Figure 2), S significantly increased corn grain yield for the shoulder (103.1 bu/A vs. 128.5 bu/A) and backslope positions (119.4 bu/A vs. 150.6 bu/A). There was no significant grain yield response to S on the footslope where the topsoil was 24-36 inches in depth.

Visual symptoms. Visual symptoms are not the best indicator of the occurrence of S deficiencies. Sometimes the leaf-striping symptoms may be stronger in one season than in another. They could dissipate somewhat or intensify as the growing season progresses. The onset of leaf-striping may also occur at different growth stages. Mild onset of leaf striping may not be alleviated very much by S applications. Plant tissue analysis is the best indicator for S deficiencies and S response potential.

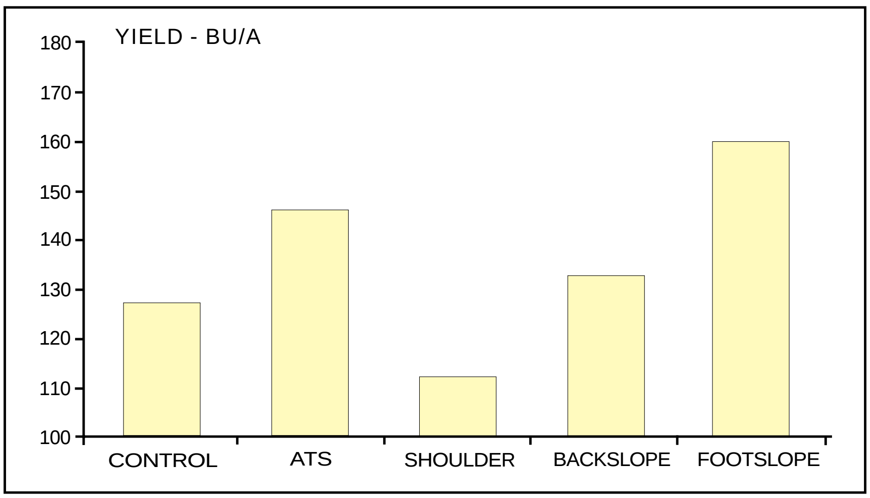

Figure 1. Corn grain yield response for treatmants and landscape positions, ATS @ 25 lbs/A, Woodard and Bly, Garretson, SD, 2000.

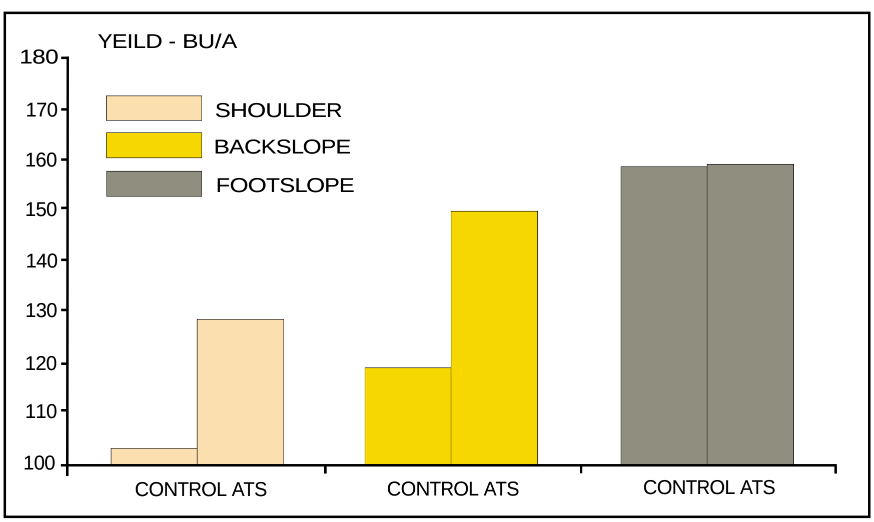

Figure 2. Mean corn yield responses to ATS on landscape positions, ATS @ 25 lbs/A, Woodard and Bly, Garretson, SD, 2000.

Methodology

Field site was near Garretson, South Dakota. The site has an extensive history without tillage and a rolling landscape—different from the site chosen in 1999.

Fertilizers. Two tanks contained UAN. One tank contained the ATS, which was applied 5 inches from the planted row. Another two tanks contained starter (7-21-7), some of which was applied with the seed.

S placement. ATS was applied at a two-inch depth by five-inch wide configuration with respect to seed placement.

Planting. Corn (DeKalb DK 477) was planted at a population of 26,500 seeds/A on May 3.

Plots. Corn plots 15 feet wide by 40 feet long were established on the shoulder, backslope, or footslope positions.

Fertilizer rate/A. S was applied as ATS at rates as shown in Table 1. Included in the table are rates/A for N, P, and K.

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