Soybean Response to Sulfur Application with Balanced Nitrogen Rates

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INTRODUCTION

Sulfur and Nitrogen conjointly play vital role in protein synthesis and affects the composition of seed storage proteins (Amir & Hacham, 2008). The atmospheric S deposition was major source of S for crops previously. The recent stricter emission regulations has resulted dramatic reductions in atmospheric S deposition (Mitchel & Likens, 2011). Planting of high yielding crop varieties have further depleted S from the soils throughout the Midwest and several parts of the worlds. There are more observations of soybean yield and seed protein response to added S. We conducted a field study between 2019 and 2021 around Brookings, SD to investigate the effect of S sources and S rates with balanced N rates on soybean yield and seed protein content.

OBJECTIVES

- To determine the effect of S rates on soybean yield and seed protein content.
- To determine the effect of S sources on soybean yield and seed protein content.

MATERIALS AND METHODS

Study years: 2019 to 2021
Location: Brookings, South Dakota
Experimental design: Randomized complete block design with four replications
Plot dimensions: 4.6 m wide (6 rows with 0.76 m row spacing) and 15 m long
Soybean variety: AG15X9 (2019), AG16X0 (2020), and AG15XF1 (2021)

Treatment Structure

Sulfur Source	S rate (kg ha-1)	Equalizer fertilizer
MES 10 (12-40-0-10S)	5.6, 11.2, 22.4 and 33.6	None
Tiger XP (0-0-0-85S)	5.6, 11.2, 22.4 and 33.6	Urea and TSP
AMS (21-0-0-24S)	5.6, 11.2, 22.4 and 33.6	Urea and TSP

* **MES** = Microessential S, **AMS** = Ammonium sulfate, **TSP** = Triple superphosphate

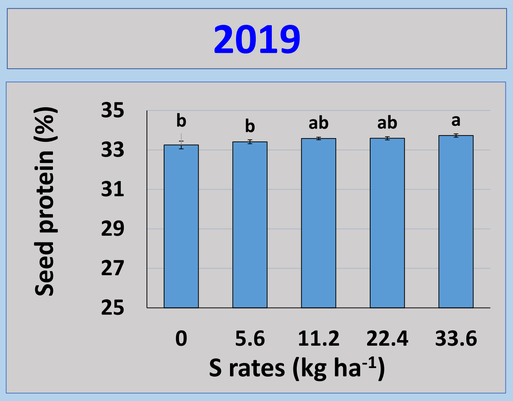
- Urea and TSP were added to provide equal amounts of N and P within the same S rates from different S sources. Therefore, each **5.6, 11.2, 22.4, 33.6 S kg ha^{-1}** rates contained **6, 12, 24, 36 N kg ha^{-1}** respectively.
- MES 10 and Tiger XP contained both elemental S and SO_4^{2-} whereas AMS only contained SO_4^{2-}.
- Fertilizers were broadcasted right after the planting.
- The treatment mean differences were tested either at 0.05 or 0.1 significance level.

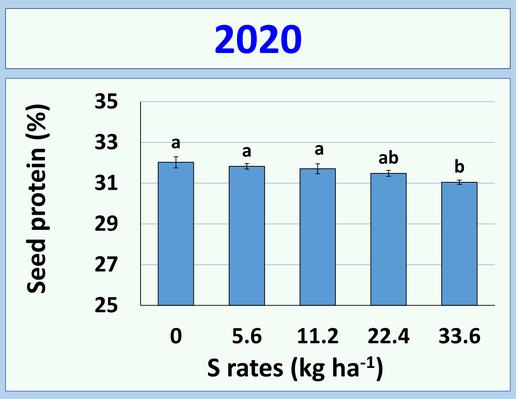
Soil properties of experiment site for the 0-15cm

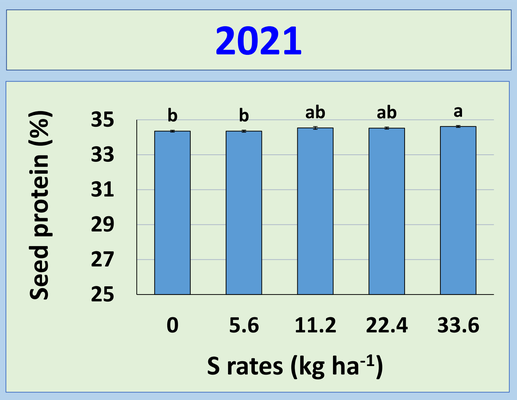
Soil Parameters	2019	2020	2021
Soil pH	6.1±0.2	5.6±0.1	7.3±0.2
Organic matter (%)	3.7±0.1	3.5±0.2	3.9±0.1
NO_3-N (ppm)	3±0.0	4.7±0.6	6.5±1.4
Bray-1 P (ppm)	13.4±3.0	28±3.5	8.9±0.7
SO_4-S (ppm)	2.8±0.1	6.8±1.0	8.5±1.3

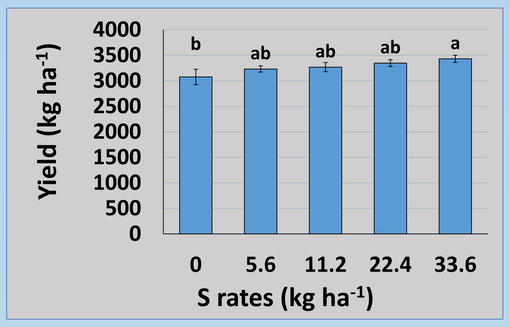
RESULTS

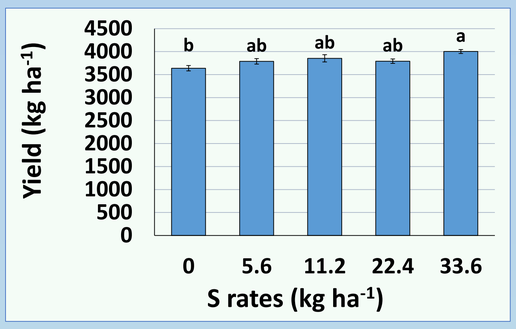
S rates effects

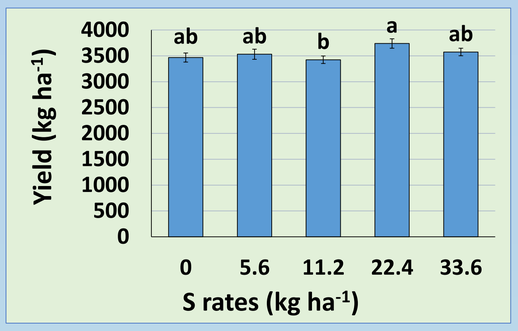






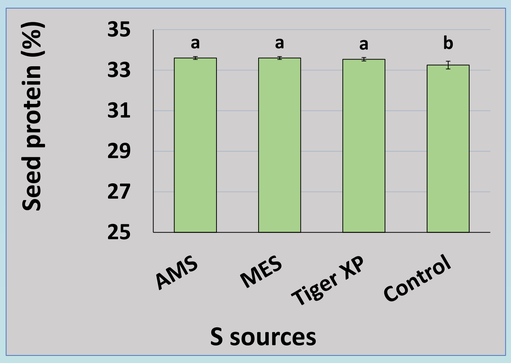


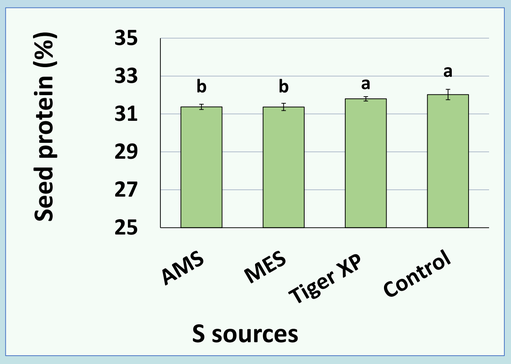


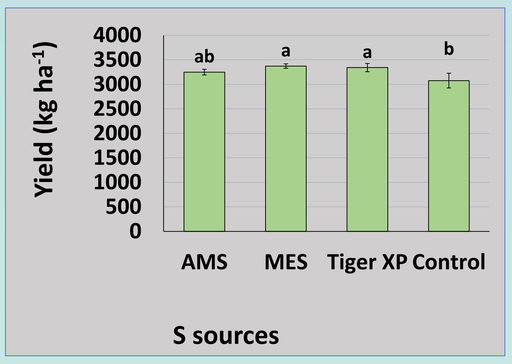


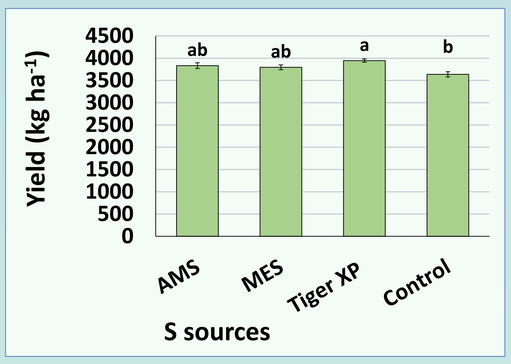
S rates effects on soybean yield and seed protein content between 2019 and 2021.

S sources





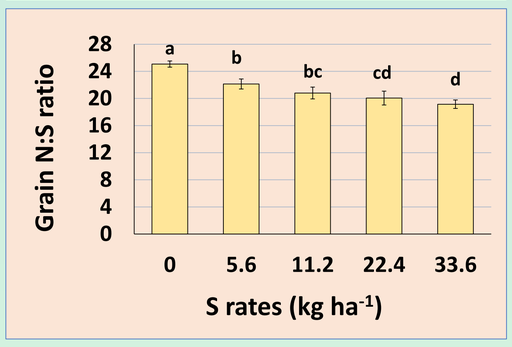




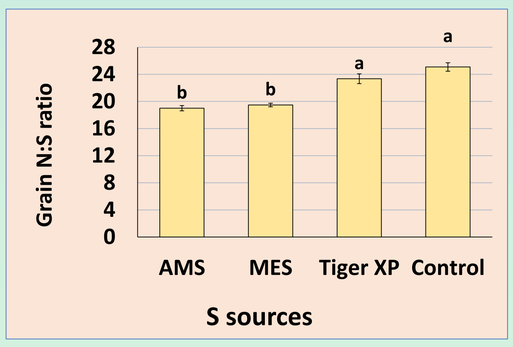
S sources did not affect seed protein content and soybean yield in 2021.

S rates and sources effect on grain NS ratio

Effect of S rates



Effect of S sources



S sources and rates affected the grains NS ratio only in 2020.

Acknowledgement

- South Dakota Nutrient Research and Education Council
- SDSU Ag Experiment Stations
- USDA NIFA Hatch project

Discussion

- The results did not show the interaction of S rates and sources. The soil organic matter content was higher in the experimental plots above (>3 %) in all three years.
- Application of 30 S kg ha^{-1} resulted higher yield in 2019 and 2020 and increased seed protein content in 2019 and 2021 as compared to control . The Application of 30 S kg ha^{-1} reduced the seed protein content in 2020 but significantly reduced the grain N:S ratio as compared to control.
- S sources showed varied response on soybean yield and seed protein content. In 2020, AMS resulted lower seed protein content but also reduced the grains N:S ratio significantly as compared to control.

CONCLUSIONS

The effect of S rates and sources with balanced nitrogen rates on soybean seed protein content and yield was variable. The variable results could be due to different soil and climatic factors, and remobilization of S and N during reproductive growth stages.

References

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