Effectiveness of Three Sulfur Fertilizer Forms as Sources of Sulfur for Canola

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Introduction

Elemental sulfur (S^O) is often considered as a slow release S fertilizer, as it has to be oxidized to sulfate (SO_4^{2-}) to become available for crops. The conversion rate of S^O to SO_4^{2-} is strongly dependant on the size of S^O particles and on the soil conditions it applied. Factors affecting soil microbial activity and population such as soil texture, moisture content, temperature, organic matter addition can directly affect S^O oxidation rate. SulFur 95 is an elemental S fertilizer which has not been fully investigated for its effectiveness under the unique weather, soil and crop management conditions in Saskatchewan. This poster describes a 1997 field experiment in the Black soil zone, which addressed soil and crop response to three S fertilizer forms: SulFur 95 (S^O), Gypsum ($CaSO_4$) and Ammonium Sulfate (NH_4SO_4) for canola production.

Materials and Methods

Date: 1997 Growing Season

Site: Conservation Learning Center Research Farm-l 5 km south of Prince Albert, SASK

Soil: Meota (Black) sandy loam with moderate N and S deficiency.

Fertilizer & application rates:

Control (CT)	17.5 N	30 N	70 N
SulFur 95 (SF)	17.5 N	30 N	70 N
	20 s	40 s	80 s
Gypsum (CS)	17.5 N	30 N	70 N
	20 s	40 s	80 S
Ammon. sulfate (AS)	17.5 N	30 N	70 N
	20 s	40 s	80 S

N: Nitrogen S: Sulfur Unit: kg ha^{-1}

All fertilizers were broadcasted on April 23, and allowed to remain on the surface until the seeding on May 30. An Edward Hoe Drill was used for seeding of Polish Canola (Hysin 101) and produced a shallow incorporation of the fertilizers with soil.

Experimental design: Randomized complete block with 4 replicates

Plot size: 4X8m

Results and Discussion

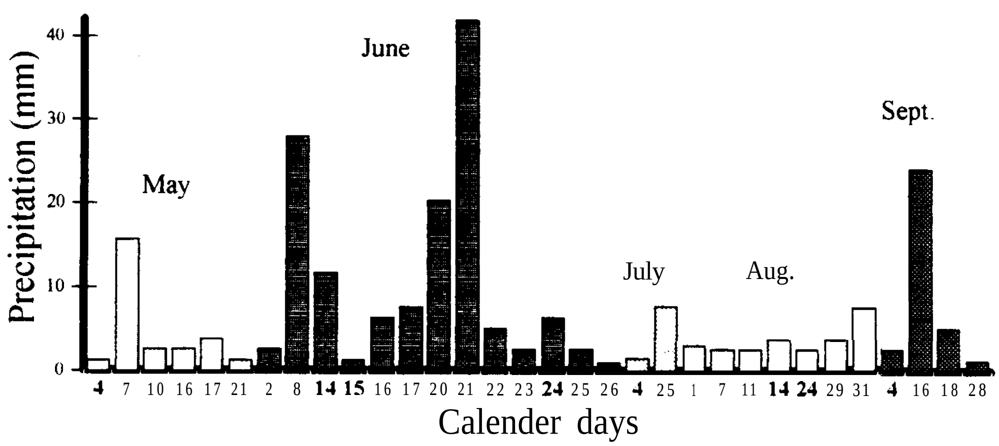


Fig. 1. Daily precipitation during growing season in 1997 near Prince Albert, SASK. Wet conditions experienced in May and June would have enhanced solubilization of

Gypsum along with dispersion, weathering and oxidation of SulFur 95. The dry conditions in July and August that coincided with the critical flowing period probably limited the crop response to applied fertilizers.

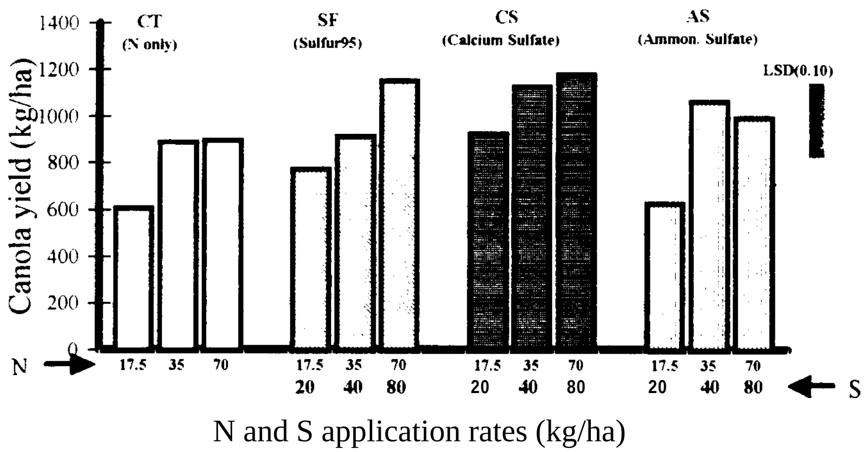
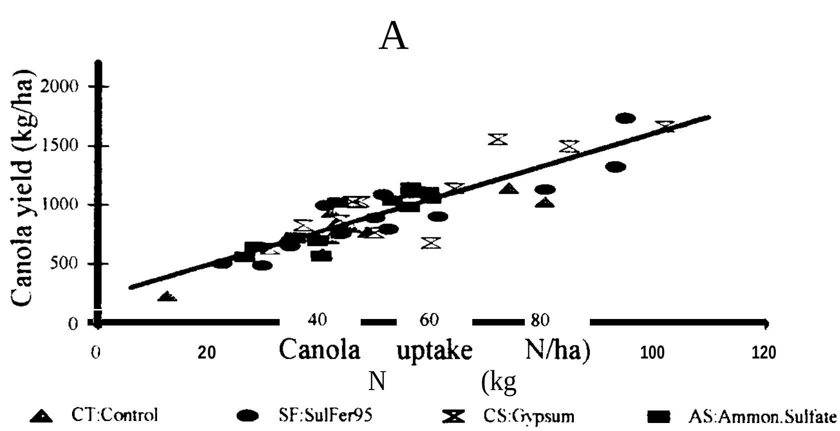


Fig. 2. Canola yield as influenced by N and S fertilization.

Generally, canola yield increased with increased N and S fertilization. The combination of N and S at highest application rates often significantly improved yield over those with low rates of N or N+S application.



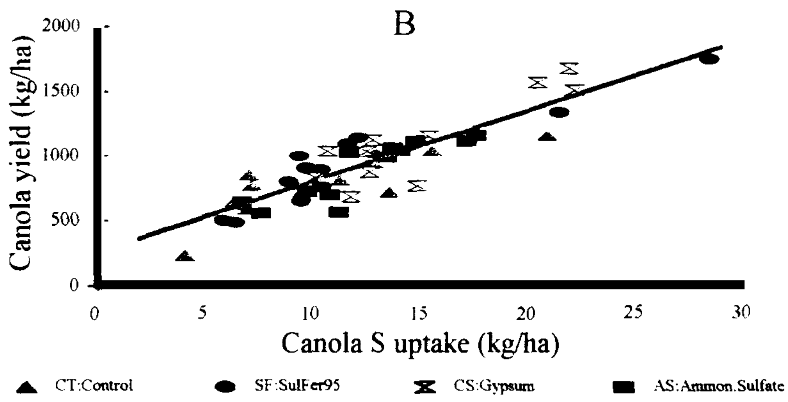


Fig. 3. Correlations between (A). Canola yield and N uptake (Y=208+14.1X; r-O.881 P<0.001); and (B). Canola yield and S uptake (Y=249+54.9X; r=0.886 P<0.001).

The highly correlated relationships indicate that both increased N and S uptake due to fertilization were associated with high yield.

The following equation was used to estimate the contribution of each S fertilizer to crop S uptake over the control at each level of N application:

$$\text{Contribution of S applied (\%)} = \frac{\text{S uptake from treatment} - \text{S uptake from CT}}{\text{Fertilizer S applied}} \times 100$$

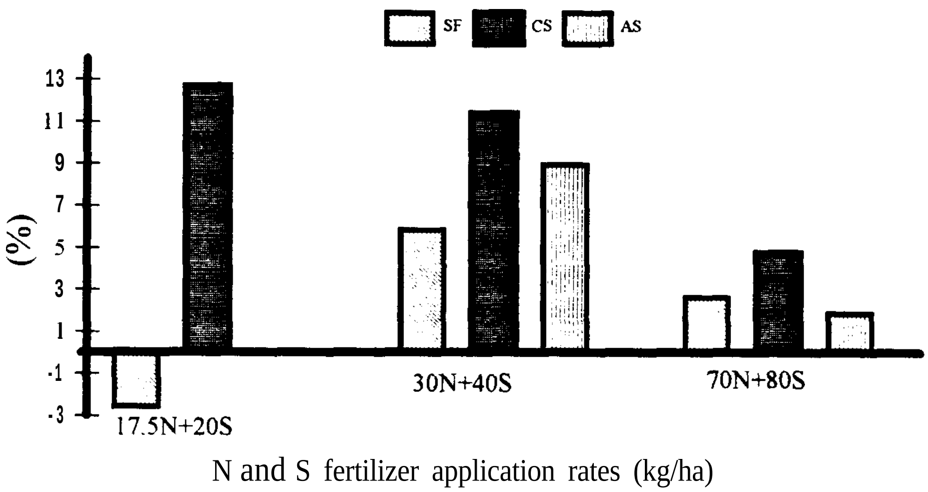


Fig. 4. Relative contribution of the three S fertilizers to crop S uptake.

Gypsum appeared to have higher efficiency in increasing crop S uptake than the other two sources at all three levels of N application. Application of SulFur 95 and Ammon. Sulfate at the rate of 20 kg ha“ in combination with 17.5 kg N ha^{-1} was not effective in contributing to enhanced S uptake

The following equation was used to calculate percentage of sulfate remaining in soil as a result of S fertilizer application:

$$\text{Sulfate in soil (\%)} = \frac{\text{Amount of sulfate in S fertilized treat} - \text{Amount of sulfate from CT}}{\text{Fertilizer S applied}} \times 100$$

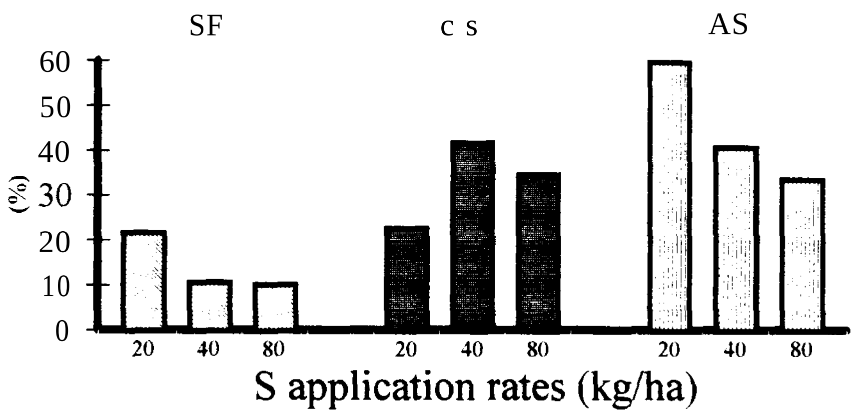


Fig. 5. Percentage of S applied present in soil (O-60cm) as sulfate at the end of growing season.

Large differences in the amount of sulfate present in soil at the end of 1997 growing season were found at the same rate of S application for the three S sources. Overall, higher residual sulfate levels were observed for the sulfate fertilizer forms compared to SulFur 95. We expect that the differences in residual soil available S may influence crop growth in the following year. This study will follow the residual effects of the 1997 application into 1998 and 1999 cropping seasons.

Conclusion

All three S fertilizers had potential to increase canola yield if applied with suitable amount of N. Under the experimental conditions at this site in 1997, Gypsum appeared to have higher efficiency than the other two S fertilizers in increasing crop S uptake.

Acknowledgment

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