

Effect of Sulphur Source on Grain Yield and Sulphur Recovery in Crop Rotations

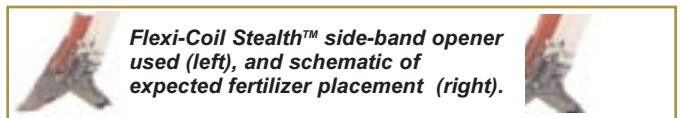
Written by
The Agronomy Group

executive summary

Field studies were established at 3 sulphur (S) deficient sites in Alberta and Saskatchewan in 1999 to study the rate at which banded S fertilizer sources become plant available. After 3 years of applying the S treatments each year, the ammonium sulphate (AS) fertilizer source resulted in the highest yields and the highest recovery of S in grain, when compared to an elemental S-bentonite source (S⁰), and a blended source of fine S⁰ and AS (50-50). The conversion of the S⁰ sources into plant available S was not rapid enough to supply crop requirement when 20 lb S per acre, per year was applied in a band.

introduction

- Ammonium sulphate (AS) and elemental sulphur (S⁰) are the two main S fertilizer sources used in Western Canada. While AS provides S in the plant available sulphate form, S⁰ first needs to undergo oxidation. Elemental S fertilizers that are well distributed by surface broadcasting, and are subject to granule decomposition by freeze-thaw action (fall application) can oxidize to plant available S forms for the following crop.



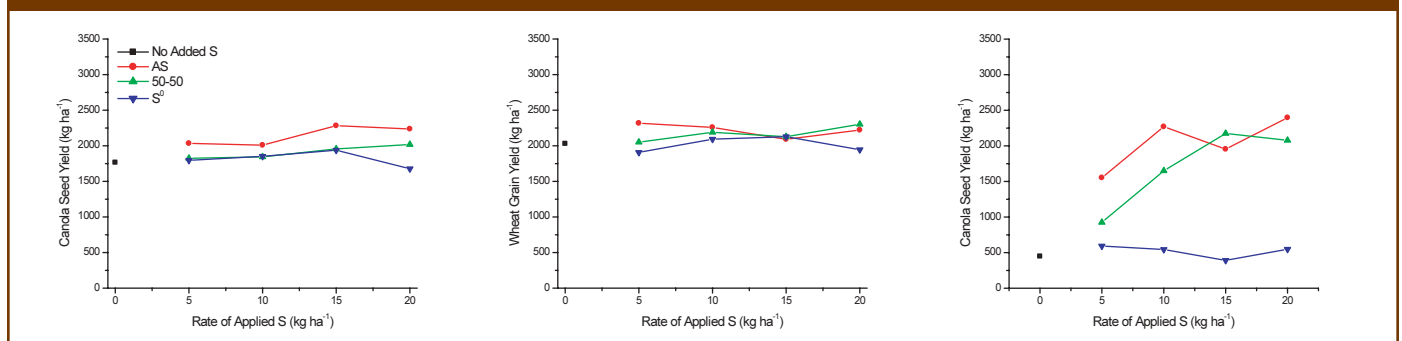
Flexi-Coil Stealth™ side-band opener used (left), and schematic of expected fertilizer placement (right).

- Achieving the desired distribution and application lead-time for S⁰ oxidation becomes more difficult in direct seeding systems, where the plant nutrients are applied in a band at the time of seeding. When S⁰ sources are applied in confined band or seedrow applications, the rate of oxidation may be too slow to maximize crop uptake.

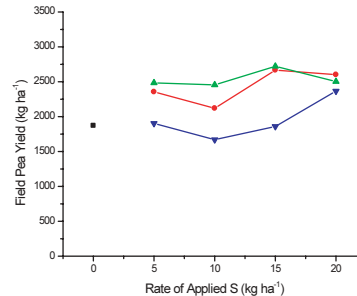
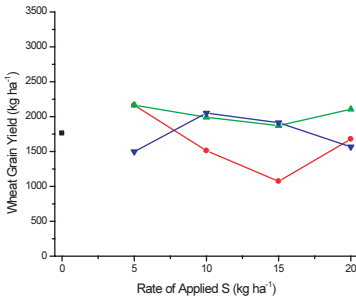
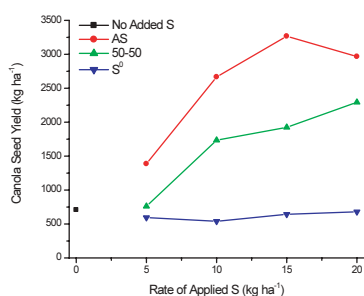
the sites

- Field trials were conducted at Athabasca AB, Canwood SK, and Naicam SK from 1999 to 2001. The crop sequence was canola-wheat-canola at Athabasca and Canwood, and canola-wheat-field pea at Naicam.
- Soil test sulphate was 2 parts per million (ppm) or less in the top foot, and less than 1 ppm in the 1 - 2 foot depth.
- Sulphur recovery was calculated for each site using the 20 lb S per acre per year rate of each product.

Yield response of crops to S rates and sources: Canwood SK; 1999, 2000, 2001



Yield response of crops to S rates and sources: Naicam SK; 1999, 2000, 2001



Canola at Naicam SK in 1999 from left – No added S; 20 lb S as AS; 20 lb S as S⁰

results

1. YIELD

Yield responses to added S were detected in 6 of 9 site-years. Yields at Canwood and Naicam were considered average for the region, while yields at Athabasca (not shown) were low, due to drought stress in all three years. Canola, as expected, was the most responsive crop to added S.

The yield results indicate that little S from the S⁰ sources became available over the three years of application. This was particularly noticeable at the Canwood site in the 2001 crop year, where 3 annual applications of 20 lb per acre of S as AS, resulted in a canola seed yield 437% higher than that of 3 annual applications of 20 lb per acre of the S⁰ source. Field peas at Naicam in 2001, did appear to respond to added S⁰ at the 20 lb per acre annual application rate, indicating that it took 3 years for the oxidation of S⁰ to begin to take effect at this site.

2. SULPHUR RECOVERY FROM GRAIN

At the application rate of 20 lb S per acre per year, the S⁰ treatment did not result in more S recovery compared to the no S check in 7 of 9 site-years. At the same rate, recovery of S in grain from the AS treatment was

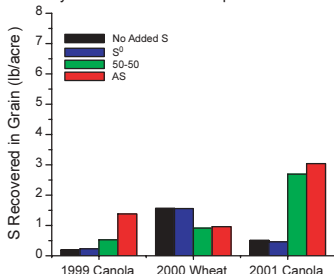
greater than the check in 7 of 9 instances. At Athabasca in 2000, salt injury reduced S recovery from AS at this rate compared to the check, while at Naicam in 2000, there was no increase in S recovery with this treatment.

In year 3 at Naicam, there was some increase in S recovery by S⁰ over the check. This would indicate that some of the S⁰ has begun to oxidize and become crop available. This amount was still significantly less than what was required by the crop when compared to the AS and 50-50 treatments.

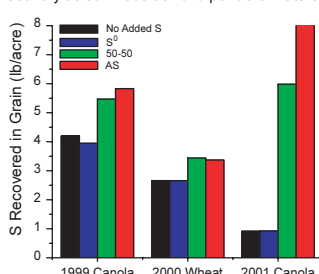
conclusions

- The S⁰ oxidation rate of banded treatments was low. Plant available S to maximize yield was not provided by either the S⁰ treatment or the 50-50 treatment, even after 3 years of annual applications. In the case of the S⁰ treatments at Canwood and Athabasca there appeared to be no availability of the S⁰ after this time, while at Naicam, about 50% of the crop requirement was provided by the third year.
- It is critical to achieve dispersion of S⁰ particles to facilitate oxidation. If the granule does not disperse, or disperses slowly, the surface area of particles is limited and the oxidation process is slowed. ■

S Recovery at Athabasca at 20 lb per acre Rate of Applied S



S Recovery at Canwood at 20 lb per acre Rate of Applied S



S Recovery at Naicam at 20 lb per acre Rate of Applied S

