

June 2006

Elemental sulphur for canola production

Sulphur (S) is an important component of proper nutrition for canola production and ranks as the third most limiting nutrient on the prairies. In fact, canola is more sensitive to low sulphur levels than cereal crops.

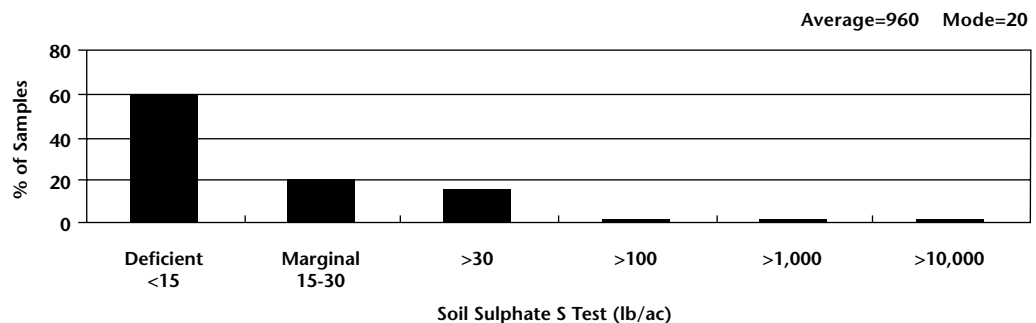
Sulphur is part of structural and enzymatic components within canola plants. Sulphur is a key component of two essential amino acids, cysteine and methionine and is needed for protein and chlorophyll synthesis. Sulphur is also important for glucosinolate formation which is an important group of secondary plant sulphur compounds.

Sulphur availability in the soil can be extremely variable within fields. For example, Figure 1 shows extreme sulphate S variability on a 60 acre Solonchic field near Stettler, AB in 1994. Composite samples were taken from each acre and tested separately. The average worked out to be 960 lb sulphate S/ac in the two foot depth, which is excessive from the soil test standpoint. However, the average value is heavily skewed by the few samples with extremely high sulphate S values (maximum 19,000 lb sulphate S/ac).

A better indicator of the most typical value for the field would be the value class that occurs most frequently (the "mode"). In this example, the mode was just 20 lb sulphate S/ac, which is deficient. Therefore, the majority of this field would likely respond to S fertilizer.

This example illustrates that single composite soil samples from fields with high S variability can be difficult to interpret. A soil that tests deficient for S is probably truly deficient, unless underlain by a subsoil sulphate salt layer, while soils testing medium or high for S may have deficient areas that are skewed by areas with excessive S. It's important to use proper sulphur fertilization methods to help avoid sulphur deficiencies and subsequent yield loss in areas of low sulphate S.

Figure 1: Sulphate S Variability





There are many different sulphur fertilizers available on the market in various forms including sulphates and elemental S as well as blended products that include various ratios of elemental and sulphate S. Each requires a different management system to maximize the nutrient potential of the product.

For immediate crop uptake, sulphate formulations should be used. Sulphate is highly soluble and moves easily with water in the soil. Fertilizer use efficiency is generally the highest when sulphate fertilizer is placed near roots for easy access. Under dry spring conditions, broadcast sulphate fertilizer can be stranded with resulting poor uptake. Under such dry conditions however, canola germination and establishment will also be severely affected. Under average to good moisture conditions, sulphate fertilizer can be broadcast-incorporated in the spring with good results. On sandy soils, sulphate leaching can occur during wet periods. Therefore, spring application of sulphur fertilizer is best for those soils.

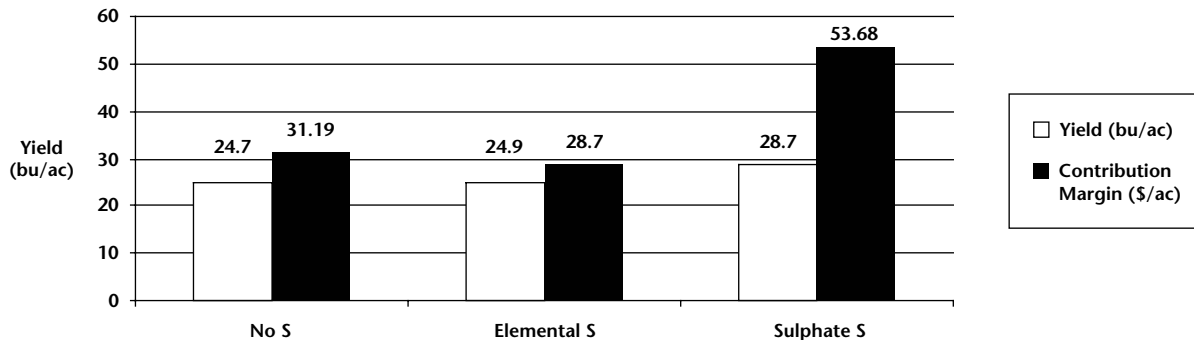
Sulphur fertilizer containing elemental sulphur must be managed differently from sulphate based fertilizer. Elemental sulphur has advantages of a ready supply in western Canada, low production and transportation costs, and fewer drill fill operations due to its high S analysis. However, elemental sulphur has a significant disadvantage--availability is delayed until soil bacteria oxidize it into the sulphate form.

The conversion rate from elemental sulphur to sulphate depends on the particle size, the degree of dispersion in the soil, and the growing conditions, such as moisture and temperature, for the bacteria. Common elemental sulphur fertilizers are formulated as granules or pastilles (split pea shape) for ease of shipping and handling, each consisting of thousands of individual particles. The surface area of these individual particles is the access where the soil bacteria "feed", converting the elemental sulphur to sulphate. Small particles have the largest surface area and, therefore, the fastest oxidation rate.

Field scale research conducted at Canola Production Centres in 1998 by the Canola Council of Canada studied the differences in efficacy between sulphate S fertilizer and elemental S fertilizer. The study was conducted on four fields that tested low for sulphate S. Approximately 20 lb/ac of S was banded in the treatments that received S.

Sulphate S provided a yield and economic advantage over elemental sulphur on all sites where the study was conducted (Figure 2). The yield increase was significant on two fields and is likely due to the elemental sulphur being banded prior to seeding vs. surface applied well before it was needed by the crop. Results from this study were similar to trends established in other small plot research.

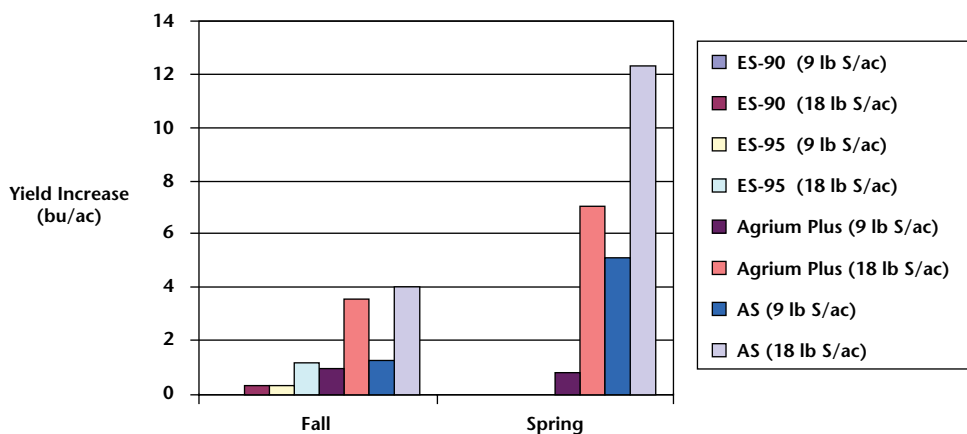
Figure 2: Elemental sulphur vs. sulphate sulphur comparison, 1998 Canola Production Centre Annual Report



An extensive four year sulphur study conducted by Sukhdev S. Malhi, Ph.D., at AAFC in Melfort, SK compared the affects of application timing of various sulphur fertilizers on canola yields. Fall sulphur applications were surface-broadcast in late September or early October and incorporated in the spring at seeding. Spring applications were surface-broadcast and incorporated at seeding.

In the first year of application, neither elemental sulphur nor elemental sulphur blended with sulphate S (Agrium Plus) applied in the spring provided as much additional canola yield as sulphate S. Elemental sulphur fertilizers did provide some additional yield when applied in the fall, but yield gains were much lower compared to spring applied sulphate S.

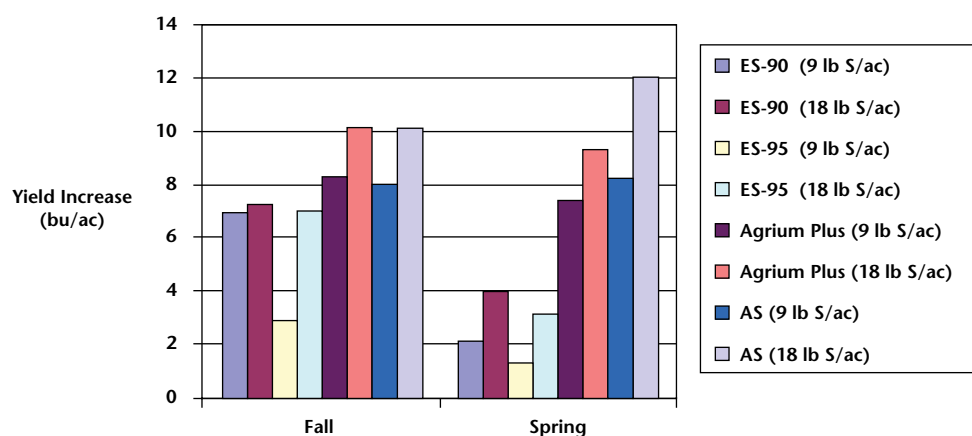
Figure 3: Seed yield increase from various sulphur fertilizers applied at two rates to canola near Tisdale, SK in 1999.



Source: Sukhdev S. Malhi, Ph. D., AAFC Melfort, SK

Yearly applications of the various sulphur fertilizers did increase canola yields by year four of the study. However, annual applications of elemental S, particularly when applied in spring, did not provide as much additional yield as spring applied sulphate S (Figure 4).

Figure 4: Seed yield increase from various S fertilizers applied at two rates to canola near Tisdale, SK in 2002.



Source: Sukhdev S. Malhi, Ph. D., AAFC Melfort, SK

The results of these field studies demonstrate the importance of using sulphate S fertilizers to avoid risk of yield loss for canola on fields that test marginal to deficient for S. Growers who do use elemental sulphur will achieve consistent response by surface broadcasting the granules, allowing time for granule breakdown by rain/frost/snow, then mixing the particles with soil by tillage.

Therefore, apply elemental sulphur fertilizer at least the fall before seeding canola. In some cases, elemental sulphur fertilizer application needs to be two years before seeding canola. Adding some ammonium sulphate to the seeding fertilizer blend may still be wise insurance. Growers who only apply sulphur to the canola phase of their rotation should not rely on elemental sulphur fertilizer.

Effective use of elemental sulphur fertilizer requires:

- careful consideration of the specific product's particle size
- attention to the application method and timing
- severity of S deficiency
- soil leaching risk
- field history of elemental sulphur use.