Canola Needs Sulphur

By A.J. Good and John S. Glendinning

Canola is a crop of increasing importance in Australian agriculture. Because of the particular growing season, canola is grown during the winter period even though the varieties grown are all spring varieties. The crop is planted in late autumn, about the month of May, and harvested in spring during the October to November period.

Sulphur (S) deficiency in canola was recognised as a serious problem in the crop in New South Wales (NSW), Australia, in 1992, although symptoms were noticed on numerous occasions before that time. Since then, research has shown that the problem can be effectively diagnosed in ample time to enable recommendations for remedial action which is optimum fertilizer application for the growing crop.

Results from this research were adopted as standard practice by over 90 percent of canola growers in NSW within 2 years of this project being started.

The Research Programme

This research was carried out in commercial fields which were being surveyed as a part of a wider investigation into farmer practices. The trial sites were selected at random from the survey fields and were not based on soil characteristics or previous cropping history. Soil analyses were carried out after the sites were finalised.

The broad objectives of the research programme were to:

- Determine the optimum rate of S and nitrogen (N) fertilizer in relation to soil type, previous cropping history, soil fertility, and N fertilizer use.
- Develop a soil test to indicate the likelihood of response by canola to S fertilizer.
- Develop a tissue test to diagnose S deficiency in young canola crops that would enable deficient crops to be treated in time to achieve an economic yield increase in the current season.

Cooperating organisations were CSIRO Division of Plant Industries, Canberra, and the University of New England in Armidale, Northern NSW. The field programme was conducted by Incitec Ltd.

Results

The optimum rate of S fertilizer to apply is affected by previous cropping history of a field, the level of N fertility, balanced nutrition

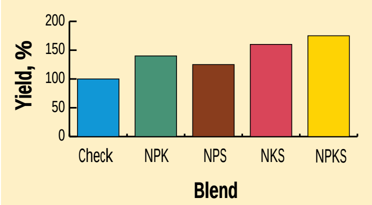

Figure 1. Balanced fertilization increases canola yields (Alberta data).

with phosphorus (P), potassium (K), and other important nutrients, and soil type.

The average seed yield response to 40 kg/ha S fertilizer at responsive sites was 1,285 kg/ha after pasture and 280 kg/ha after a cereal crop (**Table 1**).

All plots received adequate P for the soil and conditions. In addition, all plots, whether following a previous cereal crop or pasture, responded significantly to N fertilizer at rates up to 160 kg/ha. Data from Canada substantiate the benefit of balanced nutrition as depicted in **Figure 1**.

Another effect of S treatment was to improve the oil content of the canola seed. The most significant effects were found where canola was grown after a legume-dominant pasture, as shown in **Table 2**. Failure to apply S resulted in a drop in oil content of up to 8 percent (not shown) and an average of nearly 3.0 percent.

Table 1. The effect of S fertilizer and previous crop on yield of canola.

Rate of S fertilizer, kg/ha	Yield, kg/ha, after:	
	Cereal	Pasture
0	2,629	3,248
10	2,754	4,119
20	2,820	4,380
40	2,909	4,533

Table 2. Effect of S fertilizer and previous crop on oil content of canola seed.

Rate of S fertilizer, kg/ha	Oil content, %, after:	
	Cereal	Pasture
0	43.73	39.07
10	44.10	39.90
20	44.10	41.72
40	44.07	42.01

Soil Tests

Soil analysis by the KCl-40 test provides a useful guide to the S fertilizer needs of the canola crop. Interpretation of the results of analysis of soil samples for canola fields takes into account the soil S level in both surface samples (0 to 10 cm) and deep samples (10 to 60 cm). In this research, on soils that tested in the low range for S and where no S fertilizer was applied, the crop exhibited obvious visual symptoms of S deficiency and suffered yield losses greater than 1,000 kg/ha. On soils testing in the medium range and that received no S fertilizer, yield losses were less than 500 kg/ha. The crop showed no obvious visual symptoms of S deficiency.

Plant Tests

The tissue sampling and testing procedure developed enables growers to collect samples early in the life of the crop so that a corrective fertilizer S treatment would effect a significant economic response.

Of prime importance is the need to ensure simplicity in the sampling procedure. This work showed that samples of whole tops are as effective as the usual youngest fully expanded leaf (YFEL). This is an important consideration with canola because growth stages become very difficult to distinguish once stem elongation takes place.

Critical levels of total S in the whole tops have been determined for the “flower bud visible” (FBV) growth stage. At this stage, the critical level for low yielding crops was shown to be 0.3 percent S, while for high yielding crops it is 0.45 percent S.

The N:S ratio in plant tissue, widely used in assessing the S

This photo shows a general view of the trial site at Wellington. The low and nil S treatments are those which appear grey.

nutrition in the winter type canola varieties grown in Europe, seems to be of little value for the "spring" varieties grown in Australia.

Sulphur Application

When S deficiencies are known to exist, it is common practice to apply the crop's S requirement either at or before planting time. However, there are occasions when S deficiencies are not recognised until after the crop has emerged. Unfortunately, little information was available to guide those in this situation.

The application of 40 kg/ha of S fertilizer before stem elongation occurs (about 70 days after planting) gave almost total yield and quality recovery. The comparison effect of post-planting applications of S fertilizer versus treatment at planting, on yield and other measurements of the canola crop, are shown in **Table 3**.

Table 3. Effects of time of application of 40 kg/ha of S to canola.

	Stage of application					
	Sowing	RS	BV	SE	FL	Control (nil S)
Yield – t/ha	2.17	2.30	2.04	2.16	1.84	1.01
Oil content – %	43.4	42.6	42.9	42.8	41.6	33.6
S concentration – %	0.45	0.46	0.47	0.46	0.46	0.24
Glucosinolate – %	5.92	6.90	6.80	6.74	7.50	0.35

Note: RS = 5-6 leaf rosette; BV = flower buds visisble; SE = stem elongation; FL = start of flowering

Recommendations

Sulphur removal and uptake efficiencies can vary considerably. Recommended rates of application obviously depend on the previous fertilizer and cropping history, but are particularly influenced by the availability of N, P, K, boron (B), and other nutrients.

In general, it can be said that for growing canola on soils testing low in S, a 40 kg/ha S application is recommended. Where higher S levels exist...whether measured by soil test or estimated by previous history, 20 kg/ha S is the recommended rate of application. BCI

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