Sulphur and nitrogen nutrition of canola, Sea Lake

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SUMMARY

When superphosphate was the commonly used cropping fertiliser, adequate sulphur nutrition was assured. With the move to high analysis fertiliser such as MAP and DAP sulphur deficiencies have become more common. Of all winter crops canola is most prone to show sulphur deficiency. Canola has high requirements for sulphur. It is twice that of pulses and five times greater than wheat for the same yield. At Sea Lake in 1999, a product or group of products that supplied a balanced level of phosphorus, nitrogen and sulphur produced the highest yields, however DAP proved the most economic.

Sulphur can be supplied to crops in a variety of ways. Sulphur can be supplied from soil organic matter and most soils of the central and eastern Mallee have low organic matter reserves. The use of high analysis fertilisers in recent years has reduced the input of sulphur, therefore sulphur deficiencies are likely to be seen on farms that made an early switch to these fertilisers. To overcome the threat of sulphur deficiency it has become common practice among canola growers to either:

- apply gypsum.
- continue using superphosphate.
- apply a balanced nitrogen, sulphur and phosphorus product
- use a urea/sulphate of ammonia blend rather than straight urea.
- use a high analysis Grain Legume fertiliser that is fortified with sulphur.

The sulphate form of sulphur, which is readily available to plants, must be used on canola. The elemental sulphur products used in this trial need to be converted to inorganic sulphate sulphur by acidification to be available to the crop. This may be too slow or too late for the crop if sulphur is limited during early growth.

METHOD

Canola was sown with four common methods of applying sulphur; Superfect, Pivot 15, Stimulus and gypsum. Two new products with elemental sulphur, Pivocoat DAP Sulphur 10% and Pivocoat TSP Sulphur 20% were also included. TSP, DAP and MAP were included as controls. All treatments were applied at a common rate of 16kg/ha of phosphorus with the seed and with or with out 100kg/ha of urea. Urea was deep banded at sowing and the gypsum was applied 4 weeks prior to sowing. The treatments were replicated three times, in a randomised complete block design, grain yield and oil content were measured.

Table 4.11 Paddock History

Year	Crop	Fertiliser	Rate
1994	Long Fallow		
1995	Schooner Barley	DAP	64kg/ha (no sulphur)
1996	Peas	Grain Legume Super	75kg/ha (5kg/ha of sulphur)
1997	Chebec Barley	DAP	65kg/ha (no sulphur)
1998	Peas	SuPerfect	100kg/ha (11kg/ha of sulphur)

Table 4.12 Soil test results

Soil type	Colwell P	Sulpur KCl	Organic carbon
Sand	29 ppm	14 ppm	0.44%

RESULTS

Although the objective of this trial was to analyse responses to sulphur, the only significant effect on yield was that of nitrogen, when comparing triple super and MAP without urea (Treatments 1 and 6) with all treatments with urea or the application of Pivot 15 and DAP. Triple super and MAP provided none or 7kg/ha of nitrogen with the grain at sowing, these two treatments were significantly the lowest yielding except for Superfect, which indicates the requirement for "starter nitrogen" at sowing.

The average yield difference between treatments with and without nitrogen (treatments 1, 5, 6, 10 and 11 compared with treatments 2, 3, 4, 7, 8, 12, 13 and 14) was 0.2t/ha.

Table 4.13 Treatments and rates

No.	Treatment	Nitrogen kg/ha	Sulphur kg/ha	Yield t/ha	% increase	Extra profit $/ha
1	TSP at 16P[1]	0.00	0.79	1.07	0	0
2	SuPerfect 16P[2]	46.0	20.00	1.25	117	9.22
3	DAP S10% at 16P[2]	59.57	8.09	1.25	117	-0.98
4	TSP S20% at 16P[2]	46.00	17.83	1.41	132	37.56
5	Pivot 15 at 16P[1]	18.60	12.78	1.25	117	30.54
6	MAP at 16P[1]	7.34	1.10	1.04	98	-9.90
7	Pivot 15 at 16P[2]	64.60	12.78	1.40	131	27.34
8	MAP at 16P[2]	53.34	1.10	1.30	122	18.34
9	MAP at 16P plus Stimulus at 46N[1]	53.34	24.33	1.32	123	-3.69
10	SuPerfect 16P[1]	0.00	20.00	1.12	105	5.83
11	DAP at 16P[1]	14.40	1.28	1.24	116	39.34
12	TSP at 16P plus Gypsum at 2.5t/ha[2]	46.00	425.79	1.35	127	11.41
13	DAP at 16P plus Gypsum at 2.5t/ha[2]	60.40	426.28	1.34	126	2.8
14	MAP at 16 P plus Gypsum at 2.5t/ha[2]	53.34	426.10	1.45	136	31.72
	% CV			**11.5**		
	LSD (P <0.05)			**0.164**		

[1] no urea; [2] urea at 46kgN/ha

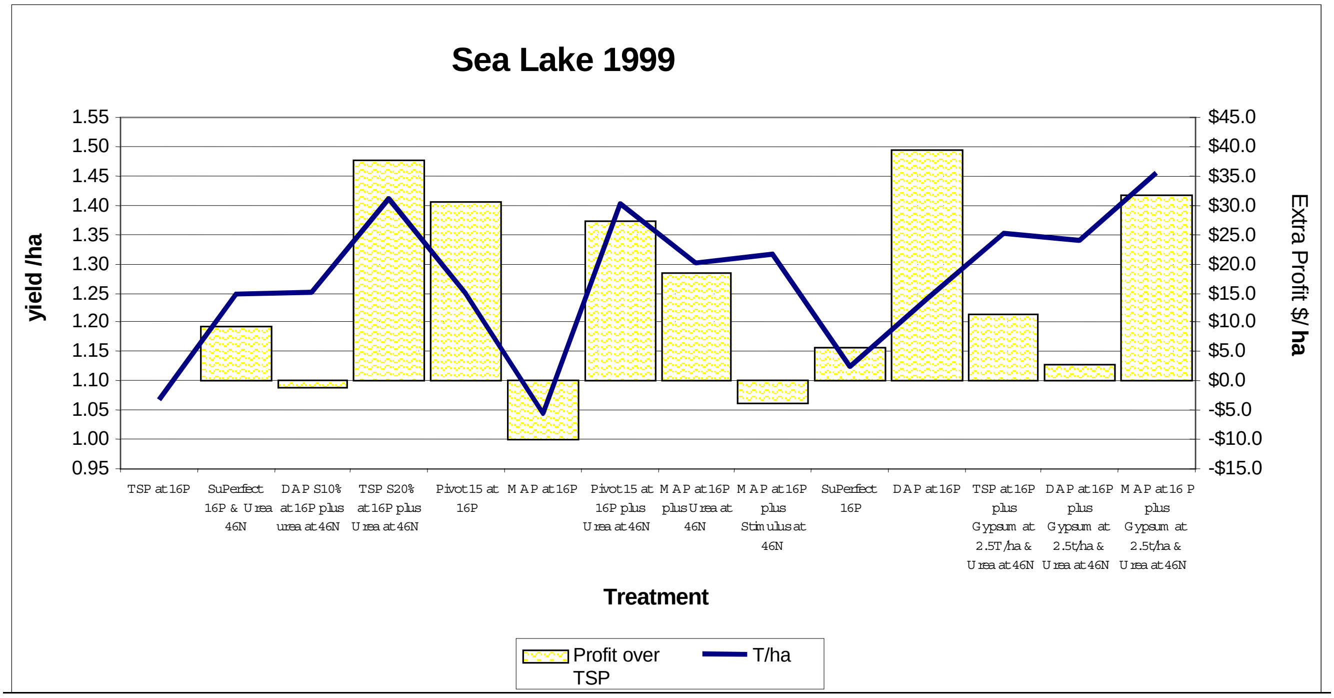
There was no response to sulphur. Both DAP and Pivot 15 have similar yields and Pivot 15 supplied 13kg of sulphur compared with 1kg from DAP. The results did not show any yield or economic benefit from using gypsum (Treatments 12, 13 and 14) over fertiliser based sulphur products. Similarly, the application of Stimulus (24%S) with MAP (Treatment 9) did not improve yield. The treatments supplying elemental sulphur (Treatments 3 and 4) did not achieve significant yield responses compared with treatments with similar sulphur and nitrogen inputs.

Table 4.14 Oil content %

No.	Treatment Name	Oil Content %
1	TSP at 16P[1]	40.00
2	SuPerfect 16P[2]	39.10

3	DAP S10% at 16P[2]	38.30
4	TSP S20% at 16P[2]	38.40
5	Pivot 15 at 16P[1]	40.50 (max)
6	MAP at 16P[1]	39.70
7	Pivot 15 at 16P[2]	38.40
8	MAP at 16P[2]	38.10
9	MAP at 16P plus Stimulus at 46N[1]	37.60 (min)
10	SuPerfect 16P[1]	38.90
11	DAP at 16P[1]	39.70
12	TSP at 16P plus Gypsum at 2.5t/ha[2]	38.60
13	DAP at 16P plus Gypsum at 2.5t/ha[2]	38.50
14	MAP at 16 P plus Gypsum at 2.5t/ha[2]	37.90
	Average	**38.84**

Figure 4.8 Canola yields and Profit



INTERPRETATION

A response to nitrogen was expected as soil testing prior to sowing had revealed a low to moderate level of 40kg/ha of available soil nitrogen at 10 –60cm. A crop target yield of 1.5 t/ha would require 70kgN/ha and allowing for 15kg/ha to be mineralised during the growing season an extra 15kg/ha theoretically was only needed at sowing. Pivot 15 and DAP (Treatments 5 and 11) supplied 18.6 and 14.4kg respectively. DAP was the most profitable treatment with an extra profit of $39/ha over the control treatment of TSP. Pivot 15 was also very profitable at $31/ha. Completing a deep soil nitrate test, is an invaluable tool to make informed nitrogen decisions.

The failure of gypsum to increase yields indicates that sulphur based fertiliser products may be more efficient method than spreading gypsum. Unless gypsum is required to amend soil structure problems it could be considered expensive and unnecessary if only applied for sulphur. With soil sulphur level at 14ppm and 16kg/ha of sulphur applied in the previous three years, a sulphur response unexpected.

Although DAP was the most profitable, applying urea was still a good investment. The 0.2t/ha yield increase gained from applying 100kg/ha of urea equals a 100% return on investment, if canola and urea are both valued at $300/t.

Pivot 15 with or without urea provided a balanced nutrition package. There would be an adequate nitrogen supply during the growing season, adequate sulphur for this season's crop and a positive sulphur balance for future crops.

TAKE HOME MESSAGE

- Deep soil nitrate tests are a valuable tool to make informed nitrogen decisions.
- Checking soil sulphur budgets, knowing soil organic carbon and sulphur levels, will provide a good guide to sulphur needs when growing canola.
- Using sulphur-based fertilisers regularly should prevent sulphur deficiencies occurring.
- If sulphur based fertiliser are used regularly, gypsum should only be needed to amend soil structure problems.