# Do canola cultivars differ in sulphur fertilizer requirements for optimum yield, seed quality and S uptake?

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## BACKGROUND

- On marginally S-deficient soils, combinations of high N rates with more frequent production of high S using and high yielding crops and cultivars with increased cropping intensity result in faster depletion of S from soil.
- Because of high S requirements, canola is more prone to S deficiency than cereals.
- In recent years, many canola producers in the Parkland region have experienced substantial losses in seed yield, apparently due to severe S deficiency at flowering and pod formation stages.
- Crop yield response to S fertilization on S-deficient soils depends on soil type, with significant increase on coarse textured soils but not on medium textured soils.
- Response of different cultivars for the *Brassica species* to S fertilization in controlled condition and some field studies has not been conclusive.
- As *B. napus* and *B. rapa* canola cultivars grown in the Parkland region differ in their growth rate, yield potential, rooting system, and genetics, there may be a potential to use high S utilization efficiency canola cultivars to optimize yield and seed quality benefits from fertilization of S-deficient soils.
- But, there is limited field research information on the relative response of canola cultivars to S fertilization in this region.

## OBJECTIVE

- The objective of this study was to compare the relative response of selected canola cultivars to S fertilization in S-deficient soils, so as to optimize seed yield and quality benefits and to consider different S fertilizer recommendations for the various cultivars.

## MATERIALS AND METHODS

- A three site-years field study was conducted on S-deficient Gray Luvisol (Boralfs) soils in northeastern Saskatchewan (Table 1).
- There were sixteen treatments in a factorial combination of four S rates (0, 5, 10 and 15 kg S $ha^{-1}$, as K2SO4) with four cultivars (Quantum and AC Excel – *Brassica napus* L; Maverick and Parkland – *B. rapa* L.).
- A randomized complete block design (RCBD) was used to arrange plots in four replications.

- Each plot received a blanket application of 120 kg N, 30 kg P and 20 kg K $ha^{-1}$.
- All fertilizers were broadcast on soil surface and incorporated into the soil.
- A double-disc press drill was used to seed canola at 17.8 cm row spacing and 9 kg $ha^{-1}$ seed rate.
- Data were recorded on yield, total S concentration, S uptake in seed and straw, and protein and oil concentration in seed.

**RESULTS**

- For yield of seed and straw and S uptake of seed, both the actual values and response to S fertilization was relatively greater for the two *B. napus* cultivars compared to the two *B. rapa* cultivars.
- The differences between the *B. napus* and *B. rapa* cultivars tended to increase with increase in S rate.
- But the response of seed quality measurements and S uptake in straw to S fertilization was not influenced by the cultivars, although there were differences between actual values for the cultivars.
- For all four cultivars, however, generally yield responded up to the 10 kg S $ha^{-1}$ rate, and seed quality and S uptake measurements responded up to 15 kg S $ha^{-1}$ rate.
- Response to S fertilization was generally of quadratic nature for seed and straw yield, oil and protein concentration in seed, and S uptake in seed, while the nature of response for S concentration in seed and S uptake in straw was not consistent.
- The yield, seed quality and S uptake data suggest no need for different S fertilization recommendation for each cultivar.
- In summary, the results suggest that increase in seed yield from S fertilization varies with canola cultivars, but similar fertilizer S rate for different cultivars.

**CONCLUSIONS**

- Response to S fertilization was relatively greater for seed and straw yield, and S uptake in seed of both *Brassica napus* cultivars (Quantum and AC Excel) compared to both *B. rapa* cultivars (Maverick and Parkland).
- The actual seed and straw yield, and S uptake in seed were also generally higher for *B. napus* than *B. rapa* cultivars.
- Thus, the differences in seed and straw yield, and S uptake in seed between *B. napus* and *B. rapa* cultivars tended to increase with increase in S rate.
- The response of seed quality measurements (oil, protein and S concentrations), and S uptake in straw did not show a consistent influence of the cultivars, even though the actual values for the cultivars were different.
- Response to S fertilization was generally of quadratic nature for seed and straw yield, oil and protein concentration in seed, and S uptake in seed; while the nature of response for S concentration in seed and S uptake in straw was not consistent.
- Generally, all cultivars had near maximum seed and straw yield at 10 kg S $ha^{-1}$, while near maximum oil, protein, and S concentrations in seed as well as the S uptake in seed and straw were observed at 15 kg S $ha^{-1}$.

- Overall, seed and straw yield of *B. napus* cultivars was more responsive to S fertilization than of *B. rapa* cultivars but the data did not indicate any need for different fertilizer S rate for each cultivar.

**ACKNOWLEDGEMENTS**

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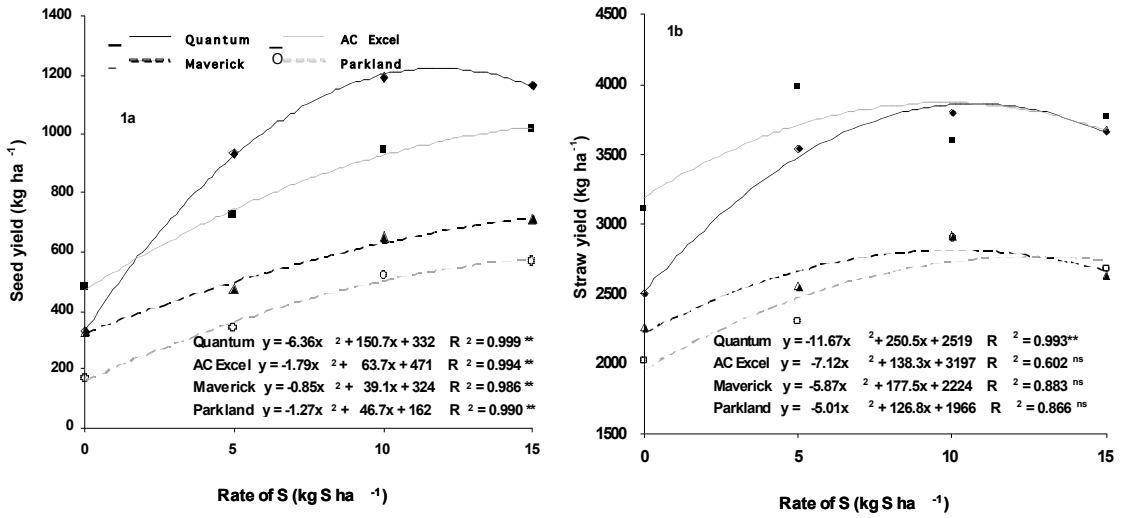


Figure 1. Seed and straw yield of four canola cultivars as a function of S rates in north-eastern Saskatchewan (mean of three site-years).

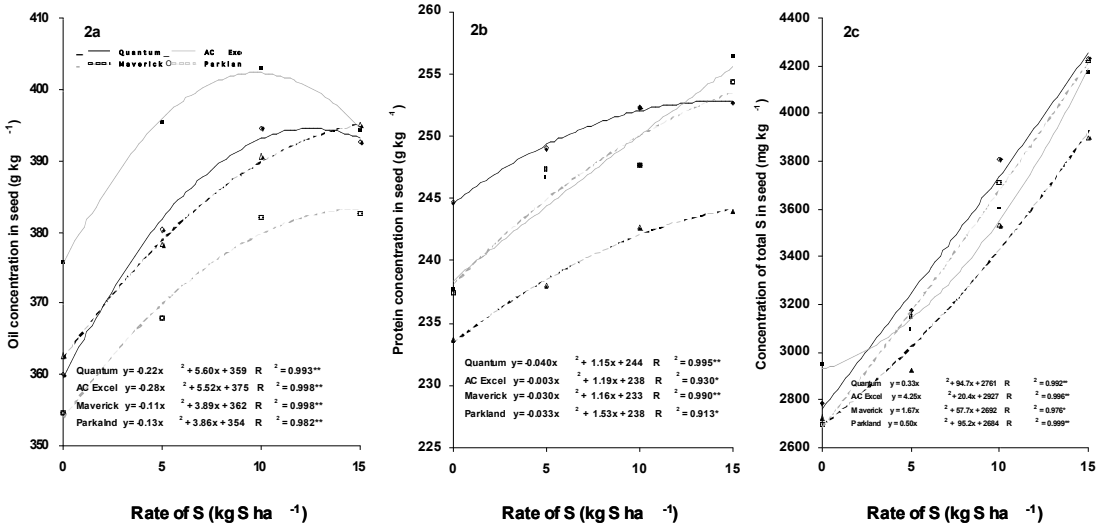


Figure 2. Oil, protein, and total S concentration in seed of fou r canola cultivars as a function of S rates in north -eastern Saskatchewan (mean of three site -years).

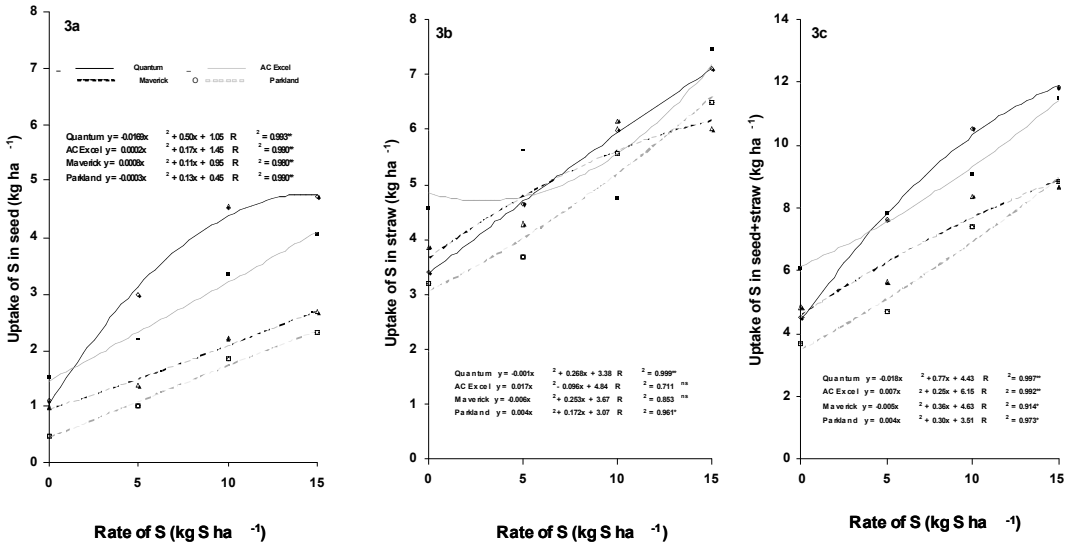


Figure 3. Uptake of S in seed, straw and seed+straw of four canola cultivars as a function of S rates in north-eastern Saskatchewan (mean of three site-years).

Table 1. Some characteristics of soils for the different site-years in north-eastern Saskatchewan

| Site-year | Great Group[Z] | Depth (cm) | Texture | Organic matter (%) | pH (1:2 water) | $SO_4$-S (mg $kg^{-1}$) | $NO_3$-N (mg $kg^{-1}$) |
|---|---|---|---|---|---|---|---|
| Tisdale 1999 | Gray Luvisol | 0-15 | Sandy loam | 4.6 | 6.6 | 10.0 | 6.4 |
| | | 15-30 | | | 6.9 | 9.0 | 5.0 |
| | | 30-60 | | | 8.1 | 8.4 | 11.0 |
| Tisdale 2000 | Gray Luvisol | 0-15 | Sandy loam | 4.6 | 6.7 | 9.4 | 20.0 |
| | | 15-30 | | | 7.4 | 4.8 | 4.2 |
| | | 30-60 | | | 8.1 | 5.0 | 2.6 |
| Archerwill 2000 | Gray Luvisol | 0-15 | Sandy loam | 5.4 | 7.4 | 8.2 | 14.2 |
| | | 15-30 | | | 7.6 | 7.4 | 8.0 |

[Z] Based on Canadian Soil Classification System.