Sulfur Use in Canola in 2014

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Overview

- Canola has long been regarded as having a high nutritional requirement for Sulfur.
- Canola-growers have regularly applied Sulfur though broadcast gypsum at rates of 300-500 kg/ha or single superphosphate, sulphate of ammonia or select starter fertilisers with higher S levels.
- ‘White flower/pale flower and low yielding crops’ observed in 1989/1990 in southern and central NSW.
- Historical Sulfur x Nitrogen responses from a group of trials in NSW in 1992 where the most common canola yield response was to 20 kg/ha S and 80 kg/ha N.
## Fertiliser supplies of Sulfur (S)

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Sulfur (%)</th>
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<tbody>
<tr>
<td>Gypsum (natural) or Phosphogypsum</td>
<td>10-17% (depends on grade and purity)</td>
</tr>
<tr>
<td>Single Superphosphate</td>
<td>11</td>
</tr>
<tr>
<td>Granulated ammonium sulfate (Gran-am)</td>
<td>24</td>
</tr>
<tr>
<td>Ammonium phosphate sulfate (e.g. Granulock 15)</td>
<td>10.5</td>
</tr>
<tr>
<td>MAP</td>
<td>1.5</td>
</tr>
<tr>
<td>DAP</td>
<td>1.6</td>
</tr>
</tbody>
</table>
Testing for Sulfur in the soil

- 2 Tests: S (monocalcium phosphate or MCP) or S (KCL-40)
- Low levels < 5 mg/kg or 5 ppm per 10cm depth
  - ppm=mg/kg
- **Soil concentration (mg/kg) x bulk density x sample depth (cm)/10 = Nutrient (kg/ha)**
- Historical Sulfur trials recorded levels for 0-10 or 0-15cm only
- Sulfur is a soluble anion, a topsoil test doesn’t tell you anything about the distribution of the nutrient.
- In late 80’s and 90’s - MCP test widely used, regarded as being a poor indicator of plant-available levels.
- KCL-40 main test used now, an estimate of Sulfur level now plus a proportion of what can mineralise, but still underestimates: only shows 6-10% increase above the MCP test. Neither test gives confidence to advisors about the potential of soil to mineralise Sulfur to the plant available sulfate form.
BFDC Interrogator

- BFDC is the *Making Better Fertiliser Decisions for Cropping Systems in Australia* Project run by NSW DPI, funded by GRDC and supported by FIFA.
- No Sulfur Trials in Canola from SA, Victoria, Tasmania and Queensland recorded in the database.
- Only Sulfur Response Trials for Canola have been conducted in NSW and WA.
- Canola responses to Sulfur from 1992 demos were recorded at very low soil levels, close to zero and commonly around 5 ppm.
- Some calibration work on Sulfur now being done in Northern NSW, Queensland and WA.
Sulfur Deficiency

• If you want to use soil tests to assist in decision-making then establish a sulphate profile (0-60cm or 0-100cm) for the root-zone rather than rely on a 0-10cm test as the topsoil depth of soil may look deficient but S levels in the profile could be adequate below.

• Similarity with Magnesium, there may be a bulge further down the profile. Is the Sulfur sitting above or below a 30cm depth? Depends on the soil type, if a duplex soil type like a chromosol and how free-draining they are.

• Two amino acids - Cystine and Methionine have a Sulfur bond, may not form as you boost the nitrogen level and the plant’s requirements for Sulfur increases. So yield potential can be restricted by Sulfur. This explains the N induced Sulfur deficiency experienced in the late 80’s and early 90’s where soil Sulfur levels were extremely low, as low as 5ppm.
Sulfur Supply and Demand

- Wetter years can bring ideal conditions for mineralisation of S, or be responsible for leaching events.
- Floodwaters can bring Sulfur into paddocks.
- Now the estimate for the requirement for Sulfur is 2.5 kg Sulfur per tonne of grain (0.25%) but this estimate needs to be refined with some well replicated trials to back it up.
- Compare average removal rates between seasons, 2.5 kg for a 1 t/Ha Canola crop in a dry year versus 6 kg for a 2.4 t/Ha Canola crop in a good season.
- There should be a good residual value from all previous applications whether gypsum, Gran-am, single super or many applications of MAP and DAP from previous crops.
What Sulfur deficiency looks like
Background for growing Canola

- Has usually been a Liming program on-farm if soils are acidic.
- May have been a Gypsum program for amelioration of sodic soils with high exchangeable sodium (Na+).
- Traditionally higher Fertility, higher organic matter paddocks but now rotated in most paddocks.
- Dr Mark Conyers (NSW DPI, Wagga Wagga) uses Organic Nitrogen not Organic Matter -either the Kjeldahl N or Leco N tests (same answer) to estimate the potential for mineralisation in a soil but a difficult task for forecasting as dependent on temperature and soil moisture conditions which can’t be predicted in advance.
- If single super was applied in a recent pasture phase or Gran-am used earlier in the rotation on canola then little need to provide additional Sulfur in this season’s canola crop.
### Longevity of Gypsum Applications

<table>
<thead>
<tr>
<th>Rotation</th>
<th>Gypsum (kg/ha)</th>
<th>Sulfur (at 10-15% S)</th>
<th>Canola Yield (t/ha)</th>
<th>Estimate of Sulfur used by a canola crop</th>
<th>No. of Canola Crops a single Gypsum application can last for</th>
</tr>
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<tr>
<td>C/W</td>
<td>300</td>
<td>30-45 S</td>
<td>2.0</td>
<td>5-10 kg S/ha</td>
<td>3-9 Crops, canola every 2nd year to last 6-18 years</td>
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<td>300</td>
<td>30-45 S</td>
<td>2.0</td>
<td>5-10 kg S/ha</td>
<td>3-9 Crops, canola every 4th year to last 12-36 years</td>
</tr>
</tbody>
</table>

Conclusion on Sulfur Inputs for Canola

- Without ignoring the requirement for Sulfur we can save on present rates and timings of Sulfur fertilisers, thereby saving on cropping costs.
- Know what Sulfur Deficiency symptoms look like - cupping of leaves, purpling/reddening of leaves or paler to white flowers, poor pod-set. Some of these symptoms may be confused with other diagnoses so get an agronomist’s opinion.
- Nutrient budget for Sulfur requirement for S by canola is only moderate - about 2.5 – 3.0 kg/tonne of grain not 10 kg sulphate-S per tonne of grain which would be considered high.
- Record history of Gypsum and Gran-am applications in paddocks as one application can last a number of canola crops (3 or more) before soil levels of S drop back down. See the Longevity Table on the previous slide.
- Higher organic matter soils that don’t leach easily are going to have the greatest capacity to store what we provide and to mineralise their own Sulfur.
- We shouldn’t guess. It should be an educated estimate.
- For high cost crops, start using nutrient budgets.