Low fertiliser inputs to canola in lower rainfall areas

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Key messages

• Canola responded to phosphorus by 70-200kg/ha – in line with expectations based on previous research

• Soil testing to depth can indicate adequate levels of sulfur and potassium for canola in low rainfall areas

• We did not observe any responses to foliar applications of a zinc and manganese mix.

Background

Canola yields are inherently low and variable in low rainfall areas. Therefore it is inevitable growers will choose low input and low risk agronomy. However inputs such as herbicides and insect control, are either mandatory or outside of their control. One of the few inputs growers might be able to manipulate is fertiliser.

Over two years we evaluated the response of canola in lower rainfall areas to phosphorus, sulphur, potassium and micronutrients. Our sites in 2016 were located at Grass Patch, Pingrup and Varley and in 2017 at Grass Patch and Lake Grace.

Main treatments in 2017 included:

• No fertiliser
• No fertiliser + 10kg N/ha at sowing
• 100kg Superphosphate/ha (9.1% P, 11% S)
• Superphosphate + 10kg N/ha at sowing as urea (46%N)
• No fertiliser at sowing plus 120kg* gypsum/ ha (15%S) applied six weeks after sowing
• No fertiliser at sowing plus 100kg Muriate of potash/ha (MOP, 50% K) applied six weeks after sowing
• Superphosphate + 10kg N/ha at sowing + 120kg gypsum/ha

Figure 1 Grass Patch low fertiliser experiment 25 August 2017. (Right) No fertiliser at sowing plus 120kg Gypsum/ha top-dressed six weeks after sowing plus 35N top-up, (Left) No fertiliser at sowing plus 120kg Gypsum/ha top-dressed six weeks after sowing

Grass Patch low fertiliser experiment 25 August 2017. (Right) 100kg/ha Superphosphate + 10kg N/ha at sowing + 35N top-up, (Left) 100kg ha Superphosphate + 10kg N/ha at sowing
• Superphosphate + 10kg N/ha at sowing + 120kg gypsum/ha + 100kg MOP/ha
• Superphosphate + 10kg N/ha at sowing + 120kg Gypsum/ha + 100kg MOP/ha + Micro sprays (0.4kg Zn/ha and 1kg Mn/ha sprayed onto foliage six weeks after sowing)

*400kg Gypsum/ha in 2016

At 6-8 weeks we also included a +/- top-up nitrogen treatment of 25-45kg N/ha (rate was site dependent) as urea granules or a solution of urea and ammonium nitrate (UAN) which is 42% N by volume..

Response to Phosphorus (P)

Previous work has shown canola is known to require 30-50% less phosphorus (P) than cereals (Bolland 1997) and Brennan and Bolland (2007) found yield response of less than 200kg/ha when P soil tests (Colwell P) were greater than 20mg/kg. Our experiments in lower rainfall areas in 2016 and 2017 closely followed the response to P shown by previous researchers with responses ranging from 70kg/ha at Lake Grace in 2017 with a soil test of 34mg/kg, to 200kg/ha at Varley in 2016 with a soil test of 25mg/kg (Figure 2).

Response to Potassium (K)

Brennan and Bolland (2006) and our experiments in lower rainfall areas in 2016 and 2017 found yield responses of less than 150kg/ha when potassium (K) soil tests of the top 10cm or in the 10-30cm layer of soil were >60mg/kg (Figure 3).

Response to Sulfur (S)

Brennan and Bolland 2006b found no relationship between sulfur levels in the top 10cm of soil and canola yield. Similarly canola yield was not related to soil tests at 10-20cm or 20-30cm. However if the sulfur soil test results from each layer is added together a good relationship with canola yield was found (Figure 4).

Sulfur levels in the top 30cm of soil were greater than 30mg/kg at the three sites in 2016 and at Grass Patch in 2017. Therefore we expected and observed no yield response to applied S in canola. Note if we used only the top 10cm of soil to evaluate S levels we would have classed the Grass Patch 2016 and 2017 sites as deficient. At Lake Grace in 2017 sulfur levels in the top 30cm of soil was only 12mg/kg, therefore we expected a large yield response to applied S of 250kg/ha, but recorded a grain yield increase of only 50kg/ha.

Our main method of applying S was to top-dress 400kg gypsum/ha in 2016 and 120kg gypsum/ha in 2017 at 4-6 weeks after sowing, supplying 18-58kg S/ha. However it should be noted the superphosphate treatments would also supply 1kg S/ha so we would have supplied up to 69kg S/ha in some treatments. At Pingrup and Grass Patch in 2016 we observed some ill thrift in canola plants following the application of the gypsum, which we believe may have been a salt effect so we reduced the rate of gypsum in 2017.

Figure 2 Grain yield response of canola in WA to 40kg P/ha (Brennan and Bolland 2007) and to 9kg P/ha at three sites in 2016 and two sites in 2017

Figure 3 Grain yield response of canola to 60kg K/ha (Brennan and Bolland 2006) and to 50kg K/ha at three sites in WA in 2016 and two sites in 2017
Response to micro-nutrients Zn and Mn

In the Mallee areas in the south-east of WA it is normal practice to apply zinc (Zn) and manganese (Mn) as foliar sprays to cereals, but it is unclear if canola will also respond to Zn and Mn sprays.

Critical soil levels of zinc and manganese are not available for canola and should be used with caution for cereals in WA. We found Zn levels at Grass Patch in both years (1.5mg/kg in 2016 and 0.6mg/kg in 2017) and Pingrup in 2016 (1.5mg/kg) to be higher than the critical DTPA levels for wheat of 0.3mg/kg, whilst Varley in 2016 (0.3mg/kg) and Lake Grace in 2017 (0.3mg/kg) were considered marginal. Critical DTPA Mn levels appear to be ill defined for crops in WA. In the USA critical soil Mn levels for corn are 1mg/kg and all of our sites except Lake Grace in 2017 (0.9mg/kg) had levels greater than 1mg/kg.

We applied Zn and Mn as a foliar spray 5-6 weeks after sowing using 1kg ZnSO₄/ha and 4kg MnSO₄/ha to supply 0.4kg Zn/ha and 1.44kg Mn/ha.

We observed no significant yield response to micro-nutrient sprays at any site.

Response to Nitrogen (N)

We top-dressed 10kg N/ha as urea (46% N) at sowing immediately in front of the seeder and then came back within eight weeks to top-dress 15kg N/ha as urea at Pingrup and Varley in 2016 and Lake Grace in 2017. At Grass Patch in 2016 we applied top-up N as a foliar spray of UAN (42% N) at eight weeks (15N) and a further 15kg N/ha at 10 weeks due to continued wet conditions. Similarly in 2017 at Grass Patch we applied top-up N as a foliar spray of UAN (42% N) at eight weeks (15N) and a further 20 kg N/ha at 12 weeks due to continued wet conditions.

Even with a relatively good background N, canola responded to applied N in 2016. Response to N ranged from 4kg of grain per unit of N applied at Grass Patch to 9kg at Pingrup. In 2017 both sites had low soil N levels, whilst canola did respond to applied N, the magnitude of the responses to N were lower than expected – due perhaps to low yields at both sites.

Figure 4 Grain yield response of canola of canola to 15kg S/ha (Brennan and Bolland 2006b) and to 58-69kg S/ha at three sites in WA in 2016 and 29kg S/ha at two sites in 2017