DAW00277
Tactical Break Crop Agronomy in Western Australia

16ES06 Are low fertiliser inputs a viable option for canola in low rainfall areas?

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Location of trial	Grass Patch

Summary (Key messages)

- ***No response to fertiliser applications of K, S and micro nutrients.***
- ***There was a yield response to P and N.***
- ***In this environment a low input or balanced approach to fertiliser inputs minimises input costs without risking to production.***

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. We have previously shown nitrogen rates in low rainfall regions should be in the range of 0 to 30 kg N/ha and that decisions regarding N top-ups can be delayed until 12 weeks after sowing – which is around the start of flowering. However we have not evaluated the response of canola to reduced inputs of other nutrients such as phosphorus and sulphur in low rainfall areas.

Canola is known to require 30 to 50% less P than cereals (Bolland 1997) and Brennan and Bolland (2007) found yield response of less than 200 kg/ha when P soil tests (Colwell P) were greater than 20 mg/kg. Of the 39 trial sites we have used for our canola trials since 2013, no site had Colwell P lower than 20 mg/kg (Mean 39, min 21 and max 59). Brennan and Bolland (2006) found yield response of less than 150 kg/ha when K soil tests of the top 10cm or in the 10-30 cm layer of soil were > 60 mg/kg. 90% of our trial sites had K >60 mg/kg in top 10 cm. Similarly if the top 30cm of soil has more than 30 mg/kg of S then yield response in canola is unlikely (adapted from Brennan and Bolland 2008). About half of our sites had S > 30 mg/kg in the top 30cm of soil. Therefore it appears on paper that in the majority of instances where we have conducted canola trials over the last 4 years we were unlikely to see yield responses to S, P or K. It is feasible then that canola may not require compound fertiliser at sowing in low rainfall sites.

Aim

To evaluate the response of canola to low fertiliser inputs

Trial Details

- Property: Danny Sanderson's Grass Patch
- Growing Season rainfall (GSR, April to October) = 258 mm
- Soil type: Scaddan loam (0.92% organic carbon), SYN estimate of available N = 75 kg N/ha
- Paddock rotation 2016 canola, 2015 barley, 2014 barley, 2013 barley, 2012 barley
- 36 treatments:– 8 sowing treatments x +/- N 8 weeks after sowing x +/- N 10 weeks after sowing
- 4 replicates
- Sowing date April 28
- Seeding rate – Target density 40 plants/m² - ATR Bonito 2.8 kg/ha

Treatments and Assumptions used in Gross Margins

8 sowing treatments x +/- 15 kg N/ha 8 weeks after sowing x +/- 15 kg N/ha 10 weeks after sowing

Sowing treatments (1) Nil, (2) P (9.1 kg P/ha), (3) P + N (10 kg N/ha), (4) S (58 kg S/ha), (5) K (50 kg K/ha), (6) P + N + S (7) P + N + S + K, (8) P + N + S + K + Micronutrients 0.4 kg Zn/ha and 1 kg Mn/ha

Seeding N applied as Urea, Top-ups applied as liquid UAN

Fertiliser costs of Superphosphate (9.1% P, 11% S) $395/t, Gypsum (15% S) $30/t, Muriate of Potash (MOP, 50% K)) $672/t, Urea (46% N) 524/t, Zinc Sulphate (40% Zn) $1800/t, Manganese Sulphate (36% Mn) $1308/t, UAN (42% N by volume) $0.64/L, foliar/top-dressing application costs $8/ha, fertilisers added at sowing costs $0/ha. Non fertiliser costs of $194/ha.

Oil bonus +/- 1.5% per unit of oil (%) either side of 42%, with no oil ceiling. Grain worth $550/t

Results

Soil analysis indicated that the site had adequate levels of P (23 mg/kg) and K (140 mg/kg) in the top 10 cm of soil and S (36 mg/kg) in the top 30 cm of soil. Therefore we expected yield responses to be less than 200 kg/ha for P and less than 150 kg/ha for K and no response to applied S. Overall we found no seed yield response to applied S and K or micro nutrients and 120 kg/ha response to applied P.
Visually the canola responded to applied N and we found on average 15N applied at 8 weeks after sowing increase yield by 50 kg/ha, which was insufficient to cover the cost of applying 15N of $28/ha.
Maximum yield of 1.30 t/ha was produced by applying Superphosphate plus 10N plus 400 kg/ha of gypsum at sowing followed by 15N at 8WAS and 10WAS. However there was no significant difference between the yield of this treatment and Superphosphate plus 10N by 15N at 8WAS, which we would consider district practice.
Maximum gross margin of $460/t was also produced by applying Superphosphate plus 10N plus 400 kg/ha of gypsum at sowing followed by 15N at 8WAS and 10WAS. But once again lower input treatments produced margins which were statistically similar. The lowest input cost treatment which matched the gross margins was Superphosphate at sowing.

Table 1 Soil analysis at Grass Patch in 2016

Trait	Unit	Depth		
		0-10	10-20	20-30
Colour		LTGR	GRBR	BRGR
Gravel	%	5-10	5	5
Texture		Loam	Heavy clay	Heavy clay
Ammonium Nitrogen	mg/Kg	3	4	3
Nitrate Nitrogen	mg/Kg	18	3	4
Total Nitrogen	%	0.08	0.04	0.03
Phosphorus Colwell	mg/Kg	23	11	3
Potassium Colwell	mg/Kg	140	416	619
PBI		17.6	86.1	125.7
Sulphur	mg/Kg	6	10.5	18.9
Organic Carbon	%	0.92	0.38	0.24
Conductivity	dS/m	0.148	0.202	0.24
pH Level (CaCl2)	pH	5.4	8.3	8.8
pH Level (H2O)	pH	6.2	9.5	9.8
DTPA Copper	mg/Kg	0.53	0.49	0.45
DTPA Iron	mg/Kg	70.3	19.83	23.3
DTPA Manganese	mg/Kg	3.02	1.07	1.02
DTPA Zinc	mg/Kg	1.51	0.42	0.16
Exc. Aluminium	meq/100g	0.041	0.088	0.064
Exc. Calcium	meq/100g	1.47	5.51	6.44
Exc. Magnesium	meq/100g	0.77	4.81	6.26
Exc. Potassium	meq/100g	0.36	1.07	1.59
Exc. Sodium	meq/100g	0.5	2.63	4.69
Boron Hot CaCl2	mg/Kg	1.02	8.87	14.34
Aluminium CaCl2	mg/Kg	0.25		

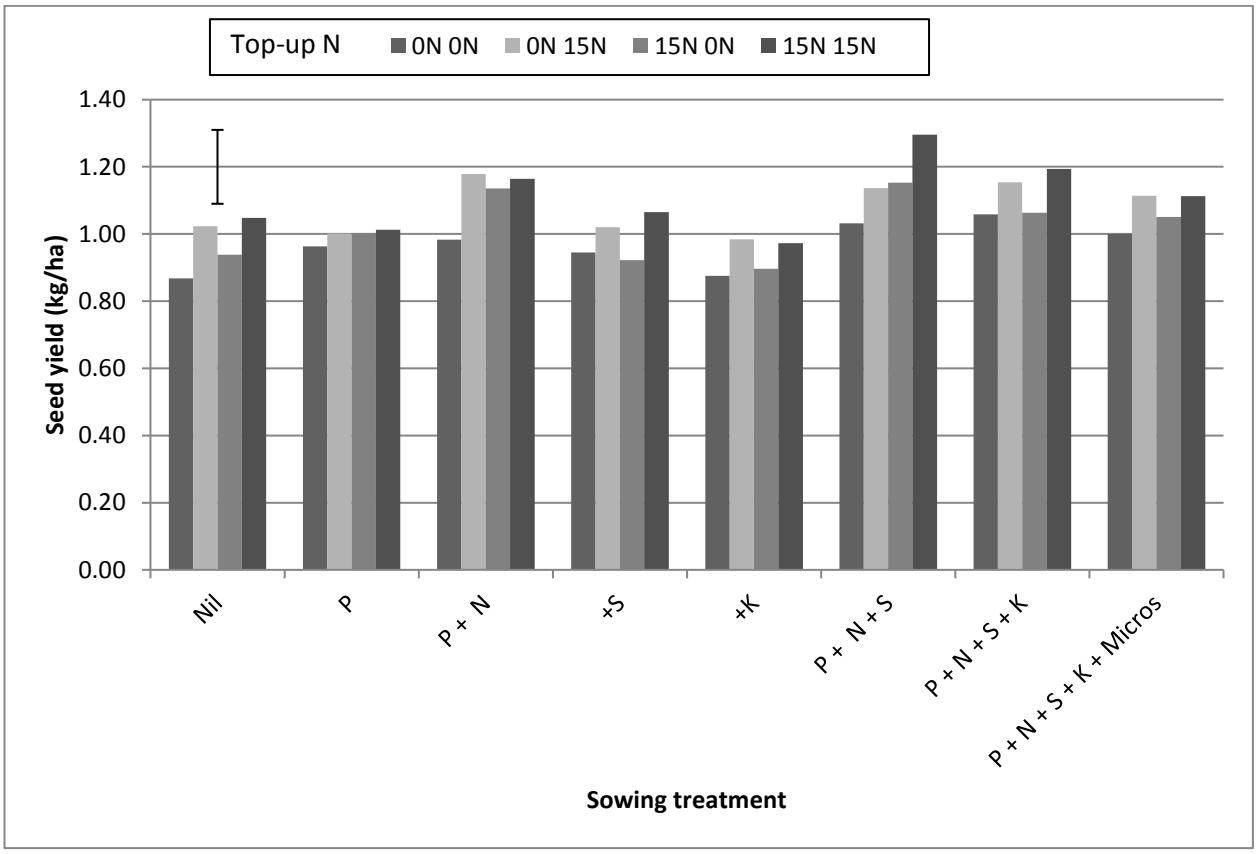

Figure 1 Seed yield of canola at Grass Patch in 2016.

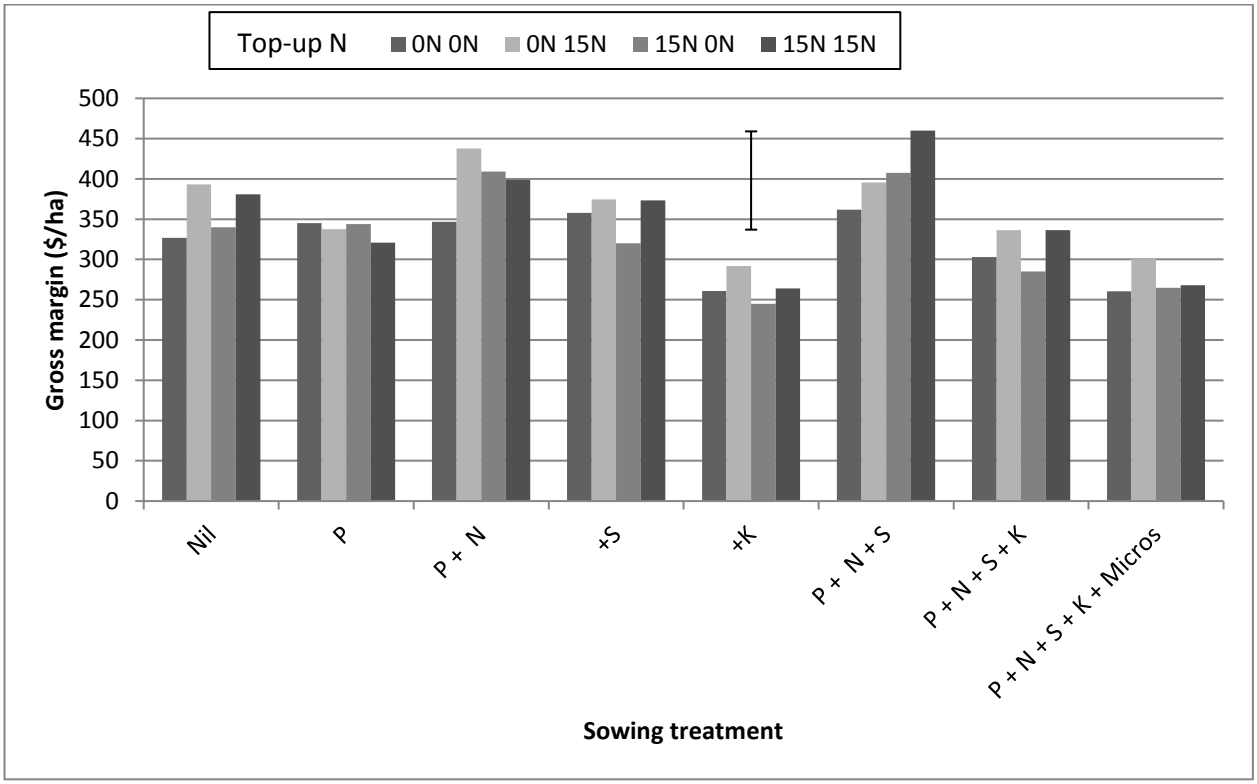

Figure 2 Gross margin of canola at Grass Patch in 2016.

Conclusion

At Grass Patch in 2016 there was no response to fertiliser applications of K, S and micro nutrients. There was a yield response to P and N. Considering the costs of inputs the lowest cost treatment which provided equal maximum gross margin was to apply only Superphosphate at sowing – equivalent to 9 kg P/ha. In this region farmers typically apply Superphosphate plus N or a compound fertiliser at sowing and top-up N at 4- 6 weeks after sowing. This approach in this experiment would have had higher up front input costs, did increase yield but did not lead to higher gross margins. But the farmer approach also is a more balanced nutrient approach, in that nutrients are replaced to balance out nutrients removed in the seed.

Acknowledgements

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Links

For other reports related to this trial see https://www.agric.wa.gov.au/canola or visit GRDC's on-farm trial web site at https://www.farmtrials.com.au

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