GOA Trial Site Report

Can splitting phosphorous application reduce establishment losses and maintain yield in canola?

Trial code:	**GANU02521-1**
Season/year:	Winter 2021
Location:	'Woodlands', Tottenham
Collaborators:	Eric Fishpool

Keywords

GANU025, canola, phosphorous, split application, establishment, Tottenham

Key findings

- Placement of starter fertiliser with the seed negatively impacted germination.
- Yield increases to fertilizer rates up to ~20 kg P/ha.
- There was little or no oil response to P.

Background

Grain Orana Alliance (GOA) has been investigating options to reduce the negative impact of starter fertiliser on canola establishment since 2015.

A summary of the key findings includes:

- canola establishment can be affected by rates as low as 10 kg/ha phosphorus (P) ~50 kg mono ammonium phosphate (MAP)
- placement of fertiliser under the seed (>2cm separation) will mostly eliminate establishment damage, except at very high rates in some circumstances
- placement of P on the soil surface (either prior to sowing or broadcast post-sowing) eliminated damage to the crop and, in most trials, no yield reduction resulted
- where yield loss did occur due to this placement method, the season was generally drier with potentially less root activity on the soil surface.

GOA aims to investigate 'split applications' as an alternative, where a small portion of the starter fertiliser is placed with the seed and the remainder applied to the soil surface.

- Lower fertilizer quantities at sowing should maximise emergence and will increase machinery efficiency with less time spent refilling the seeder.
- The surface applied fertiliser could possibly be delayed
- Develop options for growers who do not have the machinery to deep band fertilizer.

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Aims

To investigate whether splitting the application of P can minimise establishment damage while maintain yields, particularly in dry years. Split P applications to include timing, rates and placement options.

Methods

Trial details						
Trial year	Winter 2021					
Sowing configuration	250 mm row spacing, knife point press wheel Deep Blade Seeding					
Paddock history	2020 wheat		**Soil test**	Nitrogen (N) (kg/ha)	Colwell P (ppm)	Sulfur (ppm)
	2019 barley		0-10cm	32	43	2
			10-120cm	62	-	-
Key dates	Sowing	Harvest	Comment: marginal establishment			
	21/4/2021	17/11/2021				

Treatments: All P applied as MAP

Placement	**Description**	
With seed	Traditional method of P application, banded with the seed in the same pass	
Immediately before sowing (IBS)	Broadcast onto the soil surface prior to sowing to be incorporated by the seeder	
Broadcast	Spread on the soil surface post-plant, no incorporation	
Split - high	Base rate: 10 kg/ha P with seed and the balance IBS	These treatments included a 0 P with balanced N (as urea) to test the effect of the N component of MAP on establishment
Split - low	Base rate: 5 kg/ha P with seed and the balance IBS	
Control	No P applied, all application methods used	

Rates

Rates P (kg/ha)	0	5	10	15	20	30	N in MAP balanced with urea.
MAP (kg/ha)	0	23	46	68	91	137	Control plots – N (Urea) added IBS. Split treatments – Balanced N also split.

Trial design	Type: small plot (~12m x 2m) Design: split randomized block Replication: 4	Analysis ASREML – randomized complete block Tested to a 95% confidence interval
Observations and measurements	• Plant establishment • Grain yield and quality	

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Growing season rainfall

Table 1. 2021 rainfall and long-term rainfall at Tottenham[1]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2021	54	87	133	0	11	65	49	26	42	22	129	49	**667**
LTA	48	47	43	35	36	36	31	31	29	41	40	45	**462**

Results

Plant Establishment

- Placement of starter fertiliser with the seed negatively impacted germination at rates equivalent to 15 kg P/ha and above.
- Where 20 kg P/ha was applied, there was a 37% reduction in establishment compared to the control (Figure 1).
- There was no difference between the split low and split high with no P (balanced N only) and the control.

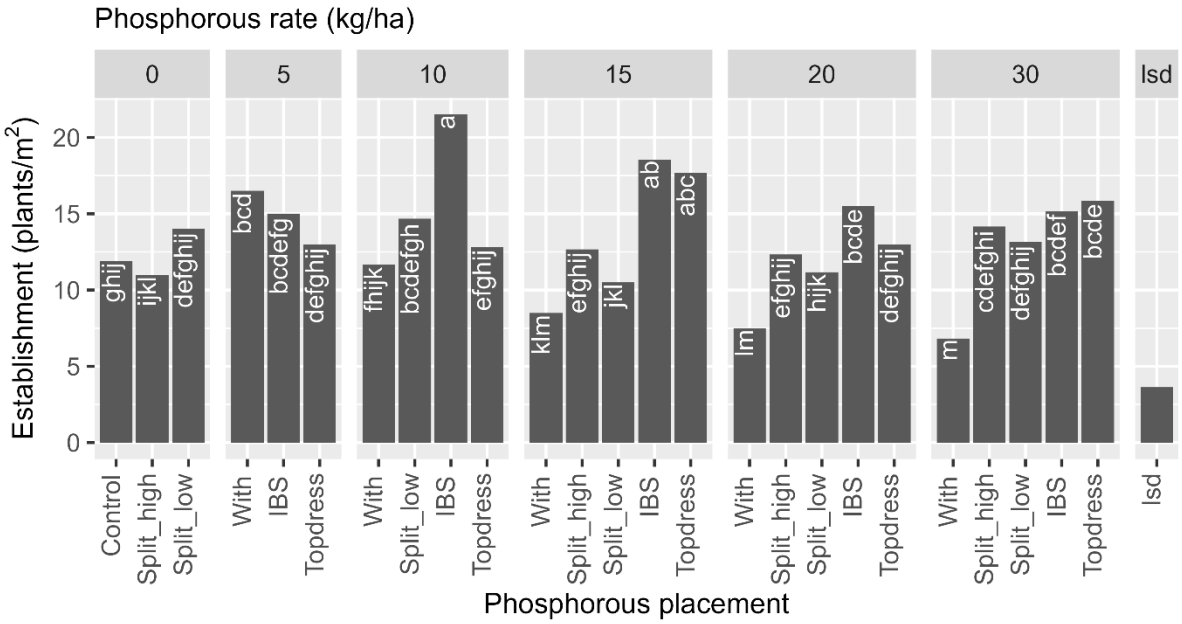

Figure 1. Canola establishment in response to varying rates and placement of P. Treatments with the same letter are not significantly different.

[1] SILO BOM Gridded Data

Yield

- There was a yield response to the differing rates of P.
- Yields increase up to fertilizer rates of ~20 kg P/ha.
- Splitting the P application did not result in lower yields.
- The split low treatment had higher yields than the IBS treatment and with treatment at the 20 and 30 kg P/ha rates respectively (Figure 2).

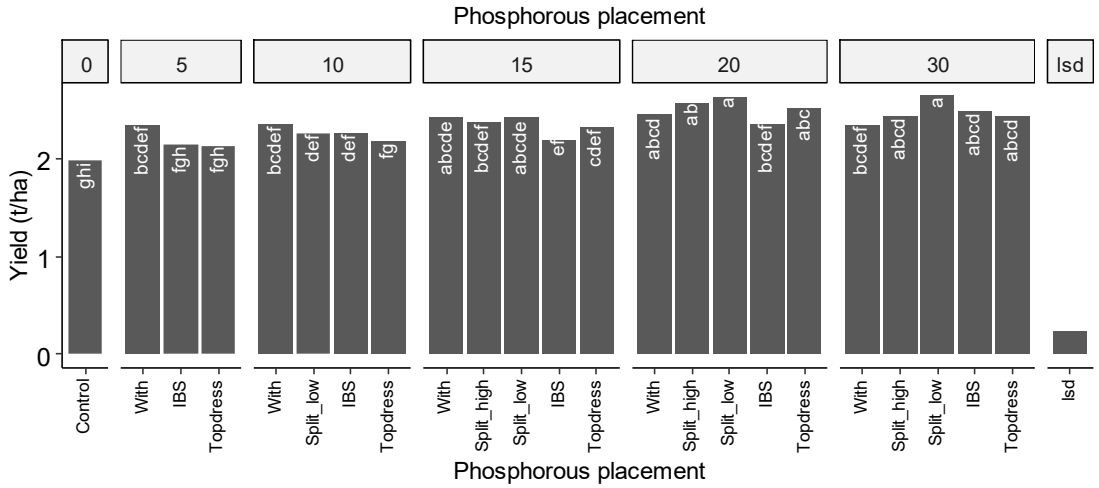

Figure 2. Canola yields (t/ha) in response to varying rates and placement of P. Treatments with the same letter are not significantly different.

Oil

- Application of 15 kg P/ha resulted in a higher oil content than the split low treatment.
- The control had lower oil content than the split low, IBS and Topdressed treatments at 30 kg P/ha Figure 3).

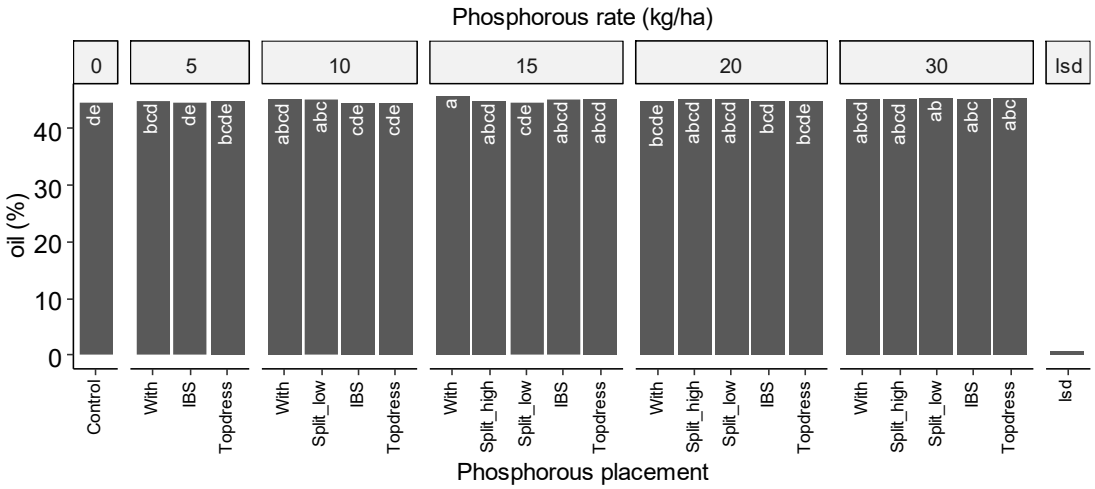

Figure 3. Canola oil (%) in response to varying rates and placement of P. Treatments with the same letter are not significantly different

Discussion

This trial was sown at ~25-35 mm seeking moisture. There was a significant rainfall event soon after which washed soil back into the furrows and limited germination to an average of 13 plants/m^2. Germination where P was placed with the seed tended was supressed, particularly at the higher rates, supporting placement of starter fertiliser away from the seed.

2021 was an above average rainfall season, and the canola was able to overcome the low plant stand and yielded an average of 2.3 t/ha across the trial. Although germination was supressed where P was placed with the seed at the higher P rates, the crop was still able to compensate in these treatments and yielded as well as other placement options.

There was a P response of around 0.5 t/ha between the best yielding treatments and nil P applied. This may not have been expected due to the relatively high starting P (Colwell P of 43 ppm), which should have been sufficient to support a 2 t/ha canola crop as the National Crop suggests that 95% maximum canola yield can be achieved with 25 ppm[2] P.

The results from this site support the placement of starter fertiliser away from the seed or splitting the application so reduce the amount placed with the seed to optimise establishment and sowing efficiencies.

[2] smartfertilisers.com.au/making-sensible-phosphorus-decisions/

Conclusion

Placement of P away from the seed at rates higher than 5 kg/ha rates can reduce negative impacts on germination. However, in dry seasons this may have limited availability to the plant.

Splitting the application to apply a smaller portion of the fertiliser may also reduce the impact and maintain sufficient P in a location where the plant has better access to it in dryer years.

Even in soils with seemingly adequate levels of P it is still a good idea to use starter fertiliser.

Acknowledgements

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DISCLAIMER — TECHNICAL

Appendix 1

Phosphorous							
Rate	Placement	Plant establishment		Yield		Oil	
(kg/ha)		(plants/m2)		(t/ha)		(%)	
0	Control	11.9	ghij	2.0	ghi	44.6	de
	Split_high	11.0	ijkl	1.9	hi	44.3	e
	Split_low	14.0	defghij	1.8	i	44.6	cde
5	IBS	15.0	bcdefg	2.1	fgh	44.5	de
	Topdress	13.0	defghij	2.1	fgh	44.8	bcde
	With	16.5	bcd	2.3	bcdef	45.0	bcd
10	IBS	21.5	a	2.3	def	44.6	cde
	Split_low	14.7	bcdefgh	2.3	def	45.2	abc
	Topdress	12.8	efghij	2.2	fg	44.7	cde
	With	11.7	fhijk	2.4	bcdef	45.0	abcd
15	IBS	18.6	ab	2.2	ef	45.1	abcd
	Split_high	12.7	efghij	2.4	bcdef	44.9	abcde
	Split_low	10.5	ijkl	2.4	abcde	44.7	cde
	Topdress	17.7	abc	2.3	cdef	45.1	abcd
	With	8.5	klm	2.4	abcde	45.6	a
20	IBS	15.5	bcde	2.4	bcdef	45.0	bcd
	Split_high	12.3	efghij	2.6	ab	45.1	abcd
	Split_low	11.2	hijk	2.6	a	45.2	abcd
	Topdress	13.0	defghij	2.5	abc	44.9	bcde
	With	7.5	lm	2.4	abcd	44.7	bcde
30	IBS	15.2	bcdef	2.5	abcd	45.1	abcd
	Split_high	14.2	cdefghi	2.4	abcd	45.1	abcd
	Split_low	13.2	defghij	2.6	a	45.4	ab
	Topdress	15.8	bcde	2.4	abcd	45.3	abc
	With	6.8	lm	2.3	bcdef	45.1	abcd
lsd	lsd	3.6		0.2		0.7	