

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

Trial code:	GANU02521-4
Season/year:	Winter 2021
Location:	'Gindurra', Canowindra
Collaborators:	Viridis Ag, Rob Atkinson

Keywords

GANU025, canola, phosphorous, split application, establishment

Key findings

- Placement of starter fertiliser with the seed can reduce plant establishment.
- The lowest plant population was where the highest rate of P was placed with the seed.
- Plant population decreased with increasing rates of P.
- Splitting the application and/or moving all or part of the fertiliser away from the seed reduces the impact on germination without impacting yields.

Background

Grain Orana Alliance (GOA) has been investigating options to reduce the negative impact of starter fertiliser on more than 24 canola establishment trials over 7 years.

A summary of the key findings:

- 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 (deep banding) with greater than 2 cm of 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 smaller 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 refilling time of the seeder.
- The surface applied fertiliser could possibly be delayed, particularly in circumstances where establishment is more risky (dry sowing or on marginal moisture)
- Develop options for growers who do not have the machinery to deep band fertilizer.

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 date			Winter 2021				
Sowing configuration			250 mm row spacing, disc seeder.				
Paddock history	2020 Wheat (5.5 t/ha)			Soil test	Nitrogen (N) (kg/ha)	Colwell P (ppm)	Sulfur (ppm)
	2019 Canola			0-10cm		48	8
	2018 Pasture			0-60cm	~100		
Key dates	Sowing		Harvest		Comment: very good establishment		
	3/5/2021		23/11/2021				
Treatments: All P applied as MAP							
Placement	Description						
With seed	Traditional method of P application, banded with the seed in the same pass						
IBS (immediately before sowing)	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						
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 Control plots – N (Urea) added IBS Split treatments – Balanced N also split
MAP (kg/ha)	0	23	46	68	91	137	
Trial design	<u>Type:</u> small plot (~12m x 2m)					Analysis ASREML – randomized complete block. Tested to a 95% confidence interval	
	<u>Design:</u> split randomized block						
	<u>Replication:</u> 4						
Observations and measurements	<ul style="list-style-type: none">Plant establishmentVegetation index (2) NDVI – results not providedGrain yield and quality						

Growing season rainfall

Canowindra rainfall (mm)

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL
2021	61	76	101	1	34	88	75	64	72	44	130	47	791
Long term average	46	53	61	37	36	53	47	41	47	49	73	60	604

Results

Plant Establishment

- Established plant population ranged from 40-50 plants/m².
- The lowest plant population was 33 plants/m² where the highest rate of P was placed with the seed.
- Placement of P with the seed tended to result in decreasing populations as the rate of P increased (**Figure 1**), rates of 15 kg/ha and above were significantly lower than the control.

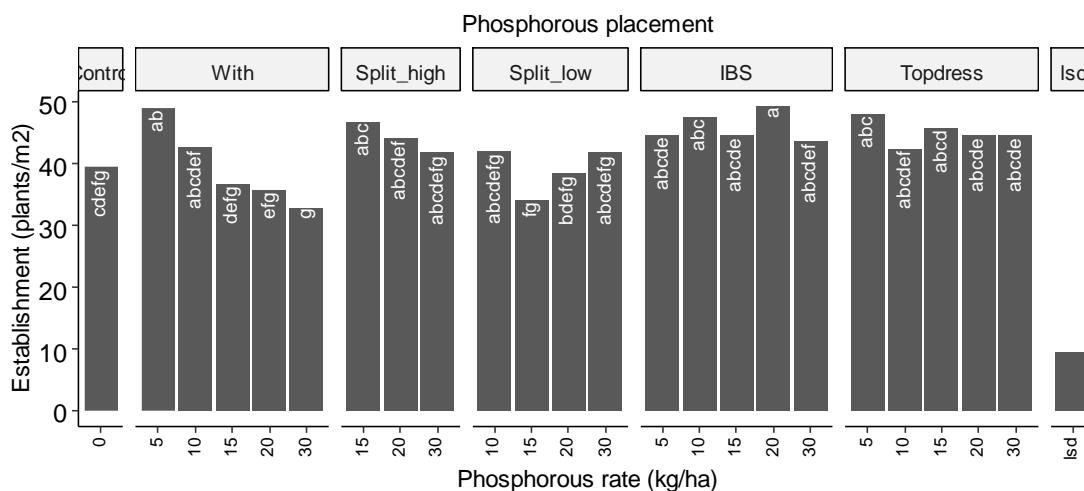


Figure 1. Canola establishment in response to varying rates and placement of P. Treatments with the same letter are not significantly different.

Yield

- There was a yield response to P of >1t/ha when comparing the control with that of the split low and IBS treatments at the highest rate.
- A yield increase of 0.3-0.5 t/ha was measured with the addition of 5 kg/ha P (**Figure 2**).

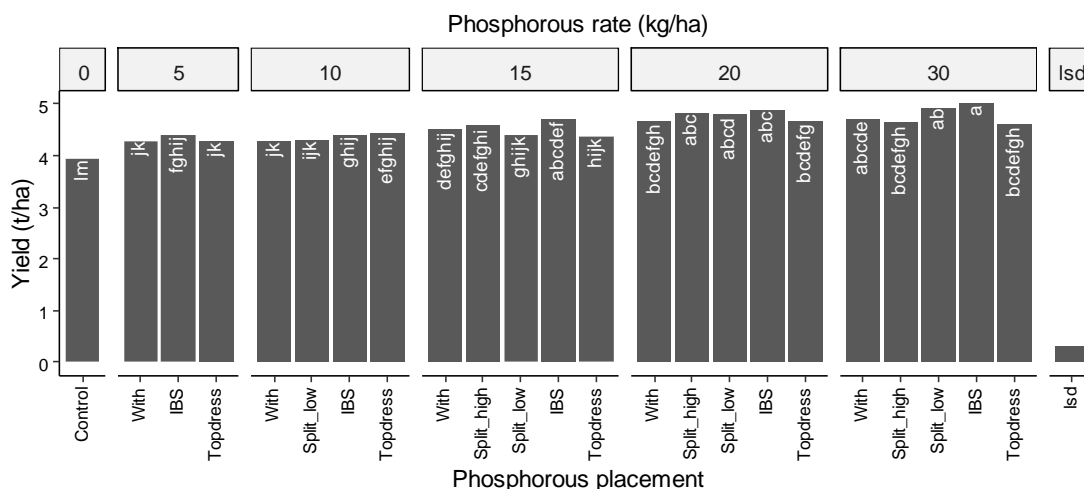


Figure 2. Canola yields (t/ha) in response to varying rates and placement of P. Treatments with the same letter are not significantly different.

Oil

- There was less than 1% difference in oil content between the highest and lowest treatments.
- Where oil is lower than control corresponds to where yields were higher, tending to indicate a yield dilution effect (**Figure 3**).

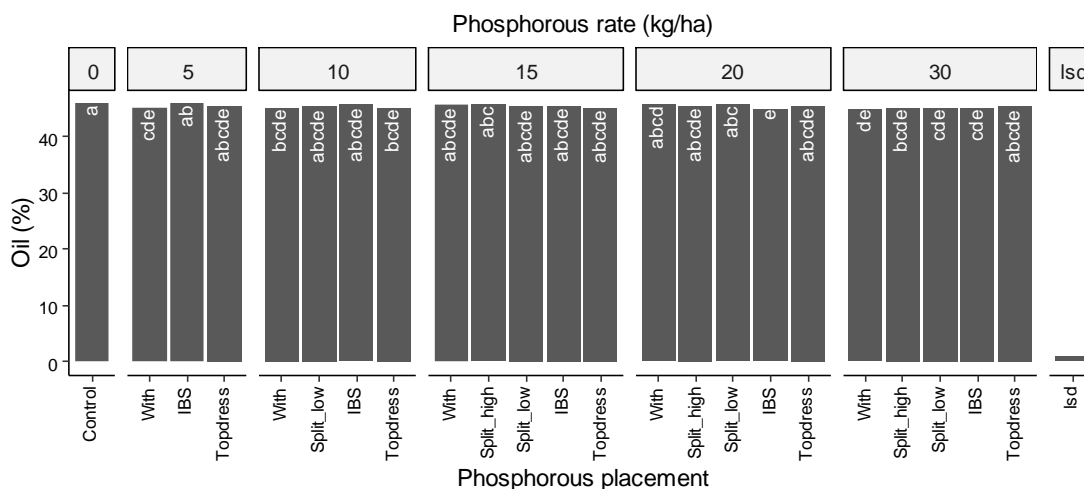


Figure 3. Canola oil (%) in response to varying rates and placement of phosphorous. Treatments with the same letter are not significantly different.

Discussion

2021 was a very good season with close to optimal sowing conditions with ~290 mm of in-crop rain.

Crop establishment tended to decrease as the rate of starter fertiliser increased when it was placed with the seed. This might be expected as the narrow opening slot of the disc seeded has a tendency for less seed fertiliser separation than knife point systems.

Where a reduced amount of P was placed with the seed (split application) there were in greater differences in establishment compared to where it was placed away from the seed.

Overall establishment was very good with populations more than adequate for optimal yields in all treatments.

There was a yield response to starter fertiliser of close to 0.9 t/ha up to the rate of 20 kg P/ha (**Figure 4**). Placement of starter fertiliser either as a split application or away from the seed (IBS or topdressed) did not result in any yield reductions compared to where it was placed with and was a slight improvement over where it was IBS.

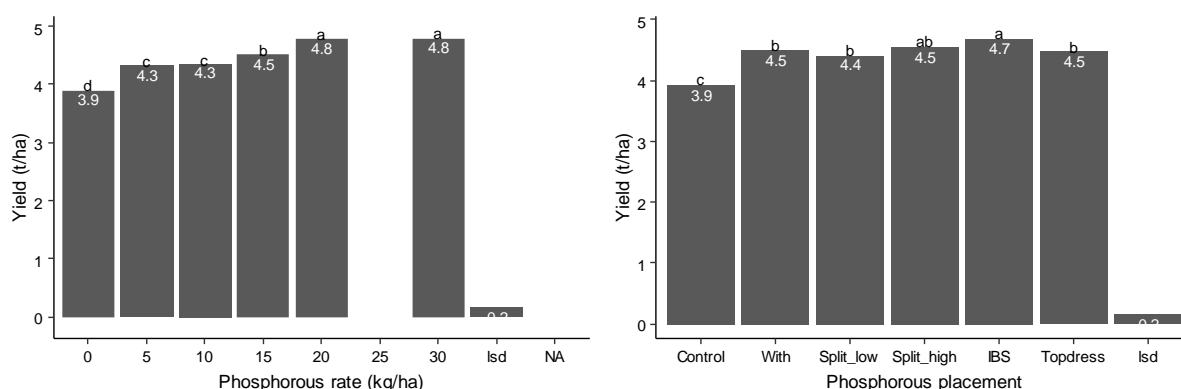


Figure 4. Canola yields (t/ha) in response to rate and placement of P. Treatments with the same letter are not significantly different.

Conclusion

Placement of P away from the seed at higher starter fertiliser rates may reduce negative impacts on germination. Placement of starter fertiliser away from the seed can result in similar yields to placement of P with the seed.

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Appendix

Phosphorous				
Rate	Placement	Plant establishment	Yield	Oil
(kg/ha)		(plants/m ²)	(t/ha)	(%)
0	Control	39.6cdefg	3.9lm	45.8a
5	IBS	49.0ab	4.3jk	45.0cde
	Topdress	44.8abcde	4.4fghij	45.8ab
	With	48.1abc	4.3jk	45.4abcde
10	IBS	42.7abcdef	4.3jk	45.1bcde
	Split_low	42.2abcdefg	4.3ijk	45.4abcde
	Topdress	47.7abc	4.4ghij	45.7abcde
	With	42.5abcdef	4.4efghij	45.0bcde
15	IBS	36.7defg	4.5defghij	45.5abcde
	Split_high	46.8abc	4.6cdefghi	45.7abc
	Split_low	34.1fg	4.4ghijk	45.2abcde
	Topdress	44.7abcde	4.7abcdef	45.5abcde
	With	45.8abcd	4.4hijk	45.1abcde
20	IBS	35.7efg	4.7bcdefgh	45.7abcd
	Split_high	44.2abcdef	4.8abc	45.4abcde
	Split_low	38.5bdefg	4.8abcd	45.7abc
	Topdress	49.4a	4.9abc	44.8e
	With	44.7abcde	4.7bcdefg	45.4abcde
30	IBS	33.0g	4.7abcde	44.9de
	Split_high	42.0abcdefg	4.7bcdefgh	45.0bcde
	Split_low	41.8abcdefg	4.9ab	45.0cde
	Topdress	43.7abcdef	5.0a	45.0cde
	With	44.7abcde	4.6bcdefgh	45.3abcde
Isd	Isd	9.6	0.3	0.8