GOA Trial Site Report

Phosphorous placement and its effect on establishment and performance of canola

Trail Code: GONU00515-2

Season/year: Winter 2015

Location: 'Spicers Creek', Wellington

Collaborators: Joe and Sam Mason

Keywords

GONU00515-2, phosphorus, deep banding, IBS, canola, germination, establishment. Wellington

Take home messages

Increasing rates of Phosphorus (P) or varying it placement in relation to the seed had no statistically significant impact on established plant populations.

Placing the P below or above the seed at higher rates did result in a trend to result in higher populations than when the same rate was applied with the seed.

Canola yields or oil percentage did not result in any statistically significant response to any added P at this site despite a Colwell P of 12 mg/kg.

There was only a trend for yields to increase from Nil P up to 10kg/ha often with little further increase at 20 kg/ha.

The trend for increased yields as P rate increased was similar regardless of whether the P was placed below, with or above the seed which deserves further investigation.

Background

Phosphorus is considered important nutrient for canola production at two key stages in the growth cycle, establishment – to support root development and during biomass accumulation.

Traditionally, the phosphorus has been applied only at planting and often banded in close proximity to the seed. This approach is likely based on the fact that P is quite immobile in the soil and needs to be placed close to the developing root systems of crops.

Damage to establishing crops by placing fertiliser close to seed has long been accepted but trials in 2013 by the Department of Primary Industries[1] demonstrated significant reductions in crop establishment with increasing rates of P (up to 20 kg/ha). Yields also increased with increasing rates of P despite the suppression in emergence. However, the need to increase seeding rates to compensate for these establishment losses to achieve acceptable plant stands is a significant cost to growers. Another aspect is issue is the unpredictability and variability of the level of impact of establishment, this can make targeting an ideal seeding rate difficult. If the effect on establishment

[1] https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/02/Canola-agronomy-research-in-central-west-NSW

is more than predicted very poor stands may eventuate and in those situation the crop may not recover.

The dilemma therefore exists- canola crops require P to optimise yields but placing it with the seed can lead to significant issues. The DPI trials did not investigate alternate methods of applying P fertiliser to the canola crop.

Many modern seeding machines possess the ability to band fertiliser below the seed and also there is the opportunity with any sowing equipment to broadcast fertiliser either pre or post seeding. This trial is designed to investigate if the application of P using these alternate methods or placement of P could avoid the damage at establishment while maintaining the P fertilizer response.

Aims

Determine if varying the placement and the rate of P fertiliser can reduce the negative impact on crop establishment, while maintaining the P responsiveness of canola yields.

Methods

The trial was a small plot, randomised complete block design with three replicates established in the Autumn of 2015.

The trial looked at the rate of P applied and its placement on germination and yield of canola seeded at two differing plant populations. All combinations these three variable were used in the trial design.

- **Rates:** Three rates of P in the form of Triple Super were applied at 0, 10, and 20 kg/ha of P
- **Placement:** The P fertiliser was applied by three methods-
  - Below the seed, in a band approximately 7-8 cm below the soil surface and 4.5 – 5 cm directly below the seed apply in the same pass
  - With the seed- banded with the seed in the same pass
  - Broadcast onto the soil surface prior to seeding so as to be incorporated by the seeder (IBS)
- **Plant population:** A high plant population of 45 plants/m^2 and low population of 15 plants/m^2

Table 1. Trial site details

Trial Establishment Date	Autumn 2015	Seeding rate	0.8 & 2.5 kg/ha
Crop and Variety	Canola – 43C80CL	Harvest Date	11/11/2015
Sowing date	29/4/2015	Row Spacing	27.5 cm
Seedling equipment	Double Boot Tyne	Soil type	Clay Loam
Nitrogen Crop Nutrition (kg/ha)	100 (seeding) + 100 (top-dressed) Urea	Previous Crop	Wheat
Site Nutrition: Phosphorus	Colwell P: 12 ppm	Pre Sowing Stubble Management	Cultivated

Results were analysed using ANOVA for the analysis of variance and results compared by using a least significant difference (LSD) method with a 95% confidence interval. Any references to

differences between treatments should be assumed to be statistically different unless otherwise stated.

Results

A table of the full results are contained in Appendix 1 at the end of the document.

Plant Establishment: There were no statistically significant influence of the rate or placement of P fertiliser on the resultant plant populations as illustrated in Figure 1.

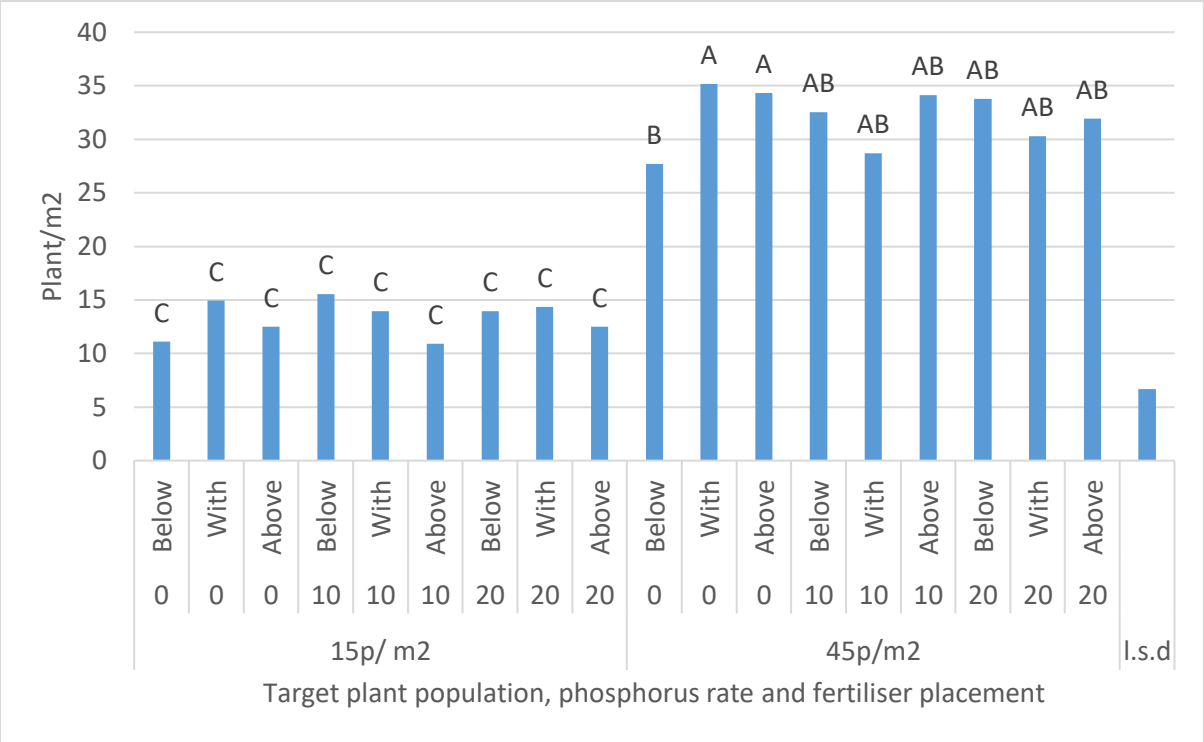

Figure 1 Plant population (plants/m^2) 29 days after sowing (DAS)

Plant Vigour: was assessed using a handheld GreenSeeker NDVI 5 times during the growing season.

- **Seed rate:** Differences in the vegetation index were detected at all 5 assessment dates
- **P rate:** No differences were detected in the P rate for the first two assessments (29 and 55DAS), for the remaining three assessment dates treatments with no P had lower vegetation index than either the 10 or 20 P kg/ha treatments.
- **Location:** There was no clear pattern of influence of the location of the P on the vegetation index

Yields: At either of the two target populations at any one of the three different P placements there was no influence of the P rate. Also at either of the two target populations at any one P rate there was no influence of P placement.

Oil %: At either of the two targeted plant populations there was no influence of P rate or placement on oil%.

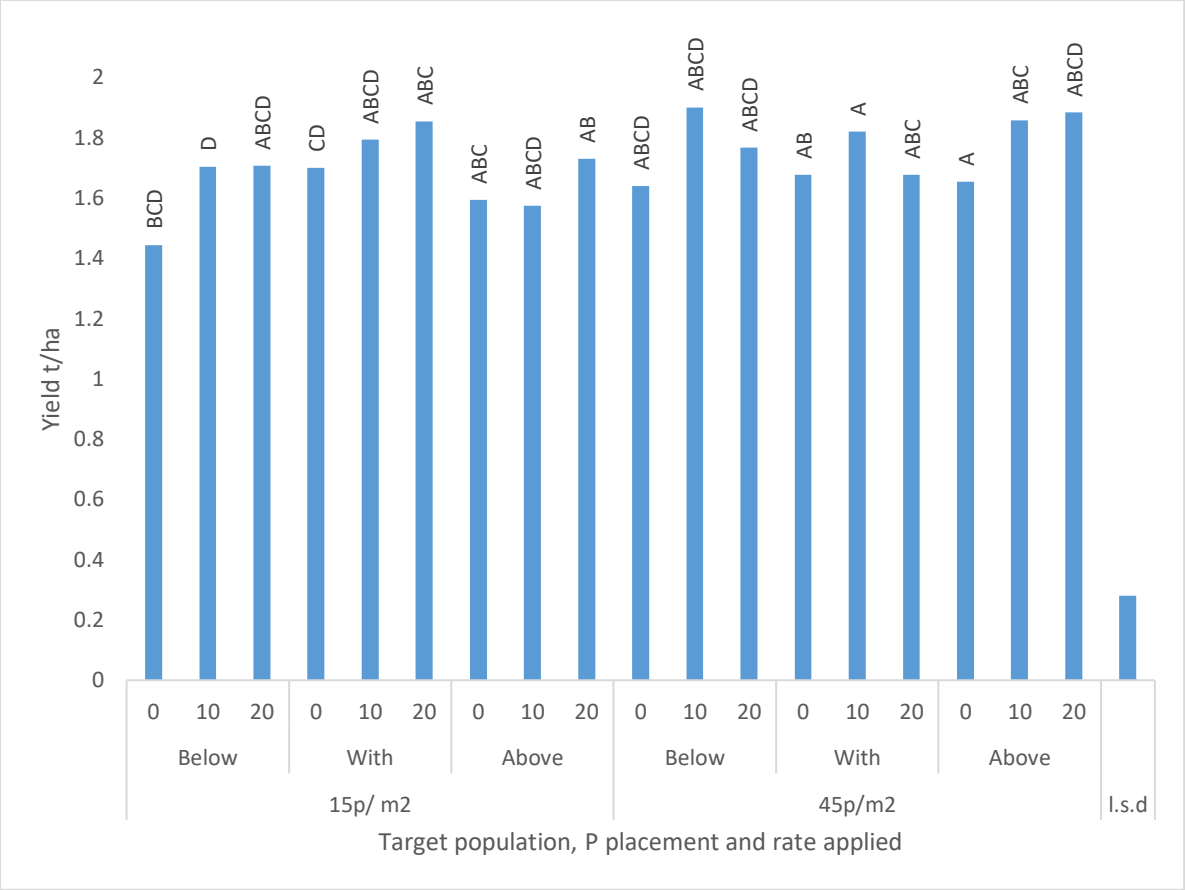

Figure 2 Yield response in two target plant populations in response to varied P rate and placement

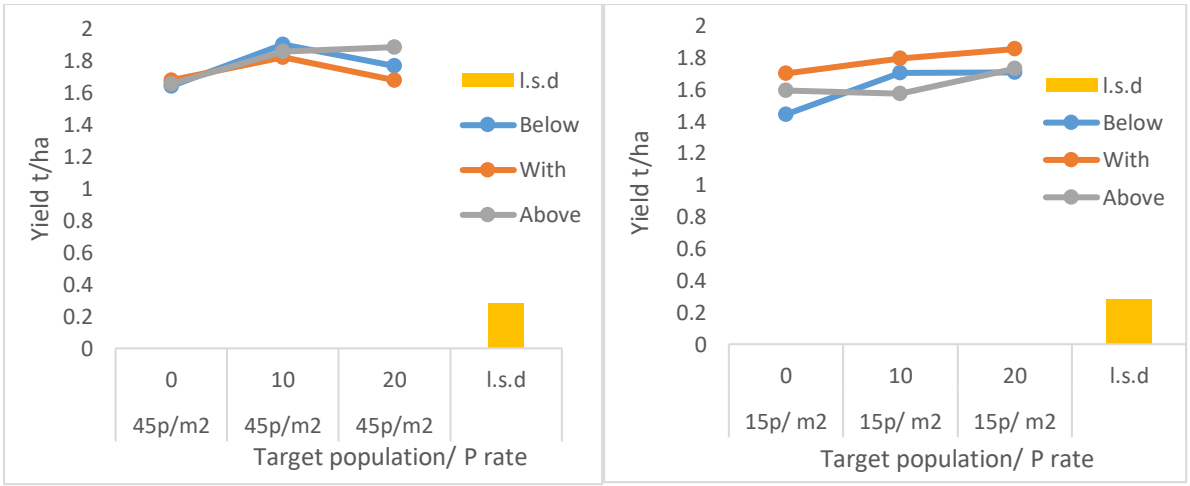

Figure 3 Yield response at two target populations to various P rates, by P placement options.

Discussion

The conditions at sowing and just after were very wet at this site, this may explain the limited impacts of the P on canola germination (when compared to the experience of the DPI) and the limited variation to P placement.

Only at the higher target population with both 10kg/ha or 20 kg/ha of P applied was there a trend for higher plant populations when the fertiliser was placed either above or below the seed but as discussed above this was not statistically significant.

In this trial, as detailed above there was no overall significant impact on yield in response to P rate or placement. There was a number of comparisons that can be seen in Figure 2 and Figure 3 that showed a trend for yield to increase as P rate is increased regardless of the placement of the P. That is, it did not matter where the P was placed either with, below or above the seed a similar trend to respond was apparent.

However, as the site is not clearly responsive to increasing P rates it cannot be conclusively said that the placement of P had no effect on the relative crop response, but the similarity in responsiveness regardless of P placement suggest that the placement of P deserves further investigation.

In this trial plant reducing plant populations from 35 to 15 plants/m^2 did not result in lower yields. This would tend to suggest that a 50% reduction in emergence due to fertiliser effects will not always result in a yield penalty due to canola's ability to compensate. However, there is a danger if targeting a low population and there was a negative impact establishment that plant populations could drop well below a range in which the canola can compensate- a situation that was not demonstrated in this trial.

Conclusion

In this trial there was a limited effect of P fertiliser on canola establishment regardless of the rate applied or its placement. As such the trial is inconclusive as to whether varying the placement of P is a useful strategy to avoid potential negative effects of P fertiliser at seeding.

The trial did not show a statistically significant increase in yield to the increasing rate of P fertiliser although a trend did exist. As the trial was not clearly responsive to P no conclusions can be drawn as to the relative efficiencies of applying P fertiliser either above or below the seed but yields tended to follow the same upwards trend to increasing P rates regardless of its placement. This observation requires further investigation.

Acknowledgements

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Appendix

Table 2. Impact of plant populations, P rates and P placement on yield and % oil of canola. Results followed by the same letter are not significantly different.

Target Plant Population	P-rate (kg/ha)	P Placement	Plant Population plants/m^2		Yield (t/ha)		Oil %	
15p/ m2	0	Below	11.11	C	1.44	D	38.0	ABC
		With	14.95	C	1.70	ABCD	38.8	A
		Above	12.523	C	1.59	BCD	38.8	A
	10	Below	15.557	C	1.70	ABCD	37.0	BCD
		With	13.937	C	1.79	ABC	37.9	ABC
		Above	10.907	C	1.57	CD	38.2	ABC
	20	Below	13.937	C	1.71	ABCD	36.7	CD
		With	14.343	C	1.85	AB	37.2	BCD
		Above	12.527	C	1.73	ABC	38.0	ABC
45p/m2	0	Below	27.677	B	1.64	ABCD	38.4	AB
		With	35.153	A	1.68	ABCD	39.0	A
		Above	34.347	A	1.65	ABCD	37.5	ABCD
	10	Below	32.527	AB	1.90	A	37.5	ABCD
		With	28.687	AB	1.82	ABC	37.5	ABCD
		Above	34.14	AB	1.86	AB	37.9	ABC
	20	Below	33.777	AB	1.77	ABC	36.1	D
		With	30.303	AB	1.68	ABCD	36.7	CD
		Above	31.92	AB	1.88	A	36.8	BCD
		l.s.d	6.66		0.28		1.6	