GOA Trial Site Report

Phosphorous placement and its effect on establishment and performance of canola

Trail Code: GONU00515-1

Season: Winter 2015

Location: 'Inglewood', Gilgandra

Trial Co-operators: Kilby family

1.1 Keywords

GONU00515-1, phosphorus, deep banding, IBS, canola, germination, establishment, Gilgandra

1.2 Take home messages

Increasing rates of Phosphorus (P) placed with the seed had a limited effect on germination, only at the highest rate of P was establishment lower.

Placing the P below the seed also had little effect on germination but there was a trend for less suppression of germination when the P was placed above the seed.

Placement of P below the seed or on the soil surface resulted in a similar yield response to when it was placed with the seed.

Canola yields increased with increasing rates of applied P

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

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

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.

1.4 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.

1.5 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	30/10/2015
Sowing date	27/4/2015	Row Spacing	27.5 cm
Seedling equipment	Double Boot Tyne	Soil type	Sandy Clay Loam
Nitrogen Crop Nutrition (kg/ha)	100 (seeding) + 100 (top-dressed) Urea	Previous Crop	Wheat
Pre Sowing Stubble Management	Burnt pre-sowing	Starting Soil Nutrition	Colwell P: 21 ppm Sulphur: 6 ppm

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.

1.6 Results

Plant Establishment: In the low population treatments an average plant density of 14.6 plants/m^2 was achieved (against a target of 15) while in the high population treatments 30.4 plants/m^2 was achieved against the target of 45.

For the low population treatments there was **no** impact on germination regardless of P rate or placement.

At the higher plant population, only the 20 kg P/ha placed with the seed had a lower plant population than the nil P treatment but also when the same amount broadcast on the surface. At the lower rate of 10 kg/ha of P there was no impact on germination.

However, there was a trend for lower or no P treatments or where P was placed away from the seed (i.e. above or below) to result in the higher plant populations.

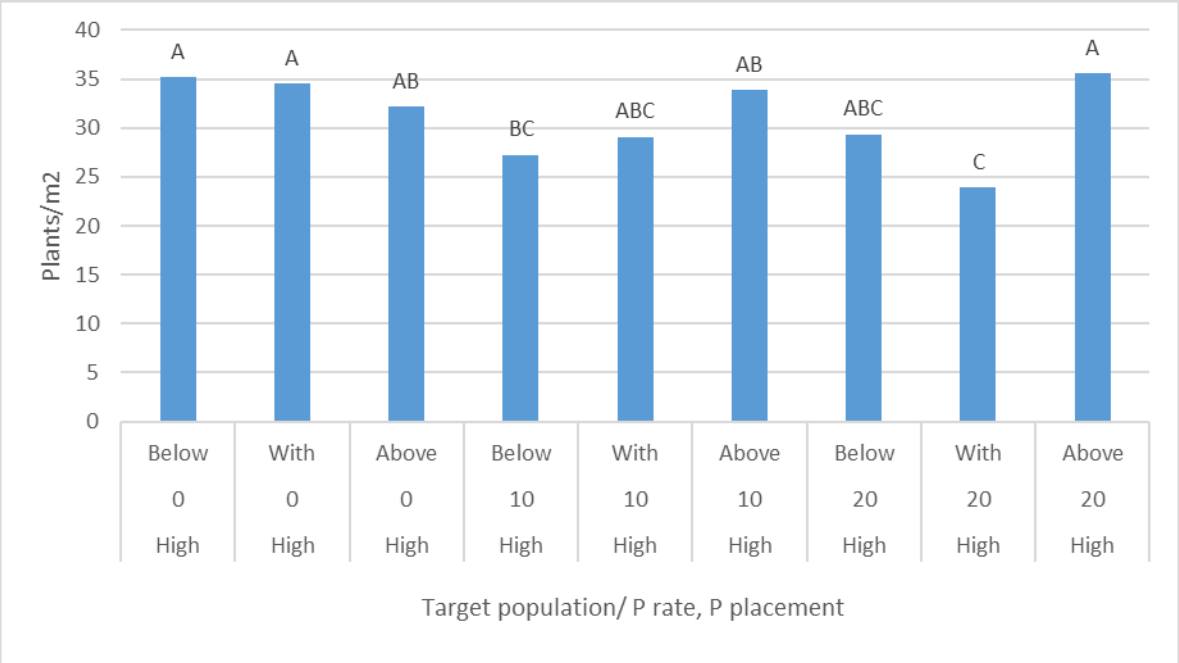

Figure 1. Plant establishment (plants/m^2) in response to P rate and P placement with the high targeted plant population.[2]

Yields: The crop yields at this site tended to increase as the P rate increased. Any differences in plant population were not evident in the final yields nor was there any yield difference between the 3 placement options, the interaction between these treatment effects can be seen in Figure 2.

[2] Treatments with the same letter are not significantly different from each other.

Figure 2. Crop yield and oil% response in two targeted plant populations to differing P rate and P placement

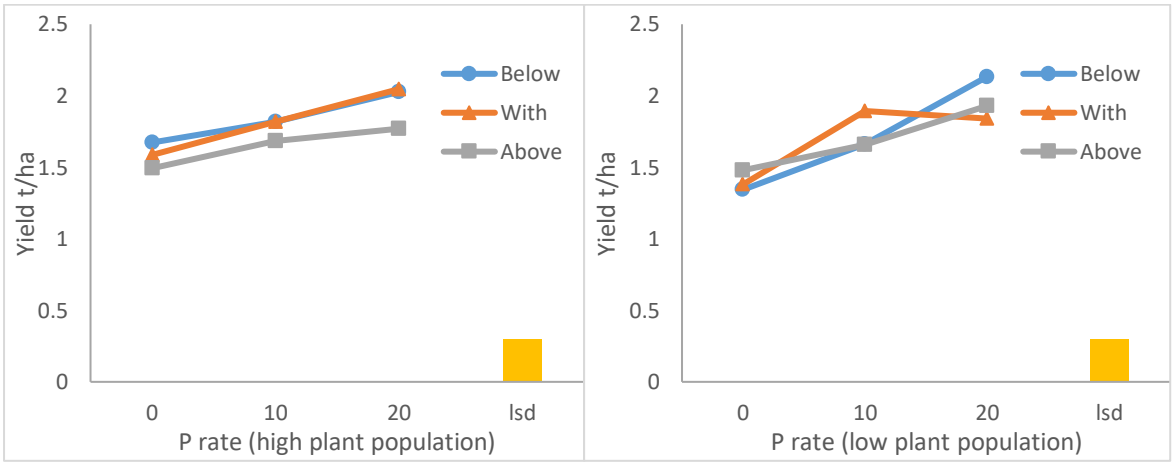

Figure 3. Yield response for the high (left) and low (right) plant populations to various P rates by P placement options.

1.7 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.

In this trial the placement of P on the soil surface followed by incorporating it by sowing (IBS) yielded as well as placing P with or below the seed at planting. This is an interesting observation as it was

not expected to show a yield response, due to the relative immobility of P in the soil. It would appear that the relatively shallow incorporation and wet conditions has allowed the plant to access this P. It may also be possible that the P placed in a band may limit how easily it can be accessed under dry conditions.

In this trial plant reducing plant populations from 30 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.

1.8 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 show a positive response in yield to the increasing rate of P fertiliser increasing yield by 500 kg/ha from the addition of 20 P kg/ha. Interestingly the relative response to increasing P rates regardless of the placement was similar indicating that spreading P on the surface, or deep banding P fertilisers may be a comparable alternative to placement with the seed.

1.9 Acknowledgements

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, the authors would like to thank them for their continued support. Special thanks goes out to the Kilby family from Gilgandra who hosted this trial.

1.11 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.

Targeted plant population	P rate (kg/ha)	P placement	Yield (t/ha)		Oil (%)	
15	0	Above	1.6	EFGHI	42.1	ABCDE
		Below	1.3	I	41.9	BCDE
		With	1.4	HI	41.9	BCDE
	10	Above	1.7	EFGH	42.2	ABCD
		Below	1.7	DEFGH	41.4	CDE
		With	1.9	ABCDE	42.1	ABCD
	20	Above	2.0	ABCD	41.4	CDE
		Below	2.1	A	41.5	CDE
		With	1.8	ABCDEF	41.4	DE
45	0	Above	1.5	GHI	42.5	AB
		Below	1.7	DEFGH	42.6	AB
		With	1.6	FGHI	42.9	A
	10	Above	1.7	DEFG	42.1	ABCD
		Below	1.8	BCDEF	41.9	BCDE
		With	1.8	BCDEF	42.3	ABC
	20	Above	1.7	CDEFG	42.0	ABCDE
		Below	2.0	ABC	41.8	BCDE
		With	2.0	AB	41.2	E
		LSD (95%)	0.3		0.3	