GOA Site Report

Phosphorous placement and its effect on establishment of lupins

Trail Code: GONU00916-3

Season: Winter 2016

Location: 'Lucky Corner', Coonamble

Collaborators: Tim Johnson

Keywords

GONU009, Lupins, phosphorus placement, phosphorus response, Coonamble

Take home messages:

Lupin establishment can be affected by starter P fertilizer at higher rates. Consider placement of some or all P away from the seed.

Background

Phosphorus (P), while an important nutrient for lupin production, is generally not considered a major limiting factor as lupins are relatively efficient in extracting soil P. Some research, however, has found yield responses to P application and there is also some evidence suggesting that higher rates can adversely affect lupin germination, particularly on drier soils[1]. This therefore, questions is yield response masked by germination limitations? Research by Scott et al. 2003[2] examined responses to P with various placement (below seed, with seed and above seed) in Southern NSW. They found banding P below seed resulted in slightly enhanced yields. Their trial used row spacing of 17 cm. There is speculation that wider row spacing (with subsequent increase in P applied with seed) may have a greater adverse impact on germination.

P is generally applied at planting with seed, and in zero tillage farming this is generally considered to be almost the only opportunity for introducing it into the system. Anecdotal evidence suggests that this practice may have negatively influenced crop establishment.

Trials referred to above tend to indicate the importance of P application at planting on crop yield. Left unanswered is 'would yields be improved if P could be applied early or in a better location (in relation to seed) to minimise adverse impact on plant germination?' As P is relatively immobile in the soil it would be reasonable to assume that P placed above the seed (i.e. incorporation by sowing) will not have a negative effect on germination, but may also not be available for uptake by germinating plants.

[1] Lupin Growth and Development, NSW DPI, 2011

[2] Scott BJ, Carpenter DJ, Braysher BD, Cullis BR, Evans CM, 2003. Phosphorus fertiliser placement for lupins in southern NSW. Australian Journal of Experimental Agriculture 43(1), 79–86.

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Aims

1. Determine effect on crop establishment of P placement, either below, with or above (broadcast) seed
2. Determine the effect on yield from various P placement treatments

Methods

Treatments: To investigate the influence of P placement and rate on germination and yields, four rates were applied (0, 5, 10 and 20 kg P/ha) in four locations relative to the seed, below (in a band approximately 7-8 cm below the soil surface (4.5-5 cm below the seed), with the seed, broadcast onto the soil surface and incorporated by sowing (IBS) and broadcast onto the soil surface post sowing. The full treatment list is shown in Annex 1.

The trial was established in the Autumn of 2016 and used a full factorial randomized complete block design with three replicates. Plot size was approximately 2 m wide and 10 m in length. The main details of the trial are outlined in Table 1.

Table 1. Trial site details

Trial Establishment Date	Autumn 2016		
Crop and Variety	Lupins - Albus	**Seeding rate**	100 kg/ha
Sowing date	6/5/2016	**Harvest Date**	N/A
Seedling equipment	Double Boot Tyne	**Row Spacing**	27.5 cm
Crop Nutrition (kg/ha)	nil	**Soil type**	Sandy Clay Loam
Previous Crop	Wheat	**Pre-Sowing Stubble Management**	Burnt pre-sowing
Soil test results:			
Colwell P:	0-10 cm 27 ppm 0-60 cm 10 ppm	**Phosphorus** Buffering Index:	0-10 cm: 40 10-60 cm: 64

Results

Plant Establishment: Approximately 32 plants/m^2 were established across all treatments, slightly lower than the target of 35 plants/m^2. Placement of P with seed at 10 and 20 kg P/ha reduced establishment from 33 where no P was applied to 26 and 21 respectively. Other placement options did not reduce plant establishment when compared to no added P.

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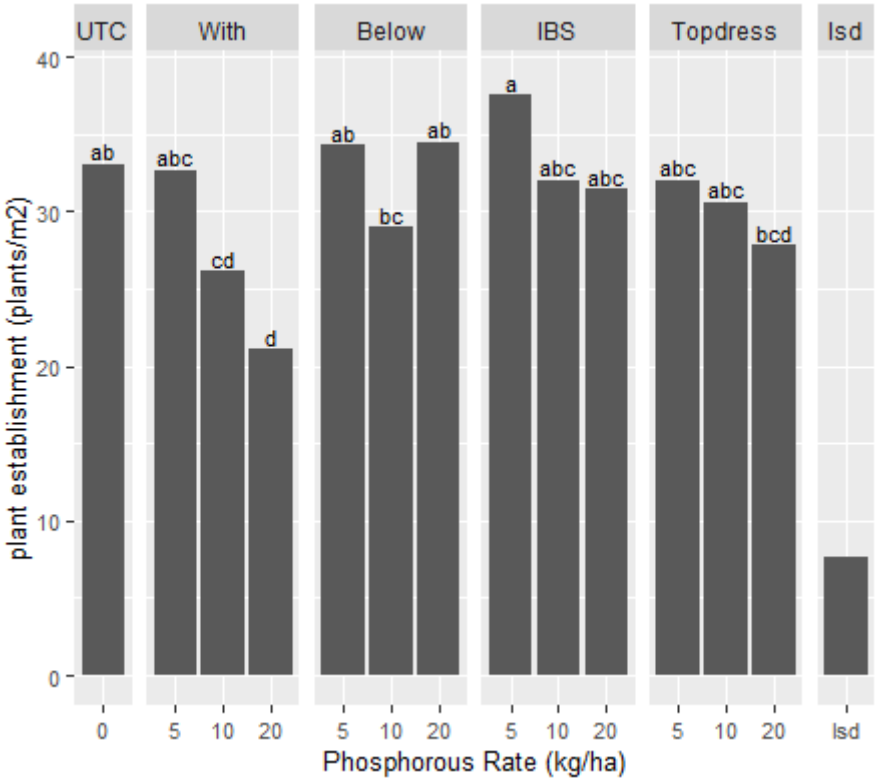

Figure 1. Plant establishment

*values with the same lettering are not significantly different from each other

Yield: Wet conditions and partial flooding decimated the crop and it was not harvested.

Discussion

The DBS (deep blade system) ripped to a depth of about 8 cm (~5 cm below the seed) for all treatments. This would provide a 'soft' or 'unconsolidated' landing for seed and any P placed with it. This may not be a true reflection of a tyne system where seed and fertiliser are essentially hitting the bottom of the furrow together. This may reduce impact of P on germination, particularly where P was placed 'with' seed.

Where P was placed with seed at the highest rate the reduction in plant establishment was about 36% (and about 20% where 10 kg P/ha was placed with seed) compared to no P or placement away from seed. However, there was no significant reduction in plant establishment where 5 kg P/ha was placed with seed. There was no adverse impacts on plant establishment by placement of P away from the seed.

Conclusion

Trial results suggest that plant establishment can be affected by placement of phosphorous with the seed, particularly high rates. Placement of P either below the seed or on the soil surface resulted in establishments similar to where no P was applied. It is not known what effect these alternative placements have on yield.

Acknowledgements

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Appendix

Annex 1. Treatment list and results

P Rate (kg/ha)	P Placement	Plant Est Count (plants/m^2)	Groups
0		33	ab
5	Below	34	ab
5	IBS	38	a
5	Post plant	32	abc
5	With	33	abc
10	Below	29	bc
10	IBS	32	abc
10	Post plant	31	abc
10	With	26	cd
20	Below	34	ab
20	IBS	31	abc
20	Post plant	28	bcd
20	With	21	d
	lsd	8	