

## Phosphorous placement and its effect on establishment of lupins

**Trail Code:** GONU00917-3  
**Season:** Winter, 2017  
**Location:** 'Glenmuir', Armatree  
**Collaborators:** Mick O'Brien

### Keywords

GONU009, Lupins, phosphorus placement, phosphorus response, Armatree

### Take home messages:

Results suggest that plant establishment can be affected by placement of phosphorous with seed. Placement of starter fertilisers below the seed may be safer if that option is available.

Results also suggest that a P response from lupins even in low P soils is difficult. If looking to maintain soil P for subsequent crops, it is recommended to favour other placement options. If these are not available, consider increasing sowing rate.

### 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 the P application and there is also some evidence suggesting that higher rates can adversely affect lupin germination, particularly on drier soils<sup>1</sup>. This poses the question "is yield response masked by germination limitations"? Research by Scott et al. 2003<sup>2</sup> looked at P responses to various placements (below seed, with seed and above seed) in Southern NSW. They found that banding P below the seed resulted in slightly enhanced yields. A row spacing of 17 cm was used and there was speculation that a wider row spacing (with subsequent increase in P applied with seed) may adversely 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. Question left unanswered is 'would yields be improved if P could be applied early or in a better location (in relation to seed) to minimise impact on plant germination?' As P is relatively immobile in

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<sup>1</sup> Lupin Growth and Development, NSW DPI, 2011

<sup>2</sup> 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.

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 the germinating plants.

## Aims

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

## Methods

**Treatments:** Investigate influence of P fertiliser 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; 1. 'below' in a band approximately 7-8 cm below the soil surface (4.5-5 cm below the seed), 2. 'with' seed, 3. 'IBS' - broadcast onto the soil surface and incorporated by sowing, and 4. 'Post Plant' broadcast onto the soil surface post sowing. A control treatment was also included where no fertiliser was applied (though had all the same cultural treatments). Full treatment list and results are provided in the Appendix.

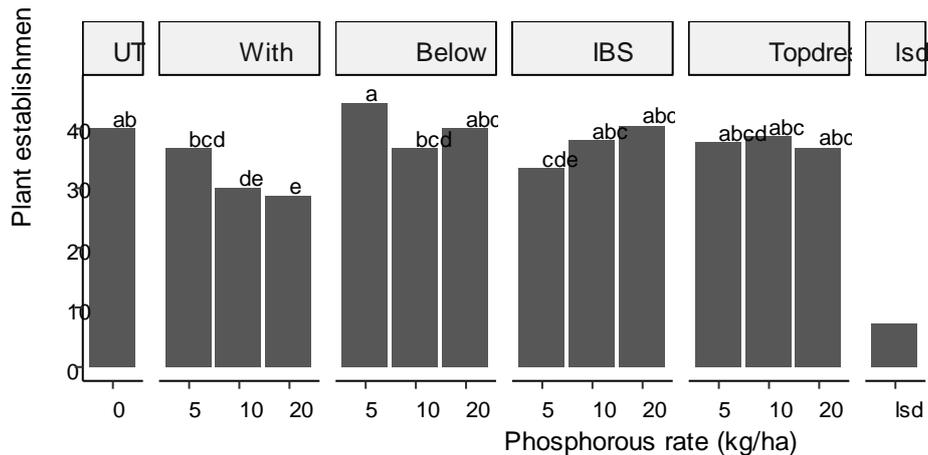
The trial was established in Autumn 2017 and used a full factorial randomised complete block design with three replicates. Plot size was approximately 2 m wide and 10 m in length. Main details of the trial are outlined in Table 1.

**Table 1.** Trial site details

<b>Trial Establishment Date</b>	Autumn 2017		
<b>Crop and Variety</b>	Lupins - Albus	<b>Seeding rate</b>	100 kg/ha
<b>Sowing date</b>	25/4/2017	<b>Harvest Date</b>	3/11/2017
<b>Seedling equipment</b>	Double boot knife point press wheel	<b>Row Spacing</b>	27.5 cm
<b>Crop Nutrition (kg/ha)</b>	nil	<b>Soil type</b>	Sandy Loam
<b>Previous Crop</b>	Wheat	<b>Pre-Sowing Stubble Management</b>	Standing stubble, narrow windrows burnt
<b>Soil test results:</b>			
<b>Colwell P:</b>	0-10 cm 24 ppm 0-30 cm 11 ppm	<b>Phosphorus Buffering Index:</b>	0-10 cm: 37 10-60 cm: 35

## Results

**Plant Establishment:** An average of approximately 37 plants/m<sup>2</sup> were established across all treatments. Placement of P with the seed reduced plant establishment by up to 25% at the highest rate of P, compared to where no P was applied. There was no difference in plant establishment when other placement options were compared to the control (**Figure 1**).



**Figure 1.** Plant establishment for the various seed placement options. Data with the same letter are not significantly different.

**Yield:** Average yield was 1.5 tonnes/ha. No treatments, either placement or rate, were significantly different to the control treatment.

## Discussion

There was a reduction in plant establishment from placing P fertiliser with seed. Application of various P treatments was undertaken at sowing and the impact of placement of P fertiliser with seed may have been reduced by the double boot planting system (DBS). The DBS ripped to depth of 6-7 cm (~3-4 cm below the seed) for all treatments. This action would have resulted in a 'soft' or 'unconsolidated' landing for seed and any P placed with it. These results may not be a true reflection of a single tyne system where seed and fertiliser are essentially hitting the bottom of the furrow together, where it is possible that establishment issues may be exacerbated.

There was also no adverse impacts on plant establishment by placement of fertiliser P away from the seed, either below, IBS or post plant.

This lupin crop achieved moderate yields of 1.5 t/ha. P removal in grain would be around 4-5 kg/ha. Although soil testing indicated moderate to low P levels (Colwell P 0-10 cm of 24 ppm, equivalent of approximately 30 kg P/ha), this should have been sufficient for the modest yield and would account for a lack of yield response. The moderate yields were likely the result of the low rainfall received in 2017.

## Conclusion

Results suggest that plant establishment can be affected by placement of phosphorous with seed. Placement of starter fertilisers below the seed may be safer if that option is available.

Results also suggest that a P response from lupins even in low P soils is difficult. If looking to maintain soil P for subsequent crops, it is recommended to favour other placement options. If these are not available consider increasing sowing rate.

# GOA Site Report

## Acknowledgements

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial co-operation and support of GRDC. The authors would like to thank them for their continued support. Special thanks go to Mick OBrien who hosted this trial.

## Appendix

**Table 2.** Impact of P rates and P placement on plant establishment and yield of lupins. Results followed by the same letter are not significantly different.

P-rate (kg/ha)	P Placement	Yield (t/ha)		Plant Establishment Count (plants/m <sup>2</sup> )	
0	Control	1.5	ns	40.0	ab
5	Below	1.3	ns	44.3	a
10	Below	1.6	ns	36.5	bcd
20	Below	1.4	ns	39.9	abc
5	IBS	1.4	ns	33.3	cde
10	IBS	1.6	ns	38.0	abc
20	IBS	1.6	ns	40.4	abc
5	Post plant	1.6	ns	37.5	abcd
10	Post plant	1.5	ns	38.4	abc
20	Post plant	1.7	ns	36.7	abcd
5	With	1.4	ns	36.5	bcd
10	With	1.5	ns	29.9	de
20	With	1.5	ns	28.7	e
	lsd			7.4	