GOA Trial Site Report

Can phosphorous rates on wheat be reduced when late sowing into limited soil moisture?

Trial code:	GONU02118-5
Year:	Winter, 2018
Location:	'Glen Yarra', Forbes, NSW
Trial partners:	Matt Duff and Matt Shepherd

Keywords

GONU021, wheat, nutrition, phosphorous, drought, yield limited, limited soil moisture, Forbes

Key messages

- This trial was sown very late (start of July), well outside the recommended sowing window
- There was no interaction between applied phosphorus and yield or grain quality.
- Cutting back P rates in this trial in this year would have saved the grower money.

Background

2018 was one of the driest seasons on record in Central West NSW and as the season progressed, farmers were faced with:

1. A significantly shorter season
2. Marginal soil moisture profiles
3. Forecasts for less than average rainfall.

All of which would contribute to a reduced yield potential for any crop sown into these conditions. Farmers were asking whether it would be feasible to cut back phosphorous (P) rates at sowing to reduce costs without limiting yield.

Phosphorous is a key requirement for early crop development, with its demand typically greatest for the first 6 weeks after sowing. Limited P availability during this period is likely to slow plant development and further reduce the yield potential. It is well known that P is not used all in one year and is generally available for subsequent crops. The decision process is further complicated as each farmers situation is different depending on the inherent and residual levels of soil P, the planting system used (drill versus disk) and whether controlled traffic is being used.

Past experience[1] would suggest that the requirement for early P in crop development is ~1

[1] GRDC Wheat Grownotes – Northern Region

kg/ha, which needs to be close to the seed and the emerging roots. Subsequent P requirements match biomass accumulation of 5 kg P /1 t/ha grain yield potential, and this is typically sourced from wherever the roots are active within the profile (i.e. where there is moisture).

Trials conducted in 2003 in Victoria[2] found that there were considerable yield reductions by delaying sowing (from May to June to July), however, across the 2 sites there was little to no P response at any of the timings. This may have something to do with the sites being assessed as having reasonable P levels prior to trial (as subsoil P was not tested, only tested the 0-10 cm layer). In contrast research in Western NSW[3] from 1993 found that later sowing required higher levels of P fertiliser to achieve the same yields as earlier plantings, however, these plantings were conducted early in the sowing window (April compared to May) and not necessarily under drought conditions.

Aims

- Validate current recommendations regarding P requirement following a drought year (either low yielding or crop failure) in terms of yield and grain quality.
- Determine by how much a farmer might be able to reduce P rates given application of P and a crop failure for the subsequent crop

Methods

- Small plot randomised complete block split design, 6 replicates.
- Six rates of P: 0, 5, 10, 15, 20 and 40 kg/ha. As triphos

Results were analysed by Analysis of Variance (ANOVA) and results compared by using 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. The ANOVA and LSD tests are used to measure the difference between the averages. A statistically significant difference is one in which we can be confident that the differences observed are real and not a result of chance.

Table 1. Trial site details

Establishment date	Winter 2018		
Crop and variety	Wheat Spitfire	**Sowing rate**	60 kg/ha
Sowing date	7/7/2018	**Harvest date**	4/12/2018
Seedling equipment	Knife point/press wheel	**Row Spacing**	27.5 cm
Crop nutrition (kg/ha)		**Soil type**	(Grey clay) vertosol
Previous crop (and yield)	Wheat	**Pre-sowing stubble management**	Direct drilled
Soil residual nutrition (at sowing)	Colwell P ~ 46 ppm,	**Nitrogen (N)**	0-10cm ~ 57 kg/ha, 10-90cm ~ 122 kg/ha

[2] https://www.farmtrials.com.au/trial/13734

[3] http://www.publish.csiro.au/an/EA97104

Results

The full results are listed in the attached annex.

At this site there was no interaction between applied P and yield or grain quality (**Figure 1**). Yields were low, between 0.6- 0.69 t/ha. Protein levels were >16% and screenings ranged from 4.6- 5.7%.

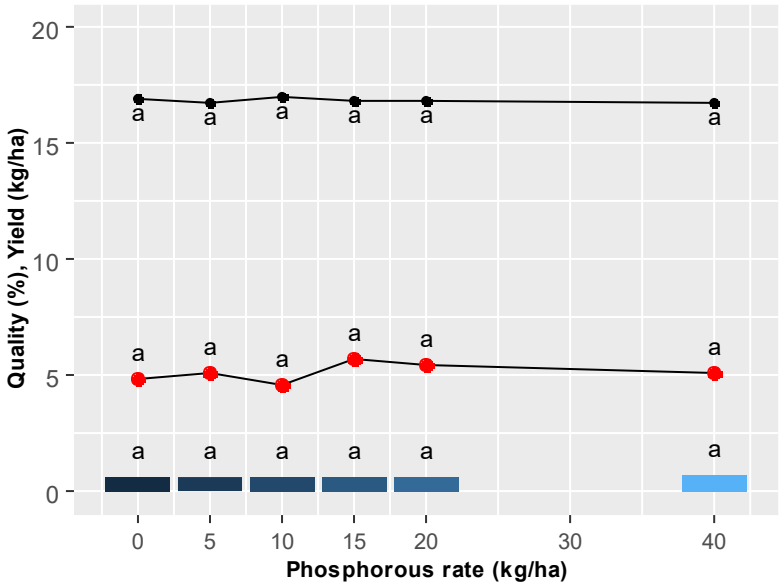

Figure 1. Wheat yields (bars, kg/ha), grain quality/screenings (%, red line), and protein (%, black line) in response to increasing rates of applied P fertiliser (kg/ha). Treatments with the same letter within each variable are not significantly different.

Discussion

This paddock was sown in the beginning of July, very late and well outside the recommended sowing window for the short season variety sown, Spitfire. Rainfall was also well below average, prior to sowing approximately 109 mm fell in the fallow (and about half of this prior to Christmas). In-crop rainfall was approximately 140 mm. This is well down on the average of 450 mm.

Starting P levels in this paddock (~46 ppm in the top 10cm) would be 'non-responsive' to applied P. As such the application of P in a short and moisture limited season did not produce any yield of grain quality benefit.

2018 was a very dry season and it is likely that even the highest yielding treatments (~0.69 t/ha) was at best only marginally profitable. Using a simple economic analysis comparing the increase in yield considering the additional cost of fertiliser and grain quality shows that cutting back P rates would have saved the grower money. In this case the change in the net return was very closely related to the fertiliser costs. If the farmer had chosen not to apply P in this paddock he would have been $30-40/ha better off than applying a rate between 10-20 kg/ha (**Figure 2**). Going to even higher rates resulted in less net returns than not applying any P.

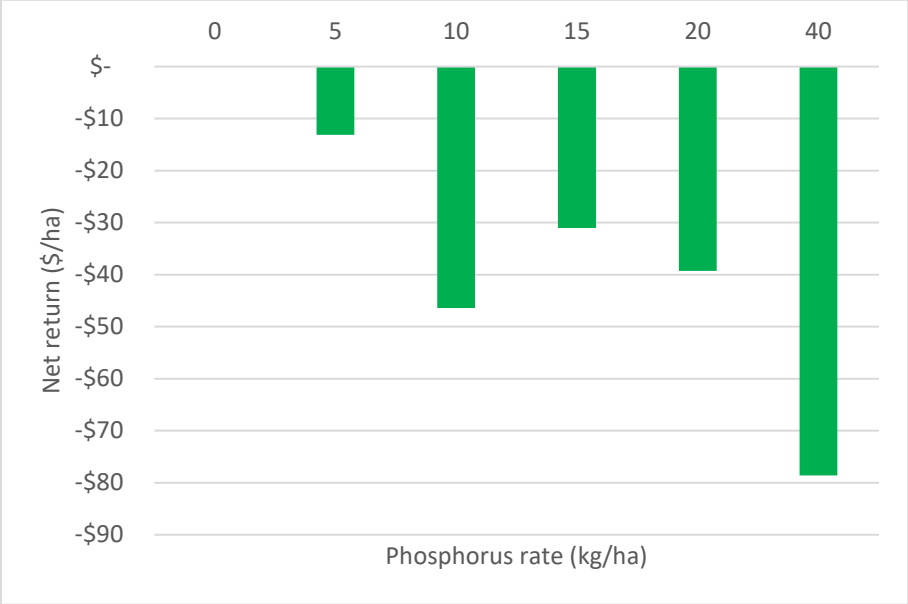

Figure 2. Net return ($/ha) from increased rates of P (kg/ha) at sowing.

Conclusion

- There was no interaction between applied P and yield or grain quality.
- This trial was sown very late and in a low rainfall year
- If paddock does not have a history of P responsiveness and/or soil tests are adequate, then reducing or eliminating P may not limit yield potential.
- Conduct periodic soil testing and use test strips to better understand paddock P responsiveness.

Acknowledgements

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Appendix

Table 2. Site results

P Rate	Protein		Screenings		Yield	
(kg/ha)	(%)		(%)		(t/ha)	
0	16.9	a	4.9	a	0.60	ab
5	16.8	a	5.2	a	0.63	ab
10	17.0	a	4.6	a	0.60	b
15	16.8	a	5.7	a	0.65	ab
20	16.6	a	5.4	a	0.66	ab
40	16.8	a	5.1	a	0.69	a
lsd	0.6		2.2		0.13	