

Residual phosphorus following a drought



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This trial was sown at Hopetoun using the 2006 phosphorus (P) rate trial in which both fluid and granular fertilisers were applied at different rates. The objective of the trial was to determine the residual value of the P fertilisers following a drought. Two additional P treatments were applied in 2007 to determine if crop response to fluid and granular forms of P was different to that obtained in the 2006 season.

Take home messages

- *P fertilisers applied in 2006 did not improve grain yield in 2007, even at the high P rate (18 kg P/ha).*
- *In terms of residual value, there was no difference between granular and fluid P.*
- *2007 applied fluid P (TGMAP) at 6 kg P/ha increased dry matter at GS30 from fresh granular P and control treatments.*
- *Soil testing is a useful tool for estimating P status in the soil.*

Background

Phosphorus can exist in the soil in many forms. Some of these forms are available to crop immediately (orthophosphates) and a proportion will have to undergo some sort of breakdown (mineralisation) before it can be accessed by crops. The majority of the fertiliser applied in 2006 would have dissolved and be present in the soil either bound to soil particles or free in the soil solution.

The amount of P available for the next year's crop will depend on what proportion of fertiliser-P is still in these plant-available forms.

In 2006, granular (MAP) versus fluid (technical grade MAP) P rate trial was established. Wheat (cv Annuello) was sown in mid-May with varying P rates (0, 3, 6, 12, 18 kg P/ha) of both products. Grain yields did not exceed 1.5 t/ha, so it would be fair to suggest that if 1 t/ha of wheat grain removes 3-4 kg P/ha, then there should be plenty of fertiliser P remaining at the higher rates.

Fluid fertilisers have been suggested to have a greater residual value than granular products. This trial aimed to determine if there was a residual value from the two fertiliser formulations following the drought in 2006.

Method

Location: Hopetoun
Replicates: Four



Plot size:	2m × 20m
Crop:	Wheat (cv Wyalkatchem)
Previous crop:	Wheat stubble
Sowing date:	9 May 2007
Target seeding density:	175 plants/m ²
Seeder:	Cone Seeder – no till, narrow points, press wheels, 20.2cm row spacings (8-inch)
Herbicide:	10/5/06 Roundup PowerMax (1.5L/ha) TriflurX (1L/ha) 26/7/06 Hussar (200g/ha)
Fertiliser:	Urea (15kg N/ha) (deep banded below the seed)
Soil Type:	Mallee sandy clay loam with moderate subsoil constraints
Soil pH:	Topsoil 8.6 (H ₂ O)
Colwell P:	18ppm
Rainfall:	366mm annual (186mm growing season rainfall (April-October))

The treatments listed in Table 1 were applied in two ways; TGMAP (fluid) in a dribble band (a continuous stream of liquid behind the tyne with a water rate of 320L/ha) and the MAP (granule) was banded with the seed.

Fertilisers

- Mono-ammonium Phosphate, MAP (N10-P22-K0-S1): a commonly used fertiliser in the Mallee (granule).
- Technical Grade Mono-ammonium Phosphate, TGMAP: same formulation as MAP but mixed with water before application (fluid).

Table 1. List of treatments used in this trial.

Treatments	2006 P rate (kg P/ha)	2007 P rate (kg P/ha)	Application Method
Control	0	0	
MAP	3	0	Banded
TGMAP	3	0	Dribble Band
MAP	6	0	Banded
TGMAP	6	0	Dribble Band
MAP	12	0	Banded
TGMAP	12	0	Dribble Band
MAP	18	0	Banded
TGMAP	18	0	Dribble Band
MAP	0	6	Banded
TGMAP	0	6	Dribble Band

Measurements

Plant numbers were recorded at the 2-3 leaf stage of the crop. At GS30 (end of tillering), tiller numbers and dry matter production were recorded. Complete tissue analysis was also undertaken using ICP-AES analysis of the whole shoots (at GS30). Head counts were taken at anthesis and the crop was harvested on 20 November. Hand cuts were taken pre-harvest to determine the harvest index for all treatments. Harvest index is a measure of the grain produced in proportion to the dry matter at the time of harvest.

Results

Residual P did not improve emergence, early tillering or dry matter production (Table 2). However, freshly applied P as a fluid in 2007, resulted in a 20% increase in dry matter over the control. The amount of P taken up by the crop in those plots was also greater. The granular formulation did not improve crop growth. Grain yield was not significantly affected by residual treatments or the 2007 applied P compared to the control (no P for two years).

Tissue concentrations taken at GS30 indicated that the crop was not limited by other nutrients. The critical value for P (%) for wheat at GS30/1 is 0.20%. The control contained more than adequate amount of P, subsequently no yield difference was required.

A build up of phosphorus from the 2006 applications was evident with the trend shown in Figure 1.

Table 2. Responses in wheat production in 2007.

Treatment	Plant counts (m2)	Tiller counts (per m2 at GS30)	Dry matter at GS30 (kg/ha)	Whole Shoot P-Conc at GS30 (%)	Shoot P-uptake (kg P/ha)	Grain Yield (t/ha)
Control	155	412	309	0.38	1.18	1.8
2006 MAP (3kg P)	153	374	303	0.38	1.14	1.7
2006 MAP (6kg P)	143	364	297	0.43	1.29	1.7
2006 MAP (12kg P)	158	392	328	0.40	1.31	1.7
2006 MAP (18kg P)	167	397	300	0.41	1.23	1.6
2006 TGMAP (3kg P)	152	375	291	0.40	1.18	1.6
2006 TGMAP (6kg P)	158	403	269	0.40	1.09	1.7
2006 TGMAP (12kg P)	142	328	325	0.42	1.38	1.7
2006 TGMAP (18kg P)	145	420	303	0.43	1.28	1.7
2007 MAP (6kg P)	149	388	303	0.44	1.30	1.9
2007 TGMAP (6kg P/ha)	166	501	372*	0.44	1.63*	1.9
Significant Difference	NS	NS	P<0.05	NS	P<0.05	NS
LSD (P<0.05)			50		0.42	
CV %	3.7%	10.3%	4.5%	17.4%	6.5%	4.4%

* indicates the treatment is statistically different from the control

Interpretation

Responses to P are limited by many factors. Seasonal differences, sowing time and soil type all influence nutrient responses. Responses to P applications are often smaller (especially in dry years) with early sowing and regular applications of P (which have boosted soil reserves to Colwell P greater than 15ppm).

Both 2006 and 2007 were extremely difficult years and many would hope they do not represent the future. However, these years did provide two different conditions for cereal growth. In 2006, there was a dry start with no rain recorded for seven weeks after sowing. Subsequently, growth was slow and no differences were recorded in dry matter and grain yield with increasing rates of fertiliser P. In 2007, the site received over 200 mm rainfall prior to sowing (January-May). This, in combination with warm moist conditions at the time of sowing, meant early growth was vigorous and P responses more likely. The only dry matter response recorded was in the 2007 applied fluid 6 kg P/ha treatment. The soil reserves of available P were quite high (Colwell P 25ppm in control plots) and would have supplied the majority of the needs for the early growth. The availability of P in this trial during tillering was recorded and is reported in Sean Mason's article published in this publication.

The amount of P available to the crop was greater at the higher rates of applied P as shown in Figure 1. This supports the theory that if the previous crop has not used all the available P, then the remaining P should build up reserves and become available next year. It is very interesting to note that the control was able to grow 1.2 t/ha in 2006 and 1.8 t/ha in 2007 without any addition of extra P.

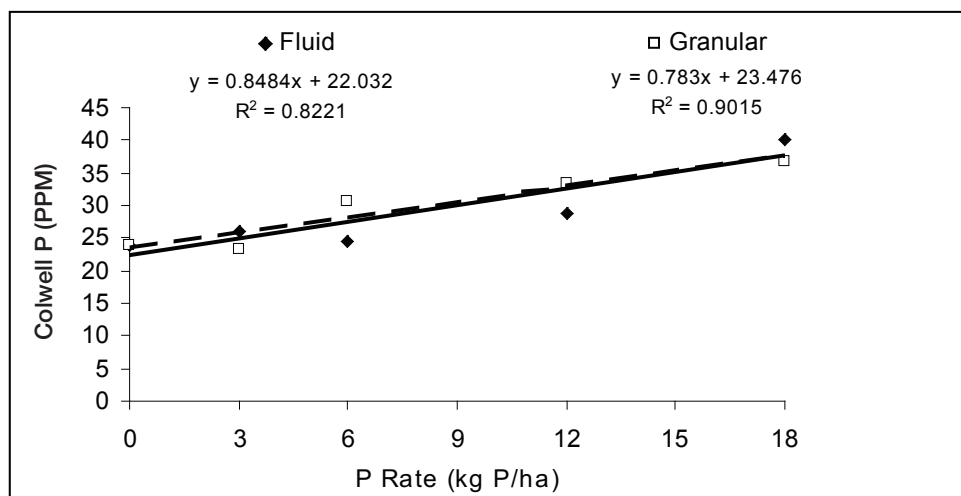


Figure 1. Increasing Colwell P with rising P rates (samples taken in January 2007).

Commercial Practice

When making fertiliser decisions it is important that you consider each paddock on its own merits, not make a blanket decision for the whole farm. Previous applications that have not been used by the previous crop should be available to following crops. Based on this data and previous BCG findings, wheat can be successfully grown without P additions if soil reserves of P are high.

If you are considering making fertiliser changes in 2008, it is strongly recommended that soil tests are conducted. Soil testing is equivalent to a lifeline on 'Who wants to be a millionaire' – a tool used for assisting decisions that have the potential to make or SAVE you a lot of money in 2008!