

# Measuring the effect of residual P

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RESEARCH

## Searching for answers



### Location:

Minnipa Ag Centre

### Rainfall

Av. Annual: 325 mm

Av. GSR: 241 mm

2011 Total: 404 mm

2011 GSR: 252 mm

### Yield

Potential: 4.0 t/ha (B)

Actual: 2.3 t/ha

### Paddock History

2010: Wheat

2009: Wheat

2008: Wheat

### Soil Type

Red sandy loam

### Plot Size

1.4 m x 12 m x 4 reps

## Why do the trial?

While we know soil reserves of phosphorus (P) are an important source of P for crops, we do not have a good understanding of how long soil P reserves last or how applied fertilisers contribute to soil reserves.

In order to assess the relative value of current and previous fertiliser applications, we are measuring crop response in a field trial at Minnipa to different fertiliser rates over time, with soil P levels measured annually as Colwell P. Since 2010 DGT (EPFS Summary 2009, pg 150) has also been used to measure soil P levels.

## How was it done?

To measure comparative wheat yields in response to different P rates and years of application, a 4 year replicated trial was established in Paddock South 1, Minnipa Agricultural Centre in 2009. Table 1 shows the P application rates on each of the 10 treatments over the 4 years of the study. The site had an initial Colwell P level of 27 mg/kg (0-10 cm). Deep banded DAP is used as the P supply with the N balanced using urea to give a total of 18 kg N/ha. In 2011 the trial was sown on 23 May with Scope barley at 50 kg/ha.

Soil samples (0-10 cm) were taken before sowing in 2011 between the rows in a zigzag pattern from each plot to assess the effect of the treatments on soil P fertility. Dry matter production was sampled on 23 August (end of tillering). Grain yield and grain quality were measured at maturity. All plots were kept weed free.

## What happened?

Colwell P measurements taken before sowing in 2011 ranged from 27-31 mg/kg, and were less than the 2010 Colwell P levels of 36-37 mg/kg, but similar to the 2009 measured 27 mg/kg. The increase in Colwell P from 2009 to 2010 was similar between all treatments. By 2011 Colwell P had declined back to the 2009 measured level (27 mg/kg) providing no or only 5 kg/h of P had been previously added. For all the other treatments Colwell P has fallen from the 2010 levels but were still higher than the original measured amount (Figures 1a and 1c).

Similar trends were seen using the DGT-P soil test (Figure 1b and 1d). There has been a reduction in P levels to near critical value levels in 2011 and therefore the results from the final year of this trial (2012) will be extremely interesting in terms of soil analysis and crop response.

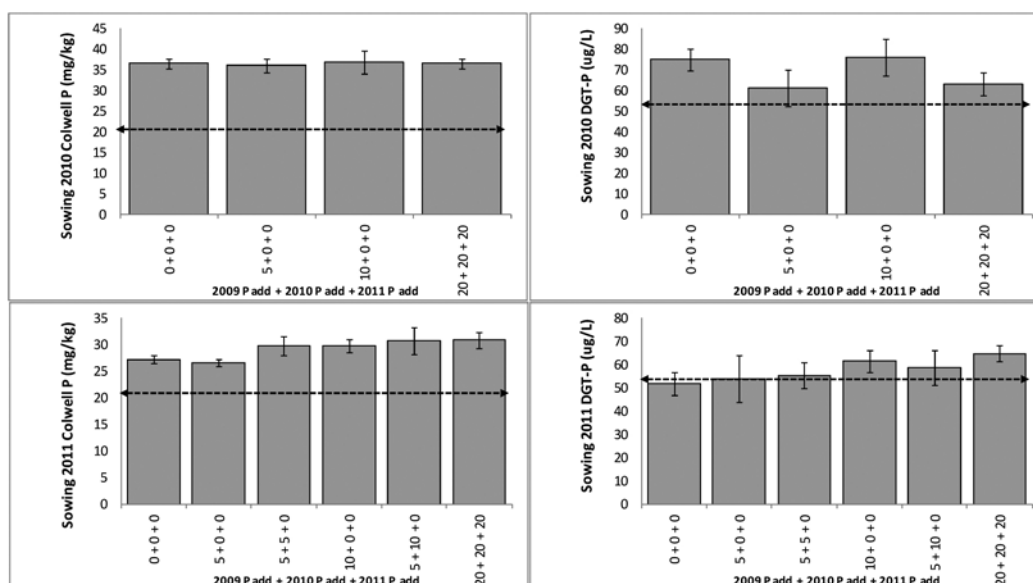
Nutrition

## Key message

- Despite three years of above average rainfall, a red calcareous sandy loam at Minnipa with soil phosphorus reserves of 27 mg/kg of Colwell P has not required any added P fertiliser for maximum cereal grain yields.

Table 1 Phosphorus (kg/ha) to be applied over the 4 year duration of the project, 2009-2012

4 YEAR PLAN	Year 1	Year 2	Year 3	Year 4
Treatment	2009	2010	2011	2012
1	20	20	20	20
2	0	0	0	0
3	10	0	0	0
4	5	10	0	0
5	5	5	10	0
6	5	5	5	10
7	5	0	0	0
8	5	5	0	0
9	5	5	5	0
10	5	5	5	5



**Figure 1a** (top left) Colwell P and 1b (top right) DGT-P values measured at sowing in 2010. 1c (bottom left) Colwell P and 1d (bottom right) DGT-P values measured at sowing in 2011. The dashed line represents the critical soil test value.

**Table 2** Biomass and grain yield response to P fertiliser applied in 2009+2010+2011

P applied (kg/ha)	Dry matter 23/8/2011	2009 Wheat yield (t/ha)	2010 Wheat yield (t/ha)	2011 Wheat yield (t/ha)
0+0+0	2.3	4.0	2.7	2.1
20+20+20	2.7	4.0	2.8	2.3
<b>2009 applied fertiliser</b>				
5+0+0	2.2	3.9	2.7	2.1
10+0+0	2.3	4.0	2.7	2.1
<b>2010 applied fertiliser</b>				
5+5+0	2.3		2.8	2.2
5+10+10	2.5		2.8	2.1
<b>2011 applied fertiliser</b>				
5+5+5	2.6			2.2
5+5+10	2.8			2.3
LSD ( $P=0.05$ )	ns	ns	ns	ns

Despite a trend for higher biomass production with applied P in 2011 there were no grain yield or quality responses to applied P measured in 2011 (Table 2). Test weights were 62-65 kg/hL, screenings 5.1-7.3% and protein 10.8-11.4%. Due to the lack of response to added P in this soil it is not yet possible to assess the residual value of P fertiliser as all treatments have had the same yield in every season of the experiment.

### What does this mean?

Although there was a trend towards increased biomass in response to applied P in 2011 for the third year in a row, there was no yield response to P in this trial, indicating that the measured P was sufficient to grow a productive

crop in each of those years. Similar results were previously reported in this trial (EPFS 2009, pg 156-157 and EPFS 2010, pg 112-113) and in trials done by Sean Mason (EPFS 2009, pg 150-153).

Both the Colwell P and DGT soil P tests had values close to or greater than their respective critical values and therefore both these tests correctly predicted a marginal to nil response to P applications. Starting P levels using DGT-P were higher for this paddock compared to the paddock North 1 (see P replacement trials) explaining why this paddock continues not to respond to P application compared to responses seen with the replacement trial. Soil analysis will continue for the final year of this trial to measure any changes

in soil P and if there is any impact of differing regimes on crop performance.

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