# Wheat Variety Response to P on Grey Calcareous Soil

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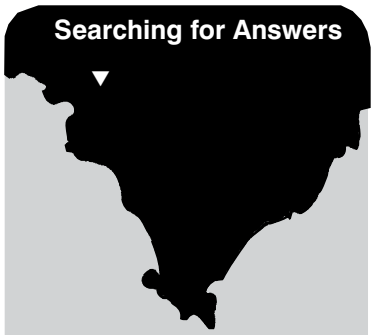
DEMO
RESEARCH




**Location:**
Mudamuckla
**Rainfall**
Av. Annual: 290 mm
Av. GSR: 216 mm
2010 Total: 347 mm
2010 GSR: 275 mm
**Yield**
Potential: 3.3 t/ha (W)
Actual: 2.4 t/ha (Mace - 4 units P/ha)
**Paddock History**
2009: Canola and medic feed
2008: Barley - Maritime 0.88 t/ha
2007: Barley - Barque 0.30 t/ha
**Paddock History (replicated trial)**
2009: Wheat
**Soil Type**
Grey calcareous sandy loam
**Soil Test**
Colwell P, Mineral N
**Plot Size**
9 m x 4 reps
**Yield Limiting Factors**
Mice damage early in the season

## Key messages

- **There was no yield response to increased P rates in any variety tested suggesting that adequate available soil P masked any purported difference in P use efficiency between varieties.**
- **However, there was a trend in that the grain yield of the variety Axe increased in response to higher levels of P in both the replicated and broad acre studies.**

## Why do the trial?

Previous research has shown that there is considerable variation in the efficiency of phosphorus use among varieties of wheat (EPFS Summary 2009 pp 37-38). A replicated trial and a paddock sized demonstration was designed to compare P efficiency of commonly grown varieties (plus a few new ones) on the upper EP to provide farmers with better knowledge of their current varieties, or select new varieties that may better utilise applied P in a grey calcareous soil. The paddock sized evaluation was seeking to clarify the most appropriate fertiliser strategy for different zones in the paddock and the relationship with different varieties.

## How was it done?

A replicated trial was established at Mudamuckla on 2 June on a grey calcareous sandy loam. Seven varieties of wheat were grown at 3 rates of phosphoric acid (0, 4 and 8 kg P/ha) with all varieties sown at a calculated density of 150 seeds/$m^2$. Measurements taken during the year included; soil chemical analysis, plant establishment, grain yield and quality. All plots received standard weed management.

In a neighbouring paddock, four wheat varieties, (Axe, Gladius, Mace and Yitpi) were sown with up to 6 treatments 4, 6, 8, 10 and 12 kg P/ha (phosphoric acid delivered as fluid) plus nil P. Strips were sown the length of the paddock using the different phosphorus rates and wheat varieties. All strips were harvested with a commercial header using a yield monitor to record wheat yields. This repeated a 2009 evaluation (EPFS summary 2009; Mudamuckla Focus Paddock, p 93).

## What happened?

Soil tests taken before seeding from the replicated trial indicated that the Colwell P level at the trial site was 43 mg/kg and the mineral N levels were 155 kg/ha (0-60 cm). There was mice damage at emergence resulting in some established plant differences between treatments, all treatments were less than the planned 150 plants/$m^2$ (Table 1). There was no grain yield response to applied P within any variety. Protein contents, test weights and screenings were also similar within each variety.

## What does this mean?

The Colwell P levels, 43 mg/kg, measured before seeding suggest that there may have been sufficient available P in the soil for the 2010 growing season. No statistically significant response to applied rates of P in grain production in any of the varieties would support this suggestion. The paddock this trial was in has an excellent P history, which may be compounded by a string of below average production years where the inputs exceed the nutrients exported in the grain.

***Table 1 Wheat establishment, grain yield and quality, gross income (GI) calculations in response to variety and P rate in the 2010 replicated trial***

| Variety | P rate (kg/ha) | Establishment (plants/m²) | Yield (t/ha) | Test Weight (kg/hL) | Protein (%) | Screenings (%) | Pay Grade | GI ($/ha) |
|---|---|---|---|---|---|---|---|---|
| Axe | 0 | 128 | 1.8 | 78.4 | 11.1 | 2.6 | APW1 | 524 |
| | 4 | 113 | 1.7 | 79.4 | 11.1 | 2.3 | APW1 | 457 |
| | 8 | 117 | 2.0 | 79.2 | 10.7 | 2.2 | APW1 | 555 |
| Gladius | 0 | 114 | 2.2 | 78.6 | 11.0 | 2.1 | APW1 | 638 |
| | 4 | 102 | 2.1 | 78.4 | 11.0 | 2.4 | APW1 | 585 |
| | 8 | 108 | 2.2 | 78.7 | 11.1 | 1.9 | APW1 | 596 |
| Lincoln | 0 | 133 | 1.9 | 77.5 | 9.4 | 4.5 | ASW1 | 473 |
| | 4 | 123 | 2.0 | 75.7 | 9.1 | 5.7 | AGP1 | 458 |
| | 8 | 125 | 2.0 | 78.2 | 9.5 | 4.5 | ASW1 | 471 |
| Mace | 0 | 133 | 2.3 | 77.2 | 9.9 | 2.8 | ASW1 | 590 |
| | 4 | 101 | 2.4 | 78.8 | 9.9 | 3.0 | ASW1 | 611 |
| | 8 | 126 | 2.1 | 78.0 | 10.3 | 2.0 | ASW1 | 511 |
| Scout | 0 | 132 | 1.7 | 79.6 | 10.1 | 2.5 | ASW1 | 435 |
| | 4 | 87 | 1.8 | 79.0 | 10.2 | 3.5 | ASW1 | 438 |
| | 8 | 107 | 1.7 | 79.2 | 10.0 | 3.2 | ASW1 | 394 |
| Wyalkatchem | 0 | 101 | 2.2 | 77.0 | 10.0 | 2.3 | ASW1 | 559 |
| | 4 | 131 | 2.1 | 76.9 | 9.6 | 1.8 | ASW1 | 530 |
| | 8 | 121 | 2.3 | 78.4 | 9.8 | 1.6 | ASW1 | 565 |
| Yitpi | 0 | 110 | 2.0 | 79.7 | 11.5 | 4.2 | H2 | 631 |
| | 4 | 129 | 2.0 | 78.9 | 11.5 | 3.0 | H2 | 603 |
| | 8 | 127 | 2.1 | 79.1 | 11.5 | 3.7 | H2 | 624 |
| *LSD (P=0.05)* | | *29* | *0.3* | *1.8* | *0.7* | *1.0* | | |

***Table 2 Grain yields, gross margin, extra income and return on investment from the P applied in the 2010 broad acre evaluation***

| Variety | P applied (kg/ha) | Yield (t/ha) | Gross margin ($/ha) | Extra $ from P* ($/ha) | Return on P investment (%) |
|---|---|---|---|---|---|
| Axe | 0 | 1.9 | 485 | | |
| | 4 | 2.1 | 529 | 59 | 279 |
| | 8 | 2.4 | 589 | 135 | 333 |
| Gladius | 0 | 2.3 | 598 | | |
| | 4 | 2.3 | 583 | 1 | -94 |
| | 6 | 2.4 | 598 | 24 | 4 |
| | 8 | 2.2 | 542 | 25 | -179 |
| | 10 | 2.3 | 571 | 13 | -67 |
| | 12 | 2.5 | 597 | 46 | -1 |
| Mace | 0 | 2.3 | 600 | | |
| | 4 | 2.0 | 605 | 21 | 32 |
| | 6 | 2.4 | 611 | 34 | 47 |
| | 8 | 2.5 | 629 | 60 | 92 |
| Yitpi | 0 | 2.1 | 524 | | |
| | 4 | 2.2 | 548 | 40 | 156 |
| | 8 | 2.3 | 564 | 71 | 129 |

*Income was based on $300/t for the grain with variable costs from a calculated on Mudabie farm figure of $92/ha + $4 for every unit of P applied. * Extra total income from applying P as compared to nil P (yield x $300)*

However, in both the replicated trial and the broad acre evaluation there was a trend from the wheat variety Axe to respond to increased levels of P application. This replicates the 2009 broad acre study where there was also a suggestion of an Axe response to increasing P rates. The 2009 response was not repeated with Gladius in 2010 with no suggestion of increased yield from increased P application rates (0, 4, 6, 8, 10 and 12 kg/ha).

It must be remembered that seeding was relatively early in May 2009 and in 2010 the growing season was longer than usual, both situations that would not benefit the comparative yield of the early maturing Axe above the other early-mid season to mid season varieties in the study. The 8 kg of applied P allowed the Axe to achieve a similar yield to other varieties irrespective of their applied P rate. Indications were that all other varieties with longer growing seasons in an above rainfall season with a soft finish, were able to meet required P demands from the soil P reserves.

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*General notes on broad acre study*

- The rainfall was adequate up until late September with the 48 mm of rain in the last 3 days of October too late for the earlier maturing Axe and Mace.
- Protein levels were low due to seasonal conditions and the high yields and all varieties were APW quality.
- All varieties yielded more under higher fertiliser rates. With exceptional yields and high prices, putting on high rates of fertiliser was a great investment (Table 2).
- As in 2009, Axe was the most responsive variety with 8 units increasing yields by 0.44 t/ha giving a return on investment of 333% (gain from fertiliser less cost of fertiliser then divided by the cost of the fertiliser). Mace, Yitpi and Gladius had similar yield responses to phosphorus despite a couple of aberrations in the Gladius yields.
- When comparing varieties at 4 units of P (normal practice) yields were Axe 2.12 t/ha (97% of Yitpi); Gladius 2.3 t/ha (105%); Mace 2.38 t/ha (109%) and Yitpi 2.19 t/ha (100%).
- The good zones (usually sandier soil on hills) were still the best yielding parts of the paddock unless limited by nitrogen deficiency, grass or root disease. The wet season reduced the variation across the paddock by improving yields on the average and poor zones as the lower water holding capacity of the soils was not so limiting in 2010. The poor zones were still the lowest yielding areas of the paddock.
- Using a P replacement strategy, replacing the phosphorus removed by the grain in this paddock in 2010 (3 kg P/t of wheat) will require 7 units of phosphorus next year which is above the normal rate.

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