

Phosphorus rate trial and alternative fertilisers

Key findings

- After 4 years of no applied phosphorus fertiliser grain yield of barley was significantly lower than where phosphorus had been applied.
- Alternative phosphorus sources such as biosolids, chicken litter or biochar, produced significantly lower yields compared to phosphorus fertiliser.

Why do the trial?

To investigate the impact of conventional phosphorus fertilisers and alternative sources of phosphorus on the grain yield and quality of barley.

How was it done?

Plot size	1.4m x 10m	Fertiliser	Urea @ 35 kg/ha at sowing Urea @ 50 kg/ha 10 th August Phosphorus applied as per treatment
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Seeding date	11 th June 2010	Variety	Flagship barley @ 80 kg/ha
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Trial 1. Phosphorus rate: randomised complete block design with 3 replicates and 4 treatments.

Treatments were re-sown over the same treatments from 2007, 2008 and 2009.

Trial 2. Biosolids and chicken litter: randomised complete block design with 3 replicates and 8 treatments.

A single application of biosolids and chicken litter were broadcast by prior to sowing in 2008. The biosolids + 65 kg/ha single super and chicken litter + 65 kg/ha single super treatments had a repeated application of 65 kg/ha single super in 2009 and 2010.

Treatments were sown over the same treatments areas each year.

Trial 3. Biochar, phosphorus solubiliser and Avail fertiliser treatment: randomised complete block design with 3 replicates and 12 treatments.

Avail phosphorus fertiliser enhancer was included in 2010 as a single treatment or with either 5 or 10 kg P/ha. All other previously applied treatments of biochar or phosphorus solubiliser received phosphorus (single super) only.

Treatments were sown into standing wheat stubble from the 2009 commercial crop.

Single superphosphate was used as the standard phosphorus treatment.

The initial Colwell soil phosphorus (March 2007) was 40 mg/kg (0 – 10 cm)

The phosphorus buffering index (PBI) was 102.

Plots were assessed for grain yield, protein, test weight and screenings with a 2.2 mm screen and retention with a 2.5mm screen.

Samples of the biosolids and chicken litter used in 2008 were analysed for nutrient concentration (Table 1).

Table 1: Fertiliser nutrient concentrations (kg/t) of biosolids and chicken litter applied in 2008.

Nutrient	Single superphosphate	DAP	Biosolids	Chicken litter
Nitrogen	0	180	15	43
Phosphorus	90	200	10	8
Potassium	0	0	8	2
Sulphur	110	15	8	6
Zinc	0	0	1	1

Results

In the long term phosphorus experiment (Trial 1) the grain yield ranged between 4.72 t/ha (nil phosphorus) to 5.49 t/ha (15 kg P/ha). While this was not statistically significant at the 95% level, there is still a trend where the nil treatment has produced the lowest grain yield, after 4 years of receiving no phosphorus. Protein was also significantly lower with this treatment.

In trial 2 the addition of 10 or 12 kg P/ha for the past 3 seasons significantly increased grain yield compared with no phosphorus. The biosolid or chicken litter treatments alone were lower yielding. Treatments had no effect on grain quality.

In trial 3 grain yields ranged between 4.39 t/ha and 5.20 t/ha, with no difference in grain quality between the treatments. All treatments receiving 5 or 10 kg P/ha for the past 2 seasons were significantly higher yielding. The addition of biochar, phosphorus solubilisers or Avail did not increase grain yield.

Table 2: Trial 1. Grain yield (t/ha), protein (%), test weight (kg/hL), retention (%) and screenings (%) at Hart in 2010.

Treatment	Grain yield (t/ha)	Protein (%)	Test weight (kg/hL)	Screenings (%)	Retention (%)
Nil	4.72	10.7	67.7	1.4	90.7
5kg/ha P	4.97	11.7	67.4	1.4	89.2
10kg/ha P	5.00	11.7	68.3	1.5	90.0
15kg/ha P	5.49	11.4	68.0	1.4	91.2
LSD (0.05)	ns	0.4	ns	ns	ns

Table 3: Trial 2. Grain yield (t/ha), protein (%), test weight (kg/hL), retention (%) and screenings (%) at Hart in 2010.

Treatment	Grain yield (t/ha)	Protein (%)	Test weight (kg/hL)	Screenings (%)	Retention (%)
Nil	4.40	11.0	67.9	1.6	88.9
5t/ha Biosolids	4.86	11.4	68.6	1.4	89.8
5t/ha Biosolids + 12kg/ha P	5.06	11.0	68.5	1.7	88.5
3t/ha Chicken litter	4.40	11.3	68.5	1.7	88.5
3t/ha Chicken litter + 12kg/ha P	5.30	11.2	68.5	1.9	88.1
10kg/ha	5.20	10.7	68.1	1.6	89.8
LSD (0.05)	0.24	ns	ns	ns	ns

Table 4: Trial 3. Grain yield (t/ha), protein (%), test weight (kg/hL), retention (%) and screenings (%) at Hart in 2010.

Treatment	Grain yield (t/ha)	Protein (%)	Test weight (kg/hL)	Screenings (%)	Retention (%)
Nil	4.48	11.4	67.4	1.9	89.3
5kg/ha P	5.10	11.5	67.6	2.0	86.4
10kg/ha P	5.10	11.5	68.2	1.7	87.6
500kg/ha Biochar	4.43	11.5	67.5	1.7	88.4
500kg/ha Biochar + 5kg/ha P	4.91	11.3	68.2	1.7	88.5
500kg/ha Biochar + 10kg/ha P	5.20	11.0	68.0	1.6	89.9
500kg/ha Biochar + Liquid P	4.77	11.4	68.0	1.6	90
P solubiliser	4.39	11.4	67.2	1.8	87.5
P solubiliser + 5kg/ha P	4.97	10.8	67.7	1.7	88.3
P solubiliser + 10kg/ha P	5.15	11.4	67.1	1.4	87.9
Avail + 5 kg P	4.82	11.2	67.2	1.9	87.9
Avail + 10 kg P	4.92	11.8	68.3	1.6	90.1
LSD (0.05)	0.31	ns	ns	ns	ns