

# Fluid Phosphorus in the Mallee Landcare Delivery Sites



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## Aim

To determine if fluid sources of phosphorus (P) have a greater efficiency for cereal production in the Southern Mallee.

To ascertain whether the effectiveness and delivery of micronutrients, such as Zinc (Zn), is improved when supplied as a fluid.

## Take home messages

- *There was no significant difference in early dry matter (GS30) or grain yield from the application of P at three trial sites at Hopetoun, Sea Lake and Waitchie*
- *The addition of chelated Zn and Flutriafol failed to increase grain yield at any of the sites*
- *There was no yield difference when P was supplied either as a fluid or a granular product*
- *There was no increase in grain yield from the addition of P or Zn at any of the sites.*

## Methods

Location: Hopetoun, Sea Lake and Waitchie

Replicates: 4

Sowing date: 27 May (Waitchie and Sea Lake), 28 May (Hopetoun)

Target Plant density: 175 plants/m<sup>2</sup>

Crop type: Young (Sea Lake), Derrimut (Hopetoun and Waitchie)

Seeding equipment: Narrow point, press wheels and 20cm row spacing.

Three replicated field trials were established at the BCG Landcare Delivery sites at Hopetoun, Sea Lake and Waitchie. The trials compared four P rates (4.5, 9.0, 13.5, and 18kg P/ha) supplied as either granular or fluid products (Table 1). A control treatment (0kg P/ha) was included to determine if there was a response to P addition.

One granular (Granulock Supreme Z) and two fluid P treatments contained Zn. Stoller Broadacre Zinc™ (Zn: 10% w/v, SG 1.38) was used to enrich phosphoric acid with Zn for one of the treatments. Where this fertiliser was applied the rate of zinc was kept constant at 0.28kg Zn/ha, regardless of the rate of P applied. The other Zn treatments were pre-formulated and so the rate of Zn increased with P rate (Table 1).

Interaction of nutrition with fungicide was investigated at Hopetoun and Waitchie. Flutriafol (Impact®) was added to the PA plus Zn mixture for control of stripe rust (*Puccinia striiformis*).

**Table 1.** Treatments applied at Hopetoun, Sea Lake and Waitchie.

Treatment	Product	Application Rate	P rate (kg P/ha)	Zn Rate (kg Zn/ha)	Impact <sup>®</sup> (ml/ha)*
Control	-	-	0	0	0
MAP	Granular	20 kg/ha	4.5	0	0
		41 kg/ha	9	0	0
		61 kg/ha	13.5	0	0
		82 kg/ha	18	0	0
Granulock Supreme Z	Granular	20 kg/ha	4.5	0.2	0
		41 kg/ha	9	0.41	0
		61 kg/ha	13.5	0.61	0
		82 kg/ha	18	0.82	0
Phosphoric Acid, PA (81% H <sub>3</sub> PO <sub>4</sub> )	Fluid	17.4 L/ha	4.5	0	0
		34.7 L/ha	9	0	0
		52.1 L/ha	13.5	0	0
		70 L/ha	18	0	0
PA + ZincSol	Fluid	17 L/ha	4.5	0.28	300
		35 L/ha	9	0.28	300
		52 L/ha	13.5	0.28	300
		70 L/ha	18	0.28	300
Easy NP	Fluid	28 L/ha	4.5	0	0
		56 L/ha	9	0	0
		84 L/ha	13.5	0	0
		113 L/ha	18	0	0
Easy NP + Zinc	Fluid	31 L/ha	4.5	0.27	0
		63 L/ha	9	0.55	0
		94 L/ha	13.5	0.83	0
		125 L/ha	18	1.10	0

\* *Flutriafol* was only applied at Hopetoun and Waitchie site.

All three sites were sown to wheat, cv. Young was grown at Sea Lake and cv. Derrimut at Hopetoun and Waitchie.

Each trial was monitored regularly for weeds, pests and disease. The crop was treated with standard pesticide inputs. None of the sites received any extra nitrogen other than what was applied in the products.

Plant establishment (GS13), shoot number & dry matter production (GS30), head number (GS85), grain yield and quality (GS99) for each site was collated during the season.

Soil analysis was undertaken prior to sowing. Tissue testing was conducted at GS30 to measure foliar Zn levels.

Both the granular and fluid treatments were banded with the seed.

#### *About the fertilisers*

- **Mono-ammonium Phosphate, MAP** (N10:P21.9:S1:Zn0) a commonly used granular P fertiliser supplied by Incitec Pivot.



- **Granulock Supreme Z (N11:P21.8:S4:Zn1)**, zinc enriched granular P fertiliser with a similar analysis as MAP, supplied by Incitec Pivot.
- **Phosphoric Acid, PA (81% H<sub>3</sub>PO<sub>4</sub>) (N0:P31.6:S0:Zn0)**: highly acidic fluid P fertiliser. Produced by melting rock phosphate in an electric furnace. PA is the cheapest and more pure source of fluid P.
- **Easy NP (N11.0 P16.0 w/v)** Ammoniated poly- phosphate liquid P fertiliser, supplied by Incitec Pivot.
- **Easy NP + Zn (N9.9 P 14.4 Zn 0.68% w/v)** Ammoniated poly-phosphate, enriched with zinc in chelate form.
- **Stoller Broadacre Zinc™ (N0:P0:S4.6:Zn10)**: fluid zinc fertiliser.  
A chelated Zinc compound registered for foliar application and seed dressing/coating.

## Results

### Rainfall

The rainfall data for each site is presented in Table 2. Below average annual and growing season rainfall .

**Table 2.** Rainfall data for the trial sites at Hopetoun, Sea Lake and Waitchie.

	Hopetoun	Sea Lake	Waitchie
<b>GSR</b>	146	139	108
<b>Long-term Average GSR</b>	200	214	202
<b>Annual Rainfall</b>	247	294	268
<b>Long-term Average Annual</b>	348	329	305

### Soil analysis

The soil results showed that all sites had adequate levels of P (Table 3). Tissue analysis taken at GS30 showed Zn was not limiting.

**Table 3.** Soil analysis for trial sites at Hopetoun, Sea Lake and Waitchie, conducted 9 April 2008.

	Hopetoun	Sea Lake	Waitchie
<b>pH (CaCl<sub>2</sub>)</b>	-	7.8	8.0
<b>Colwell P</b>	52	44	26
<b>PBI</b>	54	38	100
<b>Available N (0-100cm) (kg N/ha)</b>	31	79	56
<b>Available Moisture (0-100cm) (mm)</b>	24	0	0

### Crop growth and yield

At Hopetoun and Sea Lake there were no significant differences in plant establishment, shoot number, dry matter production, head number or yield between any of the treatments applied and the control plots. Significant differences in plant establishment were detected at Waitchie but these differences were not related to P or Zn rate. No other significant differences in yield, shoot number, dry matter or head number were detected at Waitchie. Average yield at Sea Lake was 2.0t/ha, 0.17t/ha at Waitchie and 1.8t/ha at Hopetoun.

### Fluid vs Granular P

There was no significant difference overall between the fertiliser forms applied at Hopetoun and Waitchie. At Sea Lake, the granular products yielded slightly higher than the fluid products (Table 4).

**Table 4.** The effect of P form on grain yield at Waitchie, Hopetoun and Sea Lake, mean of all P and Zn rates.

P Form	Grain Yield (t/ha)		
	Sea Lake	Hopetoun	Waitchie
Granular	2.04	1.85	0.14
Fluid	1.97	1.86	0.18
<b>LSD (P&lt;0.05)</b> <b>C.V. %</b>	<b>S</b> <b>0.06</b> <b>6.5%</b>	<b>NS</b> <b>6.2%</b>	<b>NS</b> <b>11.4%</b>

### Zinc

No significant difference in yield was found from the addition of Zn above the control. There was also no difference in yield between the forms of zinc applied (fluid vs granule) at any of the sites (Table 5). Increasing the rate of Zn did not improve grain yield.

**Table 5.** Affect of Zn on grain yield applied with 9kgP/ha in fluid and granular forms.

Treatment	Grain Yield (t/ha)		
	Sea Lake	Hopetoun	Waitchie
<b>Control</b>	1.96	1.79	0.14
<b>MAP</b> (9kg P/ha, 0kgZn/ha)	1.99	1.86	0.14
<b>Granulock Supreme Z</b> (9kg P/ha 0.41kg Zn/ha)	1.94	1.82	0.18
<b>Easy NP</b> (9kg P/ha, 0kgZn/ha)	2.00	1.77	0.22
<b>Easy NP- Zn</b> (9kg P/ha, 0.55kg Zn/ha)	1.87	1.97	0.19
<b>LSD (P&lt;0.05)</b> <b>C.V. %</b>	<b>NS</b> <b>5.0%</b>	<b>NS</b> <b>8.2%</b>	<b>NS</b> <b>27.2%</b>

### Disease

Stripe rust was not present at any of the sites and there was no significant affect of Impact on crop yield (Table 6). In terms of physical compatibility, both products (PA and Flutriafol) mixed well, with no precipitation evident.

### Grain quality

There was no significant difference in grain quality (protein and screenings) for any of the treatments applied, at any of the sites. The mean protein at Hopetoun, Sea Lake and Waitchie were 9.3%, 11.6%, 13.6% respectively and the screenings were 7.6%, 7.9%, and 8.7% respectively.

**Table 6.** The addition of fungicide to phosphoric acid at Waitchie and Hopetoun.

Treatment	Grain Yield (t/ha)	
	Hopetoun	Waitchie
Control	1.79	0.14
PA (9kg P)	1.82	0.16
PA (9kg P) + Flutriafol	1.97	0.15
LSD (P<0.05)	NS	NS
C.V %	8.3%	36.5%

## Interpretation

Overall, there were no differences in crop growth or yield related to application of P and Zn as either fluid or granular products at the three sites. All three sites had adequate soil P levels (Colwell P > 26ppm) and relatively low PBI values (<100) and so are unlikely to be responsive to applied P (based on previous studies and BCG trials).

Though the addition of Zn did not increase grain yield at any of the sites, compatibility did not appear to be a problem. Tissue analysis (not presented) showed adequate levels of Zn in the control treatments, so responses to Zn application were also unlikely.

Stripe rust was not found at the Hopetoun or Waitchie sites, despite being reported in district. This meant any benefit of the addition of Flutriafol could not be assessed.

## Application

While fertiliser prices for the 2009 season have fallen from their peak at \$1400/t MAP in 2008, the cost of fluids compared to granular products (on average 1.5 times the cost of MAP) is still prohibitive without consistent evidence of yield improvement.

Significant yield increases (up to 40% increase in wheat yield) to fluids have been found in South Australia. These soils are predominantly alkaline, calcareous soils ( $\text{CaCO}_3 > 90\%$ ), contrary to the Victorian Mallee where the soil are not calcareous ( $\text{CaCO}_3 < 30\%$ ). For the Victorian Mallee, BCG and DPI studies have shown no or only slight yield increase from fluids. The greatest advantage of fluids is likely to be a logistical practice and the ability to mix different rates of micronutrients and fungicides together.

If considering replacing granular P fertiliser with a fluid, thoroughly research the costs involved and compare the cost of fluid products to granular products on a per kilogram P basis. The capital investment to convert to fluid ranges from \$25,000-30,000 depending on the size of the seeder.

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