P x K response in cereals

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Purpose: To investigate responses to phosphorus and potassium in wheat.

Location: Badgingarra

Soil Type: Blackbutt Sand

Soil Results:

Depth	P	K	S	Cu	Zn	OC	pH	PBI	Nitrate	Ammonium
0 – 10	9	36	3	1.1	0.82	1.18	5.2	15.45	1	2
10 -20	4	30	4	0.42	0.35	0.35	4.6	18.85	0	0

Rotation: Pasture 2010

BACKGROUND

Soil testing of the site showed low phosphorus and potassium levels. The trial was established to provide information on the response of wheat to phosphorus and potassium on a sandy soil. The data generated will be used to verify the response curves for phosphorus and potassium in our soil recommendation model.

TRIAL DESIGN

Plot size: 1.84m x 12m

Replicates: 3 (randomized blocks)

Machinery: Small plot seeder, knife points and press wheels

Crop details: Mace wheat @ 90kg/ha on 9 June 2011

Fertiliser: **At seeding** UAN @ 50L/ha, Cu @ 300gm/ha and Zn @ 300gm/ha injected

Post: UAN @ 50L/ha (14 July); UAN @ 40L/ha (4 August)

Herbicide: **Pre:** Roundup @ 2L/ha; Avadex @ 1.8L/ha; Trifluralin @ 2.5L/ha; Diuron @ 400ml/ha

Post : Monza @ 25gm/ha (14 July)

Fungicide Prosaro @ 300ml/ha (4 August)

Treatments:

Table 1: *Details of P x K treatments*

Treatment No.	Treatment	Seeding Fertiliser Rate Banded		Seeding Fertiliser Rate Banded		Top dressed Fertiliser – Immediately post seeding	
1	0 P 0 K	-		-		-	
2	6 P 0 K	TSP	29 kg/ha	-	-	-	-
3	12 P 0 K	TSP	58 kg/ha	-	-	-	-
4	18 P 0 K	TSP	88 kg/ha	-	-	-	-
5	24 P 0 K	TSP	106 kg/ha	-	-	-	-
6	0 P 10 K			MOP	20 kg/ha	-	-

Treatment No.	Treatment	Seeding Fertiliser Rate Banded		Seeding Fertiliser Rate Banded		Top dressed Fertiliser – Immediately post seeding	
7	12 P 10 K	TSP	58 kg/ha	MOP	20 kg/ha	-	-
8	24 P 10 K	TSP	106 kg/ha	MOP	20 kg/ha	-	--
9	0 P 20 K			MOP	40 kg/ha	-	-
10	12 P 20 K	TSP	58 kg/ha	MOP	40 kg/ha	-	-
11	24 P 20 K	TSP	106 kg/ha	MOP	40 kg/ha	-	
12	12 P 10 K TD	TSP	58 kg/ha	-	-	MOP	20 kg/ha
13	12 P 20 K TD	TSP	58 kg/ha	-	-	MOP	40 kg/ha
14	12 P 40 K TD	TSP	58 kg/ha	-	-	MOP	80 kg/ha

RESULTS

Table 2: *P x K treatment and vigour score, yield, protein, hectoliter weight and screenings results*

Treatment No.	Treatment	Crop Vigour Score	Yield (T/ha)	Protein %	Hectolitre Weight	Screenings %
1	0 P 0 K	60.0	3.31	10.1	73.3	1.66
2	6 P 0 K	83.3	4.12	9.8	75.3	2.17
3	12 P 0 K	80.0	4.10	10.1	72.0	1.56
4	18 P 0 K	90.0	4.00	10.3	72.8	1.79
5	24 P 0 K	85.0	4.13	9.9	75.1	1.83
6	0 P 10 K	66.7	3.36	10.3	72.0	1.82
7	12 P 10 K	80.0	3.93	10.0	74.2	1.82
8	24 P 10 K	91.7	4.15	10.2	73.9	1.56
9	0 P 20 K	53.3	3.31	9.8	75.6	1.71
10	12 P 20 K	80.0	3.82	10.2	73.0	1.91
11	24 P 20 K	86.7	4.11	10.0	74.2	1.55
12	12 P 10 K TD	80.0	4.05	10.2	75.1	1.29
13	12 P 20 K TD	80.0	4.01	10.1	74.8	1.50
14	12 P 40 K TD	73.3	3.62	10.5	75.8	1.14
LSD		17.3	NS			

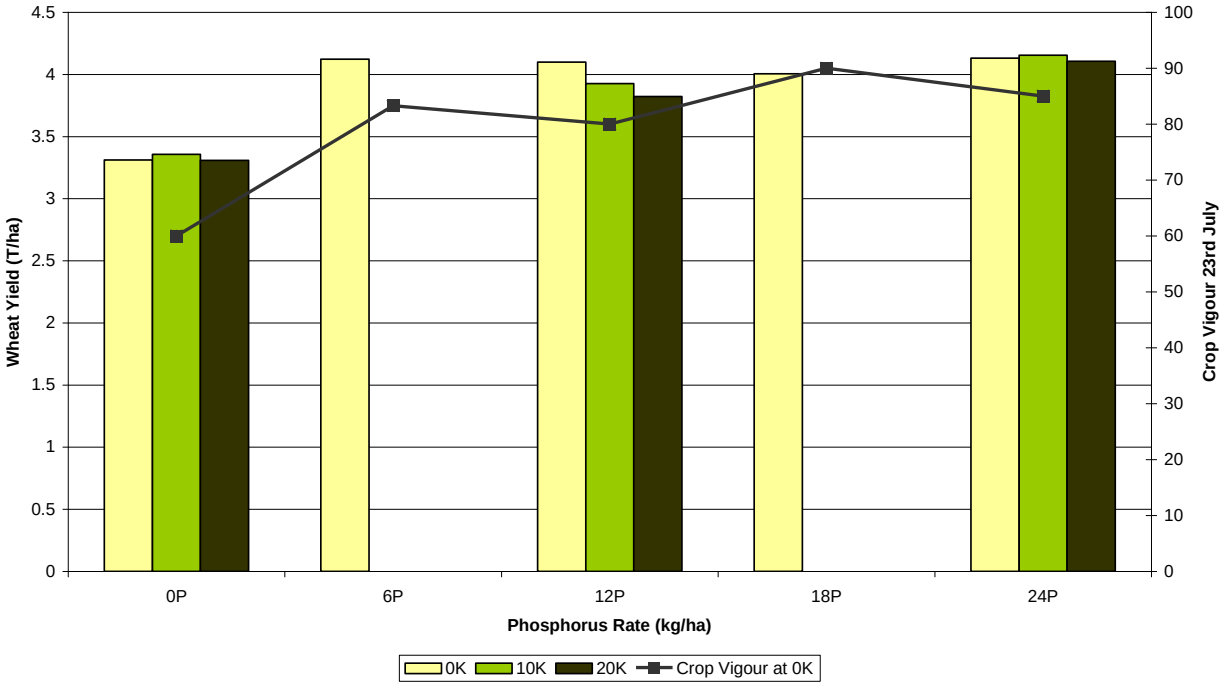

Figure 1: *Wheat yield responses to Phosphorus at varying rates*

Crops were assessed for early crop vigour at 45 DAS, with visual ratings ranging from 53.5 to 91.7 across all treatments. Figure 1 shows the treatments that had 0 kg P/ha were significantly less vigorous than the treatments that had phosphorus applied irrespective of the potassium rate applied. This demonstrates the importance of phosphorus early in crop growth when cell division and multiplication is rapid and very energy consuming.

Figure 1 also shows the yield response to applied phosphorus. All plots that had 0P applied yielded an average of 3.325 t/ha, whereas the average of all plots that had phosphorus applied was 4.00 t/ha. This response was not significant due to some variation in plot yields across the trial due to barley grass and sub clover but it does show the value of phosphorus to crop production.

The response to phosphorus application did lead to additional returns as a result of the increased yield achieved. Applying 6 kg/ha of phosphorus resulted in an additional $141 per hectare. As the yield did not respond above 6 kg/ha of phosphorus the return started to diminish due to the increased expenditure on Fertiliser. The trend was the same for potassium as there was no yield response to applied potassium as shown in Figure 2.

Table 3: *Return per hectare at different phosphorus and potassium rates.*

Potassium applied (Kg/ha)	**Phosphorus applied (Kg/ha)**				
	0	**6**	**12**	**18**	**24**
0	$592.40	$733.40	$707.80	$667.80	$672.00
10	$568.40		$658.20		$662.00
20	$561.80		$622.80		$637.60

(On farm wheat price of $200/T, variation in grade due to protein or hectolitre wt not taken into account on individual treatments but in average price, $3.50 / unit of P, $1.50 / unit of K and $1.60 / unit of N)

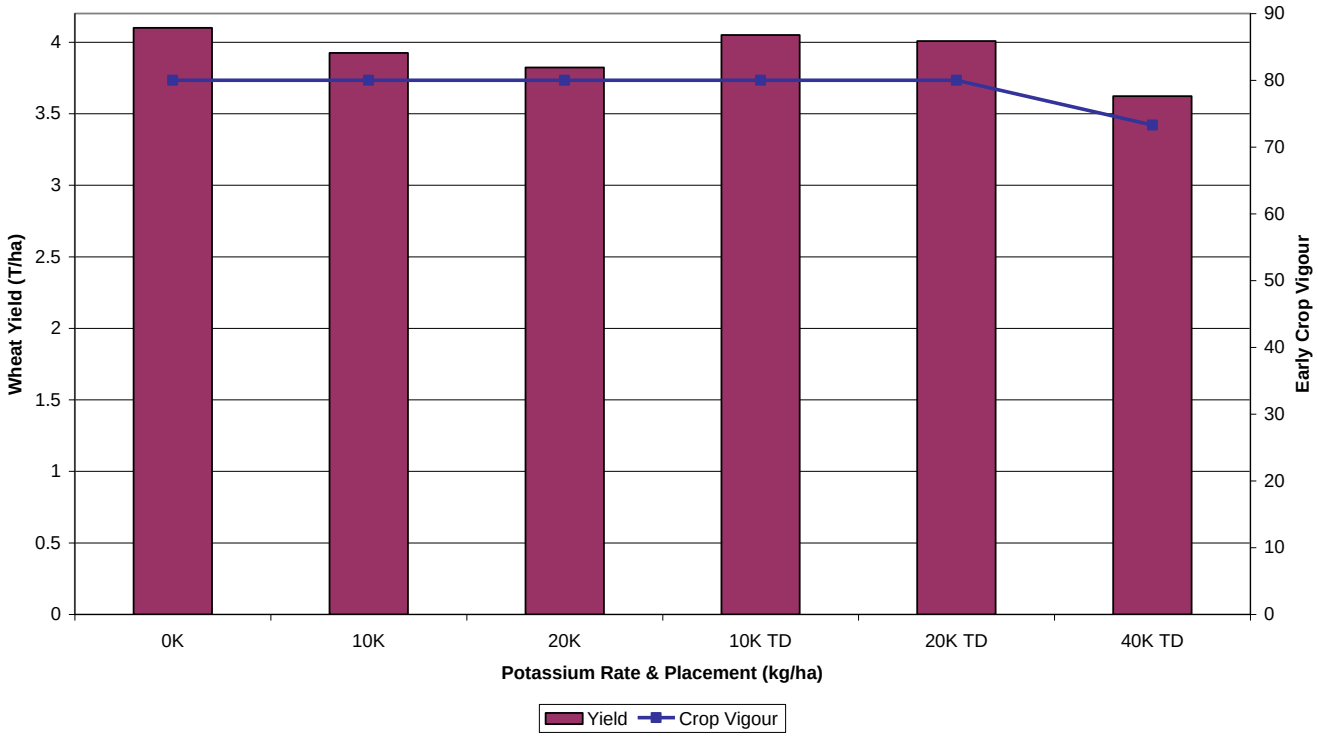

Figure 2: *Crop response to applied potassium at 12 kg P/ha*

There was no yield or early crop vigour response to applied potassium in this trial even though the soil test results of 36 mg/kg in 0 – 10 cm and 30 mg/kg in 10 – 20cm are relatively low. Figure 2 also shows the response to drilled or topdressed potassium where 12 kg P/ha was applied. With the good moisture conditions all year it is likely that the wheat crop was better able to source potassium from the soil surface or sources below 20cm. This may indicate that there is a lot more value in subsoil potassium levels, especially if the subsoil pH is not limiting root growth. It is important to do subsoil testing for pH but it will be worthwhile analyzing these samples for potassium levels to determine the size of the nutrient pool available to the crop.

Grain quality was not impacted markedly by the applied phosphorus or potassium in this trial. The protein was around 10% with some treatments falling below this level. Grain protein below 10% results in the delivery grade falling from APW2 to ASW1 which has an impact on the value per tonne. This low protein result and a lack of screenings indicates that the trial was marginal for nitrogen and this may have limited the response to phosphorus and potassium.

SUMMARY

- The early crop vigour results in this trial demonstrates the need to apply fresh phosphorus to crops at seeding to ensure good plant shoot and root growth during the early stages of crop growth.
- There was no difference observed between potassium drilled with the seed or topdressed immediately after sowing. Good rainfall conditions early in the season may have rapidly moved the topdressed potassium into the root zone of the crop therefore overcoming any differences due to placement. Subsoil testing for potassium may be important to determine the size of the soil potassium pool.

REVIEWED: Brett Beard, Summit Fertilisers

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