Phosphorus by Nitrogen Response in Wheat

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AIM To investigate responses to phosphorus and nitrogen in wheat.

TRIAL SITE

Location: West Midlands Group Trial Site, 'Scotney's' Mungedar Road, Badgingarra

Rainfall: Growing season rainfall in 2012 (April to October) was 337mm compared to the average of 470mm. May and July were particularly dry.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012	23.6	37.6	0.8	6.8	15.0	113.2	24.0	100.0	73.2	5.0	96.8	14.6
Average	9.2	15.7	15.8	27.3	69.7	104	104.7	84.1	51.4	29.2	20.2	9.8

Soil Type: Gravelly sand

Soil Test Results:

Depth	P	K	S	Cu	Zn	OC	pH	Al	PBI	Nitrate	Ammonium
0 – 10	23	131	7	0.75	1.32	1.28	5.0	1.3	29	41	5
10 -20	2	57	13	0.15	0.05	0.31	4.2	15	38	3	1

Rotation: Pasture 2011, Pasture 2010

TRIAL DESIGN

Plot size: Length 12.0m, width 1.84m, row spacing 22.9cm (9")
Machinery use: Small plot seeder, knife points and press wheels
Replicates: 3 (randomized blocks)
Crop type: Cobra wheat
Seeding rates and dates: 70kg/ha sown on 18th May 2012

TREATMENTS

Site was topdressed with 3 T/ha lime and 50 kg/ha Muriate of Potash in late April by the grower.

Nitrogen treatments applied as a split treatment of UAN on 11th July and 8th August 2012

Pre emergent

Herbicides	1.5L/ha Sprayseed, 100g/ha Lontrel, 400ml/ha Diuron & 118gm/ha Sakura
Insecticides	1L/ha chlorpyriphos & 200ml/ha Talstar

Post emergent

Herbicides	11th July	670ml/ha Velocity & 5gm/ha Ally
Fungicides	8th August	500ml/ha Tilt

Treatment No.	Treatment	Seeding Fertilizer Rate Banded		N top up rate 4WAE		N top up rate 10WAE	
1	0 P 0 N		0 kg/ha				
2	0 P 40 N		0 kg/ha	UAN	47.5 L/ha	UAN	47.5 L/ha
3	0 P 80 N		0 kg/ha	UAN	95.0 L/ha	UAN	95.0 L/ha
4	0 P 120 N		0 kg/ha	UAN	142.5 L/ha	UAN	142.5 L/ha
5	8 P 0 N	TSP	39 kg/ha				
6	8 P 40 N	TSP	39 kg/ha	UAN	47.5 L/ha	UAN	47.5 L/ha
7	8 P 80 N	TSP	39 kg/ha	UAN	95.0 L/ha	UAN	95.0 L/ha
8	8 P 120 N	TSP	39 kg/ha	UAN	142.5 L/ha	UAN	142.5 L/ha
9	16 P 0 N	TSP	78 kg/ha				
10	16 P 40 N	TSP	78 kg/ha	UAN	47.5 L/ha	UAN	47.5 L/ha
11	16 P 80 N	TSP	78 kg/ha	UAN	95.0 L/ha	UAN	95.0 L/ha
12	16 P 120 N	TSP	78 kg/ha	UAN	142.5 L/ha	UAN	142.5 L/ha
13	24 P 0 N	TSP	117 kg/ha				
14	24 P 40 N	TSP	117 kg/ha	UAN	47.5 L/ha	UAN	47.5 L/ha
15	24 P 80 N	TSP	117 kg/ha	UAN	95.0 L/ha	UAN	95.0 L/ha
16	24 P 120 N	TSP	117 kg/ha	UAN	142.5 L/ha	UAN	142.5 L/ha

TRIAL LAYOUT

Mungadar Road

Fence line

N ↓

Buffer					
Buffer					
1	0 P 0 N	**6**	8 P 40 N	**14**	24 P 40 N
2	0 P 40 N	**7**	8 P 80 N	**2**	0 P 40 N
3	0 P 80 N	**5**	8 P 0 N	**8**	8 P 120 N
4	0 P 120 N	**3**	0 P 80 N	**12**	16 P 120 N
5	8 P 0 N	**10**	16 P 40 N	**4**	0 P 120 N
6	8 P 40 N	**4**	0 P 120 N	**11**	16 P 80 N
7	8 P 80 N	**8**	8 P 120 N	**3**	0 P 80 N
8	8 P 120 N	**9**	16 P 0 N	**13**	24 P 0 N
9	16 P 0 N	**1**	0 P 0 N	**9**	16 P 0 N
10	16 P 40 N	**16**	24 P 120 N	**7**	8 P 80 N
11	16 P 80 N	**15**	24 P 80 N	**5**	8 P 0 N
12	16 P 120 N	**13**	24 P 0 N	**6**	8 P 40 N
13	24 P 0 N	**14**	24 P 40 N	**10**	16 P 40 N
14	24 P 40 N	**2**	0 P 40 N	**1**	0 P 0 N
15	24 P 80 N	**11**	16 P 80 N	**15**	24 P 80 N
16	24 P 120 N	**12**	16 P 120 N	**16**	24 P 120 N
Buffer					

RESULTS

Observations of crop vigour during the growing season are shown in Table 1. Early observations of crop vigour (11th July) found that the 0P plots at all rates of nitrogen were significantly less vigorous than the plots that had phosphorus applied, with the plants in the highest rates of P applied showing the highest vigour. This response to applied P was still evident at the later observations of crop vigour on 8th August. This 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.

Plant tests taken on the 7th August showed little differences between the treatments with all plots being low in nitrogen, nitrate and phosphorus but adequate or high for all other nutrients.

Grain yields (Table 1 & Figure 1) do not show significant responses to the application of nitrogen and phosphorus at this site. There is a trend to higher yields as the phosphorus rate increases from 0P to 8P or 16P. It also shows that at 0P there is no response to applying nitrogen whereas in the presence of phosphorus there is a response to applying nitrogen. The highest yield and gross margin was achieved where 24 units of phosphorus and 120 units of nitrogen were applied and this was statistically higher than any other treatment in the trial.

Table 1. Crop vigour and grain yield responses to nitrogen and phosphorus.

Treatment No.	Treatment	Crop Vigour (%) 11/07/2012		Crop Vigour (%)		Crop Yield (t/ha)	
1	0 P 0 N	33	*c*	53	*d*	3.01	*d*
2	0 P 40 N	40	*bc*	67	*c*	3.13	*cd*
3	0 P 80 N	50	*abc*	68	*c*	3.33	*bcd*
4	0 P 120 N	47	*abc*	63	*c*	3.17	*bcd*
5	8 P 0 N	70	*a*	77	*b*	3.23	*bcd*
6	8 P 40 N	60	*abc*	83	*ab*	3.63	*bcd*
7	8 P 80 N	63	*ab*	85	*ab*	3.66	*bcd*
8	8 P 120 N	60	*abc*	80	*ab*	3.88	*bcd*
9	16 P 0 N	67	*ab*	82	*ab*	3.53	*bcd*
10	16 P 40 N	67	*ab*	88	*ab*	4.09	*bc*
11	16 P 80 N	60	*abc*	88	*ab*	3.87	*bcd*
12	16 P 120 N	73	*a*	85	*ab*	4.01	*bcd*
13	24 P 0 N	77	*a*	92	*a*	3.85	*bcd*
14	24 P 40 N	73	*a*	93	*a*	4.18	*b*
15	24 P 80 N	73	*a*	87	*ab*	3.78	*bcd*
16	24 P 120 N	73	*a*	93	*a*	4.81	*a*
	LSD (<0.001)	*18*		*8*		*0.58*	
	CV	*17*		*6*		*9.41*	

Grain quality in the trial was good (Table 2) with grain protein around 13 percent, good hectolitre weights and limited screenings. The wheat grade was either H1 or H2 and this was determined by which side of 13 the grain protein was. The grain protein levels are probably attributable to the good clover base in the pasture phase the previous two years which led to the high soil nitrate levels shown in the soil test results.

The high quality and grain yield delivered gross margins that ranged from $927 at the zero fertilizer plots to $1286 for the highest phosphorus and nitrogen rate. There is a positive return to applying phosphorus at this site but adding nitrogen did not appear to increase returns at the various phosphorus rates applied.

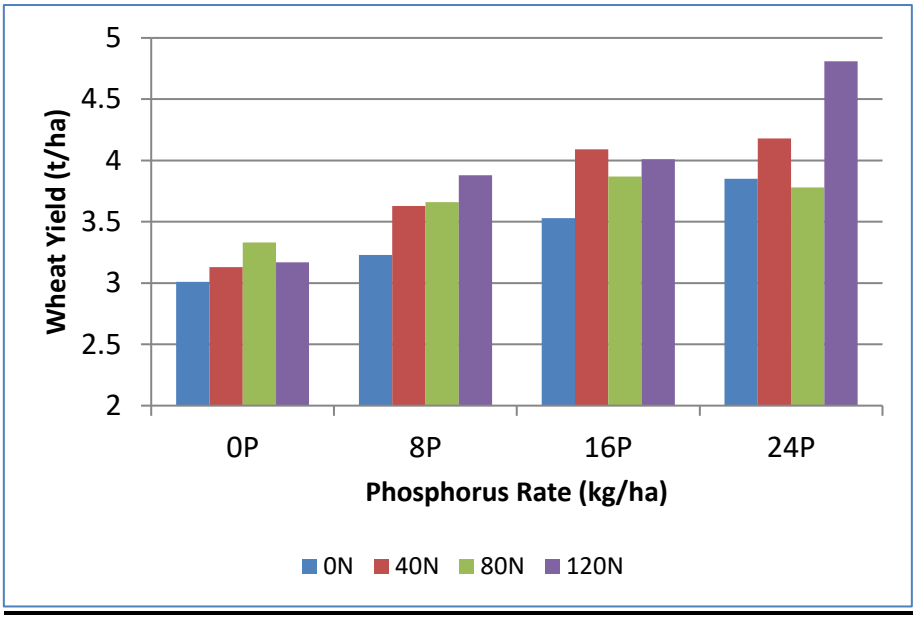

Figure 1. Wheat grain yield in response to varying rates of nitrogen and phosphorus application.

Table 2. Grain quality and gross margin responses to nitrogen and phosphorus.

Treatment No.	Treatment	Protein %	Hectolitre Wt kg/hl	Screenings %	Wheat Grade	Gross Margin $/ha
1	0 P 0 N	12.6	77.3	2.12	H2	$927.08
2	0 P 40 N	13.0	77.4	2.40	H1	$935.95
3	0 P 80 N	12.9	76.4	2.70	H2	$925.64
4	0 P 120 N	12.9	77.4	3.25	H2	$826.36
5	8 P 0 N	12.9	78.5	2.30	H2	$968.68
6	8 P 40 N	12.8	79.0	1.83	H2	$1,041.88
7	8 P 80 N	13.1	78.5	1.28	H1	$1,026.74
8	8 P 120 N	13.4	78.3	1.73	H1	$1,046.04
9	16 P 0 N	12.6	78.5	1.70	H2	$1,034.92
10	16 P 40 N	12.8	78.3	1.83	H2	$1,157.40
11	16 P 80 N	13.1	78.8	1.31	H1	$1,066.73
12	16 P 120 N	12.5	79.4	1.15	H2	$1,032.76
13	24 P 0 N	12.6	78.8	1.77	H2	$1,107.32
14	24 P 40 N	12.8	78.8	1.13	H2	$1,158.96
15	24 P 80 N	13.1	77.4	3.11	H1	$1,012.22
16	24 P 120 N	13.0	79.2	1.51	H1	$1,286.67

(* Gross Margin is calculated using crop yield and grain values, APW2 $300/t with grade spreads, and subtracting the cost/unit of P and N applied, $3.27 /kg P and $1.25 /kg N)

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