Wheat inputs experiment

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Key points

- Plant densities above about 70 plant/m^2 (35kg/ha of seed) can produce similar yields to crops sown at normal rates (60–80kg/ha for 120–170 plant/m^2) when phosphorus (P) is applied at sowing and nitrogen (N) application is restricted to low levels until first node (GS31).
- In high-rainfall years, 70 plants/m^2 will produce lower yields than crops with higher plant numbers, unless some nitrogen is applied at the five-leaf stage (GS15). If nitrogen is applied at GS15, similar yields can be obtained.
- There may be opportunities to use phosphorus in crop to maximise yields. More work needs to be carried out to confirm this.
- Lower than optimal tiller numbers can still produce acceptable yields and water use efficiencies in (WUE) wet years.

Location: Balldale, NSW

Rainfall:
Annual: 855mm (av 504mm)
GSR: 426mm (av 319mm)
Sowing moisture: Field capacity

Soil:
Type: Red chromosol
pH ($CaCl_2$): 5.3
P (Colwell): 43mg/kg
Deep soil nitrogen: 53kg/ha

Sowing information:
Sowing date: 22 May 2010
Variety: Ventura (untreated)
Row spacing: 18cm

Paddock history:
2009 — wheat
2008 — canola (hay)

Plot size: 1.5m x 16m

Replicates: 3

Aim

To assess if the previous year's results from this experiment could be replicated in a year with average to above average growing season rainfall (GSR).

Method

A replicated experiment was established to test the effect of varying seed and phosphorus and nitrogen fertiliser inputs on tiller count and yield of wheat.

2010 results

See Table 1 for results.

TABLE 1 2010 results for the wheat inputs experiment

Treatment summary	Plants (plants/m^2)	Tillers (tillers/m^2 at GS30)	Yield (t/ha)	Gross margin ($/ha)
S35/P0/N0+0	67	221	2.8	428
S35/P20/N0+0	68	322	3.8	508
S35/P20/N0+20	72	290	4.0	503
S35/P20/N0+40	71	283	4.7	598
S35/P20/N0+80	75	310	5.5	684
S35/P20/N20+20	72	367	5.3	707
S35/P20/N20+60	74	389	6.4	853
S35/P15/N0+40	74	281	4.8	634
S70/P0/N0+0	124	307	3.2	457
S70/P20/N0+0	124	468	3.9	500
S70/P20/N0+20	127	511	4.4	567
S70/P20/N0+40	120	499	5.5	746
S70/P20/N0+80	119	509	6.5	855
S70/P15/N0+40	121	290	5.0	669
S70/P5/N0+40	129	377	4.6	624
S70/P5+15[1]/N20+60	121	614	6.4	836
S70/P5+10+5[1]/N0+40	120	444	4.9	626
S70/P5+0+15[1]/N0+40	135	355	4.4	538
S70/P0+10+10[1]/N0+40	127	293	3.8	426
S35/P5+15[1]/N20+60	73	571	6.4	845
LSD (0.05)	33	64	0.4	74
Standard deviation	18	61	0.7	
Mean	101	385	4.8	
CV	17.8%	15.7%	14.5%	

Sowing rate (kg/ha) / phosphorus rate (kg/ha) / nitrogen rate (kg/ha). Phosphorus (P) fertiliser as triple super applied at sowing unless otherwise stated. Nitrogen (N) applied as urea in a split application at GS15 and GS31. First number in the nitrogen column is the amount of nitrogen (kg/ha) applied at GS15 and the number after the plus (+) is nitrogen (kg/ha) applied at GS31.

[1] In these treatments phosphorus applied at sowing, GS15 and GS31 at the rate (kg/ha) indicated. First number is the amount applied at sowing + phosphorus applied at GS15 + phosphorus applied at GS31.

Observations and comments

Results from 2010

- Plant densities of about 70 plants/m² (from 35kg/ha of seed) resulted in significantly lower yields than plant densities of about 125 plants/m² (from 70kg/ha of seed), unless nitrogen was applied at about growth stage GS15.
- Providing 20kg/ha of nitrogen was applied at GS15, 70 plant/m² produced yields that were not significantly different to those produced from the higher (125 plants/m²) plant density.
- Applying nitrogen at GS15 (five-leaf stage) significantly raises tiller numbers.
- So long as 5kg/ha of phosphorus is applied at sowing, more phosphorus can be added at GS15 and produce yields that are not significantly different to those produced from the same amount of phosphorus applied at sowing.
- Applying this additional phosphorus at GS31 produced yields that were significantly lower than those produced by applying it all at sowing.

Results from the three years' work

- Yields of wheat can be maximised from plant numbers of about 70 plants/m². From these experiments, these plant densities could be produced from about 35kg/ha of seed sown using a tined machine with 18cm spacings.
- Plant densities of less than about 70 plants/m² significantly reduces yields in a year with close to average GSR.
- When compared with the plant numbers produced from 70kg/ha of seed (125–150 plants/m²), 35kg/ha of seed (70 plants/m²) produced:
  - Significantly higher yields in low GSR years.
  - Similar yields in average GSR years.
  - Significantly lower yields in wetter than average GSR years, unless nitrogen is applied at about the GS15 stage.
- Applying nitrogen at GS15 significantly raises tiller numbers and thus yield.
- Optimum phosphorus rates vary from 5–15kg/ha depending on the original phosphorus soil test levels and possibly the yield potential.
- Optimum tiller numbers are 250–400 tillers/m² at GS31 depending on the yield potential. This is lower than the usually accepted target of 500 tillers/m².
- There may be opportunities to split phosphorus fertiliser applications provided a minimum of 5kg/ha is applied at sowing. Further work needs to be carried out to confirm this.
- Additional amounts of in-crop phosphorus can be applied until about GS15 to produce yields that are not significantly different to the same amount applied at sowing.

SPONSORS

Grains Research and Development Corporation (GRDC) through a Southern Agribusiness Extension Grant, Mr C Cay, Mrs S Cay, Mr O Smith.

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