3.3 Cereal Row Spacing Trials

3.3.1 Barley row spacing trial - Inverleigh, Vic

Location:
Inverleigh (Higgins) Research Site.

Funding:
This was a GRDC funded trial through the National Barley Agronomy Project.

Researchers:
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Thanks to Leigh Higgins for providing the land for this trials programme.

Background/Aim:
The barley row spacing trial has the overall objective of defining the benefits of wide row spacing for residue flow and inter-row crop establishment versus the potential reduction in yield and quality for higher rainfall cropping zones of southern Australia.

The individual objectives within the trial are as follows:

- To determine how nitrogen timings developed for canopy management (based on stem elongation timings) apply to wider row spacing (300mm compared to 200mm) for both dry matter production, yield and grain quality outcomes.
- To establish whether the interaction between row spacing and nitrogen timing differs between lower and higher rainfall scenarios.

Take home messages:

- ***Row Spacing:*** Row Spacing was found to be a significant (p=0.01) factor in crop yield and development. At the narrow 200mm row spacing there was a greater density of plant, shoot and head numbers than in the 300mm row spacing. Head numbers are a key contributor to the yield potential of any crop, and this was reflected in the overall yield, with the 200mm row spaces achieving a yield of 2.56 t/ha, significantly higher than the 2.30 t/ha for the 300mm row spacing.

- ***Nitrogen Timing:*** The nitrogen timing had a significant (p=0.05) effect on the quality parameters of the grain, however did not affect the yield outcome of the trial. Despite any affect between treatments the grain was ultimately downgraded to feed quality based on protein and test weight.

- ***Variety:*** There were significant (p=0.01) differences observed between the five barley varieties used in this trial. Commander (WI3416-1572) produced significantly more shoots and heads than all other varieties. This may be attributed to it being a mid maturing variety with high tillering capacity. There were also significant differences observed in yield, where Capstan, Commander and VB0432 being the highest yielding varieties. Quality parameters also significantly varied, however all varieties were downgraded to feed.

Treatments:

A. Cultivars (Sowing Date – 16th July 2008)
1. Gairdner – mid/late malt variety
2. Capstan – mid/late feed variety
3. WABAR2315 – mid season malt variety
4. Commander (WI3416-1572) – mid season malt variety
5. VB0432 – potential Gairdner type malt variety

B. Nitrogen timing (nitrogen rates are expressed as **kg/ha N NOT product)**
1. No nitrogen (0-60cm profile N was 20.45 mg/kg or 30.7 kgN/ha)
2. 100 kg/ha N Seedbed
3. 50:50 split between seedbed & GS30-31 (50kg/ha N at each timing)
4. 100 kg/ha N GS30-31

C. Row width
1. 200mm or 8" (Narrow)
2. 300mm or 12" (Wide)

Above: Barley row spacing trial, Inverleigh, Oct 2008

Results and discussion:

Row spacing:
Row spacing was determined to have a significant (p=0.01) effect on crop development. Plant, shoot and head counts were all found to be significantly higher at 200mm compared to 300mm row spacing (Figure 1). This measure of crop production ultimately leads to a significant difference in overall yield as grain and head numbers each contribute to yield potential (Figure 4).

Nitrogen timing:
No significant difference was observed between nitrogen timing on crop development for plant, shoot and head numbers in the 2008 barley trial. A visual response was observed for late applied nitrogen where all varieties at both row spacing's displayed delayed senescence. However this did not contribute to a greater proportion of head densities.

Variety:
Variety choice had a significant (p=0.01) effect on shoot and head numbers, however, it didn't affect plant establishment. Figure 3 shows that Commander (WI3416-1572) had a significantly higher number of shoot and head counts per square meter than all other varieties. Gairdner and Capstan had significantly (p=0.01) lower shoot numbers, while Gairdner had the lowest head counts of all varieties.

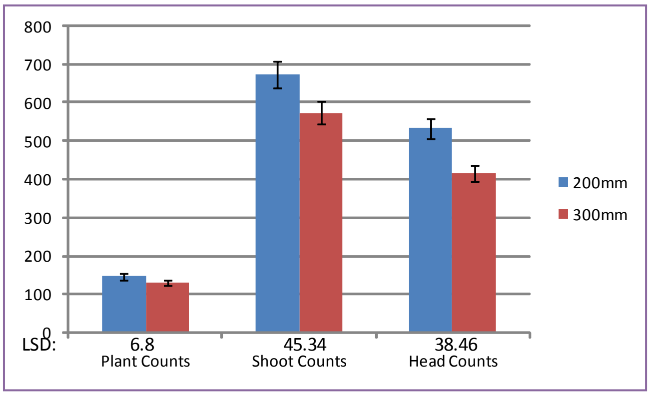

Figure 1: Effect of row spacing on crop development (counts/m^2) - means of 4 nitrogen treatments and 2 varieties. Error bars show levels of significant difference based on LSD figures provided.

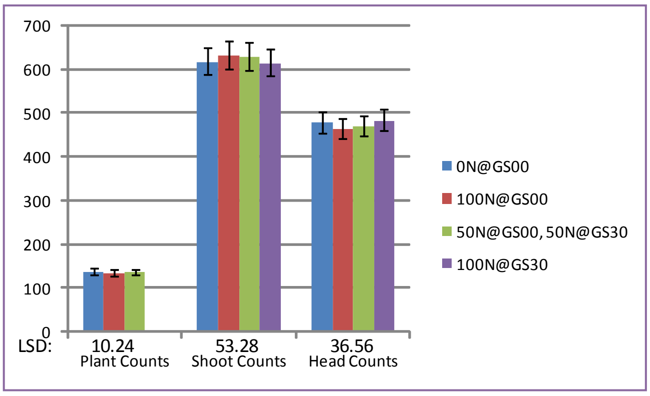

Figure 2: Effect of Nitrogen timing on crop development (counts/m^2) - means of 2 row widths and 2 varieties.

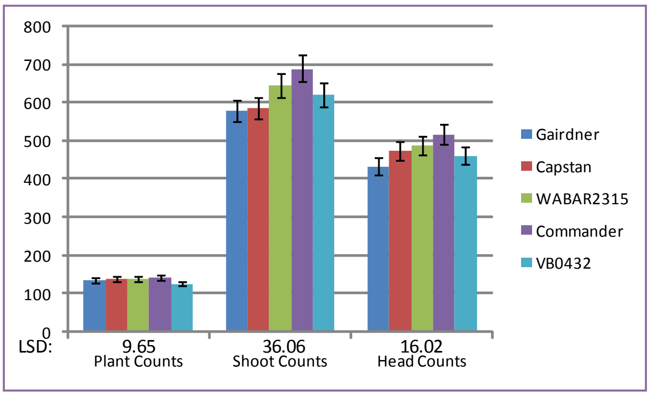

Figure 3: Effect of variety on crop development (counts/m^2) - means of 4 nitrogen treatments and 2 row widths.

Row spacing:
Row spacing had a significant (p=0.01) effect on crop yield across all varieties and nitrogen timings. Figure 1 identified that the 200mm row spacing produced a greater number of plant, shoot and head densities. These factors give an overall contribution to crop yield being higher in the 200mm row spacing.

The harvest index was found to have been greater at 300mm compared to the 200mm row spacing. Harvest index is a measure of the proportion of grain to dry matter production. In this case, the 300mm row spacing produced more grain per unit of dry matter grown than the 200mm row spacing. However as mentioned above, the 200mm row spacing produced more dry matter than the 300mm row spacing, and hence an overall greater yield.

Nitrogen timing:
Nitrogen timing was found not to have any statistical affect on crop yield. Nitrogen timing was found to have a significant (p=0.01) effect on protein. The control and 100 kg N/ha at GS30 were found to have significantly lower protein levels than the early and split nitrogen timings. The low protein levels in the late applied nitrogen treatments may be a direct effect of the dry season, where nitrogen uptake was not optimal in the latter part of the season.

Test weights were also found to be significantly (0.05) different, where the control treatment displayed the highest test weight, significantly greater than the split nitrogen timing which recorded the lowest. The 100 kg N/ha applied at seeding and the split nitrogen timing both produced a significantly (P<0.05) lower retention scores than the control and 100 kg N at GS30 treatments. Consequently the opposite can be said about screenings (Figure 5).

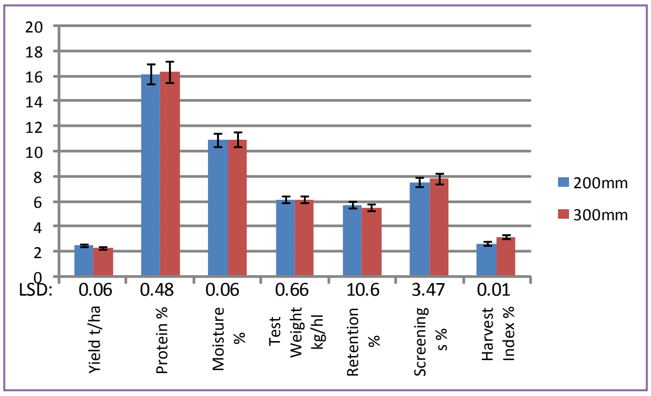

Figure 4: Effect of row spacing on seed yield and quality - means of 4 nitrogen treatments and 2 varieties.

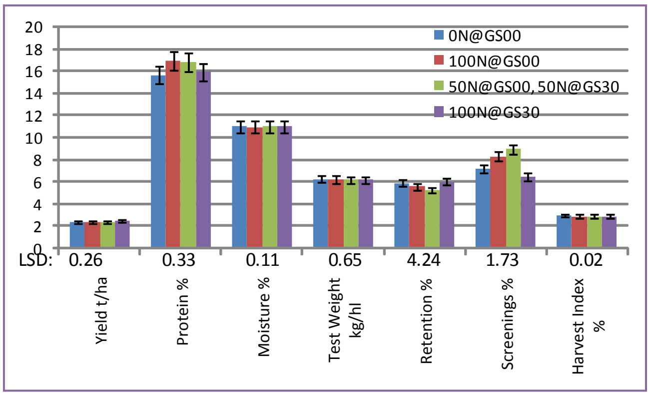

Figure 5: Effect of Nitrogen timing on seed yield and quality - means of 2 row widths and 2 varieties.

Variety:
There was a significant (p=0.01) difference observed between yield for the five varieties used in the 2008 trial. Capstan, Commander (WI3416-1572) and VB0432 were the highest yielding varieties, significantly better than Gairdner and WABAR.

There were significant (p=0.01) differences found in the quality parameters of the treatments. Although all varieties had protein levels above malting specifications, Commander had the lowest protein percentage and VB0432 had the highest protein. All varieties had moisture levels within receivable standards. Capstan and Commander had the lowest test weight scores, while Gairdner, WABAR and VB0432 were significantly higher, however all varieties were graded to feed.

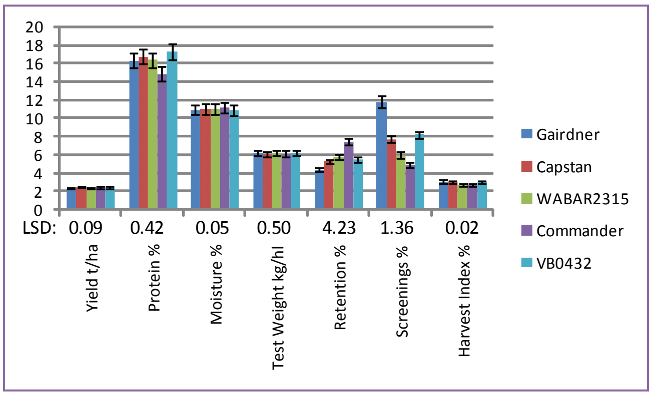

Figure 6: Effect of variety on seed yield and quality - means of 4 nitrogen treatments and 2 row widths.

Note: Test Weighs (kg/hl) and Harvest Index (%) are graphed as 10% of observed values.

Table 1: Effect of variety on seed yield and quality - means of 4 nitrogen treatments and 2 row widths.

	Yield t/ha	Protein %[1]	Moisture %[1]	Test Weight kg/hl[1]	Retention %[1]	Screenings %[1]	Resultant Classification[1]
Gairdner	2.37	16.29	10.93	62.55	43.63	11.81	F2
Capstan	2.52	16.72	10.98	61.10	52.91	7.69	F2
WABAR2315	2.36	16.34	10.99	62.54	58.19	6.00	F2
Commander	2.46	14.85	11.12	61.58	74.06	4.91	F2
VB0432	2.43	17.28	10.85	62.52	55.13	8.19	F2
LSD	0.09	0.42	0.05	0.50	4.23	1.36	
P value	0.0078	0.0001	0.0001	0.0001	0.0001	0.0001	

[1] Quality parameterization is based on 2008-2009 NACMA Barley Standards and should be used as a guide only.

Conclusion:
The various management components of crop agronomy are all important for optimizing crop structure, yield and quality.

Row spacing choice was a key decision in maximizing plant, shoot and head numbers, with the 200mm row spacing all significantly higher than the wider 300mm row spacing. This ultimately contributed to the yield being significantly higher in the 200mm row spacing for the 2008 season.

Nitrogen timing was also a critical decision in the quality of the grain produced; however it was all ultimately downgraded to feed, especially with high nitrogen rates employed and a very dry finish to the season. This gave little reason to conduct gross margin analysis.

Variety choice was the factor that showed most response. Commander produced the greatest number of shoots and heads, and was one of the higher yielding varieties along with Capstan and VB0432. In the short growing season, Gairdner did not perform well when compared to other types more suited to the season.