3.3.2 Integration of row spacing with canopy management principles in higher rainfall cropping environments - Mininera, Vic

Location: Mininera Research Site.

Funding: GRDC; Project No. SFS00017, 2.2.01 – Optimising cereal profitability in the high rainfall zone through the integration of disease management and canopy management principles.

Researchers: Nick Poole - FAR, NZ
Rohan Wardle, Ben O’Connor - SFS

Authors: Ben O’Connor & Rohan Wardle - SFS.

Background/Aim: Protocol 2, as part of a larger national canopy and disease management project, has the overall objectives of defining the benefits of wide row spacing for residue flow and inter-row crop establishment versus the potential reduction in yield and quality in the higher rainfall cropping zones of southern Australia. This trial examines how two varieties (Bolac; AH quality white milling and Beaufort; ASW quality red feed), two row spacings of 200mm & 300mm and the influence of 4 nitrogen treatments influence the outcomes of crop structure, yield and grain quality.

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:
- **Dry Matter:**
  Dry matter production was significantly greater where upfront nitrogen treatments were applied compared to the nil and GS31 applied treatments. The very high soil nitrogen reserve (359kgN/ha to 60cm) resulted in the nil nitrogen treatment having the same dry matter production as the GS31 N applications at harvest. The nil nitrogen plots produced significantly more plants at establishment when compared to the up front and split (50% seedbed & 50% GS31) nitrogen treatments, however, these plants when recorded at GS31 were significantly lower for tiller counts than the nitrogen applied treatments. The full GS31 rate and split (50% seedbed & 50% GS31) application treatments thus yielded (5.02t/ha & 5.10t/ha respectively) significantly more than the upfront (4.88t/ha) or nil nitrogen (4.79t/ha) applied treatments.

- **Row Spacing:**
  300mm row spacings produced lower plant establishment, dry matter, head counts and final yield than 200mm row spacings. The difference in dry matter at harvest was 2.9t/ha more for the 200mm row spacing, which translated to 5.6% or 0.27t/ha in yield. The differences in dry matter production throughout the season were not always significant, but there was a trend for wider row spacings to produce lower dry matters. Of interest for wider row spacings was the fact that protein and test weight were significantly higher in the 300mm treatments, possibly a compensation only for the decrease in yield.

- **Variety:**
  Beaufort as a variety produced more dry matter up to GS39, but at GS61 this outcome was reversed, with Bolac producing significantly more dry matter by GS99 (or physiological maturity). Bolac, as an average had significantly higher plant and head counts than Beaufort across both nitrogen and row spacing treatments. For yield, these increases in crop performance did not translate to greater returns, with Beaufort yielding significantly more than Bolac (5.09t/ha vs 4.80t/ha). Protein and test weight were significantly higher in the Bolac wheat when averaged across row spacing & nitrogen treatments.

Treatments:

**Cultivars**
1. Bolac – mid/late white milling wheat
2. Beaufort – mid/late ASW quality feed wheat

**Nitrogen timing** (nitrogen rates are expressed as kg/ha N NOT product)
1. No nitrogen (0-60cm profile N was 41.1 mg/kg or 359kgN/ha)
2. 50 kg/ha N Seedbed
3. 50 kg/ha N GS30-31
4. 50:50 split between seedbed & GS30-31 (25kg/ha N at each timing)

**Row width**
1. 200mm or 8” (Narrow)
2. 300mm or 12” (Wide)
Results and discussion:
Nitrogen timing:
Dry matter production was found to significantly differ across 4 nitrogen timings throughout the 2008 growing season at the SFS Mininera research site (Figure 1). At GS39 or full flag leaf emergence, the nil nitrogen treatment had significantly less (p=0.001) dry matter production than the split application at GS61, the nil nitrogen treatment had again, significantly less (p=0.001) dry matter production than the nitrogen applied in the seedbed, with the latter applied GS30-31 treatment not showing significant differences to the nil treatment, due mainly to a high soil reserve N. In total, nitrogen applied in the seedbed had significantly greater (p=0.001) dry matter production at physiological maturity than the nil nitrogen and nitrogen applied at GS30-31 treatments.

Row spacing:
The 200mm row spacing was found to have significantly (p=0.05) more dry matter production than the 300mm row spacing at GS22 (Figure 2). From that stage on throughout the growing season, based on the assessment schedule, dry matter production was not found to be significantly different at any other growth stage for row spacing throughout this trial. Dry matter production at the 200mm row spacing was observed to be higher than the 300mm row spacing at GS99, however, this was only significantly different at 7% probability.

Variety:
The effect of variety on dry matter production (Figure 3) was significantly different (p=0.01 & 0.05) at GS32 and GS39 where Beaufort produced more dry matter than Bolac. At GS99 Bolac reversed this trend (with a cross over occurring at GS61) and produced significantly more dry matter than Beaufort.

Row spacing:
Row spacing had a significant effect on (p=0.05) crop development (Figure 5); plant and head counts were significantly higher at the 200mm row spacing compared to 300mm row spacing.

Variety:
Bolac had significantly (p=0.05) higher plant and head counts than Beaufort (Figure 6). There was no significant difference in tiller counts when comparing row spacing or variety.
Yields achieved in the 200mm row spacings were significantly (p=0.05) higher compared to the 300mm row spacings. Protein and test weight were significantly higher in the 300mm row spacing (figure 8).

**Variety:**
Beaufort had significantly (p=0.001) higher yields than Bolac (Figure 9). Protein and test weight were significantly higher in the Bolac wheat. Beaufort had significantly higher screenings; however this is an effect of the harvest process (cracked grain), not a treatment response.

**Nitrogen timing:**
Nitrogen timing had a significant (p=0.01) effect on seed yield and quality (Figure 7). The nil nitrogen and nitrogen applied in the seedbed treatments had significantly lower yields than when nitrogen was applied at GS30-31 and split application. Protein was also significantly lower in the nil nitrogen treatment. Nil nitrogen had the highest screening percentages which were significantly higher (p=0.05) than nitrogen applied in the seedbed, which had the least, with the split and GS30-31 treatments not significantly differing to the former treatments. Nitrogen applied in the seedbed had significantly higher (p=0.01) test weights compared to all other treatments.
Conclusion:
In a decile 1 climatic scenario this season, Nitrogen timing was found to significantly affect dry matter production; where nitrogen applied in the seedbed produced the greater quantity of dry matter, but yielded the least grain in tonnes per hectare. Nitrogen applied at GS30-31 and the split application yielded significantly higher grain than the nil and full upfront treatments. Dry matter production, plant and head counts were all significantly greater at the 200mm row spacing when compared to the 300mm row spacing, thus resulting in a significantly higher yield for crops sown at 200mm. Beaufort, although being classified as a feed wheat, produced a greater amount of dry matter compared to Bolac up until GS39 and still significantly out yielded Bolac for seed yield by physiological maturity.

With this overall trial outcome for 2008 and a similar data set from 2007, farmers should be confident that narrow row spacings will yield significantly more than wider rows, with variety choice and nitrogen timing still critical components of paddock and economic outcomes. The data generated from this trial will also be run through a treatment financial analysis to further appreciate paddock gross margin returns upon completion of project. This trial will continue for a further two seasons to fully evaluate these canopy management principles in the cooler HRZ cereal production regions of SW Victoria.