4. Crop Agronomy Trials

4.1 Cereal Row Spacing Trials

4.1.1 The Effect Of Different Wheat Varieties, Row Spacing and Nitrogen Timing On Grain Yield, Grain Quality, Weed Incidence And Residue Load - Mininera, Vic

Location:
Mininera Research Station, Tattyoon Rd, Mininera

Funding:
This trial was funded by SFS as an initiative to help develop alternatives to burning crop stubbles in the HRZ of SE Australia.

Researchers:
Rohan Wardle – SFS,
Mark Steele – La Trobe University Research Project.

Author:
Rohan Wardle, SFS.

Acknowledgements:
Special thanks to Rowly Patterson and Bert McArthur for allowing us to use the Mininera trial site and support from the Streatham Branch Committee for guidance, ideas and trial inputs.

Rainfall (mm) Apr - Nov 07: GSR 430mm

Summary of Findings:

- Wider row spacings (300mm vs 200mm) significantly reduced yield when averaged across three wheat varieties and two nitrogen timings. Wider rows reduced crop income in excess of $100/ha.
- The cultivar (variety) grown was just as important as row spacing in determining yield. When averaged across the different row spacings and nitrogen timing treatments, Kellalac yielded 4.61t/ha, Bolac 5.12t/ha and Beaufort 5.72t/ha.
- Tiller counts were significantly less when moving to the wider row spacing widths. At the 200 mm row width, Beaufort had significantly fewer tillers/m^2 than Kellalac, which in turn had significantly fewer tillers than Bolac. When the row spacing increased to 300mm, both Kellalac and Bolac had a significant reduction in tillers, while counts for Beaufort did not drop significantly. Kellalac had the fewest number of tillers at the wider row spacing.
- Row widths of 200mm with nitrogen applied at GS00 & GS31, tended to give higher yields (5.30t/ha & 5.33t/ha respectively) when compared to a row spacing of 300mm with nitrogen applied at GS00 (5.09t/ha) & GS31 (4.88t/ha).

Background to the trial:
Alternate stubble management practices to burning in the HRZ of Victoria are now being recognised as having significant environmental and soil health benefits. The effects of increasing row width on cereal grain yield and quality, are however not fully understood.

Key Trial Objectives:

- To assess the potential yield loss/gains when increasing the seed row width for the benefits of subsequent inter-row (no-till) cropping
- To determine if nitrogen application efficiency can be increased in wider row spacing
- To assess the varietal yield response to row spacing and nitrogen application
- To assess weed incidence and disease pressure across each seed row width

Table 4.1: Trial inputs

Sowing dates:	Sown 28th May 2008
Fertiliser at sowing:	100kg/ha Granulock Supreme CuZn
Harvest date:	8th January 2008

Soil nitrogen at planting was 31mg/kg nitrate in a dry February, taken to 60cm.

Greenseeker™ (NDVI) was one tool used on fortnightly timings up to GS70 to determine if canopy greenness at flowering correlated with final yield.

	Type	Product	Rate
Herbicides and insecticides applied	Pre-sowing knockdown	Roundup PowerMax	1.5 l/ha +
		Triflur	480 @ 1.2l/ha
	Post emergence herbicides	No post emergence herbicides were used in this trial to help assess weed interactions	
Fertiliser	Applied at seeding (GS00)		90 kg/ha
	Either applied at GS00 or GS31	Urea	33.6 kg N/ha

Trial Design:

This trial was a completely randomized block design. Four replicates were used, with twelve treatments in total; three varieties x two row spacings x two nitrogen timings.

Trial Results:

This row spacing trial was undertaken at the Southern Farming Systems Mininera research site to evaluate yield across two row spacings (200mm and 300mm), three wheat varieties (Kellalac (L), Bolac (ML) and Beaufort (M)) and two nitrogen timings (GS00 and GS31). The results obtained include:

1. The variety grown and row spacing had a significant impact on yield (P<0.01)
2. The variety x nitrogen interaction was significant at P<0.05
3. Tiller numbers were significantly (P<0.01) greater per square metre in the narrow row spacing compared to the wide row spacing, for Kellalac and Bolac, but not so for Beaufort.
4. Heads per square metre were significantly (P<0.01) greater in all narrow row treatments across all varieties (447hpsm vs 385hpsm, LSD = 31hpsm), when compared to wider row treatments.
5. Bolac had significantly (P<0.01) more hpsm (457hpsm) than Kellalac (383hpsm) or Beaufort (407hpsm) LSD = 38hpsm, but this did not represent a yield benefit over Beaufort, as grain size (thousand grain weights) was significantly (P<0.01) greater for Beaufort (38.06g vs 33.39g for Bolac and 33.41g for Kellalac).
6. Protein percentages were significantly (P<0.01) less for Beaufort (11.64%) when compared to Bolac (13.56%) and Kellalac (13.13%) LSD = 0.35%, showing an inherent expression of lower protein set down in the feed type grain.
7. Screening percentages was significantly less in Bolac (0.73%) than in Kellalac (1.26%) and Beaufort (1.3%), LSD = 0.23%.
8. Later applied Nitrogen also resulted in a significantly higher protein percentage as an average across all varieties (12.98% vs 12.57%) LSD = 0.28%. Later applied nitrogen did also show a significant (P<0.01) benefit in test weight across all varieties (75.46kg/hl vs 75.00kg/hl) LSD = 0.39.
9. There was no identified correlation between the canopy greenness at flowering and final yield, using the Greenseeker™ (NDVI)
10. Greenseeker ™ did not appear to show a strong relationship with previous NDVI assessments, r^2<0.47, making future use of this tool in wide rows less reliable.

Table 4.2: Treatment interactions across wheat variety, row spacing width and timing of nitrogen

Crop Interactions	Variety t/ha	Row Space t/ha	V x N t/ha	V x RS t/ha	RS x N t/ha	V x RS Tills/m^2	RS x N x V GS00NGS31N	
Variety								
Kellalac	4.61x							
Bolac	5.12b							
Beaufort	5.72a							
Row Spacing								
200mm		5.31a						
300mm		4.98b						
Variety x N Timing								
Kellalac GS00N			4.77					
Kellalac GS31N			4.45					
Bolac GS000N			5.06					
Bolac GS31N			5.18					
Beaufort GS00N			5.76					
Beaufort GS31N			5.68					
Spacing								
Kellalac 200mm				4.72cd		550b	4.81	4.64
Bolac 200mm				5.36b		605a	5.21	5.51
Beaufort 200mm				5.86a		501c	5.90	5.84
Kellalac 300mm				4.49d		417d	4.73	4.26
Bolac 300m				4.88c		518bc	4.92	4.85
Beaufort 300mm				5.58ab		473c	5.62	5.53
Row Spacing x Nitrogen								
200mm GS00N					5.30			
200mm GS31N					5.33			
300mm GS00N					5.09			
300mm GS31N								
LSD (0.01)	**0.2**	**0.17**		**0.29**	**NS**	**45**	**NS**	**NS**
LSD (0.05)			**0.21**					

Means followed by the same letter do not significantly differ (P=0.01, LSD), NS = Not Significant.

Table 4.3: Gross returns averaged across variety, row spacing and N timing

Treatment	Kellalac	Bolac	Beaufort	200mm	300mm
Gross Output /Ha @ $400/t	$ 1,844.00	$ 2,048.00	$ 2,288.00	$ 2,124.00	$ 1,992.00

Trial Observations:

- There was no significant difference (trend only, with P=0.06) between narrow row spacing with nitrogen applied up front or in crop, compared with wider row spacing and nitrogen applied, suggesting an important nitrogen timing/management decision needs to be made if changing row widths.
- Disease did not appear to be significantly worse in the narrower row spacing treatments within the susceptible cultivar Kellalac. Both stripe and leaf rust presence and severity were assessed at GS70, 10 days after rainfall.
- Weed incidence was not significant across this site, thus it could not be concluded to have any effect on crop performance across row spacing widths or varieties within this trial.
- Stubble residue loads or harvest indices were not able to be calculated due to the lateness of the season and lack of resources to undertake this comprehensive assessment.

Economic Analysis

This report has not considered any costs savings of wide rows compared to narrow rows, such as:

- not having to manipulate crop residues with wider row spacing
- being able to sow at greater speeds using wider row spacing
- the reduction in horse power pulling fewer tines through the ground at seeding.

Photo 4.1: General view of wheat row spacing trial.

Photo 4.2: Bolac wheat at 300mm row spacings, N@GS31.