3.2 BARLEY CANOPY TRIAL - GNARWARRE

Location: "South Roxby" Gnarwarre

Researchers:
Nick Poole (FAR) New Zealand)
Dominic Bolton (SFS Ltd Geelong)
Wes Arnott (SFS Ltd Geelong)
Colin Hacking (SFS Ltd Geelong)

Objective:
The trial examines how three different plant populations and different nitrogen-timing strategies influence the structure and yield of the barley crop canopy. The impact of treatment was assessed in terms of crop structure, yield, quality and predisposition to disease.

Within the trial there are a number of specific objectives, namely:

- To determine whether nitrogen timing interacts with plant population in terms of yield.
- To determine whether plant population and nitrogen timing influence disease levels in the different Victorian climates.
- To examine how nitrogen timing influences green area index during grain fill and green leaf retention.
- To determine which combination of plant population and nitrogen timing gives the best opportunity of securing malting quality.

Summary:

1. Effect of plant population and nitrogen management on canopy structure
Widely differing plant populations of winter barley and nitrogen management produced near identical yields, despite the fact that crop structure was strongly influenced by these two parameters. However in terms of grain quality there were strong differences, which could be attributed to the different crop structures created by sowing rate and nitrogen.

For each nitrogen timing tested, there was a trend for higher plant populations to increase screenings percentage, since higher plant populations created more competition between tillers, which reduced grain size. Nitrogen timed at GS26 (end of tillering) and GS31 (1st node) created higher tiller number and ear number than the unfertilised control and the GS39 nitrogen timing. Nitrogen timed at these same growth stages i.e. GS26 and 31 also produced the poorest grain test weights, though lower plant population reduced the effects on test weight.

2. Influence of plant population on yield and grain quality
Established plant populations of 117,196 and 300 plants/m2 with Gairdner produced no yield difference (averaged over the 4 nitrogen treatments), despite significantly higher tiller and ear numbers/m2 with the highest population compared to the lowest. This would indicate that the plant compensated from lower populations by increased thousand grain weight (t.g.w.) and/or increased grains per ear.

In terms of grain quality, lower plant populations produced significantly lower screening levels (7%) and higher grain test weights (1.1 kg/hl).

There was no significant difference in terms of grain protein, though previous work has suggested protein content is lowered with higher seed rate.

3. Influence of nitrogen management on yield and grain quality
The first wheat rotation position (1st cereal after canola) plus 34 kg/ha N soil nitrogen in the 0-60 cm profile resulted in no statistically significant yield increase from nitrogen application. The absolute yields suggested a small 2-4% yield increase from application of nitrogen, depending upon timing. Despite the small impact of nitrogen timing on yield, there were effects of the nitrogen on grain quality and crop structure. 100kg/ha of applied N increased grain protein levels from 10.2 % to 14% with the GS 26 (end of tillering) and GS31 (1st node) timings. Whilst it might have been expected for the latest nitrogen timing (GS 39 flag leaf emergence) to produce the highest protein, it was actually lower at 12%.

The GS26 and GS31 applications increased screenings and reduced grain test weight in comparison to the unfertilised control. In part this may have been the result of excessive tiller production in season with a dry finish, creating lots of small undersized grains.

4. Interactions between plant population and nitrogen management
Where nitrogen was applied late or not at all, there was no yield penalty or grain test weight penalty from higher seeding rates, whereas with GS26 N applications in particular, there was a non-significant yield advantage to lower seed rates and a significant test weight advantage.

Treatment List & Method:

Gairdner barley was established on 7th August 2003 in a 1st cereal situation following canola. This low planting was due to the poor establishment of the June sown trial.

The crop was planted at three plant populations and treated with applied nitrogen at three different timings (see Table 23). The site had on average 34 kg/ha N of soil mineral N at sowing, based on 0-60cm profile.

Table 23: Target Plant Population and Actual Plant Populations (plants/m^2) Established at Sowing

Seed Rate	1000 Grain wt grams	Sowing Rate kg/ha	Target Population Plants/m^2	Plants/m^2 Established	Seed Rate	Treatment Plan			
						F1	F2	F3	F4
P1	50	53	85	117	**P1**	1	2	3	4
P2	50	100	160	196	**P2**	5	6	7	8
P3	50	147	235	300	**P3**	9	10	11	12

Key:

P1: Established plant population 117 per square metre
P2: Established plant population 196 per square metre
P3: Established plant population 300 per square metre

F1: Control untreated
F2: 100 kg/ha N GS26 on 15/10/03
F3: 100 kg/ha N GS31 on 26/10/03
F4: 100 kg/ha N GS39 on 11/11/0

Crop Structure Assessments:

Table 24: Influence of Plant Population on Tiller Numbers/m^2 Assessed at GS32

Plant Population	Tillers/m^2
P1	706.3
P2	782.8
P3	791.9
Average	**760.3**
LSD	**69.8**

There were significantly more tillers/m2 with the 300 plants/m2 population than there was with the 117 plants/m2 population.

Table 25: Influence of Nitrogen Timing on Tiller Numbers/m2 Assessed at GS32

Fertiliser	Tillers/m^2
F1	668.5
F2	870.5
F3	850.7
F4	651.5
Average	**760.3**
LSD	**80.5**

Nitrogen timed at GS26 (end of tillering) and GS31 (1st node) produced 200 tillers/m2 more than the untreated control and the late timed GS39 timing (flag leaf emergence)

Table 26: Influence of Nitrogen Timing and Plant Population on Tiller Numbers/m^2 Assessed at GS32

Treatment	Tillers/m^2
1	591.5
2	819.5
3	852.5
4	561.5
5	717.5
6	874.5
7	891.0
8	648.0
9	696.5
10	917.5
11	808.5
12	745.0
Average	**760.3**
LSD	**134.9**

The pattern was the same as Table 25 with GS26 nitrogen timings producing the highest tiller numbers, but with increasing seed rate also having a significant effect.

Table 27: Influence of Plant Population on Ear Numbers/m^2 Assessed at Harvest

Plant Population	Ears/m^2
P1	545.3
P2	588.9
P3	642.8
Average	**592.3**
LSD	**90.7**

There were significantly more ears/m2 with the 300 plants/m2 population than there was with the 117 plants/m2 population.

Table 28: Influence of Nitrogen Timing on Ear Numbers/m2 Assessed at Harvest

Fertiliser	Ears/m^2
F1	576.3
F2	635.3
F3	619.3
F4	538.2
Average	**592.3**
LSD	**104.8**

There were no significant differences when nitrogen timings were averaged over the 3 seed rates.

Table 29: Influence of Nitrogen Timing and Plant Population on Ear Numbers/ m2

Treatment	Ears/m^2	Treatment	Ears/m^2
1	500.5	8	546.5
2	654.0	9	602.5
3	594.5	10	707.5
4	432.0	11	625.0
5	626.0	12	636.0
6	544.5	**Average**	**592.3**
7	638.5	**LSD**	**181.3**

The pattern was the same as Table 28 with GS26 nitrogen timings producing the highest ear numbers, but this was rarely significant due to the high LSD.

Table 30: Crop Structure Assessments for the Different Combination of Plant Population and Nitrogen Timing (Plants/m2, Tillers/m2, Tillers/plant, Ears/m2 and Ears/Plant)

Treatment	Plants/m^2	Tillers/m^2	Tillers/plant	Ears/m^2	Ears/Plant
1	117	591.5	5.1	500.5	4.3
2	117	819.5	7.0	654.0	5.6
3	117	852.5	7.3	594.5	5.1
4	117	561.5	4.8	432.0	3.7
5	196	717.5	3.7	626.0	3.2
6	196	874.5	4.5	544.5	2.8
7	196	891.0	4.5	638.5	3.3
8	196	648.0	3.3	546.5	2.8
9	300	696.5	2.3	602.5	2.0
10	300	917.5	3.1	707.5	2.4
11	300	808.5	2.7	625.0	2.1
12	300	745.0	2.5	636.0	2.1
Average		**760.3**	**4.2**	**592.3**	**3.3**
LSD		**134.9**		**181.3**	

Table 31: Influence of Plant Population on Yield and Quality (Average of 4 Nitrogen Treatments) - Gnarwarre

Plants Population (pl./m2)		Yield t/ha	Test Weight kg/hl	Screen %	% Protein
P1	117	5.65	64.4	30.1	12.7
P2	196	5.69	64.0	33.7	12.6
P3	300	5.69	63.3	37.0	12.6
LSD(5%)		**0.28**	**0.7**	**6.7**	**0.6**
Significance of linear trend		**ns**	*	*	**ns**

Plant population had no effect on yield or protein, but did influence screenings and grain test weight.

Higher plant populations reduced test weight (1.1 kg/hl) and increased screenings (7%)

Table 32: Influence of Nitrogen Timing on Yield and Quality (Average of 3 Plant Populations) - Gnarwarre

Main effect of Nitrogen	Yield t/ha	Test Wt kg/hl	Screen %	% Protein
F1	5.54	65.2	27.2	10.2
F2	5.66	61.5	44.8	14.0
F3	5.77	63.2	36.2	14.3
F4	5.72	65.7	26.3	12.0
LSD(5%)	**0.26**	**0.8**	**4.6**	**0.4**
Significance of:				
Control vs Nitrogen (CvN)	*ns*	***	***	***
Lateness of N	*ns*	***	***	***

There were no significant effects of nitrogen application or timing on yield, however again nitrogen application had a significant influence on grain quality, with earlier nitrogen applications reducing grain test weight, increasing screenings and protein in comparison to no nitrogen or later nitrogen.

Table 33: Influence of Nitrogen Timing and Plant Population on Yield and Quality - Gnarwarre
Treatment means (Plant population x Nitrogen interaction)

Fertiliser Treatment	Plant Population	Yield t/ha	GrainTest Weight kg/hl	Screen %	% Protein
F1	P1	5.61	65.6	24.2	10.2
	P2	5.48	65.5	26.3	10.2
	P3	5.51	64.6	31.0	10.3
F2	P1	5.89	63.0	40.9	13.7
	P2	5.54	61.4	46.0	14.2
	P3	5.57	60.2	47.6	14.1
F3	P1	5.63	63.7	32.0	14.5
	P2	5.88	63.0	39.4	14.3
	P3	5.80	62.9	37.1	14.0
F4	P1	5.45	65.5	23.2	12.4
	P2	5.85	66.1	23.3	11.6
	P3	5.87	65.4	32.4	12.0
Within Seed rates		*0.46*	*1.4*	*8.0*	*0.8*
Other Comparisons		*0.46*	*1.3*	*9.0*	*0.8*
CV%		*5.5%*			
Significant Interaction Contrasts					
		Srate(lin)	*Srate(lin)*	*Nil*	*Nil*
		xNlateness	*xNlateness*		

Note: ns=not significant; *=5% sig; **=1% sig; ***=0.1% sig.

There were significant differences between individual treatments, however there was an interaction between plant population and nitrogen timing, which suggested that the detrimental effects of high plant population on quality and yield was less pronounced with later timed nitrogen.

Conversely earlier nitrogen timing at GS26 whilst being detrimental to screenings across all plant populations, was most suited to the lowest plant populations.

Disease levels were low and there was no evidence that different nitrogen regimes influenced crop canopy disease levels.

www.sfs.org.au - Some items you may find on the web site...

- About Southern Farming Systems (general information).
- Link to Bureau of Meteorology for Rainfall Intensity and Location - watch the actual real time rain coming across your farm (or not!)- updated every 10 minutes.
- Becoming a Member - all you want/need to know - application form available online.
- Photo Gallery.
- Events and "What's New" listings.
- Publications:
  - Newsletters.
  - Southern Farming Systems Stock and Land Articles.
  - Interesting Information.
  - Purchase form and details for the Cropping Guidelines for Southern Victoria Producers (Ute Guide Format).
- List of Southern Farming Systems Branches and who runs what at each (with photos).
- List of trial sites and trials.
- Sponsors page and details.