Wheat canopy management

This trial was funded by GRDC

Key findings

- Nitrogen application timing produced no significant differences to grain yield.
- Grain yield was reduced by 12% with the presence of ryegrass.
- Crop sensors were able to accurately measure crop dry matter.

Why do the trial?

- To improve the nitrogen and water use efficiency of wheat by manipulating canopy size and structure using post sowing applications of nitrogen and different row spacing.
- To maintain yield and quality, while reducing the risks associated with excess early crop growth.
- To compare how different nitrogen strategies effect crop competition with annual ryegrass.
- To compare and investigate the value of different optical crop sensors.

How was it done?

Plot size	450mm (18") spacing 2.7m x 10m 225mm (9") spacing 1.4m x 10m	**Fertiliser**	Single super (0:9:0:11) @ 60kg/ha
Seeding date	22nd May 2008		
Available soil moisture 27th March (0-60cm)	0mm	**Soil nitrogen 27th March (0-60cm)**	117kg/ha

1. The trial was a randomised complete block design with 3 replicates, 2 row spacings, 2 varieties, 2 nitrogen timings and 3 nitrogen rates.

Treatments

Row spacing	225mm (9") 450mm (18")
Varieties	Wyalkatchem Correll
Nitrogen rates	Nil (0kg/ha) 30kg N/ha (65kg urea/ha, 46:0) 60kg N/ha (130kg urea/ha, 46:0)

Nitrogen timings	Incorporated by sowing (IBS)
	Start of stem elongation (GS31)

IBS nitrogen was broadcast by hand and incorporated by sowing.

1st node (GS31) nitrogen was broadcast by hand on the 31st July, the rainfall following the application was,

application was,	31st July	0.4mm
	4th August	2.6mm
	5th August	15.4mm

4 optical crop sensors were used to scan plots at GS22,14 (10th July), GS31 (1st August), GS33 (22nd August) and GS39 (29th September). The sensors used were the Greenseeker, Crop circle, Topcon (prototype) and the Yara N-sensor active light sensor (ALS).

2. The ryegrass competition trial was a randomised complete block design with 2 ryegrass densities and 3 nitrogen timings.

Treatments

Nil ryegrass or 25kg/ha ryegrass incorporated by sowing (IBS).

Nil urea, urea @ 100kg/ha IBS or urea @100kg/ha GS31.

Ryegrass was established in the weed competition trial by broadcasting 25kg/ha ryegrass and incorporating with narrow points prior to sowing.

Plot edge rows were removed prior to harvest.

Ryegrass density was assessed by quadrat plant counts.

All plots were assessed for grain yield, protein, test weight, screenings less than 2.0 mm and grain weight.

Results

Wyalkatchem (1.47t/ha) was the highest yielding variety compared to Correll (1.33t/ha) (Table 1).

Grain yield and grain weight were not affected by the application of any nitrogen, while protein increased significantly with an increase in nitrogen rate.

Nitrogen timing had no impact on grain yield, but delaying application of nitrogen until 1st node (GS31) increased protein by an average of 0.4%.

Averaged across both varieties and nitrogen rates there was no significant difference in grain yield or protein between either narrow or wide rows. The narrow row spacing and the high rates of nitrogen reduced grain yield for both Correll and Wyalkatchem. However, at the wider row spacing grain yields were reduced for both varieties and nitrogen rates, with the exception of Wyalkatchem with no nitrogen.

The individual grain weight of Correll sown on narrow row spacing was the lowest in the trial.

Table 1: Grain yield, protein and grain weight for row spacing, variety and nitrogen rate at Hart in 2008.

Row spacing	Variety	Nitrogen rate (kg/ha)	Grain yield (t/ha)	Protein (%)	Grain Weight (mg)
Narrow 225mm (9")	Correll	0	1.59	13.7	25.8
		30	1.50	16.1	24.8
		60	1.40	17.4	23.6
	Wyalkatchem	0	1.48	12.7	25.7
		30	1.63	14.3	27.5
		60	1.52	15.8	27.0
Wide 450mm (18")	Correll	0	1.19	15.9	23.3
		30	1.16	17.5	22.3
		60	1.17	18.3	22.6
	Wyalkatchem	0	1.52	12.9	26.5
		30	1.36	15.2	25.4
		60	1.30	16.4	24.8
LSD (0.05)					
Row spacing			0.3	1.1	ns
Variety			0.1	0.4	0.6
Nitrogen rate			0.1	0.5	ns
Row spacing*Variety			0.2	0.9	ns
Row spacing*Variety*Nitrogen rate			0.2	1.1	1.5

Screenings (less than 2.0mm) were not significantly affected by row spacing, nitrogen timing or rate. Correll had 43.9% screenings and Wyalkatchem had screenings 23.6% (LSD 0.05, 4.9%). The application of 60kg/ha nitrogen increased screenings by 9% from 29% (0kgN/ha) to 38% (60kgN/ha) (LSD 0.05, 6.0%) averaged across both varieties.

Wyalkatchem produced 11% more shoots per square metre than Correll across all treatments (Table 2). It is also clear from Table 2 that as nitrogen rate increases so too does the shoot number regardless of variety, row spacing or nitrogen timing. Sowing on wider rows produced less shoots than narrow rows.

Table 2: Shoot number (shoots per square metre) for variety, row spacing and nitrogen rate at Hart in 2008.

Variety	Row spacing	Nitrogen rate (kg N/ha)		
		0	30	60
Correll	Narrow	413	437	490
	Wide	344	346	435
Wyalkatchem	Narrow	461	530	535
	Wide	403	404	413
LSD (0.05)				
Variety			43	
Row spacing			43	
Nitrogen rate			53	

Sowing on wide rows produced 10% fewer heads compared to narrow rows across all treatments, 305 and 274 heads per square metre respectively. Hence, a variation in shoot number did not influence head number.

Crop sensors: The latest Yara N-sensor with its own light source, was able to measure a relationship with grain yield for Correll wheat at full flag leaf emergence (GS39) (Figure 1). During the growing season the other sensors produced good relationships with crop biomass one of which is displayed in Figure 2.

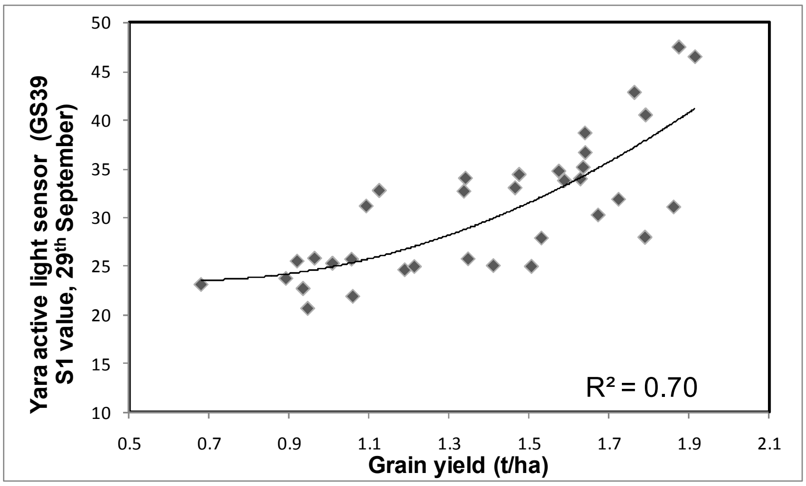

Figure 1: Grain yield (t/ha) and Yara S1 index from the Yara N-sensor (ALS) on Correll wheat at full flag emergence, 29th September at Hart in 2008.

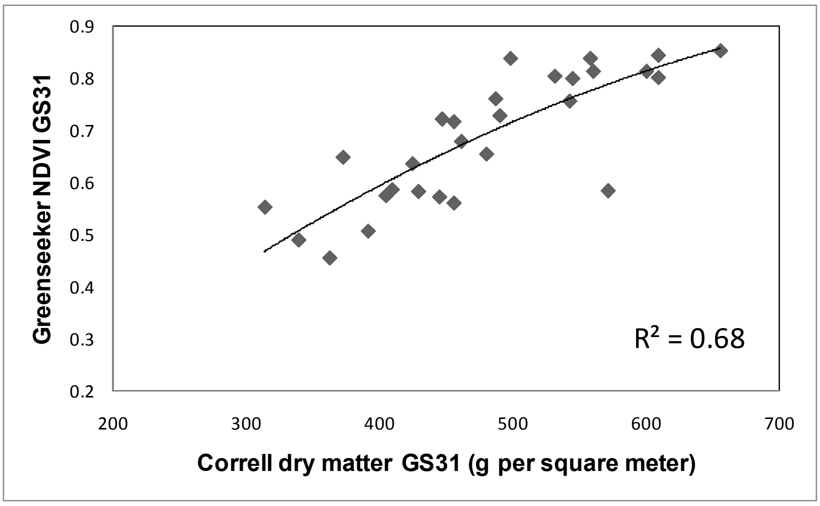

Figure 2: Dry matter production at 1st node (GS31) for Correll treatments and Greenseeker NDVI at Hart in 2008.

Ryegrass competition trial:

318 ryegrass plants per square metre reduced grain yield by 0.2t/ha or 11% (Table 4). Nitrogen timing did not produce significantly different grain yield results.

Table 4: Grain yield (t/ha) for ryegrass treatments averaged across nitrogen timings.

Ryegrass density (plants/m²)	Grain yield (t/ha)
7.2	1.75
318.0	1.54
LSD (0.05)	0.08

The presence of ryegrass or nitrogen timing did not influence grain protein.