Wheat canopy management

This trial was funded by GRDC, in collaboration with Nick Poole (Foundation of Arable Research, NZ) and the Mid-North High Rainfall Site.

Key findings

- Grain yields increased with the addition of nitrogen, producing a maximum of 4.64 t/ha, with 75 kg N/ha.
- Nitrogen application timing produced no significant differences to grain yield.
- Crop sensors used at early stem elongation, were able to accurately measure crop nitrogen uptake and tiller number.

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.
- To maintain yield and quality, while reducing the risks associated with excess early crop growth.
- To compare and investigate the value of different optical crop sensors.

How was it done?

Plot size	1.4m x 10m	**Fertiliser**	Triple super (0:20:0) @ 90 kg/ha
		Variety	Mace wheat @ 70 kg/ha
Seeding date	7th May 2009		
Available soil moisture 1st April (0-90cm)	23mm	**Soil nitrogen 21st May (0-90cm)**	146 kg N/ha

This trial was conducted at the Mid-North High Rainfall site, at Tarlee, under the supervision of Jeff Braun and Mick Faulkner, Agrilinks Agricultural Consultants. The trial was a randomised complete block design with 3 replicates, 5 nitrogen rates and 3 nitrogen timings.

The sowing nitrogen treatments were applied by spreading sulphate of ammonia onto the sown plots, prior to rain. The 1st node (23rd July, GS31) and flag leaf emerged (14th August, GS37) were applied using urea broadcast by hand prior to rain.

3 optical crop sensors were used to scan plots at 2 tillers (GS22,14, 23rd June), 1st node (GS31, 31st July), 2nd node (GS32, 6th August) and flag leaf emerged (GS37, 14th August). The sensors used were the Greenseeker, Crop circle, and the Yara N-sensor active light sensor (ALS). Digital photos were also captured at each scanning.

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

Results

At Tarlee grain yields ranged from 2.95 t/ha (0 kg N/ha, at sowing) to 4.64 t/ha (100 kg N/ha, at sowing). Grain yields increased significantly with the addition of nitrogen up to 75 kg N/ha, averaged across all nitrogen timings (Figure 1) (Table 1). There was no difference in grain yield between nitrogen applied at sowing and that applied at GS31.

Grain protein significantly increased with nitrogen rate and post emergent applications, particularly for rates above 25 kg N/ha. Grain weight decreased with increasing nitrogen, especially the 75 kg N/ha treatment (Table 1 & 2). Harvest index was significantly higher with the addition of any nitrogen, compared to the control (0 kg N/ha).

Table 1: The response in grain yield (t/ha), protein (%), screenings (%), grain weight (mg) and harvest index to the addition of nitrogen, averaged across all nitrogen application timings at Tarlee in 2009.

Nitrogen rate (kg/ha)	Grain yield (t/ha)	Protein (%)	Screenings (%)	Grain weight (mg)	Harvest index
0	3.07	9.5	0.8	43.8	28
25	3.45	9.7	0.9	42.0	31
50	4.07	9.8	0.9	42.3	32
75	4.45	10.2	1.0	40.7	33
100	4.59	10.5	1.1	41.2	34
LSD (0.05)	0.20	0.3	ns	1.3	4

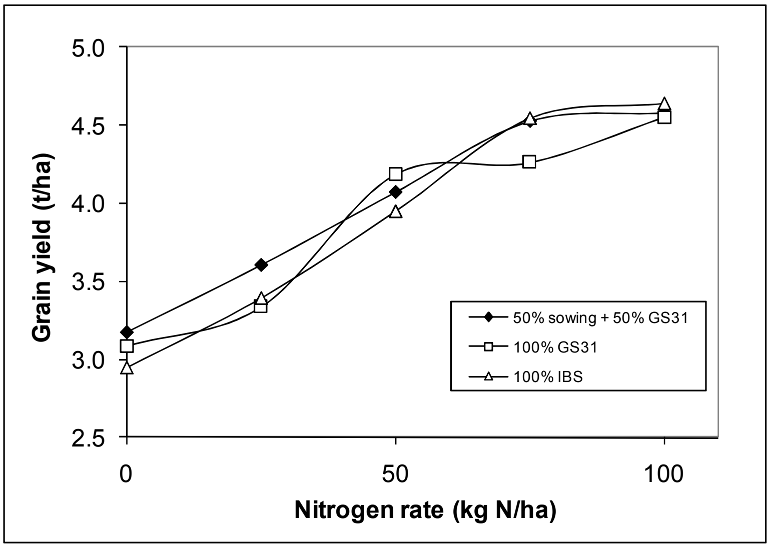

Figure 1. Grain yield (t/ha) for nitrogen rate and application timing at Tarlee in 2009 (LSD 0.05 – 0.35 t/ha).

Table 2: The response in grain yield (t/ha), protein (%), screenings (%), grain weight (mg) and harvest index to the addition of nitrogen, for 75 kg N/ha only at Tarlee in 2009.

Nitrogen rate (kg/ha)	Grain yield (t/ha)	Protein (%)	Screenings (%)	Grain weight (mg)	Harvest index
GS31 + GS37	4.15	10.3	1.1	41.5	33
GS37	4.04	10.8	1.2	42.8	30
LSD (0.05)	ns	0.1	ns	ns	ns

During the growing season the crop sensors produced good relationships with crop biomass, crop nitrogen uptake and tiller number (Figures 1,2 & 3). Importantly, these interactions are very good between late tillering and early stem elongation, when crop potential and further nitrogen requirements are being considered. This matches results achieved in previous years of this project. Using digital images to determine the percentage of green area was also effective for measuring tiller number (Figure 2), compared with Greenseeker NDVI (Figure 1).

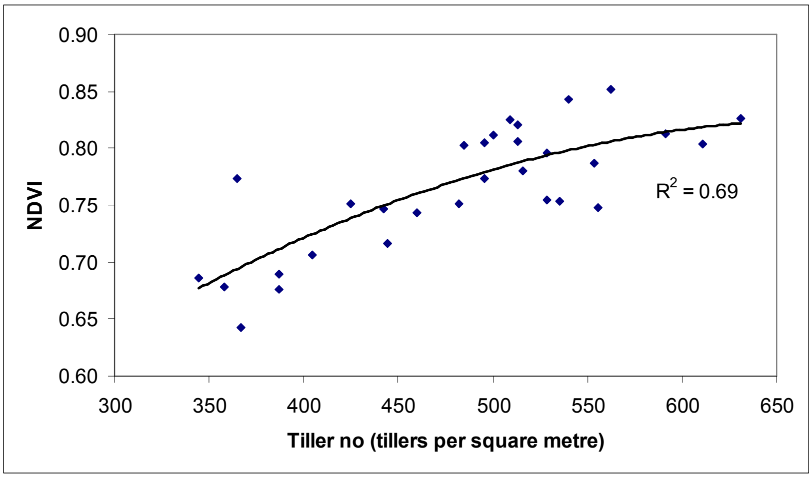

Figure 1: Tiller number and Greenseeker NDVI for all nitrogen rates and application timings at 1st node (GS31) for Mace wheat at Tarlee in 2009.

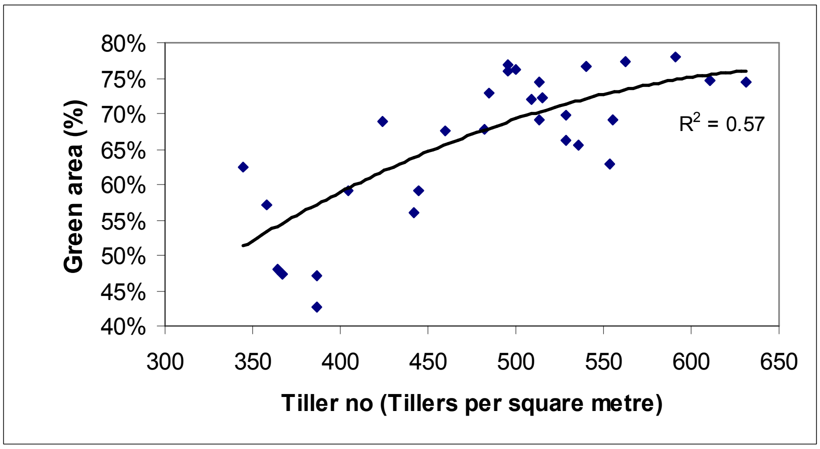

Figure 2: Tiller number and green area % for all nitrogen rates and application timings at 2nd node (GS32) for Mace wheat at Tarlee in 2009.

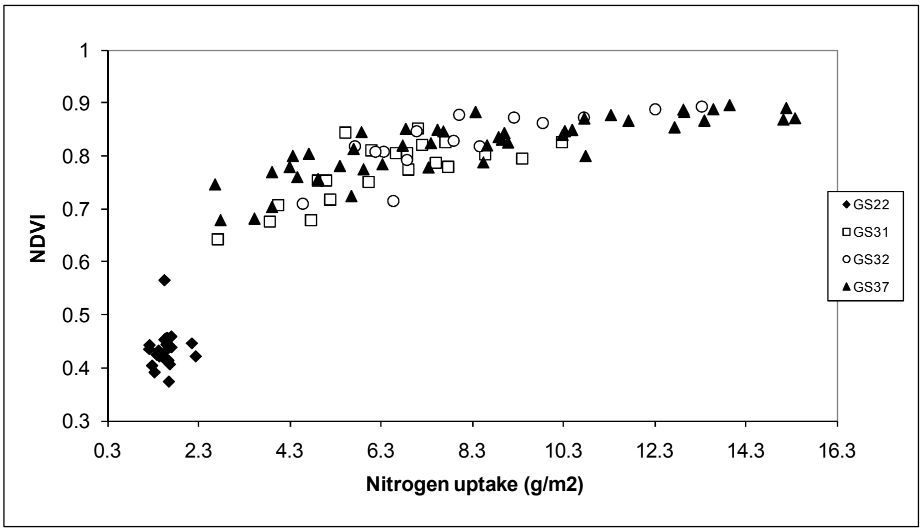

Figure 3: Nitrogen uptake (g/m2) and Greenseeker NDVI across all nitrogen rates and timings for Mace wheat at Tarlee in 2009.

Peter Hooper
Hart Field-Site Group Trials Manager