

Effect of sowing date, nitrogen application rates and timing on grain yield and quality of six wheat varieties - Barellan 2015

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Introduction

Varieties can differ in their ability to yield at various sowing dates. The same goes for their response to various rates of nitrogen and how they turn that nitrogen into yield and protein. This trial was designed to measure the influence of sowing date and nitrogen rate across six common wheat varieties.

This experiment is one in a series of nitrogen experiments aimed at establishing variety responses to different nitrogen application rates and timings.

Site details

Location: Barellan, NSW

Trial period: 2015

Co-operators: Jeff Savage

Soil type: Red/brown sandy loam

Previous crop/s: Wheat

Sowing date: TOS: 1 30th April, 2015 TOS 2: 26th May, 2015

Planter: Tractor pulled Morris contour drill parallelogram cone seeder

Harvest date: 19th November, 2015

Starter Fertiliser: 60kg MAP

Soil tests:

pH (CaCl₂): 4.5

Nitrogen: 82.67 Kg N/ha (0-60cm)

Phosphorous: 50ppm (Colwell)

In-crop rainfall: 273mm (April – Oct)

Herbicides:

Knockdown - R'up + Ester sprayed

Pre-emergent - 2.5 L Boxer Gold + 1.6L Avadex

Post-emergent - 300ml Axial + 800ml MCPA 750 + 100g Lontrel + 1% Adigor

Fungicides:

150ml Prosaro (end July)

400ml Amistar Xtra (early September)

Key findings

- Sowing time had a huge effect on grain yield.
- Delaying sowing time reduced grain yield, TOS 1 yielded 4.84 t/ha and TOS 2 yielded 3.55 t/ha.
- Suntop was the highest yielding variety, 4.47 t/ha.
- Lancer was the lowest yielding variety, 3.73 t/ha.
- Given profitability and return on investment 40 kg N/ha at sowing was the ideal rate of nitrogen.

Treatments

- 2 Times of Sowing TOS 1 30th April, 2015
 TOS 2 26th May, 2015
- 6 Varieties Condo
 Emu-Rock
 EGA_Gregory
 Lancer
 Spitfire
 Suntop
- 2 Nitrogen timings N1: At sowing
 N2: late tillering to first node stage
- 5 nitrogen rates N1 Rates: 0, 20, 40, 80, 160 kg/ha
 N2 Rate: 40 kg/ha

Results

Measurements taken from all plots included plant counts, Normalised Digital Vegetation Index (NDVI), grain yield and grain quality, with grain yield statistically analysed.

Plant Counts (plant/m²)

Plant counts were taken on all varieties on the 10th June for time of sowing 1 and on the 29th June for all varieties in time of sowing 2. For TOS 1 plant counts ranged from 29 plants/m² for EGA_Gregory with 160kg N applied at sowing to 93 plants/m² for EGA_Gregory with 40kg N applied at sowing and 40kg N topdressed. For TOS2 plant counts ranged from 33 plants/m² for Condo with 160kg N applied at sowing to 116 plants/m² for Lancer with 0kg N applied at sowing (figure 1). The average plant count for TOS 1 was 70 plants/m² and for TOS 2 it was 85 plants/m².



Figure 1: Average plant population (plants/m²) for each variety, sowing time and nitrogen treatment.

NDVI

Crop vigour was measured at heading/flowering using a hand held NDVI. Values for TOS 1 ranged from 0.54 for Condo with 0kg N applied at sowing up to 0.83 for Lancer with 40kg N applied at sowing and 40kg N topdressed. For TOS 2 values ranged from 0.40 for Condo with 0kg N applied at sowing up to 0.77 for Lancer with 40kg N applied at sowing and 40kg N topdressed (figure2). The average NDVI value was 0.73 for TOS 1 and 0.64 for TOS 2.

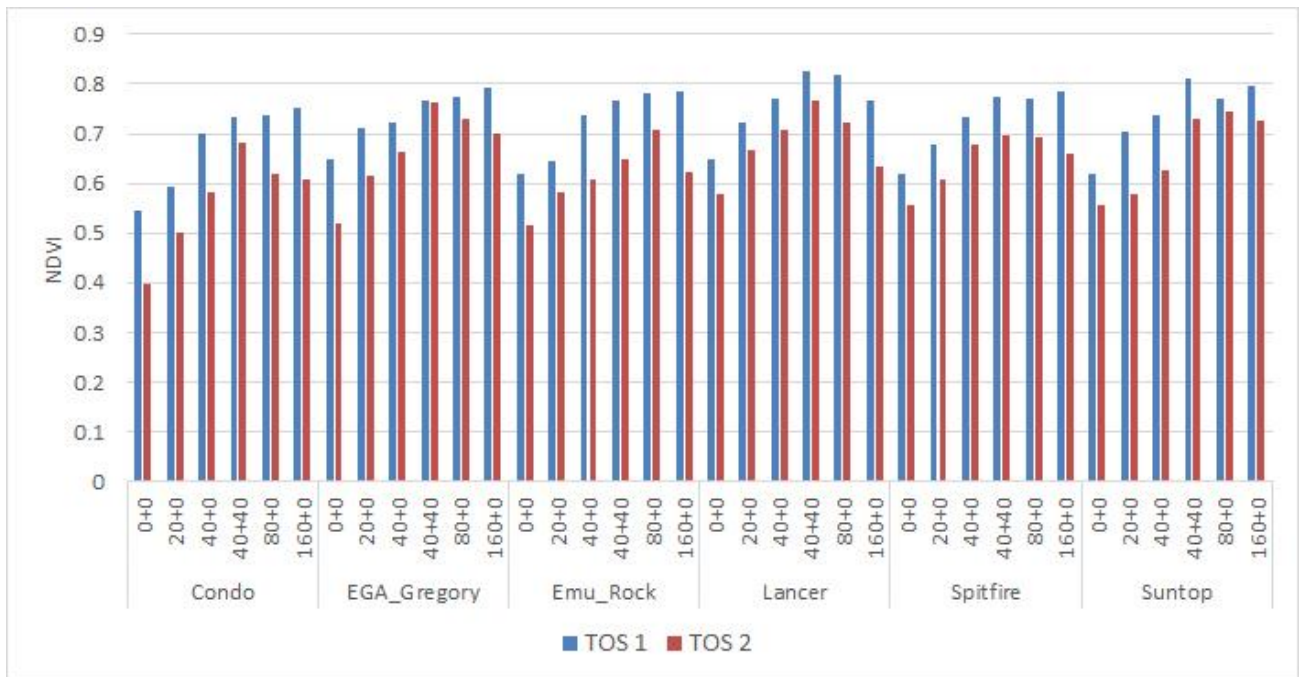


Figure 2: Average NDVI for each variety, time of sowing and nitrogen treatment.

Grain Yield

Variety, TOS and N treatment had significant effects on grain yield. Across sowing times and N treatment the highest yielding variety was Suntop, with a grain yield of 4.47 t/ha, and the lowest yielding variety was Lancer, with a grain yield of 3.73 t/ha.

Delaying sowing time significantly reduced yield. Grain yield for TOS 1 was 4.84 t/ha, whilst TOS 2 had a grain yield of 3.55 t/ha.

For TOS 1, Lancer with 0kg N/ha applied at sowing was the lowest yielding treatment, with a grain yield of 3.50 t/ha (figure 3). The highest yielding treatment for TOS 1 was Condo with 40kg N/ha applied at sowing and 40kg N topdressed, with a grain yield of 6.42 t/ha. For TOS 2 Lancer with 160kg N/ha applied at sowing was the lowest yielding, with a grain yield of 2.33 t/ha. Emu_Rock with 40kg N/ha applied at sowing had the highest grain yield of 4.84 t/ha for TOS 2.

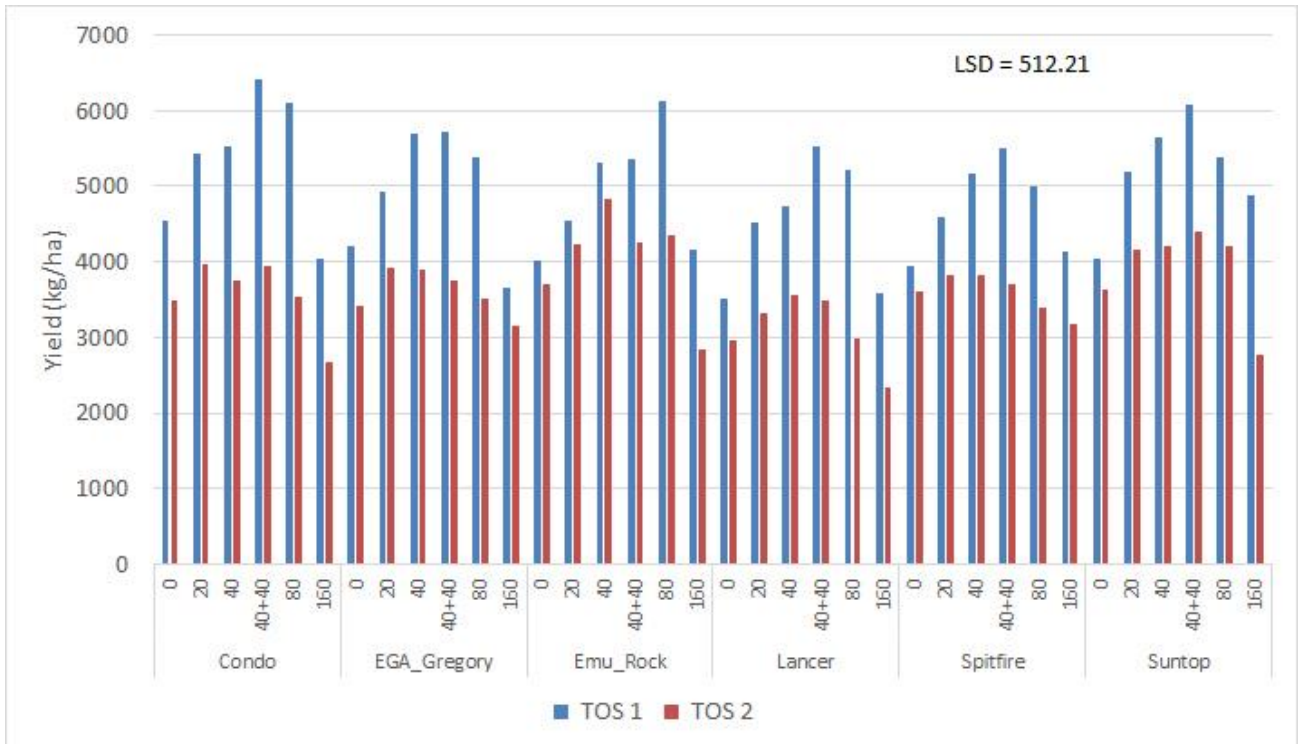


Figure 3: Grain yield for each variety, time of sowing and nitrogen treatment (LSD=512.21 kg/ha).

Grain Protein

Grain quality was yet to be analysed at time of writing.

Return on Investment

TOS 1 had a higher return on investment and profit than TOS 2, Table 1. Whilst, applying 40kg N/ha at sowing and topdressing with 40kg N/ha gave the highest profit, the best combination of profit (\$217.40) and return on investment (310%) was where 40kg N/ha was applied at sowing.

Table 1: Economic analysis of return on investment of nitrogen across TOS 1 and TOS 2 at Barellan in 2015.

Nitrogen treatment	Grain yield kg/ha		Cost of nitrogen (urea @ \$550/t)	Cost of application (\$/ha)	Grain yield benefit kg/ha		Profit \$/ha		Return on investment	
	TOS 1	TOS 2			TOS 1	TOS 2	TOS 1	TOS 2	TOS 1	TOS 2
0+0	4040	3469	0	0	0	0	0	0	0	0
20+0	4866	3907	22.6	25	825	438	\$133.96	\$48.82	281%	103%
40+0	5348	4009	45.2	25	1307	540	\$217.40	\$48.62	310%	69%
40+40	5769	3918	90.4	32	1729	449	\$257.97	-\$23.59	211%	-19%
80+0	5542	3669	90.4	25	1501	200	\$214.89	-\$71.38	186%	-62%
160+0	4079	2820	180.8	25	38	-649	-\$197.39	-\$348.63	-96%	-169%
					1080	196	\$ 125	-\$ 69	178%	-16%

Summary

Sowing time had a huge effect on grain yield. Delaying sowing time reduced grain yield in all varieties across all nitrogen treatments. Varietal maturity was also a key factor, with Suntop the highest yielding variety across sowing times and Lancer the lowest yielding variety.

The effect of nitrogen varied between the two sowing times. For TOS 1 splitting nitrogen was the highest yielding treatment for all varieties. For TOS 2, although more variable, lower rates applied at sowing were higher yielding, although still not comparable to yields of TOS 1. For both sowing times applying too high a nitrogen rate at sowing significantly reduced yield. These effects reflect the drier end to the season.

For TOS 1 the highest yielding variety and treatment was Condo with 40kg N/ha applied at sowing and 40kg N topdressed, with a grain yield of 6.42 t/ha. For TOS 2 the highest yielding variety and treatment was Emu_Rock with 40kg N/ha applied at sowing with a grain yield of 4.84 t/ha.

The ideal target rate of nitrogen, given profitability and return on investment was 40 kg N/ha.

Acknowledgements

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