

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

Trial period: 2015

Co-operators: Jeffrey Muirhead

Soil type: Dark Brown Sandy Loam

Previous crop/s: Wheat

Sowing date: TOS: 1 29th April, 2015 TOS 2: 26th May, 2015

Planter: Tractor pulled Morris contour drill parallelogram cone seeder

Harvest date: 11th November, 2015

Starter Fertiliser: 60kg MAP

Soil tests:

pH: 4.6 CaCl₂

Nitrogen: 36.04 Kg N/ha (0-60cm)

Phosphorous: 24ppm (Colwell)

In-crop rainfall: 230mm (April – Oct)

Herbicides:

Pre-emergent - 2.5 L Boxer Gold + 1.6L Avadex + 2L R'up Ultra Max

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 yield
- Delaying sowing time reduced grain yield in all varieties across all nitrogen treatments.
- TOS 1 yielded 3.39 t/ha and TOS 2 yielded 1.99 t/ha.
- Emu_Rock was the highest yielding variety, 2.86 t/ha.
- Lancer was the lowest yielding variety, 2.39 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 29th 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 3rd June for time of sowing 1 and on the 7th July for all varieties in time of sowing 2. For TOS 1 plant counts ranged from 67 plants/m² for Condo with 160kg N applied at sowing to 115 plants/m² for Lancer with 0kg N applied at sowing. For TOS2 plant counts ranged from 21 plants/m² for EGA_Gregory with 160kg N applied at sowing to 106 plants/m² for EGA_Gregory with 0kg N applied at sowing (figure 1). The average plant count for TOS 1 was 92 plants/m² and for TOS 2 it was 73 plants/m².

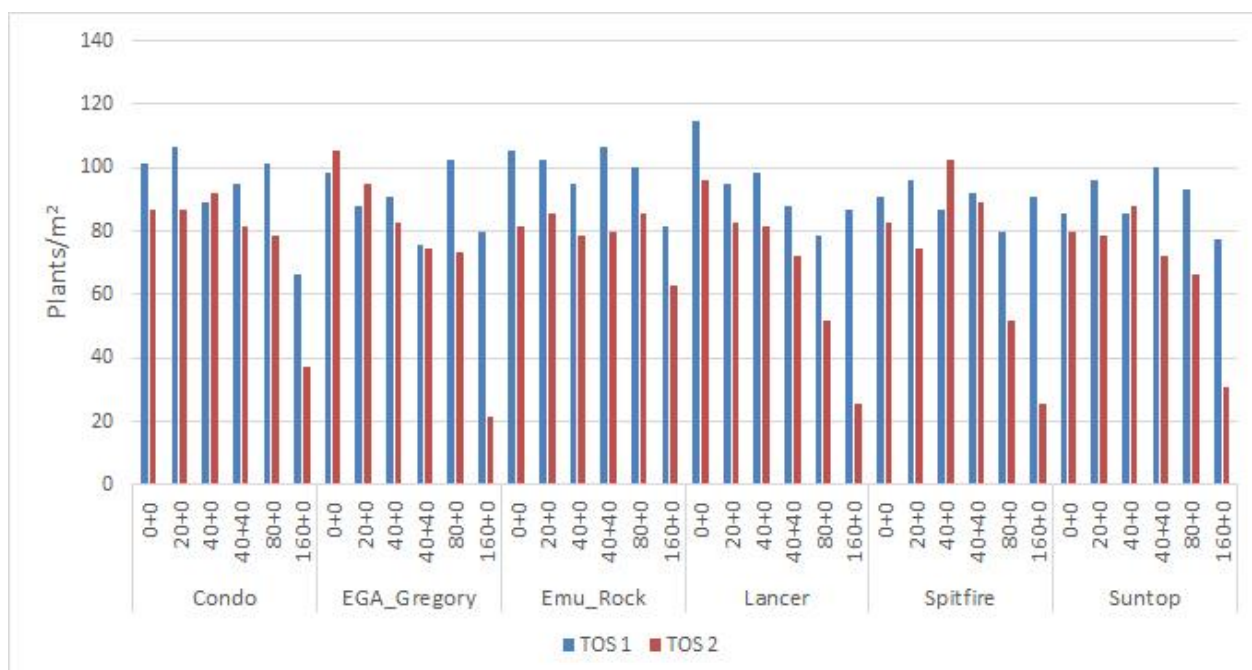


Figure 1: Average plant population (plants/m²) for each variety, sowing time and nitrogen treatment.

NDVI

Crop vigour was measured at heading/flowering using a hand held NDVI. Values for TOS 1 ranged from 0.35 for Condo with 0kg N applied at sowing up to 0.76 for Lancer with 160kg N applied at sowing. For TOS 2 values ranged from 0.35 for EGA_Gregory and Emu_Rock with 0kg N applied at sowing up to 0.56 for Lancer with 80kg N applied at sowing (figure2). The average NDVI value was 0.60 for TOS 1 and 0.46 for TOS 2.

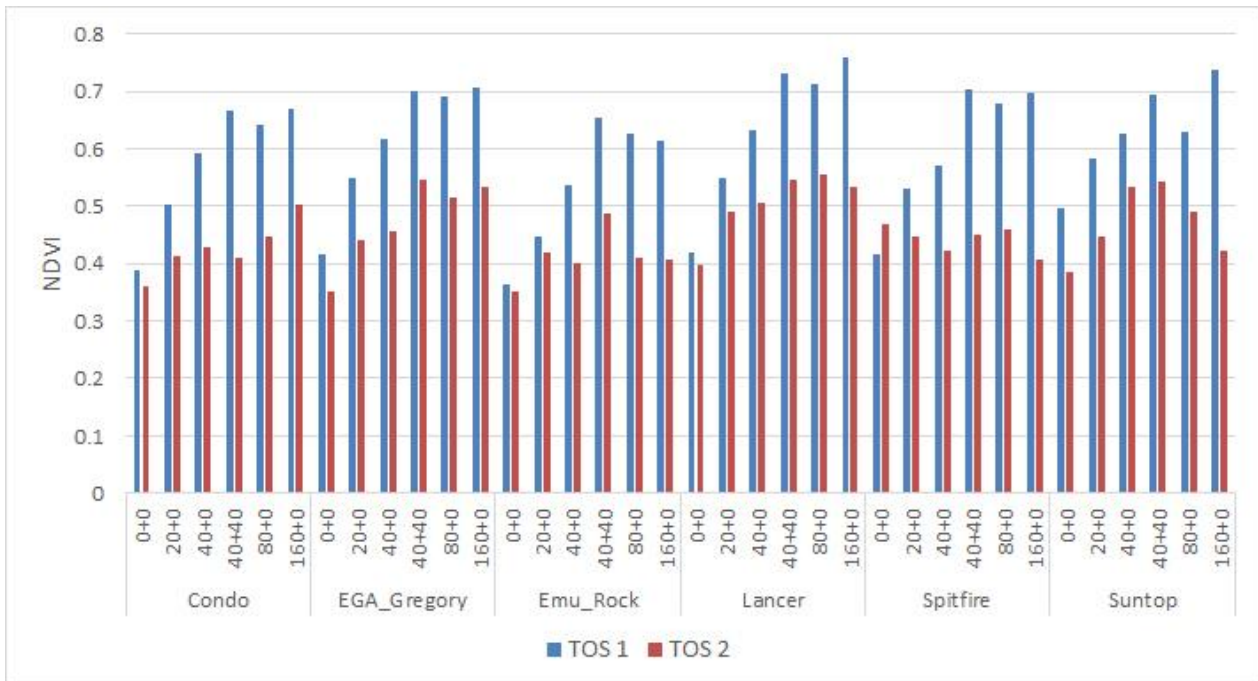


Figure 2: Average NDVI for each variety, time of sowing and nitrogen treatment.

Grain Yield

Variety, TOS and N treatment had significant effects on grain yield. Across sowing times and N treatment the highest yielding variety was Emu_Rock, with a grain yield of 2.86 t/ha, and the lowest yielding variety was Lancer, with a grain yield of 2.39 t/ha.

Delaying sowing time significantly reduced yield. Grain yield for TOS 1 was 3.39 t/ha, whilst TOS 2 had a grain yield of 1.99 t/ha.

For TOS 1, EGA_Gregory with 0kg N/ha applied at sowing was the lowest yielding treatment, with a grain yield of 2.53 t/ha (figure 3). The highest yielding treatment for TOS 1 was EGA_Gregory with 40kg N/ha applied at sowing, with a grain yield of 5.32 t/ha. For TOS 2 Condo with 160kg N/ha applied at sowing was the lowest yielding, with a grain yield of 1.02 t/ha. Emu_Rock with 40kg N/ha applied at sowing and 40kg topdressed had the highest grain yield of 2.94 t/ha for TOS 2.

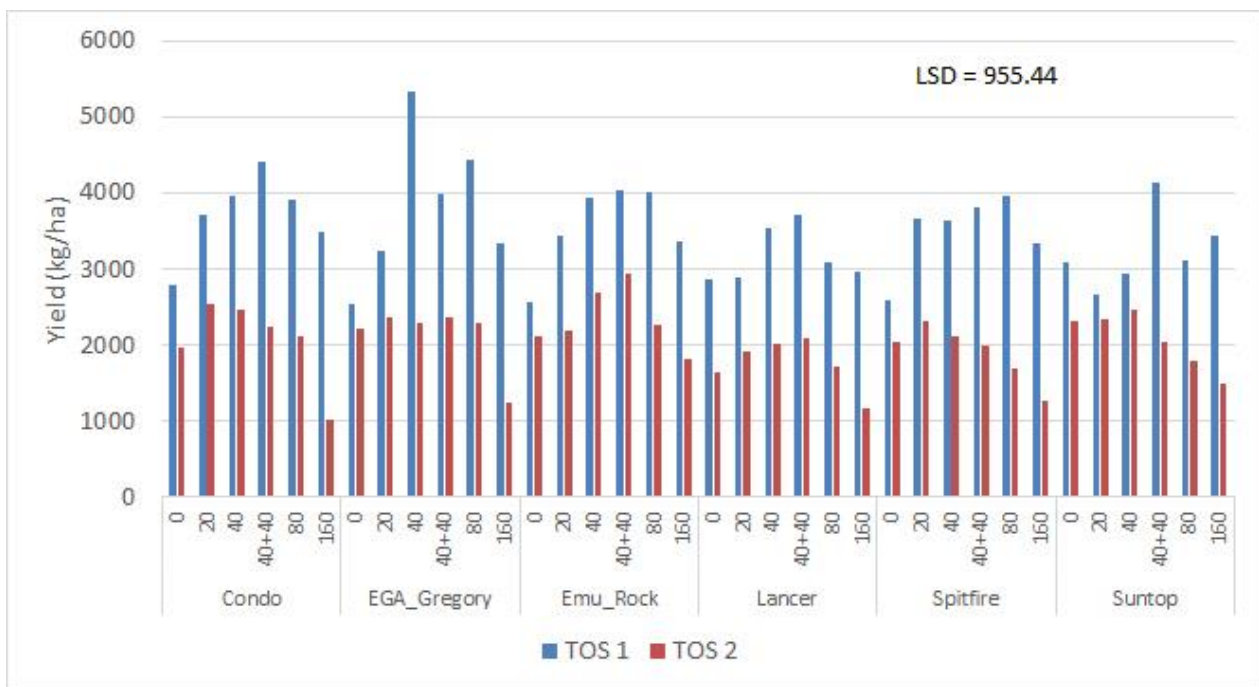


Figure 3: Grain yield for each variety, time of sowing and nitrogen treatment (LSD=955.44 kg/ha).

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. Applying 40kg N/ha at sowing gave the highest profit (\$184.25) and return on investment (262%).

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

Nitrogen treatment	Grain yield kg/ha		Cost of nitrogen (urea @ \$520/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	2727	2044	0	0	0	0	0	0	0	0
20+0	3260	2272	22.6	25	533	229	\$69.68	\$2.71	146%	6%
40+0	3884	2328	45.2	25	1157	284	\$184.25	-\$7.64	262%	-11%
40+40	4008	2267	90.4	32	1280	224	\$159.29	-\$73.17	130%	-60%
80+0	3746	1970	90.4	25	1019	-74	\$108.77	-\$131.67	94%	-114%
160+0	3314	1324	180.8	25	587	-719	-\$76.74	-\$364.01	-37%	-177%
					915	-11	\$ 89	-\$ 115	119%	-71%

Summary

The dry spring contributed to lower yields across both sowing times. Sowing time had a huge effect on yield. Delaying sowing time reduced grain yield in all varieties across all nitrogen treatments. Matching sowing time with varietal maturity is an important factor. Lancer was the lowest yielding variety and Emu_Rock the highest yielding variety in this trial.

For TOS 1, although variable, the highest yields were achieved where either 40kg N/ha was applied at sowing or where 40kg N/ha was applied at sowing plus a topdressing. For TOS 2 grain yield decreased as nitrogen rate increased above 40kg N/ha.

For TOS 1 the highest yielding variety and treatment was EGA_Gregory with 40kg N/ha applied at sowing, with a grain yield of 5.32 t/ha. For TOS 2 the highest yielding variety and treatment was Emu_Rock with 40kg N/ha applied at sowing and 40kg topdressed, with a grain yield of 2.94 t/ha.

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

Acknowledgements

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