Effect of sowing date and nitrogen rate on grain yield of six wheat varieties – Lockhart 2015

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Key findings

- Increased nitrogen application rates equated to increased grain yield.
- Early sowing had a grain yield advantage of 0.74 t/ha averaged across all varieties and nitrogen application rates.
- Corack was the highest yielding variety in this trial.
- Splitting nitrogen application in the second time of sowing increased grain yield.
- Grain protein concentration increased as nitrogen application rates increased.
- The highest proteins occurred at the maximum nitrogen rate of 160 kg/ha in Lancer$^{\Phi}$, EGA_Gregory$^{\Phi}$ and Spitfire$^{\Phi}$ from the 12 May sowing.

Introduction

Varieties can differ in their ability to yield at various sowing dates. Varieties also differ in their response to different rates of nitrogen (N) and how they convert it into yield and protein. This experiment was designed to measure the influence of sowing date and N rate on six common wheat varieties.

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

Site details

Location	Lockhart NSW
Soil type	Grey vertosol
Previous crop	Canola
Stubble management	Direct drill
Planter	Plot air seeder, DBS tynes
Fertiliser	100 kg/ha Superfect
Soil tests:	pH 4.8$_{Ca}$ phosphorus 41 mg/kg nitrogen 70 kg N/ha (0–30 cm)
Herbicides	Knockdown: Roundup CT 1.5 L/ha Pre-emergent: Logran 35 g/ha + Sakura 118 g/ha Post-emergent: Precept 500 mL/ha + Lontrel 150 mL/ha. Axial 150 mL/ha
Fungicide	Flutriafol 400 mL/ha on fertiliser at sowing Prosaro 150 mL/ha + Hasten 1% v/v
Harvest date	21 November 2015

Treatments

Varieties	Corack$^{\Phi}$ EGA_Gregory$^{\Phi}$, Lancer$^{\Phi}$	Spitfire$^{\Phi}$ Suntop$^{\Phi}$ Trojan$^{\Phi}$
Sowing dates	TOS 1: 23 April TOS 2: 12 May	
Nitrogen fertiliser	0, 20, 40, 80, 160 kg N/ha at sowing 40 kg N/ha top-dress TOS 1: 14 July, TOS 2: 28 August	

Seasonal review

The 2015 season had a good autumn break and a cold, wet winter. Total rainfall at the site was 386 mm of which 256.5 mm was in-crop rainfall

Table 1. Rainfall for 2015 at Lockhart. Growing season (April–October) rainfall 257 mm

Lockhart rainfall for 2015 (mm)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
38	25	0	59	19	70	25	62	19	3.5	45	22

(Table 1). The long-term average in-crop rainfall is 302.5 mm. The winter provided ideal conditions for growth; however, the spring period was dry and hot with only 18.5 mm falling in September during the critical grain filling period.

Results

Flowering

Delayed flowering dates correlated with a decreased grain yield (Figure 1). The 12 May sowing date flowered later than the optimal window and flowered under heat stress conditions (7 days >33 °C in early October). At both sowing dates there was a trend toward lower grain yields as the flowering date was delayed.

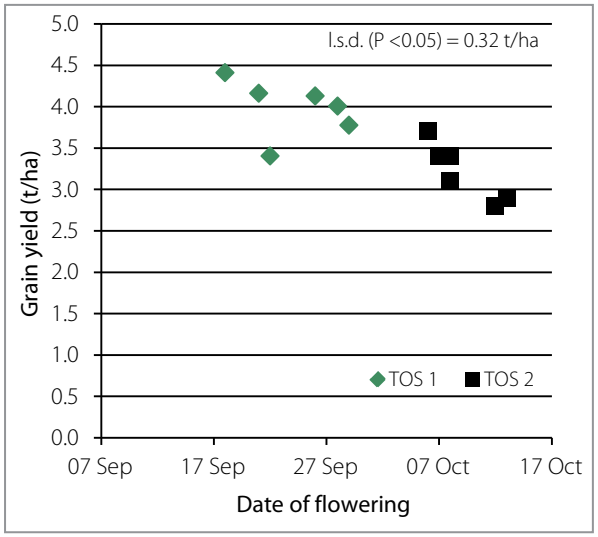

Figure 1. Anthesis date and grain yield of six varieties averaged across nitrogen rates at Lockhart, 2015.

Grain yield

Variety and N rate had significant effects (P <0.05) on grain yield (Figure 2). The interaction between variety and sowing date was also significant (P <0.05). Averaged across variety and N rate, delaying sowing from 23 April until 12 May decreased yield by an average of 0.74 t/ha (Table 2).

Table 2. Average grain yield of six wheat varieties sown at two dates at Lockhart in 2015.

Sowing date	Grain yield (t/ha)
23 April	3.98
12 May	3.24
l.s.d. (P <0.05)	0.32

Figure 2 shows that there was a consistent increase in grain yield as the N rate increased across all varieties sown on 23 April (TOS 1). Grain yield plateaued as the N rate exceeded 80 kg/ha in the 12 May sowing (TOS 2). The split application (28 August) on the second sowing date produced more dry matter per hectare, which correlated with increased grain yield. This could be linked to some waterlogging events during winter when N applied at sowing might not have been available for plant growth for periods during the growing season.

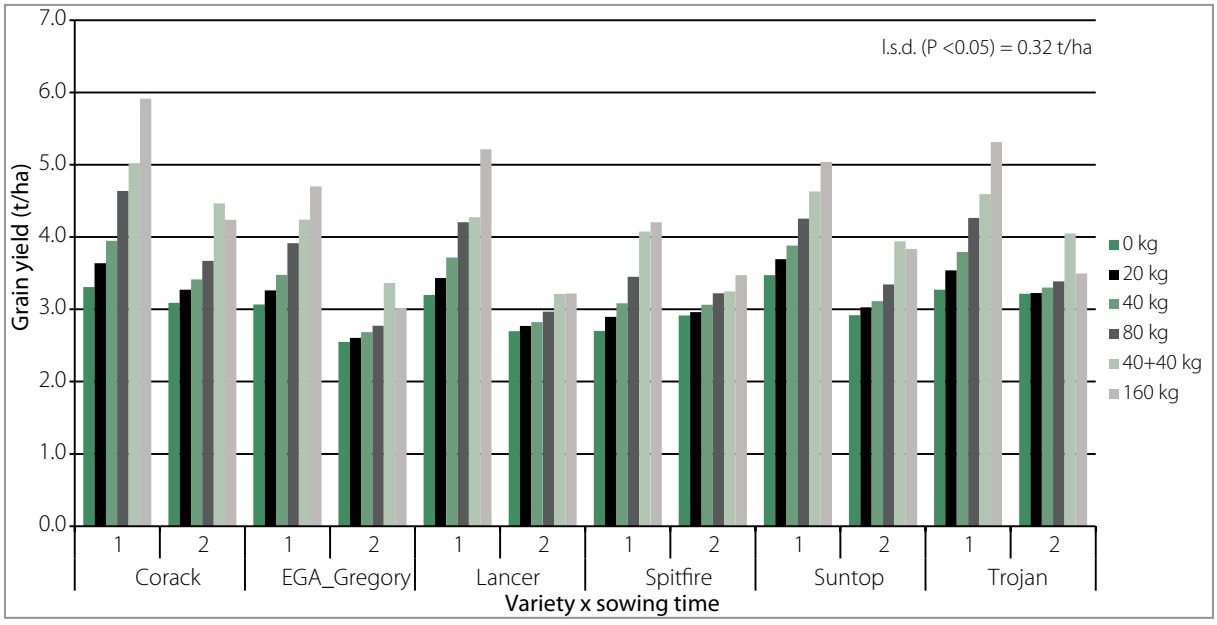

Figure 2. Grain yield of six wheat varieties at five nitrogen rates at Lockhart in 2015.

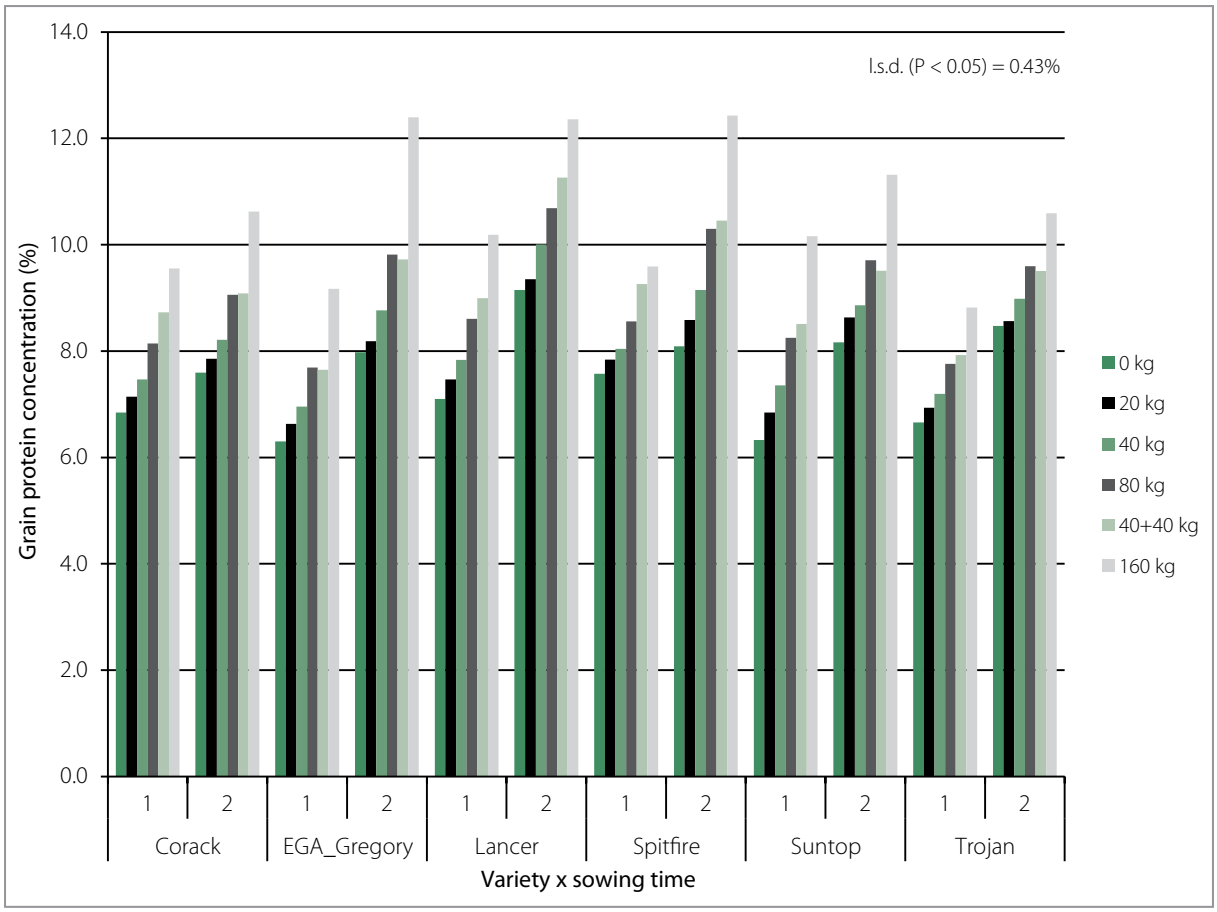

Figure 3. Grain protein concentration of six wheat varieties at five nitrogen rates at Lockhart in 2015.

Grain protein

There was a significant interaction for variety by N application and sowing time by N application ($P < 0.05$). Lancer and Spitfire had the highest grain protein averaged across sowing time and application rates. For the first sowing, grain protein increased as the N rate increased. For the second sowing, there was no significant difference between the 80 kg/ha N rate at sowing and the split application of 40 kg/ha N at sowing and 40 kg/ha N at GS31. The highest grain protein was measured from the 160 kg/ha N rate from the 12 May sowing date in EGA_Gregory, Lancer and Spitfire (Figure 3).

Summary

Matching the variety phenology with the optimal flowering period was critical to maximising grain yield. As the flowering date was delayed, grain filling was occurring under heat stress conditions decreasing the grain yield potential. As N rates increased, grain yield and grain protein increased. This site was very responsive to applied N. Averaged across varieties and nitrogen rates there was a 0.74 t/ha penalty for delaying sowing by 19 days (23 April to 12 May) in 2015. There was a significant ($P < 0.05$) increase in grain protein across all varieties as N rates increased. Grain protein increased by 2.9%from the 0–160 kg/ha applied N. The highest grain protein recorded was 12.4% from the second sowing, most likely a reflection of the hot, dry finish.

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