What effect does time of sowing and nitrogen have on wheat yield?

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Key findings

- Sowing date combined with appropriate variety selection and adequate nitrogen supply was key to increasing grain yields.
- Nitrogen fertiliser decision needs to consider the maximum attainable yield and be adjusted for the seasonal conditions and initial available soil nitrogen.

Why do the trial?

Breeding for improved wheat yield over the past six decades has resulted in varieties that take up and use more Nitrogen (N). This means the N management of new varieties needs to continuously be assessed and adjusted.

In addition, there is increasing interest in adjusting sowing time to stretch the window for completing sowing operations on farm. To improve yield and maintain protein content under earlier sowing times, it is important to consider which varieties are most suited, and if your N management needs to be adjusted.

How was it done?

Plot size	1.75 m x 6 m
Seeding date	13 May 2017, 26 May 2017, 9 June 2017, 23 June 2017
Fertiliser	Urea; @ 0 kg/N ha; @ 50 kg N/ha; @ 100 kg N/ha; @ 150 kg N/ha
	Application time: 50% at 2-4 leaf & 50% at GS31

Field trials were carried out during 2017 in two locations (Turretfield and Hart) in the Mid-North of South Australia. Trials consisted of a combination of four sowing times, six wheat varieties, and four N rates at each location. The earliest sowing time was on the 12-13th of May 2017 and the following sowings were at fortnightly intervals. The latest sowing was on the 23rd of June.

Varieties were chosen based on those commonly grown, N requirement and phenology (Table 1). Nitrogen treatments consisted of unfertilised control, and three fertiliser rates (50, 100 and 150 kg N/ha) applied as urea. In all cases, N application was split in 50% at 2-4 leaf and 50% just before stem elongation (GS31).

Table 1. Wheat varieties trialed at Hart and Turretfield in 2017.

Variety	Maturity type
Axe (AGT)	early flowering and very early maturity variety suited to southern Australia
Cobra (LongReach)	high yielding early-mid maturity variety suited to high yielding areas of Southern Australia
Mace (AGT)	early to mid-season maturity and has been the leading wheat variety in both WA and SA in recent seasons
Scout (LongReach)	mid maturity variety, derived from Yitpi
Spitfire (LongReach)	is an early mid maturing variety with high grain size and consistently high grain protein
Trojan (LongReach)	mid-late maturing variety

Results and discussion

Grain yield was affected by sowing time, location, N rates and variety. Yields at Hart were in general 1.0 t/ha higher compared to Turretfield. However, differences between locations were reduced from 1.2 t/ha in early-mid May sowing time to less than 0.5 t/ha in the mid-late June (Figure 1).

At both sites Mace was the highest yielding variety (4.3 t/ha in first sowing time) but was not different from Cobra, Trojan or Scout (Figure 2). Spitfire was the lowest yielding variety at both the first (3.8 t/ha) and last sowing time (2.7 t/ha). Mace remained the highest yielding variety across all times of sowing. The early maturing variety Axe, did not show any advantages when sown in mid-May compared to late June. Sowing in mid-May produced a significant positive effect on grain yield only when N availability (soil + fertiliser) was above 150 kg N/ha.

Nitrogen fertilisation had a significant effect on grain yield with differential response between location, sowing time, and varieties. At Hart, N fertilisation increased the grain yield in the first and second sowings (before June) but did not improve yield when sowing in early or late June. At Turretfield, where initial soil N was exceptionally high (279 kg N/ha), N fertilisation reduced the grain yield in the first sowing time, with no effect in the later sowings (Figure 1). While in most cases yield decreased as seeding date was delayed into June, sowing time did not affect yield when fertilising at the maximum rate at Turretfield.

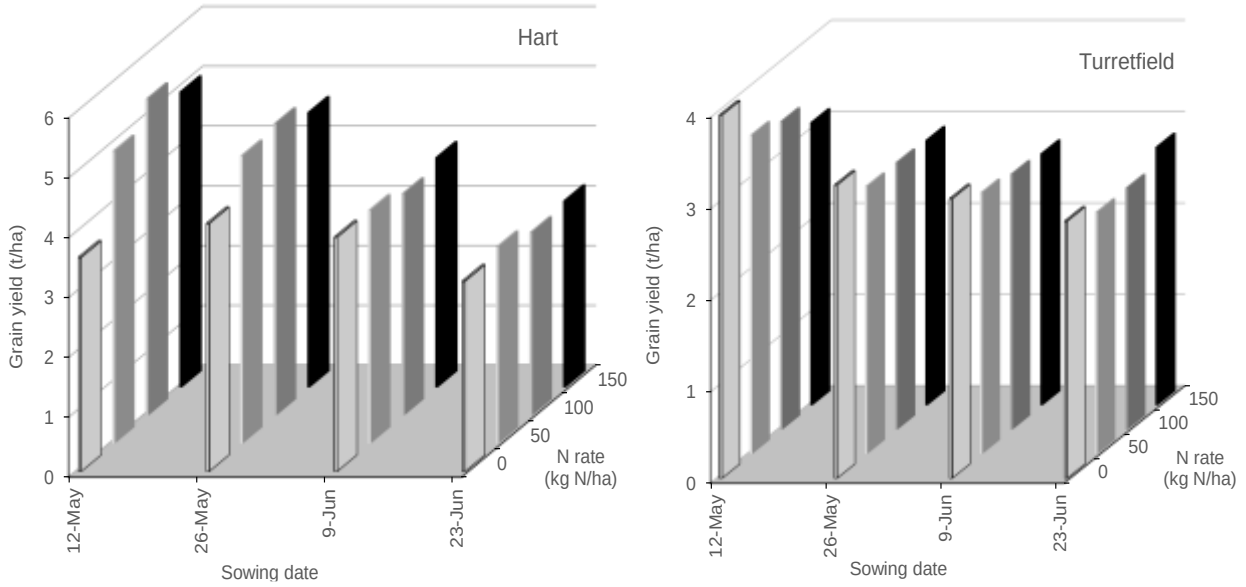

Figure 1. Grain yield across sowing date and N rate for both trial sites. Initial soil N was 111 kg N/ha at Hart and 279 kg N/ha at Turretfield. Least significance difference between bars were 0.21 t/ha for sowing time and 0.1 t/ha for N rate.

The varieties displayed different response to N depending on sowing time and location. The early maturing (Axe) and the mid-long maturing variety (Trojan) did respond positively to N supply. However, the mid maturity varieties (Mace, Cobra and Spitfire) did not respond to N fertilisation. Scout did not respond to N up to 150 kg N/ha and had a yield reduction at this rate (Figure 2). Differences between the varieties were also observed with sowing time, except in the late May sowing. For all varieties, yield declined with delayed sowing. The average rate of yield decline was 25.5 kg/ha of grain per day delay in sowing. Axe had lower yield than other varieties in the first sowing time (Figure 3).

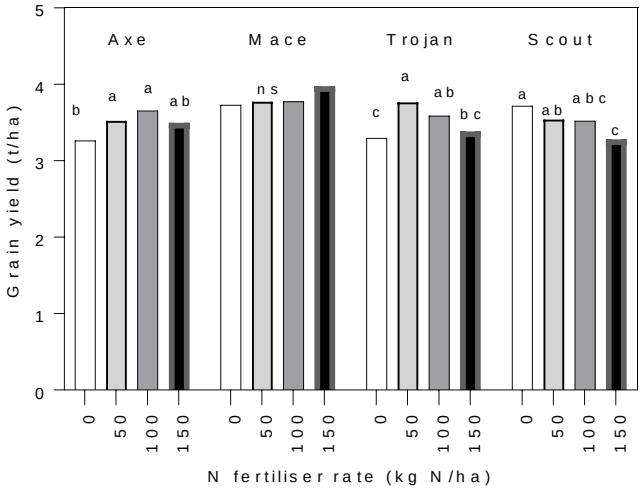

Figure 2. Average response of wheat varieties to N rates at both sites.

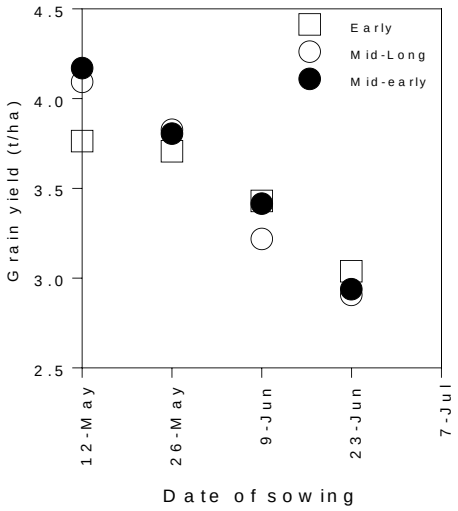

Figure 3. Average response of early, mid-early and mid-long varieties to sowing date.

Summary / implications

Sowing on time in early-mid May produced the highest grain yields at Hart in 2017. However, when considering this sowing time, variety and N supply become important. The benefits of sowing early can be obtained when using mid-maturity varieties and when providing the crop with enough N to maximise its productivity. The N response in terms of grain yield differ between very early, mid early, and mid-long varieties.

Acknowledgements

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Wheat ToS trial at Hart on June 22, 2017