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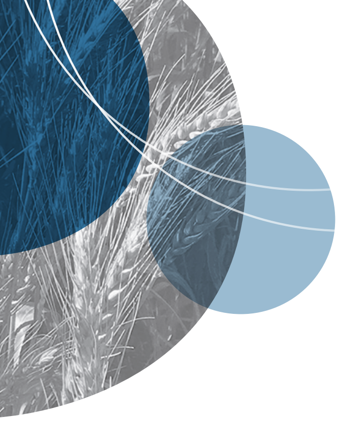

Agronomy – cereals

Early sowing options: sowing date influence on phenology and grain yield of long-season wheat genotypes – Wallendbeen 2018

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Key findings

- Yields of winter wheats sown early were similar to yields of well-adapted spring types sown within their optimal window.
- New winter genotypes had different phenology responses compared with current commercial genotypes, suggesting that management can manipulate cultivar performance and can vary across growing environments.

Introduction

Recent trends in earlier sowing have renewed grower interest in winter wheats and breeder focus on selecting and releasing new winter genotypes suited to southern NSW farming systems. In 2018, a field experiment was conducted at Wallendbeen in southern NSW to evaluate current commercial genotypes in conjunction with new breeder lines suited to early sowing. This paper presents results from the Wallendbeen site, focusing on the influence that sowing date (SD) had on the phenology, grain yield and quality of 16 wheat genotypes.

Site details

Location	Braeside, Wallendbeen, NSW
Soil type	Red kandasol
Previous crop	Canola
Sowing	Direct drilled with DBS tynes spaced at 250 mm using a GPS auto-steer system Target plant density: 140 plants/m^2
Soil pH_{Ca}	4.6 (0–10 cm); 5.4 (10–30 cm)
Mineral nitrogen (N)	113 kg N/ha at sowing (1.8 m depth)
Fertiliser	82 kg/ha mono-ammonium phosphate (MAP) (sowing) Urea 87 kg/ha (spread 7 June)
Weed control	Pre-emergent: Sakura® 118 g/ha + Logran® 35 g/ha + Avadex® Xtra 1.6 L/ha
Disease management	Seed treatment: Hombre® Ultra 200 mL/100 kg Fertiliser treatment: Flutriafol (250 g/L) 400 mL/ha In-crop: Prosaro® 300 mL/ha (5 July)

In-crop rainfall	219 mm (April–October); long-term average – 460 mm 17 mm recorded between harvest dates
Harvest date	27 November 2018 5 December 2018 Manning⟨PBR⟩ (SD1, SD2 and SD3) and DS Bennett⟨PBR⟩ (SD3) due to delayed maturity.

Treatments

Sixteen wheat genotypes with varying responses to vernalisation and photoperiod (Table 1) were sown on three sowing dates: SD1: 28 March, SD2: 13 April and SD3: 1 May 2018.

Table 1. Expected phenology types of experiment genotypes at Wallendbeen, 2018.

Phenology type	Sub-category	Genotypes
Winter	Slow	Manning⟨PBR⟩, RGT Accroc
	Mid–slow	DS Bennett⟨PBR⟩, ADV08-0008
	Mid	EGA Wedgetail⟨PBR⟩, LongReach Kittyhawk⟨PBR⟩, ADV13-1292
	Mid–fast	Illabo⟨PBR⟩
	Fast	Longsword⟨PBR⟩
Spring	Very slow	LongReach Nighthawk⟨PBR⟩ (LPB14-0392), RGT Zanzibar, Sunlamb⟨PBR⟩, Sunmax⟨PBR⟩
	Slow	Cutlass⟨PBR⟩
	Mid–slow	LongReach Lancer⟨PBR⟩, LongReach Trojan⟨PBR⟩

Results

Phasic development

Generally, the genotype and sowing date combinations that flower in mid–late October at Wallendbeen achieve the highest grain yields.

In this experiment, there was significant variation in genotype pre-flowering stages with respect to sowing date (Figure 1), which influenced the flowering by grain yield responses. Faster developing spring types (with minimal response to vernalisation), sown early (when temperatures are warmer and days longer), progressed quickly and suffered significant yield penalties from flowering outside the optimal flowering period (OFP). For example, LongReach Lancer⟨PBR⟩ sown on SD1 at Wallendbeen, flowered on 27 August. However, when sown on SD3 (within an appropriate sowing window for its given phenology type), LongReach Lancer⟨PBR⟩ flowered on 13 October and within the OFP. In contrast, the winter wheats all had a prolonged vegetative phase and achieved relatively stable flowering dates across the sowing treatments (Figure 1). Despite this, there was significant variation in phasic duration among the winter types, indicating varied responses to vernalisation and photoperiod, which also influenced grain yield responses (Figure 2).

Mid-winter types Illabo⟨PBR⟩, EGA Wedgetail⟨PBR⟩ and LongReach Kittyhawk⟨PBR⟩ recorded similar flowering dates from each sowing date, however we observed differences in date of GS30 (start of stem elongation) in response to sowing date. From SD1, LongReach Kittyhawk⟨PBR⟩ reached GS30 six days and 14 days faster than Illabo⟨PBR⟩ and EGA Wedgetail⟨PBR⟩ respectively, while in SD2, LongReach Kittyhawk⟨PBR⟩ was four days faster to GS30 than both Illabo⟨PBR⟩ and EGA Wedgetail⟨PBR⟩. There was no difference in GS30 dates in SD3.

The fastest developing winter type, Longsword⟨PBR⟩ had a shorter vegetative period than the mid-winter types: 17 days faster to GS30 than EGA Wedgetail⟨PBR⟩ in SD1 and six and eight days faster in SD2 and SD3. It was also 4–5 days quicker to flowering thereafter.

The slow-winter types, DS Bennett⟨PBR⟩, Manning⟨PBR⟩ and RGT Accroc, were significantly slower to GS30 and flowering than the other winter types. DS Bennett⟨PBR⟩ showed very stable flowering dates across the three sowing dates, flowering nine days later than EGA Wedgetail⟨PBR⟩ in SD1, six days later in SD2 and two days later in SD3. There was also notable variation in the grain-filling phase among the slower winter types, with RGT Accroc 3–5 days quicker to physical maturity than Manning[ϕ], despite similar flowering dates.

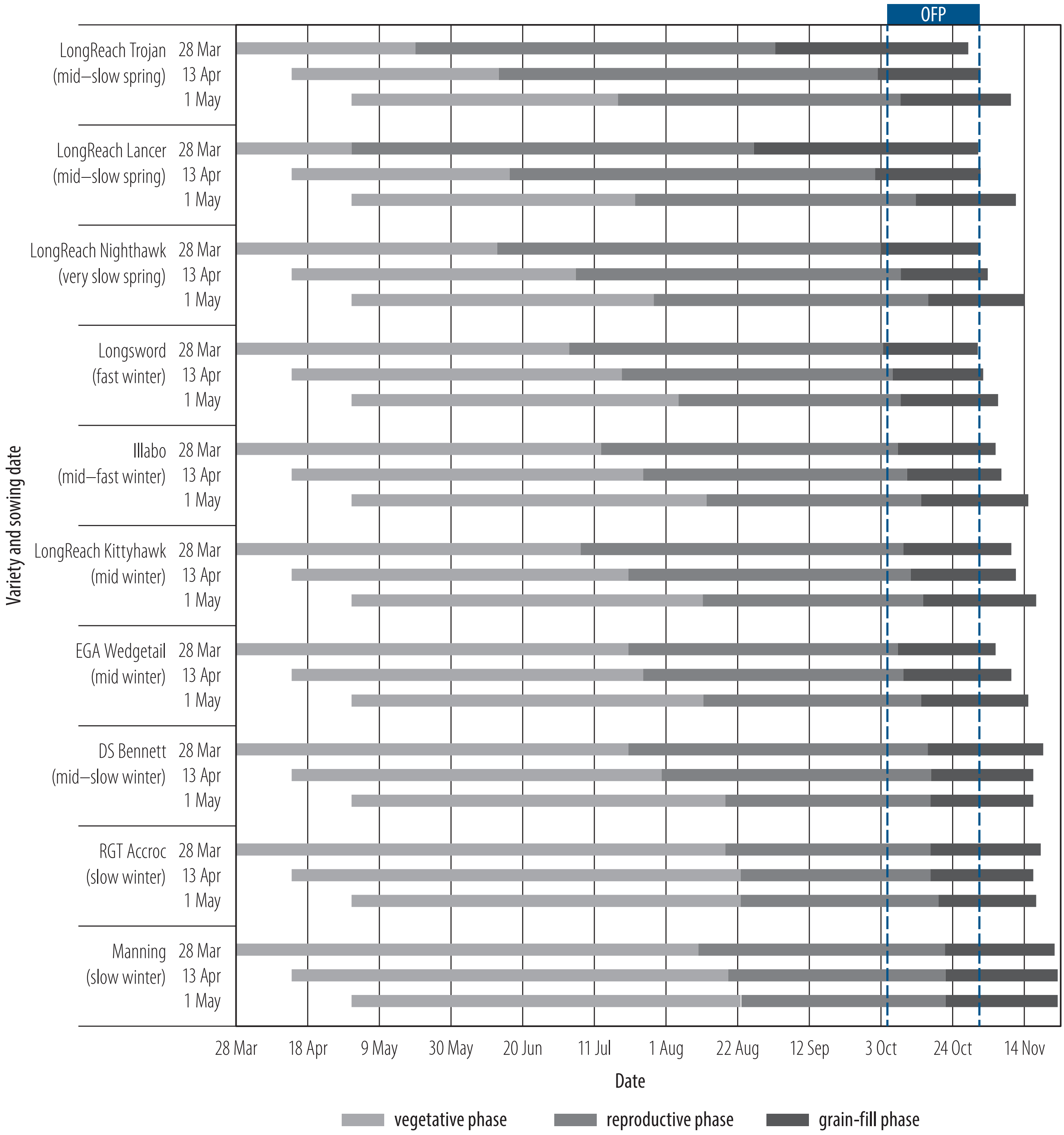

Figure 1. Sowing date influence on phasic development of selected genotypes sown on 28 March, 13 April and 1 May at Wallendbeen, 2018.
Vegetative phase (sowing to GS30); reproductive phase (GS30 to flowering); grain-fill phase (flowering to maturity).
Blue dotted lines indicate optimal flowering period (OFP).

Grain yield

Generally, the winter genotypes achieved consistently high yields across sowing dates at the Wallendbeen site in 2018, and some newer winter genotypes indicated a possible yield advantage compared with benchmark variety EGA Wedgetail⁽ᵖ⁾. However, there was an influence of the varied phenology responses reported among the winter types, whereby the accelerated development, and earlier flowering quicker winter types (Illabo⁽ᵖ⁾ and Longsword⁽ᵖ⁾) and spring genotypes (LongReach Lancer⁽ᵖ⁾ and LongReach Trojan⁽ᵖ⁾), resulted in significant yield penalties (Figure 2; Table 2), from SD1. This yield response to sowing date for Illabo⁽ᵖ⁾ and Longsword⁽ᵖ⁾ is consistent with 2017 results (Harris et al. 2018), indicating optimal sowing dates from mid April onwards when ungrazed. Despite the yield penalty from SD1, spring types were capable of similar yields (and flowering dates) as winter types when sown later in SD3, within their recommended sowing window.

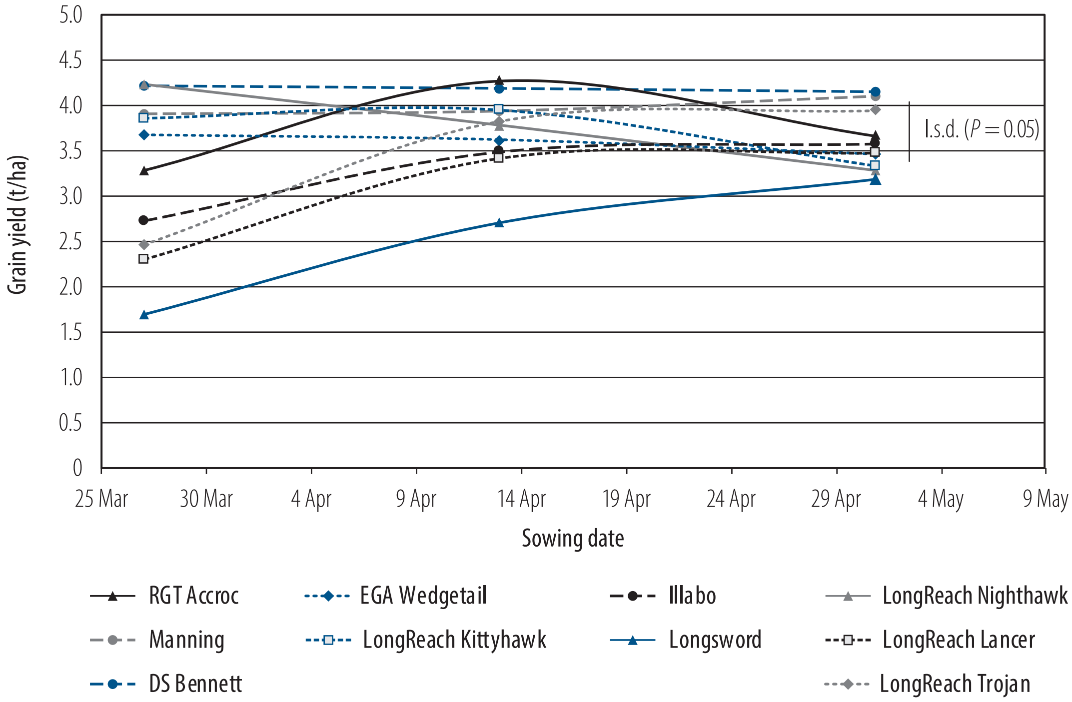

Figure 2. Grain yield responses across three sowing dates: 28 March, 13 April and 1 May at Wallendbeen, 2018; l.s.d., least significant difference.

Table 2. Grain yield of genotypes across three sowing dates at Wallendbeen in 2018.

Genotype	Grain yield (t/ha)		
	SD1: 28 March	SD2: 13 April	SD3: 1 May
ADV08-0008	3.81	3.49	3.65
ADV13-1292	3.11	3.37	3.56
Cutlass	0.32	3.12	3.81
DS Bennett	4.23	4.20	4.16
EGA Wedgetail	3.68	3.63	3.48
Illabo	2.73	3.50	3.59
LongReach Nighthawk	4.24	3.79	3.29
LongReach Kittyhawk	3.87	3.96	3.35
LongReach Lancer	2.30	3.43	3.49
LongReach Trojan	2.47	3.84	3.96
Longsword	1.70	2.71	3.19
Manning	3.92	3.95	4.11
RGT Accroc	3.30	4.29	3.68
RGT Zanzibar	3.51	3.25	3.64
Sunlamb	4.07	3.65	3.83
Sunmax	4.50	3.48	3.44
Mean	3.24	3.60	3.64
Mean (Winter)	3.26	3.43	3.46
Mean (Spring)	3.62	3.88	3.82
l.s.d. genotype	0.38		
l.s.d. SD	0.16		
l.s.d. genotype × SD	0.66		

Grain quality

Genotype, sowing date and the interaction between sowing date and genotype significantly affected grain protein, test weight and screenings in 2018 (Table 3). With the exception of Sunmax$^{\phi}$, LongReach Nighthawk$^{\phi}$ (SD1) and DS Bennett$^{\phi}$ (SD3), all commercial genotypes achieved greater than 11.5% grain protein. Most genotypes achieved a test weight of >76 kg/hL, with the exception of Cutlass$^{\phi}$, Manning$^{\phi}$ and RGT Accroc (SD1), and Sunlamb$^{\phi}$ (SD3). Many genotype by sowing time combinations recorded high screenings (>5%) in 2018 (Table 3), however, Longsword$^{\phi}$ consistently recorded low screenings.

Summary

Despite below average rainfall in 2018, high grain yields were achieved from various genotype by sowing date combinations. Winter genotypes were generally stable in flowering time and grain yield responses across sowing dates from late March to early May, however, we did report significant differences in phasic development among the winter types, suggesting cultivar performance can be manipulated with management (sowing date) and can vary across growing environments. The faster developing spring genotypes were not suited to early sowing, however, some were able to achieve comparable grain yields when sown at an optimal time e.g. LongReach Trojan$^{\phi}$ 1 May (SD3). These results highlight the importance of matching genotype and sowing date to achieve OFP as an effective management strategy to optimise grain yields, as well as highlighting the opportunity for early-sown winter wheat in grain-only systems.

Table 3. Protein (%), screenings (%) and test weight (kg/hL) of genotypes across three sowing dates at Wallendbeen in 2018.

Genotype	SD1: 28 March			SD2: 13 April			SD3: 1 May		
	Protein (%)	Test weight (kg/hL)	Screenings (%)	Protein (%)	Test weight (kg/hL)	Screenings (%)	Protein (%)	Test weight (kg/hL)	Screenings (%)
ADV08-0008	12.1	76.6	18.0	12.9	77.7	19.0	13.3	78.4	17.6
ADV13-1292	13.2	77.1	5.9	13.0	80.1	5.2	13.1	80.6	5.2
Cutlass	16.6	71.7	4.4	12.4	80.4	6.8	12.6	79.6	10.7
DS Bennett	11.7	79.3	7.3	11.7	80.4	5.2	10.5 [A]	81.3 [A]	3.8 [A]
EGA Wedgetail	12.7	76.8	8.5	13.3	78.1	5.9	14.1	77.7	6.3
Illabo	14.1	75.3	7.0	12.9	77.4	9.6	13.6	78.2	8.1
LongReach Kittyhawk	12.3	81.2	11.5	12.2	82.0	9.7	13.4	81.7	7.7
LongReach Lancer	15.4	76.4	8.7	13.2	79.2	7.5	13.6	79.1	9.2
LongReach Nighthawk	11.2	79.8	6.2	12.0	80.2	6.5	14.3	80.7	6.1
LongReach Trojan	13.9	79.8	4.2	12.9	80.4	6.9	12.5	79.3	9.2
Longswor	15.4	76.0	1.5	13.8	80.0	2.1	13.5	79.8	2.6
Manning	11.6 [A]	75.7 [A]	5.7 [A]	12.2 [A]	77.9 [A]	3.6 [A]	11.5 [A]	77.1 [A]	4.1 [A]
RGT Accroc	13.7	75.2	15.1	11.6	78.8	10.8	14.6	77.1	9.1
RGT Zanzibar	13.1	76.6	15.6	12.9	78.1	11.8	12.6	78.8	15.0
Sunlamb	12.4	78.2	7.5	13.1	79.1	5.2	13.7	75.8	4.0
Sunmax	11.0	80.1	12.2	13.0	80.1	10.1	12.4	80.9	11.5
l.s.d. genotype	0.8	1.0	1.5						
l.s.d. SD	0.4	0.4	0.7						
l.s.d. genotype × SD	1.4	1.7	2.6						

[A] harvested following 17 mm rain due to delayed maturity.

Reference

Harris F, Kanaley H, McMahon G, Copeland C and Petty H 2018. Early sowing options: sowing date influence on phenology and grain yield of long-season wheat genotypes – Wallendbeen 2017; D Slinger, T Moore and C Martin (eds). *Southern NSW research results 2018*, pp. 49–53. NSW Department of Primary Industries.

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