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Influence of sowing date on phenology and grain yield of fifteen barley varieties and nine wheat varieties – Matong 2017

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Key findings

- The highest grain yields in 2017 were obtained from the first sowing date.
- In 2017, frost and rainfall had a significant influence on grain yield responses to sowing date.
- Seasonal conditions altered expected phenology responses of genotypes in 2017.

Introduction

This experiment was conducted to investigate the sowing date effect on phenology and grain yield of 15 commercially relevant barley varieties compared with nine wheat varieties.

Site details

Location	'Yarrawonga', Matong NSW
Soil type	Brown chromosol
Previous crop	Canola
Sowing	Direct drilled with DBS tynes spaced at 250 mm using a GPS auto-steer system
Target plant density	150 plants/m^2
Fertiliser	80 kg/ha mono-ammonium phosphate (MAP) (sowing) 40 kg/ha urea (surface spread) 24 April
Weed control	Knockdown: Paraquat 250® 2.0 L/ha Pre-emergent: Boxer Gold® 2.5 L/ha Post emergent: LVE MCPA 600® 600 mL/ha + Archer® 150 mL/ha (2 August)
Disease management	Seed treatment: Hombre Ultra® 200 mL/100kg Flutrialfol-treated fertiliser 400 mL/ha In-crop: Prosaro® 300 mL/ha (12 July)
In-crop rainfall	134.7 mm (April–October) (long-term average is 319 mm)

Treatments

Fifteen barley and nine wheat varieties were sown on three sowing dates: 24 April, 9 May and 30 May (Table 1).

Table 1. Barley and wheat varieties included in the experiment at Matong, 2017.

Species	Variety
Barley	AGTB0015, Biere, Commander$^{\Phi}$, Compass$^{\Phi}$, Fathom$^{\Phi}$, Bottler, La Trobe$^{\Phi}$, Navigator$^{\Phi}$, Oxford, RGT Planet$^{\Phi}$, Rosalind$^{\Phi}$, Spartacus CL$^{\Phi}$, Urambie$^{\Phi}$, Westminster$^{\Phi}$, WI4592
Wheat	Beckom$^{\Phi}$, Condo$^{\Phi}$, Cutlass$^{\Phi}$, EGA Eaglehawk$^{\Phi}$, Emu Rock$^{\Phi}$, LongReach Kittyhawk$^{\Phi}$, LongReach Lancer$^{\Phi}$, Scepter$^{\Phi}$, LongReach Trojan$^{\Phi}$

Total rainfall for the growing season (April to October) was 134.7 mm, well below the long-term average of 319 mm (Figure 1).The site received 42 mm of rain in January with no rain recorded in February or March. In April, 19 mm of rain was recorded, just before the first sowing date (24 April). However, the next significant rain was not until 18 May (8 mm), which meant conditions were

drier for the second and third sowing dates (9 May and 30 May). The site recorded below average rainfall throughout the growing season, with no rain recorded from 19 August to 8 October, which coincided with the critical late-reproductive and early grain filling period of many genotypes.

In addition, the site had severe frost conditions throughout the growing season, recording 74 days below 0 °C, with 54 of these being below –2 °C (measured at crop height with an unshielded Tiny Tag) from 31 May until 21 September.

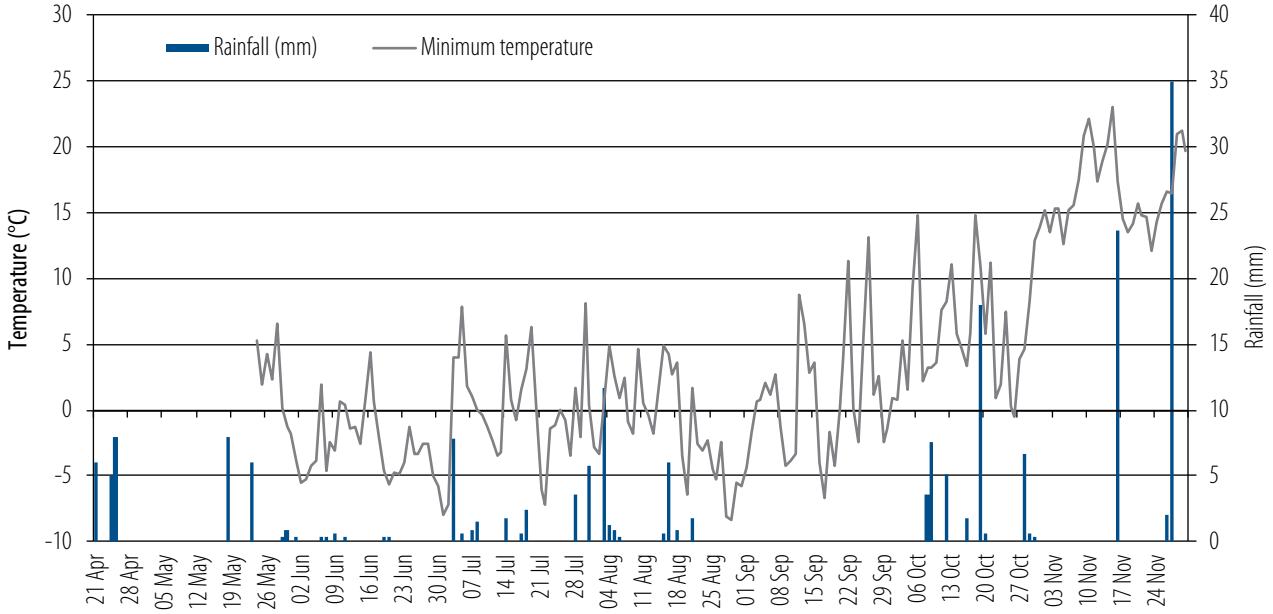

Figure 1. Minimum temperatures (recorded from unshielded Tiny Tag at crop height) and rainfall from 21 May to 30 November at the Matong site, 2017.

Results

Phenology

Optimum grain yield is achieved when genotypes are matched with sowing date to ensure flowering occurs at an appropriate time. Previous results have indicated that the genotype and sowing date combinations which flower mid–late September at Matong have the highest grain yields (Harris et al. 2017). However, in 2017, the early stem frost damage and moisture stress influenced the plant flowering window. Significant tiller death and late tiller regrowth was reported across all sowing dates and genotypes, which consequently altered phenology and uniformity of maturity in plots. In 2017, other experiments reported a positive relationship between delayed stem elongation onset and grain yield due to reduced exposure to the number and severity of frosts (e.g. Harris et al. 2018; Petty et al. 2018). However, the severe freezing temperatures and dry conditions at the Matong site nullified any association between phenology and grain yield responses to sowing date for either barley or wheat genotypes in 2017 (Table 2, Figure 2).

Grain yield

The highest grain yields were obtained from the first sowing date (24 April), (Table 2); Rosalind$^{\Phi}$ the highest yielding barley variety (2.19 t/ha) and Cutlass$^{\Phi}$ the highest yielding wheat variety (1.95 t/ha). This is a contrast to 2014–16 results where the highest reported yields were achieved from a mid May sowing for many barley varieties (Harris et al. 2017).

Despite the adverse climatic conditions during the growing season, some varieties achieved similar yields from the 2017 harvest, maintaining their relative yield ranking across sowing dates, for example Rosalind$^{\Phi}$ for barley and Scepter$^{\Phi}$ and Cutlass$^{\Phi}$ wheat. (Table 2).

Table 2. Grain yield, yield ranking (1–15 for barley, 1–9 for wheats) and stem elongation date (GS31) of barley and wheat varieties sown on three sowing dates at Matong, 2017.

Variety	Sowing date								
	24 Apr			9 May			30 May		
	Grain yield (t/ha)	Yield ranking	GS31 date	Grain yield (t/ha)	Yield Ranking	GS31 date	Grain yield (t/ha)	Yield ranking	GS31 date
Barley									
AGTB0015	1.31	11	2 Jul	1.16	8	28 Jul	0.97	12	16 Aug
Biere	1.29	12	10 Jul	1.04	10	30 Jul	1.00	10	16 Aug
Bottler	1.58	7	28 Jun	0.81	12	26 Jul	0.99	11	16 Aug
Commander	1.24	14	17 Jul	0.73	15	8 Aug	1.59	1	20 Aug
Compass	1.74	5	8 Jul	1.61	1	1 Aug	1.12	7	16 Aug
Fathom	1.96	4	30 Jun	1.24	5	1 Aug	1.47	3	16 Aug
La Trobe	1.57	8	25 Jun	1.20	7	24 Jul	1.58	2	16 Aug
Navigator	1.26	13	22 Jul	0.79	13	16 Aug	0.87	14	24 Aug
Oxford	1.59	6	22 Jul	1.54	2	8 Aug	1.07	9	24 Aug
RGT Planet	1.17	15	10 Jul	0.84	11	30 Jul	0.77	15	18 Aug
Rosalind	2.19	1	20 Jun	1.45	3	17 Jul	1.18	5	16 Aug
Spartacus CL	2.00	2	28 Jun	1.26	4	24 Jul	1.18	5	16 Aug
Urambie	1.96	3	30 Jul	0.75	14	18 Aug	0.97	12	23 Aug
Westminster	1.45	9	17 Jul	1.06	9	6 Aug	1.19	4	24 Aug
WI4592	1.35	10	12 Jul	1.24	5	1 Aug	1.10	8	20 Aug
Wheat									
Beckom	1.32	5	12 Jul	1.01	8	5 Aug	1.20	2	21 Aug
Condo	0.84	9	28 Jun	1.16	3	30 Jul	0.89	8	16 Aug
Cutlass	1.95	1	28 Jun	1.28	2	1 Aug	1.19	3	21 Aug
EGA Eaglehawk	1.14	7	17 Jul	1.11	4	13 Aug	1.14	4	23 Aug
Emu Rock	0.91	8	22 Jun	1.04	6	20 Jul	0.94	7	16 Aug
LongReach Kittyhawk	1.18	6	11 Aug	0.88	9	18 Aug	1.12	5	24 Aug
LongReach Lancer	1.61	3	10 Jul	1.06	5	13 Aug	0.83	9	24 Aug
Scepter	1.81	2	3 Jul	1.46	1	1 Aug	1.57	1	19 Aug
LongReach Trojan	1.58	4	3 Jul	1.03	7	5 Aug	0.98	6	16 Aug
Mean Barley	1.58			1.11			1.14		
Mean Wheat	1.37			1.11			1.10		
l.s.d. variety × sowing date ($P<0.05$) barley = 0.55									
l.s.d. variety × sowing date ($P<0.05$) wheat = 0.61									

Grey shading indicates highest yielding wheat and barley varieties.

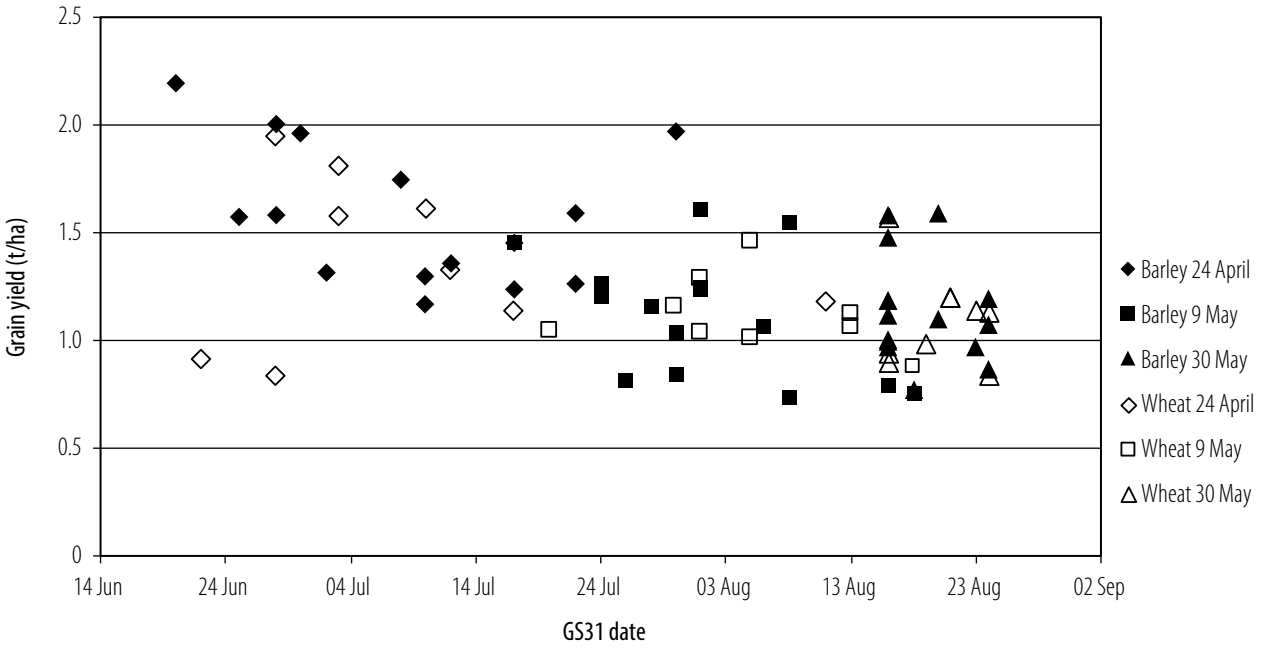

Figure 2. Stem elongation date (GS31) and grain yield of barley (solid marker) and wheat (open marker) varieties for three sowing dates at Matong, 2017.

Summary

The extreme frosts and below average rainfall throughout the growing season in 2017 significantly influenced the phenology and grain yield of genotypes in response to sowing date. The yield responses to sowing date for genotypes are different from those recorded in the 2014–16 experiments at Matong.

Matching genotype and sowing time to achieve flowering at an appropriate time is the most effective strategy for optimising grain yield responses; the results reported for 2017 highlights the importance of making decisions based on results from a number of seasons.

References

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