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Effect of sowing date on grain yield of twenty three wheat and seven barley varieties—Lockhart 2014

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Introduction

This experiment was designed to assess the effect of early and late sowing dates on the phenology and grain yield of several newer wheat and barley varieties in comparison with commonly grown varieties in southern NSW. Wheat and barley varieties respond differently to sowing time. There are different responses in flowering time and relative grain yield with changes in time of sowing. This experiment is one in a series of time of sowing experiments aimed at determining variety responses to sowing time.

Site details

Location	Lockhart, NSW
Trial period	2014
Soil type	Grey vertisol
Previous crop/s	Barley
Stubble management	Direct drill, standing stubble
Planter	Plot air seeder, 250 mm DBS tynes
Harvest date	19 November 2014
Fertiliser	100 kg/ha DAP
Soil pH _{Ca}	6.6
Nitrogen	180 kg/ha to 1.2 m depth
Phosphorous	35 mg/kg
Herbicides	Knockdown: RoundupCT 1.5L/ha Pre-emergent: Logran 35g/ha + Boxer Gold 2.5l/ha Post Emergent: Precept 500 mL/ha + Lontrel 150 mL/ha
Fungicide	Flutriafol @ 400ml/ha on fertiliser at sowing

Treatments

Varieties	Twenty three wheat and seven barley varieties (including pre-released lines) (Table 2).
Sowing dates	TOS 1 – 29 April 2014
	TOS 2 – 19 May

Results

Grain yield

Variety and sowing date had highly significant effects on grain yield ($P < 0.001$). The interaction between variety and sowing date (Table 2) was also significant ($p < 0.001$). Delaying sowing from 29 April until 19 May increased yield by an average of 1.02 t/ha (Table 1).

Key findings

- Flowering occurred approximately three weeks earlier than normal because of the warmer temperatures in autumn and winter.
- Early flowering varieties in the first sowing date were badly affected by severe stem frosts.
- Barley varieties tolerated early frost events better than wheat in TOS 1.
- Six of the seven barley varieties were among the 12 top yielding lines in TOS 1.
- Hindmarsh, Fathom and Commander were the highest yielding varieties in TOS 2.
- In TOS 2, Hindmarsh out-yielded the best wheat (Corack) by 0.7 t/ha.

The severe frost events in late July and early August killed the main stems of the early maturing varieties. Barley varieties were less affected by the frost events in TOS 1 and were the top yielding lines in TOS 2 (Table 2).

Grain protein

Variety ($P < 0.001$) and sowing date ($P < 0.05$) and the interaction between variety and seeding date were significant for grain protein concentration and grain nitrogen yield (Table 3). There was a strong correlation with total nitrogen removal and grain yield (Table 3).

Grain nitrogen yield (kg/ha) was calculated using the formula:

$$\text{Grain nitrogen yield} = \text{yield} * (\text{grain protein concentration} * 1.75)$$

Grain quality information on screenings and test weight were not available at the time of publication.

Table 2: Average grain yield of twenty three wheat and seven barley varieties sown at two dates at Lockhart in 2014.

Sowing date	Grain yield (t/ha)
TOS 1 - 29 April	1.12
TOS 2 - 19 May	2.17
l _{sd}	0.245

Table 1: Average grain yield and rank of twenty three wheat and seven barley varieties sown at two dates at Lockhart in 2014.

TOS 1 – 29 April			TOS 2 – 19 May		
Variety	Yield (t/ha)	Rank	Variety	Yield (t/ha)	Rank
Sunvale	1.71	1	Hindmarsh	3.58	1
Fathom ^b	1.70	2	Fathom	3.44	2
Elmore	1.68	3	Commander	3.25	3
Compass ^b	1.65	4	Compass	3.20	4
Sunguard	1.58	5	Corack	2.86	5
Lancer	1.55	6	La_Trobe	2.85	6
Hindmarsh ^b	1.54	7	Buloke	2.63	7
Commander ^b	1.42	8	Mace	2.53	8
Gauntlet	1.36	9	GrangeR	2.41	9
GrangeR ^b	1.33	10	Elmore	2.38	10
LPB09-0515	1.28	11	Emu Rock	2.32	11
La_Trobe ^b	1.23	12	Spitfire	2.24	12
Condo	1.19	13	Condo	2.10	13
Viking	0.97	14	Sunguard	2.02	14
Kiora	0.97	15	Sunmate	1.97	15
Impala	0.97	16	LPB10-0018	1.86	16
EGA_Wedgetail	0.96	17	Lancer	1.81	17
Livingston	0.95	18	Kiora	1.80	18
Suntop	0.93	19	Impala	1.79	19
Mace	0.93	20	Sunvale	1.77	20
Corack	0.91	21	Bolac	1.75	21
Bolac	0.91	22	Dart	1.73	22
Buloke ^b	0.89	23	Livingston	1.73	23
EGA_Gregory	0.89	24	Suntop	1.69	24
Sunmate	0.88	25	LPB09-0515	1.68	25
EGA_Eaglehawk	0.85	26	Viking	1.66	26
LPB10-0018	0.72	27	Gauntlet	1.62	27
Emu Rock	0.66	28	EGA_Gregory	1.62	28
Dart	0.61	29	EGA_Eaglehawk	1.46	29
Spitfire	0.58	30	EGA_Wedgetail	1.27	30
Isd	0.58				

^b barley

Table 3: Grain protein concentration and grain nitrogen yield of twenty three wheat and seven barley varieties sown at two dates at Lockhart in 2014.

Variety	Grain protein (%)			Grain nitrogen (kg/ha)		
	TOS 1 – 29 April	TOS 2 – 19 May	mean	TOS 1 – 29 April	TOS 2 – 19 May	mean
Bolac	15.1	15.1	15.1	23	46	34
Buloke ^B	15.8	14.7	15.2	25	69	47
Commander ^B	14.5	14.0	14.2	36	79	57
Compass ^B	14.7	13.5	14.1	42	76	59
Condo	15.7	14.7	15.2	34	54	44
Corack	15.3	14.5	14.9	22	74	48
Dart	16.0	15.3	15.6	16	49	32
EGA_Eaglehawk	14.6	14.5	14.6	21	41	31
EGA_Gregory	14.1	14.1	14.1	21	42	32
EGA_Wedgetail	14.6	15.1	14.9	24	36	30
Elmore	14.9	16.2	15.6	44	67	56
Emu Rock	15.8	14.8	15.3	18	60	39
Fathom ^B	14.9	13.6	14.3	45	82	64
Gauntlet	14.4	14.9	14.7	33	41	37
GrangeR ^B	15.4	15.6	15.5	34	77	56
Hindmarsh ^B	15.0	13.3	14.1	41	85	63
Impala	14.0	14.4	14.2	25	43	34
Kiora	15.5	15.4	15.4	27	49	38
La_Trobe ^B	16.4	13.5	14.9	36	64	50
Lancer	14.3	15.5	14.9	38	50	44
Livingston	14.8	14.6	14.7	23	47	35
LPB09-0515	14.4	15.8	15.1	32	46	39
LPB10-0018	14.4	14.2	14.3	17	47	32
Mace	15.5	14.4	14.9	25	64	44
Spitfire	16.7	15.4	16.1	17	59	38
Sunguard	14.3	15.2	14.7	39	52	46
Sunmate	14.2	15.1	14.6	21	53	37
Suntop	15.2	15.1	15.2	24	44	34
Sunvale	14.3	15.5	14.9	42	51	46
Viking	14.8	15.4	15.1	25	43	34
Isd	0.72					

^BBarley

Discussion

The combination of the warm autumn and early winter temperatures accelerated crop development exposing the crop to the stem frost events in July and August. Fast maturing varieties sown early elongated and flowered outside their preferred window, exposing them to severe frosts which significantly reduced grain yield. The grain yield recorded from TOS 1 was recovered from secondary tiller regrowth after the frosts. The plants had the capacity to regenerate after the death of the main tillers producing enough secondary regrowth to recover some grain yield. The lack of spring rainfall was also a contributing factor to reduced yields from the first sowing date. Barley varieties performed strongly in this experiment, especially at TOS 2.

Grain nitrogen yield was higher in the second TOS, a response to the increased grain yields. Grain protein concentration was higher in the first TOS and is likely a reflection of a combination of the frost damage and the dry spring which contributed to low grain yields.

Averaged across both sowing dates barley varieties had higher grain nitrogen yield than wheat.

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