

Optimising grain yield of thirty-two wheat varieties across sowing dates – Condobolin 2016

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Key findings

- Scepter[®] (6.17 t/ha) yielded the highest from the 20 April sowing date; Cutlass[®] (4.38 t/ha) yielded the highest from the 19 May sowing date; and Viking[®] (3.22 t/ha) yielded the highest from the 1 June sowing date.
- The 20 April sowing germinated and established well before the waterlogged conditions occurred during late May and early June causing reduced germination and poorer establishment for the 19 May and 1 June sowing dates (SD). This low establishment resulted in reduced yields between sowing dates of 0.78 t/ha from SD1 and SD2 and 1.01 t/ha from SD2 and SD3.
- Grain yields of varieties were highest when they were sown in their recommended sowing window.

Introduction

The experiment was designed to evaluate the response to sowing time of 32 current and new wheat varieties within the Central West region of NSW.

To optimise the yield potential of wheat varieties it is necessary to understand the variety response to varying sowing times. It is important to choose a current variety best suited to a given sowing time. Varieties have different phenology so it is important to select the variety with the correct phenology to optimise the yield potential.

This experiment was part of a series of experiments sown across NSW in a range of agronomical zones aimed at establishing variety response to sowing dates. The three sowing dates selected for this experiment represented a range suitable for the region.

Site details

Location	Condobolin Agricultural Research and Advisory Station (Condobolin ARAS)
Soil type	Red-brown earth, pH _{Ca} 6.5 (0–10 cm)
Previous crops	Lucerne pasture (2012–15) Fallowed August 2015
Fertiliser	70 kg/ha mono-ammonium phosphate (MAP) + Jubilee (Flutriafol 500g/L) at 400 mL/ha (fungicide on fertiliser)
Soil available nitrogen	225 kg/ha (0–60 cm), soil test conducted in February 2016
Growing season rainfall (1 April–30 September)	467 mm
Harvest dates	SD1 and SD2: 28 November SD3: 2 December
Weed control	Once established, the experiment was well maintained and weed-free. Grass weeds were controlled with in-crop herbicide application of Axial [®] at 300 mL/ha + Adigor [®] at 500 mL/100 L of water. An application of Precept [®] at 1 L/ha + Hasten [™] at 500 mL/100 L water for broadleaf control. Broadleaf weeds were further controlled with a late season application of L.V.E. Agritone [®] at 500 mL/ha + Ally [®] at 5 g/ha.

Season conditions

The growing season rainfall at the experiment site was above average with the Condobolin ARAS recording 466.8 mm. The long-term average (LTA) growing season rainfall is 192.1 mm. There was 80.9 mm of rain during January with no rain recorded in February and below-average rainfall during March and April. There was above-average rainfall during the May to September period with Condobolin ARAS receiving the highest June rainfall in recorded history (Table 1).

This above-average rainfall resulted in secondary growth on some varieties and harvest was delayed. The late season varieties EGA Wedgetail^(b) and EGA Eaglehawk^(b) had higher yields than expected on the later sowing times (Table 2).

There were two sub-zero frost events at Condobolin during the growing season. On 26 June and again on 27 August, the temperature was -0.6 °C.

Irrigation and sowing conditions

The site was irrigated with 25 mm of water applied on 18 April to allow the early sowing treatment to establish within the early sowing period for the Condobolin region. The irrigation provided adequate moisture and SD1 established quickly and evenly.

There was a scheduled two-week interval between each sowing time within this experiment. SD2 was delayed by an additional two weeks due to wet conditions in the latter part of May. SD3 was sown two weeks after SD2.

The high rainfall during late May and June caused waterlogging resulting in seed burst, rotting seed, soil sealing and poor early vigour.

Table 1. Monthly rainfall 2016 and long-term average (LTA) at Condobolin ARAS.

Monthly rainfall (mm)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Growing season
2016	80.9	0	21.8	21.4	60.2	161.5	37.1	43.4	143.2	31.6	40.8	56.7	698.6	466.8
LTA	39.9	41.1	34.3	29.8	34.4	34.0	32.3	32.5	29.1	41.3	39.3	39.7	427.7	192.1

Treatments

Wheat varieties (32)

Beckom^(b), Bolac^(b), Condo^(b), Corack^(b), Cutlass^(b), LongReach Dart^(b), DS_Darwin^(b), DS_Spring, EGA Eaglehawk^(b), EGA Gregory^(b), EGA Wedgetail^(b), Emu Rock^(b), Hatchet CL Plus^(b), HTWYT_012, Janz, LongReach Lancer^(b), Livingston^(b), LongReach Flanker^(b), LPB12-0391, LPB12-0494, LPB12-0648, LongReach Reliant^(b), Mace^(b), Mitch^(b), Scepter^(b), LongReach Spitfire^(b), Sunguard^(b), Sunmate^(b), Suntop^(b), LongReach Viking^(b), VO7176-69, Wallup^(b).

Sowing date (SD)

SD1: 20 April

SD2: 19 May

SD3: 1 June

Results

The grain yield, when averaged over all varieties for each sowing time, was SD1 4.39 t/ha, 0.78 t/ha higher than SD2 (3.61 t/ha). SD2 was 1.01 t/ha higher yielding than SD3 (2.60 t/ha).

The lower grain yield from SD2 and SD3 were likely the result of poor establishment due to wet conditions post-sowing and waterlogging for the majority of the growing season and grain filling period.

There was a significant ($P = 0.05$) interaction between sowing date and variety. Scepter^(b) (6.17 t/ha) yielded the highest from SD1, Cutlass^(b) (4.38 t/ha) from SD2 and Viking^(b) (3.22 t/ha) was the highest yielding variety from SD3.

The fast maturing lines such as Hatchet CL Plus^(b), Condo^(b), LongReach Spitfire^(b) and Livingston^(b) were low yielding from SD1. The early maturing lines flowered during August and suffered frost damage from the 27 August frost event. Hatchet CL Plus^(b) yielded the lowest from SD1 and SD2 (2.48 t/ha and 2.67 t/ha respectively) (Table 2).

Some varieties had large interactions with sowing date, e.g. EGA Gregory^{db}, Wallup^{db} and Scepter^{db}. EGA Gregory^{db} and Wallup^{db} were low-yielding from SD1 and higher yielding from SD2 and SD3. Scepter^{db} was relatively high yielding from SD1 and SD2 and relatively low yielding from SD3.

Table 2. Grain yield and rank of 32 wheat varieties sown on three sowing dates at Condobolin, 2016.

Variety	Sowing date					
	SD1 – 20 April		SD2 – 19 May		SD3 – 1 June	
	Yield (t/ha)	Rank	Yield (t/ha)	Rank	Yield (t/ha)	Rank
Beckom	5.36	5	3.80	13	2.99	4
Bolac	5.16	8	3.69	16	2.78	10
Condo	3.40	28	3.87	9	2.38	23
Corack	4.07	20	3.61	17	2.50	20
Cutlass	5.51	3	4.38	1	2.94	5
LongReach Dart	3.83	23	2.86	31	2.31	28
DS_Darwin	4.62	14	3.83	11	2.68	13
DS_Spring	3.70	24	3.54	20	2.56	18
EGA Eaglehawk	5.33	6	3.79	14	2.75	11
EGA Gregory	3.99	21	4.20	2	2.94	6
EGA Wedgetail	5.51	4	3.94	7	3.10	2
Emu_Rock	3.63	25	3.10	28	2.50	19
Hatchet CL Plus	2.48	32	2.67	32	2.48	22
HTWYT_012	3.01	30	3.40	23	2.32	27
Janz	4.99	10	3.52	22	2.49	21
LongReach Lancer	5.06	9	3.88	8	2.57	17
Livingston	2.95	31	3.12	27	2.05	31
LongReach Flanker	3.57	26	4.08	5	2.83	8
LPB12-0391	4.36	18	3.38	25	2.37	24
LPB12-0494	4.31	19	3.31	26	2.36	25
LPB12-0648	5.63	2	4.11	3	3.08	3
LongReach Reliant	3.31	29	3.39	24	2.28	29
Mace	4.68	13	3.53	21	2.73	12
Mitch	4.99	11	3.82	12	2.66	14
Scepter	6.17	1	4.11	4	2.62	15
LongReach Spitfire	3.43	27	3.55	19	2.59	16
Sunguard	4.54	16	2.99	29	2.00	32
Sunmate	4.62	15	2.94	30	2.11	30
Suntop	4.47	17	3.74	15	2.32	26
LongReach Viking	5.16	7	3.85	10	3.22	1
V07176-69	4.80	12	3.56	18	2.81	9
Wallup	3.91	22	4.06	6	2.91	7
l.s.d ($P < 0.05$)	0.56					

Grain quality

There was a significant ($P = 0.05$) interaction between the variety and sowing date for protein, screenings and test weight (Table 3).

The grain protein decreased for most varieties with the later sowing date(s). This decrease might be due to the waterlogged conditions for much of the growing season and the high rainfall during September, which coincided with the grain filling period.

Table 3. Protein (%), screenings (%) and test weight (kg/hL) of 32 wheat varieties sown on three sowing dates at Condobolin, 2016.

Variety	Sowing date								
	SD1 – 20 April			SD2 – 19 May			SD3 – 1 June		
	Protein (%)	Screenings (%)	Test weight (kg/hL)	Protein (%)	Screenings (%)	Test weight (kg/hL)	Protein (%)	Screenings (%)	Test weight (kg/hL)
Beckom	11.41	21.51	81.66	10.01	31.26	83.29	10.16	46.07	83.20
Bolac	12.32	12.21	82.51	10.82	27.74	82.89	10.66	35.35	81.59
Condo	13.37	34.31	82.00	11.12	49.76	83.93	11.10	72.18	83.08
Corack	13.00	13.11	80.98	11.68	31.73	82.33	11.15	40.83	82.22
Cutlass	11.27	26.87	81.47	9.92	31.10	82.04	10.28	42.62	80.36
LongReach Dart	14.98	11.28	81.36	11.76	32.55	83.20	11.20	44.13	82.76
DS_Darwin	12.90	19.00	82.63	10.54	30.04	83.47	10.52	40.78	83.60
DS_Spring	12.21	29.42	82.22	10.55	37.16	83.65	10.15	52.17	83.09
EGA Eaglehawk	11.42	26.84	82.50	10.74	34.37	82.48	10.77	34.04	81.79
EGA Gregory	11.83	43.61	82.42	10.87	33.34	84.14	10.36	46.88	83.70
EGA Wedgetail	10.76	18.24	81.20	10.76	24.95	80.92	10.37	35.02	80.12
Emu Rock	13.16	19.88	79.27	11.69	42.84	81.63	11.51	58.16	81.04
Hatchet CL Plus	16.24	11.87	76.48	12.34	28.31	81.38	11.79	43.25	80.87
HTWYT_012	14.76	4.68	79.24	11.74	14.59	83.14	11.00	30.69	82.54
Janz	12.38	12.70	82.90	10.92	20.86	84.48	10.87	34.60	83.09
LongReach Lancer	12.93	24.88	82.37	11.87	30.29	83.60	11.79	36.07	82.81
Livingston	14.89	13.78	80.62	11.54	31.62	83.47	11.72	46.53	82.37
LPB12-0391	12.68	9.47	83.07	11.19	18.40	84.33	10.68	29.13	83.47
LPB12-0494	12.81	13.29	79.92	11.24	45.98	82.69	10.68	57.12	83.06
LPB12-0648	11.18	22.40	84.57	10.67	32.24	84.19	10.74	33.58	83.91
LongReach Flanker	11.49	33.86	82.89	10.26	31.79	84.57	10.33	41.93	83.53
LongReach Reliant	12.29	36.58	83.14	10.44	41.99	84.44	10.11	59.12	83.86
Mace	13.37	10.44	81.47	10.85	26.32	82.44	10.29	36.95	82.32
Mitch	10.33	22.40	81.34	8.98	33.60	82.18	9.31	51.03	81.08
Scepter	12.42	23.07	82.36	10.02	35.09	83.41	10.46	59.61	82.75
LongReach Spitfire	15.13	17.68	81.71	12.73	31.66	83.69	12.01	45.17	83.32
Sunguard	12.22	35.58	82.66	11.16	33.50	83.38	11.05	42.50	82.08
Sunmate	12.34	30.90	81.53	10.39	57.17	83.06	10.51	63.13	81.88
Suntop	12.56	32.86	81.17	10.64	43.94	83.58	10.18	59.93	82.66
LongReach Viking	11.93	9.65	83.45	10.43	24.85	84.56	9.79	29.86	84.16
V07176-69	11.90	27.85	82.55	10.58	31.37	83.80	9.95	36.47	83.56
Wallup	14.47	3.79	79.94	11.7	12.28	83.02	11.45	12.78	83.28
Min	10.33	3.79	76.48	8.98	12.28	80.92	9.31	12.78	80.12
Mean	12.72	21.06	81.68	10.98	32.27	83.23	10.72	43.68	82.60
Max	12.64	43.61	84.57	12.73	57.17	84.57	12.01	72.18	84.16
I.s.d. ($P = 0.05$)									
SD	0.16	4.42	0.43						
Variety	0.35	3.90	0.38						
Variety \times SD	0.61	7.06	0.71						

There was a significant difference in test weights between the three sowing dates. Test weights from all varieties were above the wheat receival standard (68–76 kg/hL).

Screenings were high in this experiment ranging from 3.79% for Wallup[Ⓛ] to 43.61% for EGA Gregory[Ⓛ] from the 20 April SD, 12.28% for Wallup[Ⓛ] to 57.17% for Sunmate[Ⓛ] from the 19 May SD and 12.78% for Wallup[Ⓛ] to 72.18% for Condo[Ⓛ] from the 1 June SD (Table 3). This was, in part, due to the waterlogged conditions that occurred during the growing season.

Summary

Sowing varieties in the correct sowing window means they are more likely to achieve their potential yield. This experiment is part of the Variety Specific Agronomy Packages project, for which experiments have been conducted within NSW for a number of years.

In 2015, the first SD was 1.16 t/ha higher yielding than the third SD. This yield difference was due to a very dry spring during the grain-filling period. In 2016, there was a difference in yield of 1.79 t/ha from SD1 to SD3. This difference might have been due to waterlogging during the early establishment and the grain-filling period for SD2 and SD3.

The potential to maximise grain yield is increased when variety selection is matched to a sowing time. Hatched CL Plus[Ⓛ] is an early-maturing variety. For SD1 and SD2 it flowered during August and was affected by the 27 August frost event and was the lowest-yielding variety in both of these sowing dates.

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