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Response of wheat to nitrogen application and sowing time—Condobolin 2014

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Introduction

The experiment was conducted to determine the response of nine current wheat varieties sown at two dates to different rates and time of nitrogen application in the low rainfall zone. The experiment was established to measure grain yield and grain quality.

Site details

Location	Condobolin Agricultural Research and Advisory Station
Soil type	Red brown earth
Previous crop/s:	Wheat 2012 and 2013
Sowing dates	2 May and 21 May
Fertiliser	70 kg/ha MAP + Jubilee 400 mL/ha
Available N	68 kg/ha (0–60 cm)
In-crop rainfall	155 mm
Harvest date	21 and 27 November 2014

Treatments

Wheat varieties:	See *Table 2*
Nitrogen rates:	0, 20, 40, 80, 40 + 40 split* and 160 kg/ha

* Split application 40 kg/ha at sowing, 40 kg/ha @ GS 31

Season Conditions

In 2014 at Condobolin there were nine frost events in July with the coldest -3.8°C on 14 July. A further 13 frosts occurred in early August with the lowest recorded temperature of -5.4°C on 3 August. Between 2 August and 15 August, there were 10 mornings below -2.0°C.

The rainfall for the growing season was below average, with the Condobolin Agricultural Research and Advisory Station recording 155 mm April–October (*Table* 1). The bulk of this rain fell between April and June (113 mm). Long-term average (LTA) growing season rainfall is 209 mm.

Rainfall for the fallow period was 204.6 mm with 104.5 mm falling in March. LTA for the same period is 153 mm.

The experiment was sown into moisture and established quickly and evenly. The experiment was weed-free as a result of effective pre- and post-emergent herbicides. Low growing season rainfall (GSR) meant that the majority of crop growth was attributed to stored soil moisture.

Key findings

First time of sowing

- Yields were reduced by severe stem frost damage in July and August.
- Increasing nitrogen rates decreased grain yield at the first TOS.
- The highest yields were recorded in the zero nitrogen treatments.
- Sunguard was the highest yielding variety 1.07 t/ha.

Second time of sowing

- Emu Rock and Livingston yielded the highest, 1.19 t/ha and 1.11 t/ha, respectively.
- Averaged across all varieties and nitrogen rates, 20 kg/ha of applied nitrogen resulted in the highest yield.

Results

Variety and nitrogen rate interaction was highly significant ($p<0.001$). There was a significant difference ($p<0.05$) between the grain yields of the nine varieties (*Table 2*) and the response of grain yield to applied nitrogen (*Table 3*). At the first time of sowing, Sunguard

Table 2: Grain yield (t/ha) for nine wheat varieties sown 2 and 21 May at Condobolin, 2014. (Note LSD represents the differences within each TOS only)

Variety	Yield (t/ha)	
	TOS 1 - May 2	TOS 2 - May 27
Emu Rock	0.36	1.186
Livingston	0.80	1.106
Dart	0.49	0.995
Spitfire	0.62	0.965
Wallup	0.96	0.952
Sunguard	1.07	0.841
Suntop	0.70	0.818
EGA_Gregory	0.55	0.552
Lancer	0.92	0.516
l.s.d. ($p<0.05$)	0.12	0.150

Table 1: Monthly rainfall at the Condobolin Agricultural Research and Advisory Station, 2014.

Monthly Rainfall (mm)													Total	In-crop
Dec 2013	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec		
18.2	35.2	46.7	104.5	28	27.6	57.4	9.2	21.9	11	11.5	17.7	88.6	477.5	155.1

(1.07 t/ha), Wallup (0.96 t/ha) and Lancer (0.92 t/ha) were the highest yielding varieties. At the second sowing time Emu Rock (1.89 t/ha) was the highest yielding variety and Lancer (0.52 t/ha) was the lowest yielding.

There was a significant difference ($p<0.05$) between applied nitrogen rates averaged across all varieties. At the first time of sowing there was a decrease in grain yield as nitrogen rates increased. In the later time of sowing, grain yield decreased as nitrogen rates increased above 20 kg/ha (*Table 3*).

Table 3: Grain yield (t/ha) for six nitrogen application rates sown 2 and 21 May at Condobolin, 2014.

Nitrogen application (kg N/ha)	Yield (t/ha)	
	TOS 1 - May 2	TOS 2 - May 27
0	0.83	0.87
20	0.74	0.99
40	0.71	0.89
80	0.69	0.87
40+40 split	0.67	0.83
160	0.68	0.83
l.s.d. ($p<0.05$)	0.10	0.12

Grain Quality

The grain quality results were not available at the time of writing this report. Quality tests for grain protein, grain test weight and screenings will be conducted on the harvest samples.

Discussion

The experiment was sown on 2 May and 21 May 2014. The early sowing date had significant yield reduction from the frost events of July and August. The dry spring in 2014 also contributed to lower grain yields across both sowing dates. The ability of the plants to recover after the frosts was limited although some re-tillering occurred.

In the second sowing time the earlier maturity varieties such as Emu Rock and Dart yielded better than longer season spring wheats like Lancer. Whilst not an early maturing wheat, Livingston performed very well at the second sowing date (*Table 2*). The early maturing type varieties were more advanced during the dry spring conditions and, hence they filled slightly more grain with the limited available soil water before the season cut out. They were also late enough sown to avoid the severe frost damage of the first TOS.

The slow to medium maturing varieties, Lancer and EGA_Gregory yielded the lowest, 0.52 and 0.55 t/ha respectively in the second TOS. The lower yields of these longer season varieties could be attributed to the drier spring finish at Condobolin in 2014. Their yields in the first TOS were severely limited by the frost events that occurred in July and August.

It is likely that in the absence of the severe frost events that occurred during 2014 there would have been a significantly different outcome to this experiment; in particular the low yields of TOS1, therefore these results should be treated with caution.

Grain yield decreased as nitrogen rates increased in the first time of sowing. The increased biomass produced from high nitrogen application resulted in varieties "haying off". The second sowing date showed a significant response to 20 kg N/ha at sowing over the nil treatment.

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