Sowing date effect on flowering and grain yield of eight canola varieties – Leeton 2019

Tony Napier and Daniel Johnston (NSW DPI, Yanco); Rohan Brill (formerly NSW DPI, Wagga Wagga)

Key findings

- In a season characterised by low frost severity, Nuseed Diamond was the highest yielding variety for all three sowing dates.
- In a low frost severity season, earlier sowing on 27 March and 11 April achieved a higher grain yield compared with the later sowing on 30 April.
- Triazine tolerant varieties were generally lower yielding compared with other varieties with a similar phenology.
- Winter type canola yield and oil performance were comparable with spring types when sown before mid April and could be worth considering as a dual-purpose crop due to the additional value generated from grazing.

Introduction

This experiment was designed to increase the understanding of:

- canola yield potential in the high yielding irrigated zone of southern NSW
- the effect of climatic stress at different canola growth stages.

Improved understanding of variety-specific sowing date effects will enable growers to select a variety with the appropriate plant maturity type and sowing date to minimise environmental stresses and ensure that the critical growth periods coincide with the most favourable growing conditions.

Eight canola varieties with differing phenologies were evaluated for three sowing dates from late March to the end of April.

Site details

Location	NSW DPI – Leeton Field Station
Soil type	A grey clay soil, pH_{Ca} 6.4
Previous crop	Barley (irrigated)
In-crop rainfall	• 177 mm (April 2019–October 2019) (equivalent to 1.8 ML/ha). • April: 52 mm; May: 36 mm; June: 37 mm; July: 22 mm; August: 13 mm; September: 10 mm and October: 7 mm.
Irrigation schedule	• Flood irrigated on 12 March, before the first sowing date (SD1), with an estimated 220 mm (2.2 ML/ha). • Immediately after the first and second sowing date (SD1 and SD2), 10 mm was applied with dripper tubes; SD3 germinated on moisture. • Three flood irrigations with an estimated 80 mm per irrigation or 2.4 ML (15 August, 18 September and 11 October). • Total moisture supply approximately 6.4 ML.

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Soil test	Mineral nitrogen (N) of 78.8 kg N/ha (90 cm) and phosphorus (P) (Colwell) of 53 mg/kg (10 cm).
Base fertiliser	• Mono-ammonium phosphate (MAP) at 200 kg/ha (20 kg N/ha and 44 kg P/ha). • Gran-Am at 200 kg/ha (41 kg N/ha and 48 kg sulfur (S)/ha). • Urea at 240 kg/ha (110 kg N/ha).
Topdressing fertiliser	• When plots were at 8-leaf stage – urea at 141 kg/ha (65 kg N/ha). • When plots were at visible bud stage – urea at 141 kg/ha (65 kg N/ha).

Treatments

Variety

Eight varieties described in Table 1.

Table 1 Eight canola varieties included in the experiment at Leeton, 2019.

Variety	Type	Description
Nuseed Diamond	Spring	Fast developing, conventional hybrid variety
ATR Bonito$^{\Phi}$	Spring	Mid–fast developing, triazine tolerant (TT) open pollinated (OP) variety
Pioneer® 44Y90 (CL)	Spring	Mid–fast developing, Clearfield® (CLF) hybrid variety
Pioneer® 45Y91 (CL)	Spring	Mid developing, CLF hybrid variety
Archer	Spring	Mid–slow developing, CLF hybrid variety
ATR Wahoo$^{\Phi}$	Spring	Mid–slow developing, TT OP variety
SF Edimax CL	Winter	Very slow developing, CLF variety
Hyola® 970CL	Winter	Very slow developing, CLF variety

Sowing date (SD)

SD1: 27 March 2019

SD2: 11 April 2019

SD3: 30 April 2019

Results

Phenology

Nuseed Diamond was the fastest developing spring variety from SD1 with flowering starting on 1 June, 66 days after sowing (Figure 1). Temperature primarily drives Nuseed Diamond's development (no vernalisation requirement), therefore warmer temperatures hastened development.

Hyola® 970CL was the slowest winter variety to start flowering from SD1, taking 184 days from sowing. This is a winter variety and has a strong vernalisation requirement, therefore it will not start flowering until after winter finishes.

ATR Wahoo$^{\Phi}$ was the slowest spring variety to start flowering from SD1, taking 127 days from sowing to flowering.

Slower developing spring varieties have a response to both thermal time and vernalisation. Most spring varieties only have a small response to vernalisation, but this will still delay the start of flowering when conditions are warm (i.e. when sown early). The stronger the vernalisation influence, the greater the delay to flowering.

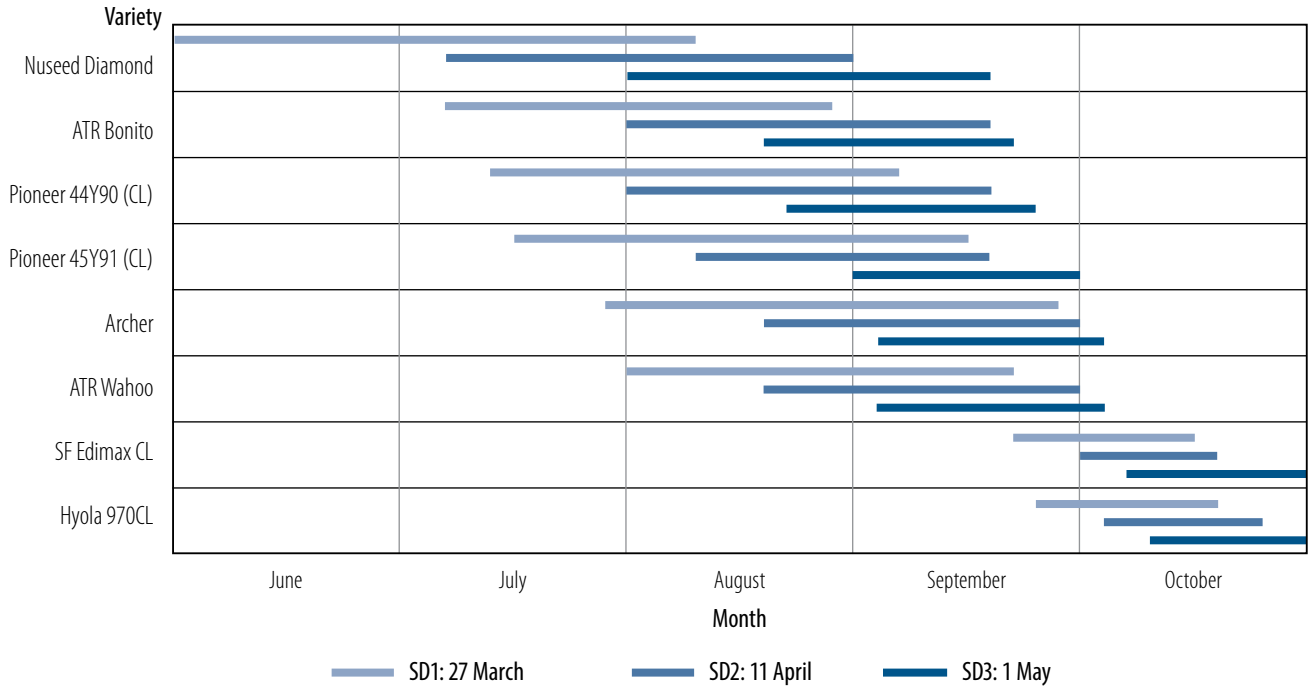

Figure 1 Flowering period of eight canola varieties sown on three sowing dates at Leeton, 2019.

Seasonal conditions

Only a few major frosts were recorded early in the 2019 season. No significant frost occurred after 23 June 2019 (Figure 2). This differed from the previous two seasons where multiple major frosts occurred during the flowering and podding periods up until mid September. Higher than average maximum temperatures were recorded during September and October in the 2019 season, but no extremes above 35 °C were recorded until 6 October 2019 when all spring types had finished flowering.

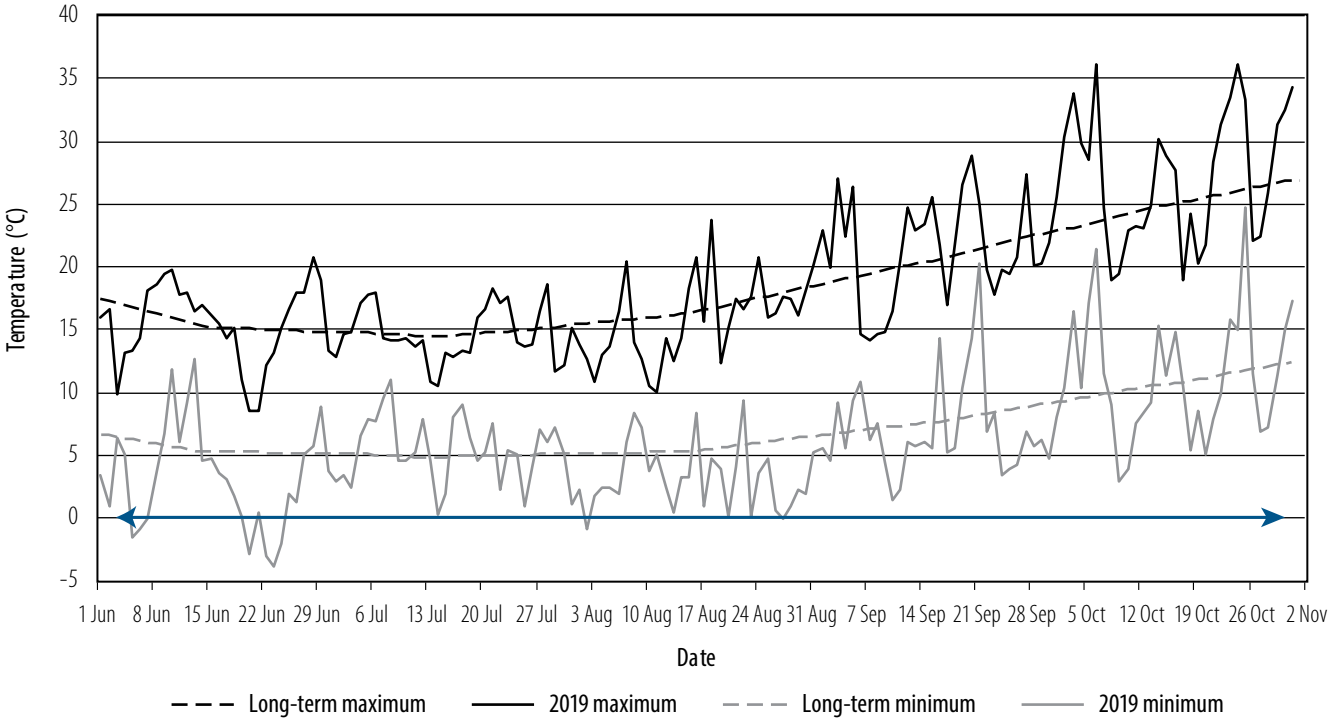

Figure 2 Maximum and minimum temperatures at Leeton during canola flowering period, 2019.

Grain yield

Nuseed Diamond (spring variety) had the highest grain yield with an average of 3.96 t/ha across all sowing dates and was significantly higher yielding than all other varieties (Table 3). The second sowing date of Nuseed Diamond had the highest grain yield at 4.15 t/ha and was statistically similar for both SD1 and SD3.

Pioneer® 45Y91 (CL) (SD1) was the second highest yielding spring type with a grain yield of 2.97 t/ha and was statistically similar for SD2, the spring varieties ATR Bonito$^{\Phi}$ (all SDs), Pioneer® 44Y90 (CL) (SD1 and SD2) and Archer (all sowing dates).

Hyola® 970CL (SD1) was the highest yielding winter variety with 3.29 t/ha and was statistically similar for SD2 and SF Edimax CL (SD1 and SD2).

ATR Bonito$^{\Phi}$ (SD2) was the highest yielding TT variety at 2.82 t/ha and was significantly higher yielding than the other TT variety, ATR Wahoo$^{\Phi}$, for all sowing dates.

Sowing date had a significant effect on yield. Both SD1 and SD2 yielded significantly higher than SD3 (Table 2). SD1 had the highest grain yield with an average of 2.97 t/ha; SD2 had 2.89 t/ha; SD3 had the lowest average yield at 2.28 t/ha.

Not all varieties showed a response to sowing date. The spring varieties Nuseed Diamond, ATR Bonito$^{\Phi}$ and ATR Wahoo$^{\Phi}$ had statistically similar grain yields for all sowing dates. All other varieties had a significantly higher yield in SD1 compared with SD3.

Table 2 Grain yield (t/ha) and oil content (%) averaged across eight canola varieties sown on three sowing dates at Leeton, 2019.

Sowing date	Grain yield (t/ha)	Oil content (%)
SD1: 27 March	2.97	41.59
SD2: 11 April	2.89	42.00
SD3: 30 April	2.28	41.19
l.s.d. (P<0.05)	0.201	0.496

Oil content

The spring variety ATR Bonito$^{\Phi}$ had the highest oil concentration, averaging 43.52% for all sowing dates, significantly higher than all other varieties (Table 3). ATR Wahoo$^{\Phi}$ had the lowest oil concentration averaging 40.45% for all sowing dates and was statistically similar to Archer and Pioneer® 45Y91 (CL), all spring varieties.

Sowing date significantly affected oil content, with SD2 having an average oil concentration of 42.0% – significantly higher than SD3 which averaged 41.19% (Table 2).

There was a significant interaction between variety oil content and sowing date for ATR Bonito$^{\Phi}$, which had a significantly higher oil concentration in SD2 and SD3 compared with SD1. This result was unexpected as delayed sowing is usually associated with reduced oil content. Both winter varieties (SF Edimax CL and Hyola® 970CL) had a significantly reduced oil concentration for the delayed sowing dates.

Table 3 Grain yield (t/ha) and oil content (%) of eight canola varieties sown on three sowing dates at Leeton, 2019.

Variety	Grain yield (t/ha)				Oil content (%)			
	SD1: 27 March	SD2: 11 April	SD3: 30 April	Average	SD1: 27 March	SD2: 11 April	SD3: 30 April	Average
Nuseed Diamond	3.91	**4.15**	3.82	**3.96**	40.54	42.16	41.24	41.31
ATR Bonito	2.68	2.82	2.53	2.67	42.49	**44.17**	43.89	**43.52**
Pioneer 44Y90 (CL)	2.87	2.36	2.09	2.44	41.89	41.14	40.79	41.27
Pioneer 45Y91 (CL)	2.97	2.38	2.08	2.48	40.42	41.81	41.26	41.16
Archer	2.81	2.87	2.69	2.79	40.41	41.19	41.46	41.02
ATR Wahoo	2.17	2.22	1.66	2.02	40.69	40.77	39.88	40.45
SF Edimax CL	3.10	3.17	1.80	2.69	42.42	42.00	40.24	41.55
Hyola 970CL	3.29	3.12	1.57	2.66	43.89	42.75	40.74	42.46
l.s.d. ($P<0.05$)	0.568			0.328	1.404			0.811

Bolded values indicate the highest value and underlined numbers indicate the lowest value for each group.

Conclusion

The 2019 experiment demonstrated that sowing on 27 March and 11 April (SD1 and SD2) gave the highest grain yield with a significant yield reduction when the sowing date was delayed to 30 April (SD3). The high yield in SD1 for 2019 was due to a warmer than average winter and no significant frosts during flowering or podding. In previous years, significant frosts during winter adversely affected the early sown (SD1) spring varieties, which resulted in lower grain yields.

Nuseed Diamond (a fast-developing conventional spring type hybrid) was the highest yielding variety for all sowing dates in 2019. The variety has also been the highest yielding variety over the past two seasons, but only for the later sowing dates. In most years, the faster developing varieties have performed poorly at SD1 due to frost damage.

In this year's experiment, ATR Wahoo$^{\Phi}$ (an OP TT spring type) was the lowest yielding variety for SD1 and SD2, and the second lowest yielding variety at SD3. Triazine tolerant varieties (TT) have consistently yielded least over the past three seasons. Growers will need to consider using TT varieties where specific weed control is required, but in doing so, could incur a yield penalty. In situations where conventional herbicides can control weeds, Nuseed Diamond should be considered for a late April sowing time to achieve maximum yields while avoiding frost damage.

The two winter varieties (SF Edimax CL and Hyola® 970CL) also benefited from an earlier sowing date (SD1 and SD2) with grain yield and oil concentration significantly declining when the sowing date was delayed to 30 April (SD3). The overall performance of the winter varieties was comparable with most spring varieties for yield and oil concentration and could have a potential fit as a dual-purpose crop (grain and forage) in the irrigated production areas of southern NSW. Results from previous seasons have shown mixed results for winter types, demonstrating that not every season would produce a favourable result.

If considering growing a winter type as a dual-purpose crop, don't delay sowing past 11 April.

Acknowledgements

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