

Canola phenology - targeting varieties to flowering dates in different environments

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Take home messages

- Matching flowering date to sowing date is important to minimise the risk of plant stress caused by frost, disease, heat and lack of moisture
- Canola varieties varied markedly in the time it took from sowing to the start of flowering.

Introduction

An important management strategy to maximise yield potential for canola is to sow varieties within their correct sowing window so they start flowering within the optimum flowering period for a particular location. Flowering too early increases the risk of frost damage, upper canopy blackleg and sclerotinia stem rot infection. Flowering too late increases the risk of damage from heat or moisture stress or both, potentially reducing yield.

The optimum start of flowering (determined as 50% of the plants with one open flower) differs for each location. For Trangie, this date is between 15 July and 12 August, with the optimum date being 29 July. The optimum start of flowering for Wagga Wagga is between 31 July and 1 September, with the optimum date around 16 August. For varieties to start flowering within this period, a variety's phenology needs to be understood so growers can sow varieties in the correct window for flowering to start during this optimum time.

Experiments at Trangie and Wagga Wagga in 2018 and 2019 and Wagga Wagga in 2020, examined the phenology of commercial and newly released varieties sown at two sowing dates. Data from trials at Trangie in 2018 and 2019 and Wagga Wagga in 2020 is presented. Phenology and yield data from an Optimised Canola Profitability experiment at Condobolin in 2018 which included five commercial varieties, two nitrogen rates with a wet and dry treatment is also included.

Treatments

Variety

Table 1 lists the details of the varieties sown across the years at Trangie and Wagga Wagga.

Table 1. Details of the varieties sown at Trangie (2018 & 2019) and Wagga Wagga (2020). Grey boxes indicate which sites each variety was sown for those years

Variety	Phenology	Maturity	Herbicide Tolerance	Plant Type	Trangie 2018	Trangie 2019	Wagga Wagga 2020
Archer	Slow	Late	CLF	Hybrid			
ATR Bonito [Ⓛ]	Mid-fast	Early	TT	Open-pollinated (OP)			
ATR Mako [Ⓛ]		Mid		Open-pollinated (OP)			
ATR Stingray [Ⓛ]	Fast	Early	TT	Open-pollinated (OP)			
ATR Wahoo [Ⓛ]	Mid-Slow	Mid	TT	Open-pollinated (OP)			
Bayer 3000TR		Early-mid	RR/TT	Hybrid			
Banker CL				Hybrid			
GT-53	Mid	Mid	RR	Hybrid			
Hyola 350TT	Fast	Early	TT	Hybrid			
Hyola 410XX	Mid-fast	Early-mid	TruFlex RR	Hybrid			
Hyola 506RR			RR	Hybrid			
Hyola 530XT	Mid-fast	Mid	TruFlex RR/TT	Hybrid			
Hyola 540XC		Early-mid	TruFlex RR/CLF	Hybrid			
Hyola 550TT	Mid-fast	Mid	TT	Hybrid			
Hyola 580CT	Fast	Mid	CLF/TT	Hybrid			
Hyola Enforcer CT		Early-mid	CLF/TT	Hybrid			
Hyola Garrison XC		Early-mid	TruFlex RR/CLF	Hybrid			
HyTTec Trident	Mid-fast	Early	TT	Hybrid			
HyTTec Trifecta		Mid	TT	Hybrid			
HyTTec Trophy	Mid	Mid	TT	Hybrid			
InVigor R 4022P	Mid-fast	Early-mid	RR	Hybrid			
InVigor R 5520P	Mid-slow	Mid	RR	Hybrid			
InVigor R3520		Early-mid	RR	Hybrid			
InVigor T3510	Mid-fast	Early	TT	Hybrid			
InVigor T4510	Mid-fast	Early-mid	TT	Hybrid			
Nuseed Diamond	Fast	Early	Conventional	Hybrid			
Nuseed Quartz	Mid	Early-mid	Conventional	Hybrid			
Pioneer 43Y23 (RR)		Early	RR	Hybrid			
Pioneer 43Y29 (RR)	Mid-fast	Early	RR	Hybrid			

Pioneer 43Y92 (CL)	Mid-fast	Early	CLF	Hybrid			
Pioneer 44T02 (TT)		Early-mid	TT	Hybrid			
Pioneer 44Y27 (RR)	Mid-fast	Early-mid	RR	Hybrid			
Pioneer 44Y90 (CL)	Mid-fast	Early-mid	CLF	Hybrid			
Pioneer 44Y94 (CL)		Early-mid	CLF	Hybrid			
Pioneer 45T03 (TT)	Mid-fast	Mid	TT	Hybrid			
Pioneer 45Y25 RR		Mid	RR	Hybrid			
Pioneer 45Y28 (RR)		Mid	RR	Hybrid			
Pioneer 45Y91 (CL)	Mid-slow	Mid-late	CLF	Hybrid			
Pioneer 45Y93 (CL)	Mid-slow	Mid	CLF	Hybrid			
Saintly CL	Mid-fast	Early	CLF	Hybrid			
SF Ignite TT	Mid-slow	Mid-late	TT	Hybrid			
SF Spark TT	Fast	Early	TT	Hybrid			
SF Turbine		Early-mid	TT	Hybrid			
Victory V7001CL		Late	CLF	Hybrid			
Victory V5003RR		Mid	RR	Hybrid			
Victory V75-03CL	Mid-slow	Mid	CLF	Hybrid			
Xseed Condor		Mid	RR TruFlex	Hybrid			
Xseed Raptor	Mid-fast	Early-mid	RR TruFlex	Hybrid			

CLF = Clearfield, TT = Triazine tolerant, RR = Roundup Ready® (D) protected under the Plant Breeders Rights Act 1994

Sowing dates and treatments

The first sowing date for Trangie in 2018 was in late March, however it was abandoned due to poor establishment caused by high temperatures and a rapidly drying seedbed, so an alternate sowing was done in late May. Table 2 lists the sowing dates for each year for each location.

At Condobolin in 2018, five commercial grown varieties were chosen with a wet and dry treatment. Each variety had two N rates applied a rate to suit a decile 3 rainfall year and a rate for a decile 9 rate rainfall year (Table 3).

Table 2. The sowing dates for each year at each of the locations

	Trangie 2018	Condobolin 2018	Trangie 2019	Wagga Wagga 2020
SD 1	26-Apr	5-Apr	4-Apr	26-Mar
SD 2	23-May	26-Apr	26-Apr	27-Apr

Table 3. Treatment list for Condobolin 2018

Varieties	Water Treatment	Nitrogen Rates
Nuseed Diamond	Dry (151mm in season)	Decile 3 (72 N Units)
ATR Stingray [Ⓛ]	Wet (307mm in season)	Decile 9 (150 N Units)
ATR Bonito [Ⓛ]		
Pioneer 44Y90 (CL)		
ATR Wahoo [Ⓛ]		

Results

Phenology

In 2018 at Trangie, the earliest varieties to start flowering from the 26 April sowing date were Hyola 350TT, ATR Stingray[Ⓛ] and Nuseed Diamond, with these varieties flowering at the start of the optimum flowering period of 15 July. Hyola 580CT and InVigor T4510 flowered right on the optimum date of 29 July from the 26 April sowing (Figure 1). From this same sowing date, the long season varieties ATR Wahoo[Ⓛ] and Victory V7001CL flowered outside the optimum flowering window by up to 13 days. From the later sowing date of the 23 May in 2018, all varieties flowered after the optimum start of flowering period. The short season varieties, Hyola 350TT, ATR Stingray[Ⓛ] and Nuseed Diamond reached start of flowering between the 18 August and 21 August. The late season varieties did not start flowering until early September, placing them at a high risk of heat stress (Figure 1).

The first sowing date for Trangie in 2019 was 4 April, the second sowing date 26 April. Nuseed Diamond and Hyola 350TT were the first to flower on 13 and 14 June, well before the optimum start date for Trangie. Varieties flowering this early puts them at a higher risk of frost damage, upper canopy blackleg infection and sclerotinia stem rot. The late maturing varieties were the only ones to start flowering after 15 July from the 4 April sowing date, with SF Ignite TT flowering closest to the optimum date of 29 July. From the late sowing date of 26 April, all early–mid, mid and late season varieties flowered within the optimum start of flowering period. The early season variety Nuseed Diamond started flowering just outside the optimum period between on the 15 July. (Figure 2).

Nuseed Diamond was the first to flower from the 26 March sowing at Wagga Wagga in 2020, flowering on the 13 June, 48 days before the optimum start of flowering period of the 31 July. The only varieties to flower after the 31 July from the 26 March sowing were InVigor R 5520P, Pioneer 45Y23 (CL), Pioneer 45Y91 (CL), Pioneer 45Y28 (RR), ATR Wahoo[Ⓛ] and SF Ignite TT. ATR Wahoo[Ⓛ] and SF Ignite TT were the latest to flower on the 10 August. Delaying the sowing date to late April (27 April), the majority of varieties started flowering within the optimum start of flowering period for Wagga Wagga (31 July – 1 September), the earliest being Nuseed Diamond on 10 August. Pioneer 45Y91 (CL) was the last variety to reach start of flowering on 4 September (Figure 3).

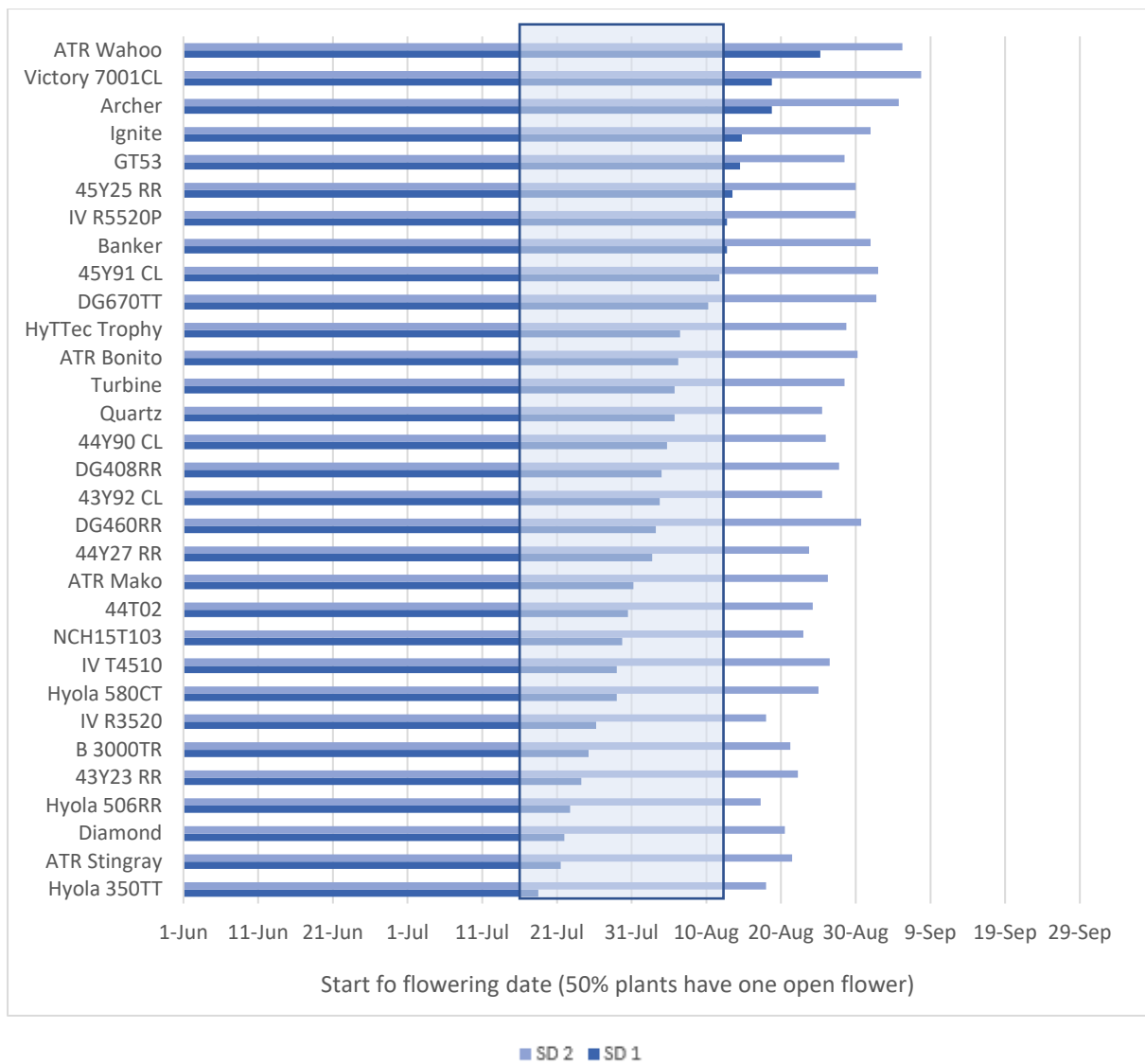


Figure 1. Flowering dates for 2018 Trangie. The shaded area shows the optimum start of flowering period (when 50% of plants have one open flower) for Trangie (15 July to 12 August). Sowing date (SD) 1 (darker bars) was 26 April, sowing date 2 (lighter bars) was 23 May (Some of the varieties in the figure above are protected under the Plant Breeders Rights Act 1994. Please see Table 1 for which varieties)

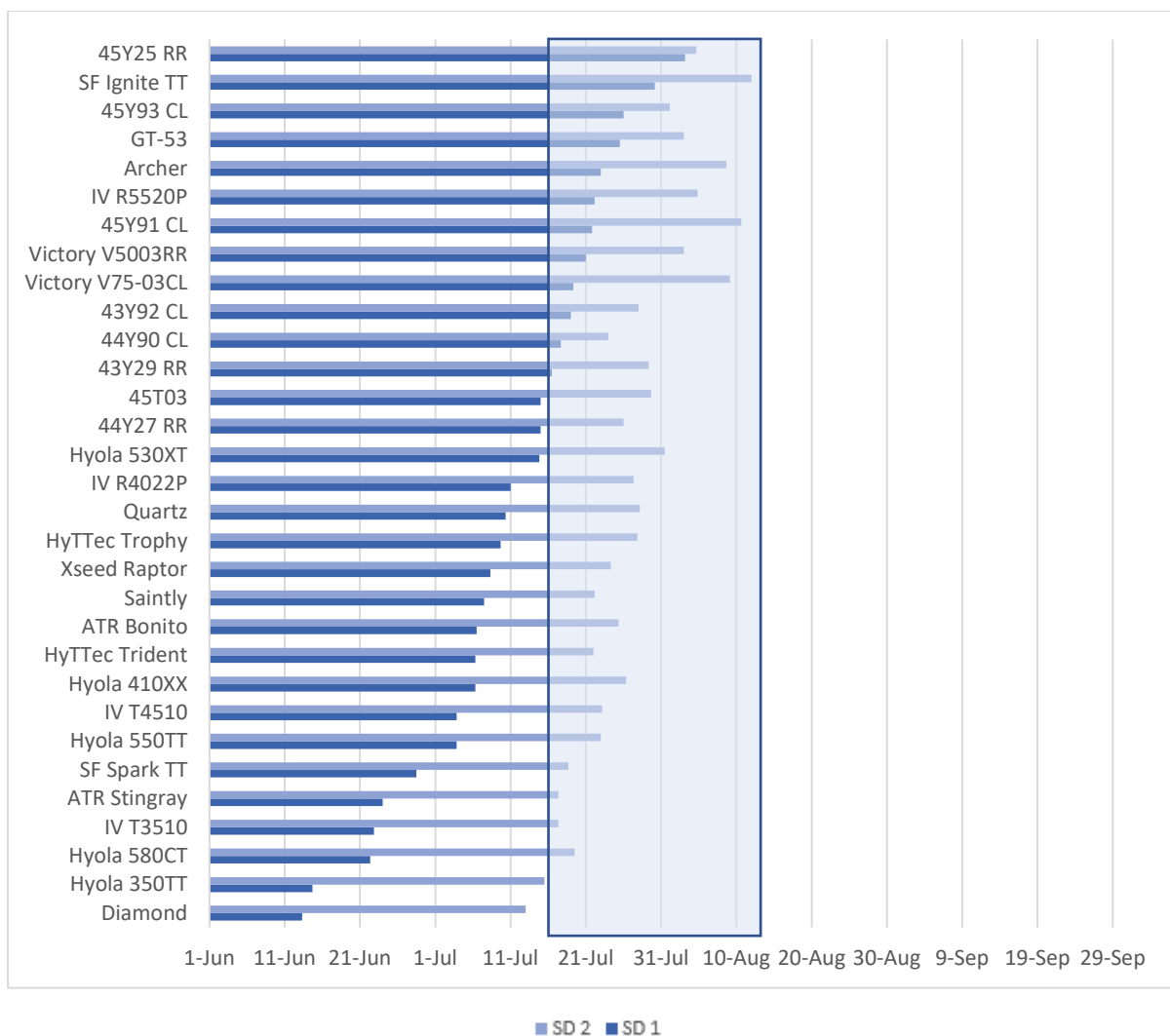


Figure 2. Flowering dates for Trangie, 2019. The shaded area shows the optimum start of flowering period (when 50% of plants have one open flower) for Trangie (15 July to 12 August). Sowing date (SD) 1 (darker bars) was 4 April, sowing date 2 (lighter bars) was 26 April. (Some of the varieties in the figure above are protected under the Plant Breeders Rights Act 1994. Please see Table 1 for which varieties)

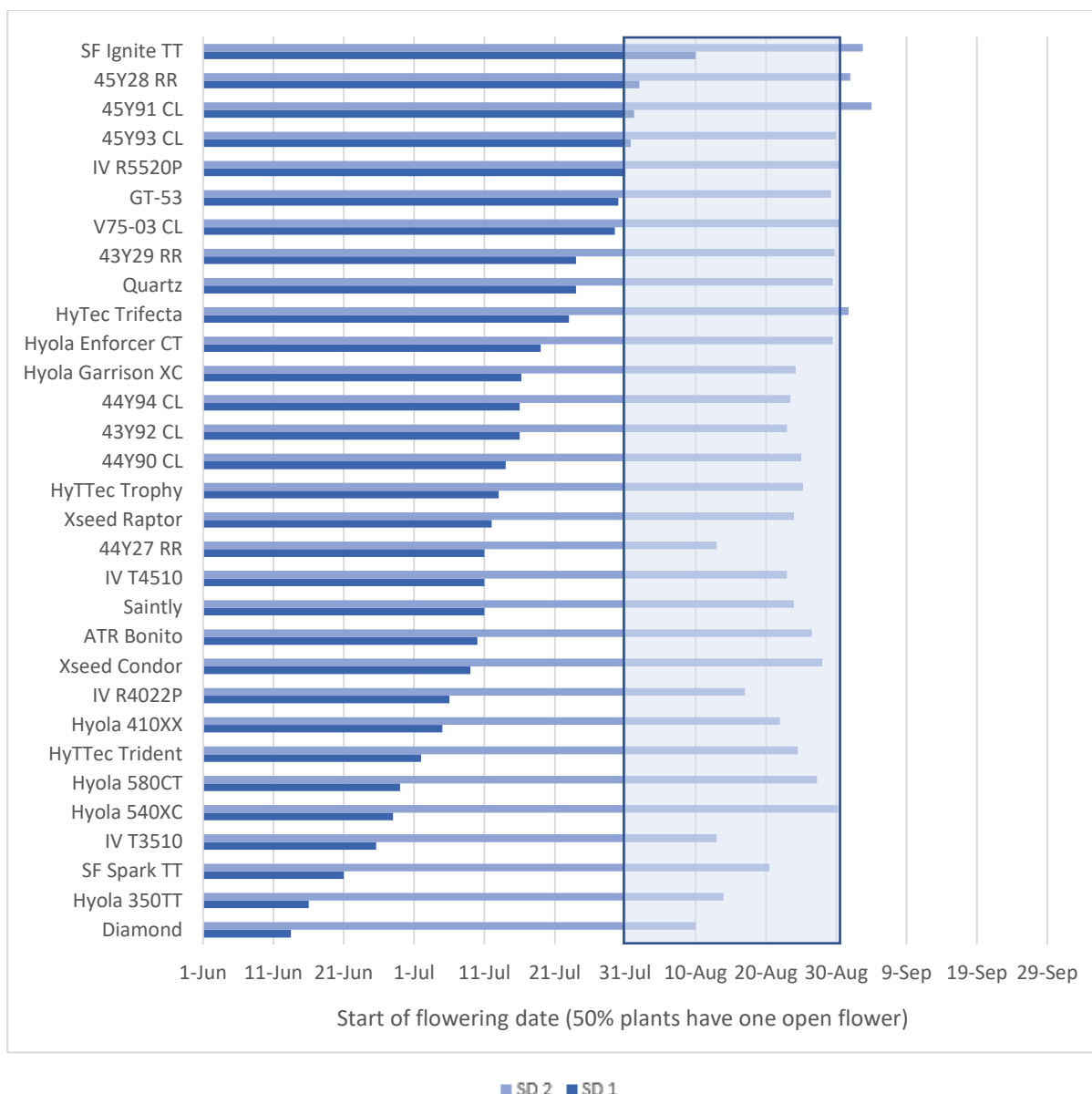


Figure 3. Flowering dates for Wagga Wagga, 2020. The shaded area shows the optimum start of flowering period (when 50% of plants have one open flower) for Wagga Wagga (31 July to 1 September). Sowing date (SD) 1 (darker bars) was 26 March, sowing date 2 (lighter bars) was 27 April.

(Some of the varieties in the figure above are protected under the Plant Breeders Rights Act 1994. Please see Table 1 for which varieties)

At Condobolin in 2018, Nuseed Diamond with a Decile 9 N rate and watered to achieve a total supply of 307mm (subsoil water + in-crop rainfall) was the quickest to flower from the first sowing date (5 April), flowering on 3 July, 23 days earlier than the optimum start of flowering period (26 July – 16 August). Both Nuseed Diamond and ATR Bonito[®] with a Decile 9 N rate in the dry treatment (151mm in season rainfall), flowered close to the optimum start of flowering date of 9 August from the first sowing date, up to a month later than the watered treatment, indicating that moisture stress in plants will delay the start of flowering. In most cases, varieties in the dry treatment flowered well after those in the wet treatment, with the mid and longer season varieties (ATR Bonito[®] from the second sowing date, Pioneer 44Y90 (CL) and ATR Wahoo[®]) flowering outside the optimum flowering window, putting them at a high risk of heat stress (Figure 4).

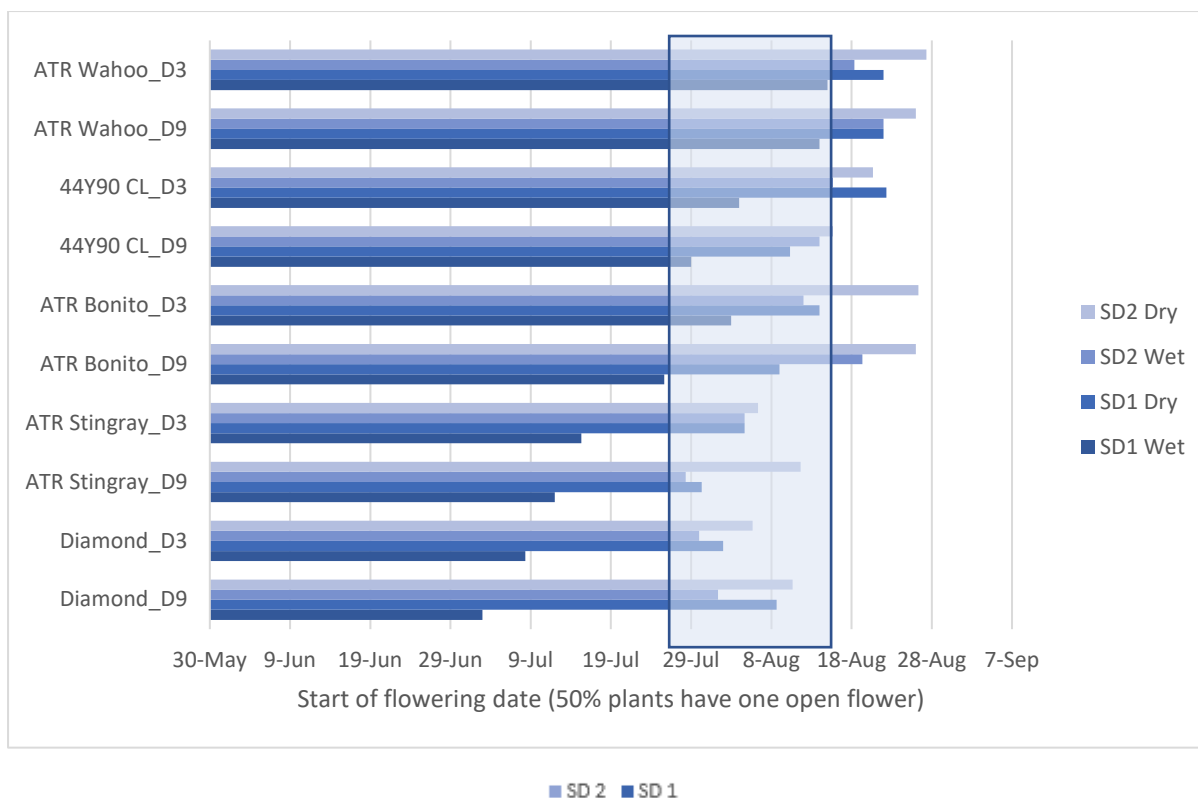


Figure 4. Start of flowering dates (50% of plants have one open flower) for wet and dry treatments and N rates for Condobolin, 2018. D3 and D9 relate to the Decile N rates applied. Shaded area is the optimum flowering window for Condobolin (26 July to 16 August). Sowing date (SD) 1 (darker bars) was 5 April, sowing date 2 (lighter bars) was 26 April. (Some of the varieties in the figure above are protected under the Plant Breeders Rights Act 1994. Please see Table 1 for which varieties)

Discussion

Flowering time and therefore flowering within a particular period for a given location is one of the most important drivers of grain yield in canola. Having an understanding of a variety's phenology and how that variety responds to temperature influences how the variety will perform in different environments and the correct sowing window in which that variety should be sown. During the leaf production stages of canola growth, varieties can be influenced by thermal time, photoperiod or vernal time, or a combination. For instance, winter varieties (not included in these experiments) need a period of vernalisation (cold temperatures) before they will switch from vegetative stages (leaf production) to reproductive stages (bud and flower production) of growth. The time taken within the reproductive stage, for buds to elongate and initiate flowers is also influenced by thermal time and photoperiod. There is no vernalisation requirement within the reproductive stage.

Although the spring varieties included at Trangie and Wagga Wagga did not require vernalisation before reproductive stages were initiated, the differences observed in flowering times show that the varieties still have different thermal and photoperiod requirements before they will begin flowering. The fast spring varieties such as Nuseed Diamond and Hyola 350TT do not require much thermal time for them to shift to reproductive stages and begin flowering. When these varieties are sown early, they can be exposed to warmer temperatures soon after sowing which increase the accumulated thermal time causing them to begin flowering earlier. In contrast, slow spring varieties such as ATR Wahoo and SF ignite TT, require a longer period of thermal time before they will begin flowering. Varieties sown in different environments will change the length of time it takes for those varieties to begin flowering. Fast springs will still be fast springs, however in a warmer environment

such as Trangie, accumulated thermal time will be quicker than for a cooler environment like Wagga Wagga.

Understanding how a variety responds to thermal time and photoperiod and therefore knowing a variety's phenology will influence a grower's decision on when to sow that variety to avoid flowering when the risk of frost, disease, heat or moisture stress is higher.

Conclusion

Canola varieties differ in their flowering times depending on where and when they are sown. Sowing a fast variety too early can lead to flowering when the risks of frost and disease are high; sowing a slow variety too late increases the risk of heat and moisture stress.

Matching a variety's phenology to its sowing time is critical for flowering to start during the optimum flowering period for each region, which is when environmental and disease risks are balanced for the highest yield potential. More information on sowing windows to suit variety phenology can be found in the DPI's [Winter crop variety sowing guide 2020](#).

Further information

<https://www.dpi.nsw.gov.au/agriculture/broadacre-crops/guides/publications/winter-crop-variety-sowing-guide>

<https://grdc.com.au/resources-and-publications/all-publications/publications/2018/ten-tips-to-early-sown-canola>

<https://grdc.com.au/resources-and-publications/all-publications/publications/2019/20-tips-for-profitable-canola-central-and-southern-nsw>

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Ⓓ Varieties displaying this symbol beside them are protected under the Plant Breeders Rights Act 1994.