Improving grower confidence in late sown canola

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Take home messages

- Sowing canola on time yielded higher than sowing late and is the best option if seasonal conditions allow
- Low plant population (less than 30 plants/m^2) often resulted in yield penalties regardless of the time of sowing (TOS); increasing population to greater than 30 plants/m^2 resulted in higher yield regardless of TOS
- Varietal choice had a large yield impact and varieties tended to maintain their relative yield ranking regardless of TOS
- Quick developing varieties did not always perform better when sowing was delayed
- Hybrids yielded better than open pollinated (OP) varieties
- Yield from late sowing was generally acceptable when using an appropriate sowing rate (greater than 30 plants/m^2) and a suitable variety
- If considering sowing canola late, a hybrid variety with mid-quick phenology that performs well in your environment is likely to do better than an open pollinated triazine tolerant variety.

Background

There is now a strong body of research showing that early sowing of canola, i.e. before the 25 April, positively affects crop yields (Paddock Practices: Canola - linking variety choice to time of sowing, to drive profitability of early sown canola & Canola's deep roots - agronomy to capture benefits and manage legacies). These studies also show the importance of matching varieties to sowing date for optimal crop performance and reliability and have resulted in many growers sowing earlier than the historical norm. Prior to this research, the canola sowing window opened on the arbitrary date of the 25 April or ANZAC day. Due to this shift to earlier sowing, many growers now see the ANZAC day as the closing date where they start considering alternate crop options.

In the Orana region, history shows that we often don't get sufficient moisture for a sowing opportunity before this date. Conversely, conditions may be too wet to sow, as was experienced in the Parkes Shire in 2024.

Growers are then faced with the tough decision to change crop species to maintain profitability, while weighing up the wider ramifications of not having canola in the rotation for the important role it plays in terms of disease, weed, logistical and risk management. Pulses are the most likely alternative break crop; however, these do not suit all paddocks or growers.

In the face of these challenges the question was often asked by growers can we improve the performance of canola when sowing later, outside of the recommended window?

There are 2 key agronomic levers growers can relatively easily manipulate when late sowing:

1. change variety
2. increase sowing rate.

Research by Grain Orana Alliance (GOA) in the 2018 drought showed that late sown (5th July) hybrid imidazolinone tolerant (IMI; Clearfield®) canola substantially outyielded open pollinated (OP) triazine tolerant (TT) varieties with similar maturity and outperformed many of the alternate crop types that growers may consider.

There is also research demonstrating varietal comparisons and other studies showing the influence of sowing rate, but there is little data investigating a combination of these factors and the influence of a late time of sowing (TOS).

Aim

Investigate the effect of changing variety (maturity and production system) and interactions with plant population to improve late sown canola performance.

The trials

From 2020 to 2024 GOA conducted 9 small plot trials using a split design with 4 replications. Trials included:

1. six varieties
2. two TOS
3. three target plant populations.

Canola varieties tested were selected to broadly represent farmer options of:

- phenology (when sown before 15 April, NSWDPI Winter crop sowing guide 2024): mid to fast
- type: hybrid and OP
- herbicide tolerance group: conventional (conv), imidazolinone tolerant (IMI) and triazine tolerant (TT) (Table 2)

Note: This work references specific varieties however readers should consider the broader characteristic(s) they represent.

Variety phenology relates to the relative rate at which the canola plant reaches the start of flowering. There are 4 groupings- fast, mid-fast, mid-slow and slow. Fast varieties have a short period between seeding and flowering and are thought to be more suited to later sowings, and inversely slow phonologies do not reach flowering for much longer and so thought suited to earlier sowings.

The first TOS was targeted at the ‘late end of the optimal’ range for mid and fast phenology (or early-mid developing) varieties. The second TOS was sown a month or more later to be well outside the optimal window. Details of TOS at all sites are provided in Table 1.

Table 1. Sowing dates, growing season rainfall (GSR) and long-term GSR at each site.

		Sowing date		Rainfall (mm)*		
Year	**Location**	**TOS 1**	**TOS 2**	**GSR**	**Long term GSR**	**Δ**
2020	Eugowra	7 May	10 Jun	476	327	146%
	Nyngan	28 Apr	29 May	204	222	92%
2021	Canowindra	3 May	2 Jun	393	343	115%
	Warren	27 Apr	25 May	236	245	96%
2022	Fifield	19 Apr	14 Jun	635	266	239%
2023	Gilgandra	19 Apr	1 Jun	140	288	49%
	Trundle	19 Apr	2 Jun	117	268	44%
2024	Ballimore	22 Apr	21 May	338	320	106%
	Parkes	23 Apr	22 May	366	294	124%

*Queensland Government (2025). SILO Gridded Data. Retrieved from LongPaddock. https://www.longpaddock.qld.gov.au/silo/

Three plant populations were targeted:

1. low (~10 plants/m^2)
2. medium (targeted to be in the optimal range of 20–50 plants/m^2, as recommended by the NSW DPIRD Winter Crop Sowing Guide
3. high (~60 plants/m^2)

Actual sowing rates are provided in Table 2.

Table 2. Varietal information and sowing rates (note that sowing rates varied from year to year depending on seed size and assumed a 65% establishment rate*)

					Sowing rate (kg/ha)		
Variety	**Seed size (seeds/kg)**	**Type**	**Phenology**	**Plant height**	**10****	**30****	**60****
43Y92 CL	168,600	Hybrid IMI	Mid-fast	Medium	1.0	2.9	5.7
45Y91 CL	189,100	Hybrid IMI	Mid-slow	Medium–tall	0.9	2.7	5.4
45Y93 CL	179,100	Hybrid IMI	Mid	Medium–tall	1.0	2.9	5.8
45Y95 CL	182,100	Hybrid IMI	Mid	Medium–tall	0.9	2.7	5.4
ATR Bluefin	325,000	OP TT	Fast	Short	0.5	1.5	3.0
ATR Stingray	320,000	OP TT	Fast	Short	0.5	1.6	3.2
Nuseed Diamond	205,000	Hybrid Conv.	Fast	Medium	0.8	2.3	4.6
Hyola 350 TT	140,000	Hybrid TT	Fast	Medium	1.2	3.6	7.3
HyTTec® Trophy	250,000	Hybrid TT	Mid-fast	Medium–tall	0.6	1.9	3.7
HyTTec® Velocity	200,000	Hybrid TT	Fast	Medium	0.8	2.4	4.7

*Industry standard quoted as 60%, GrowNote-Canola-North-3-Planting.pdf https://grdc.com.au/__data/assets/pdf_file/0030/369273/GrowNote-Canola-North-3-Planting.pdf)
** Target plant population (plants/m^2)

Results

The results were analysed using ASReml (Gilmour *et al.,* 2025), references to differences are statistically significant (*P*=0.05). Results with both one-way and two-way interactions are presented below. Results with the same letter are not significantly different.

This research covers 9 trials over 5 years resulting in a very large data set. For the purposes of this paper, only impacts on yield will be discussed. While there existed differences in oil and protein content, they were in part related to changes in yield and the relative dilution of these attributes. The differences observed were relatively small.

Time of sowing

Time of sowing had a large influence on yield (Table 3), with TOS2 reducing yield by 1.38 t/ha at Canowindra in 2021. Parkes 2024 was the only site where yields were similar at both TOS.

Table 3. Effect of time of sowing on yield (t/ha) across all sites. Values with the same letter within each year/site (row) are not significantly different. Δ is the difference between TOS1 and TOS2.

		Yield (t/ha)				
Year	Site	TOS1		TOS2		Δ
2024	Ballimore	1.88	a	1.64	b	0.24
	Parkes	1.79	a	1.63	a	ns
2023	Trundle	1.33	a	0.40	b	0.93
	Gilgandra	1.02	a	0.41	b	0.61
2022	Fifield	2.58	a	2.17	b	0.41
2021	Canowindra	3.84	a	2.46	b	1.38
	Warren	3.48	a	2.29	b	1.19
2020	Eugowra	3.14	a	2.36	b	0.79
	Nyngan	3.12	a	1.90	b	1.22

Plant population

Increasing plant population increased yield (Table 4). The lowest populations had the lowest yield at all sites. The yield differences between the low and the high populations ranged from 0.13 t/ha at Warren up to 0.72 t/ha at Parkes in 2024 (Table 4). At all sites, moving from a low to mid population universally improved yield. Similarly, moving from a mid to high population either improved or had no effect on yield (except at Warren 2021 where yield was reduced).

Table 4. Effect of increasing plant population on canola yield (t/ha) across all sites. Values with the same letter within each site (row) are not significantly different. Δ is the difference between low and high plant population treatments.

		Plant population						
		Low		Medium		High		Δ
Year	Site	Yield (t/ha)						
2024	Ballimore	1.51	c	1.80	b	1.96	a	0.45
	Parkes	1.29	c	1.82	b	2.02	a	0.72
2023	Trundle	0.66	c	0.93	b	1.02	a	0.37
	Gilgandra	0.56	c	0.75	b	0.84	a	0.28
2022	Fifield	2.15	c	2.45	b	2.53	a	0.38
2021	Canowindra	2.86	c	3.23	b	3.36	a	0.50
	Warren	2.71	c	3.09	a	2.84	b	0.13
2020	Eugowra	2.64	b	2.82	a	2.79	a	0.15
	Nyngan	2.26	b	2.62	a	2.65	a	0.39

Variety

Variety choice had the largest effect on yield across all sites. This ranged from 0.4 t/ha at Gilgandra in 2023 up to 1.43 t/ha at Canowindra in 2021.

The OP varieties yielded the lowest at all sites.

Table 5. Effect of variety on canola yield (t/ha) across all sites. Values with the same letter within each site (row) are not significantly different. Δ is the difference in yield between the highest and lowest yielding variety at the site.

		Yield (t/ha)																				
Year	Site	Diamond		HyTTec Velocity		45Y95 CL		43Y92 CL		45Y91 CL		45Y93 CL		HyTTec Trophy		ATR Bluefin		ATR Stingray		Hyola 350 TT		Δ
2024	Ballimore	2.07	a	1.91	b	1.90	b	1.60	c					1.83	b	1.23	d					0.84
2024	Parkes	1.81	b	1.85	ab	1.97	a	1.81	ab					1.73	b	1.08	c					0.89
2023	Trundle	1.11	a	0.98	b			0.83	c			0.80	c	0.85	c			0.64	d			0.47
2023	Gilgandra	0.91	a	0.78	b			0.68	d			0.68	cd	0.73	c			0.51	e			0.40
2022	Fifield	2.48	b	2.34	c			2.50	b			2.67	a	2.34	c			1.93	d			0.74
2021	Canowindra	3.51	b					3.52	b			3.72	a	3.18	c			2.29	e	2.69	d	1.43
2021	Warren	3.33	a					3.02	b			3.13	b	2.81	c			2.46	d	2.54	d	0.87
2020	Eugowra	3.10	a					3.02	ab	2.95	bc			2.83	c			2.21	e	2.39	d	0.89
2020	Nyngan	3.12	a					2.79	b	2.53	c			2.29	d			2.05	e	2.27	d	1.07

Time of sowing and plant population

At all sites the lowest population, regardless of the TOS, had the lowest yield (except for TOS1 at Eugowra), see Figure 1.

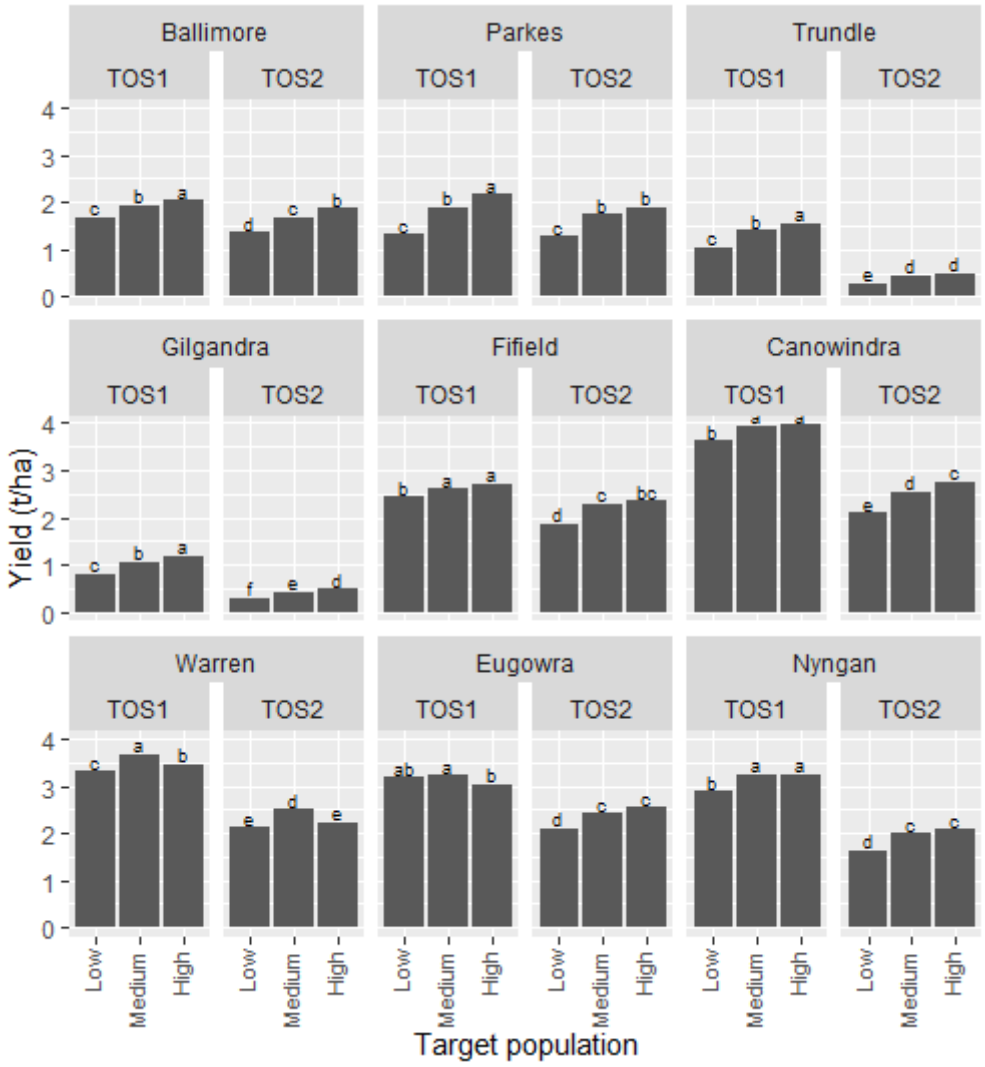
High plant populations at TOS1 yielded:

- higher than the low population at 8 (out of 9) sites and equal to the low population at the remaining site
- higher than the medium population at 4 sites
- the same as the medium population at 3 sites
- lower than the medium population at 2 sites.

High plant populations at TOS 2 yielded:

- higher than the low population at 8 (out of 9) sites
- higher that the medium population at 3 sites
- the same as the medium population at 5 sites
- lower than the medium population at 1 site.

Figure 1. Effects of time off sowing and plant population on canola yield. Results with the same letter within a site are not significantly different.

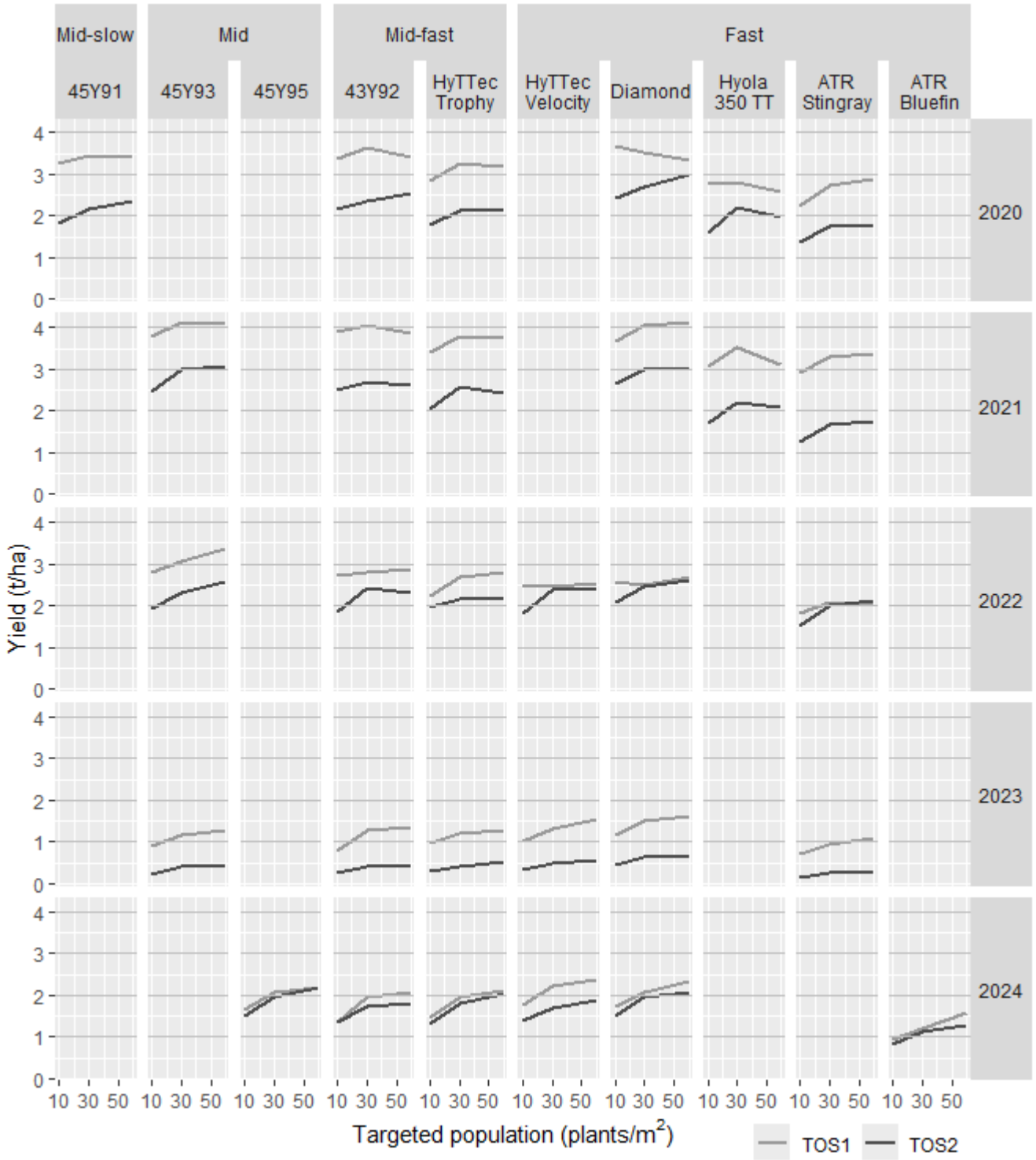


Variety and time of sowing by year

There were 10 varieties included in this research, though not all were grown at every site in every year. Varieties have been grouped by a combination of phenology group (NSWDPI Winter crop variety sowing guide 2021 and 2024) and year to simplify data interpretation. Hybrids outperformed the OP varieties (ATR Stingray and ATR Bluefin) at every TOS/site.

Switching to a variety with a fast phenology from a mid, did not universally improve yield (Figure 2). For example, both mid varieties yielded the same or better than the fast varieties (except for Nuseed Diamond) in all years.

Figure 2. Effects of time off sowing, variety (grouped by phenology category) and population on canola yield in each year of the research.



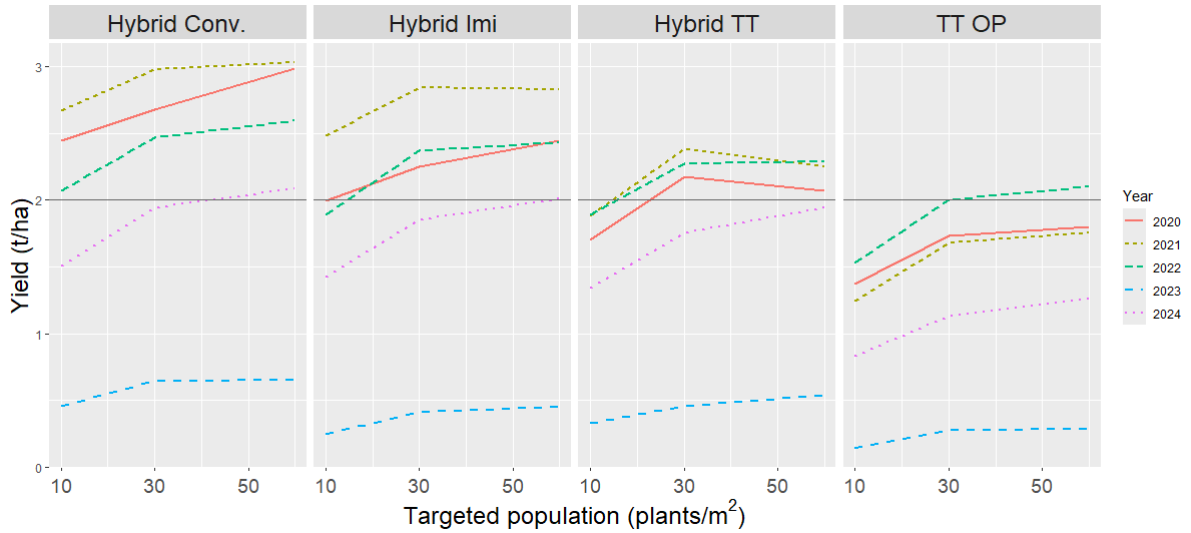
Yield and late sowing

When looking at the range of yield outcomes there are many instances where the hybrid varieties yielded >2 t/ha (Figure 3) such as in 2020, 2021 and 2022 when they were grown at a medium or high plant population. The hybrid conventional yielded as high as 3 t/ha in 2020 and 2021 at the high plant population. In 2024, 2 t/ha was only achieved by the hybrid IMI and hybrid conventional varieties at the high population. In every year the OP TT lines underperformed

when compared to the hybrid varieties. Comparing the best yields for hybrids and OPs in each year across populations, the yield deficit from growing an OP TT ranged from 0.37–1.27 t/ha.

The TT OP lines were the lowest yielding in 2023 which was a very dry year, particularly at the low population; lifting the population doubled the yield (~0.14–0.28 t/ha). The hybrid conventional more than doubled the TT OP yield with ~0.65 t/ha at the medium/high population.

Figure 3. Canola yield of the different type/herbicide group varieties at TOS2 by year.



Discussion

Unsurprisingly, sowing on time (TOS1) yielded higher than sowing later (TOS2) and is the best option if seasonal conditions allow. The inclusion of TOS1 was to allow comparisons of the effects of population and variety choice with a situation where sowing is delayed (TOS2).

One of the hypotheses was that plant populations may have been more influential on yields if sowing is delayed, however the data tend to suggest it is not. Almost universally lower yields resulted from the lowest plant populations, regardless of the TOS whilst improvement in yield by increased populations were evident at both TOS. In several cases, yield improvements were attained by targeting a 'high' population (i.e. hybrid conventional and hybrid IMI in 2020), but this response tended to be variety and TOS specific. This set of experiments has shown that growers should be targeting the recommended (NSW DPIRD) target plant populations.

The second hypothesis is that changing to a 'faster phenology varieties in later sowing situations would result in better performance, however this was not observed in these trials; however other 'faster' varieties not tested may provide different outcomes.

In this research hybrids, regardless of variety, outperformed the OP types. Although it is recognised that the number of varieties included was limited.

Overall, it was observed that lines which performed well when sown on time also performed well when sowing was delayed. Low yielding varieties tended to always be low yielding regardless of TOS.

The low yield results for the late sown OP TT varieties may provide some insight into growers' lack of confidence in late sown canola. It is plausible that to keep canola in the rotation, growers have sown late, selected a fast OP TT variety to keep seed costs down, and used a lower than optimal sowing rate and/or achieved poor establishment (OP TT have low seedling vigour). As a result, yields have not stacked up economically against alternative crops.

Growing a hybrid variety at a higher plant population showed that yields can be attractive for late sown canola, and in many cases may have an equal or higher economic return than most alternate crop options. Canola is generally regarded as having higher input costs than alternative crops, and with later sowing inputs may need be adjusted to reflect the reduced yield potential, but not to limit yield potential.

This research suggests that there are easy to implement options such as variety choice and plant population (sowing rate) that can improve yields and grower confidence in sowing canola well outside of its recommended window.

Conclusions

Sowing on time yielded higher than sowing later and is the best option if seasonal conditions allow.

Recommended or higher sowing rate across both TOS resulted in the best yields, while low plant populations across both TOS resulted in lower yields. Growers should target the recommended sowing rates, particularly if sowing towards the end of the variety's recommended window and target higher plant populations if sowing later than recommended.

There was little evidence that changing to a quicker developing variety resulted in increased yield with delayed sowing. Better performing varieties tended to yield best, even with delayed sowing.

If considering sowing canola late, choose a variety with mid-fast phenology and always choose a variety with high yield potential (this is might most likely be a hybrid). Target a plant population of 30 plants/m^2 or more. Adjust fertiliser inputs (but don't resort to nil) such as nitrogen to match the reduced yield potential.

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