

Targeting high canola yields (5t/ha) in southern New South Wales

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Keywords

- canola, variety, sowing date, biomass, harvest index, yield components.

Take home messages

- Variety choice has a large effect on yield in high yielding environments; plan the rotation so that the highest yielding variety can be grown.
- Nuseed Diamond was the most consistently high yielding variety at both Wallendbeen (dryland) and Leeton (irrigated).
- Nuseed Diamond grew similar biomass (by maturity) as that grown by slower hybrids but had a higher harvest index.
- Open-pollinated, triazine tolerant (OP TT) canola was on average 0.95t/ha lower yielding than the best hybrid. In expected high yielding situations, the cost of hybrid seed is justified.
- Winter canola (ungrazed) varieties were generally lower yielding than the best hybrid spring canola variety.

Introduction

The High Yielding Canola Agronomy project was conducted as part of the NSW DPI/GRDC's Grains Agronomy and Pathology Partnership (GAPP). The aim was to determine the optimum plant types to target yields 5t/ha or greater in southern NSW environments. The main factors considered included phenology (rate of development), breeding type (hybrid versus OP) and herbicide tolerance (TT versus non-TT). Wallendbeen was selected as a cool, long season dryland environment and Leeton was selected as a warm irrigated environment.

Methodology

Six canola varieties, representing a diverse range of canola variety types (Table 1) were sown at three

sowing dates (late March, mid-April, late April/early May) from 2017 to 2019 at Leeton and Wallendbeen. Rainfall was lower than the long-term average of 470mm, for all years, with Wallendbeen receiving 358mm, 205mm and 288mm from 1 March to 31 October in 2017, 2018 and 2019, respectively. Leeton was fully irrigated, and therefore, crops were not limited by moisture stress. Frost was not a major issue in 2018 or 2019 at both sites however 2017 was a very frosty year, with minimum temperatures less than -5°C experienced at Leeton and -2.5°C at the Wallendbeen site. Due to low rainfall and vigilant management, disease and insect pressure was low at both sites across all years. Nitrogen (N), sulphur (S) and phosphorus (P) nutrition was applied at 'luxury levels' (above 'normal' grower practice) to maximise yield potential.



Table 1. Varietal descriptions and trial entries (shaded cells) included in High Yielding Canola Agronomy trials from 2017 to 2019.

	Phenology	Type	Herbicide tolerance	Wallendbeen			Leeton		
				2017	2018	2019	2017	2018	2019
Nuseed Diamond	Fast	Hybrid	Conventional						
Pioneer®44Y90 (CL)	Mid-fast	Hybrid	Imidazolinone						
ATR Bonito [Ⓛ]	Mid-fast	OP	Triazine Tolerant						
Nuseed Quartz	Mid	Hybrid	Conventional						
HyTTec® Trophy	Mid	Hybrid	Triazine Tolerant						
Pioneer®45Y91 (CL)	Mid-slow	Hybrid	Imidazolinone						
Pioneer®45Y25 (RR)	Mid-slow	Hybrid	Roundup Ready						
ATR Wahoo [Ⓛ]	Mid-slow	OP	Triazine Tolerant						
Archer	Slow	Hybrid	Imidazolinone						
Victory V7001CL	Slow	Hybrid	Imidazolinone						
SF Edimax CL	Winter (Very slow)	Hybrid	Imidazolinone						
Hyola®970CL	Winter (Very slow)	Hybrid	Imidazolinone						
Phoenix CL	Winter (Very slow)	Hybrid	Imidazolinone						

Results and discussion

Grain yield

Over the six site years, Nuseed Diamond was clearly the best performing variety for yield. Only in the frosty year of 2017 at Leeton was it not ranked in the top five treatments (shaded cells) from any of the sowing dates (Table 2). It was in the top five for yield for at least two sowing dates in all other trials. For 2017 and 2018, the next highest yielding variety was Pioneer®45Y25 (RR). Only at Leeton in 2017 did a winter variety yield at least as well as the best hybrid and there was generally no significant difference between the winter varieties except from early sowing at Wallendbeen in 2019 where SF Edimax CL was higher yielding than Hyola®970CL. The highest yielding OP TT treatment was on average 0.95t/ha lower yielding than the highest yielding hybrid.

What are the characteristics of a high yielding variety?

High biomass

Hybrid varieties always grew more biomass than OP TT varieties. Surprisingly, Nuseed Diamond grew similar biomass (by maturity) as slower varieties such as Pioneer®45Y91 (CL) and Archer but did so in less time, indicating a higher radiation use efficiency.

High harvest index (HI)

Nuseed Diamond was the only variety able to consistently maintain a very high harvest index (usually above 0.30) along with a high biomass, indicating its ability for efficient growth and an efficient conversion of biomass into grain.

Yield components

Grain yield was driven by seed number rather than seed size. Nuseed Diamond was ranked above average for seeds/pod and pods/m². Most other varieties were high for one component and low for the other. For example, the OP TT varieties ATR WahooA and ATR BonitoA and the winter varieties SF Edimax CL and Hyola®970CL were ranked high for seeds/pod but low for pods/m². Conversely, Archer, Pioneer®45Y91 (CL) and Pioneer®44Y90 (CL) were ranked high for pods/m² but low for seeds/pod.

Grain size

While grain size was variable and overall not a major factor influencing yield, there were some consistent trends. Pioneer®44Y90 (CL), Pioneer®45Y91 (CL) and Victory V7001CL tended to have relatively small grains whereas, the winter varieties tended to have relatively large grain.

Grain quality

There were large differences in oil % between sites and seasons but the differences between varieties was less clear. More details will be provided on oil concentration within the presentation at the 2020 Wagga Wagga GRDC Grains Research Update. It is worth noting that at a grain yield of 4t/ha and a price of \$550/tonne, a yield difference of 0.3t/ha (which was common in this project) equates to the same amount of income as an oil difference of 5% (uncommon in this project).



Table 1. Grain yield of canola varieties sown at three sowing dates at Wallendbeen and Leeton in 2017, 2018 and 2019. Shaded cells indicate the four highest yielding treatments in each year at each site.

Wallendbeen				Leeton			
2017				2017			
	28-Mar	13-Apr	1-May		27-Mar	11-Apr	2-May
Diamond	3.7	4.6	4.8	Diamond	2.3	3.0	4.3
44Y90 (CL)	4.1	4.3	4.4	44Y90 (CL)	3.3	4.1	4.0
ATR Bonito	4.1	4.3	3.9	ATR Bonito	3.0	3.4	3.8
45Y25 (RR)	4.1	4.7	4.7	45Y25 (RR)	3.4	4.4	4.7
ATR Wahoo	3.9	4.0	4.0	ATR Wahoo	3.0	3.7	4.0
Victory V7001CL	3.9	4.0	3.6	Victory V7001CL	3.2	3.5	3.6
Edimax CL	3.9	3.9	3.5	Edimax CL	4.7	4.6	4.2
Hyola 970CL	4.0	4.0	3.8	Hyola 970CL	4.2	4.6	4.2
L.S.D. (P=0.05)	0.38			L.S.D. (P=0.05)	0.77		
2018				2018			
	27-Mar	12-Apr	1-May		27-Mar	11-Apr	1-May
Diamond	4.6	4.1	3.4	Diamond	4.5	5.3	5.3
44Y90 (CL)	3.5	3.9	2.9	44Y90 (CL)	4.4	4.4	3.9
ATR Bonito	3.7	2.8	2.3	ATR Bonito	3.9	4.2	3.6
45Y25 (RR)	4.1	3.2	2.6	45Y25 (RR)	4.8	5.4	4.4
45Y91 (CL)	4.3	3.6	2.8	45Y91 (CL)	5.6	5.0	3.8
ATR Wahoo	3.4	2.6	2.1	ATR Wahoo	3.3	4.1	3.3
Archer	3.7	3.2	2.4	Archer	5.1	4.9	4.1
Victory V7001CL	2.6	2.0	1.7	Victory V7001CL	4.1	4.7	3.0
Edimax CL	2.9	2.0	1.3	Edimax CL	3.6	3.0	2.2
Hyola 970CL	2.5	1.6	1.3	Hyola 970CL	3.5	3.1	2.3
Phoenix CL	2.7	1.8	1.5	Phoenix CL	3.2	3.2	2.1
L.S.D. (P=0.05)	0.44			L.S.D. (P=0.05)	0.77		
2019				2019			
	28-Mar	11-Apr	30-Apr		27-Mar	11-Apr	30-Apr
Diamond	3.7	3.3	2.4	Diamond	4.0	4.2	3.8
44Y90 (CL)	3.0	2.5	1.7	44Y90 (CL)	2.9	2.4	2.1
ATR Bonito	2.8	2.3	1.6	ATR Bonito	2.7	2.9	2.6
Quartz	3.4	3.1	2.2	45Y91 (CL)	3.0	2.4	2.1
HyTTec Trophy	3.3	2.7	2.1	Archer	2.8	2.9	2.7
45Y91 (CL)	3.3	2.7	1.5	ATR Wahoo	2.2	2.2	1.7
ATR Wahoo	2.5	2.0	1.5	Edimax CL	3.1	3.2	1.8
Archer	2.8	2.7	1.5	Hyola 970CL	3.3	3.2	1.6
Edimax CL	1.8	1.3	0.8	L.S.D. (P=0.05)	0.57		
Hyola 970CL	1.1	0.9	0.7				
L.S.D. (P=0.05)	0.44						



Conclusion

This work highlights the importance of variety choice when targeting a high canola yield. Nuseed Diamond was the highest yielding variety overall but given it only has conventional herbicide tolerance it is often not considered by growers. The challenge is then to set up the farming system (through crop rotation and integrated weed management) to grow the best variety (coupled with a robust pre-emergent herbicide strategy) rather than having the variety choice dictated by weed burden.

The seasonal conditions of 2017 to 2019 favoured early flowering, which is partly the reason for the success of the very early sown Nuseed Diamond treatments. When seasons shift back to average or above average it is expected that Nuseed Diamond will perform best from a later sowing date, enabling it to make use of good springs but also to avoid high disease risk from early flowering.


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