

Hyper yielding crops lifts canola yield above 6 t/ha

Rohan Brill¹, Darcy Warren², Tracey Wylie², Kat Fuhrmann², Aaron Vague², Max Bloomfield², Kenton Parker² and Nick Poole²

¹ BrillAg

² FAR Australia

Key words

canola, hybrid, nutrition, manure, fungicide

GRDC code

FAR2004-002SAX

Take home messages

- Grain yield reached well over 6 t/ha at Millicent and Wallendbeen in 2021, 1 t/ha above the highest yields observed in 2020
- Yield plateaued from nitrogen application either below or up to 150 kg/ha applied N
- The application of animal manure lifted yield by a further 11-18% above the maximum yield from applied N
- Variety choice has a major impact on achieving hyper yields, with 45Y95 CL being the standout variety in 2021.
- Further research will determine the mechanisms behind the strong yield response from animal manure and how nutrition can drive hyper yields of canola.

Background information

The canola component of the GRDC and FAR Australia Hyperyielding Crops project commenced in 2020 with sites at Gnarwarre, Victoria; Millicent, South Australia; and Wallendbeen NSW. The focus has been on determining the management factors including variety choice, nutrition, fungicide and canopy management required to achieve a canola yield of 5 t/ha. Variety choice and nutrition were the two most important factors driving canola yield in these high yielding environments in 2020, with fungicide and seeding rate less important. Highest yields were at Wallendbeen with 5.6 t/ha of 45Y28 RR with 225 kg/ha N applied. At Gnarwarre, highest yield was 4.8 t/ha of 45Y28 RR with 106 kg/ha N applied with 5 t/ha pig manure. At Millicent highest yield was 4.6 t/ha of 45Y93 CL. All results from 2020 are available at: <https://faraustralia.com.au/wp-content/uploads/2021/04/210325-HYC-Project-2020-Results-Canola-Final.pdf>.

2021 hyper yielding canola trials

Trials with a similar focus were conducted in 2021 in the same environments as 2020. Yields were higher in 2021 at all sites, with two of the three sites achieving a grain yield of 6 t/ha, well above the target yield of 5 t/ha (Figure 1). This paper outlines the key management strategies to achieve these very high yields at each site.

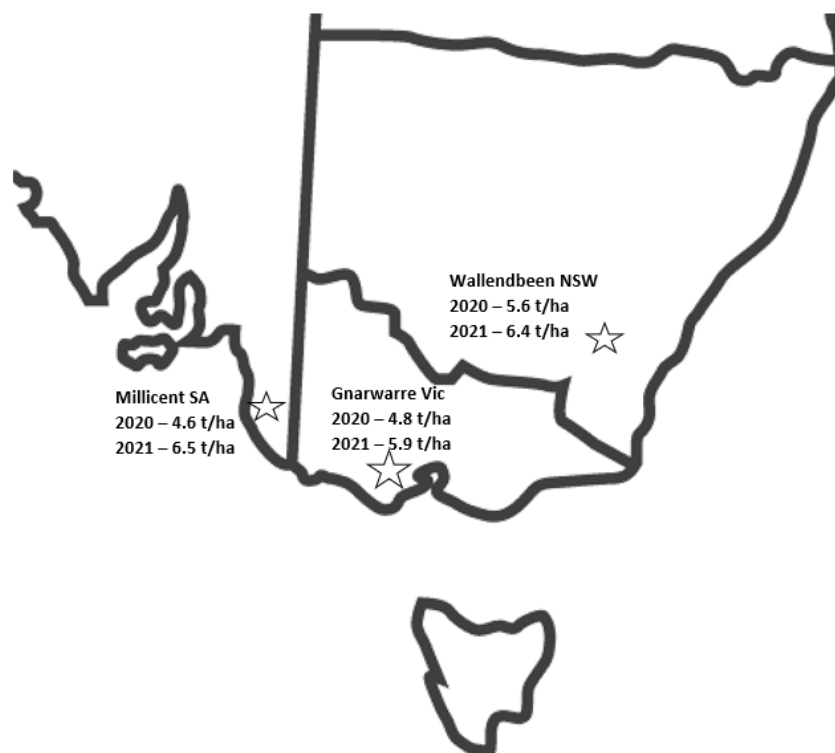


Figure 1. Grain yield of the highest yielding canola treatments at three sites in 2020 and 2021.

Methodology

This paper reports on two key trial series (Table 1), the first a genotype x environment x management (GEM) trial which were split into separate winter and spring trials with three management strategies (low, medium and high input) applied to each variety (blocked by herbicide tolerance) at three locations; Gnarwarre, Millicent and Wallendbeen (Site descriptions in Table 2). The second trial series was a nutrition trial again split into separate spring and winter trials with six nutrition treatments, focusing on nitrogen management and the addition of animal manure.

There were separate fungicide, seeding rate and variety screen trials conducted at each site. Results from these will be presented at GRDC Updates and available on the FAR Australia website on completion of reports.

Table 1. Variety entries and treatments in a canola G x E x M trial and canola nutrition trial, conducted at three sites in 2021.

GEM trial series			Nutrition trial		
<i>Spring varieties</i>	<i>Winter varieties</i>	<i>Treatments</i>	<i>Spring variety</i>	<i>Winter variety</i>	<i>Treatments</i>
ATR Wahoo Ⓢ	Hyola 970CL	Low input: Seed = Maxim® XL 20% Bloom = Aviator® Xpro® 0.8 L/ha N = 150 kg/ha	45Y28 RR	Hyola Feast CL	0 kg/ha N
HyTTec® Trifecta		Medium input: Seed = Maxim XL			75 kg/ha N
45Y93 CL		150 kg/ha N			

45Y95 CL	Hyola Feast CL	20% Bloom = Aviator Xpro 0.8 L/ha N = 225 kg/ha			225 kg/ha N
45Y28 RR		High input: Seed = Saltro® Duo			300 kg/ha N
Condor TF		6-Leaf = Prosaro® 0.45 L/ha 20% Bloom = Aviator Xpro 0.8 L/ha 50% Bloom = Prosaro 0.45 L/ha N = 225 kg/ha			225 kg/ha N + Animal Manure*

*Manure applied – 6.7 t/ha pig manure at Gnarwarre and Millicent (2.7% N, 1.3%P) and 3 t/ha chicken manure at Wallendbeen (3.3% N and 0.7% P).

Table 2. Site description for three hyper yielding canola sites in 2021.

Location	Region	Average rainfall	Elevation	Soil type	Available N at sowing	Organic Carbon	Colwell P	Applied P	Applied S
<i>Gnarwarre</i>	Southern Victoria	600 mm	190 m	Sodic Vertosol	70 kg/ha (0-100 cm)	1.4%	34 mg/kg	22 kg/ha	30 kg/ha
<i>Millicent</i>	South-East SA	710 mm	20 m	Organosol	173 kg/ha (0-10 cm)	9.7%	56 mg/kg	22 kg/ha	30 kg/ha
<i>Wallendbeen</i>	South-West Slopes NSW	680 mm	540 m	Red Ferrosol	340 kg/ha (0-90 cm)	2.0%	63 mg/kg	30 kg/ha	30 kg/ha

Results and discussion

Nutrition trials

In the spring nutrition trials, yield from the application of N alone (as urea) plateaued at 150 kg/ha at Gnarwarre and 75 kg/ha at Millicent (Table 3), with no yield increase from applied N at Wallendbeen which had a starting nitrogen of 340 kg/ha in the top 90 cm. In the winter nutrition trials, there was no yield response from applied N (urea) at either Gnarwarre or Wallendbeen (winter results not yet available for Millicent) (Table 4).

Despite high starting fertility levels and saturated N responses, there were still strong responses to applied animal manure over and above high rates of applied N. This response was observed in all spring trials and one winter trial, Gnarwarre. The yield response from manure in the spring trials ranged from 11% at Wallendbeen to 18% at Gnarwarre and in the winter trials from not significant to 17.5%.

It is exciting to see such strong yield responses from nutrition above the response from applied N (urea) alone, especially to yield levels above 6 t/ha. The challenge for the project team is to better understand the reason for the strong yield response from animal manure and how that can be cost-effectively implemented across the wider grains industry.

Table 3. Effect of nutrition (applied N and animal manure) on 45Y28 RR canola at three hyper yielding canola sites in 2021. Shaded cells denote highest yield in trial.

Treatment (kg/ha N)	Gnarwarre, Vic	Millicent, SA	Wallendbeen, NSW
0	4.0	4.9	4.5
75	4.5	5.6	4.4
150	4.9	5.8	4.6
225	5.1	6.1	4.5
300	5.0	5.8	4.5
225 + Manure	5.9	6.5	5.0
l.s.d. ($p < 0.05$)	0.36	0.56	0.32

Table 4. Effect of nutrition (applied N and animal manure) on Hyola Feast CL canola at two hyper yielding canola sites in 2021. Shaded cells denote highest yields in the trial.

Treatment (kg/ha N)	Gnarwarre, Vic	Wallendbeen, NSW
0	3.8	3.8
75	3.9	3.7
150	4.1	3.6
225	4.1	3.8
300	4.0	3.7
225 + Manure	4.7	3.5
l.s.d. ($p < 0.05$)	0.51	n.s.

GEM trials

There were large differences between varieties in the spring GEM trial, with a small response from management at Gnarwarre and Wallendbeen and no management response at Millicent. At Wallendbeen there was an average yield response of 0.3 t/ha in the high input versus medium and low input management. At Gnarwarre there was 0.3 t/ha higher yield in the high input compared to low input management.

At Millicent and Wallendbeen, 45Y95 CL was the standout variety with yield of 6.4 t/ha (averaged across management levels) (Table 5). This yield is 28% higher than the target yield of 5 t/ha and highlights what can be achieved with canola when seasons, variety choice and management all align. The addition of manure to improve crop nutrition may raise the bar even higher for canola and this will be tested in the GEM trial in future years. Further sample processing and data analysis will help understand the reasons behind the standout yield of 45Y95 CL at these two sites.

45Y28 RR was the highest yielding variety in the GEM trials at Gnarwarre where Clearfield varieties were not included. However, 45Y95 CL was the highest yielding variety in the adjacent spring screen trial.

In the winter GEM trials, Hyola Feast CL yielded higher than Hyola 970CL at Wallendbeen, but there was no yield difference between the two at Gnarwarre (Table 6). There was no yield difference between the management levels in the winter GEM trial at either site.

Table 5. Effect of variety choice on grain yield (averaged across three input levels) in Spring G x E x M trial at Gnarwarre, Millicent and Wallendbeen in 2021. Shaded cells denote highest yields in the trial.

	Gnarwarre Vic	Millicent SA	Wallendbeen NSW
ATR Wahoo ^(b)	3.5	3.3	3.6
HyTTec Trifecta	3.9	4.4	5.2
45Y95 CL	*	6.4	6.4
45Y93 CL	*	5.7	5.6
45Y28 RR	4.5	5.1	4.9
Condor XT	3.9	5.1	5.2
l.s.d. ($p < 0.05$)	0.21	0.34	0.36

Table 6. Effect of variety choice on grain yield (averaged across three input levels) in Winter G x E x M trial at Gnarwarre, Millicent and Wallendbeen in 2021. Shaded cells denote highest yields in the trial.

	Gnarwarre Vic	Wallendbeen NSW
Hyola Feast CL	4.3	3.8
Hyola 970 CL	4.0	3.4
l.s.d. ($p < 0.05$)	n.s.	0.34

Discussion and conclusion

There were three major stories to emerge from 2021 hyper yielding canola trials:

1. Yield levels were above even the most optimistic forecasts for canola. 6 t/ha should be a commercial target for industry and 7 t/ha will be the next frontier for research in these environments.
2. Nutrition is not just about applied urea. Strong responses from animal manure showed the importance of nutrition to push yields to new levels. This needs to be further investigated by the project team to determine if the yield response from manure is due to its slow-release nature or from nutrients such as phosphorus and potassium that are applied along with nitrogen in animal manure.
3. Like 2020, variety choice had a large impact on grain yield outcomes. 45Y95 CL was the standout variety across the three sites in 2021.

Acknowledgements

FAR Australia and Brill Ag gratefully acknowledges the investment of the Grains Research and Development Corporation (GRDC) for the Hyper Yielding Crops Project

Collaborating partners acknowledgement

FAR Australia gratefully acknowledges the support of all of its research and extension partners in Hyper Yielding Crops project. These are CSIRO, the Department of Primary Industries and Regional Development (DPIRD) in WA, Brill Ag, Southern Farming Systems (SFS), Techcrop, the Centre for eResearch and Digital Innovation (CeRDI) at Federation University Australia, MacKillop Farm Management Group (MFMG), Riverine Plains Inc and Stirling to Coast Farmers.

We would also like to thank our host farmers in each state.

- Chris Gilbertson at Millicent
- Ewen Peel at Gnarwarre

- Charlie Baldry at Wallendbeen.

Thanks also to technical support from:

- Greta Duff and Nimesha Fernando at Gnarwarre
- Clare Gibbs, Tyler Smith and Alex Price at Wallendbeen.

Contact details

Rohan Brill

Brill Ag

Ph: 0488 250 489

Email: rohan@brillag.com.au

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

® Registered trademark