Trial 2. Nitrogen Efficiency Trial – Nitrogen Rates

Project Objective: To examine the nitrogen use efficiency of canola grown under overhead irrigation

Location: Kerang, Victoria
Sown: 23rd April 2021
Harvested: 24th November 2021
FAR Code: ICC C21-03-2
Cultivar: 45Y28 RR
Rotation position: Wheaten Hay (2020), Dryland vetch/brown manure (2019), Durum wheat (2018)
Soil Type: Neutral medium grey clay
Irrigation: Surface irrigation. Pre-irrigation in autumn plus 2 spring irrigations totalling 340mm (3.4 ML/ha)
GSR: April-October 160mm. Total water available 500mm

Key Messages:

- *Seed yield was not significantly different across the treatments receiving 120 kg N/ha or higher.*
- *Plant biomass and accumulated N differences were beginning to show at early flowering (4.89t/ha mean) and significantly less N in the unfertilised plots (75.5kg N/ha).*
- *Optimum yield of 4.19t/ha was produced from a crop canopy of 16.8t/ha biomass that had an N content of 245kg N/ha.*
- *Applying a rate of 120 kg N/ha or higher had no additional effect on harvest biomass or accumulated N content of the canopy.*
- *Application N fertiliser had no influence on oil content and test weight.*
- *While there was variation in the Harvest Index from 0.26 to 0.22, the differences were not statistically different.*
- *Water use efficiency was 9.7 kg/mm. Nitrogen use efficiency was 58.5kg N/t of grain.*

Nitrogen (N) fertiliser was applied as 50:50 2 splits at 6 leaf and late cabbage (Table 1).

Table 1. Canopy measurements – NDVI, dry matter (DM using predicted SAGI values) and accumulated plant N at early flowering (12 August) and harvest (dry matter assessments were taken on 30 October)

Treatments								
	24 June	12 July	Early Flowering			Harvest*		
Rate of Applied N	NDVI	NDVI	DM (t/ha)	Accumulated N (kg N/ha)		DM (t/ha)	Accumulated N (kg N/ha)	
0 kg N/ha	0.83	0.83	3.81	75.5	c	11.7 a	169.9	d
80 kg N/ha	0.82	0.84	4.57	125.4	b	14.7 ab	208.3	c
120 kg N/ha	0.83	0.84	5.13	162.4	ab	16.9 b	245.1	ab
160 kg N/ha	0.82	0.85	4.99	168.9	a	16.7 b	230.8	bc
200 kg N/ha	0.81	0.84	4.77	157.9	ab	16.8 b	261.4	ab
240 kg N/ha	0.82	0.83	4.93	162.4	ab	15.7 b	271.0	a
280 kg N/ha	0.82	0.83	5.16	172.5	a	16.8 b	255.5	ab
320 kg N/ha	0.83	0.84	5.73	192.1	a	17.2 b	267.1	a

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P value	0.100	0.560	0.121	<0.001	0.002	<0.001
LSD	ns	ns	ns	39.8	2.36	36.0
cv%	1.3	1.6	16.4	17.8	10.8	10.2

* Samples for analysis were taken at windrowing timing rather than at grain harvest

Early season soil N was 108.6 kg N/ha (0-60cm) from cores taken 14 days after the trial was irrigated up. This appears to have been sufficient N to allow even canopy development early in the season as indicated by the lack of difference in the NDVI measured on 12 July. Differences in biomass and the accumulated N were present at early flowering where the two lower rates of applied N produced lower totals. Rates of 120 kg N/ha or higher produced no difference in biomass or accumulated N. None of the treatments reached 7 t DM/ha biomass target at early flowering, with a grand mean of 4.89 t/ha.

Biomass at harvest followed a similar trend where the ‘0 kg N/ha’ treatment had the lowest biomass, followed by the ’80 kg N/ha and then no statistical difference in the higher rates.

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Table 2. Yield and grain quality

Treatment	Yield (t/ha)	Oil (%)	Test Weight (kg/hl)	Harvest Index
0 kg N/ha	2.78 c	46.7	67.8	0.22
80 kg N/ha	3.90 b	49.1	67.9	0.26
120 kg N/ha	4.19 ab	46.8	68.7	0.24
160 kg N/ha	4.19 ab	48.6	68.2	0.23
200 kg N/ha	4.14 ab	48.2	68.1	0.24
240 kg N/ha	4.45 ab	48.1	68.6	0.27
280 kg N/ha	4.26 ab	47.8	68.3	0.23
320 kg N/ha	4.36 ab	45.7	68.1	0.24
P Val	<0.001	0.770	0.200	0.750
LSD	0.51	NS	NS	NS
cv%	8.6	6.4	0.7	16.4

Highest yield grain was from 240 kg N/ha treatment, but this was not significantly different from the '120 kg N/ha' or higher N treatment yields.

Trial mean yield was 4.03t/ha. WUE was 9.7 kg/mm. Nitrogen use efficiency was 57 kg N/t based on the assumption that the 120 kg N/ha treatment resulted in the maximum yield.

While there were differences in the Harvest Index, these were not statistically significant.

Higher N application did not result in differences in grain quality.

SAGI statistical analysis (Predicted values for Yield, Harvest dry matter, test weight and oil content)

The following statistical analysis of key harvest assessments has been carried out by SAGI. This analysis uses spatial statistical analysis to refine predicted values for key assessment values.

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Table 1: Harvest Traits for the Treatments

Treatment	Grain Yield (t/ha)	Test Weight (kg/hL)	Harvest DM (t/ha)	Oil (%)
0	2.91 ± 0.19 - a	67.92 ± 0.28 -	11.7 ± 0.85 - a	46.88 ± 1.24 -
80	3.9 ± 0.19 - b	67.92 ± 0.28 -	14.68 ± 0.84 - ab	49.9 ± 1.19 -
120	4.09 ± 0.19 - b	68.61 ± 0.28 -	16.85 ± 0.84 - b	45.1 ± 1.2 -
160	4.17 ± 0.19 - b	68.15 ± 0.28 -	16.66 ± 0.84 - b	49.87 ± 1.18 -
200	4.05 ± 0.19 - b	68.08 ± 0.28 -	16.84 ± 0.84 - b	47.23 ± 1.21 -
240	4.37 ± 0.19 - b	68.52 ± 0.28 -	15.71 ± 0.83 - b	48.97 ± 1.14 -
280	4.14 ± 0.19 - b	68.31 ± 0.28 -	16.82 ± 0.84 - b	47.66 ± 1.17 -
320	4.18 ± 0.2 - b	68.1 ± 0.28 -	17.15 ± 0.85 - b	45.61 ± 1.23 -

Note: values expressed as mean ± standard error of prediction
- no subscripts relevant for this response

A summary of the experiment statistics is below:

Table 2: Key statistics for each response analysed

Statistic	Grain Yield (t/ha)	Test Weight (kg/hL)	Harvest DM (t/ha)	Oil (%)
LSD	0.432	0.626	2.363	3.609
Mean	4.000	68.200	15.800	47.700
Treatment_p-value	0.000	0.270	0.002	0.089
CV	15.608	0.886	15.149	5.920

Trial 3. Nitrogen Efficiency Trial – Nitrogen Timing Trial

Project Objective: To assess whether the optimum timing for applied N interacts with N rate in canola

Location: Kerang, Victoria
Sown: 23rd April 2021
Harvested: 24th November 2021
FAR Code: ICC C21-04-2
Cultivar: 45Y28 RR
Rotation position: Wheaten Hay (2020), Dryland vetch/brown manure (2019), Durum wheat (2018)
Soil Type: Neutral medium grey clay
Irrigation: Surface irrigation. Pre-irrigation in autumn plus 2 spring irrigations totalling 340mm (3.4 ML/ha)
GSR: April-October 160mm. Total water available 500mm

Key Messages:

- *There was no interaction between N rate and N timing in this trial on the RR hybrid 45Y28 indicating that yield responses to N rate were the same irrespective of timing.*
- *Accumulated N in the canopy at harvest indicated that optimum yields were achieved with crop canopies containing no more 268 kg N/ha. The unfertilised contained 180N.*

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