

Timing of Nitrogen for Canola Grown in the Medium Rainfall Areas of Western Australia



Department of
Agriculture and Food



Sally Sprigg, Research Officer and Mark Seymour, Senior Research Officer, DAFWA

Key Messages

- There were significant differences in grain yield (GY) between treatments (N kg/ha and timing), however, GY was particularly low in all treatments.
- Total nitrogen (N) increased GY significantly up to 30kg N/ha.
- Canola oil percentage decreased as N rate increased. High rates of N reduced oil significantly.
- Applying N late (12 weeks after sowing (WAS) reduced canola oil percentage, however, not significantly.
- Gross margins decreased as N rates increased, but all gross margins (GM) were negative due to poor GY. Sturt had better gross margins than Pioneer 43Y23RR due to the higher seed costs associated with RR seed.
- Pioneer 43Y23RR produced higher GY at all rates and timings of applied N other than 10N seeding and 20N 12WAS.

Aim

To investigate the N rate and time of application response of canola varieties to yield and oil content of Triazine tolerant (TT) and Roundup Ready (RR) hybrids in comparison with open-pollinated (OP) types to:

1. Provide growers in lower rainfall environments with guidelines on times of application to maximise grain and oil yields.
2. Determine if the management of hybrid canola nutrition is different to that of open pollinated varieties due to different responses to N rates and timing.

Background

In 2011 DAFWA conducted N management of hybrid and OP canola in the low rainfall WA mallee. In that trial it appeared hybrids continued to respond to N in terms of GY and \$/ha compared to OP varieties in both TT and RR technologies. Hybrids at rates of N below 25kg N/ha produced equal or better yields than OP varieties at higher rates. This opened up the idea of using the improved genetics of hybrids with low rates of N near seeding, watching the season and applying more N as the season allows.

As part of this project, trials were conducted in 2013 across several locations. The following general conclusions were drawn:

- It is important to assess the N status and ensure canola is not over fertilised (in low rainfall areas), as the reduction in oil content with increasing N could lead to large discounts.
- There exists opportunities to delay making N decisions for canola in low rainfall conditions.

Trial Details

Property	Wongan Hills Research Station				
Plot size & replication	22m x 1.54m x 3 replications				
Soil type	Brown sandy earth (with gravel)				
Soil pH (CaCl₂)	0-10cm: 6.4	10-20cm: 5.3	20-30cm: 5.3	30-40cm: 6.0	40-50cm: 6.8
EC (dS/m)	0-10cm: 0.088	10-20cm: 0.069	20-30cm: 0.057	30-40cm: 0.058	40-50cm: 0.098
Paddock rotation	2010: barley, 2011: pasture, 2012: pasture, 2013: wheat				
Variety	Sturt and Pioneer 43Y23RR				
Sowing date	13/05/2014				
Seeding rate	2.4 kg/ha Sturt and 1.5 kg/ha Pioneer 43Y23RR				
Fertiliser	13/05/2014: 65 kg/ha Big Phos banded, 22 kg/ha Urea top-dressed 15/07/2014: Urea (8 wk treatments, applied at 9 WAS) 05/08/2014: Urea (12 wk treatments)				
Herbicides & Insecticides	10/05/2014: 1.5 L/ha Roundup 13/05/2014: 100 mL/ha Bifenthrin, 1.5 L/ha Trifluralin, 2L/ha Spray.Seed 250 27/05/2014: 900 g/ha Roundup Ready on RR treatments 05/06/2014: 0.85 mL/ha Dimethoate 10/06/2014: 1% Spray Oil, 2.2 kg/ha Atrazine on TT treatments, 300 mL/ha Alpha Cypermethrin				
Harvest date	27/10/2014				
Growing Season Rainfall	276mm				

22 Treatments: 2 Cultivars (TT-OP = Sturt and RR – Hybrid = Pioneer 43Y23RR).

Results

Table 1: Rainfall (mm) at Wongan Hills 2014, compared to Wongan Research Station historical long term average (1937-2013). NB: Rainfall records incomplete from Wongan Hills Research Station in 2014, therefore Wongan Hills records were used.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2013	3.2	2	3.3	26.2	44.4	27.2	68.8	25.6	41.4	8.7	30.2	0	281
2014	11.6	1.4	6	24.8	59.2	29.4	80.6	38.6	49.8	18.4	36.4	0	356.2
Mean	15.2	15.3	18.6	22.1	47.4	61.8	62.2	47.6	27.7	18.5	12.6	9.6	354.1

Table 2: Estimates of available water.

Year	Pre-sowing (mm)	Stored pre-sowing (mm) estimate	Growing Season Rainfall (GSR, mm)	GSR + (mm)
2013	34.7	29.2	216.1	245.3
2014	43.8	31.1	276	307.1
Mean	71.2	39	270.3	309.3

Table 3: Water limited yield calculations.

GSR + stored water minus 1/3 loss	204.7mm
Potential yield (10 kg/ha/mm)	2047 kg/ha
Target yield = 75% of Potential Yield	1535 kg/ha

Sturt and Pioneer 43Y23RR responded in the same way to applied N in this trial at Wongan Hills in 2014. The grain yield of both varieties increased with total applied N up to 30kg N/ha (Table 4). Pioneer 43Y23RR produced higher grain yields at all rates and timings of applied N other than 10N at seeding and 20N 12WAS. For all rates of applied N, the timing of application had no effect on grain yield. Therefore 30kg N/ha could be applied either 30N in 8 weeks (10N at seeding and 20N at 8WAS) or 10N at seeding and 20N 12WAS with similar responses in grain yield.

Table 4: Grain yield (kg/ha) of Sturt TT and Pioneer 43Y23RR canola varieties, shown with average grain yield across varieties, for various N application rates and timings at Wongan Hills Research Station in 2014.

Nitrogen rate (kg/ha) & timing	Sturt (kg/ha)	Pioneer 43Y23RR (kg/ha)	Mean (kg/ha)
Nil	611	713	662
10N seeding	605	667	636
30N in 8 weeks	694	781	737.5
50N in 8 weeks	703	792	747.5
70N in 8 weeks	741	764	752.5
10N seeding and 20N 12WAS	731	667	699
10N seeding and 40N 12WAS	676	796	736
10N seeding and 60N 12WAS	692	747	719.5
30N in 8 weeks and 10N 12WAS	683	785	734
30N in 8 weeks and 20N 12WAS	703	708	705.5
30N in 8 weeks and 40N 12WAS	694	750	722
Mean	685	743	714

LSD = 67.

While N rate increased grain yield up to 30 kg N/ha (significant difference), N had a negative effect on canola oil percentage. Oil percentage decreased as N increased (Figure 1). Oil percentage dropped approximately 0.03% for every additional unit of N applied up to 70kg N/ha. In the majority of treatments timing also had an effect on oil percentage. Oil percentage reduced at the later timings of N, however, this only occurred when the total N rate applied over the duration of the season was 30kg N/ha and higher.

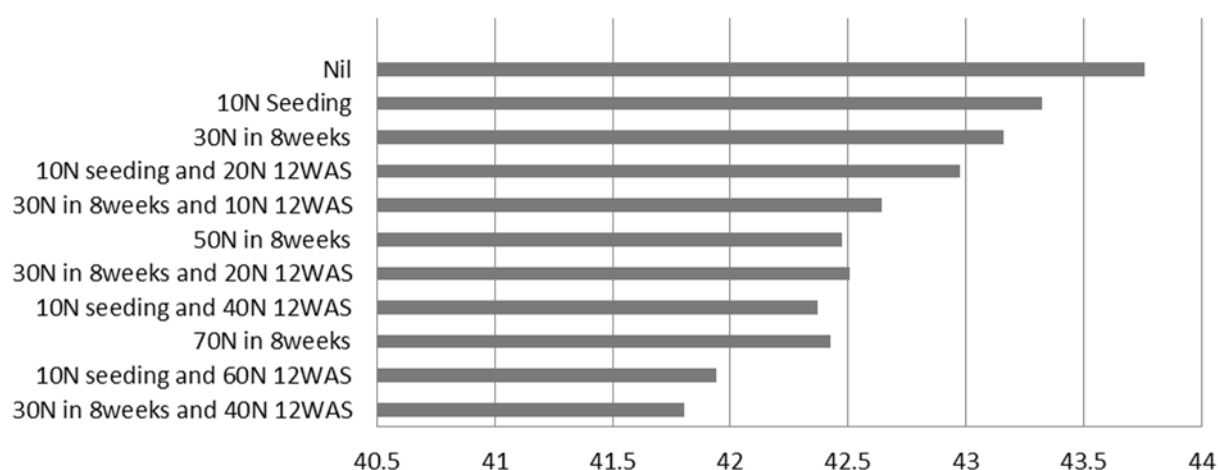


Figure 1: Effect of rate and timing of N on percentage of oil in canola at Wongan Hills Research Station in 2014 (mean of two varieties). LSD (P=0.7514).

Economic Analysis

Gross margin analysis indicates that there was no economic benefit in applying N at Wongan Hills in 2014, due to very low grain yields and the price of input costs, in particular seed costs for 43Y23RR seed. Gross margins decreased as N rates increased (Figure 2).

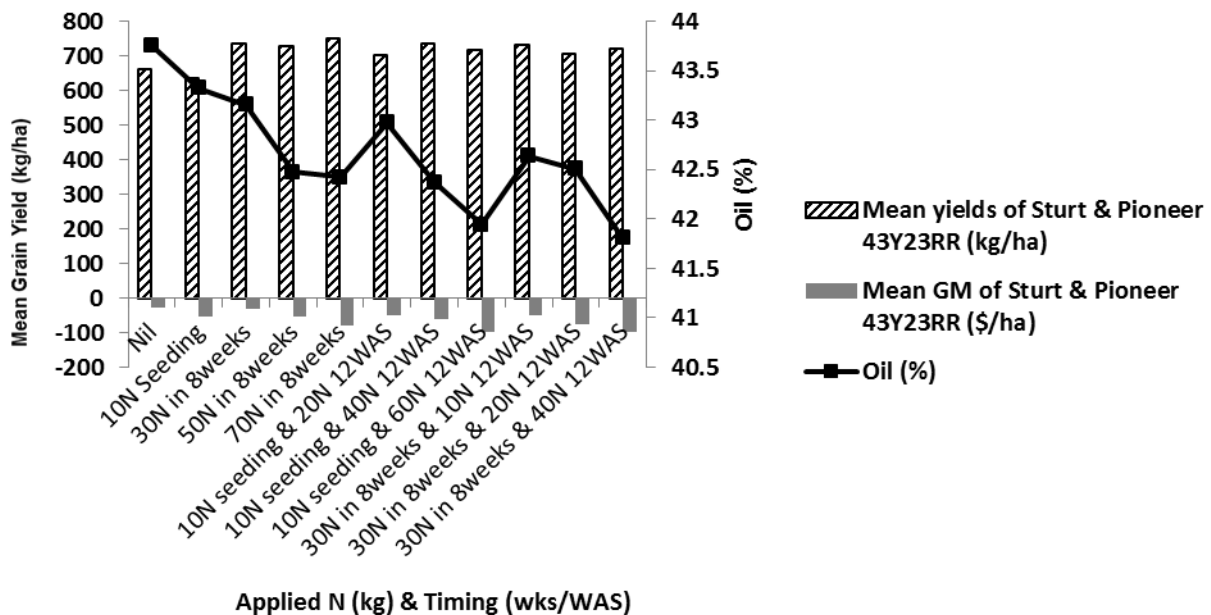


Figure 2: Effect of rate of N on grain yield (LSD = 66.8 kg/ha), oil (LSD = 0.7514%) and gross margin (LSD \$33.31/ha) of canola at Wongan Hills Research Station in 2014 (mean of two varieties).

Comments

Findings in response to N on grain and oil in 2014 are similar to those findings seen at Wongan Hills in 2013. At this trial in 2014 in the majority of treatments, canola has responded to N up to 12 WAS.

At this trial at the Wongan Hills Research Station in 2014 oil decreased quicker than grain yield increased in response to N. Now that markets do not have an oil limit, it is important for canola growers to have good working knowledge of soil N, target yield and the expected response of oil and yield, in order for them to maximise economic returns. We recommend people use tools to such as the app: *N broad acre* to assist with N management decisions.

Acknowledgements

GRDC and DAFWA for funding this project.

Mark Seymour, Senior Research Officer, Bob French, Senior Research Officer, Raj Malik, Research Officer, and Martin Harries, Research Officer, DAFWA.

Shari Dougall and Bruce Thorpe, DAFWA Wongan Hills Research Station Unit (RSU).

Laurie Maiolo, Technical Officer, DAFWA.

Paper reviewed by: Bob French, Senior Research Officer, DAFWA

Contact

Sally Sprigg, DAFWA

sally.sprigg@agric.wa.gov.au

(08) 9081 3153