

Timing of Nitrogen in Low Rainfall for Canola Yield, Oil and Returns

Mark Seymour and Bob French, Department of Agriculture and Food, WA

Key Messages

- Canola grain yield increased with nitrogen application up to 50 kg N/ha.
- Timing of nitrogen application had no effect on grain yield.
- Canola oil content decreased as nitrogen rate increased.
- Applying nitrogen late (12 weeks after sowing) reduced oil content, but only if total N applied was 50 kg/ha.
- Overall gross margins were similar at all rates of applied nitrogen or timing of nitrogen application - due to the decline of oil content as nitrogen increased.
- Hyola 404RR produced higher yields, oil and gross margins than CB Telfer TT - at all rates and timings of nitrogen application.

Aim

To investigate the nitrogen rate and time of application response of canola varieties to yield and oil content of TT and RR hybrids in comparison with open-pollinated types to:

1. Provide growers in lower rainfall environments with guidelines on optimal nitrogen rates and 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 general, as long as nitrogen is applied within 8 weeks of sowing, there is no yield penalty.

How canola responds to nitrogen applied later than 8 weeks has not been widely researched. Similarly how new generation canola such as RoundupReady (RR) hybrids respond to nitrogen has not been widely tested, particularly in low and medium rainfall areas. This trial is one of a series of 13 timing of nitrogen experiments DAFWA conducted in 2013.

Trial Details

Property	G & H Pearse Pty Ltd, west Wubin
Plot size & replication	20m x 1.54m x 3 replicates
Soil type	Sandy loam
Soil pH (CaCl₂)	0-10 cm: 4.7 10-20cm: 5.1
EC (dS/m)	0-10 cm: 0.085
Organic carbon	0.47%
Paddock rotation	2010: lupin, 2011: wheat, 2012: wheat
Variety	CB Telfer TT or Hyola 404RR
Seeding date	09/05/13
Seeding rate	Target density 30 plants/m ² 2.4 kg/ha (CB Telfer TT, assumed 50% field establishment) 3.0 kg/ha (Hyola 404RR, assumed 65% field establishment)
Fertiliser	09/05/13: 65 kg/ha BigPhos treated with Impact at sowing 05/06/13: 4 week N treatments topdressed 25/06/13: 120 kg/ha Muriate of Potash 03/07/13: 8 week N treatments topdressed
Herbicides	09/05/13: 2 L/ha Spray.Seed 250, 1.5 L/ha Trifluralin 14/05/13: 1.1 kg/ha Atrazine on TT plots 04/06/13: 900 mL/ha Roundup Ready on RR plots 17/06/13: 1.1 kg/ha Atrazine on TT plots 27/06/13: 500 mL/ha Select, 0.1% Hasten
Growing Season Rainfall	228mm

Trial Design

28 treatments: 2 Cultivars (TT– OP = CB Telfer TT and RR - Hybrid = Hyola 404RR) x 14 N treatments (see Table 4)

Table 1: Rainfall (mm) at the 2013 Main Trial Site, west Wubin in 2012 and 2013, compared to the Dalwallinu long term average (1974-2012).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2012	29	11	0	3	8	69	13	43	41	5	51	24	294
2013	8	2	36	4	53	6	50	61	39	15			273
Mean	17	17	26	20	48	48	56	46	26	18	14	18	353

Table 2: Estimates of available water.

Year	Pre-sowing (mm)	Stored pre sowing (mm), estimate	Growing season rainfall (GSR, mm)	GSR + store (mm)
2012	42	10	177	187
2013	124	30	224	255
Mean	109	38	242	280

Table 3: Water limited yield calculations.

GSR + stored water minus 1/3 loss	170mm
Potential yield (10 kg/ha/mm)	1,700 kg/ha
Target yield = 75% of Potential Yield	1,275 kg/ha

Results

Both CB Telfer TT and Hyola 404RR responded to nitrogen in the same way west of Wubin in 2013. The yield of both varieties increased in response to nitrogen application up to 50 kg N/ha (Table 4). Hyola 404RR produced higher yields (Table 4), oil (mean 50% vs. 46%) and gross margins (mean \$426/ha vs. \$238/ha) at all rates of nitrogen, than CB Telfer TT. For any given rate of applied nitrogen, the timing of the nitrogen application had no effect on grain yield. Thus 50 kg N/ha could be applied either at 4 weeks after sowing (WAS), 8 weeks after sowing, 12 weeks after sowing or in split applications with similar grain yield responses.

Table 4: Grain yield (t/ha) of both CB Telfer TT and Hyola 404RR canola varieties, also shown with average yield across varieties, for various nitrogen application rates and timings at west Wubin in 2013. 0 weeks after seeding indicates application was done at sowing. Split applications were distributed evenly to equal the total rate (unless otherwise noted).

Nitrogen rate (kg/ha)	Nitrogen applied (Weeks after seeding)	CB Telfer TT (t/ha)	Hyola 404RR (t/ha)	Mean (t/ha)
0	0	0.69	1.14	0.92
25	0	0.78	1.27	1.02
25	4	0.82	1.26	1.04
25	8	0.87	1.22	1.05
25	12	0.74	1.36	1.05
50	0	0.89	1.37	1.13
50	4	0.83	1.41	1.12
50	8	0.86	1.39	1.12
50	12	0.82	1.41	1.12
50	0 + 4	0.83	1.39	1.11
50	0 + 8	0.87	1.43	1.15
50	0 + 12	0.81	1.39	1.10
75*	0 + 4 + 8	1.00	1.38	1.19
100 [#]	0 + 4 + 8	0.94	1.45	1.19
Mean		0.84	1.35	1.09

*Split Application - 25N Seeding + 25N 4 Weeks after Seeding + 25N 8 Weeks after Seeding

Split Application - 25N Seeding + 50N 4 Weeks after Seeding + 25N 8 Weeks after Seeding

	P	I.s.d.
Variety	0.018	0.30
Nitrogen Treatment	<0.001	0.10
Variety Nitrogen Treatment	0.279	0.23
		0.15 (same variety)
CV%	8	

Although nitrogen increased the yield of canola, it had a larger negative effect on oil (Figure 2). Treatments without applied nitrogen averaged 50% oil and oil percentage decreased as nitrogen was applied. The oil dropped approximately 0.04% for every unit of nitrogen applied up to 75kg N/ha. Not only did the rate of nitrogen reduce oil, but the timing of nitrogen also had some effect on percentage oil. Applying nitrogen late at 12WAS reduced oil, but only where the total rate of nitrogen applied over the season was high (50kg N/ha). If the total rate of nitrogen applied over the season was 25kg N/ha then applying nitrogen at 12 weeks had the same effect on oil as applying nitrogen earlier in the year at seeding or 4WAS or 8WAS.

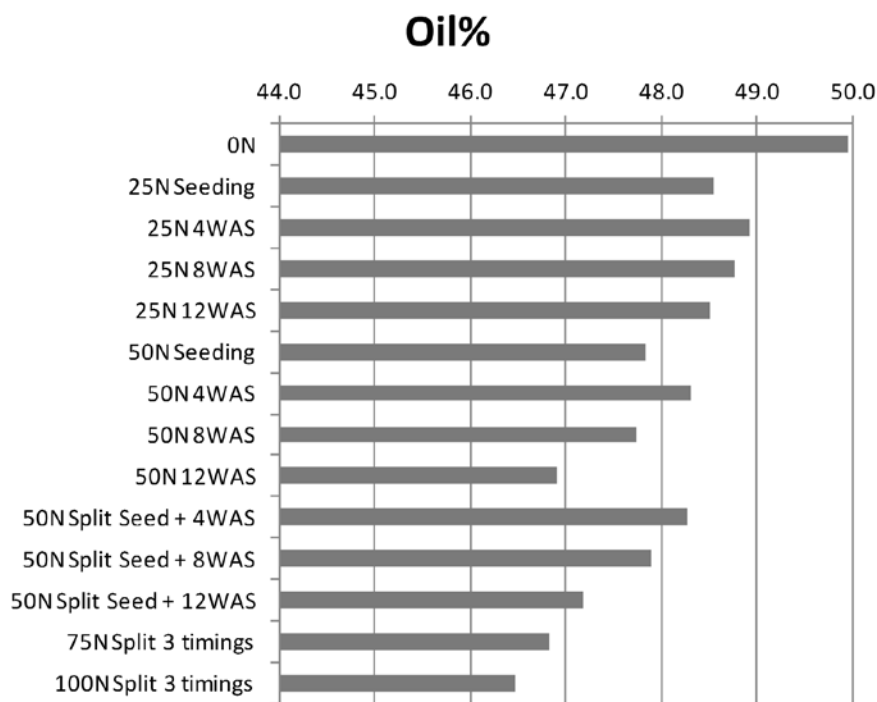


Figure 1: Effect of rate and timing of nitrogen on percentage oil in canola west of Wubin in 2013 (mean of two varieties). LSD ($P = 0.05$) for Nitrogen rate - 0.3%, Nitrogen treatment - 0.7% and interaction - 0.7%.

There was no net economic gain in applying nitrogen west of Wubin in 2013, since the lost value from the reduced oil content exceeded the value of any increased yield. Similarly timing of nitrogen had no overall effect on gross margins.

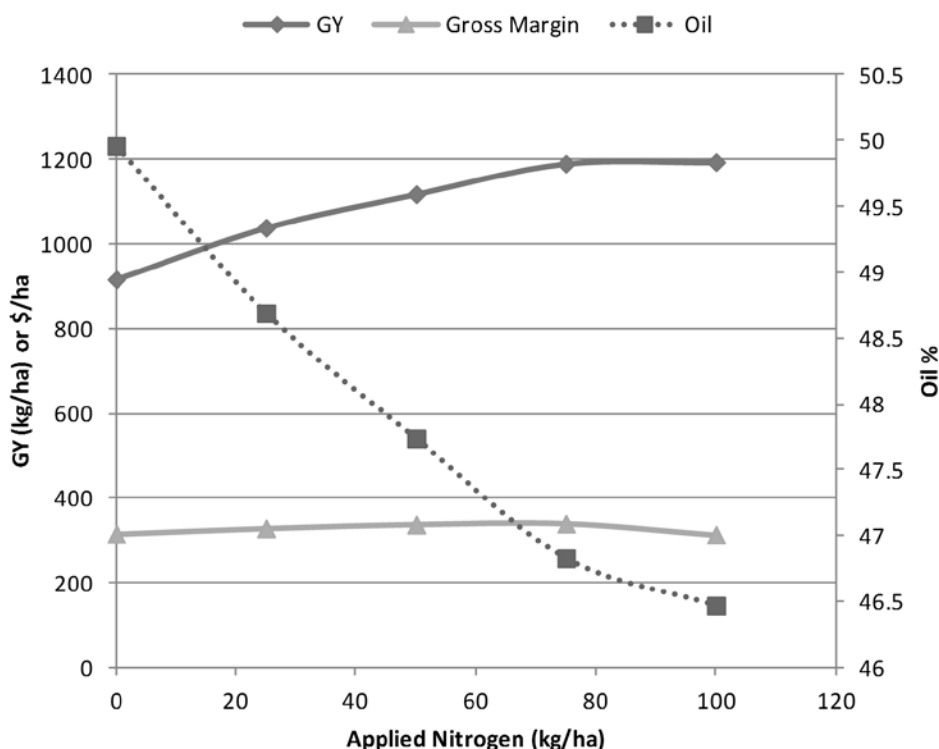


Figure 2: Effect of rate of nitrogen on grain yield (GY, LSD = 76 kg/ha), oil (LSD = 0.3%) and gross margins (LSD = \$21/ha) of canola west of Wubin in 2013 (mean of two varieties).

Comments

Previous field trials have shown canola to respond to nitrogen up to 8 weeks after sowing. In this trial series in 2013 we have shown in a number of instances that canola responds to nitrogen up to 12 weeks after sowing. We will repeat these trials in 2014 to ensure we are not just seeing the response to a kind spring.

In this trial west of Wubin in 2013 oil decreased at a faster rate than grain yield increased in response to nitrogen. Over recent years there has been a shift to markets with no oil limit. Therefore it will become increasingly important to have a good handle of soil nitrogen, target yield and the likely response of both oil and yield of canola if farmers are to maximise returns. We recommend people actively use tools like SYN to help with their nitrogen management.

Acknowledgements

GRDC and DAFWA for funding this experimental series.
Shari Dougall and Bruce Thorpe, DAFWA, Wongan Hills RSU
Andy Sutherland and Allen Randall, DAFWA, South Perth

Paper reviewed by: Jackie Bucat, Development Officer, DAFWA

Contact

Mark Seymour, DAFWA
mark.seymour@agric.wa.gov.au