Canola nitrogen management

Brianna Guidera and Sarah Noack; Hart Field-Site Group

Key Findings

- This season, the application of 100 kg N/ha at seeding provided the highest grain yields. Rates above 100 kg N/ha did not result in any yield benefit.
- Nitrogen application rate had a negative effect on oil content decreasing oil on average by 0.03% per kg applied N.
- Grain yield and oil content responses from spilt applications of N were variable in both trial years (2017 and 2020) due to seasonal conditions.

Why do the trial?

Nitrogen (N) management decisions for the best dollar return can vary from year to year and are primarily driven by seasonal conditions and attitude to risk. “How much N should be applied?” and “When should it be applied?” are two of the most challenging questions for growers. One approach to address these questions is to use an N budget, which focuses on target crop yield and grain quality. The aim of the trial was to analyse the outcomes of simple N management strategies (rate and timing) on grain yield and oil content in canola.

How was it done?

Plot size	2.0 m x 10.0 m	**Fertiliser**	DAP (18:20) + 1% Zn + Impact @ 80 kg/ha (14 kg N/ha)
Seeding date	May 5, 2020		In-season application rates of N, supplied as urea, listed in Table 1 (below).
Harvest date	November 4, 2020		
Location	Hart, SA		

The trial was a randomised complete block design using 44Y90 canola, with three replicates of five N treatments. The trial was managed with the application of pesticides to ensure a weed, insect and disease-free canopy.

Pre-seeding soil tests were taken on April 24 at depths of 0-10, 10-30 and 30-60 cm. Total available soil N was 53 kg N/ha. In-season Normalised Difference Vegetation Index (NDVI) measurements were taken on each plot to assess leaf greenness and biomass. Crop yield and oil content (%) and 1000 grain weight were measured for all plots. Daily rainfall at the Hart site was also recorded (Figure 1).

Table 5. Seeding and in-season nitrogen treatments

Treatment	Application rates/timings
1	Nil
2	100 kg N/ha @ seeding
3	50 kg N/ha @ seeding + 50 kg N/ha @ rosette
4	50 kg N/ha @ seeding + 50 kg N/ha @ rosette + 100 kg N/ha @ early flowering
5	200 kg N/ha @ early flowering

Rosette: Applied July 10
Early flowering: Applied August 5

Results and discussion

Biomass

Nitrogen management had a variable effect on NDVI during the growing season. Differences in NDVI were only present after the rosette N application (July 10) as measured on July 29 (Figure 2). Canola treated with 100 kg N/ha, both at seeding and across split applications, had the same NDVI response as plots treated with 200 kg N/ha across three split applications. Plots treated with 200 kg N/ha late in the season (early flowering August 5) had a lower NDVI response. This indicated that the crop was able to access the same amount of N from 100 kg/ha or 200 kg/ha this season. Despite Hart receiving above average annual and growing season rainfall this year, May, June and July were well below average and limited N uptake and biomass production early.

The NDVI for all treatments reached a peak in mid-July and then decreased in early August. This decrease in NDVI coincided with low rainfall in the preceding months (Figure 1) which resulted in a lack of N uptake and crop water stress. The NDVI increased again in early August after 28 mm of rainfall was received. At the last assessment the nil treatment had the lowest NDVI value, and the 50 kg N/ha at seeding and 50 kg N/ha at rosette application had the highest NDVI. All other treatments were greater than the nil but, not different to each other.

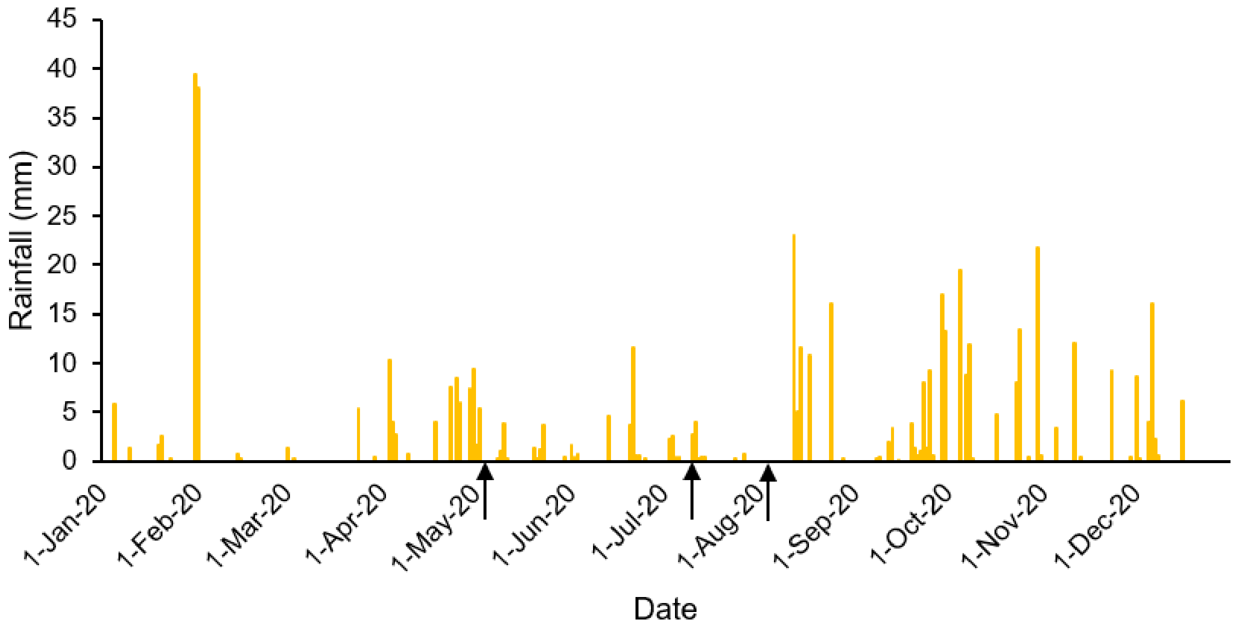

Figure 1. Daily rainfall at Hart in 2020. Black arrows indicate N fertiliser application dates.

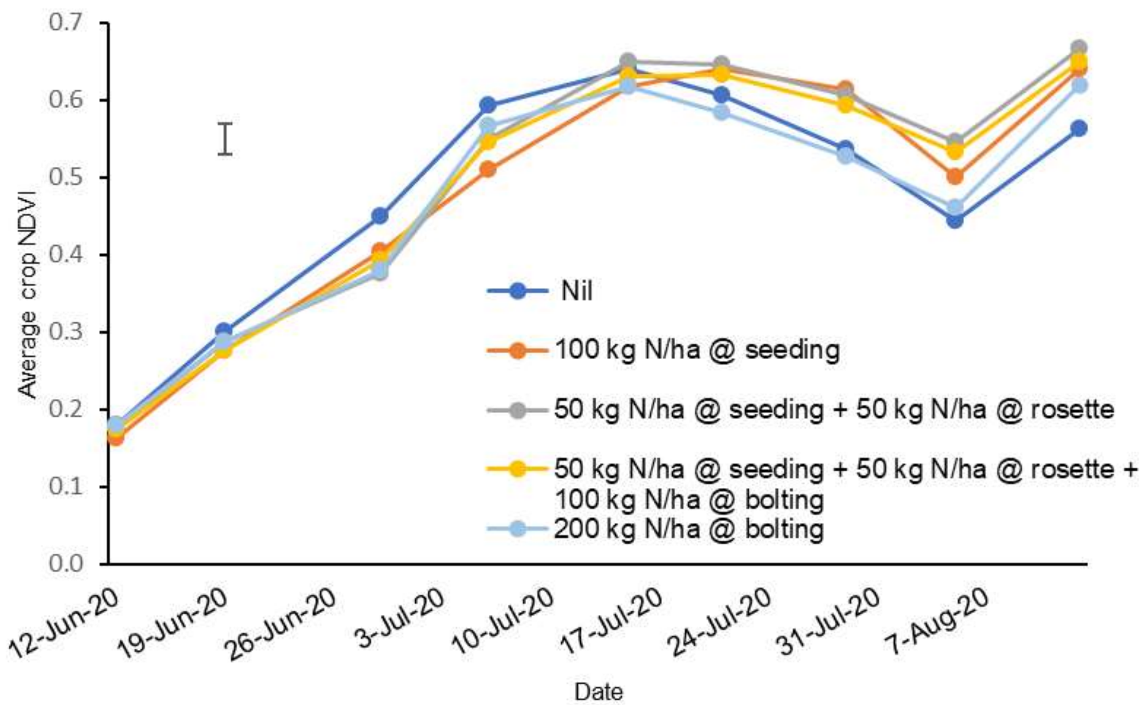

Figure 2. Crop biomass response to N applications at Hart in 2020. LSD (P≤0.05) = 0.04

Grain yield

Applying 100 kg N/ha at seeding was sufficient to produce the highest canola grain yield (Table 2) at Hart in 2020. This treatment on average yielded 0.18 t/ha higher than the nil treatment and was not different to applying 200 kg N/ha at early flowering, or to 200 kg N/ha applied across three split applications. Results from the same trial in 2017 also found applying 100 kg N/ha at seeding produced the highest yield (Table 2). However, it should be noted the late N applications were completed at bolting in 2017 whereas due to lack of rainfall events, applications in 2020 were delayed until early flowering.

In both 2020 and to a larger extent in 2017 there were scenarios where grain yield penalties occurred from delayed in-season N applications. When comparing growing season rainfall (GSR) between the seasons, 2017 was drier than 2020 overall with 191 mm and 336 mm respectively. Despite higher rainfall in 2020 there were limited events which occurred immediately after seeding, rosette and early flowering N applications. Increasingly growers are delaying applying part of their fertiliser program to minimise the risk of bulky crops early and manage seasonal conditions. In this case splitting applications are useful and if crop demand is met growers can still achieve high yields.

Oil content and grain weight

Increasing N application rate had a negative effect on oil content. The nil treatment had the highest oil content, followed by plots treated with 100 kg N/ha (alone or split application) and then plots treated with 200 kg N/ha total (Table 2). Across both seasons the 100 kg N/ha treatments contained oil contents greater than 42% (oil content where a premium is paid). On average oil content was decreased by 0.03% per kg applied N (Figure 3). This N treatment effect is common in low-medium rainfall zones. Previous research has shown oil content may decrease by 0.02 to 0.08 % per kg applied N on average (Seymour et a. 2016; Brennan and Bolland 2007a). However, generally oil content is unaffected by N application timing, though split applications have been associated with reduced oil content in dry conditions (Seymour *et al.*2016). This is consistent with the findings in 2017 and 2020 at Hart where N rate had a bigger impact on oil content compared to N application timing.

Nitrogen rate and application timing had no significant effect on 1000 grain weight, which was 3.74 g on average (Table 2).

Table 6. Canola grain yield (t/ha) and quality results at Hart for 2017 and 2020. All results are presented as the average value within each treatment. Shaded grey values indicate the highest grain yield and oil content.

Nitrogen treatment	Grain yield (t/ha)	Oil content (%)	1000 seed weight (g)
2017 season (GSR 191 mm)			
Nil	1.07[a]	44.3[c]	
50 kg N/ha @ seeding + 50 kg N/ha @ rosette	1.31[b]	42.8[bc]	
50 kg N/ha @ seeding + 50 kg N/ha @ rosette + 100 kg N/ha @ bolting	1.31[b]	41.1[ab]	
100 kg N/ha @ seeding	1.40[bc]	43.9[c]	
200 kg N/ha @ bolting	1.52[c]	38.5[a]	
LSD (P≤0.05)	***0.2***	***2.7***	
2020 season (GSR 336 mm)			
Nil	0.55[a]	47.1[c]	3.8
50 kg N/ha @ seeding + 50 kg N/ha @ rosette	0.55[a]	43.2[b]	3.6
50 kg N/ha @ seeding + 50 kg N/ha @ rosette + 100 kg N/ha @ early flowering	0.62[ab]	41.3[a]	3.6
100 kg N/ha @ seeding	0.73[b]	43.2[b]	3.8
200 kg N/ha @ early flowering	0.77[b]	41.7[a]	3.9
LSD (P≤0.05)	***0.15***	***0.70***	*NS*

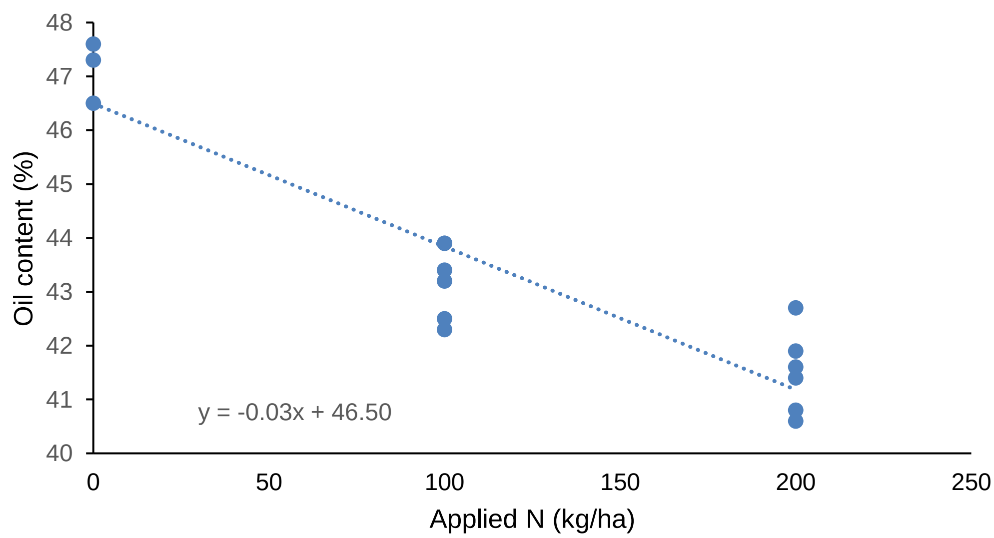

Figure 3. Canola oil content (%) response to total rate of applied N (kg/ha).

Summary

This report gives an example of how N management may affect canola grain yield and quality. The trials were conducted across two differing seasons which included prolong periods of dry which impacted crop N uptake. Overall application of 100 kg N/ha at seeding was sufficient to achieve the right balance between grain yield and oil content in these trials. The outcomes may have been quite different in a wet year. Economic factors such as current grain prices, cost of production and personal attitude to risk need to be accounted for to develop a nitrogen budget to estimate returns.

Acknowledgements

The Hart Field-Site Group would like to thank Pioneer® Seeds for donating the canola seed for the trial.

References

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