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# Effect of nitrogen rate on grain yield and grain oil concentration of canola— Canowindra 2014

Colin McMaster, Rob Dunkley NSW DPI, Cowra,  
Rohan Brill NSW DPI, Wagga Wagga and Don McCaffery  
NSW DPI, Orange

## Introduction

Advances in canola breeding (hybrid technology) have commonly led to grain yield increases of 0.30–0.60 t/ha across southern NSW. It is hypothesised that an increase in grain yield potential may also require additional N inputs to meet crop N demand.

The aim of this experiment was to evaluate the effect of nitrogen rate on grain yield and grain oil concentration of six canola varieties. The varieties used in this experiment were selected to cover a range of canola phenology and herbicide groups, and include open-pollinated and hybrid Clearfield, open-pollinated and hybrid triazine tolerant (TT), and conventional-herbicide specialty-oil hybrid.

## Site details

Location	Canowindra
Soil type	Red brown earth
Previous crop/s	Barley
Stubble management	Stubble retained
Sowing date	1 April 2014
Harvest date	13 November 2014
Fertiliser	80 kg/ha MAP
Soil pH <sub>Ca</sub>	6.4
Nitrogen	60 kg N/ha predrilled as anhydrous ammonium
Phosphorus	96 mg/kg (Colwell)
In-crop rainfall	192 mm

## Treatments

Six canola varieties	43C80 CL, 45Y88 CL, ATR-Gem, Hyola® 559TT, Hyola® 577CL, Victory V3002
Five nitrogen rates	0, 20, 40, 80 and 160 kg N/ha (pre-drilled urea)

\* Paddock had a basal application of 60 kg N/ha applied prior to sowing (as anhydrous ammonia).

## Results

### Grain yield

Grain yield was significantly affected by variety selection ( $P < 0.001$ ) and nitrogen rate ( $P = 0.0053$ ). The interaction between variety and N rate was not significant ( $P = 0.984$ ) in this experiment.

The highest yielding variety was 45Y88 CL with a 0.44 t/ha grain yield benefit over the lowest yielding variety ATR-Gem (*Figure 1*).

## Key findings

- Highest yielding variety was 45Y88 CL, 0.44 t/ha higher than the lowest yielding variety, ATR-Gem.
- There was no significant interaction between variety and N response.
- Hybrids were more N-use efficient than open-pollinated varieties.
- Soil N levels are likely to be lower following a hybrid canola compared to open-pollinated varieties.
- Nitrogen applied at 40 kg N/ha produced maximum grain yield with a 0.24 t/ha benefit over the Nil N rate.
- Oil concentration was reduced as N rate exceeded 40 kg N/ha.
- Victory V3002 had significantly higher oil concentration than other varieties.
- Total harvested oil was 181 kg/ha more with hybrids than open-pollinated varieties.

Grain yield increased by 0.24 t/ha with the addition of 40 kg N/ha (*Figure 2*). The higher N fertiliser rates of 80 and 160 kg N/ha did not further increase grain yield.

### Grain oil concentration (%)

Grain oil concentration was significantly affected by variety selection ( $P < 0.001$ ) and nitrogen fertiliser rate ( $P < 0.001$ ) (*Figure 3 and 4*). The interaction between variety and N rate ( $P = 0.114$ ) was not significant in this experiment.

Victory V3002 produced the highest grain oil concentration of 44.8%, which is 3.8 percentage points higher than the lowest grain oil concentration variety 45Y88 CL (41.0%).

Additional N fertiliser at rates of 80 kgN/ha and 160 kg N/ha reduced oil percentage points by 2.18 and 3.17 respectively compared to the 0 kg N/ha treatment.

### Harvest oil yield

The amount of oil removed per hectare was significantly affected by variety ( $P < 0.001$ ), however N rate ( $P = 0.251$ ) and the interaction between N rate and variety was not significant ( $P = 0.987$ ) (*Figure 5*).

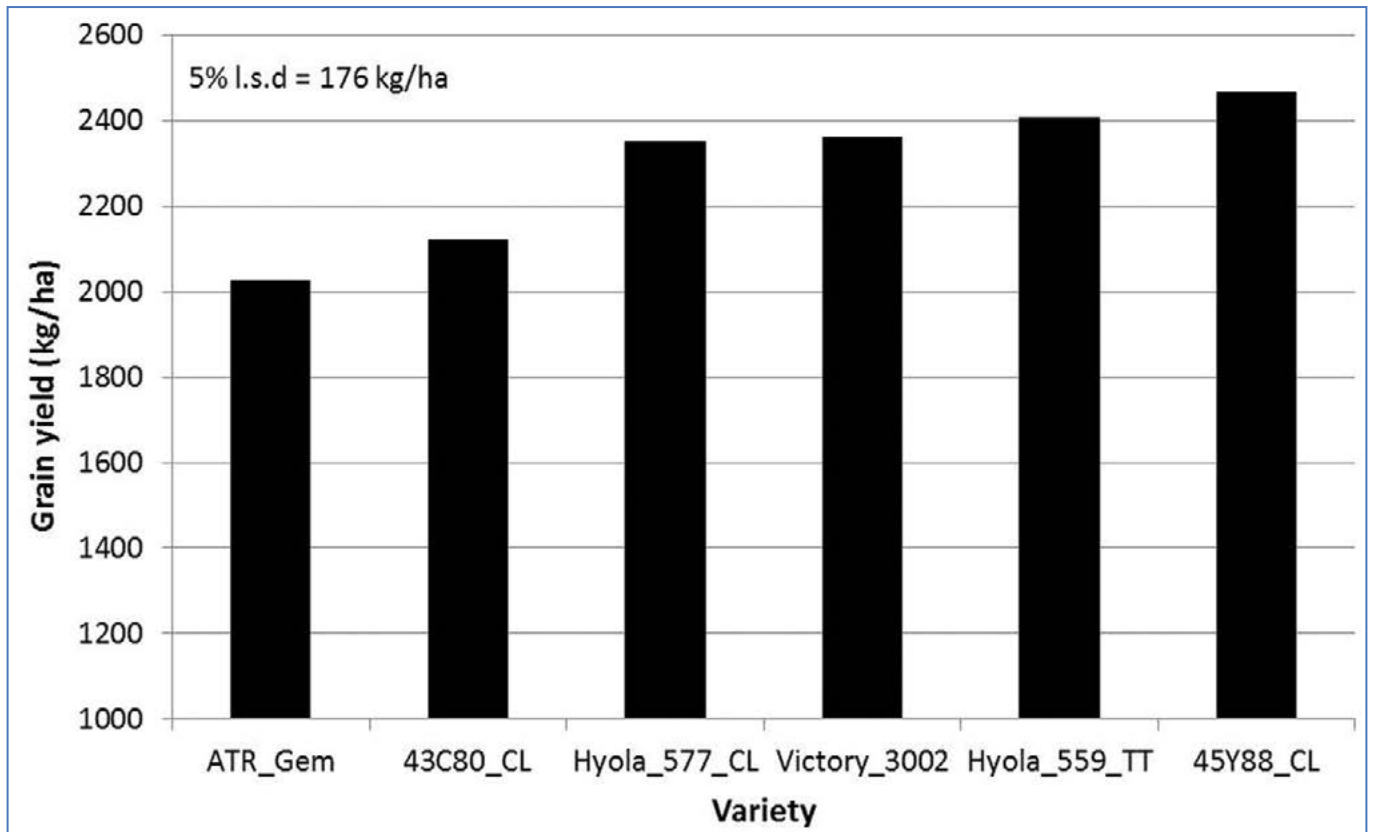


Figure 1: Grain yield of six canola varieties averaged across five nitrogen rates at Canowindra in 2014

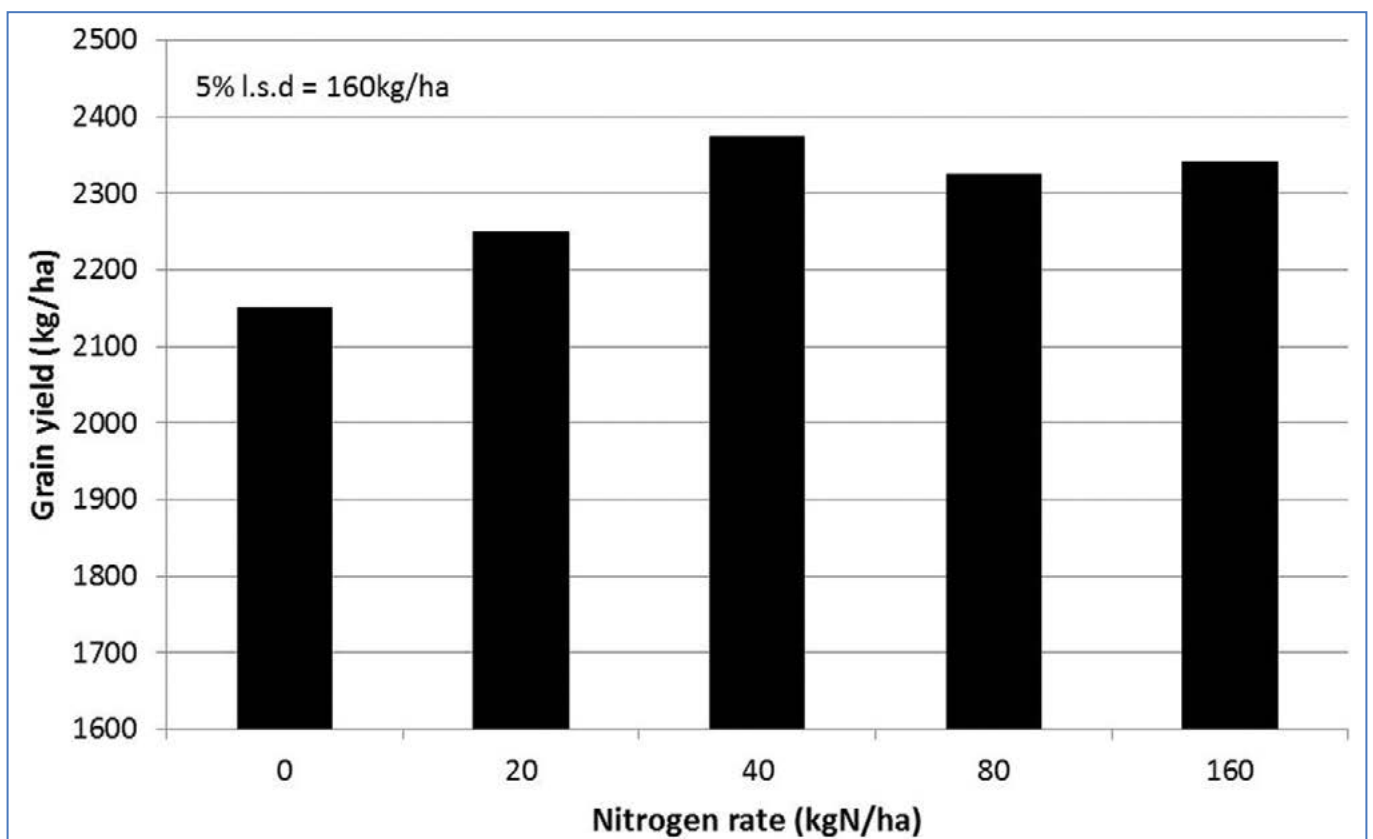


Figure 2: Grain yield benefit of five nitrogen fertiliser rates averaged across six canola varieties at Canowindra in 2014.

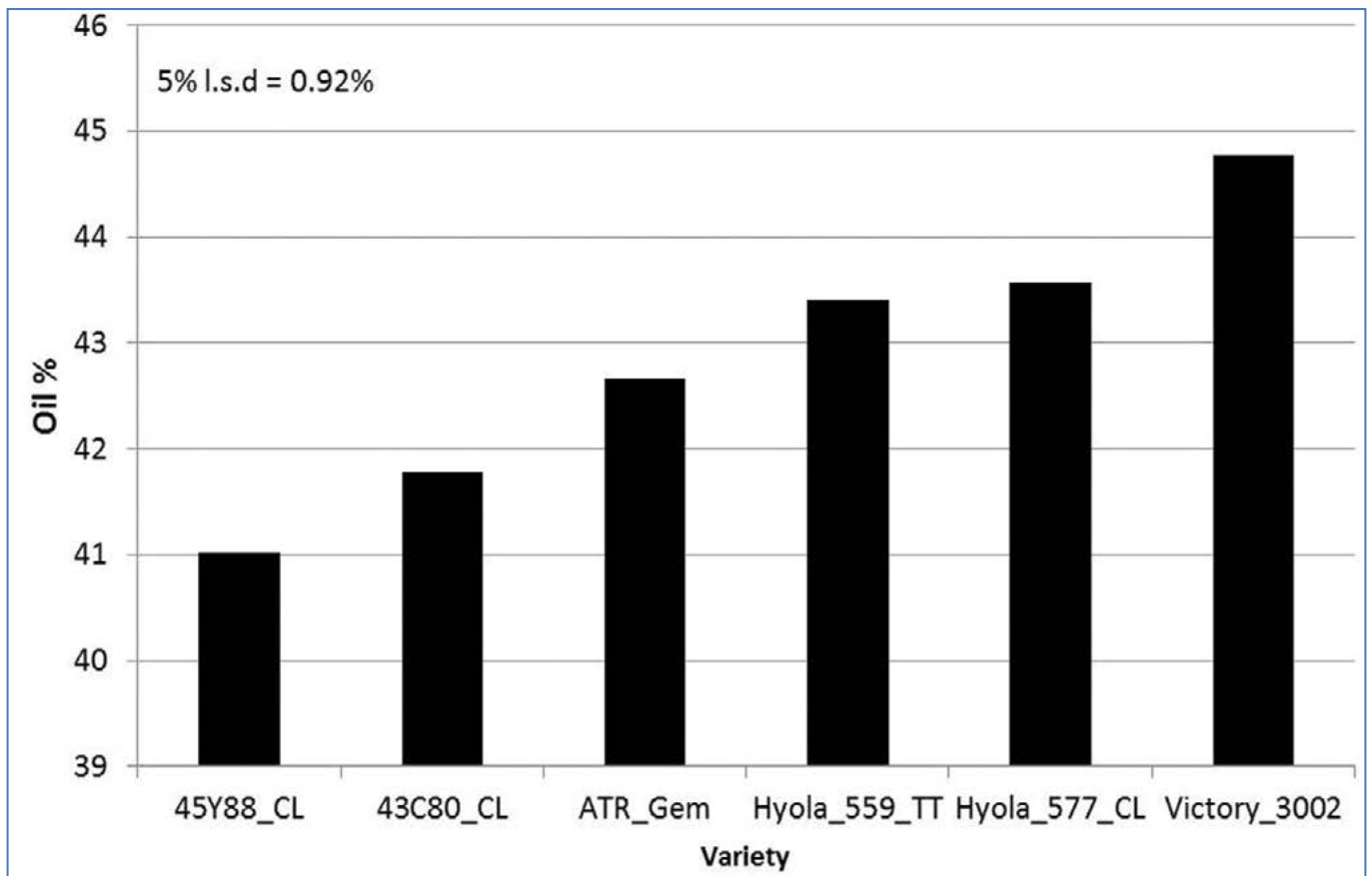


Figure 3: Grain oil concentration of six canola varieties averaged across five nitrogen rates at Canowindra in 2014.

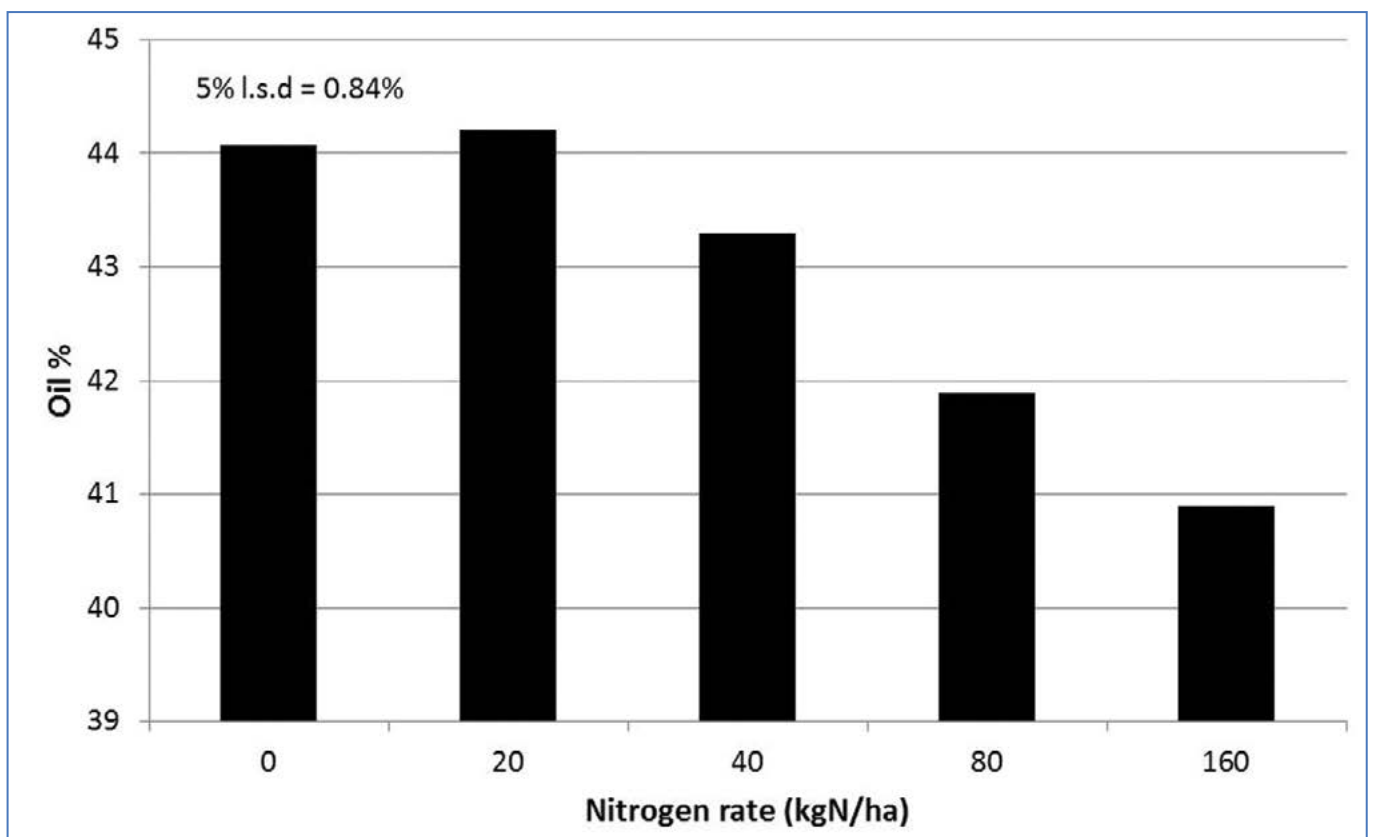


Figure 4: Grain oil concentration of five nitrogen rates averaged across six canola varieties at Canowindra in 2014.

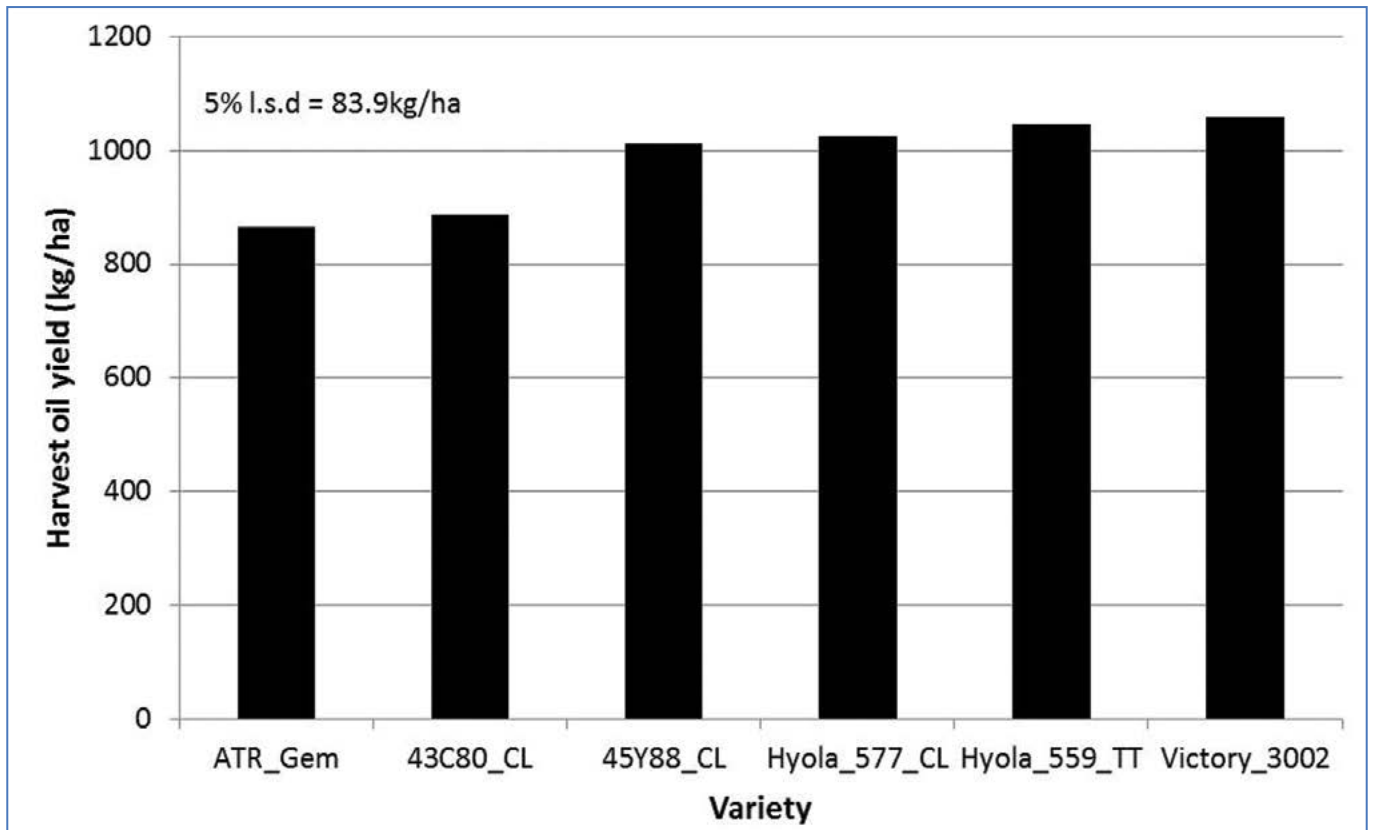


Figure 5: Harvest oil yield of six canola varieties averaged across five nitrogen rates in at Canowindra in 2014.

### Summary

There was a 0.44 t/ha grain yield benefit from selecting a Clearfield hybrid (45Y88 CL) over an open-pollinated TT variety (ATR-Gem) in this experiment.

Despite the grain yield response of the hybrid, there was no significant interaction between variety and applied nitrogen. This would suggest that hybrids are more N-use efficient than open-pollinated canola varieties and hence they are better scavengers of N. However this also means that soil N levels will be more depleted following a hybrid canola crop compared to an open-pollinated variety.

Interestingly, oil concentrations decreased as the N fertiliser rate increased. There was a 0.8 percentage point oil concentration decrease with the additional 0.24 t/ha grain yield response from the top performing N rate (40 kg N/ha) treatment. As the N fertiliser rate increased to 80 and 160 kg N/ha, there was a respective oil percentage point decrease of 2.2 and 3.2 with the additional 0.17 and 0.19 t/ha grain yield response.

This trend has been well reported in other studies (Hocking and Stapper, 2001), and was found to be linked to increased moisture stress after flowering and during grain fill. The moisture stress experienced in this experiment was directly related to the additional biomass accumulated as a result of additional nitrogen fertiliser.

Varietal differences in oil concentration were evident in this experiment, with the specialty oil variety Victory V3002 having a significantly higher oil concentration than all other canola varieties. However, when this was converted to total oil harvested there was no significant difference between Victory V3002 and any of the hybrid varieties, whilst there was 0.17 and 0.19 t/ha less oil removed in the open-pollinated varieties, 43C80 CL and ATR-Gem respectively.

### Reference

Hocking, P.J. and Stapper, M. (2001). Effects of sowing time and nitrogen fertilizer on canola and wheat, and nitrogen fertilizer on Indian mustard. I. Dry matter production, grain yield, and yield components. *Australian Journal of Agricultural Research* 52:623-634.

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