



Optimizing nitrogen fertility for hybrid canola

CATEGORY [soils and fertility](#) | February 8, 2024

Canola yield increased by up to 40% with increasing N rate up to 134 lbs/ac (150 kg/ha) pre-plant (i.e. close to seeding) application via broadcast or banding. There was no significant difference in yield between pre-plant only N application and a split pre-plant plus top-dress application.

Hybrid varieties of canola are widely grown on the Prairies, but their yield response to N fertilizer has not been recently updated, especially as newer, higher yielding hybrids are introduced to the market place. A research study was conducted across Canada to investigate hybrid canola yield response and N use efficiency (NUE) to N fertilization, and to determine site-specific economic optimum N rates (EONR).

A 4-year field trial was conducted at each site from 2018 through 2022. The sites were at Beaverlodge and Olds, AB, Scott, Swift Current and Melfort, SK, Brandon and Carman, MB, and Ottawa, ON.

Site-specific canola hybrids were used across years, including 6074RR, PV581GC, PV533G, L233P, L255PC, and L252. They were seeded to ensure a minimum plant density of 7 plants per square foot (80 plants/m²). Preceding crops varied and included oat, wheat, canola, barley, or corn.

Eight fertilizer treatments were compared with urea (46-0-0) applied at:

- Pre-plant 45 lbs N/ac (50 kg N/ha),
- Pre-plant 90 lbs N/ac (100 kg N/ha),
- Pre-plant 134 lbs N/ac (150 kg N/ha),
- Pre-plant 178 lbs N/ac (200 kg N/ha)
- Split 45 lbs N/ac (50 kg N/ha) at pre-plant plus 45 lbs N/ac (50 kg N/ha; N50 +50) top-dressed at the 4-6 leaf stage
- Split 45 lbs N/ac (50 kg N/ha) at pre-plant plus 90 lbs N/ac (100 kg N/ha; N50 +100) top-dressed at the 4-6 leaf stage,
- Split 45 lbs N/ac (50 kg N/ha) at pre-plant plus 134 lbs N/ac (150 kg N/ha; N50 +150) top-dressed at the 4-6 leaf stage, and
- Unfertilized control treatment (N0).

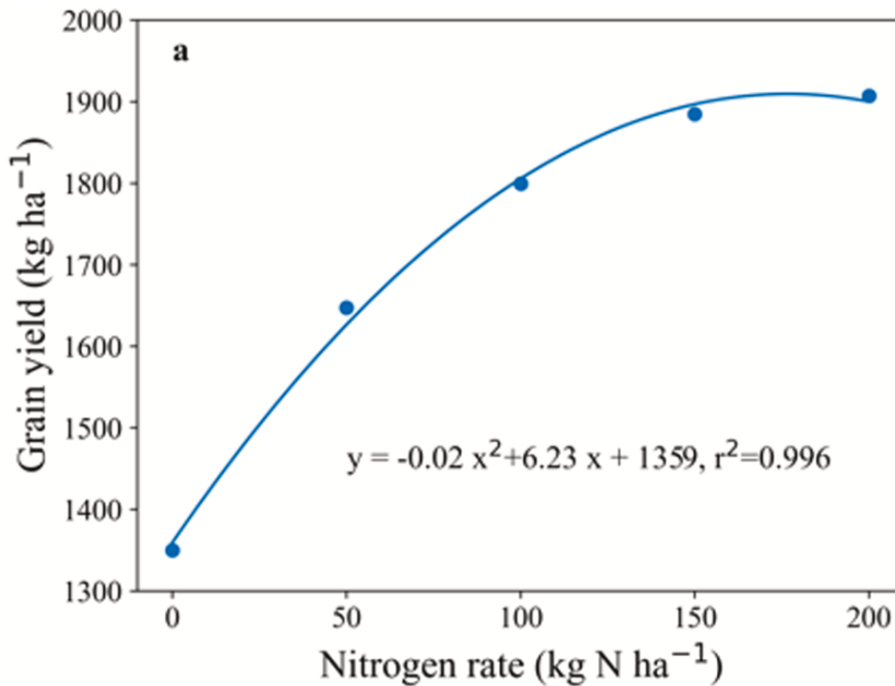
Composite soil samples were collected prior to planting at each site in each year. Phosphorus (P), potassium (K) and sulfur (S) were applied and incorporated as required. These applications added an additional 15.6 lbs N/ac (17.5 kg N/ha).

Yield response to N

Canola yield significantly increased by up to 40% with increasing N rate up to 134 lbs/ac pre-plant application. The estimated maximum yield at the 139 lbs N pre-plant rate (156 kg N/ha) was slightly higher but not significantly different than the 134 lbs N rate. Further increases in N application may result in lower yields due to factors other than N application limiting yield development.

Across years, the highest average yield was at the Olds site in the Black soil zone at 41 bu/ac (2323 kg/ha) and lowest average yield was at Swift Current at 18 bu/ac (1011 kg/ha) due to severe drought and uneven rainfall. The highest yield of 65 bu/ac (3644kg/ha) was at Beaverlodge in 2019.

The response of canola yield to nitrogen (N) application rates



Source: Wen et al. 2023

Nitrogen application method – all pre-plant or split – did not significantly affect canola yield. However, there were some individual site-year cases where differences were observed. At 8 of 32 site-years, the split application strategy produced similar to slightly higher canola yield than pre-plant-only N.

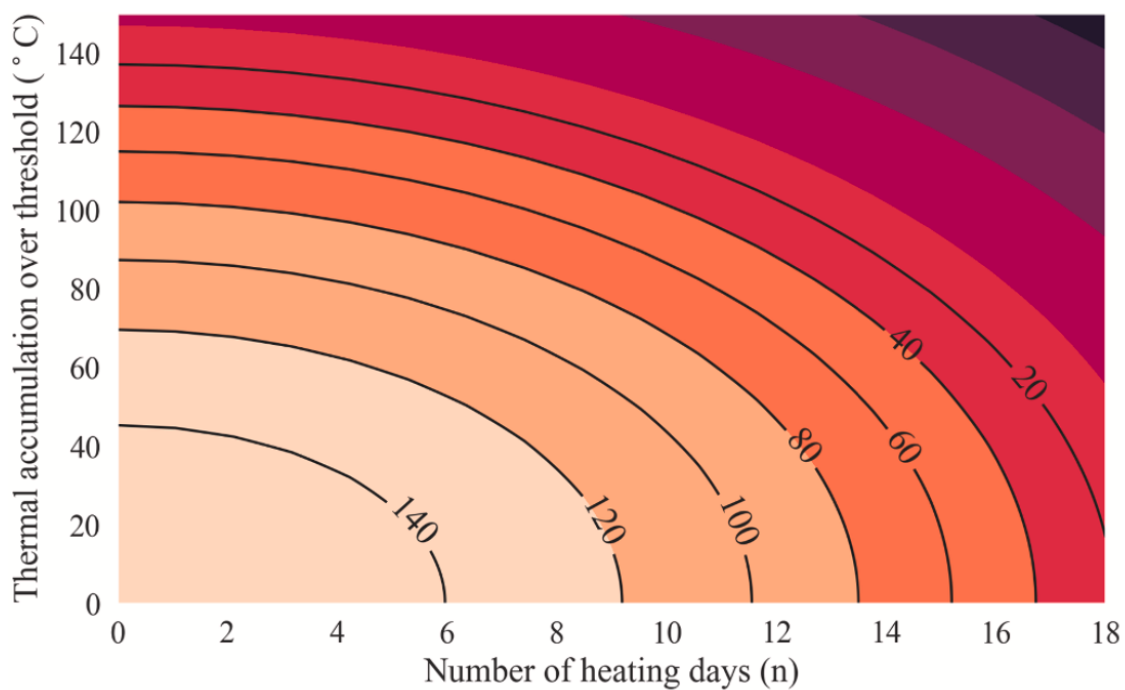
For example, at Ottawa in 2021, the split-N treatment produced 19% higher yields than the equivalent preplant-only application under normal rainfall and slightly cooler conditions. At Melfort in 2022, the opposite was observed with the pre-plant applications yielding higher than split applications under environmental conditions of sufficient rainfall leading up to topdressing N followed by moderate drought stress.

Nitrogen fertilizer rate significantly impacted NUE. The highest NUE was at pre-plant 45 lbs N and the lowest at pre-plant 178 lbs N, and this trend occurred at 25 of 32 site-year cases. Nitrogen use efficiency decreased from 13 to 6.6 lbs yield/lbs N input (6 to 2.8 kg yield/kg N) as N fertilizer rate increased from 45 to 178 lbs N/ac. Overall, application method did not affect NUE.

Analysis of the data found that the number of heat-stress days (i.e. days with temperature above 29.5°C) and heat-induced thermal accumulation 4 weeks before and after flowering directly impacted canola response to N fertilization and EONR.

The EONR was calculated taking into consideration the yield and N rate responses and the price ratio of N fertilizer to canola seed. The EONR was impacted by heat-stress days and thermal accumulation.

The economic optimum nitrogen rates (kg N/ha) as displayed on the contour curves after being calibrated by incorporating the number of heat-stress days and thermal accumulation (i.e., heat-stress index) over the threshold of 29.5°C



Source: Wen et al. 2023

The EONR varied by site, and was estimated at 75 to 90 lbs N/ac (85 to 100 kg N/ha) in the low-yielding Brown soil zone, 130 to 148 lbs N/ac (146 to 166 kg N/ha) in the Black soil zone, and 125 lbs N/ac (140 kg N/ha) in Ontario.

The researchers suggest that a split-N method be considered as a strategy to help adjust topdressing levels to account for early season weather conditions. This could help achieve the goals of increasing canola productivity and reducing greenhouse gas (GHG) emissions from fertilizer use.

However, significant rainfall after topdressing N is required, and the energy and time costs must also be considered.

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Guoqi Wen, Bao-Luo Ma, Mervin St. Luce, Kui Liu, Patrick S. Mooleki, Stephen Crittenden, Robert Gulden, Greg Semach, Paul Tiege, Prabhath Lokuruge, Optimizing nitrogen fertilization for hybrid canola (*Brassica napus* L.) production across Canada, *Field Crops Research*, Volume 302, 2023, 109048,

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