Optimizing Nitrogen Strategies for Sustainable Canola Production in Manitoba

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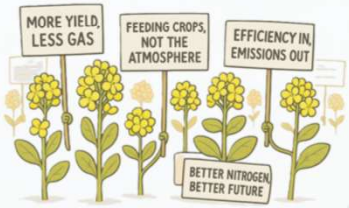
SUMMARY

- Surface or shallow-band application of SuperU (a commercially available urea enhanced with both urease and nitrification inhibitors) proved most effective at reducing N_2O emissions while boosting canola yield
- The use of nitrification inhibitors with deep-banded urea is critical to mitigate environmental impact
- Although split N application lowered cumulative N_2O emissions, it did not improve canola yields and therefore cannot be recommended for the Prairies
- The findings are relevant for sandy soils under drought conditions



Background

Nitrous oxide (N_2O) emissions from croplands, strongly stimulated by the application of N fertilizers, represent a major contributor to Canada's greenhouse gas footprint. Recognizing this challenge, the Government has committed to a 30% reduction in N_2O emissions by 2030. Achieving this ambitious target without compromising crop productivity requires the adoption of effective mitigation practices that enhance N use efficiency, minimize environmental losses, and sustain crop yields for more efficient canola production.

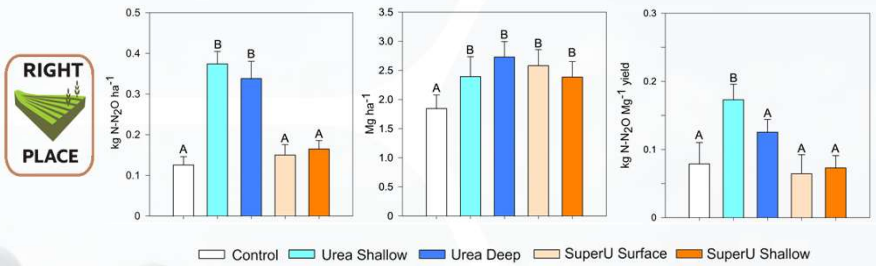
Experimental Design

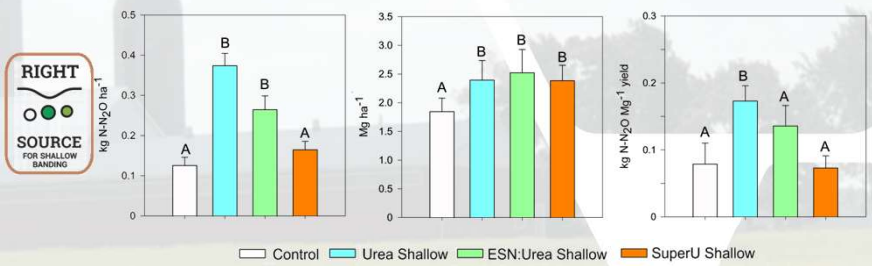
Five site-year trials were conducted on commercial fields with **coarse-textured soils**. All years of the study were **16-46% drier** than normal. The treatments varied by **Application Timing**, **Nitrogen Source, and Placement Method.** The applied N fertilizer rates varied within the range of 95-124 kg N/ha Additionally, a zero-nitrogen control treatment was included at each site-year to serve as a baseline for comparison.

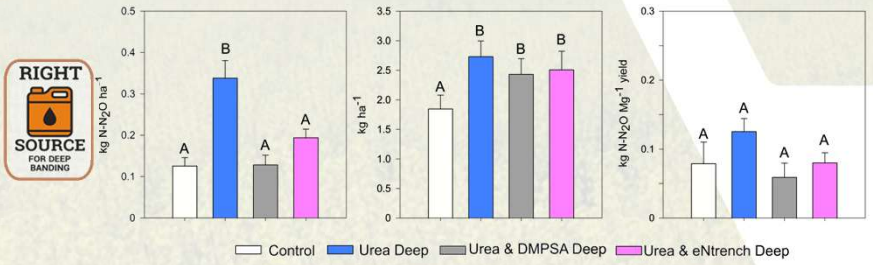
We measured **cumulative N_2O emissions** over the growing season (from planting to harvest), canola **grain yield**, and **N_2O emission intensity –** the ratio of emissions to yield.

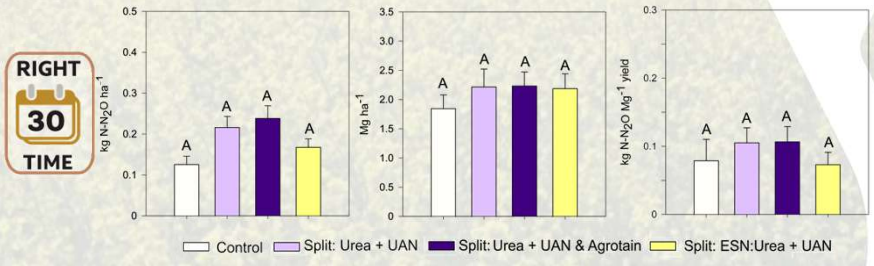
Results

Cumulative N_2O emissions — *Grain yield* — *Emission intensity*









Discussion

Placement method did not influence the N_2O emissions from either urea or SuperU. Surface and shallow placement of SuperU resulted in only minimal N_2O increases while markedly improving canola grain yield. In contrast, only shallow-banded urea elevated N_2O emission intensity (meaning more greenhouse gas emitted per unit of yield).

Shallow banding of a mixture of ESN (60%) and conventional urea (40%) tended to reduce N_2O emissions (by 23%) compared with shallow-banded conventional urea. However, shallow banding of SuperU significantly reduced N_2O emissions (by 56%), maintaining canola yield.

The use of nitrification inhibitors with deep banding of N fertilizers reduced N_2O emissions to levels close to Control (0 N) while maintaining high canola yields. Compared with conventional urea, nitrification inhibitors reduced N_2O emissions by 43-62%.

The Prairies' short growing seasons favour early maturing canola varieties, for which nitrogen is critical in the early growth stages. Although split N application does not increase N_2O emissions compared to 0 N Control, it does not lead to higher yields and requires additional labour.

Acknowledgements