Nitrogen Management Practices for High Canola Yield and Environmental Benefits in Alberta

Rayna Thoms, Min Yuan, Scott Chang

Forest Soils Lab, Department of Renewable Resources, University of Alberta

Background

- In 2023, Alberta produced 16.7% of all Canola in Canada[2].

- Canola production, as well as many other crops, rely on **Nitrogen (N)** fertilizer to deliver high yield crops.

- The over-production of **greenhouse gas** (**GHG**) emissions is the primary driver of Climate Change .

  - N fertilizers are responsible for 5% of global **GHG** emissions when they are converted/contribute to the production of carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4) .[1]

- Woodchips are a common waste product from the lumber industry[4]; if left unused they produce CO_2 and CH_4 during decomposition[3]. Woodchips are used to make the **CCT-Nitro** fertilizer being tested in this study.

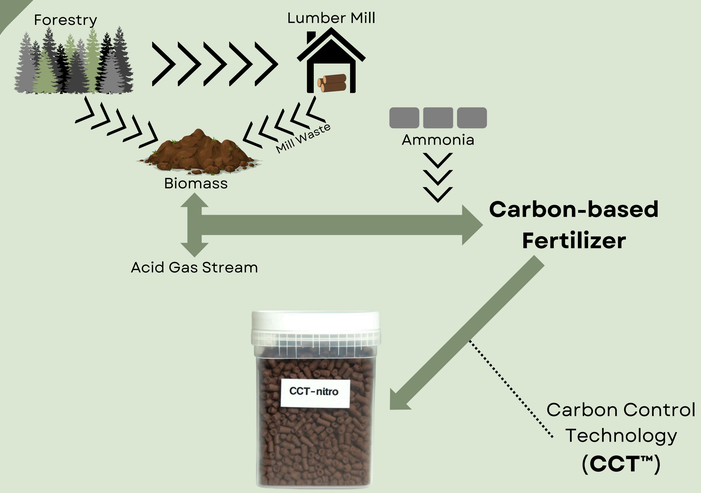
Figure 1: Woodchips

Key Terms: **Broadcast** (An application process in which fertilizer is distributed evenly on surface before seeding); **Banding** (An application process in which fertilizer is inserted into the crop's root area).

Objectives

- Determine the effectiveness of **CCT-Nitro** fertilizer at enhancing crop growth and **yield** compared to conventional **N** fertilizers**.**
- Determine if **CCT-Nitro** fertilizer reduces the quantity of **GHG** emitted compared to conventional **N** fertilizers**.**
- Determine the optimal application process to apply **CCT-Nitro** to the soil (**banding** or **broadcast**).

Methods



Treatments:

- Control, no N
- **CCT-Nitro** (Broadcast)
- **CCT-Nitro** (Banding)
- Urea (Broadcast)
- Urea (banding)
- Urea+Nitrain (Broadcast)

Figure 2: Representation of how experimental units were laid out. Each unit is 10*2 m²

Figure 4: Gas Chambers

Figure 3: Experimental Units

Gas Sampling

1. Gas samples were collected from sealed gas chambers using syringes and vacuumed vials.
2. Once the fertilizers were applied, **GHG** levels were tested twice a week for 4 weeks, followed by once a week for 8 weeks.
3. CO_2, N_2O, and CH_4 levels in vials were tested using CP-3800 Gas Chromatograph (figure 6), which then input the collected data into the database.

Figure 5: Glass Vial

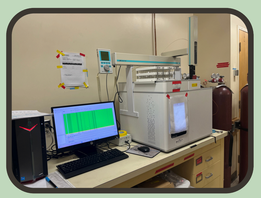


Figure 6: CP-3800 Gas Chromatograph

Figure 7: Canola harvested for analysis in 2023 trial

Plant/Crop Sampling

- Tissues are analyzed from Rosette and 50% Flowering stages.
- Biomass and Yield are measured.

Soil Sampling

- Soil is collected monthly from late May to September (Growing Season).
- 5 soil cores are randomly collected from topsoil (0-6 inches) in each plot, which are combined for more representative sample.

Anticipated Results

- **Banding** application of **CCT-Nitro** will result in greater crop yield, less **GHG** emissions, and enhanced soil fertility.
- Because of Canola's heavy reliance on **N** fertilizers, Canola production could have significant impact on the **GHG** emissions in Alberta.
- It is imperative that optimal and effective practices for managing **N** fertilizers are researched and applied to the industry.
- These practices can lead to higher yield in crops, while additionally providing environmental benefits by reducing **GHG** emissions.

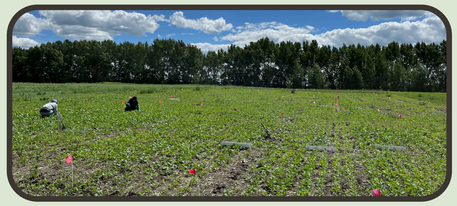


Figure 8: Collecting samples from Beaumont Plot

Acknowledgements

Thank you to the WISEST Team for their support, as well as sponsors including The University of Alberta, Sulvaris, and Canada Summer Jobs.

Literature Cited

1. Gao, Y., & Cabrera Serrenho, A. (2023, February 9). Nature News. https://www.nature.com/articles/s43016-023-00698-w
2. Barthet, V.J. (2024, Mar 28). Canadian Grain Commission. https://www.grainscanada.gc.ca/en/grain-research/grain-harvest-export-quality/canola/2023/report-quality-canola-2023.pdf
3. Roberta Pastorelli, Alessandro E. Agnelli, Isabella De Meo, Anna Graziani, Alessandro Paletto, Alessandra Lagomarsino. (2017, June 27). MDPI. https://www.mdpi.com/1999-4907/8/7/224
4. González, A., Riba, J.-R., Puig, R., & Navarro, P. (2014, November 22). Renewable and Sustainable Energy Reviews. https://www.sciencedirect.com/science/article/pii/S1364032114009447