The Effects of Nitrogen Fertilizer Rates on Greenhouse Gas Emissions and Potato Production in Delta, British Columbia

Chantel Chizen[1], Maja Krzic[1], Sean Smukler[1], and T. Andrew Black[1]

[1]Faculty of Land and Food Systems, The University of British Columbia, Vancouver, Canada

INTRODUCTION

- The Fraser River delta in British Columbia (BC) is one of the most productive agricultural regions in Canada (Fig. 1).
- Potatoes are one of the main crops in this region.
- This region continues to experience intensification of agricultural practices, including N fertilizer application rates, to maintain yields amid environmental pressures.
- Excessive N fertilizer rates are a primary contributor to agricultural greenhouse gas (GHG) emissions in the form of N_2O.
- The effects of climate change are predicted to intensify the current drainage and production issues, thus reducing the future production capability of this region.

STUDY OBJECTIVE

- To evaluate the effects of N fertilizer application rates of 0, 90, and 120 kg N ha^{-1} on GHG emissions (CO_2, N_2O, and CH_4) and potato production in Delta, BC.

This study is a part of 5-year project within the Agricultural Greenhouse Gas Program, which aims to quantify GHG emissions and develop best management practices to mitigate GHG emissions in the Fraser Valley.

STUDY LOCATION

Fig. 1. Location of study sites in Delta, BC. Point 1 is the productive site and point 2 is the unproductive site.

PROJECT DESIGN

- 3 fertilizer treatments assigned randomly at the productive and unproductive sites (Fig. 2).
- Kennebec potatoes - planted in late May, harvested in September 2018.

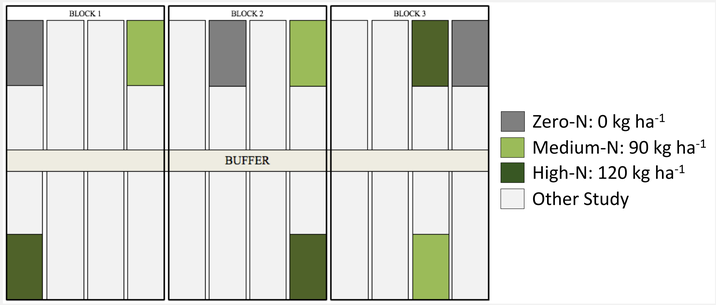

Fig. 2. Experimental layout. Note: this is repeated on 2 sites.

SAMPLING & MEASUREMENTS

- GHG measurements, every 2 weeks (May – October) using a static chamber method and Gasmet DX 4040 (Fig. 3).
- Plant available N (NH_4-N and NO_3-N), at 0-10 and 15-30 cm depths.
- Plant biomass, mid- and end of the season.
- Yield, end of the growing season.

Fig. 3. Gasmet DX 4040 and static chamber.

PRELIMINARY RESULTS

- N_2O emissions peaked following fertilizer application and all emissions increased in the Fall following precipitation events (Fig. 4).
- Soil NH_4-N was present in relatively high levels for both the medium- and high- N treatments at the end of the growing season (Fig. 5).

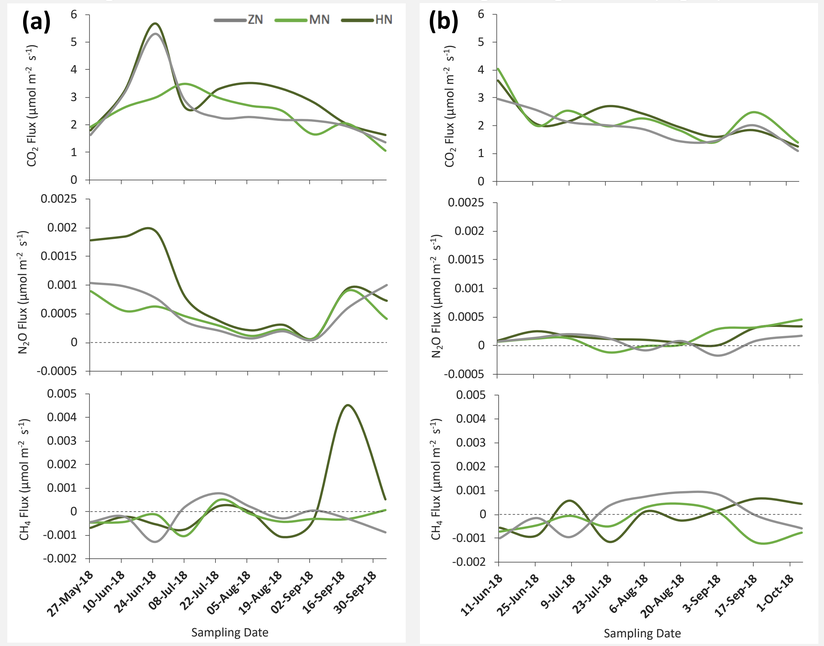

Fig. 4. GHG emissions (CO_2, N_2O, and CH_4) in the productive site (a) and the unproductive site (b). Fertilizer was applied on June 1, 2018.

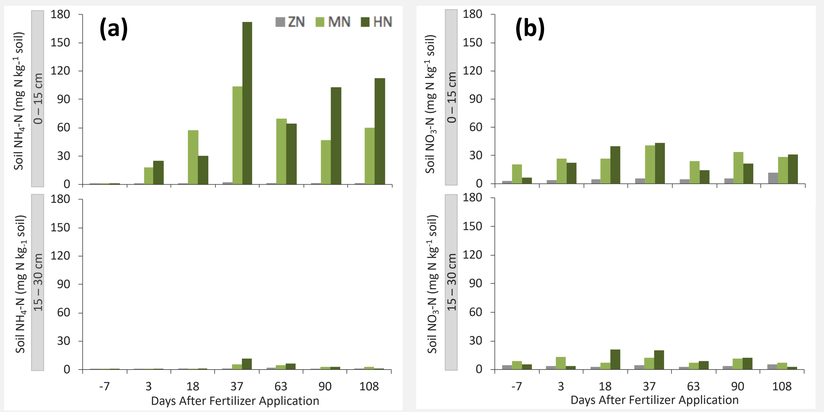

Fig. 5. Soil NH_4-N (a) and NO_3-N (b), at 0-15 cm and 15-30 cm depths at the productive site during the growing season.

SUMMARY

- The medium and high N fertilizer rates were associated with higher N_2O emissions following fertilization and residual NH_4-N.
- This data will contribute to existing agricultural GHG emissions records for the Fraser Valley.
- The findings will assist in the development of BMPs to improve N fertilizer use efficiency and mitigate climate change.

THE UNIVERSITY OF BRITISH COLUMBIA

Faculty of Land and Food Systems

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For more information please contact Chantel Chizen (cchizen@mail.ubc.ca)