Microbial enzyme activity in irrigated canola (*Brassica napus L.*) plots receiving different nitrogen applications

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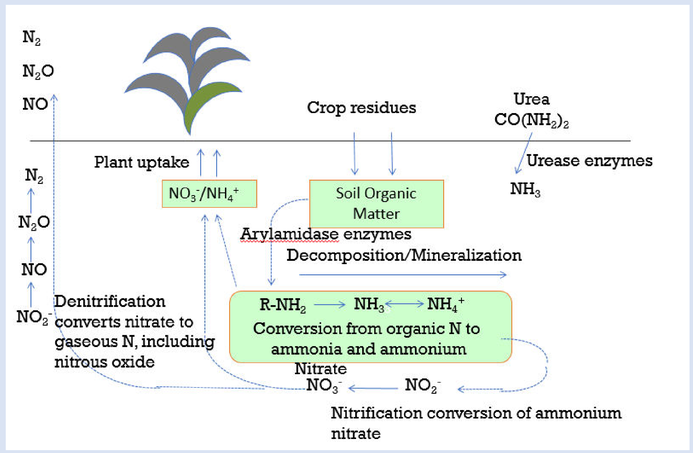
Introduction

Soil enzymes play an important role in controlling the reactions that govern nutrient cycling and organic matter decomposition. Management practices such as irrigation and nitrogen (N) fertilizer application have diverse effects on microbial activities in the soil. Substrate (organic N, NH_4^+ and NO_3^-) availability depends on microbial conversion of added fertilizer or organic matter.



Objectives

Evaluate effect of rate and timing of N application on N mineralization by measuring (i) arylamidase and urease enzyme activities and (ii) potential nitrification and denitrification activities in soils from irrigated canola plots receiving different N applications.

Materials and Methods

- Soils were collected from a small plot study (RCBD with 4 reps) at the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC) located in Outlook, SK.
- Irrigated canola was grown in 2015 and 2016. In both years, the previous crop was hard red spring wheat.
- **N treatments:** non-fertilized (0N) check; 110 and 220 kg N ha^{-1} applied as urea (46-0-0) at seeding; and a split application with half the fertilizer-N (55 and 110 kg N ha^{-1}) applied at seeding and the remainder (55 and 110 kg N ha^{-1}) applied just prior to bolting.
- N application method: broadcast & incorporate at seeding; topdress at bolting.
- N cycling enzyme activity assays were conducted (urease, arylamidase, potential nitrification and denitrification enzyme activity).
- 2015 (Site A) and 2016 (Site B) growing season data were analyzed using a repeated measures mixed model-analysis. Following the 2015 season, the field site was relocated so that the canola crop was always seeded into wheat stubble.

Results

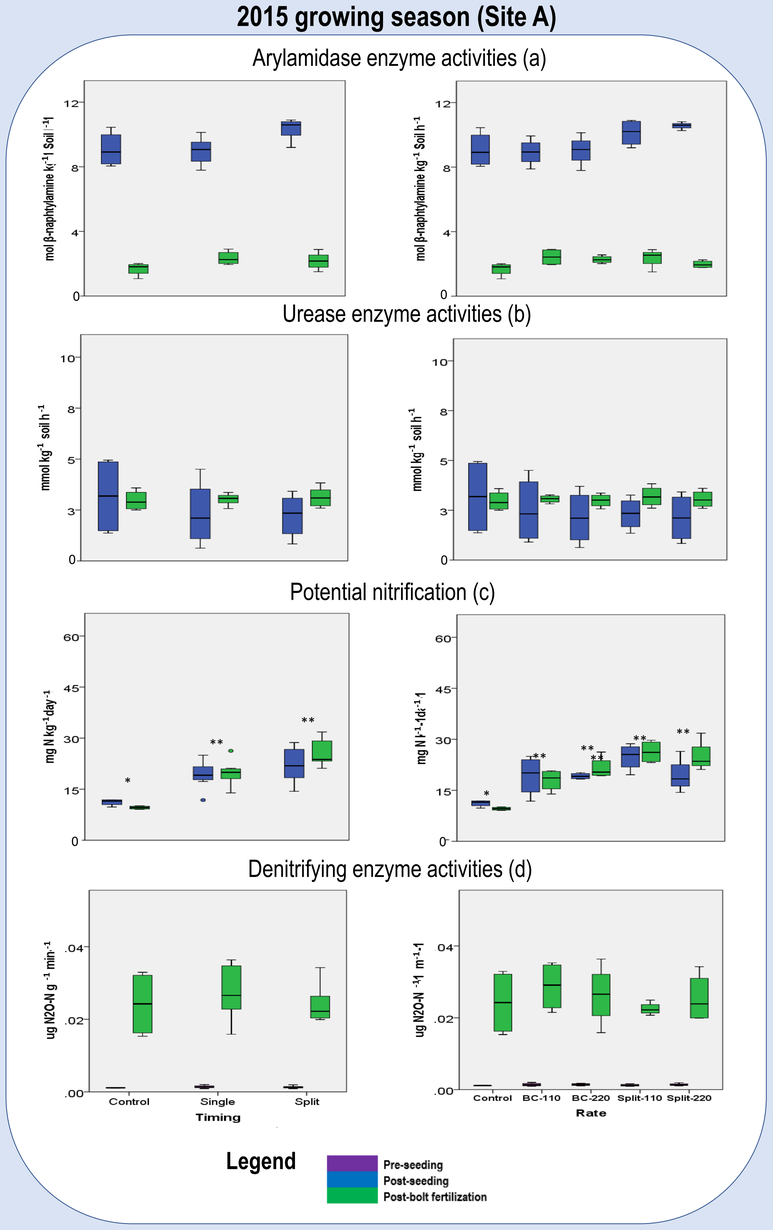


Fig. 1. Effect of N rate, timing of N application, and seasonality on soil (0–10 cm) (a) arylamidase enzyme activities (b) urease enzyme activities (c) potential nitrification and (d) denitrifying enzyme activities.

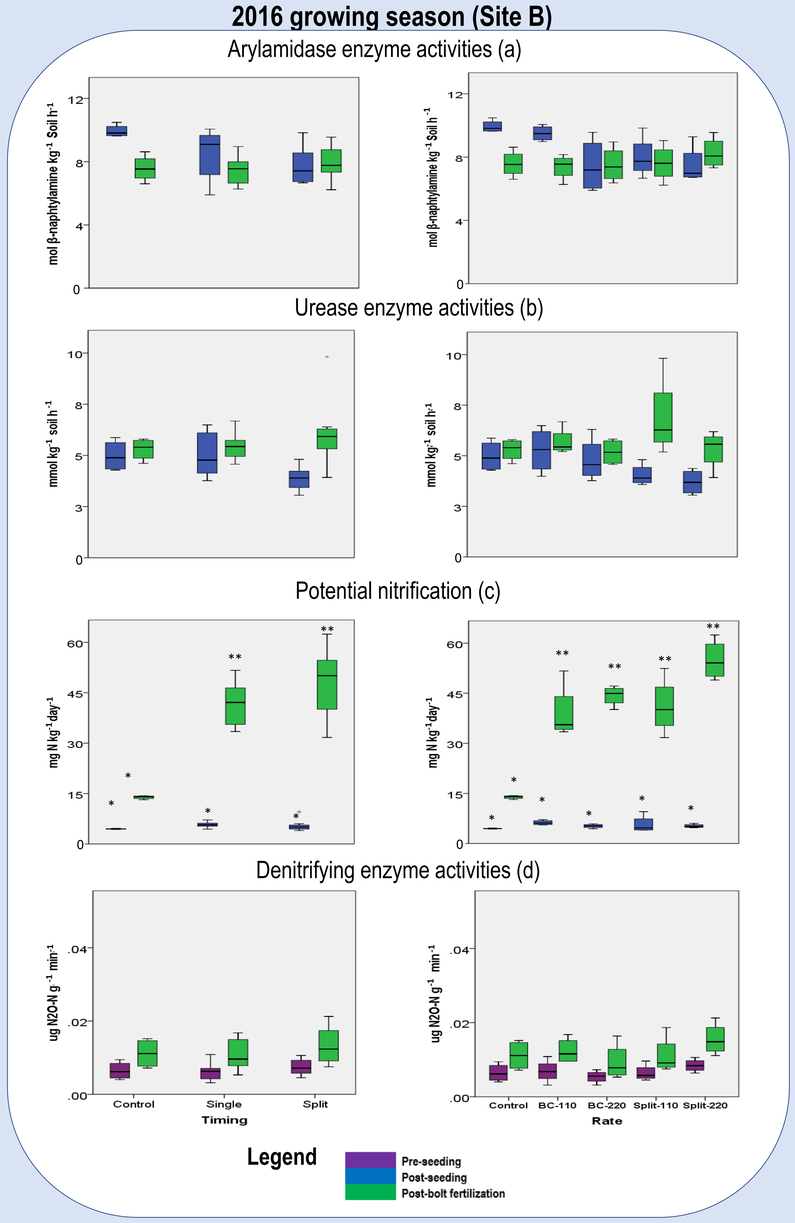


Fig. 2. Effect of N rate, timing of N application, and seasonality on soil (0–7.5 cm) (a) arylamidase enzyme activities (b) urease enzyme activities (c) potential nitrification and (d) denitrifying enzyme activities.

Summary and Conclusions

Preliminary results suggest that biological conversions of fertilizer N to NO_3 in soil are affected by rate and timing of the N application, but that seasonal variations are often greater than those associated with the fertilizer application.

- Seasonal variations in arylamidase activity (Fig. 1a) were significant (P = 0.001) in 2015, with the enzyme activities being greater early in the season (immediately after seeding) than later in the season (following the split application), but not in 2016 (P = 0.340) (Fig. 2a). Neither rate nor timing of the N application had an effect on arylamidase activity.
- Potential nitrification was significantly (P = 0.001) affected by N rate in 2015 (Fig. 1c) and 2016 (Fig. 2c). However, seasonal variations in potential nitrification were significant (P = 0.001) only in 2016 (Fig. 2c).
- Urease (Fig. 1b & 2b) and denitrification enzyme activity (Fig. 1d & 2d) were not affected by either N rate, timing of the N application, or seasonality.

Next steps

Relating these conversions to canola yield and gaseous N losses as N_2O is underway.

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