

# Determining soil nitrogen (N) processes using enzymology in response to varying N treatments across four diverse *Brassica napus* (canola) lines

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# Introduction

- Canada is the highest canola producer
- 20 million metric tonnes in 2018 produced
- Canola requires high N inputs
- Nitrogen use efficiency (NUE)
- Assist plant breeders through improved understanding of belowground interactions to improve NUE

# Introduction



**UREA**

DECAYING ORGANISMS,  
ROOT EXUDATES, ETC.

MICROBIAL ENZYMES  
TRANSFORMATION

UREASE ENZYME

**Soil Organic Nitrogen**

AMMONIUM  
 $\text{NH}_4^+$

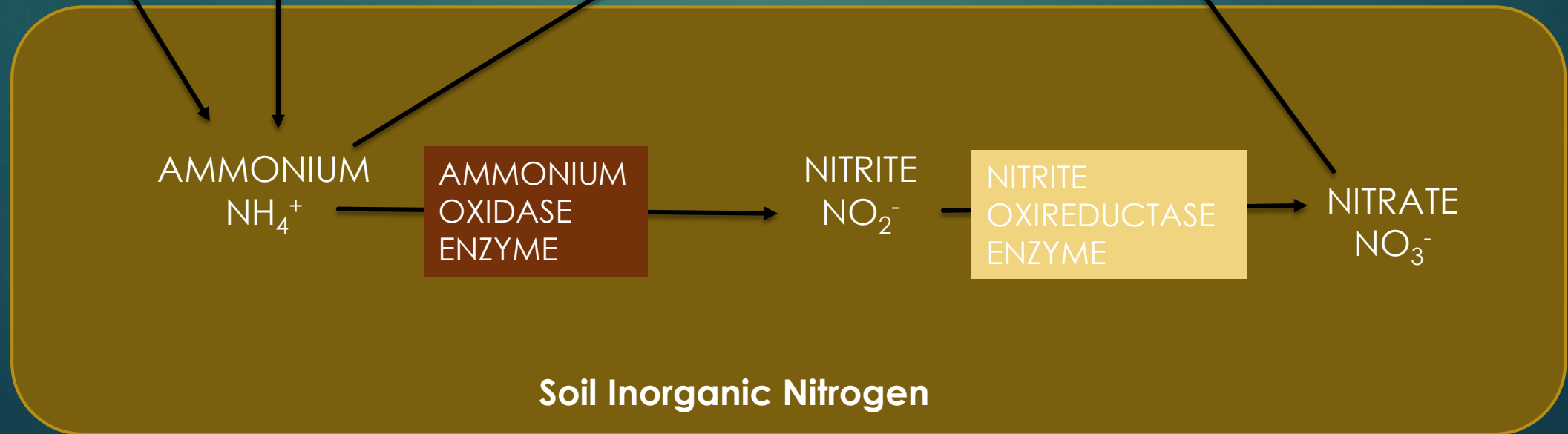
AMMONIUM  
OXIDASE  
ENZYME

NITRITE  
 $\text{NO}_2^-$

NITRITE  
OXIREDUCTASE  
ENZYME

NITRATE  
 $\text{NO}_3^-$

**Soil Inorganic Nitrogen**



# Objective



To evaluate the interaction between canola lines, N fertilizer rates, and phenotypic stage on soil N and microbial function and how this affects canola N uptake.

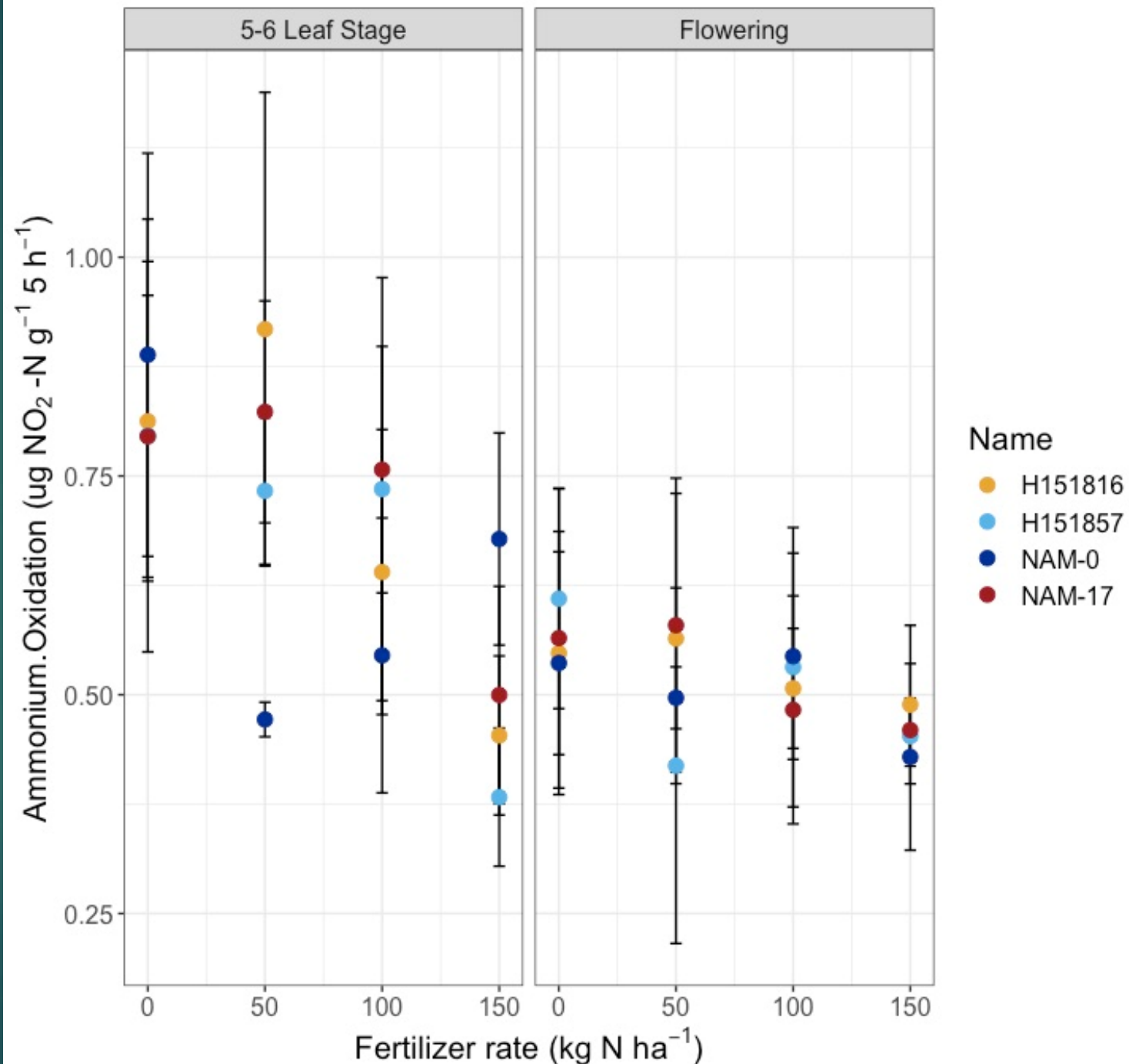
# Methods

- ▶ Dark Brown Chernozem in Saskatoon (Llewellyn farm)
- ▶ 2 parent lines, and 2 hybrids lines
- ▶ Nitrogen fertilizer rates: 0, 50, 100, 150 kg N ha<sup>-1</sup>
- ▶ Collection times (5-6 leaf stage and at flowering)
- ▶ Soil and root samples taken to 10 cm depth, aboveground plant sampled



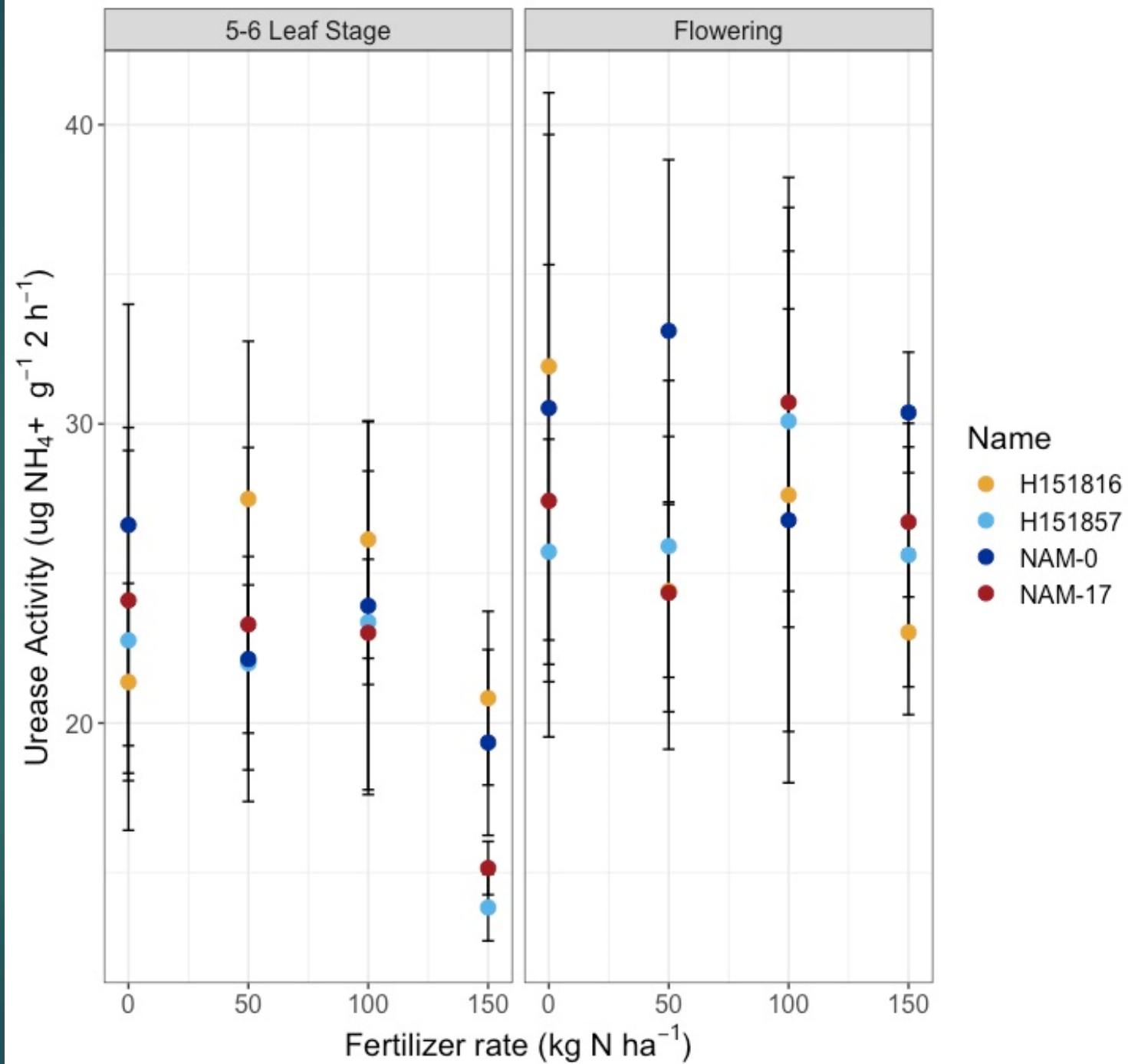
# Results and Discussion

Nitrogen rates ( $p = 0.0093$ ) and phenotypic stage ( $p = 0.0002$ ) significantly affected ammonium oxidation. Canola lines ( $p = 0.8359$ ) did not significantly affect ammonium oxidation.



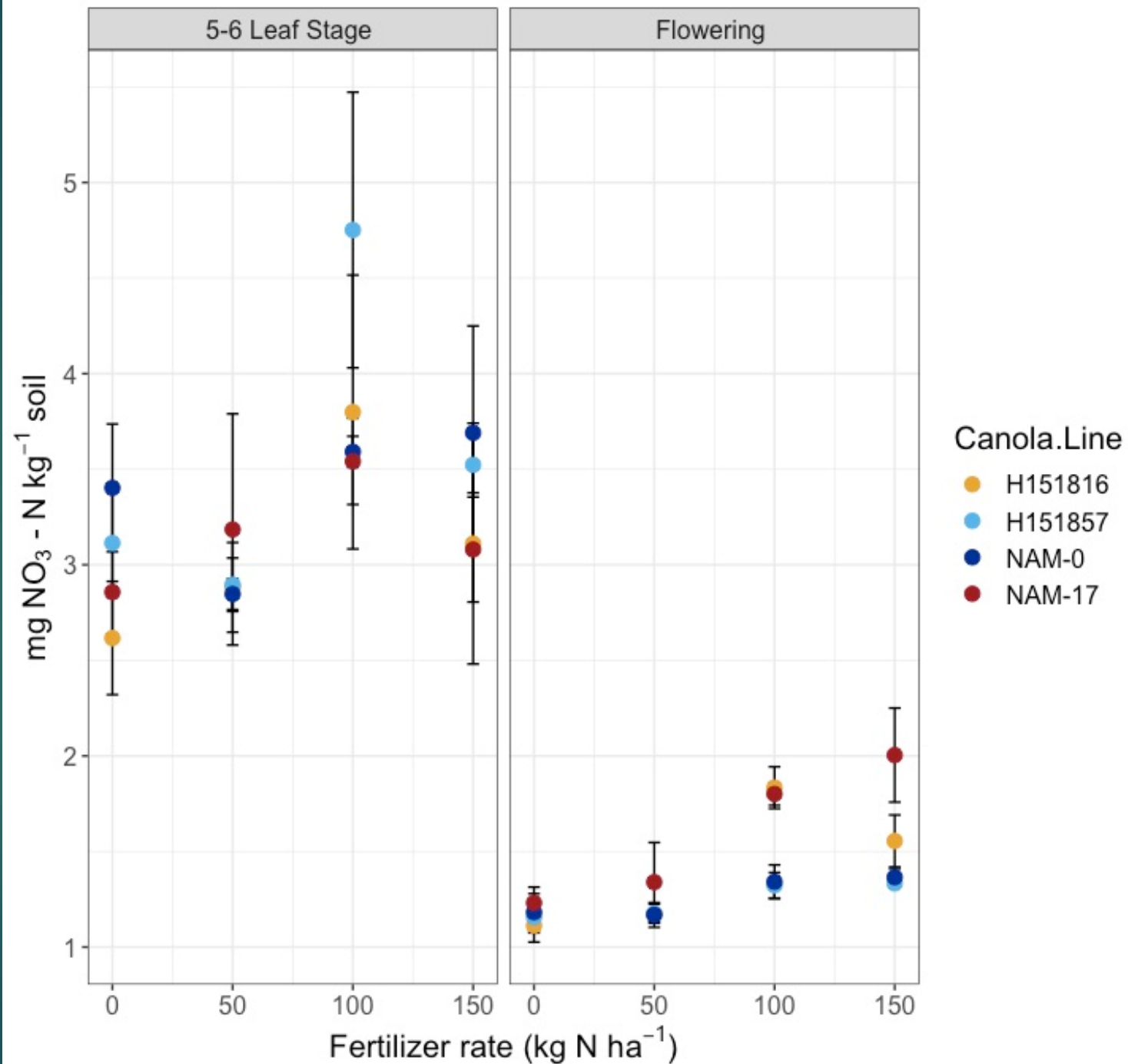
# Results and Discussion

Phenotypic stage ( $p = 0.0005$ ) significantly affected urease activity. Canola lines ( $p = 0.5557$ ) did not significantly affect ureolytic enzyme.



# Results and Discussion

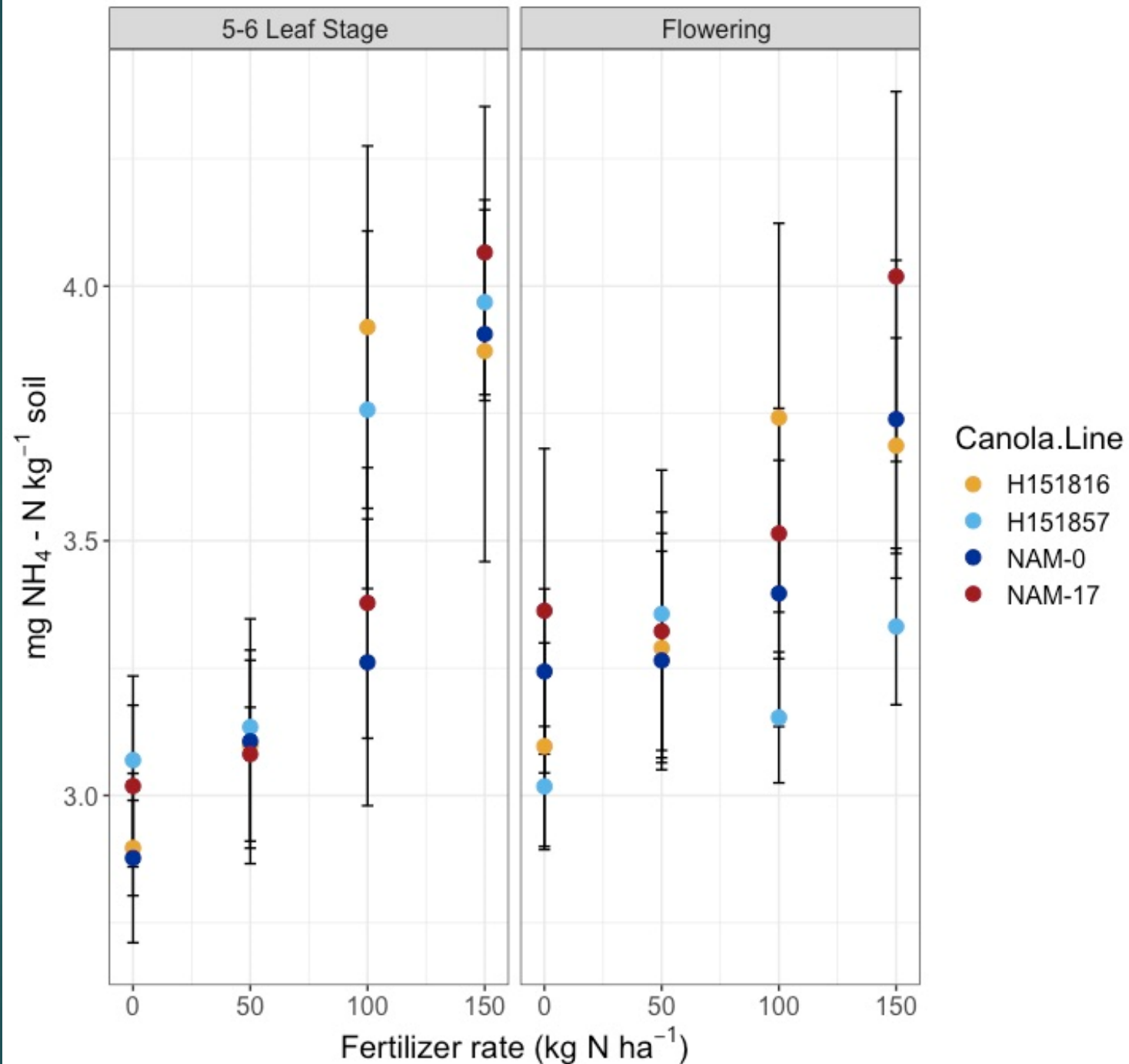
Significant 2-way interaction between canola lines and phenotypic stage ( $p = 0.0012$ ) on soil  $\text{NO}_3^-$ -N





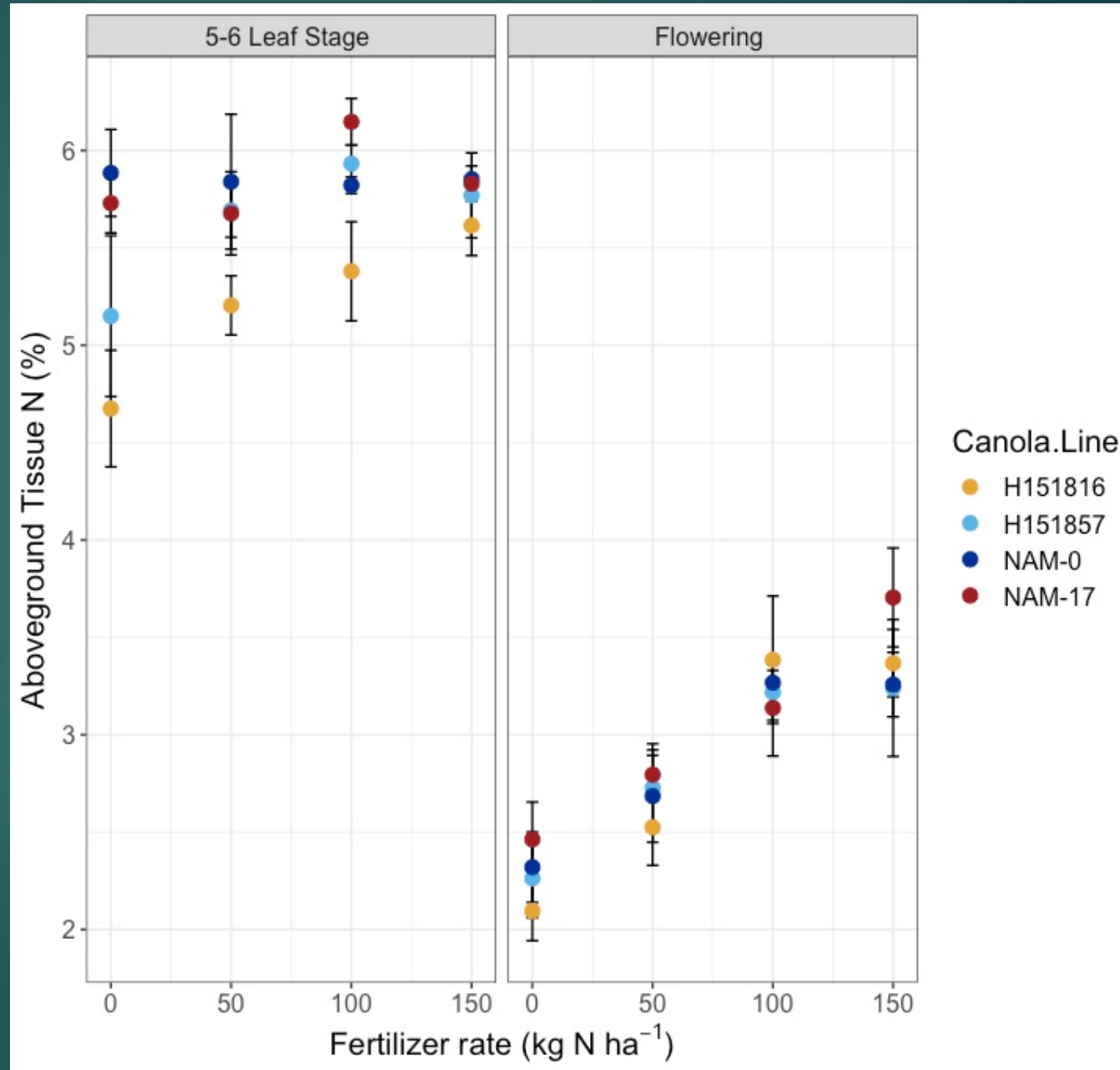
# Results and Discussion

- Significant 2-way interaction between canola lines and phenotypic stage ( $p = 0.0786$ ) on soil  $\text{NH}_4^+\text{-N}$ .
- Significant 2-way interaction between N rates and phenotypic stage ( $p = 0.0065$ ) on soil  $\text{NH}_4^+\text{-N}$ .



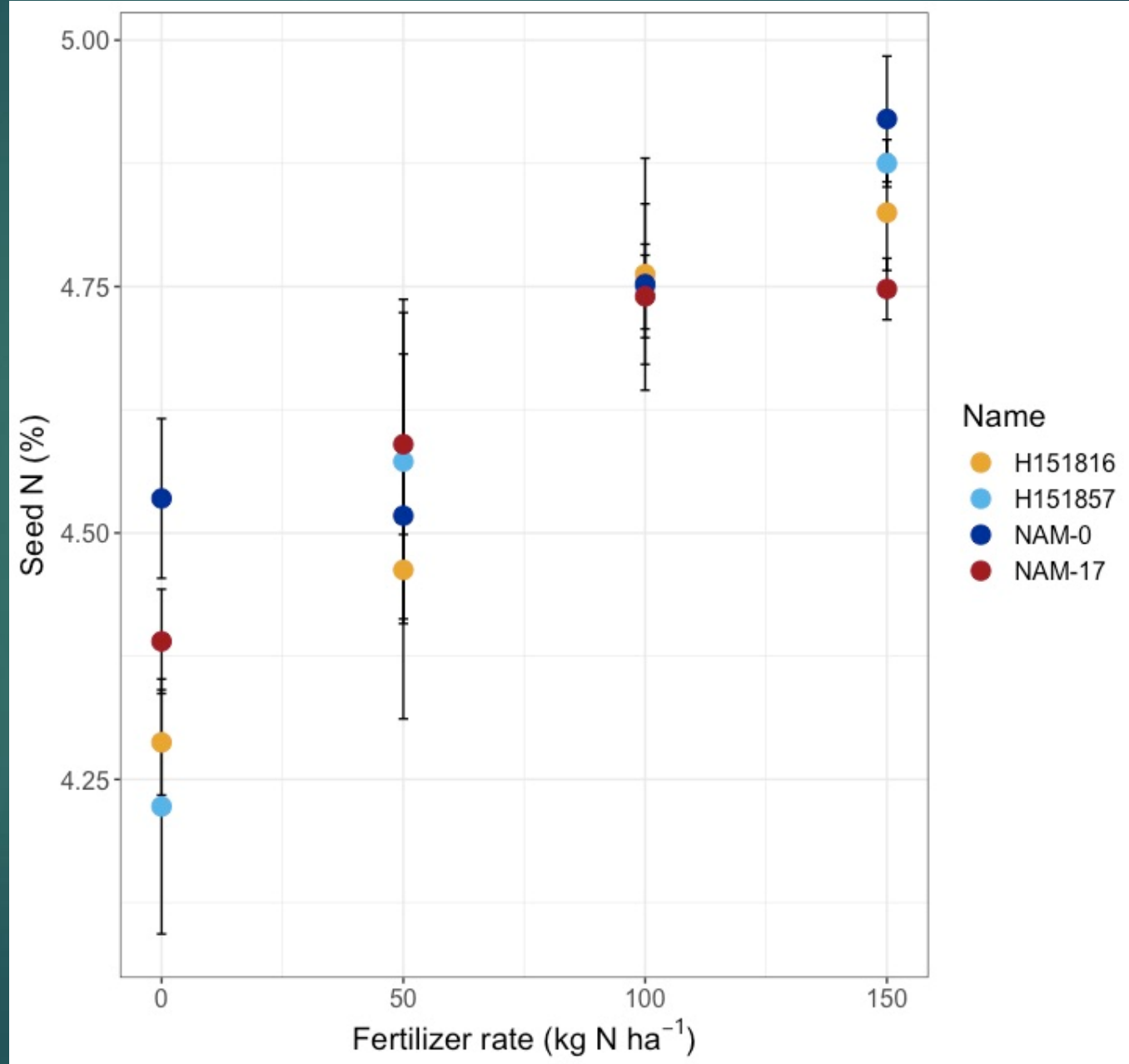
# Preliminary Result and Discussion

- Significant 2-way interaction between canola lines and phenotypic stage ( $p = 0.0149$ ) on percent plant N.
- Significant 2-way interaction between N rates and phenotypic stage ( $p = 0.0010$ ) on percent plant N.



# Preliminary Result and Discussion

Nitrogen rates significantly affected percent seed N ( $p < 0.0001$ ).



# Conclusion

- ▶ Phenotypic stage significantly affected microbial enzymes, soil  $\text{NO}_3^-$ -N and  $\text{NH}_4^+$ -N, and plant percent N.
- ▶ Canola genotypes significantly affected soil  $\text{NO}_3^-$ -N and  $\text{NH}_4^+$ -N, and percent plant N.
- ▶ Nitrogen rates significantly affected ammonium oxidase, soil  $\text{NO}_3^-$ -N and  $\text{NH}_4^+$ -N, plant and seed percent N.

# Acknowledgements

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