



MinnesotaCorn

RESEARCH & PROMOTION COUNCIL

PROGRESS REPORT

PROJECT TITLE: Mitigating Cold and Warm Season Nitrogen Losses from Corn Systems

PROJECT NUMBER: 6135-24DD

REPORTING PERIOD: Jan 1 to March 31, 2025

PRINCIPAL INVESTIGATOR: Tim Griffis

ORGANIZATION: University of Minnesota

PHONE NUMBER: 612-625-3117

EMAIL: timgriffis@umn.edu

1.) PROJECT ACTIVITIES COMPLETED DURING THE REPORTING PERIOD. *(Describe project progress specific to goals, objectives, and deliverables identified in the project workplan.)*

This report summarizes key research activities related to our mesocosm heating and freeze-thaw experiments. The results presented below were derived from Michelle Bohnen's MS Thesis research which has been supported by this project. Michelle Bohnen successfully defended her thesis dissertation on February 3, 2025. In this report we provide a summary of key findings from her soil warming experiments.

2.) IDENTIFY ANY SIGNIFICANT FINDINGS AND RESULTS OF THE PROJECT TO DATE.

Soil warming experiments were conducted to examine the efficacy of a dual inhibitor-based EEF in a warmer climate. These experiments were conducted in an indoor mesocosm facility over three growing seasons. The interaction between growing season and temperature effects altered cumulative N₂O emissions and emission factors ($p < 0.05$). Warmer soil temperatures did not always cause higher N₂O emissions due to limitations imposed by soil water content. The experimental data indicated that there were different environmental conditions among growing seasons which led to growing season having significant effects on crop yield, leachate N loss, and plant N concentrations and yields. The higher temperature treatments (soil warming experiments) had significantly less leachate N mass loss and less plant N concentrations than the unheated treatments ($p < 0.05$). Finally, our results indicated that there was better plant N acquisition for lower soil temperatures than higher soil temperatures.

3.) CHALLENGES ENCOUNTERED. *(Describe any challenges that you encountered related to project progress specific to goals, objectives, and deliverables identified in the project workplan.)*

Given recent turnover in project personnel, I am currently training a new technician to help run the mesocosm facility. He is learning how to operate the chamber system and the warming and cooling

system. This change in personnel has slowed some of our progress on the freeze/thaw experiments. The freeze-thaw experiments will be our priority moving forward.

4.) FINANCIAL INFORMATION (*Describe any budget challenges and provide specific reasons for deviations from the projected project spending.*)

5.) EDUCATION AND OUTREACH ACTIVITIES. (*Describe any conferences, workshops, field days, etc attended, number of contacts at each event, and/or publications developed to disseminate project results.*)

Our MS student (Michelle Bohnen) and Research Scientist (Sam Strack) gained hands-on experience working in the mesocosm facility. They gained new knowledge regarding the biogeochemical cycling of nitrogen and improved our understanding of how climate change can impact reactive nitrogen losses from cropping systems. Michelle Bohnen graduated from the LAAS program in February 2025 and Sam Strack has recently joined our LAAS graduate program.