PROGRESS REPORT

PROJECT TITLE: **Climate Change Impacts on Minnesota Corn Production and Environmental Consequences**
REPORTING PERIOD: Jan 1, 2019 to March 31, 2019
PROJECT NUMBER: MN CORN RES & PROMO COUNCIL 4118-15SP (no cost extension)
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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 our activities related to the no-cost extension of this research project. Our work over the last 3 months has focused on completing a final experiment and developing a manuscript for the *Journal of Environmental Quality* that summarizes all of the mesocosm experiments. In these experiments we have examined how climate change (i.e. increased spring precipitation) will impact reactive nitrogen losses and corn yield. Further, we have examined how a split application of nitrogen fertilizer impacts nitrous oxide emissions and nitrate in runoff.

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

The figures below highlight a number of key findings from this research.

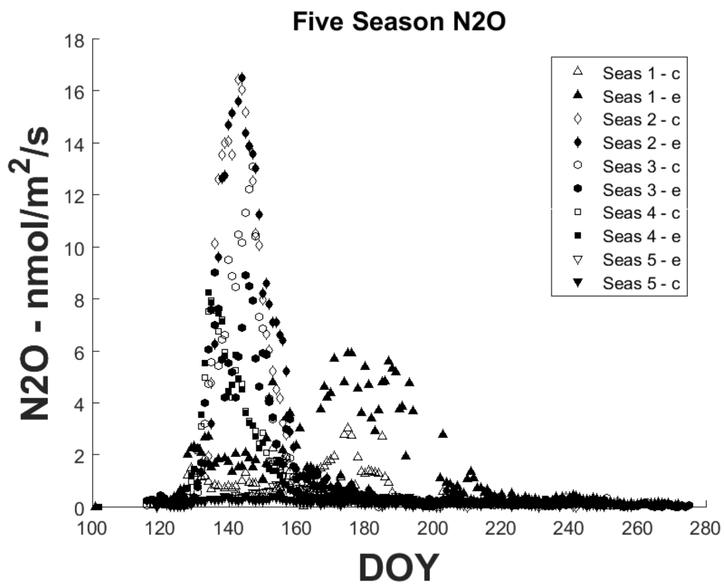

Figure 1 above shows the nitrous oxide emissions measured from each mesocosm for five different experimental trials. This result demonstrates that the mesocosm systems do an excellent job in simulating realistic nitrous oxide emissions. These emissions are comparable to fluxes we have measured under field conditions.

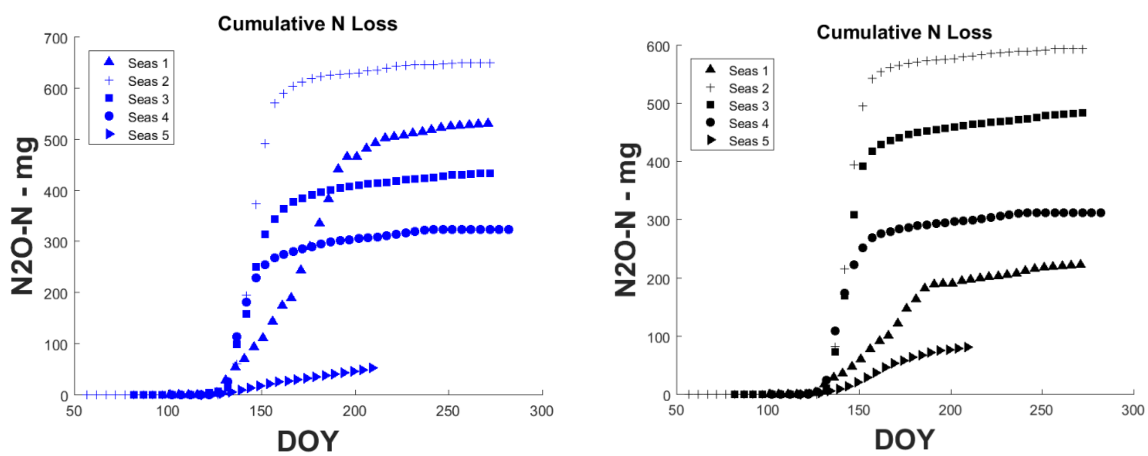

Figure 2 above shows cumulative nitrogen loss for experimental treatments for all five growing seasons (left panel) and cumulative nitrogen loss for control treatments (right panel) for all five growing seasons. The key conclusion here is that enhanced spring-time precipitation is highly like to increase reactive nitrogen losses.

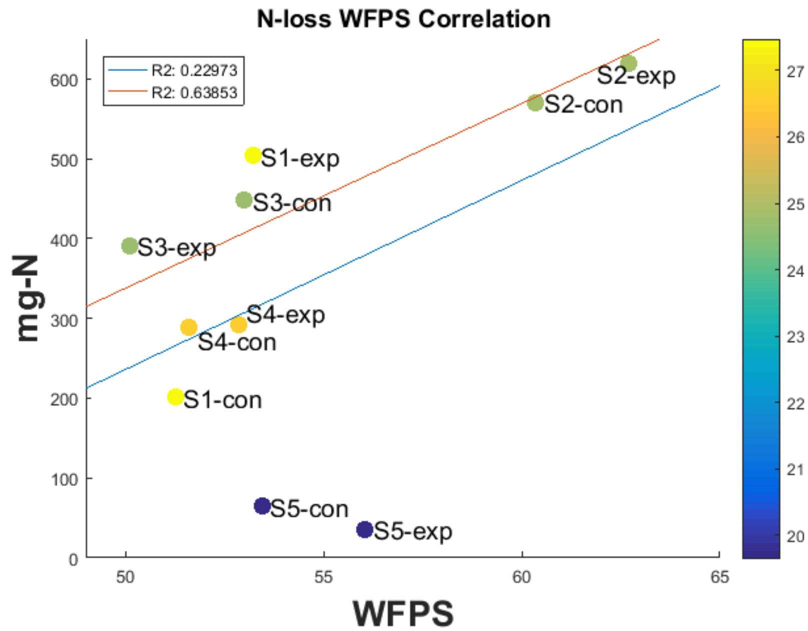

Figure 3 shows nitrogen loss correlated with water filled pore space. Nitrogen loss and water filled pore space were calculated during periods of peak emissions for each growing season. Peak emissions corresponded to DOY 120-220 for growing season 1 and DOY 120-180 for growing seasons 2-5. Emissions were computed as cumulative nitrous oxide nitrogen lost during this period. Median air temperature for each time frame is on the color bar axis. Taken together, Figure 3 indicates that wetter and warmer conditions enhance the reactive nitrogen loss from the system.

Finally, we have shown that nitrous oxide and ammonia emissions and drainage water nitrate are substantially reduced when managing nitrogen inputs using a split application approach.

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

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

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

The experiments are being led by MS student (Lee Miller) and Postdoc (Zhongjie Yu) in the Land and Atmospheric Science program. Two undergraduate students from the ESPM program have been hired to help with these experiments.