INNOVATION GRANT FINAL REPORT

PROJECT TITLE: Performance and cost-benefit analysis of bioreactor systems for P mitigation in Northwest Minnesota
REPORTING PERIOD: 2021-2024
FARMER INNOVATOR: John Swanson
COLLABORATING ORGANIZATION/PERSON: Lindsay Pease / UMN
PHONE NUMBER:
EMAIL:

1.) PROJECT ACTIVITIES COMPLETED DURING THE REPORTING PERIOD. (*Describe project progress specific to goals, objectives, and deliverables identified in your project proposal.*
We will have nitrogen inflow data from tile drainage lines for 2021-2024. We will also have phosphate numbers from the bioreactor discharge beginning in August 2024. This data will be compiled by Dr. Lindsay Pease in November. Most of the funding for this project has come through Dr. Pease and the University of Minnesota. A final report for 2024 data and costs will be available soon. A culvert was installed to give access to the bioreactor.

2.) IDENTIFY ANY SIGNIFICANT FINDINGS AND RESULTS OF THE PROJECT. (*This could include photo documentation of the project at various stages if you haven't already provided these as well as final relevant images of the project at completion. Any data analysis (<u>especially Level 3 Grants</u>), graphics or record of observations throughout the growing season or during the field day event are also anticipated.)*

The early part of 2024 had delays due to high rainfall and backup in the county ditch. We will have data of nitrates and phosphate from drain tile as a sampler has been generating data since 2021. The bioreactor installation was finished in the late fall of 2023. The sampler from the bioreactor was installed in August 2024.

During the bioreactor's first month of operation, it removed 60% of the nitrate load that was diverted from the lift station. There was not any significant phosphorus load in the tile drainage from the field during August or September 2024. The bioreactor released a small pulse of phosphorus (< 1 lb P) during its initial start-up phase. This is expected and normal for bioreactors. After this first pulse, P concentrations from the bioreactor normalized at very low concentrations that are not of environmental concern (<0.04 ppm P).

Woodchips being dumped into the lined, excavated pit during construction of the bioreactor in November 2023.

Four monitoring wells were installed in the middle of the bioreactor as it was being filled with woodchips

The bioreactor is covered with a soil cap during installation in November 2023.

View of the bioreactor after installation in November 2023

Dr. Lindsay Pease (right) and Dr. Murad Ellafi (left) of University of Minnesota installing an automated water sampler at the bioreactor outlet in August 2024.

3.) CHALLENGES ENCOUNTERED. (*Describe any challenges that you encountered related to project progress specific to goals, objectives, and deliverables identified in the project proposal.*)
The irrigation that covers a part of the drain field broke down in August 2024 and ran in one spot for 12 hours because of a flat tire on one drive wheel which broke a drive shaft. The other wheel kept turning so the automatic system on the irrigation did not shut down. Additional nitrates may have been released and the data may show that increase. The original delays were due to Dr. Pease not receiving funding when originally planned. During the spring of 2024, we had 110% of the normal rainfall during the months of April, May, and June causing the county ditch to have a high-water level and the bioreactor was under water for several weeks. Beaver dams on adjacent land downstream also contributed to the county ditch backed up. This ditch does not have much elevation change so the dams had a large effect. The ditch has been cleaned so hopefully these problems will not be repeated. The auto sampler to measure nitrates and phosphates coming out of the bioreactor was not able to be installed until August because of the flooding.

4.) EDUCATION AND OUTREACH ACTIVITES. *(Describe any opportunities to engage with farmers, influencers or the media about your project.)*
A field day was held at the site for hydrologists and people interested in water quality in Summer 2023. A bus was provided. Approximately 35 people attended. Dr. Pease presented an update on construction and initial performance of the bioreactor to this group in September 2024.

5.) HOW CAN WE HELP? *(Please let us know how we can improve the experience for the next generation of projects.)*