FOR ADMINISTRATIVE USE
Program Area Code Proposal Code

Minnesota Wheat Research and Promotion Council

RESEARCH PROPOSAL GRANT APPLICATION

1. NAME AND ADDRESS OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

Name: Regents of the University of Minnesota
Address: Sponsored Projects Administration
450 McNamara Alumni Center, 200 Oak Street SE
Minneapolis, MN 55455-2070

2. TITLE OF PROPOSAL
The Role of Water in Fertilizer Loss in Northwest Minnesota Wheat Production

3. PRINCIPAL INVESTIGATOR(S)
Dr. Lindsay Pease

PI# 2 Name:

PI# 3 Name:

4. PI #1 BUSINESS ADDRESS

UMN Northwest Research & Outreach Center
2900 University Ave
Crookston, MN 56716

5. PROPOSED PROJECT DATES (calendar years)
April 1, 2020 – March 31, 2021

Note: Research Reports are Due November 15th of Each Year

6. TOTAL PROJECT COST

7. PI #1 PHONE NO.

(218) 281-8608

8. RESEARCH OBJECTIVES: (List objectives to be accomplished by research grant)

1. Establish one fully instrumented, on-farm water monitoring research site to improve our ability to capture fertilizer loss in surface runoff and subsurface drainage discharge at the field scale.
2. Collect grab samples of tile discharge and soil samples from four satellite on-farm locations to broaden the interpretation and applicability of findings across Northwest Minnesota's wheat growing region.
3. Establish a 4R Field Day event in Northwest Minnesota to help Red River Basin farmers optimize fertility strategies and minimize loss via runoff and subsurface tile discharge.
4. Bring a greater understanding of the role that water and soil moisture plays in the movement of fertilizer both within and out of the soil profile for farmers who grow wheat rotations in the greater North Central region.

Attach a 2-page detailed discussion of importance of the proposal to wheat profitability; how study complements previous research in area; procedures to be used; and competency of the research group in achieving research objectives. (Please keep the proposal concise, only 2 pages will be provided reviewers).

Signature Of Principal Investigator	**Date**	**Phone Number**
Lindsay Pease	**1/24/20**	**218-281-8608**

Signature Of Authorized Representative	**Title**	**Date**
Amy Brick Skoog	Principal Grant Administrator	30 January 2020

Address Of Authorized Representative	**Phone Number**
Office of Sponsored Projects Administration 450 McNamara Alumni Center, 200 Oak Street SE, Minneapolis, MN 55455-2070	612-624-5599

Minnesota Wheat Research and Promotion Council
RESEARCH PROJECT PROPOSAL
(2-pages maximum)

Project Title:
The Role of Water in Fertilizer Loss in Northwest Minnesota Wheat Production

Importance of this project to the profitability of wheat producers:
High-quality wheat production relies on strategic application of fertilizers and good luck with the weather. Although growers are not able to control the weather, they are able to optimize nitrogen and phosphorus applications to produce maximum quality yield. Fertilizer is a major expense in crop production, so any unintentional losses following heavy rainfall events can add up to a significant expense across all acres. Despite the importance of nutrient management in wheat production, much of our current understanding of fertilizer movement and loss is based on corn-soybean rotations from the lower Midwest (e.g., Hanrahan et al. 2019, King et al. 2018), far outside of Minnesota's primary wheat-growing region. In light of the wet weather during planting and harvest in recent years, there is an *urgent need* to evaluate the role of water in off-site fertilizer movement for wheat-based rotations in Northwest Minnesota. In the short term, this knowledge will aid growers in making informed fertilizer applications based on soil moisture and weather conditions. It will also improve our understanding of the potential impact of wheat production on the environment. In the long-term, collection of nitrogen loss data will help to strengthen the position of wheat growers in demonstrating proactive, voluntary efforts toward water quality improvement if faced with increased regulation in the future.

Procedures:
- Establish one fully-instrumented primary field site on a cooperating producer's field to monitor nitrogen and phosphorus loss in surface runoff, soil moisture, and rainfall.
- Conduct directed grab sampling from subsurface drainage discharge (when present) at four additional on-farm locations. These four sites will not have intensive water monitoring, but will improve to assist in broader interpretation of findings at primary site.
- Water samples will be analyzed for Total Nitrogen, Total Phosphorus, Nitrate, and Dissolved Phosphorus.
- Each field site will be sampled once per month for plant available nitrogen and phosphorus during the growing season at shallow (0 to 8 in.) and deeper (8 to 24 in.) to capture in-season fertility changes.
- Statistical analysis on grab sample data will be conducted using multilinear regression according to the procedures outlined in Pease et al. (2018b) to identify interactions between soil moisture, rainfall, runoff/discharge, nitrogen loss, and phosphorus loss.
- Findings from this project will be strengthened using shared data from a new research initiative between Minnesota, Manitoba, and North Dakota focused on understanding of the interaction between agricultural management and water quality throughout the broader Lake Winnipeg Basin watershed.

Regional linkage to other research activities:
Drainage Research Plots at the Northwest Research & Outreach Center – A fully-instrumented field site in a Soybean-Wheat Rotation in Crookston, MN. Monitoring data (discharge, water quality, management information) from this site will be used in conjunction with the results for the proposed project to strengthen the overall findings of the proposed project regarding fertilizer loss in subsurface drainage water.

Lake Winnipeg Basin 4R Project – A collaborative, international effort between Minnesota, Manitoba, and North Dakota to improve understanding of agricultural management and water quality on a North-South gradient in the Lake Winnipeg Basin. Collaborating institutions include University of Minnesota, North Dakota State University, Minnesota Department of Agriculture, and University of Manitoba.

Minnesota Discovery Farms Project – On-farm water quality monitoring conducted throughout the state of Minnesota. Currently, this effort has limited locations in the Red River Basin region of Minnesota.

List current or potential other funding sources for this project:
Red River Basin Watershed Management Board (Pending securing additional funding): $35,000 (partial funding) to ensure long-term support of instrumentation and data analysis at proposed on-farm research site

4R Research Fund (Pending securing additional funding): $800,000 towards long-term data collection in this project and incorporating its results as described above (Lake Winnipeg Basin 4R Project).

Research Group:
Dr. Lindsay Pease, Assistant Professor and Extension Specialist in Nutrient and Water Management
Heidi Reitmeier, NWROC Soils Researcher 2, and UMN Graduate Student

Relationship to past projects:
This work will build on previous and ongoing projects that explore the nitrogen balance in subsurface drained fields by expanding the scope to include phosphorus in addition to nitrogen, and will aid in broadening the interpretation of prior research findings from plot-scale to field-scale. Findings and results that came out of projects similar to the proposed work have been published in Pease et al. (2018a), Pease et al. (2018b), and Hanrahan et al. (2019).

Estimate the budget requirements:

Personnel
Salary & Fringe

- **NWROC Soils Researcher 2** to assist with sample collection across locations, data processing, and, analysis.
  - 10% FTE at base $40,000 = $4,000
  - Fringe at 29.5% =$1,180
- **Undergraduate student assistant** for Dr. Lindsay Pease, Principle Investigator, to assist with sample collection, data processing, and analysis.
  - $12/hr x 120 hr/yr = $1,440

Supplies & Materials
General Operating Supplies

- Food and rentals for 4R Field Day = $2,000

Laboratory Supplies
The funding requested for laboratory supplies to analyze soil samples and gas flux samples is as follows:

- Approx. 150 water samples/year x $5/sample = $750
- Approx. 50 soil samples/year x 2 depths x $5/sample = $500

Field Supplies

- Miscellaneous field supplies (wiring, tubing, bags, sample bottles, etc.) = $2,500
- Surface flume to measure surface runoff = 1 site x 2/site x $1500 = $3,000
- Solar panel and battery for automated water sampler = 1 site x 2/site x $1200 = $2,400

Non-capital Equipment

- Soil moisture sensors ($200 x 4 sites x 3 depths) = $2,400
- Sonic ranging sensor (1 site x 1/site x $1375) = $1,375
- Water level and barometric pressure logger for discharge monitoring in lift station (1 site x 2/site x $900) = $1,800
- Automated water samplers (1 site x 2/site x $3500) = $7,000

Professional Services
Professional Services

- Printing services for outreach materials, postcards, and mailers = $500

Travel

- MN travel: Travel within MN for field data collection and in-person meetings with cooperators = $3,000
- National travel: Travel to present results at regional extension events and meetings = $1,000

References:
Hanrahan, B.R., K.W. King, M.R. Williams, E.W. Duncan, **L.A. Pease**, and G.A. LaBarge. 2019. Nutrient balances influence hydrologic losses of nitrogen and phosphorus across agricultural fields in northwestern Ohio. Nutrient Cycling in Agroecosystems 113(3):231–245.

King, K.W., M.R. Williams, G.A. LaBarge, D.R. Smith, J.M. Reutter, E.W. Duncan, and **L.A. Pease**. 2018. Addressing agricultural phosphorus loss in artificially drained landscapes with 4R nutrient management practices. Journal of Soil and Water Conservation 73(1):35–47.

Pease, L.A., K.W. King, M.R. Williams, G.A. LaBarge, E.W. Duncan, and N.R. Fausey. 2018a. Phosphorus export from artificially drained fields across the Eastern Corn Belt. Journal of Great Lakes Research 44(1):43–53.

Pease, L.A., N.R. Fausey, J.F. Martin, and L.C. Brown. 2018b. Weather, landscape, and management effects on nitrate and soluble phosphorus concentrations in subsurface drainage in the Western Lake Erie Basin. Transactions of the ASABE 61(1):223–232.