


# Minnesota Wheat Research and Promotion Council

## RESEARCH PROPOSAL GRANT APPLICATION

<b>1. NAME AND ADDRESS OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE</b>  <b>Name:</b> Regents of the University of Minnesota <b>Address:</b> Sponsored Projects Administration 450 McNamara Alumni Center, 200 Oak Street SE Minneapolis, MN 55455-2070		
<b>2. TITLE OF PROPOSAL</b> Evaluating the impact of drain spacing and fungicide seed treatment on common root rot and Fusarium crown rot in wheat		
<b>3. PRINCIPAL INVESTIGATOR(S)</b> <b>Ashok Kumar Chanda (PI)</b> Jochum Wiersma (Co-PI) Jeffrey Strock (Co-PI) Lindsay Pease (Co-PI)	<b>4. PI #1 BUSINESS ADDRESS</b> Northwest Research and Outreach Center 2900 University Avenue Crookston MN 56716	
<b>5. PROPOSED PROJECT DATES (Jan 1 – Dec 31)</b>  January 01, 2022 – December 31, 2022 Note: Annual Research Reports are Due November 15th	<b>6. TOTAL PROJECT COST</b>  \$24,763.00	<b>7. PI #1 PHONE NO.</b>  218-281-8625
<b>8. RESEARCH OBJECTIVES:</b> (List objectives to be accomplished by research grant)  Evaluate the impact of tile drain spacing and fungicide seed treatments on wheat 1. Stand establishment 2. Incidence and severity of Fusarium crown rot (FCR) and common root rot (CRR) 3. Grain yield  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).		
<b>Signature</b> 		<b>Date</b>  1/11/22

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## RESEARCH PROJECT PROPOSAL

### (2-pages maximum)

#### Abstract

Despite the connection between soil moisture, soil temperature and root diseases, the interaction between subsurface drainage spacing and fungicide seed treatment has not been adequately studied in the Red River Valley (RRV). Without this information, growers cannot fully evaluate the costs of subsurface drainage systems against its potential benefits for wheat production. This project is specifically aimed at evaluating artificial drainage, specifically drain spacing on stand establishment, incidence and severity of Fusarium crown rot (FCR) and common root rot (CRR) of wheat, and their impacts on grain yield.

#### Describe the background for your proposed project and the importance of this project to the profitability of wheat production in MN

There are a number of potential options for reducing crop damage, disease incidence, and yield loss caused by waterlogging/drought. Selecting crop varieties with tolerance to waterlogging/drought and resistance to plant disease can be very useful. Excess moisture can also be managed by installing artificial drainage, and by increasing evapotranspiration and soil profile drying using cover crops. Although genetic tolerance, cover cropping, and artificial drainage methods should all be evaluated, this project is specifically aimed at evaluating artificial drainage, specifically drain spacing. Excess or limited water stress to plants can lead to both lost productivity and increased disease susceptibility. Both directly and indirectly, these stresses make wheat vulnerable to damage by pathogens, especially in the early stages of plant development. In the RRV, dry soil conditions can favor development of CRR, caused by *Bipolaris sorokiniana* under cooler soil conditions, or FCR, caused by Fusarium spp. under warmer soil conditions. Dry conditions during the latter part of the growing season, can aggravate FCR. The evaluation of wheat fungicide seed treatments in North Dakota showed variable results since 2014 (A. Friskop, 2021, [https://www.ndsu.edu/agriculture/sites/default/files/2021-07/2.CPR\\_May%206.2021.pdf](https://www.ndsu.edu/agriculture/sites/default/files/2021-07/2.CPR_May%206.2021.pdf)) partly due to variable weather conditions from year to year. Conversely, periods of high rainfall can lead to waterlogging that can last from hours to days due to the slow internal drainage of clayey soils. Surface run-off can also move pathogen propagules within a field. Crop tolerance to excess water stress depends on both its ability to survive when its root system is submerged and its ability to recover after the soil profile drains. Wet soil conditions during seedling emergence and stand establishment favor root rot caused by *Pythium* spp. Excess water is often associated with exacerbation of root rots by anaerobic soft rot causing bacteria and other saprophytic fungi present in the soil. Infected plants may die as seedlings, survive in a weakened, lower-yielding state, or outgrow the initial infection if the conditions are favorable later in the growing season. The proposed research at Northwest Research & Outreach Center has various drain spacings, which create a variety of soil moisture profiles and allow studying the impact of excess and limited soil moisture on root rot diseases. We expect the gradient in drainage coefficients to reduce the year-to-year variability in soil moisture content that yield the previously reported inconsistencies in results.

#### Research methods

This research will be conducted at the Northwest Research and Outreach Center in Crookston, MN. The soil at the site is classified as a Hegne silty clay loam, a poorly drained soil. The research plot area, established in 2001, consists of a combination of undrained and drained experimental units. Subsurface drainage is installed at a depth of about 40 inches. The site consists of five drain spacings: 15, 25, 40 and 60 ft. apart and a control which is undrained, representing drainage intensities (water removal rates) of 0.25, 0.50, and 0.75 in/d. Replicated plots will be included for each drain tile spacing for blocks planted with wheat. This experiment will be conducted within a six-acre, four crop research experiment. This study site has a wheat–sugarbeet–corn–dry bean rotation with every crop present every year beginning 2021. There are four blocks consisting of 55 ft. wide strips of each crop in the rotation planted perpendicular to the drain tile. Agronomic practices, including varieties, weed control, tillage and fertility will follow Extension recommendations. The need for

artificially infesting plots with *Bipolaris sorokiniana* and *Fusarium spp.* will be determined prior to planting. A fungicide seed treatment combination (QoI + DMI + metalxyl/mefeoaxam) that has efficacy against *Pythium spp.*, CRR and FCR will be selected. Data will be collected for early season stands as a measure of incidence of CRR and FCR seedling infections, incidence of premature white heads as a measure of late-season CRR and FCR infections, and grain yield as a measure of severity of sub-lethal CRR and FCR infections at harvest. One treatment will include an untreated control. Inclusion of artificial subsurface drainage is expected to affect the root rot incidence over the control (undrained); in addition, further decreases in disease incidence is expected with the use of fungicide seed treatment. Isolates will be recovered from each treatment/drain spacing combination to determine the causal agent of the root rot either by culture morphology or sequencing ETF-1a region.

4 yr rotation plan				
Year	Area 4	Area 3	Area 2	Area 1
2021	<b>Wheat</b>	Corn	Sugarbeet	Dry bean
<b>2022</b>	Sugarbeet	Dry bean	Corn	<b>Wheat</b>
2023	Corn	<b>Wheat</b>	Dry bean	Sugarbeet
2024	Dry bean	Sugarbeet	<b>Wheat</b>	Corn

#### Timeline for completion

**Mar-May:** Inoculum preparation (if needed), spreading inoculum (if needed), Planting; **May-Aug:** stand counts, root rot assessment and harvest; **Sept-Dec:** Data analysis, report writing and dissemination of research at winter grower meetings

#### Outreach plan

The collected data and interpretations are disseminated to the greater public through extension talks and presentations, including the Small Grains Update, Prairie Grains Conference, Southern Small Grains Tour, and the Best of the Best in Wheat and Soybean Research series of meetings.

#### List other current or pending funding sources for this project:

**Current:** Northarvest Bean Growers Association. Title, “Dry bean Response to Drainage and Fungicide treatment in Northwest Minnesota,” Jeff Strock, Lindsay Pease, and Ashok Chanda, 2021.

#### **Pending:**

Sugarbeet Research & Education Board of MN & ND. Title, “Evaluating the impact of drain spacing on soil health and Rhizoctonia root rot in sugarbeet,” Ashok Chanda, Lindsay Pease, and Jeff Strock, 2022.

#### Research group (other collaborators not listed as PIs):

#### Relationship to past projects and research conducted by you or others in the region:

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## RESEARCH PROJECT PROPOSAL BUDGET

<p><b>Project Title:</b></p> <p>Evaluating the impact of drain spacing and fungicide seed treatment on common root rot and Fusarium crown rot in wheat</p>			
Principal Investigator(s) / Project Director(s)	Funds Requested For		
	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)
A. Salaries and Wages	\$	\$	\$
1. Co-principal Investigator(s)			
2. Senior Associates			
3. Research Associates – Post Doctorate			
4. Other Professionals	\$13,000.00		
5. Graduate Students			
6. Prebaccalaureate Students	\$896.00		
7. Secretarial - Clerical			
8. Technical, Shop and Other			
B. Fringe Benefits	\$3,767.00		
C. Consulting and Professional Services			
D. Supplies and Services	\$5,000.00		
E. Travel	\$1,000.00		
F. Sub-Contracts			
G. Repairs & Maintenance			
H. Rentals & Lease			
I. Other Expenses	\$1,100.00		
<b>TOTAL AMOUNT OF THIS REQUEST (per year)</b>	<b>\$24,763.00</b>	<b>\$</b>	<b>\$</b>