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
454 McNamara Alumni Center, 200 Oak Street SE
Minneapolis, MN 55455-2070

2. TITLE OF PROPOSAL
University of Minnesota Wheat Breeding Program

3. PRINCIPAL INVESTIGATOR(S)	**4. PI #1 BUSINESS ADDRESS**
James A. Anderson	Dept. of Agronomy & Plant Genetics 411 Borlaug Hall 1991 Upper Buford Circle St. Paul, MN 55108
PI# 2 Name: Jochum Wiersma	
PI# 3 Name:	

5. PROPOSED PROJECT DATES (calendar years)	**6. TOTAL PROJECT COST**	**7. PI #1 PHONE NO.**
1/1/25-12/31/27 Note: Research Reports are Due November 15th of Each Year	$812,440	612-625-9763

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

1. Develop improved wheat varieties and germplasm combining high grain yield, disease resistance, and end-use quality

2. Provide performance data on wheat varieties adapted to the state of Minnesota

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**
James A. Anderson	November 18, 2024	612-625-9763

Signature Of Authorized Representative	**Title**	**Date**
Kelsey Grachek Digitally signed by Kelsey Grachek Date: 2024.11.21 09:10:58 -08'00'	Senior Grants Officer	11/21/2024

Address Of Authorized Representative	**Phone Number**
Kelsey Grachek, Senior Grants Officer, 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
FULL RESEARCH PROPOSAL TEMPLATE
For Crop Year 2025

(Maximum Two Pages, Plus Itemized Budget)

Please Note: To speed up and streamline the granting process, we now require full proposals be submitted by 1:00 PM CST on November 22, 2024. You will need to include an itemized budget with your proposal that has been approved by your organization's accounting and/or sponsored programs department.

Project Title: University of Minnesota Wheat Breeding Program
Principle Investigator (PI): James A. Anderson, Professor
Organization: University of Minnesota
Email address and Primary phone number: ander319@umn.edu, 612-625-9763

Additional Investigator(s): Jochum Wiersma, Extension Professor
Organization: University of Minnesota
Email address and Primary phone number: wiers002@umn.edu, 218-281-8629

Project Period: January 1, 2025 – December 31, 2027
Estimated cost: $812,440

Abstract

Genetic improvement of wheat is crucial to meet the needs of both growers and consumers. The University of Minnesota's breeding program focuses on developing high-yielding, lodging and disease-resistant varieties with good quality and evaluates ~50 varieties in statewide trials to help growers make informed choices. By using advanced techniques like genomic prediction and drone technology, the program aims to accelerate the development of superior wheat varieties. Recent UMN releases have had significant impact on regional wheat production, and this germplasm is widely used by other breeding programs.

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

Genetic improvement of wheat varieties is critical to meet both producer and end-user needs. The most important traits are grain yield, lodging resistance, disease resistance (predominantly Fusarium head blight and bacterial leaf streak), and end-use quality which includes protein content, pre-harvest sprouting resistance, and milling and baking quality. Our breeding program is well-positioned and experienced in breeding for all of these important traits. Our goal is to continue to release high yielding, disease resistant varieties with good end-use quality. In addition, we coordinate the testing of ~50 public and private released hard spring wheat varieties per year in statewide trials to assess their performance in yield nurseries, end-use quality, and reactions to important diseases. This information is critical for growers to make informed variety selections. Plant breeding is a numbers game. Assuming that exceptional germplasm is available and the best crosses are made, the more lines that are tested, the better chance of identifying improved varieties. We are using predictive breeding approaches that leverage affordable DNA sequencing. Drones and other imaging equipment is also being used to automate and improve data collection.

Variety choice is a critical component to profitable wheat production. Since 2016, University of Minnesota developed varieties were grown on an estimated 39% of Minnesota's wheat acres. Recent UMN releases that have been grown on large acreage in the region include 'Linkert' (2013), 'Bolles' (2015), 'Shelly' (2016), 'MN-Torgy' (2020), and 'MN-Rothsay' (2022). Linkert was the no. 1 variety in Minnesota from 2016-2020 and MN-Torgy was no. 1 in 2023. Germplasm from our breeding program also is being used as parents by private and public breeding programs in the region.

Research methods:
Approximately 300 crosses are made per year. Winter nurseries are used to advance early generation material when appropriate, saving 1-2 years during the process from crossing to variety release. Early generation selection is practiced in nurseries in St. Paul (primarily for leaf rust and stem rust resistance) and Crookston. Approximately 480 new lines are evaluated in preliminary yield trials annually at 3 locations. Advanced yield trials - containing approximately 200 experimental lines – are evaluated at 10-11 locations. Table 1 shows the number of anticipated yield plots at each testing location. All yield nurseries are grown as 50-80 sq. ft. plots. Misted, inoculated Fusarium head blight nurseries are grown in Crookston and St. Paul and an inoculated leaf and stem rust nursery is grown in St. Paul. These nurseries involve collaboration with agronomists and pathologists at these locations and are funded from other resources. We are implementing genomic prediction in the breeding program. This involves predicting the performance of experimental lines based on DNA sequence information using a training population of related lines. This allows us to find the rare lines that combine all the necessary traits and proportionally advance a larger number of high potential lines for continued testing, ultimately resulting in greater gains from selection and more successful releases.

Table 1. Anticipated number of yield plots at each location 2025-2027.

* Additional locations containing AY1 (named varieties) are grown at Becker, Benson, and Le Center and are funded by a different Wheat Council grant.

Outline the timeline for completion:
This is a continuation of the University of Minnesota Wheat Breeding and Genetics Project. We expect new varieties to be released from the program on average of at least one every few years.

What methods, if any, will be used to disseminate your research findings out to the greater public, beyond the final report due to Minnesota Wheat Research and Promotion Council:
Wheat cultivar performance of ~50 spring wheat cultivars is reported annually to growers via print media (*Prairie Grains* and *Seed Growers Guide)* and the MAES's 2024 *Minnesota Field Crop Variety Trials*., web-accessible publications (https://varietytrials.umn.edu), winter meetings, and field day presentations. Variety releases are published in the *Journal of Plant Registrations*.

List potential collaborators or co-investigators you may consider inviting to participate:

Ruth Dill-Macky, Brian Steffenson	Dept. of Plant Pathology, UMN
George Annor	Dept. of Food Science & Nutrition, UMN
Pablo Oilvera, Matt Moscou, Yue Jin	USDA-ARS Cereal Disease Lab, St. Paul
Jason Fiedler	USDA-ARS Genotyping Center, Fargo
Linda Dykes	USDA-ARS Wheat Quality Lab, Fargo

Estimate the budget requirements:

Salaries and Fringe Benefits ($665,640)

- St. Paul field technician (M.S. level) and ½ salary of lab technician (salaries $352,362, fringe $113,813)
- Crookston technician (B.S. level) (Salary $138,403, fringe $44,704)
- Roseau technician (5% of Don Vellekson's time for plot care at Roseau): Salary $12,364, fringe $3,994)

Prebaccalaureate Students ($58,000)

- Support plot work and sample processing for Anderson ($29,000) and Wiersma ($29,000)

Supplies and Services ($30,000):

- Expendables including envelopes and bags ($7,800)
- ASREML-R software for statistical analyses ($1,200)
- 1/3 the total costs of DNA extraction, reagents, and sequencing for genomic selection on 2,500 F_5 lines ($21,000). The remainder of this expense is paid by USWBSI grants.

Travel ($30,000):

- Mileage charges for on-farm yield trials ($16,000)
- Partial travel costs for Anderson project personnel to visit plots and take notes/harvest ($10,000)
- Vellekson travel to/from Roseau ($4,000)

Rentals & Lease ($28,800)

- Rental charge for use of new plot combine on St. Paul campus (40 hours per year @$240/hr.)

List sources and amounts of additional funding for this project, and indicate if they have committed to provide funding or if you have requested funding:

- Breeding and Genomic Selection for Fusarium Head Blight Resistance in Spring Wheat, J. Anderson, 6/24-5/25, US Wheat and Barley Scab Initiative via USDA-ARS, $154,608
- Breeding Disease Resistant Wheat, J. Anderson, 7/24-6/25, Minnesota Small Grains Initiative via MAES, $78,058
- NIFA CAP for Innovation in Genomic Technology to Accelerate Breeding: "Leveraging high-throughput genotyping and phenotyping technologies to accelerate wheat improvement", Dubcovsky et al., 1/22-12/26, USDA-AFRI, $15,000,000 ($542,855 to Anderson & Sadok)
- Analysis of data from the hard red spring wheat varieties grown in cooperative plot and nursery experiments for yield and other agronomic traits, Anderson, J.A., 7/23-6/25, USDA-ARS Specific Cooperative Agreement, $136,380
- Continued provision of rapid end-use quality characterization services to the University of Minnesota Wheat Breeding Program, G. Annor and J.A. Anderson, 1/24-12/25, MN Wheat Research & Promotion Council, $30,000
- Centralized Genomic Selection Resources to Accelerate Breeding FHB-Resistant Spring Wheat Cultivars, Fiedler, J, A. Green, J. Anderson, K. Glover, J. Cook, 5/24-4/25, US Wheat and Barley Scab Initiative via USDA-ARS, $150,160
- Southern Minnesota Small Grains Research & Outreach Project, J.J. Wiersma, 1/24-12/26, MN Wheat Research & Promotion Council, $74,992
- Optimization of Bacterial Leaf Streak Screening Nurseries for Hard Red Spring Wheat in Minnesota, R. Curland, R. Dill-Macky, and J. Anderson, 1/25-12/26, MN Wheat Research & Promotion Council, $96,408, submitted
- Breeding to boost seed-filling and increase Minnesota wheat yields, W. Sadok and J. Anderson, 1/25-12/25, MN Wheat Research & Promotion Council, $53,531, submitted

Submit full proposal (max. 2 pages) and itemized budget to bsorenson@mnwheat.com by 1:00 PM, 11/22/24

Minnesota Wheat Research and Promotion Council

RESEARCH PROJECT PROPOSAL BUDGET

Project Title: University of Minnesota Wheat Breeding Program

Principal Investigator(s) / Project Director(s) James A. Anderson Jochum J. Wiersma	Funds Requested For		
	Year 1 Crop Yr 2025	Year 2 Crop Yr 2026	Year 3 Crop Yr 2027
A. Salaries and Wages	$182,000	$186,665	$192,464
1. Co-principal Investigator(s)			
2. Senior Associates			
3. Research Associates – Post Doctorate			
4. Other Professionals	163,000	167,665	172,464
5. Graduate Students			
6. Prebaccalaureate Students	19,000	19,000	20,000
7. Secretarial - Clerical			
8. Technical, Shop and Other			
B. Fringe Benefits	52,649	54,156	55,706
C. Consulting and Professional Services			
D. Supplies and Services	10,000	10,000	10,000
E. Travel	10,000	10,000	10,000
F. Sub-Contracts			
G. Repairs & Maintenance			
H. Rentals & Lease	9,600	9,600	9,600
I. Other Expenses			
TOTAL AMOUNT OF THIS REQUEST (per year)	**$264,249**	**$270,421**	**$277,770**