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 University of Minnesota 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.
01/01/2017-12/31/2017 Note: Research Reports are Due November 15th of Each Year	$ 169,555	612-625-9763

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

1. Develop improved 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	January 3, 2016	612-625-9763
Signature Of Authorized Representative	**Title** Kevin McKoskey, Director Sponsored Projects Administration	**Date** 1/5/17
Address Of Authorized Representative Kevin McKoskey, Sr. Associate Director, Office of Sponsored Projects Administration 450 McNamara Alumni Center, 200 Oak Street SE, Minneapolis, MN 55455-2070		**Phone Number** 612-624-5599

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

Project Title:

University of Minnesota Wheat Breeding Program

Importance of this project to the profitability of wheat producers:

Linkert was the no. 1 variety in Minnesota in 2016, sown on 27.8% of the state's wheat acres (Minnesota Wheat Growers survey). WB-Mayville was the 2nd most popular variety at 13.1%, followed by Prosper (10.2%), Bolles (8.8%) and Faller (6.0%). Publicly developed varieties accounted for an estimated 60% of wheat acres in 2016 and 67% of the public share was from varieties developed primarily at the University of Minnesota. Recent releases include 'Rollag' (2011), co-release of 'Prosper' (2011), 'Norden' (2012), 'Linkert' (2013), 'Bolles' (2015), and 'Shelly' (2016). Our breeding program continues to develop some of the most scab resistant germplasm in the region and this material is used as parents by private and public breeding programs. Our goal is to continue to release high yielding, disease resistant varieties with good end-use quality. In addition, we coordinate the testing of 20-25 other public and private released hard spring wheat varieties per year in statewide trials to assess their performance in yield nurseries and reactions to important diseases. This information is critical to growers to make informed choices regarding varieties. Program funding from state and federal sources is either flat or declining. 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. New selection technologies, facilitated by cheaper DNA sequencing, is being investigated to accelerate gains in the breeding program.

Improved varieties are one of the most important components of profitable wheat production. Choice of variety is one of the most important decisions growers make each year. The development of high-yielding varieties that are resistant to the prevalent diseases and have good end-use quality are necessary to increase grower profit and protect against constantly changing pathogens and pests. As an example, a new variety that yields 4% higher will produce 3 extra bushels in a field that averages 75 bu/A.

Procedures:

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 500 new lines are evaluated in preliminary yield trials annually at 2 or 3 locations (Crookston, Morris, and St. Paul) depending on availability of seed. Advanced yield trials - containing approximately 260 experimental lines – are evaluated at up to 10 locations, depending on availability of seed. Table 1 shows the number of yield plots at each testing location.

Table 1. Anticipated number of yield plots at each location in 2017.

		No. plots per yield trial						
Location*	**U of MN or on-farm land**	**AY1 conv.**	**AY1 Intensive**	**AY2**	**AY3-8**	**PY**	**Regional**	**Total**
Crookston	U of MN	150	150	80	240	480	120	1220
Fergus Falls	On-farm	150	-	40	240	-	-	430
Hallock	On-farm	150	-	40	240	-	-	430
Lamberton	U of MN	150	150	40	-	-	-	340
Morris	U of MN	150	150	40	240	480	120	1180
Oklee	On-farm	150	-	40	240	-	-	430
Perley	On-farm	150	-	40	240	-	-	430
Roseau	U of MN	150	150	40	240	-	-	580
St. Paul	U of MN	150	-	80	240	480	120	1070
Stephen	On-farm	150	-	40	240	-	-	430
Strathcona	On-farm	150	-	40	240	-	-	430
Waseca	U of MN	150	-	-	-	-	-	150
TOTAL		1800	600	520	2400	1440	360	7120

* Additional locations containing AY1 (named varieties) are grown at Benson, Kimball, and LeCenter and are funded by a different Wheat Council proposal.

All yield nurseries are grown in small, replicated plots (approximately 50-80 sq. ft. harvested area per plot). Misted, inoculated Fusarium head blight nurseries are grown in Crookston and St. Paul and inoculated rust nurseries are grown at St. Paul. These nurseries involve collaboration with agronomists and pathologists at these locations and are funded from other resources. We are implementing genomic selection in the breeding program. This involves predicting the performance of experimental lines based on DNA sequencing of related lines. This allows us to screen a larger number of plants that we can't accommodate in our field trials, and can help us find the rare plants that combine all the necessary traits in a high yielding line.

Regional linkage to other research activities:

Our wheat breeding and genetics project collaborates with other wheat research programs at the U of M as well as other public and private breeding programs in the region. Germplasm is exchanged with other wheat breeding programs, and we will fully participate in the USDA-ARS coordinated Regional Nursery system which allows us to cooperatively test promising new lines from other programs. One regional nursery is intended for lines nearing a release decision while a second nursery screens promising sources of scab resistance.

List current or potential other funding sources for this project:

Agricultural Innovation Program (AIP) – Pakistan [support for Ph.D. candidate Yahya Rauf] J. Anderson, 10/14-12/18, CIMMYT via Univ. Cal.-Davis, $173,632

Breeding Fusarium Head Blight Resistant Spring Wheat, J. Anderson, 5/16-4/17, USWBSI (VDHR) via USDA-ARS, $111,881

Genomic Selection for Fusarium Head Blight Resistance in Spring Wheat, J. Anderson, 5/15-4/17, USWBSI (VDHR) via USDA-ARS, $39,927

Accelerated Breeding of Disease Resistant Wheat, J. Anderson, 7/15-6/17, Minnesota Small Grains Initiative via MAES, $107,457

Borlaug Higher Education Agricultural Research and Development (BHEARD) [support for Ph.D. candidate Cyrus Kimani N'dunglu], J. Bradeen, J. Anderson, M. Rouse, 8/15-7/20, BHEARD via Michigan St. Univ., $208,786

Winter Wheat in Minnesota (subcontract with NDSU and Ducks Unlimited that pays for 20% of technical support project). J.J. Wiersma, 07/01/15-06/30/18, $48,000.

Red River On-Farm Yield Trial Summer Plot Tours. J.J. Wiersma, P.A. Glogoza, and M. Smith. 01/01/2017 – 12/31/2017, $ 2,654.- (submitted to MWRPC)

Southern Minnesota Small Grains Research & Outreach Project. J.J. Wiersma and P.A. Glogoza, 01/01/2017 – 12/31/2017, $20,183.- (submitted to MWRPC)

Research Group:

Dept. of Agronomy & Plant Genetics
Jim Anderson, Susan Reynolds, Nate Stuart
Emily Conley, Jen Flor

Dept. of Plant Pathology:
Ruth Dill-Macky, Carol Ishimaru, Brian Steffenson

Dept. of Food Science & Nutrition:
George Annor

USDA-ARS Cereal Disease Lab:
Jim Kolmer, Matt Rouse, Yue Jin

Off-Campus Collaborators
Crookston:
Jochum Wiersma, Chris Olson, Madeleine Smith, Mark Hanson, Bob Bouvette

Morris: Curt Reese
Roseau: Donn Vellekson, Dave Grafstrom
Lamberton: Steve Quiring
Waseca: Matt Bickell

USDA-ARS Fargo Genotyping Center:
Shiaoman Chao

USDA-ARS Wheat Qual. Lab:
Linda Dykes

Relationship to past projects:

This is a continuation of the University of Minnesota Wheat Breeding and Genetics Project.

Estimate the budget requirements:

Salaries and Fringe Benefits ($114,405)

- St. Paul technician (B.S. level) Salary $57,000; fringe $15,618. This is the salary for the senior technician on the wheat breeding & genetics project.
- Crookston technician (0.8 FTE B.S. level) Salary $29,500 ($37,000 annual), fringe $8,083. The balance of the salary and fringe (0.2 FTE) for the Crookston technician will be paid by a Bayer/Ducks Unlimited grant to Jochum Wiersma for winter wheat research.
- Roseau technician (5% of Don Vellekson's time for plot care at Roseau): Salary $3,300, fringe $904.

Prebaccalaureate Students ($16,000)

- Support plot work and sample processing for Wiersma ($12,000)
- Support plot work and sample processing for Anderson ($4,000)

Secretarial/Clerical: $1,000, Partial support of Agronomy & Plant Genetics secretary that assists with human resources and accounting activities associated with this project

Materials and Supplies ($17,250):

- Expendables including envelopes and bags ($1,300)
- Genstat software for statistical analyses ($350)
- DNA extraction, reagents, and sequencing costs for genomic selection on 2,000 F5 lines ($15,600) Note: The US Wheat & Barley Scab Initiative is providing an additional $7,000 towards this genomic selection project.

Travel ($10,900):

- Mileage charges for on-farm yield trials ($6,400)
- partial travel costs for Anderson project personnel to visit plots and take notes/harvest ($3,000)
- Vellekson travel to/from Roseau ($1,500)
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Other Direct Costs ($10,000)

- Direct charges for field research (all locations except LeCenter, Kimball, Benson, and Roseau). The remaining field charges will be paid by fee-based testing of private company lines.

References:

Minnesota Wheat Research and Promotion Council

RESEARCH PROJECT PROPOSAL BUDGET

PROJECT TITLE:

University of Minnesota Wheat Breeding Program

Principal Investigator(s) / Project Directors(s) James A. Anderson	Funds Requested For Year 1 (2016)	Year 2 (2017)	Year 3 (2018)
A. Salaries and Wages	$	$	$
1. Co-principal Investigator(s)			
2. Senior Associates			
3. Research Associates - Post Doctorate			
4. Other Professionals	89,800		
5. Graduate Students			
6. Prebaccalaureate Students	16,000		
7. Secretarial - Clerical	1,000		
8. Technical, Shop and Other			
B. Fringe Benefits	24,605		
C. Nonexpendable Equipment (Planting and harvesting equipment use)			
D. Materials and Supplies	17,250		
E. Travel	10,900		
F. Publication Costs			
G. Computer Costs			
H. All Other Direct Costs (Attach supporting data)	10,000		
TOTAL AMOUNT OF THIS REQUEST (per year)	$ 169,555	$	$