



## Minnesota Wheat Research and Promotion Council

### RESEARCH PROPOSAL GRANT APPLICATION

<b>1. NAME AND ADDRESS OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE</b>  Name: Regents of the University of Minnesota Address: Sponsored Projects Administration 454 McNamara Alumni Center, 200 Oak Street SE Minneapolis, MN 55455-2070		
<b>2. TITLE OF PROPOSAL</b>  University of Minnesota Wheat Breeding Program		
<b>3. PRINCIPAL INVESTIGATOR(S)</b>  James A. Anderson  PI# 2 Name: Jochum Wiersma  PI# 3 Name:	<b>4. PI #1 BUSINESS ADDRESS</b>  Dept. of Agronomy & Plant Genetics University of Minnesota St. Paul, MN 55108	
<b>5. PROPOSED PROJECT DATES (calendar years)</b> 01/01/2015-12/31/2015  <small>Note: Research Reports are Due November 15th of Each Year</small>	<b>6. TOTAL PROJECT COST</b>  143,571	<b>7. PI #1 PHONE NO.</b>  612-625-9763
<b>8. RESEARCH OBJECTIVES: (List objectives to be accomplished by research grant)</b>  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   <small>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).</small>		
<b>Signature Of Principal Investigator</b> 	<b>Date</b> February 4, 2015	<b>Phone Number</b> 612-625-9763
<b>Signature Of Authorized Representative</b> 	<b>Title</b> Kevin McKoskey Senior Associate Director Sponsored Projects Administration	<b>Date</b> 2/6/15
<b>Address Of Authorized Representative</b>  Kevin McKoskey, Sr. Associate Director, Office of Sponsored Projects Administration 450 McNamara Alumni Center, 200 Oak Street SE, Minneapolis, MN 55455-2070		<b>Phone Number</b>  612.624.5599 Telephone 612.624.4843 Fax No.

# Minnesota Wheat Research and Promotion Council

## RESEARCH PRE-PROPOSAL

### (2-pages maximum)

**Project Title:** University of Minnesota Wheat Breeding Program

**Importance of this project to the profitability of wheat producers:** Improved varieties are one of the most important components of profitable wheat production. Wheat yields must increase in order for this crop to remain economically viable in Minnesota. Publicly developed varieties accounted for an estimated 55% of wheat acres in 2014 (Minnesota Wheat Growers survey). More than 25% of the public share was varieties developed primarily at the University of Minnesota. Recent releases include 'Rollag' (2011), co-release of 'Prosper' (2011), 'Norden' (2012), and 'Linkert' (2013). 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. We are taking advantage of recent technological advances (e.g. DNA markers, innovations in equipment and experimental design) and upgrading or replacing equipment to help us make the next major gain in wheat yields while providing adequate disease resistance and end-use quality. We replaced our 1980's vintage NIR protein analyzer earlier this year using Variety Development Funds.

Its electronic connectivity and ability to also do test weights contributes to more efficient sample processing. We are exploring additional technologies, including optical seed sorting to more objectively classify scabby grain from our Fusarium head blight nurseries.

**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 600 lines are evaluated in preliminary yield trials at 2 or 3 locations (Crookston, Morris, and St. Paul) depending on availability of seed annually. 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. All yield nurseries are grown in small, replicated plots (approximately 50-80 sq. ft. harvested area per plot). Nurseries to assess reaction to other diseases including Fusarium head blight and foliar diseases are grown in Crookston, Morris, and St. Paul. These nurseries involve collaboration with agronomists at Crookston and Morris, and personnel from the Plant Pathology Department and are funded from other resources.

**Table 1. Anticipated number of yield plots at each location in 2015. An additional 1,000 or more plots are anticipated from other genetic studies.**

Location*	U of MN or on-farm land	No. plots per yield trial						
		AY1 conv.	AY1 intensive	AY2	AY3-8	PY	Regional	Total
Crookston	U of MN	150	150	80	220	480	120	1200
Fergus Falls	On-farm	150	-	40	144	-	-	334
Hallock	On-farm	150	-	40	144	-	-	334
Lamberton	U of MN	150	150	40	-	-	-	340
Morris	U of MN	150	150	40	220	480	120	1160
Oklee	On-farm	150	-	40	144	-	-	334
Perley	On-farm	150	-	40	144	-	-	334
Roseau	U of MN	150	150	40	220	-	-	560
St. Paul	U of MN	150	-	80	220	480	120	1050
Stephen	On-farm	150	-	40	144	-	-	334
Strathcona	On-farm	150	-	40	144	-	-	334
Waseca	U of MN	150	-	-	-	-	-	150
<b>TOTAL</b>		<b>1800</b>	<b>600</b>	<b>520</b>	<b>1744</b>	<b>1440</b>	<b>360</b>	<b>6464</b>

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

**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.

**Research Group:**

**Dept. of Agronomy & Plant Genetics**  
 Jim Anderson, Susan Reynolds, Lance Miller  
 Emily Conley, Jen Flor  
**Dept. of Plant Pathology:**  
 Ruth Dill-Macky, Carol Ishimaru, Brian  
 Steffenson  
**Dept. of Food Science & Nutrition:**  
 Alessandra Marti (interim)  
**USDA-ARS Cereal Disease Lab:**  
 Jim Kolmer, Matt Rouse, Yue Jin

**Off-Campus Collaborators**  
Crookston/Stephen:  
 Jochum Wiersma, Galen Thompson  
 Madeleine Smith  
Morris: George Nelson  
Roseau: Donn Vellekson, Dave Grafstrom  
Lamberton: Steve Quiring  
Waseca: Tom Hoverstad  
**USDA-ARS Fargo Genotyping Center:**  
 Shiaoan Chao  
**USDA-ARS Wheat Qual. Lab:**  
 Linda Dykes, Jae Ohm

**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:** St. Paul technician (B.S. level) Salary \$53,000; fringe \$19,504. This is the salary for the senior technician on the wheat breeding & genetics project. Crookston technician (0.8 FTE B.S. level) Salary \$32,466, fringe \$11,947. 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 \$3,110, fringe \$1,144

**Prebaccalaureate Students** \$5,000 to support plot work and sample processing for Jochum Wiersma

**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:** Expendables including envelopes and bags (\$500); Genstat software for statistical analyses (\$700)

**Travel:** Mileage charges for on-farm yield trials, \$3,700 + Vellekson travel to/from Roseau, \$1,500

**Other Direct Costs:** Direct charges for field research (all locations except LeCenter, Kimball, Benson, and Roseau); \$10,000

The remaining field charges will be paid by fee-based testing of private company lines.

**List current or potential other funding sources for this project:** The projects listed below support 2 graduate students and 1 postdoc working on spring wheat, 1 field-based and 1 lab-based technician, 4-6 part-time employees (mostly undergrads), a winter nursery, Fusarium and other disease screening nurseries, and DNA marker-assisted selection.

PI's	Source	Amount	Dates	Title
J. Anderson	Minnesota Small Grains Initiative via MAES	\$111,960	7/13- 6/15	Accelerated Breeding of Disease Resistant Wheat
J. Anderson	USWBSI (VDHR) via USDA-ARS	\$43,311	5/14- 4/15	Genomic Selection for Fusarium Head Blight Resistance in Spring Wheat
J. Anderson	MAES Variety Development Fund	\$150,000	2/13- 1/16	Wheat project equipment and investigation of yield-enhancing technology and traits
J.J. Wiersma	Small Grains Initiative	\$21,250	7/14- 7/15	General Support Small Grains Specialist
J.J. Wiersma	NDSU/Ducks Unlimited	\$36,000	1/15- 12/16	Winter Wheat in Minnesota
M. Smith et al.	USWBSI	\$3,000	5/14- 4/15	Uniform Fungicide Trials

## List your programs current and pending support:

PI's	Source	Amount	Dates	Title
N. Jordan, J. Anderson, P. Porter, D. Wyse,	USDA CSREES Food & Agric. Sci. Nat. Needs Graduate and Postdoctoral Fellowship	\$156,000	1/10-12/14	Graduate Training in Agroecology: An Integrative Bioscience for Sustainable Food and Agricultural Systems
D. Wyse et al.	IREE, University of Minnesota	\$276,000	7/11-6/15	Developing Intermediate Wheatgrass for Sustainable Co-production of Fuel and Food
R. Coffman et al.	United Kingdom's Department of International Development (DFID) Bill & Melinda Gates Foundation via Cornell University	\$229,686	3/11-2/15	Durable Rust Resistance in Wheat
J. Anderson, J. Wiersma	MN Wheat Research and Promotion Council	\$144,866	1/14-12/14	University of Minnesota Wheat Breeding Program
K. Seetharaman, J.A. Anderson	MN Wheat Research and Promotion Council	\$25,000	1/14-12/14	Acquisition of Front Face Fluorescence Spectrophotometer to Study Gluten Quality
K. Seetharaman, J.A. Anderson	MN Wheat Research and Promotion Council	\$45,000	1/14-12/14	Evaluating a New Rapid Technique to Assess Spring Wheat Flour Performance
B. Steffenson, G. Muehlbauer, J.A. Anderson	MN Wheat Research and Promotion Council	\$36,355	1/14-12/14	Exploiting Genetic Variation for Wheat Improvement in the Northern Great Plains
J. Anderson, R. Bernardo, G. Muehlbauer	USDA CSREES Food & Agric. Sci. Nat. Needs Graduate and Postdoctoral Fellowship	\$234,000	1/11-12/15	Plant Breeding in the Era of Cheap Genotyping and Expensive Phenotyping
J. Dubcovsky et al.	USDA-NIFA	\$288,000	2/11-1/15	Improving barley and wheat germplasm for changing Environments (TCAP)
J. Anderson	Minnesota Small Grains Initiative via MAES	\$111,960	7/13-6/15	Accelerated Breeding of Disease Resistant Wheat
J. Anderson	USWBSI (VDHR) via USDA-ARS	\$43,311	5/14-4/15	Genomic Selection for Fusarium Head Blight Resistance in Spring Wheat
J. Anderson	USWBSI (VDHR) via USDA-ARS	\$121,671	5/14-4/15	Breeding Fusarium Head Blight Resistant Spring Wheat
B. Gill et al.	USWBSI (VDHR) via USDA-ARS	\$63,230	5/14-4/15	Cloning and Validation of the FHB1 QTL from Sumal 3 for Resistance to Wheat Scab
J. Anderson	MAES Variety Development Fund	\$150,000	2/13-1/16	Wheat project equipment and investigation of yield-enhancing technology and traits
D. Wyse et al.	MAES Variety Development Fund	\$150,000	2/13-1/16	Domestication of Field Pennycress: A new short season oil seed crop for use as a double crop/cover crop in the corn/soybean rotation
M.D. Marks, et al.	NIFA USDA & DOE	\$1,000,000	9/14-8/17	Advancing field pennycress as a new oilseed biodiesel feedstock that does not require new land commitments
P. Ismail, J. Anderson	MN Dept. of Agriculture	\$180,000	7/14-6/17	Millet as second crop in Minnesota to add value to farmers and consumers
J. Anderson et al.	MN Dept. of Agriculture	\$201,430	7/14-12/17	Improvement of field pennycress ( <i>Thlaspi arvense</i> L.) germplasm for use as a winter annual cover and oilseed crop
J. Anderson et al.	CFANS Forever Green Initiative	\$149,559	10/14-6/17	High-density Genetic Mapping of Intermediate Wheatgrass QTLs Associated with Disease and Agronomic Traits
B. Steffenson et al.	Minnesota Crop Research Grant Program	\$145,000	1/15-	Determining Best Agronomic Practices for Winter Barley Production in Minnesota
M. Swanson et al.	Minnesota Crop Research Grant Program	\$15,000	1/15-	Winter Rye Performance and Taste
Wiersma et al.	MWRPC	\$32,000	1/15-	Optimum Seeding Rate for Diverse HRSW
Holen et al.-	MWRPC	\$16,990	1/15-	Southern Wheat Research & Outreach
Kaiser et al.	MWRPC	\$15,030	1/15-	Variation in Response to Sulfur among HRSW Genotypes
Wiersma et al.	MWRPC	\$2,500	1/15-	Summer Plot Tours

## References:

**Minnesota Wheat Research and Promotion Council  
RESEARCH PRE-PROPOSAL BUDGET**

<b>PROJECT TITLE: University of Minnesota Wheat Breeding Program</b>			
<b>Principal Investigator(s) / Project Directors(s)</b> James A. Anderson Jochum Wiersma	<b>Funds Requested For</b>		
	<b>Year 1 (2015)</b>	<b>Year 2 (2016)</b>	<b>Year 3 (2017)</b>
<b>A. Salaries and Wages</b>	\$	\$	\$
1. Co-principal Investigator(s)			
2. Senior Associates			
3. Research Associates - Post Doctorate			
4. Other Professionals	\$88,576		
5. Graduate Students			
6. Prebaccalaureate Students	\$5,000		
7. Secretarial - Clerical	\$1,000		
8. Technical, Shop and Other			
<b>B. Fringe Benefits</b>	\$32,595		
<b>C. Nonexpendable Equipment (Planting and harvesting equipment use)</b>			
<b>D. Materials and Supplies</b>	\$1,200		
<b>E. Travel</b>	\$5,200		
<b>F. Publication Costs</b>			
<b>G. Computer Costs</b>			
<b>H. All Other Direct Costs (Attach supporting data)</b>	\$10,000		
<b>TOTAL AMOUNT OF THIS REQUEST (per year)</b>	<b>\$143,571</b>	<b>\$</b>	<b>\$</b>