

UNIVERSITY OF MINNESOTA

Twin Cities Campus

Sponsored Projects Administration

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November 14, 2013

David Torgerson
Executive Director
Minnesota Wheat Research & Promotion Council
2600 Wheat Drive
Red Lake Falls, MN 56750

RE: Proposal Title: *University of Minnesota Wheat Breeding Program*
University of Minnesota PI: James Anderson
University of Minnesota DUNS: 555917996

Dear Mr. Torgerson,

A proposal is hereby submitted on behalf of James Anderson in the Department of Agronomy and Plant Genetics for the above referenced project in the amount of \$144,886.

This application has been administratively approved on behalf of the Board of Regents. Questions concerning programmatic aspects of the project should be directed to the Principal Investigator. Any other questions should be directed to Amy Bicek-Skog of my staff at 612-625-0413 or via e-mail at askog@umn.edu.

Sincerely,



April Loon
Assistant Director

attachments

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: 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 2013 (Minnesota Wheat Growers survey). More than 25% of the public share was varieties developed at the University of Minnesota. Our program publicly released one new wheat variety each year since 2005-2013, with the exception of 2010. Recent releases include 'Rollag' (2011), co-release of 'Prosper' (2011), 'Norden' (2012), and 'Linkert' (2013). 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. The new Zuern combine, purchased for use in on-farm testing, has added efficiency to the breeding program because the on-board grain weighing system enhanced data flow and saved one year off the time that new experimental lines are normally selected as crossing parents. We are exploring additional technologies, including genomic selection, which show promise in accelerating breeding progress.

Procedures: Approximately 300 crosses are made per year. Winter nurseries will be used to advance early generation material, thus saving about 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 190 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 2014. 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						Total
		AY1 conv.	AY1 Intensive	AY2	AY3-6	PY	Regional	
Crookston	U of MN	120	120	80	160	480	90	1050
Fergus Falls	On-farm	120		40	160			320
Hallock	On-farm	120		40	160			320
Lamberton	U of MN	120	120	40				280
Morris	U of MN	120	120	40	160	480	90	1010
Oklee	On-farm	120		40	160			320
Perley	On-farm	120		40	160			320
Roseau	U of MN	120	120	40	160			440
St. Paul	U of MN	120		80	160	480	90	930
Stephen	On-farm	120		40	160			320
Strathcona	On-farm	120		40	160			320
Waseca	U of MN	120						120
TOTAL		1440	480	520	1600	1440	270	5750

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

Where appropriate, DNA markers are used to determine the presence of important genes in materials undergoing selection or consideration as crossing parents. Using DNA marker technology helps us choose parents that have a better chance of producing superior varieties and choose selections that have important genes for resistance to Fusarium head blight, leaf rust, and end-use quality traits.

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:

- Accelerated Breeding of Disease Resistant Wheat, J. Anderson, 7/13-6/15, Minnesota Small Grains Initiative via MAES, \$111,960
- Breeding and Genetic Investigations of Fusarium Head Blight Resistance in Spring Wheat, J. Anderson, 5/13-4/14, USWBSI (VDHR) via USDA-ARS, \$118,140
- Improving barley and wheat germplasm for changing environments, J. Dubcovsky et al., 2/11-1/15, USDA-AFRI, \$288,000
- Wheat Project Equipment and Investigation of Yield-enhancing Technology and Traits, J. Anderson, 2/13-1/16, MAES Variety Development Fund, \$150,000

Research Group:

Dept. of Agronomy & Plant Genetics

Jim Anderson, Roger Caspers, Susan Reynolds
Emily Conley, Jen Flor

Dept. of Plant Pathology:

Ruth Dill-Macky, Carol Ishimaru, Brian Steffenson

Dept. of Food Science & Nutrition:

Koushik Seetharaman

USDA-ARS Cereal Disease Lab:

Jim Kolmer, Matt Rouse, Yue Jin

Off-Campus Collaborators

Crookston/Stephen:

Jochum Wiersma, Galen Thompson
Madeline Smith

Morris: George Nelson

Roseau: Donn Vellekson, Dave Grafstrom

Lamberton: Steve Quiring

Waseca: Tom Hoverstad

USDA-ARS Fargo Genotyping Center:

Shiaoman Chao

USDA-ARS Wheat Qual. Lab:

Jae Ohm

The projects listed above are supporting 3 graduate students currently on the project, 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.

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 \$55,577; fringe \$20,452. This is the salary for the senior technician on the wheat breeding & genetics project. Crookston technician (M.S. level) Salary \$30,920, fringe \$11,378. The remaining \$20,000 of salary and fringe 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: \$905 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: Field charges: \$5,500 (\$500 per 11 locations, Benson/LeCenter/Roseau excluded) + \$4,500 plot charges for AY1 conventional/intensive at 3 locations (Roseau excluded). These trials are more expensive due to the treatments applied. 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)	Funds Requested For		
James A. Anderson Jochum Wiersma	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)
A. Salaries and Wages	\$	\$	\$
1. Co-principal Investigator(s)			
2. Senior Associates	89,607		
3. Research Associates - Post Doctorate			
4. Other Professionals			
5. Graduate Students			
6. Prebaccalaureate Students	5,000		
7. Secretarial - Clerical	905		
8. Technical, Shop and Other			
B. Fringe Benefits	32,974		
C. Nonexpendable Equipment (Planting and harvesting equipment use)			
D. Materials and Supplies	1,200		
E. Travel	5,200		
F. Publication Costs			
G. Computer Costs			
H. All Other Direct Costs (Attach supporting data)	10,000		
TOTAL AMOUNT OF THIS REQUEST (per year)	\$ 144,886	\$	\$