

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 Exploring new methods and technologies for wheat end-use quality testing and benchmarking for the University of Minnesota breeding program		
3. PRINCIPAL INVESTIGATOR(S) Dr. George Amponsah Annor <hr/> PI# 2 Name: Dr. James Anderson <hr/> PI# 3 Name:	4. PI #1 BUSINESS ADDRESS 225 Department of Food Science and Nutrition 1334 Eckles Ave, St. Paul, MN 55108	
5. PROPOSED PROJECT DATES (calendar years) January 1, 2017 – December 31, 2019 Note: Research Reports are Due November 15th of Each Year	6. TOTAL PROJECT COST \$ 70,178	7. PI #1 PHONE NO. 612-512-5647
8. RESEARCH OBJECTIVES: (List objectives to be accomplished by research grant) <ol style="list-style-type: none"> 1. Exploit the use of new methods and technologies to assess wheat protein conformation changes, gluten aggregation kinetics, dough mixing and extensibility properties and starch pasting characteristics of new wheat lines being developed by the University of Minnesota wheat breeding program 2. Identify key tests that will be used for routine wheat screening by correlating data from the new tests and methods to quality indices generated from conventional quality approaches 3. Evaluate wheat varieties grown in 2015-2016 for end-use quality 4. Evaluate wheat varieties grown in 2016-2017 for end-use quality <p>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).</p>		
Signature of Principal Investigator 	Date December 21, 2016	Phone Number 612-624-3201
Signature of Authorized Representative 	Title Principal Grant Administrator	Date 1/3/17
Address Of Authorized Representative Andrea Marshall, Principal Grant Administrator, 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:

Exploring new methods and technologies for wheat end-use quality testing and benchmarking for the University of Minnesota breeding program

Importance of this project to the profitability of wheat producers:

The University of Minnesota, through the Department of Agronomy and Plant Genetics, have been actively involved in wheat breeding and genetics, primarily with the aim of releasing high yielding, disease resistant wheat varieties with good end-use quality. Led by Dr. James Anderson, the University of Minnesota has released several improved varieties such as Rollag (2011), Linkert (2013), Bolles (2015), and Shelly (2016). In addition to the release of these improved varieties, the wheat genetics and breeding program has also successfully developed some of the most scab resistant germplasm in the region. From the end-quality use stand point, it is important that comprehensive end-use testing and benchmarking of these new varieties and many others to be released are conducted. The USDA-ARS lab in Fargo currently conducts some quality tests on wheat varieties developed by the wheat breeding program at the University of Minnesota. These tests focus on kernel and milling characteristics, falling number, protein and ash content of wheat flour, wheat dough characteristics using the mixograph and bread baking characteristics. To compliment the tests conducted by the USDA-ARS labs in Fargo, this project will be exploring the use of new testing methods and technologies that go beyond the tests conducted by the USDA-ARS labs in Fargo. These tests will focus on documenting wheat protein conformation changes, gluten aggregation kinetics, dough mixing and extensibility properties and starch pasting characteristics of the new wheat varieties. Information from these new tests are critical in selecting new wheat lines with desirable end-use qualities, and provide the basis for more informed decisions regarding variety release. Some of these proposed new tests and methods require less grain and are faster compared to conventional wheat flour quality testing methods, making them suitable for testing large numbers of samples (more than 1,000) per breeding year, and thus increasing the throughput of the breeding program.

Procedures:

Materials: Wheat varieties being developed or ready for release by the breeding program and grown at different locations will be used for the study.

1. Approximately 1,000 pre-yield trial lines grown at St. Paul will be assessed for their dough mixing and gluten aggregation kinetics using the GlutoPeak instrument (no. 1 in list below). Only 20g of grain is required for this test and it is expected that 25-30% of these 1,000 lines will be discarded because of weak gluten properties. This test is meant to replace the mixograph which requires a larger quantity of grain (60g), is slower, and is more prone to instrument operator bias. Also, we have preliminary data indicating that the GlutoPeak results are better predictors of overall gluten strength and other end-use quality parameters, vs. the mixograph.

2. 11 Minnesota advanced experimental lines and 14 named varieties with varying end-use quality characteristics grown at 3 Minnesota locations will be assessed using all of the instruments/methods listed below. This will result in a comprehensive assessment of end-use quality characteristics of recent releases and the most promising candidates for future release. Using grain from the 2016 season, the following lines and varieties will be assessed:

Bolles
Faller
Forefront
Glenn
LCS Albany
Linkert
Marshall
MN07098-6-Lr34
MN07098-6-no Lr34

MN10201-4-A
MN10201-4-B
MN10261-1
MN10281-1-98
MN11394-6
MN13074-4
MN13288-1
MN13398-2
MN13479-8
Norden
Prosper
RB07
Rollag
Shelly
SY Valda
WB-Mayville

Methods:

1. Gluten aggregation kinetics using the GlutoPeak (Brabender OHG, Duisburg, Germany)
2. Protein conformation will be measured using the Fourier transformed infrared spectroscopy (FTIR) (Bruker Optics, Billerica, MA, USA)
3. Dough mixing properties using the Farinograph-AT (Brabender OHG, Duisburg, Germany)
4. Protein Aggregation using the RC-DC protein Assay (Bio-Rad, Hercules, CA, USA)
5. Protein Surface Hydrophobicity Front Faced Fluorescence spectrophotometer (Bonomi et al 2004)
6. Readily accessible and SDS-Accessible Thiols
7. Pasting properties (Brabender OHG, Duisburg, Germany)
8. Dough extensibility (Brabender OHG, Duisburg, Germany)

Statistical analysis will be performed using SSPP 16.0 (SPSS Inc., Chicago, IL, USA).

Regional linkage to other research activities:

Collaboration will also be sought with the USDA-ARS labs in Fargo when it comes to correlating data from these proposed new tests and methods to data from conventional wheat flour quality testing methods to identify new key tests to be used for routine evaluation of wheat samples from the breeding program. The project will also collaborate with Dr. Alessandra Marti, a protein expert from the Department of Food Science, Agricultural Plant Science and Agronomy, University of Milan, Milano, Italy and also an Adjunct Professor at the Department of Food Science, University of Minnesota.

List current or potential other funding sources for this project:

We are hoping to submit a proposal to USDA to further support to project. Some funding from my start-up grants will also be used to support this project

Research Group:

I am a new Assistant Professor at the Department of Food Science and Nutrition in charge of the Grain Biopolymer Laboratory established by the late Dr. Koushik Seetharaman, who was also my advisor for my PhD. The lab focuses on research into cereal proteins and starches and is equipped with facilities capable of conducting flour quality analyses and baking trials. Two Masters students, a technician and three undergraduate students will be working in my lab beginning January 2017. The technician and an undergraduate student will be dedicated to this work.

Relationship to past projects:

This is a new proposal, but benefits from earlier research conducted at the Grain Biopolymer lab that suggests the possibility of using the proposed new methods and tests for routine end-use quality testing. This project will also be using the Front Faced Fluorescence spectrophotometer acquired earlier by the Grain Biopolymer laboratory with funding from the Minnesota Wheat Research and Promotion Council.

Estimate the budget requirements:

Funding is requested for a laboratory technician (B.S. level) (75% time) for the first year and 50% time for the second year. More details of the budget are shown.

Supplies

The \$8,000 budgeted for the duration of the project will be used to purchase materials and supplies necessary to complete the proposed experiments. Funds will be primarily required to purchase chemicals including solvents, standards and miscellaneous chemicals and lab supplies.

Travel

The travel is to support my travel (Registration, travel and accommodation) to the Annual American Association of Cereal Chemist International (AACCI) Meeting to be held in San Diego California in October 2017. Will need the same support for the same meeting to be held in London UK in 2018

Year 1: \$41,553

Year 2: \$28,625

References:

Bonomi, F., Mora, G., Pagani, M.A., Iametti, S. (2004). Probing structural features of water-insoluble proteins by front-face fluorescence. *Analytical Biochemistry*, 329, 104-111.

Minnesota Wheat Research and Promotion Council

RESEARCH PROJECT PROPOSAL BUDGET

PROJECT TITLE: Exploring new methods and technologies for wheat end-use quality testing and benchmarking for the University of Minnesota breeding program			
Principal Investigator(s) / Project Directors(s) Dr. George Amponsah Annor Dr. James Anderson	<u>Funds Requested For</u>		
	Year 1 (2017)	Year 2 (2018)	Year 3 (2019)
A. Salaries and Wages			
1. Co-principal Investigator(s)			
2. Senior Associates			
3. Research Associates - Post Doctorate			
4. Other Professionals (Laboratory Technician)	27,270	18544	
5. Graduate Students			
6. Prebaccalaureate Students			
7. Secretarial - Clerical			
8. Technical, Shop and Other			
B. Fringe Benefits	7,283	5,081	
C. Nonexpendable Equipment (Planting and harvesting equipment use)			
D. Materials and Supplies	5,000	3,000	
E. Travel	2,000	2,000	
F. Publication Costs			
G. Computer Costs			
H. All Other Direct Costs (Attach supporting data)			
TOTAL AMOUNT OF THIS REQUEST (per year)	\$ 41,553	\$ 28,625	\$