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: North Dakota State University
Address: Office of Sponsored Programs Administration
Dept #4050 PO Box 6050, Fargo, ND 58108-6050

2. TITLE OF PROPOSAL

Evaluation of Winter Wheat Germplasm for Resistance to Stem, Leaf And Stripe Rust

3. PRINCIPAL INVESTIGATOR(S)	**4. PI #1 BUSINESS ADDRESS**
Maricelis Acevedo	Plant Pathology Department NDSU Dept. 7660 P.O. Box 6050 Fargo, ND 58108-6050
PI# 2 Name:	
PI# 3 Name:	

5. PROPOSED PROJECT DATES (calendar years)	**6. TOTAL PROJECT COST**	**7. PI #1 PHONE NO.**
1/1/2011- 12/31/2013 Note: Research Reports are Due November 15th of Each Year	**$ 30,000**	701-231-8051

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

- Evaluate current winter wheat varieties, cultivars and elite breeding lines for stem, leaf and stripe rust resistance
- Screen winter wheat landraces from the USDA-ARS National Small Grain Core Collection to potentially identify new sources of resistance.

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** **701-231-8051**
Signature Of Authorized Representative	**Title**	**Date**
Address Of Authorized Representative		**Phone Number**

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

Project Title: Evaluation of Winter Wheat Germplasm for Resistance to Stem, Leaf and Stripe Rust

Importance:

Cereal rusts are a major threat to wheat production worldwide. Every year yield losses are observed in the US due to one or more of the wheat rust pathogens. Stem, leaf and stripe rust occur annually in many regions of the US. In 2010 stripe rust was the most important disease of wheat in Kansas, followed by Septoria Complex and leaf rust. Total losses due to stripe rust reached 10.3% (42.5 million bushels). Use of fungicides is an effective measure to manage rust diseases but cost millions of dollars to US wheat growers annually and requires specific application timing not always possible in our environment. Use of resistant varieties is the most economically sound and environmentally friendly rust disease management strategy.
Limited information is available about the resistance or susceptibility of winter wheat materials adapted to our region. Information obtained from the evaluation of winter wheat varieties, cultivars and breeding lines against races of leaf, stripe and stem rust will be used to determine our risk of epidemics and yield loss. Information on elite breeding lines will help the decision-making process for the selection of the new generation of parental lines that will be utilized in the winter wheat breeding program. Evaluation of landraces from the USDA National Small Grain Collection (NSGC) will give us the opportunity to potentially identify novel sources of resistance that can be incorporated into breeding programs

Background:

Leaf rust, caused by *Puccinia triticina*, is currently the most important rust disease in the Northern Great Plains. Estimated yield losses to this disease can approach 40% or more in localized epidemics, but statewide losses are generally between 1-10%. The economic impact of this level of disease is significant, representing millions of dollars in yield losses. Over 60 leaf rust resistance genes (*Lr* genes) have been identified but a limited number of those *Lr* genes are still effective to the pathogen population in our region. Moreover, there is evidence that shows that once a specific gene is deployed in a variety, selection pressure on the pathogen has resulted in subsequent higher frequency of the pathogen with virulence to the resistance gene. This is reflected on varieties that succumbed to the disease just a few years after release. New sources of resistance are needed to develop varieties with high level, long-lasting leaf rust resistance.

Wheat stripe rust, caused by *Puccinia striiformis* f. sp. *tritici*, has become increasingly important in the Southern Great Plains since 2000, due to the emergence of a new population of the pathogen (Markell and Milus, 2008; Milus et al., 2006, 2009). Evidence suggests that this new population is adapted to higher temperatures and is more aggressive. The new population of stripe rust occurs in conditions previously considered too warm for disease development and in areas where stripe rust was not a problem in the past. In 2010 stripe rust was observed in common winter and spring wheat varieties grown in the Northern Great Plains. Historically, stripe rust has been rare in the Northern Great Plains but has been observed during epidemic years in the Central Great Plains (McMullen et al., 2008). Limited information is available about stripe rust resistance in cultivars and breeding lines adapted to the Northern Great Plains.

Stem rust has been managed in the US for decades by the continuous deployment of resistant varieties. However, new, highly-virulent races in wheat growing regions parts of the world, such as Ug99 and its lineage, represent a threat to wheat production in the US.

Relationship to Past Projects:

First time application

Procedures:

The objective of the proposed project is to evaluate current winter wheat varieties, cultivars and elite breeding lines for stem, leaf and stripe rust resistance. In addition, we propose to screen 800 winter wheat landraces from the winter wheat core collection of the USDA-NSGC representative of geographic regions of the world where winter wheat has been traditionally grown. This will provide us the opportunity to potentially identify novel sources of resistance that can be incorporated into winter wheat breeding programs to expand the genetic basis of rust resistance.

Rust reaction in winter wheat varieties, cultivars, breeding lines and landrace accessions will be evaluated on seedlings in greenhouse experiments in replicated trials. Plants will be inoculated 8-10 days after planting and evaluated for rust resistance 12-14 days after inoculation. For the stripe rust resistance evaluation local isolates collected from the field and isolates representing the new races established in the Southern Plains will be utilized. For leaf rust and stem rust evaluation predominant local races available in our program will be utilized. To obtain reliable field data replicated field experiments will be artificially inoculated. Inoculum will be composed of predominant local races previously identified in ND wheat fields from natural infections. Data obtained from the variety trials will rely on natural disease pressure. Promising genotypes with stem rust resistance to local races will be included in the International Rust Nurseries in Kenya to be evaluated for “Ug99 lineage” resistance.

The research group has available the greenhouse space, growth chambers, and dew chambers necessary for the seedling evaluations for the proposed experiments. Seed, planting equipment and field plots are also available.

It is expected that all proposed experiments can be completed in two years. Replicated field experiments in multiple locations will be planted during the Fall of 2011 to be evaluated during the growing season of 2012. Inoculation protocols for leaf and stripe rust are well established in our program. Development of a reliable inoculation protocol for stripe rust evaluation will be necessary for the success of this project. The experiments will be labor intensive due to the specific temperature, humidity and light requirements for successful greenhouse inoculations.

Research Group:
Principal investigator- Dr. Maricelis Acevedo – Cereal Rust Pathologist -NDSU
Collaborators to the proposed project are:
Dr. Francois Marais- Winter Wheat Breeder - NDSU
Dr. Marcia McMullen – Cereal Diseases Extension Plant Pathologist -NDSU
Dr. Joel Ransom- Extension Cereal Agronomist- NDSU

Regional Linkages to Other Research Activities:
The NDSU cereal rust program will closely collaborate with the winter wheat breeding program. Dr Francois Marais will provide elite materials from his breeding program for evaluation. The information generated during the proposed research project will be valuable for the breeding program especially since this program is in its initial stages.

Additional Sources of Funding:
In November of 2010 a research proposal was submitted to SBARE and ND Wheat Commission for the stripe rust greenhouse evaluation.

References:

Markell, S. G., and Milus, E. A. 2008. Emergence of a novel population of *Puccinia striiformis f. sp. Tritic* in eastern United States. Phytopathology 98:632-639
Milus, E. A., Kristensen, K., and Hovmøller, M. S. 2009. Evidence for increased aggressiveness in a recent widespread strain of *Puccinia striiformis f. sp. tritici* causing stripe rust of wheat. Phytopathology 99:89-94.
Milus, E. A., Seyran, E., and McNew, R. 2006. Aggressiveness of *Puccinia striiformis f. sp.tritici* isolates in the south-central United States. Plant Dis. 90:847-852.
McMullen, M., Markell, S.G., Rasmussen, J. 2008. Rust Diseases of Wheat in North Dakota. North Dakota State University Extension Bulletin PP1361.

Minnesota Wheat Research and Promotion Council

RESEARCH PROPOSAL BUDGET

ORGANIZATION AND ADDRESS

Name: North Dakota State University
Address: Office of Sponsored Programs Administration
Dept #4050 PO Box 6050
Fargo, ND 58108-6050

Principal Investigator(s) / Project Directors(s) Maricelis Acevedo, Assistant professor	Funds Requested For Year 1 (2011)	Year 2 (2012)	Year 3 (2013)
A. Salaries and Wages	$	$	$
1. Co-principal Investigator(s)			
2. Senior Associates			
3. Research Associates - Post Doctorate			
4. Other Professionals			
5. Graduate Students			
6. Prebaccalaureate Students	4,000	4,000	
7. Secretarial - Clerical			
8. Technical, Shop and Other	6,000	6,000	
B. Fringe Benefits @ 17% (Prebaccalaureate Students) Fringe Benefits @ 36% (technician)	2,840	2,840	
C. Nonexpendable Equipment (Planting and harvesting equipment use)			
D. Materials and Supplies (planting flats, soil, fertilizer, labels, field flags, seed treatment, greenhouse space rental and other greenhouse supplies needed to carry-on proposed project)	2,160	2,160	
E. Travel (to and from field plots for planting and disease evaluation)			
F. Publication Costs			
G. Computer Costs			
H. All Other Direct Costs (Attach supporting data) - Purchase of Service -			
I. TOTAL AMOUNT OF THIS REQUEST (per year)	**$ 15,000**	**$ 15,000**	**$**