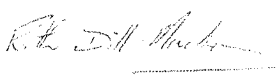



Minnesota Wheat Research and Promotion Council

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 Minnesota component of the Upper Great Plains Wheat Pathology Collaboration: Bacterial leaf streak, root and crown rots and viral diseases of wheat		
3. PRINCIPAL INVESTIGATOR(S): Ruth Dill-Macky PI# 2 Name: Madeleine Smith PI# 3 Name: Carol Ishimaru	4. PI #1 BUSINESS ADDRESS Department of Plant Pathology 495 Borlaug Hall, 1991 Buford Circle University of Minnesota St. Paul, MN 55108	
5. PROPOSED PROJECT DATES (calendar years) January 1, 2015 - December 30, 2015 <small>Note: Research Reports are Due November 15th of Each Year</small>	6. TOTAL PROJECT COST \$54,205	7. PI #1 PHONE NO. 612-625-2227
8. RESEARCH OBJECTIVES: (List objectives to be accomplished by research grant) Bacterial Leaf Streak <ol style="list-style-type: none"> 1.1. Identify the sources of resistance to BLS using the established regional collaborative field nursery 1.2. Optimize the methods for screening wheat at seedling stage in the greenhouse 1.3. Conduct genetic analysis and DNA marker development for resistance to BLS 1.4. Examine variation in pathogen virulence 1.5. Examine the influence of leaf spot pathogens and fungicide applications on BLS development 1.6. Evaluate rapid detection assays for <i>X. translucens</i> 1.7. Disseminate information to wheat growers Wheat Root and Crown Diseases <ol style="list-style-type: none"> 2.1. Complete fungal isolation from the sub crown internodes and crown samples collected in 2014 2.2. Characterize the isolated fungi based on morphological characteristics, DNA sequence, and pathogenicity tests 2.3. Optimize methods for screening wheat for reaction to root rot pathogens - in the greenhouse and field 2.4. Screen commercial cultivars and advanced breeding lines for resistance to Common root rot and Fusarium crown rot 2.5. Conduct field surveys of root rot diseases in certain regions or areas of particular interest 2.6. Conclude study examining the efficacy of seed treatments for the control of root and crown rots 2.7. Disseminate information to wheat growers Virus Diseases <ol style="list-style-type: none"> 3.1. Develop and validate diagnostic tests that characterize the viruses found in association with wheat 3.2. Examine the distribution of cereal viruses in spring and winter wheat 3.3. Determine the occurrence and distribution of cereal viruses on non-wheat hosts 3.4. Develop a management strategies for viral diseases 3.5. Disseminate information to wheat growers 		
Signature Of Principal Investigator 	Date 1-21-15	Phone Number 612-625-2222
Signature Of Authorized Representative 	Title Kevin McKoskey, Sr Associate Director Sponsor Projects Administration	Date 1/21/15
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 612-624-5066

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

Project Title: Minnesota component of the Upper Great Plains Wheat Pathology Collaboration: Bacterial leaf streak, root and crown rots and viral diseases of wheat.

Importance of this project to the profitability of wheat producers:

This project aims to improve management practices for a number of wheat diseases and thereby reduced yield and quality losses for wheat producers in Minnesota. The project focuses on three areas that are issues in the region; Bacterial leaf streak (BLS); root and crown rots; and viral diseases.

Bacterial Leaf Streak (BLS) of wheat, caused by *Xanthomonas translucens* pv. *undulosa*, has become prevalent in Minnesota, South Dakota, and North Dakota, causing economic concerns to the wheat industry. Managing BLS is difficult due to the lack of resistant cultivars and other effective tools - fungicides are ineffective against this bacterial pathogen. In addition, our knowledge on biology and epidemiology of BLS is still fairly limited. Through research funded by the MWRPC, we have clearly demonstrated the economic importance of BLS; obtained useful data on the responses of regionally adapted varieties and elite germplasm; gained first-hand knowledge of local pathogen populations; and established a regional collaborative nursery. Our research has provide valuable information for developing future control methods and set groundwork for the future research aimed to improve our understanding and develop methods for the control of the disease. In this project we plan to focus on the identification of wheat germplasm with high levels of BLS resistance, characterization of genetic resistance, and investigation of biology of the pathogen and the factors affecting the epidemiology of BLS.

The root and crown diseases are caused by a complex of fungi that can cause significant yield losses although they frequently go unnoticed as the visual symptoms of infection are generally not evident above ground. These diseases that compromise the plant's root system, affect a plants ability to take up water and nutrients are especially damaging in years when water is limiting during grain fill. Surveys in Minnesota from 2012 to 2014 have identified several root rot pathogens. Identification and determining the prevalence of pathogens involved in root rots is the initial step in disease control. In this project we plan to continue with research to identifying the pathogens and to understand the response of the wheat germplasm to these pathogens. We plan both to identify highly susceptible varieties that may be driving disease and to identifying sources of resistance that may be utilized in the development of varieties with improved tolerance to root and crown diseases.

Viral diseases such as Barley yellow dwarf, caused by Barley yellow dwarf virus (BYDV); and Wheat streak, caused by Wheat streak mosaic virus, can be devastating in years where conditions are favorable either to the insect and mite vectors which transmit these viruses or to disease development. Little is known about the epidemiology of these viral diseases and the risk factors that contribute to these diseases being more severe in this region in any given year. We also have scant data on the resistance of our elite varieties and breeding lines to these viruses. In this project we plan to identify the viral threats to wheat production in the region and characterize the viral strains of each virus identified. We also plan to test released varieties to provide recommendations and direct future breeding efforts.

Procedures:

Bacterial Leaf Streak: We have established the basic protocols needed to work with BLS and developed a regional cooperative nursery (BLSCN) in which germplasm from all seven wheat breeding programs (public and private) in the Upper Great Plains are being screened for resistance to BLS. Information obtained on the response of released varieties and elite germplasm to BLS are being utilized by breeding programs to the benefit of growers. Information on cultivar responses to BLS has been disseminated to growers through the MN variety trials bulletin.

Wheat Root and Crown Rots: In the last three years we have undertaken a project on the root and crown rots in wheat. A field survey, conducted collaboratively across the three states, has examined the distribution and prevalence of root rot pathogens as a precursor to understanding yield losses. The results from the survey have indicated that there has been a switch in the prevalence of the pathogens that incite root diseases compared to previous surveys conducted over 20 years ago. This survey has helped us prioritize research needs and has provided isolates needed for establishing screening for resistance to root and crown rots. In this project we will complete the isolation of fungal pathogens from the remaining samples collected in the 2014 survey and continue our efforts to identifying the fungi isolated using morphological and/or DNA sequencing. We have made significant progress in testing methods suitable for inoculating plants with *Bipolaris sorokiniana* and *Fusarium* spp. in the greenhouse that has facilitated our ability to screen materials for reaction to the prevalent root rot pathogens in the region. The preliminary results of field studies conducted in 2013 and 2014 (MN and ND) indicate that seed treatments do not aid initial stand establishment and are thus unlikely to provide a return on investment. We anticipate completing this study in 2015.

Viral Diseases: It is important to differentiate between viruses and the strains of viruses prevalent on wheat in Minnesota. In this project we will continue our efforts to develop effective diagnostics to distinguish the viruses and thus ascertain their relative importance in the region. Strain differentiation will also be used in determining the relative roles of alternative

host species such as the wild grasses and non-wheat hosts like barley and oats on viral epidemiology. Information on the prevalence of viruses/viral strains will be used to selecting appropriate strains for screening breeding material for resistance. We also plan on determining if planting date (fall or spring) and how insecticide treatments influence infection. From these results we plan to develop recommendations for planting dates and other measures that control viruses.

Regional linkage to other research activities: This is already a regional collaborative project involving pathologists in three states. We also have close relationships with extension personnel and wheat breeding programs in the region.

List current or potential other funding sources for this project:

MN Small Grains Initiative funding (PI's Ishimaru and Dill-Macky) for research focused on the collection and identification of bacterial isolates and greenhouse screening methods.

Funding (\$75,659) was obtained in 2014 from the South Dakota Wheat Commission to fund Dr Shakout Ali and Dr Emmanuel Byamukama. Additional funding will be requested in 2015 to meet the overall objectives of this project. NDSU researchers Dr Shaobin Zhong, Dr Zhaohui Liu and Dr Andrew Friskop plan to apply for funding (\$TBD) from the North Dakota Wheat Commission to meet overall objectives of this project.

Research Group: Dr Ruth Dill-Macky, UMN Small Grains Pathologist; lead on BLS and Root Rot sub-projects. Dr Madeleine Smith, UMN Extension Small Grains Pathologist; lead on Virus sub-project. Dr Carol Ishimaru, UMN Plant Pathologist: specialization in bacteriology. Rebecca Curland, UMN Plant Pathologist; specialization in bacteriology. Although the Minnesota research team is seeking funding within Minnesota our research is part of a larger collaborative effort comprised of pathologists from the University of Minnesota, North Dakota State University and South Dakota State University. As a team will work collaboratively to address wheat disease problems faced by wheat producers in the region. We believe this research approach harnesses our combined talents to deliver tangible results more efficiently than we could within each of our states.

Relationship to past projects: A year ago we proposed a single large collaborative research project for funding to the MWRPC and your counterparts at the South and North Dakota Wheat Commissions. We greatly appreciate the support provided by the Minnesota and South Dakota wheat growers. However without any support from the North Dakota Wheat Commission we felt it prudent for each state team to apply separately for funding in this funding cycle. Although the approach to funding the research has changed the overall goals and the collaborative nature of the research remains much the same.

Estimate the budget requirements:

Note: This is a six-month budget to bring our current project (funded from 7/1/14 to 6/30/15) in line with your regular funding cycle. Thus the project funding will mostly be used from 7/1/15 to 12/31/15.

- **Wages and Fringe Benefits:** (\$32,439)

Funds are for partial support of technical support staff and fringe benefits for each of the PI's (Dill-Macky = \$8,209 + \$2,159; Smith = \$11,341 + \$2,983; Ishimaru = \$1,700 + \$447) and student labor (Dill-Macky = \$3,000; Ishimaru \$2,600).

- **Materials and Supplies:** (\$13,266)

Materials and supplies cover disposables used in the laboratory greenhouse and field for conducting various aspect of the research. We anticipate that the bulk of this budget area will be used for culturing the pathogens, preparing inoculum and in molecular work to meet the outlined project goals. (Dill-Macky = \$4,000; Smith = \$7,500; Ishimaru = \$1,766)

- **Travel:** (\$2,500)

Funds for domestic travel are requested to pay for mileage and accommodation necessary to maintain research plots and to conduct field surveys. We also require some funding to enable the PI's to meet with colleagues in South Dakota and North Dakota to facilitate the regional collaborative research effort. (Dill-Macky = \$1,000; Smith = \$1,500; Ishimaru = \$500)

- **Other Direct Costs:** (\$6,000)

Funds (\$5,500) are requested for land charges and greenhouse bench fees (Dill-Macky = \$2,500; Smith = \$1,000; Ishimaru = \$2000)

Funding (\$500) - primarily for meeting room costs and conference calls - is also requested to facilitate project communications, including at least one face-to-face meeting of the investigators (Minnesota, South Dakota and North Dakots) involved in this project in 2015. We anticipate that the meeting would be held in the Moorhead/Fargo area.

- Total Direct Costs = \$54,205 (Dill-Macky = \$21,368; Smith = \$23,824; Ishimaru = \$9,013)

References: J.L. Stanton, R.D. Curland, C.A. Ishimaru, M.J. Smith and R. Dill-Macky. 2014. Developing inoculation methods for screening wheat for reaction to *Xanthomonas translucens* pv. *undulosa* (Bacterial Leaf Streak). *Phytopathology*, 104:S113.

Minnesota Wheat Research and Promotion Council

RESEARCH PROJECT PROPOSAL BUDGET

PROJECT TITLE: Minnesota component of the Upper Great Plains Wheat Pathology Collaboration: Bacterial leaf streak, root and crown rots and viral diseases of wheat.			
Principal Investigator(s) / Project Directors(s) Ruth Dill-Macky, Madeleine Smith and Carol Ishimaru	<u>Funds Requested For</u>		
	Year 1 (2015)	Year 2 (2016)	Year 3 (2017)
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	5,600		
7. Secretarial - Clerical			
8. Technical, Shop and Other	21,250		
B. Fringe Benefits	5,589		
C. Nonexpendable Equipment (Planting and harvesting equipment use)			
D. Materials and Supplies	13,266		
E. Travel	2,500		
F. Publication Costs			
G. Computer Costs			
H. All Other Direct Costs (Attach supporting data)	6,000		
TOTAL AMOUNT OF THIS REQUEST (per year)	\$ 54,205	\$	\$