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: 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
Collaborative Research in Minnesota on Wheat Diseases: Bacterial leaf streak, root and crown rots and viral diseases of wheat.

3. PRINCIPAL INVESTIGATOR(S)	4. PI #1 BUSINESS ADDRESS
Ruth Dill-Macky	Department of Plant Pathology 495 Borlaug Hall, 1991 Buford Circle University of Minnesota St. Paul, MN 55108
PI# 2 Name: Madeleine J. Smith	
PI# 3 Name:	

5. PROPOSED PROJECT DATES (calendar years)	6. TOTAL PROJECT COST	7. PI #1 PHONE NO.
January 1 - December 31, 2017 Note: Research Reports are Due November 15th of Each Year	$83,870	612-625-2227

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

Bacterial Leaf Streak

1.1. Co-ordinate the BSL cooperative nursery testing commercial cultivars from all wheat breeding programs in the region
1.2. Identify sources of resistance to BLS using field and greenhouse screens
1.3. Conduct studies to examine the epidemiology of BLS to determine the host range of the pathogen
1.4. Examine variation in pathogen populations
1.5. Disseminate information to wheat growers

Wheat Root and Crown Diseases

2.1. Validate and further develop screening methods for reaction to root rot pathogens in the greenhouse
2.2. Screen commercial cultivars and advanced breeding lines for resistance to Fusarium crown rot
2.3. Identify sources of resistance to FCR
2.4. Disseminate information to wheat growers

Virus Diseases

3.1. Examine the distribution of cereal viruses in spring and winter wheat
3.2. Determine the occurrence and distribution of cereal viruses on non-wheat hosts
3.3. Develop management strategies for viral diseases
3.4. Disseminate information to wheat growers

Signature Of Principal Investigator	Date	Phone Number
R.A. Dill-Macky	1/5/2017	612-625-2227
Signature Of Authorized Representative	**Title**	**Date**
andrea marshall	Principal Grants and Contracts Admin.	01/09/2017
Address Of Authorized Representative		**Phone Number**
Office of Sponsored Projects Administration 450 McNamara Alumni Center, 200 Oak Street SE Minneapolis, MN 55455-2070		612-624-5599

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

Project Title: Collaborative Research in Minnesota on Wheat Diseases: Bacterial leaf streak, root and crown rots and viral diseases of wheat.

Importance of this project to the profitability of wheat producers: This project continues our efforts to address diseases that impact the yield and quality of wheat in the Upper Great Plains, including Minnesota. The project focuses on three diseases; bacterial leaf streak (BLS); root and crown rots; and viral diseases that have been of increasing concern in recent years. The ultimate goal of the project is to deliver disease control measures for all three of these diseases.

Procedures:

Bacterial Leaf Streak

1.1. Co-ordinate the BSL cooperative nursery testing commercial cultivars from all wheat breeding programs in the region
1.2. Identify sources of resistance to BLS using field and greenhouse screens
1.3. Conduct studies to examine the epidemiology of BLS to determine the host range of the pathogen
1.4. Examine variation in pathogen populations
1.5. Disseminate information to wheat growers

We have established the basic protocols needed to work with BLS and developed a regional cooperative nursery (BLSCN). The BLSCN, established in 2012, now screens 120+ entries, released cultivars and advanced lines, submitted from seven public and private wheat breeding programs in the Upper Great Plains for resistance to BLS on an annual basis. Sources of resistance to BLS appear limited and additional sources need to be identified to increase the level of resistance in wheat. Screening nurseries achieve both these goals and thus the field screening nurseries are critical to the overall goals of the proposed project. We have a significant body of data from greenhouse testing we aim to evaluate over the coming year to determine if resistance to BLS identified in the greenhouse holds up in field testing.

We have demonstrated that the populations of *Xanthomonas* in wheat have some host specificity and this information is now being used to inform which isolates are selected for use in germplasm screening. Our understanding of the epidemiology of this pathogen is still limited and we plan to continue our work examining the *Xanthomonas* population on weed species and other crops to determine the host range of the pathogen and thus understand the role that common weeds found in and surrounding wheat fields may play in disease development. We also plan to try and determine the role of seed transmission in disease development. This work will be undertaken using multi locus sequence typing (MLST) protocols established in the previous project. If the isolates dominant on wheat are also found on specific weeds the results may provide an additional understanding of risk factors for BLS development.

Wheat Root and Crown Diseases

2.1. Validate and further develop screening methods for reaction to root rot pathogens in the greenhouse
2.2. Screen commercial cultivars and advanced breeding lines for resistance to Fusarium crown rot
2.3. Identify sources of resistance to FCR
2.4. Disseminate information to wheat growers

In the last six years we have undertaken a project on the root and crown rots in wheat. Field surveys conducted collaboratively across the three states over multiple years have 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 cause root diseases compared to previous surveys conducted over 20 years ago. This survey helped us prioritize research needs and has provided isolates needed for establishing screening for resistance to root and crown rots. Fungal pathogens from the 2012-2016 surveys have largely been identified using morphological methods and added to our collection.

Efforts in establishing a field screening nursery have been challenging, but we continue to make progress in developing methods for screening plants against *Fusarium* spp. in the greenhouse. These efforts will continue in 2017 and will ultimately facilitate our ability to identify sources of resistance and screen breeding materials for reaction to the prevalent root rot pathogens in the region.

Virus Diseases

3.1. Examine the distribution of cereal viruses in spring and winter wheat
3.2. Determine the occurrence and distribution of cereal viruses on non-wheat hosts
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The data collected over the last four years have given us information on the strains prevalent in commercial crops around the state. In the 2017 growing season, samples of grass species adjacent to fields with symptomatic small grains will be collected along with the cultivated crop species that will be examined for comparison. Strain identification will be performed utilizing the developed reverse-transcription polymerase chain reaction (RT-PCR) in the Smith lab. Samples will be collected in the field season of 2017 and lab work to identify strains present in the leaf tissues samples will continue throughout the remainder of 2017. This work should be completed in 2018.

Regional linkage to other research activities:
This research effort is linked to complementary efforts by pathologists at South Dakota State University and at North Dakota State University. We are working collaboratively on several aspects of this research project and believe that the collaborations enable us to achieve better results than if we work in isolation from colleagues in the region.

List current or potential other funding sources for this project:
1) MNWR&PC: Dill-Macky, Ishimaru and Smith. 2016. Collaborative Research in on wheat diseases: bacterial leaf streak, root and crown rots and viral diseases of wheat. $105,132. 2) MN Small Grain Initiative: Ishimaru *et al.*, 2016. Incorporating pathogen variability into breeding strategies for bacterial leaf streak resistance in wheat and barley. $54,369. (Carol is retiring in 2017 and this grant will not be renewed, though some of the project objectives will be assumed by the 2017 request of the following project). 3) MN Small Grain Initiative: Dill-Macky, 2016. Evaluation of wheat and barley breeding lines for multiple disease resistance: St. Paul. $71,811.

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 and Rebecca Curland, UMN Plant Pathologists with specializations in bacteriology will provide bacteriology support but are not seeking funding as Carol has started phased retirement.

Relationship to past projects:
We previously proposed a single large collaborative research project for funding by the MWRPC and the South and North Dakota Wheat Commissions. We greatly appreciate the support provided by the Minnesota Wheat Growers in the support of our work. Our North Dakota and South Dakota colleagues have separately sought funding within their state - the collaboration has continued despite the separation of funding. The goals of this research proposal follow the previously funded projects. From the support of our research in previous funding cycles we have made significant progress in developing techniques to work with all three diseases included in this project and many of the objectives from previously funded research projects have been completed. Similarly in this round we would expect that many of the objectives listed above should be addressed within 2-3 years.

Estimate the budget requirements:

- *Wages and Fringe Benefits*: ($67,870)

Funds are for support of a graduate student (Kristi Ledman, co-advised by Dill-Macky / Ishimaru) and partial support of technical staff for both Dill-Macky and Smith.

- *Materials and Supplies*: ($8,500)

Materials and supplies cover disposables used in the laboratory, greenhouse and field for conducting various aspects of the research. The bulk of this portion of the budget will be used for culturing pathogens, preparing inoculum, and molecular work to meet the outlined project goals.

- *Travel*: ($5,000)

Funds for domestic travel are requested to pay for mileage and accommodation necessary to maintain research plots and to conduct field work and meet with colleagues.

- *Other Direct Costs*: ($2,500)

Funds are requested to cover land use charges and greenhouse bench fees. We have requested $500 to facilitate a meeting with colleagues in the region.

- Total Direct Costs = $83,870 (Dill-Macky = $59,208; Smith = $24,662)

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* (BLS). *Phytopathology*, 104:S113.

Minnesota Wheat Research and Promotion Council

RESEARCH PROJECT PROPOSAL BUDGET

PROJECT TITLE: Collaborative Research in Minnesota on Wheat Diseases: Bacterial leaf streak, root and crown rots and viral diseases of wheat.

Principal Investigator(s) / Project Directors(s) Ruth Dill-Macky and Madeleine J. Smith	Funds Requested For 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			
5. Graduate Students	23,400		
6. Prebaccalaureate Students			
7. Secretarial - Clerical			
8. Technical, Shop and Other	20,430		
B. Fringe Benefits	24,040		
C. Nonexpendable Equipment (Planting and harvesting equipment use)			
D. Materials and Supplies	8,500		
E. Travel	5,000		
F. Publication Costs			
G. Computer Costs			
H. All Other Direct Costs (Attach supporting data) Land Use/Greenhouse Fees - $2,000, Meeting Organization - $500	2,500		
TOTAL AMOUNT OF THIS REQUEST (per year)	**$** 83,870	**$**	**$**