
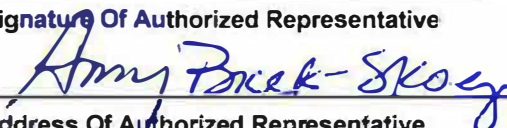


## Minnesota Wheat Research and Promotion Council

### RESEARCH PROPOSAL GRANT APPLICATION

<b>1. NAME AND ADDRESS OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE</b>  <b>Name:</b> Regents of the University of Minnesota <b>Address:</b> Sponsored Projects Administration 454 McNamara Alumni Center, 200 Oak Street SE Minneapolis, MN 55455-2070		
<b>2. TITLE OF PROPOSAL</b> Research on Bacterial Leaf Streak of Wheat		
<b>3. PRINCIPAL INVESTIGATOR(S)</b> Ruth Dill-Macky  <hr/> PI# 2 Name:  <hr/> PI# 3 Name:	<b>4. PI #1 BUSINESS ADDRESS</b> Department of Plant Pathology 495 Borlaug Hall, 1991 Buford Circle University of Minnesota St. Paul, MN 55108	
<b>5. PROPOSED PROJECT DATES (calendar years)</b>  January 1, 2020 – December 31, 2020 Note: Research Reports are Due November 15th of Each Year	<b>6. TOTAL PROJECT COST</b>	<b>7. PI #1 PHONE NO.</b>  612-625-2227
<b>8. RESEARCH OBJECTIVES: (List objectives to be accomplished by research grant)</b>  <u>Bacterial Leaf Streak</u> <ul style="list-style-type: none"> <li>Co-ordinate the bacterial leaf streak cooperative nursery (BLSCN) testing commercial cultivars and elite germplasm from the wheat breeding programs in the region</li> <li>Identify additional sources of resistance to bacterial leaf streak (BLS) using field and greenhouse screens</li> <li>Determine where in the wheat seed the bacteria (<i>Xanthomonas translucens</i> pv. <i>undulosa</i>) are surviving and examine the efficacy of seed treatments in reducing <i>X. translucens</i> pv. <i>undulosa</i> in association with seed.</li> <li>Validate PCR and LAMP assays as tools to rapidly and reliably identify <i>X. translucens</i> pv. <i>undulosa</i> in what seed, crop debris and soil</li> </ul> <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>		
<b>Signature Of Principal Investigator</b>  	<b>Date</b>  28-January-2020	<b>Phone Number</b>  612-625-2227
<b>Signature Of Authorized Representative</b>  	<b>Title</b>  Principal Grant Administrator	<b>Date</b>  19 Feb 2020
<b>Address Of Authorized Representative</b>  Office of Sponsored Projects Administration 450 McNamara Alumni Center 200 Oak Street SE Minneapolis, MN 55455-2070		<b>Phone Number</b>  612-624-5599

# Minnesota Wheat Research and Promotion Council

## RESEARCH PROJECT PROPOSAL

### (2-pages maximum)

**Project Title:** Research on Bacterial Leaf Streak and Fusarium Crown Rot of Wheat

**Importance of this project to the profitability of wheat producers:**

This project continues our efforts to address the control of two diseases that are important to wheat production in Minnesota; Bacterial leaf streak (BLS) and Fusarium root and crown rot (FCR). The ultimate goal of the project is to deliver economic control measures for these diseases, largely through the development of germplasm with improved resistance. In addition, our proposed work on BLS explores the biology of the BLS pathogen with the aim of finding additional avenues of disease control.

**Procedures:**

Bacterial Leaf Streak

- Co-ordinate the BLS cooperative nursery (BLSCN) testing commercial cultivars and elite germplasm from the wheat breeding programs in the region
- Identify additional sources of resistance to BLS using field and greenhouse screens
- Determine where in the wheat seed the bacteria (*Xanthomonas translucens* pv. *undulosa*) are surviving and examine the efficacy of seed treatments in reducing *X. translucens* pv. *undulosa* in association with seed
- Validate PCR and LAMP assays as tools to rapidly and reliably identify *X. translucens* pv. *undulosa* in what seed, crop debris and soil

We have established the basic protocols needed to work with BLS and developed a regional cooperative nursery (BLSCN). The BLSCN, first established in 2012, now screens over 110 entries, released cultivars, and advanced lines submitted from public and private wheat breeding programs in the Upper Great Plains for reaction to BLS on an annual basis. Sources of resistance in wheat to BLS are limited, there is no immunity, and additional sources need to be identified to allow breeders the genetic resources they need to increase the level of resistance in wheat. Inoculated screening nurseries achieve both these goals and thus inoculated field screening nurseries are critical.

We have demonstrated that the populations of *X. translucens* pv. *undulosa* (*Xtu*) in wheat have host specificity to wheat and this information informs us as to which isolates we should use in germplasm screening (Curland *et al.* 2018). We have determined that the *Xanthomonas* population on wheat, intermediate wheatgrass, wild rice, and the weed hosts; wild oat, quackgrass, foxtail barley, perennial ryegrass, and green foxtail are *Xtu* and that these bacteria are capable of inciting BLS in wheat (Ledman 2019).

In this project we propose to examine, using microscopy and the tracking of tagged *Xtu* strains, where in the wheat seed *Xtu* is localized and to determine the pathways of seed infection (Jonathon Jacobs, personnel communication). Specifically we want to know if *Xtu* is inside the wheat seed and associated with the embryo, or *Xtu* is surviving only on the seed exterior. In addition, we plan to validate molecular tools (PCR and LAMP assays) that have been developed to identify *Xtu*, and determine if these can be used to identify *Xtu*-contaminated seed lots and to detect the pathogen in crop residues and soil. This information will help us better understand the importance of these potential sources of inoculum and target treatments to eradicate *Xtu*, esp. from seed lots. The collection of *Xtu* isolates we developed and characterized in previous projects will be utilized in this project.

**Regional linkage to other research activities:**

The South Dakota Wheat Commission funds Dr. Shakaut Ali for his work hosting the Brookings, SD location of the BLS cooperative nursery (BLSCN). Similarly Dr. Zhaohui Liu at NSDU will host the Fargo, ND location of the BLSCN with funding from his program.

**List current or potential other funding sources for this project:**

MNWR&RC funds the current project "Research on Bacterial Leaf Streak and the Root and Crown Rots of Wheat" which provides the foundation from which this proposal was developed (\$66,618)

I get support from the Minnesota Small Grains Initiative through a project titled "Evaluation of small grains cereals for multiple disease resistance and mycotoxins." This project supports Brian Steffenson, Yanhong Dong and myself in our efforts to phenotyping wheat and barley breeding material for reaction to ten diseases including BLS. (\$79,667 = FY20 funding for Dill-Macky)

**Research Group:**

Ruth Dill-Macky is the PI who will lead the research outlined in the proposal.

Kristi Ledman, a graduate student, will work on the BLS objectives outlined in this proposal.

Rebecca Curland, a Research Professional, funded from other sources, will work on the FCR objectives outlined in this project. Rebecca has expertise in bacteriology and will also provide technical support to Kristi Ledman.

Dr. Shakout Ali at SDSU and Dr. Zhaohui Liu at NSDU will collaborate on the BLS cooperative screening nursery.

**Relationship to past projects:**

The goals of this research proposal follow as logical developments from the previously funded projects. The support of the MNWRPC in previous funding cycles has enabled us to make significant progress in addressing both BLS and FCR in wheat. The objectives from those previously funded research projects have been completed.

**Estimate the budget requirements:**

Wages and fringe benefits: \$44,897 for the support of a graduate student Kristi Ledman (\$24,898 annual salary, \$15,990 tuition, FB 16.1% [\$4,009]) to be advised by Dill-Macky and work on BLS; and \$2,000 for student labor to work on the project objectives (Crookston and St Paul).

Materials and Supplies: \$6,000 for lab supplies for culturing bacteria, inoculum production and studies (microscope and molecular assays) of the bacterial pathogen.

Other Direct Costs: \$1,200 for land rental (BLSCN) and greenhouse bench fees.

**References:**

- Curland, R.D., Saad, Y.S., Ledman, K.E., Ishimaru, C.E. and Dill-Macky, R. 2019. First report of bacterial leaf streak caused by *Xanthomonas translucens* pv. *undulosa* on intermediate wheatgrass (*Thinopyrum intermedium*) in Minnesota. *Plant Disease*, 104:279.
- Bajgain, P., Zhang, X., Turner, M.K., Curland, R.D., Dill-Macky, R., Helm, B., Dill-Macky, R., Ishimaru, C.A., and Anderson J.A. 2019. Characterization of genetic resistance to Fusarium head blight and bacterial leaf streak in intermediate wheatgrass (*Thinopyrum intermedium*). *Agronomy*, 9:429.
- Ledman, K.E. 2019. Pathovar identification and genetic diversity of *Xanthomonas translucens* strains isolated from weedy grasses and cultivated wild rice in Minnesota. M.S. Thesis, University of Minnesota, 68 pp.
- Curland, R.D., Gao, L., Bull, C.T., Vinatzer, B., Dill-Macky, R., Von Eck, L., and Ishimaru, C.A. 2018. Genetic diversity and virulence of wheat and barley strains of *Xanthomonas translucens* from the Upper Midwestern United States. *Phytopathology*, 108:443-453.