

**Minnesota Wheat Research and Promotion Council  
CROP YEAR 2013 RESEARCH REPORTING FORM  
Form Due November 15, 2013**

<b>1. PROJECT TITLE</b> Transfer of leaf and stem rust resistance genes to hard red winter wheat genetic backgrounds	
<b>2. PRINCIPAL INVESTITAGATOR (S)</b>  <b>A. PI# 1 Name:</b> GF Marais	<b>3. PI #1 Business Address</b>  Plant Sciences Department Loftsgard Hall, PO Box 6050 Fargo, ND 58108 <b>E-mail:</b> Gideon.marais@ndsu.edu
<b>b. PI # 2 Name:</b>	
<b>c. PI #3 Name:</b>	
<b>4. REPORT DATE</b> October 22, 2013	<b>5. REPORTING PERIOD</b> 2011-2013
<b>6. TERMINAL REPORT</b> <input checked="" type="checkbox"/> <b>Yes</b> <b>PROGRESS REPORT</b> <input type="checkbox"/>	
<b>7. AMOUNT OF GRANT</b> <b>\$60,915</b>	
<b>8. PUBLICATIONS</b>  None	

## 10: RELATED RESEARCH

Hybridization programs aiming to transfer specific FHB, tan spot and septoria resistance genes from spring wheat are also in progress. The genes being transferred include (a) *Fhb1*, *Fhb2*, *Fhb5A* ex Sumai 3; (b) an FHB QTL on 3AL of Frontana; (c) FHB genes on 5AS and 5AL of PI277012 (ex Dr S Xu) and (d) the tan spot and septoria resistance genes *tsn1*, *snn2*, *QTs.fcu-1BS* and *QTs.fcu-3BL* (ex Dr S Xu). The first breeding parents carrying some of these genes have been included in the 2014 crossing block in an attempt to produce cross combinations segregating for a broad spectrum of disease resistance genes.

A winter X spring wheat crossing block that aims to introduce further genes for rust and leaf spot disease resistance, wheat sawfly, sprouting tolerance, yield and quality was also introduced. The material has been used to establish a pre-breeding program that will be subjected to recurrent mass selection and gene pyramiding. In the first phase of its development this population is being selected for cold-hardiness, tan spot and *Stagonospora nodorum* resistance. The ultimate aim is to utilize superior, resistant selections from this project in crosses with the best selections from the pedigree breeding program.

A current PhD study (co-supervisor Dr Xiwen Cai) utilizes *in situ* hybridization, microsatellite and SNP analyses to further study recombinant forms of some of the alien translocations (*Lr19*, *Lr56*, *Lr59*, *Lr62*) being used in this study, and to identify those recombinants most suited for use in breeding. Regarding the *Lr19* translocation, it was found that recombinant *Lr19-149-478* is a better choice for use in the breeding program than the previously used *Lr19-149-299* recombinant. *Lr19-149-478* is more similar to the chromosome 7BL region of wheat that it replaced. Also, unlike *Lr19-149-299*, recombinant -478 can be combined with *Lr68* (also on 7BL) in resistance gene pyramids. Analyses pertaining to *Lr56*, *Lr59*, and *Lr62* are ongoing.

## 11: RECOMMENDED FUTURE RESEARCH

Establish the capacity to do large-scale marker-aided selection and pyramiding of the durable rust resistance genes *Lr34/Yr18*, *Lr46/Yr29*, *Lr68* and *Sr2*.

Apply marker-aided selection and pyramiding strategies to transfer three FHB QTL (3A gene from Frontana, *Fhb1*, and *Qfhs.ifa-5A*) to an as-broad-as-possible range of hard red winter wheat germplasm and attempt to integrate these with the durable rust resistance genes.

