PI: Gary Muehlbauer **PI's E-mail: muehl003@umn.edu**

Project ID: FY12-MU-002 **ARS Agreement #: 59-0206-9-073**

Research Category: **GDER** **Duration of Award: 1 Year**

Project Title: Rapidly Identify and Test Scab Resistance Genes.

PROJECT 2 ABSTRACT

(1 Page Limit)

Fusarium head blight (FHB, scab), a fungal disease of small grain crops caused by *Fusarium graminearum*, threatens to reduce wheat and barley to economically unviable crops in the United States. During infection the fungus produces trichothecene mycotoxins that have been shown to increase fungal virulence. To complement the current breeding efforts, my laboratory seeks to rapidly characterize genes that encode enzymes that potentially detoxify trichothecenes and transporters that move trichothecenes away from their site of action, to test the genes in transgenic wheat, and to enhance scab resistance in an elite wheat cultivar. There are three major objectives in the proposed work including: (1) rapidly test genes for trichothecene resistance; (2) characterize the function of potential trichothecene resistance genes in transgenic wheat; and (3) enhance scab resistance in an elite wheat cultivar.

We have conducted a wide array of RNA profiling experiments on barley and wheat during *F. graminearum* infection and identified potential trichothecene detoxifying genes (UDP-glucosyltransferases, cytochrome P450s and and epoxide hydrolase) and potential trichothecene transporters (ABC transporters, and glutathione-S-transferases). We will test these potential resistance genes in functional assays in yeast and *Arabidopsis*. We have established a collaboration with Dr. Gerhard Adam (Universität für Bodenkultur Wien, Austria) to screen plant genes in yeast for trichothecene resistance. Dr. Adam will screen barley genes encoding UDP-glucosyltransferases and glutathione-S-transferases. My laboratory has established a screen in *Arabidopsis* for trichothecene resistance genes. The genes encoding ABC transporters, epoxide hydrolases and cytochrome P450s, and the genes exhibiting resistance in yeast will be expressed in *Arabidopsis* and tested for trichothecene resistance.

We plan to develop transgenic wheat carrying all of the trichothecene resistance genes we identify in our screens. Previously, we showed that a barley *UDP-glucosyltransferase* (*UGT*) gene exhibits resistance to the trichothecene deoxynivalenol (DON). We developed transgenic wheat carrying the barley *UGT* and in preliminary tests showed that these transgenics exhibit high levels of type II resistance. We plan to continue to characterize these plants for resistance and use them to increase the level of scab resistance in the elite wheat cultivar Rollag.

The proposed research meets the objectives of the USWBSI and fits within the Gene Discovery and Engineering Resistance (GDER) area of research. The proposed research has specific reference to the priorities of efficiently identifying and characterizing genes that provide FHB resistance and DON reduction, and engineering transgenic wheat exhibiting FHB resistance and DON reduction.