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

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

Project Title: Characterizing Trichothecene Resistance and Developing Scab Resistant Wheat.

PROJECT 2 ABSTRACT

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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. Trichothecenes belong to a family of mycotoxins that can be divided into type A and type B. Examples of type B trichothecenes are deoxynivalenol (DON) and nivalenol (NIV). Several novel type A trichothecenes have been identified from *F. graminearum* isolates including NX-2 and NX-3. Thus, the overall aim of this project is to develop genetic approaches to increase trichothecene and FHB resistance in wheat.

Previously, we developed transgenic wheat expressing a barley UDP-glucosyltransferase (*HvUGT13248*) and showed that these transgenics exhibit high levels of FHB resistance via conjugation of DON to DON-3-O-glucoside (D3G). We introgressed *HvUGT13248* into two elite cultivars, Linkert and Rollag and have derived lines that are ready for testing. Preliminary evidence indicates that *HvUGT13248* provides resistance to a broad range of trichothecenes including type B and type A. We also conducted a large set of RNA-seq projects in wheat to detect potential resistance genes. There are three major objectives including: (1) develop elite wheat cultivars expressing *HvUGT13248* that confer FHB resistance; (2) characterize the ability of transgenic wheat expressing *HvUGT13248* to provide resistance to a broad spectrum of trichothecenes; and (3) test potential trichothecene resistance genes.

Our overall research plan includes: (1) we will test two elite wheat cultivars (Linkert and Rollag) expressing *HvUGT13248* for scab resistance in the greenhouse and field; (2) we will test transgenics expressing *HvUGT13248* for resistance to NIV, NX-2 and NX-3 and characterize the conjugation products; and (3) we will characterize genes encoding UDP-glucosyltransferases on wheat chromosome group 2 and 5 for resistance to trichothecences in functional assays in yeast and *Arabidopsis*. All genes that exhibit resistance will be transformed into wheat and tested in the greenhouse and field.

The proposed research meets the objectives of the USWBSI and fits within the Gene Discovery and Engineering Resistance (GDER) area of research. Stakeholders will benefit from this research via novel germplasm carrying resistance to FHB and trichothecenes, understanding the role of UDP-glucosyltransferases and resistance to type B and type A trichothecenes, and additional genes to test in transgenic plants or use in molecular breeding approaches.