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Project Title: Characterizing Trichothecene Resistance and Developing Scab Resistant Wheat

PROJECT 2 ABSTRACT

(1 Page Limit)

Fusarium head blight (FHB, scab), caused by *Fusarium graminearum*, is a major threat to wheat and barley crops. 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. Type B trichothecenes include deoxynivalenol (DON) and nivalenol (NIV), and type A trichothecenes include NX-2. 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 to DON- and NIV-producing *F. graminearum*. HvUGT13248 conjugates both DON and NIV with a glucoside group, resulting in detoxification of the trichothecene and increased resistance. We introgressed *HvUGT13248* into two elite cultivars, Linkert and Rollag and have derived lines that are ready for testing. Preliminary evidence indicates that *HvUGT13248* also provides resistance to the Type A trichothecene NX-2. We have also identified two wheat UDP-glucosyltransferase genes that may underlie FHB resistance QTL on chromosomes 5A and 5B. There are three major objectives including: (1) test elite wheat cultivars carrying *HvUGT13248* for FHB resistance; (2) characterize the ability of transgenic wheat carrying *HvUGT13248* to provide resistance to NX-2-producing *F. graminearum*; and (3) characterize wheat UDP-glucosyltransferase genes.

Our overall research plan has three components including: (1) testing two elite wheat cultivars (Linkert and Rollag) expressing *HvUGT13248* for scab resistance in the field; (2) testing transgenics expressing *HvUGT13248* for resistance to NX-2 and characterizing the conjugation product; and (3) characterizing genes encoding UDP-glucosyltransferases on wheat chromosome group 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 the Gene Discovery and Engineering Resistance area of research. Specifically, this research addresses the priorities to identify native wheat and barley gene variants that improve FHB resistance and/or reduce DON accumulation, and develop effective FHB resistance and/or reduced DON accumulation through transgenic strategies. 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 A trichothecenes, and additional genes to test in transgenic plants or use in molecular breeding approaches.