Project Abstract

Project Title:	Optimization of Fhb7 to enhance FHB resistance in barley	
USWBSI Project ID:	FY24-GD-004	
Principal Investigator:	Wanlong Li	South Dakota State University
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Project Summary

Fusarium head blight (FHB; scab) is a devastating disease in barley and wheat. Significant progress has been made in understanding and improving host resistance in wheat with molecular cloning of the major QTL Fhb1 and Fhb7; however, similar research with barley has lagged due mainly to the lack of highly resistant genotypes, which makes it very difficult to effectively control FHB and DON contamination*. Thus, there is an urgent need for a breakthrough in gene discovery and germplasm development to achieve higher levels of FHB resistance and a greater capacity to detoxify DON in* barley.

The use of wheat genes to breed barley FHB resistance is the road not taken because of strong reproductive barriers. Considering that Fhb7 detoxifies DON, we **hypothesize** that Fhb7 can also greatly contribute to FHB resistance in barley. Supported by a USWBSI-TSCI grant, we developed Fhb7 transgenic plants in barley cultivar Gold Promise, and detached leaf assay of these transgenic plants suggested that Fhb7 functions in barley: degrading DON and suppressing the growth of *Fusarium graminearum*. In the meantime, we developed targeted several putative insertion lines in the elite two-rowed malting barley cultivar Excelsior Gold using the CRISPR, in which *Fhb7* is expected to insert in the *mlo* locus. In this GDER proposal, we propose to enhance barley FHB resistance by better use of Fhb7 with an objective fine-tune *Fhb7* expression by inserting it in different locations of a host gene. We **expect** to develop insertion lines with enhanced *Fhb7* transcription and FHB resistance.

The proposed research addresses **our long-term goal** to improve the FHB resistance of barley and wheat using CRISPR-based approaches and aligns well with the GDER action plan: “detection and validation of host genes for resistance and susceptibility to FHB or DON accumulation”. As a team of expertise in gene discovery, germplasm, breeding, pathology, and genome editing, we have the materials, resources, and tools in place to make significant progress. Results from the proposed research will have a **positive impact** on barley production and the brewery industry, **benefiting** barley growers and end-users.

Project Timeline (YR 1)

In FY24, we will make two new CRISPR constructs to target the 5’UTR of the *Mlo* gene. These constructs will be transformed into EG barley together with *Fhb7* donor DNA by bombardment, and regenerated T0 transgenic plants will be screened for targeted insertions.