Project Abstract

Project Title:	**Pyramiding and Deployment of Multiple FHB Resistance QTLs in Hard Winter Wheat**	
Principal Investigator:	**Guihua Bai**	**USDA-ARS Hard Winter Wheat Genetics Research Unit**

Among more than 600 QTLs reported, only a few including *Fhb1*, *Fhb7* and a QTL on 2DL showed major effects on FHB resistance. Stacking these QTLs in new cultivars can achieve a high level of FHB resistance in wheat cultivars to reduce losses due to FHB and DON in US wheat. Previously, PI's team transferred *Fhb1* to HWW and started pyramiding of *Fhb1* with 2DL QTL as well as *Fhb1* with *Fhb7* and selected some pyramided lines with high FHB resistance. However, these lines still have many undesirable traits, which prevents their wide use either as resistant parents for crosses or as cultivars for commercial production. In addition, the *Fhb7* donor carries a phytoene synthase (*PSY1*) gene for yellow pigment content (YPC) that is undesirable for wheat flour quality. Our overall goals are to create new genetic resources of FHB resistance and introgress multiple FHB resistance genes into elite breeding germplasm efficiently for long-term improvement of FHB resistance using novel genomic technologies.

The objectives of this proposal are to 1) improve *Fhb7* donor by eliminating YPC trait that associates with *Fhb7*, 2) pyramid three major FHB resistance QTLs (*Fhb1*, *Fhb7* and 2DL QTL) with the QTLs for other important traits and 3) quickly deploy the set of major QTLs in HWW-CP breeding programs. The work will lead to creation of new resistant germplasm and quick release of FHB resistant HWW cultivars. We will 1) knock out the *PSY1* gene for YPC in the *Fhb7* donor parent using EMS mutagenesis; 2) pyramid the three major QTLs (*Fhb1*, *Fhb7* and 2DL QTL) in 8-12 elite HWW breeding lines with high yield, good adaptation and resistance to major local diseases, except for FHB, from the HWW-CP breeding programs using marker-assisted backcross to quickly enrich target QTLs and eliminate donors' genome content; 3) select and send the early generation backcross lines that carry at least two major FHB resistance QTLs to HWW-CP programs in OK, KS, CO, NE, SD and ND for further FHB and yield trials to select new cultivars for release or parents for further crossing. The improved *Fhb7* donor without YPC and the selected HWW germplasm lines with three major FHB resistance QTLs will be deposited in the USDA National Plant Germplasm System for public distribution, and selected breeding lines with the pyramided QTLs that are sent to HWW-CP programs will lead to quick release of FHB resistant HWW cultivars in the Great Plains.