

Project Abstract

Project Title:	Development of elite spring wheat germplasm with Fusarium head blight resistance	
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Fusarium head blight (FHB) is one of the most destructive diseases of wheat. A challenge in FHB resistance breeding is that it is difficult to integrate the FHB resistance with the adaptability. Therefore, the overall goal of this project is to develop adapted hard red spring wheat (HRSW) germplasm for HRSW breeding programs. The followings are the specific objectives: 1) Develop high-breeding value HRSW germplasm with combination of FHB resistance, adaptability, yield, and quality, 2) transfer FHB resistance from synthetic hexaploid wheat (SHW) lines into HRSW varieties, and 3) transfer and pyramid major FHB resistance QTL into HRSW varieties. For developing high-breeding value HRSW germplasm, we previously developed several elite HRSW lines carrying *Fhb1* and two PI 277012-derived 5A QTL. We have backcrossed four lines (15FAR1143-3, 15FAR1157-1, 15FAR1162-1, and 15FAR1162-1) to several HRSW varieties, including 'ND Frohberg', 'ND VitPro', 'Linkert', 'Bolles', 'Reeder' and 'Ascend-SD'. We expect to develop 500 – 1,000 BC₁-derived lines carrying the two PI 277012-derived 5A QTL and *Fhb1* by 2022. In the next funding cycle, these lines will be extensively characterized and evaluated for FHB resistance and approximately 40 top lines with improved FHB resistance will be evaluated in a yield trial for agronomic traits, yield, and quality. To transfer FHB resistance from SHW lines into HRSW varieties, we are currently transferring FHB resistance from four SHW lines SW91, SW93, SW183, and SW187 into HRSW varieties. Approximately 1,000 BC₁F₅-derived advanced lines will be developed in 2022. These lines will be extensively evaluated and characterized, and elite HRSW germplasm lines will be selected for the 2nd round of introgression and released to the HRSW breeding programs. To further improve the FHB resistance, we will transfer and pyramid 5-6 major QTL, including *Fhb1*, *Fhb2*, *Fhb4*, *Fhb5*, *Fhb7* and PI 277012-derived 5A QTL into new HRSW varieties. In this work, we will simultaneously transfer *Fhb1*, *Fhb2*, *Fhb4*, and *Fhb5* from Wangshuibai and *Fhb7* from wheat introgression lines derived from tall wheatgrass species *Thinopyrum elongatum* ($2n = 2x = 14$) and *Th. ponticum* ($2n = 10x = 70$) into ND Frohberg by backcrosses. New STARP markers for these QTLs will be developed for marker-assisted backcrosses. By implementation of this project, we will develop many elite and adapted HRSW germplasm lines carrying the multiple FHB resistance QTL with no or minimal linkage drags for the HRSW breeding programs. Thus, the outputs of this project meet the overall goal of the USWBSI.