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(1 Page Limit)

In the Great Plains, FHB can be found in most hard winter wheat (HWW) fields of Nebraska, South and North Dakota and Kansas. Recent severe FHB epidemics in these states caused about 10-15% of yield losses. Since 2010, FHB moved south to Oklahoma where FHB has never been seen before. Currently used commercial HWW cultivars in these regions most are still highly susceptible. Many Asian sources of resistance genes have been reported, but they are not present in any HWW cultivars. *Fhb1* from Sumai3 has been successfully transferred into 17 HWW cultivars in previous USWBSI-funded projects, and can provide significant reduction in FHB severity in most backgrounds in regular FHB epidemic years. However, *Fhb1* alone cannot provide sufficient protection in severe epidemics, and discovery and deployment of additional resistance QTLs are critical to further improvement of FHB resistance in HWW. Although several moderately resistant cultivars such as Overland, Everest, and Lyman have been identified in HWW, the QTLs underlining their resistance remain unknown and markers are not available for marker-assisted pyramiding of these genes with others. In this proposal, we will 1) map QTLs for FHB resistance in Lyman a cultivar from South Dakota by genotyping a RIL population (Lyman/OverleyF<sub>5</sub>) with GBS and phynotyping the population for FHB in both greenhouse and field experiments, 2) pyramid *Fhb1* and QTLs from PI 277012 in US HWW (Overland and Everest) by marker-assisted backcross (MAB) and 3) apply genomic selection (GS) in FHB breeding by analyzing GBS for the breeding materials from both Tri-state FHB nursery and the five states FHB breeding programs. GS will help to remove highly susceptible lines from CP breeding programs. The proposed research will provide new breeding technologies and germplasm to facilitate quick release of FHB resistant HWW.