FY16 USWBSI PROJECT ABSTRACT

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Project Title: Implementing Genomic Selection for FHB Resistance in Soft Winter Wheat (SWW).

PROJECT 4 ABSTRACT

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Soft red winter wheat has considerable "native" genetic variation for FHB resistance. Published literature suggests most genetic variation for FHB resistance in SRWW is due to genes of small effects. Thus much of the genetic variation for FHB resistance in SRWW is not amenable to traditional marker-assisted selection (MAS). Currently only traditional plant breeding employing phenotypic selection (PS) can affect those genes. The main problem with PS for FHB resistance is that it takes many years to complete a breeding cycle due to the years needed to inbreed a population, generate lines, obtain sufficient seed to test the lines, and acquire data over years to produce phenotypes with good predictive ability.

Our objectives are:

1. To implement Genomic Selection (GS) for FHB resistance in soft winter wheat by completing two cycles of GS.
2. Initiate evaluation of the effectiveness of GS.

Genomic selection (GS) is a technology that allows MAS to affect nearly all the genes that control FHB resistance, including those with small effects. Genomic selection begins with a training population that is phenotyped and genotyped. A prediction model is built using the data from the training population. That model is then used to predict the value of other genotyped individuals even without phenotyping those individuals. This allows a breeding cycle to be completed very quickly: we estimate that a breeding cycle of PS for FHB takes five years in winter wheat while a breeding cycle of GS in winter wheat can be completed in one year.

The accuracy of GS versus PS for FHB resistance in SRWW was evaluated in our previous USWBSI project and ranged from 0.65 to 0.70. Rudkowski et al (ref) reported a relative efficiency of 0.38 to 0.64 for different FHB resistance traits. Given that a cycle of PS and GS for FHB in winter wheat takes five and one year, respectively, then reported accuracies for GS should provide a significant increase in gain per year over PS. These results indicate that GS has potential to significantly improve the annual gain in improving FHB resistance in soft winter wheat.

Over the past three years the USWBSI has funded the phenotyping of a training population of 649 lines and the implementation of two cycles of GS. We propose to complete two addition GS cycle (cycles 3 and 4) and evaluate the effectiveness of GS by phenotyping lines derived from the first three cycles of GS.