FY22 USDA-ARS/USWBSI

Project ID: FY22-SP-007

Project Abstract

Project Title:	**Centralized Genomic Selection Resources for FHB-Resistant Spring Wheat Breeding**	
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Spring wheat is vulnerable to Fusarium head blight (FHB) or scab, and the most economical way of combating the disease is to grow varieties with genetic resistance. Genomic selection (GS) is a promising molecular breeding method to predict performance and accelerate the development of FHB resistant spring wheat cultivars that also meet performance requirements. A challenge with this method is that predicted trait metrics need to be generated rapidly every year to inform selection/crossing decisions in the next generation.

The overall goal of the project is to provide centralized resources to enable GS in all the northern US spring wheat breeding programs.

The specific objectives of the projects are to:

1) Develop a low-cost assay that is useful in US breeding programs.
2) Generate a standard pipeline for phenotyping and prediction.

The expected outcomes of these objectives are:

1) An inexpensive genotyping platform for reproducible identification of genome-wide molecular markers suitable for low-density applications such as GS.
2) A standard operating procedure for shared FHB and performance evaluation of spring wheat lines in the field. A rapid “one stop shop” that will take tissue samples and output predicted trait values.

The approaches we will use to accomplish these goals are to develop a low-density Illumina multi-species array and build infrastructure around centralized prediction services. The low-cost array will be assembled by sub-setting existing Illumina 90K and sequence-based SNPs based on consistent genomic spacing and allele frequencies in as many breeding programs as possible. To centralize prediction, we will expand the scope of the existing Uniform Regional Nursery to increase the number of entries and include scab screening. This will provide the foundation for shared prediction analysis services and will be built upon until model accuracies are sufficiently high to be useful for selection.

The outputs of this project will be a “one stop shop” where germplasm entries are sent in and predicted values are returned, allowing the breeders to focus on the other parts of their program. These predicted values will enable data-driven decisions that will accelerate the release cycle of improved FHB-resistant cultivars for the producers. Additionally, this project will result in a new low-cost array that fills an unmet need in agricultural genotyping. With it, researchers will be able to access genotyping information for applications such as diversity and fingerprinting analysis on scales that were cost-prohibitive before.