Project FY22-SP-007: Centralized Genomic Selection Resources for FHB-Resistant Spring Wheat Breeding

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1. **What are the major goals and objectives of the research project?**
   1) Develop a low-cost assay that is useful in US breeding programs.

   2) Generate a standard pipeline for phenotyping and prediction.

2. **What was accomplished under these goals or objectives?** *(For each major goal/objective, address these three items below.)*

Objective 1:

What were the major activities?
The USDA-3K has been well-validated and dual- and tri- hybridization experiments have been performed to check accuracy. Processes for automatically converting this data into standard genotyping formats have been put together.

What were the significant results?
At least 2,000 markers are non-fixed in every hexaploid wheat breeding germplasm pool tested. This is sufficient to build genomic selection models that are equivalent to those built with higher-density genotypes. Imputation accuracy varied from 93-98% median taxa accuracy. In dual and multi-mode, the clusters migrate, but with the aid of new helper scripts, 90-95% percent of the markers can still be reliably called and used with decreasing the cost to $4.67/sample in tri-mode.

List key outcomes or other achievements.
The 3K array has shown itself to be a useful genotyping platform for its intended purposes and has already drawn attention from other crops to build similar resources. Additionally, a marker-assisted report is now provided for every project that provides predicted alleles (traits) for customers.

Objective 2:

What were the major activities?
The genomic selection coordinator started 06/01/2023. In this short amount of time, she has assembled genomic selections models with the URN/URSN data. She has also used this data to identify significant gene regions through GWAS and is now able to predict line performance in individual breeding program data.

What were the significant results?
The URN/URSN data set provided enough information to generate accurate genomic selection models with the 90K and 3K array. The low-density 3K array provides the same level of performance as the more expensive high-density array.

List key outcomes or other achievements.
The project is at the point where some individual breeding programs are sending in data and getting back predicted values.

3. **What opportunities for training and professional development has the project provided?**
   The postdoc hired for this role has been exposed to wheat genomics and FHB disease resistance. She has also traveled to several field days and has interacted with producers directly.

4. **How have the results been disseminated to communities of interest?**
   The Postdoc hired in this position has presented her results at The FHB Forum and Plant and Animal genome conference

5. **What do you plan to do during the next reporting period to accomplish the goals and objectives?**
   Building upon the success of the URN models, the individual breeders will start routinely sending data to the coordinator and get predicted traits back. The coordinator will also start exploring different ways to improve model performance such as partitioning certain mega-environments, iterating training sets and adding weather data.