Project FY22-BA-013: A Low-Cost Genotyping Platform to Develop FHB-Resistant Barley

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1. What are the major goals and objectives of the research project?

The objectives of the research project are to:

1) Characterize population sub-structure and diversity of US breeding germplasm.
    a. Completed in Year 1
2) Identify a set of evenly spaced markers for a low-cost assay
3) Evaluate dual-hybridization mode of Infinium multi-species array

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

Objective 2:

a) What were the major activities?
In this period of performance, 5,952 barley samples were genotyped with the Illumina 3K and 6,120 barley samples were genotyped with Illumina 50K.

b) What were the significant results?
Ready to use genotyping files were submitted to the customers.

c) List key outcomes or other achievements.
Barley CP members used the Illumina array to genetically fingerprint lines, map QTL and generate predictors for genomic selection.

Objective 3:

a) What were the major activities?
1,920 barley samples were run in dual and tri mode on the Illumina 3K during this time period, including a validation panel for a new customer.

b) What were the significant results?
Clusters can migrate compared to single-mode requires an orthologous technique to determine the proper cluster positions and genotype call. In some cases, the clusters merge into one another when the sample pair hybridizes with the probe. However, in most cases, the anticipated target outcompetes the other crop. Approximately 5-10% of markers cannot be used in dual/multi mode, dependent on the pairing partner.

c) List key outcomes or other achievements.
A pipeline was developed to assess single-vs dual mode for any set of germplasm and provide cluster call thresholds for accurate genotyping. Every multi-project in the future can be “trained” with this pipeline to determine the most accurate call at the lowest price. Recent modifications to the pipeline allows the customer to pick a threshold miss-call rate. SNPs above this rate will be clustered with a zero-error rate, but with a larger missingness.

3. **What opportunities for training and professional development has the project provided?**
   Our Postdoctoral Researcher has been able to investigate this data and has learned scripting skills to analyze and visualize this for an *in preparation* manuscript.

4. **How have the results been disseminated to communities of interest?**
   This array is commercially available directly from Illumina and marketed by them. Most customers know about this array through direct communication.

5. **What do you plan to do during the next reporting period to accomplish the goals and objectives?**
   The 3K array is useful for its intended application of supporting genomic selection and fingerprinting. However, this use-case is not required for many Bar-CP PIs, so more 50K high-density arrays will be used in place of 3K arrays when appropriate.