

Project 2: Coordinated Fungal Biomass Measurements of FHB in Barley

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

The major goals and objectives of the research project aimed at determining the relationship between Fusarium biomass and Deoxynivalenol (DON) for the purposes of breeding spring malting and hulless barley are as follows:

Goals:

1. **Determine the Relationship Between Fusarium Biomass and DON:** The main goal is to understand how Fusarium biomass relates to DON contamination in barley, which is crucial for improving barley breeding programs.

Objectives:

1. **Establish a Fusarium Biomass Measurement Pipeline:**
 - Collect barley samples from various nurseries and breeding programs, including NABSEN, hulless barley trials, and training population trials from NDSU and UMN.
 - Process approximately 4,000 samples for Fusarium biomass measurements.
 - Develop and test a new primer/probe set in a 384 well capacity to increase throughput and accuracy of Fusarium biomass measurements.
2. **Measure Fusarium Biomass and DON in Training Populations:**
 - Measure Fusarium biomass and DON from UMN and NDSU training populations grown in FHB mist nurseries three weeks post-heading.
 - Compare these measurements to harvested grain Fusarium biomass measurements to determine if early measurements can predict harvest levels.
3. **Evaluate the Predictive Capacity of Early Measurements:**
 - Determine if Fusarium biomass and DON measurements taken three weeks post-heading can predict Fusarium biomass and DON at harvest.
 - Validate or nullify the hypothesis that early measurements can predict harvest outcomes.
4. **Enhance Breeding Selection:**
 - Assess the usefulness of Fusarium biomass measurements in enhancing genotypic analysis and selection decisions in barley breeding.
 - Provide breeders, NABSEN cooperators, and researchers with Fusarium biomass data to improve the understanding of Fusarium head blight resistance in barley.
 - Publish findings on the efficacy of Fusarium biomass measurements in FHB nurseries to contribute to the scientific community's understanding of the relationship between Fusarium biomass, infection, and DON contamination.

This study aims to provide a more comprehensive picture of Fusarium head blight resistance in barley, ultimately aiding in the development of barley varieties with improved resistance to this disease.

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

What were the major activities?

Collection of barley samples from NABSEN, hulless barley trials, and training population trials from NDSU and UMN.

Processing of approximately 4,000 samples for Fusarium biomass measurements.

Development and testing of a new primer/probe set in a 384 well capacity to increase throughput and accuracy of measurements.

What were the significant results?

Successfully processed and measured Fusarium biomass in collected barley samples.

Validated a new TaqMan Multiplex Real-Time PCR assay for high-throughput quantification of Fusarium graminearum biomass in barley spikes and grains.

List key outcomes or other achievements.

Establishment of a reliable, high-throughput pipeline for Fusarium biomass measurement in barley.

Enhanced accuracy and efficiency in measuring Fusarium biomass due to the validated primer/probe set.

Published the findings in the paper titled "Development and Validation of a TaqMan Multiplex Real-Time PCR Assay for High-Throughput Quantification of Fusarium graminearum Biomass in Barley Spikes and Grains" (<https://doi.org/10.1094/PHP-07-23-0065-RS>).

3. What opportunities for training and professional development has the project provided?

This research was part of a graduate students research program and was trained on PCR and give the opportunity to attend both the APS Plant Health Conference and the 2023 Scab forum.

4. How have the results been disseminated to communities of interest?

Published the findings in the paper titled "Development and Validation of a TaqMan Multiplex Real-Time PCR Assay for High-Throughput Quantification of Fusarium graminearum Biomass in Barley Spikes and Grains" (<https://doi.org/10.1094/PHP-07-23-0065-RS>).

Additionally, a poster and a short talk was presented at the 2023 Scab forum

5. What do you plan to do during the next reporting period to accomplish the goals and objectives?

We are investigating the occurrence of FHB symptoms on individual kernels and lack of correlation with Fusarium biomass determined by qPCR. It is critical to understand if our measurements are truly reflecting levels Fusarium biomass and understanding why individual kernels with high qPCR levels have minimum symptoms and variable DON.