Report for FY22-MG-005: Continued Deployment of Prediction Models for Fusarium Head Blight of Wheat & Barley

Note: Report must cover the *entire* duration of the project period of performance, May 1, 2022-July 30, 2026.

1. **What are the major goals and objectives of the research project?**
   - Deployment of the daily estimates of disease risk in the US.
   - Develop prototypes of a web-based user interface for delivering estimates of disease risk based on model ensembles.
   - Develop climate-based risk assessment for Fusarium head blight in the US.

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

   What were the major activities?

   The disease forecasting models were successfully delivered in the targeted areas during the 2022-2026 growing seasons. This includes development of daily maps of disease risk and coordination of the commentary provided by extension plant pathologists and agronomists. We also collaborated with the USWBSI NFO on the delivery of the expert commentary via the FHB Alerts, these alerts are sent to growers and other stakeholders through text message and email to stakeholders of the USWBSI.

   We continued to improve the user interface during this term of this project. Important changes included:

   - Upgrades to the help documentation for use of the forecasting tools in 2022, 2024 and 2026.
   - Completed improvements to the display of expert commentary by region and adjustments in the user interface to more effectively display commentary as a list with the most recent updates at the top. Users can also view all available commentary provided for a growing season at the national, or regional levels. Long-term documentation of the commentary is provided on the FHB Alerts Blog.
   - Integrated new graphing tools into the disease forecasting site that will enable users to select any section on the risk map to view recent weather and disease risk trends. These tools were fully operational for the 2025 and 2026 growing seasons.

   Develop prototypes of a web-based user interface for delivering estimates of disease risk based on model ensembles. During the term of this project, we identified candidate models that could serve as members of a model ensemble that could lead to improved predictions of disease risk. The models, proposed by development team (described separately), are logistic regression models based-on pre-anthesis weather observations.

   We have been testing the ensemble approach during the 2024, 2025 and 2026 growing seasons. This work included developing code to calculate the summaries of hourly weather data for each of the member models, calculating disease risk for each member and then developing approaches to display the unified summary of disease risk based on the

ensemble. We then developed a special user interface available only to the modeling team that allowed the detailed evaluation of the ensemble approach.

Develop prototypes of a web-based user interface for delivering estimates of disease risk based on model ensembles. During this project year identified candidate models that serve as members of the overall ensemble. These models, proposed by development team (funded separately), are logistic regression models based-on pre-anthesis weather observations. The deployment of a model ensemble requires additional quality control steps and evaluation of the input and outputs for each member model.

We have been testing the ensemble approach during the 2024 and 2025 growing season. This work includes developing code to calculate the summaries of hourly weather data for each of the member models, calculating disease risk for each member and then developing approaches to display the unified summary of disease risk based on the ensemble. This required the deployment of the models via a web-based model interface designed to support expert evaluation of the ensemble approach.

Develop climate-based risk assessment for Fusarium head blight in the US. Completed the primary analysis of the climate-based risk assessment for FHB. This includes processing decades of hourly weather data from throughout the continental US and establishing a database that will allows us to calculate estimates of crop growth stage and disease risk at a 2km grid throughout the spatial domain. We have completed our evaluations of the climate-based risk with current FHB model and are working to update the analysis with a recently released version of the forecasting model and verifying the predictions based on the gridded weather data with station-based assessments of disease risk from selected weather stations in key wheat growing regions of the US. This work will be released for use by the USWBSI community over the next year.

Completed user surveys for the FHB Prediction Center and the FHB Alert System. The modeling team collaborated with the USWBSI NFO to survey the primary users of the FHB Prediction Center and the FHB Alert System. This survey was delivered electronically to the subscribers of the FHB Alerts in 2022, and 2024. Plans are in place to survey users of these tools again in 2026. These surveys help the modeling team gather information about the user demographics, usage patterns and provides the USWBSI with valuable impact of the information about the disease forecasting effort.

What were the significant results?

New graphing features were added to the web-based tools enabling improved grower interaction with the forecasting models for the 2025 and 2026 growing seasons. These tools enabled users to select any point on the risk map to view recent weather and disease risk trends.

Extension specialists provided state and regional level commentaries to help growers interpret disease forecasting models and translate these results into practical management recommendations for FHB. There were more than 120 commentary posts to date for the 2022-2026 growing seasons.

List key outcomes or other achievements.

Disease forecasting models for FHB were successfully delivered 35 states during the 2022 - 2026 growing seasons. These tools were used by thousands of wheat and barley growers each year. User surveys documented that the information provided via these tools was of high value to their farm or business operations and helped avoid yield losses caused by FHB. Users reported that the monetary value of this information exceeded $50 million annually.

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

   Annual training on latest web-based tools for evaluating the risk of FHB in the USA was offered at multi-state committees that coordinate the extension and research work for small grain diseases in the US. Participants in this training provide specialist commentary and management that reaches thousands of producers annually.

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

   This project by its very nature is about delivering disease forecasts to small grain producers and their advisors with daily assessments of disease risk and practical management recommendations based on this information.

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

   Not applicable, this is the final report for the agreement.