

## Project 2: Improved Model Ensembles for Prediction of Fusarium Head Blight

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

The overall goal of this project is to create stable models for predicting Fusarium head blight (FHB). The specific objectives were to:

- 1) Expand the data matrix used for modeling FHB with cases representing new environments and years;
- 2) Improve predictive performance of disease forecasts by combining models representing specific epidemiological processes within model ensembles.

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

#### What were the major activities?

For **Obj 1**, additional data were collected from trials conducted by PIs in several U.S. states. During the year, integrated management trials were conducted as part of the IM\_CP in AL, DE, IL, IN, KS, KY, LA, NC, MD, MI, MO, MN, ND, NE, OH, PA, SD, TN, VA, and WI. In each trial, at least two commercial wheat cultivars, classified as susceptible, moderately susceptible, or moderately resistant, were planted. FHB index, incidence and DON data were collected from nontreated, naturally infected, non-irrigated plots of each cultivar and edited for inclusion in the master data file for FHB risk model development and validation.

**Obj 2.** The modeling team met several times during the year to discuss modeling approaches and share preliminary results. Led by Dr. Shah in the DeWolf lab, weather data were collected, summarized, and used as predictors for the development of several new model ensembles. The emphasis during the funding cycle in question was on combining weather-based logistic regression models that represented different and specific epidemiological processes (see Dr. DeWolf's Performance Report for details).

#### What were the significant results?

**Obj 1.** Several new observations were collected from the IM\_CP and added to the master dataset. Each new observation consisted of mean FHB index and corresponding DON data from a unique combination of cultivar resistance class, trial location, wheat market class, and year. Due to unfavorable weather conditions for FHB development across most of the IM\_CP trial locations, mean FHB index was zero or close to zero for most of the new observations. This is still extremely useful and valuable data for model development and testing.

**Obj 2.** Several new model ensembles were developed.

#### List key outcomes or other achievements.

**Obj 1.** The postdocs on the project worked tirelessly with the Dr. DeWolf lab and PIs on the IM\_CP to double check and correct or discard questionable data that were collected over the last eight to 10 years. This resulted in a clearer master dataset, which now consist of more than 1,200 cases.

**Obj. 2.** Some of the new model ensembles performed better in terms of prediction accuracy than the original logistic regression models that were used to build them as well as some of the earlier ensembles (see Dr. DeWolf's Performance Report for details). In addition, model results led to new insight into weather patterns associated with the development of FHB

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

The postdocs who contributed to the project learned certain basic aspects of data mining through conversations with Dr. Denis Shah via email and zoom meetings.

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

A manuscript was published, and an abstract/talk/poster presented at the 2023 USWBSI National FHB Forum.

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

Continue collecting new data through the IM\_CP and developing and testing models as proposed.