

Project 3: Fusarium Species Diversity within Spikes and Fields: Implications for FHB Management

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

The major objectives of the FY23 research program were to 1) conduct a broad geographic survey of *Fusarium* and mycotoxin diversity in FHB symptomatic wheat and barley and 2) identify whether less aggressive pathogens *Fusarium acuminatum* and *F. poae* affect FHB and DON outcomes caused by the aggressive *F. graminearum* if inoculated first or co-inoculated.

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

What were the major activities?

Objective 1: In 2022 and 2023, we visited several dozen wheat and barley fields in MD, VA, NC, KY, and IL, sampling individual symptomatic scabby spikes. To date, ~1,000 spikes from these fields have been frozen and ground, and the tissue is being prepared for sequencing the TEF-1 α gene. The spikes will be compared for biomass amounts of individual *Fusarium* species that were infecting them, using our novel SSIM method. This will enable us to make spike-to-spike comparisons of total *Fusarium* abundance, and allow us to ask questions such as whether the presence of minority *Fusarium* species within a spike tends to increase or decrease the biomass of *Fusarium graminearum* in that same spike.

Objective 2: We have performed two field experiments and five greenhouse experiments, testing pre- and co-inoculation treatments. The winter wheat variety Shirley, which is high-yielding but susceptible to FHB, was inoculated with *F. graminearum* to determine FHB outcomes and DON accumulation. The focus was a test of whether pre- or co-inoculation with the less aggressive strains *F. poae* or *F. acuminatum* would reduce *F. graminearum* disease severity or DON production. Samples were taken in three greenhouse experiments at various post-inoculation timepoints to test for the effects of the various treatments on jasmonic and salicylic acid produced by wheat. These samples and sub-samples for mycotoxin analysis are being processed by our collaborators in Peoria.

What were the significant results?

Objective 1: this work is in progress.

Objective 2: In the first year, in the greenhouse, no pre-inoculation or co-inoculation treatment of *F. graminearum* with a less aggressive strain reduced AUDPC or DON accumulation. However, in the field, disease severity and DON were reduced 24.2% and 19.0%, respectively, when *F. acuminatum* was co-inoculated with *F. graminearum* relative to inoculation with *F. graminearum* alone. Disease severity also reduced 27.7% when *F. acuminatum* was pre-inoculated. Lastly, results from the field trial showed that disease incidence was significantly reduced when *F. poae* and *F. acuminatum* were co-inoculated with *F. graminearum*, as well as when *F. acuminatum* was pre-inoculated.

Data are still being analyzed from subsequent trials.

List key outcomes or other achievements.

The experiment is still in progress; no key outcomes to report as yet.

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

Our graduate student Pete Oppenheimer is focusing on both objectives 1 and 2 as part of his PhD thesis research.

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

Preliminary results were shared at an USWBSI Forum and the 2023 APS meetings via a poster.

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

Symptomatic spike samples from several states (KY, PA, NC, MD and VA) are being evaluated individually using a novel method (SSIM) for quantifying the biomass of multiple *Fusarium* species in a sample.