Project FY22-IM-021: Fungicide and Genetic Resistance for FHB and DON Management on Winter Wheat in Ohio

---

1. **What are the major goals and objectives of the research project?**
   The overall goal of this project as part of the FHB Integrated Management Coordinated Project (**IM_CP**) is to develop best practices for managing Fusarium head blight (FHB) and deoxynivalenol (DON) management in wheat and barley that are robust to conditions experienced in production fields. The specific objectives were to:
   1) **Evaluate** the integrated effects of fungicide application and host genetic resistance on FHB and DON, with emphasis on the new combination-fungicides **Prosaro® PRO** and **Sphaerex®**.
   2) **Compare** the efficacy of Prosaro PRO, Sphaerex and **A23751C** (Pydiflumetofen + Prothioconazole) to that of existing products: **Prosaro**, and **Miravis® Ace**.
   3) Determine the additive effects of fungicide mixtures and sequential applications for managing FHB and DON; and
   4) **Assess** the **rainfastness** of Prosaro PRO, Sphaerex, and Miravis Ace under varying rainfall scenarios in presence or absence of an adjuvant.

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

   a) What were the major activities?
   For **Obj. 1 (Integrated management: IM_CP - Ohio)**, replicate plots of four soft red winter wheat cultivars with different levels of resistance to FHB were either left **1)** untreated and inoculated, **2**) untreated and not inoculated, or treated with the fungicides **3)** Prosaro; **4)** Miravis Ace; **5)** Prosaro Pro; or **6**) Sphaerex and spray-inoculated at Feekes 10.5.1. All products were applied at label-recommended rates.

   For **Obj. 2** and **3 (Wheat Uniform Fungicide Trial: UFT - Ohio)**, replicate plots of a susceptible cultivar were either left untreated or subjected to one of eight core fungicide programs consisting of Feekes 10.5.1-only or sequential applications of the fungicides tested under Obj 1, as well as A23751C, Proline, and Tebuconazole. The sequential treatments consisted of Miravis Ace applied at anthesis followed by either Prosaro, Prosaro Pro, Sphaerex, or Tebuconazole 4-6 days after anthesis. All products were applied at label-recommended rates.

   For **Obj 4 (Rainfastness [RFT]),** Field plots were established in the fall of 2023 and managed according to standard agronomic practices in the spring of 2024. However, rainfall and fungicide treatments were not applied (scope of work changed as a result of a change in the budget allocation). In the fall of 2024, plots were again established and the experiment was conducted in the spring of 2025 as planned following a split-split plot design, with surfactant (with or without a non-ionic surfactant) as the whole-plot factor, rainfall treatment (simulated rainfall start times of 0, 15, 45, and 60 min, all with a 60 min duration), as the subplot factor, and fungicide treatment (Prosaro® PRO, Sphaerex®, and Miravis® Ace) as the sub-subplot factor. At the time of this report, plots had already been treated with the fungicides, subjected to rainfall treatments, inculcated, and rated for FHB. Additional details will be presented in the FY25 Performance Progress Report.

b) What were the significant results?

Obj 1: FHB intensity was low 2024, with mean FHB index in the untreated susceptible check ranging from 0 to 9.8 %, and mean DON from 0 to 7.2 ppm. All fungicide treatments had significantly lower mean DON contamination of grain than to the nontreated check across all resistance classes. For FHB index (IND), although means were numerically lower in fungicide-treated plots, differences between treated and nontreated plots were not statistically significant. Relative to the nontreated susceptible check, management programs consisting of a fungicide application to an MR, MS, or S cultivar reduced mean IND by 64-89%, 36-72% and 36-61%, respectively, and mean DON by 90-97%, 53-68%, and 59-73%, respectively.

Obj 2: Mean FHB and DON levels in the nontreated check ranging from 3.29 to 8.89% for IND and 0.87 to 2.10 ppm for DON. All tested fungicide programs resulted in significantly lower mean IND and DON than to the nontreated check. Among treatments applied only at anthesis, Miravis Ace, Prosaro Pro, A23751C, and Sphaerex resulted in numerically lower mean IND and DON than Prosaro, but differences among the treatment means were not statistically significant. Sequential applications involving Miravis Ace followed by either Prosaro Pro or Sphaerex yielded comparable levels of mean IND and DON to a single application of Miravis Ace, Prosaro Pro, Sphaerex, or A23751C. Relative to the nontreated check, a single application of Prosaro, Miravis Ace, Prosaro Pro and Sphaerex reduced mean IND by 50, 71, 61 and 79%, respectively, and mean DON by 73, 73, 77, and 86%, respectively. Sequential application programs involving Miravis Ace followed by Prosaro Pro or Sphaerex reduced mean IND by 77 and 88%, and DON by 76 and 83, respectively. The New product, A23751C, reduced IND by 75% and DON by 81%.

Obj 3: Preliminary analyses of the data provide some evidence of additive effects of sequential applications of Miravis Ace at early anthesis followed by an application of Prosaro Pro or Sphaerax 4-6 days after early anthesis on DON reduction. However, mean levels of IND and DON were too low to truly quantify additivity.

Obj 4: No data were collected during the reporting period (experiments completed in 2024). Results from the RFT experiments planted in fall 2024 and being completed in summer 2025 will be presented in the FY25 Performance Progress Report.

c) List key outcomes or other achievements.

While FHB levels were generally low in 2024, we successfully conducted IM and UFT experiments which allowed us to evaluate and compared the efficacy of new fungicide mixtures Prosaro PRO and Sphaerex against FHB and DON when applied alone, sequentially, or as part of integrated management programs.

Obj 1: Relative to the nontreated suspectable check, the new fungicide mixtures Sphaerax and Prosaro Pro were more effective in reducing IND and DON concentrations when applied to a moderately resistant cultivar than to a susceptible cultivar. Integrated management programs incorporating Sphaerax or Prosaro Pro resulted in mean control of IND and DON that was comparable to IM programs with Prosaro or Miravis Ace.

Obj 2: Miravis Ace, Prosaro Pro, and Sphaerax were more effective (based on percent control) than Prosaro at reducing both mean IND and DON concentrations. Specifically, they reduced IND by 72, 61, and 79%, respectively, compared to 50% for Prosaro. For DON, the reductions were 74, 78, and 86% for Miravis Ace, Prosaro Pro, and Sphaerax, respectively, compared to 73 for Prosaro.

Obj 3: The results provided some evidence of additivity or sequential fungicide applications, particularly for DON reduction, but additional experiences with higher levels of mean IND and DON will be needed to better quantify additivity.

Obj 4: This study is ongoing. Disease assessments were completed and final results will be presented in the FY25 Performance Progress Report.

3. **What opportunities for training and professional development has the project provided?**
   Postdoctoral researchers, research technicians, visiting scholars and a graduate student contributed to the project and gained hands-on experience in multiple aspects of applied research. Learning opportunities included planting wheat, designing and establishing field experiments, scouting for disease symptoms, assessing and collecting data related to FHB and DON, and conducting statistical analyses. Participants were also actively involved in preparing abstracts, posters and presentation for scientific meetings; developing graphs and tables for extension outreach; and contributing to the writing of manuscript for publication.

4. **How have the results been disseminated to communities of interest?**
   Results were disseminated by way of posters, abstracts, and talks at scientific meetings, electronic newsletter articles, extension talks, and field demonstrations.

5. **What do you plan to do during the next reporting period to accomplish the goals and objectives?**
   Repeat all experiments as described under the four objectives.