Project FY22-IM-006: Evaluation of Integrated Management Programs and Fungicides for FHB & DON in Indiana

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1. **What are the major goals and objectives of the research project?**
   This research served as a location in the cooperative multi-state studies comparing the effects of integrated management (IM) and uniform fungicide (UFT) trials for FHB and DON control in wheat.
   1. Evaluate the integrated effects of fungicides and resistance on FHB and DON, with emphasis on new fungicides.
   2. Compare the efficacy of new fungicides to Prosaro, Caramba, and Miravis Ace.
   3. Generate data to quantify the economic benefit of management programs.
   4. Generate data to advance the development of FHB risk prediction models.

   The proposed research was conducted at two sites in Indiana: 1) Purdue Agronomy Center for Research and Education (ACRE) in West Lafayette, Indiana; and 2) Southwest Purdue Agriculture Center (SWPAC), Vincennes, Indiana.

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

   What were the major activities?

   Research trials were established in the fall of 2023 at both locations indicated above in Indiana, and fungicide treatments were applied in the spring of 2024. In all trials, Fusarium head blight (FHB), concentration of deoxynivalenol (DON), Fusarium damaged kernels (FDK%), foliar disease severity, yield and test weight were collected. FHB incidence was measured as the number of infected heads out of 60 plants in each plot and calculated as a percentage. FHB severity was rated by visually assessing the percentage (0-100%) of infected heads. The FHB index was calculated as: (% FHB incidence multiplied by average FHB severity)/100 per plot. Disease severity of leaves were rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot for leaf blotch. Values for each plot were averaged before analysis. A subsample of grain was taken from each plot and partitioned for DON analysis completed by the University of Minnesota DON testing lab and to determine Fusarium damaged kernels (FDK) by visually assessing the percentage (0-100%) of the infected heads. All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on least square means test (α=0.05).

   Trial specific information.

   Trial 1. Fusarium head blight (FHB) integrated management trial in central Indiana, 2024 (UFT1). The trial was established at ACRE in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 7.5-ft wide and 20-ft long, consisted of 12 rows spaced 7.5 in. apart, and the center of each plot was used for evaluation. The previous crop was corn. Wheat cultivar ‘P24R40’ was planted in 7.5-inch row spacing using a drill on 26 Oct 2023. All fungicide

applications were applied at 15 gal/A and 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart and directed forward and backward at 45-degree angle, at 3.0 mph. Fungicides were applied on 15 May and 20 May at the Feekes growth stage 10.5.1 and 10.5.1 + 5 days, respectively. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 15 May with a spore suspension (50,000 spores/ml) applied at 300 ml/plot with the CO_2 backpack sprayer. Disease ratings were assessed on 29 May. The eight center rows of each plot were harvested with a Kincaid plot combine on 28 Jun and yields were adjusted to 13.5% moisture for comparison.

Trial 2. Evaluation of foliar fungicides and varieties for fusarium head blight (FHB) management in central Indiana, 2024 (IM1). The trial was established at ACRE in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 7.5-ft wide and 20-ft long, consisted of 12 rows spaced 7.5 in. apart, and the center of each plot was used for evaluation. The previous crop was corn. Wheat varieties 'P24R40' and 'P25R61' were planted in 7.5-inch row spacing using a drill on 26 Oct, 2023. All fungicide applications were applied at 15 gal/A and 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart and directed forward and backward at 45-degree angle, at 3.0 mph. Fungicides were applied on 15 May at the Feekes growth stage 10.5.1. All plots were inoculated with a mixture of isolates of *F. graminearum* endemic to Indiana on 15 May with a spore suspension (50,000 spores/ml) applied at 300 ml/plot with the CO_2 backpack sprayer. Disease ratings were assessed on 29 May. The eight center rows of each plot were harvested with a Kincaid plot combine on 28 Jun and yields were adjusted to 13.5% moisture for comparison

Trial 3. Evaluation of fungicide efficacy for scab management in southwestern Indiana, 2024 (UFT2). A trial was established at SWPAC in Knox County, IN. The experiment was a randomized complete block design with four replications. Plots were 7.5-ft wide and 20-ft long, consisted of 12 rows spaced 7.5 in. apart, and the center of each plot was used for evaluation. The previous crop was corn. Wheat variety 'P25R40' was planted in 7.5-inch row spacing using a drill on 22 Oct 2023. All fungicide applications were applied at 15 gal/A and 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart and directed forward and backward at 45-degree angle, at 3.0 mph. Fungicides were applied on 1 May at the Feekes growth stage 10.5.1 and 5 days after on 6 May. All plots were inoculated with a mixture of isolates of *F. graminearum* endemic to Indiana on 1 May with a spore suspension (50,000 spores/ml) applied at 300 ml/plot. Disease ratings were assessed on 23 May. The eight center rows of each plot were harvested with a Kincaid plot combine on 18 Jun and yields were adjusted to 13.5% moisture for comparison.

Trial 4. Evaluation of foliar fungicides and varieties for scab management in southern Indiana, 2024 (IM2). Plots were established at SWPAC in Knox County, IN. The experiment was a strip-plot design with four replications. Plots were 7.5-ft wide and 20-ft long, consisted of 12 rows spaced 7.5 in. apart, and the center of each plot was used for evaluation. The previous crop was corn. On 11 Oct 2023 wheat cultivars 'P25R40' and 'P25R61' were drilled at 7.5 in. spacing. Fungicides were applied on 1 May at the

Feekes growth stage 10.5.1. All fungicide applications were applied at 15 gal/A and 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart and directed forward and backward at 45-degree angle, at 3.0 mph. All plots were inoculated with a mixture of isolates of *F. graminearum* endemic to Indiana on 1 May. Disease ratings were assessed on 23 May. The eight center rows of each plot were harvested with a Kincaid 8XP combine on 18 Jun and yields were adjusted to 13.5% moisture.

What were the significant results?

In 2024, weather conditions were moderately favorable for Fusarium head blight (FHB) in Indiana. High FHB was detected in the trials, and low levels of leaf blotch and leaf rust were detected.

Trial 1. Fusarium head blight (FHB) integrated management trial in central Indiana, 2024. In central Indiana UFT trial, FHB incidence, severity and index were reduced by all fungicide treatments over the nontreatment control on 29 May. Miravis Ace 5.2SC at 10.5.1 fb Prosaro Pro SC at 10.5.1 + 5 days resulted in the lowest FHB percent incidence, severity, and index, but was not significantly different from all other fungicide treatments or timings. There were no differences in treatments from nontreated control for severity of leaf blotch and leaf rust. The concentration of deoxynivalenol (DON) was significantly reduced over nontreated control by all treatments. The percent of FDK visual was significantly reduced by all fungicide programs over nontreated control except by Prosaro 421SC and Miravis Ace 5.2SC applied at 10.5.1 Feekes growth stage. Harvest moisture were higher in all fungicide applied over nontreated control. There were no significant differences between treatments for wheat yield.

Trial 2. Evaluation of foliar fungicides and varieties for fusarium head blight (FHB) management in central Indiana, 2024. FHB incidence, severity, index, DON, test weight, and yield were lowest in the resistant variety P25R61. FHB percent incidence, percent severity, and index, and leaf rust were reduced by all fungicide treatments over nontreated controls on 29 May. Applications of Prosaro 421SC, Prosaro Pro 400SC, and Sphaerex 2.50SC had the lowest percent FDK. The concentration of deoxynivalenol (DON) was significantly reduced by all the fungicides over the nontreated, inoculated and non-inoculated control. Harvest moisture was significantly higher in all treatments over nontreated controls. Wheat test weight was increased by all fungicide treatments and significantly different over nontreated controls. There was no significant difference in treatment for yield over nontreated controls.

Trial 3. Evaluation of fungicide efficacy for scab management in south western Indiana, 2024. FHB incidence, severity, and index was significantly reduced by all fungicide applications except Miravis Era at 10.5.1 Feekes growth stage when compared to the nontreated control on 23 May. The percent of FDK was significantly reduced by all fungicide programs over nontreated control, except Prosaro 421SC and Sphaerex 2.50SC at 10.5.1 Feekes growth stage. Weight of 100 kernels were reduced by Prosaro 421SC and Sphaerex 2.50SC at 10.5.1 Feekes growth stage. The concentration

of deoxynivalenol (DON) was significantly reduced by all fungicide applications except by Prosaro 421SC. Harvest moisture was significantly increased by all fungicide treatments that included two applications 10.5.1 fb 10.5.1 + 5 days. Test weight was increased by all treatments over nontreated control. All treatments increased yield over nontreated control, except Miravis Era.

Trial 4. Evaluation of foliar fungicides and varieties for scab management in southern Indiana, 2023. FHB incidence, severity, index, FDK visual, weight of 100 kernels, FDK eject, and DON were lowest in the resistant variety P25R61. FHB percent incidence, percent severity, and index, leaf blotch and leaf rust were reduced by all fungicide treatments over nontreated controls on 23 May. Application of Miravis Ace had the highest percent FDK. The concentration of deoxynivalenol (DON) was significantly reduced by all the fungicides over the nontreated, inoculated and non-inoculated controls. There was no significant difference in treatment for yield over nontreated controls.

List key outcomes or other achievements.

The results of these trials have continued to show that Miravis Ace and the new product Sphaerex are effective fungicides for FHB management. Continued evaluation of these products will be necessary to address some of the many questions being asked by stakeholders about the effectiveness, application timing, effectiveness towards other diseases, and yield and cost benefits of this new fungicide. The use of scab resistant cultivars is an important aspect of management and reduced risk of FHB, especially when there is only moderate disease pressure.

3. **What opportunities for training and professional development has the project provided?**
This project provided an opportunity to train one plant pathology graduate student, two visiting scholars, and two undergraduates on plant disease identification and quantification, along with general field research trial establishment and data analysis.

4. **How have the results been disseminated to communities of interest?**
The results were shared and combined with the multi-state data to summarize and publish in the Proceedings of the National Fusarium Head Blight Forum in 2024. They were also shared with Indiana wheat stakeholders via the annual Applied Research in Field Crop Pathology for Indiana Extension publication, 2024 (https://indianafieldcroppathology.com/wp-content/uploads/2025/03/BP-Extension-Applied-Research-on-Field-Crop-Disease-2024.pdf). In addition, Dr. Telenko presented results to Indiana growers during winter Extension meetings.

5. **What do you plan to do during the next reporting period to accomplish the goals and objectives?**
The same objectives are planned for next reporting period, four trials were planted late fall 2024, fungicide applications went out and data is currently being collected to accomplish the goals and objectives.