

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

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 2022 at both locations indicated above in Indiana, and fungicide treatments were applied in the spring of 2023. 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 ($\alpha=0.05$).

Trial specific information.

Trial 1. Fusarium head blight (FHB) integrated management trial in central Indiana, 2023 (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 18 Oct, 2022. All fungicide applications were applied at 15 gal/A and 40 psi using a CO₂ 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 22 May and 27 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 23 May with a spore suspension (50,000 spores/ml) applied at 300

ml/plot with the CO₂ backpack sprayer. Disease ratings were assessed on 10 Jun. The eight center rows of each plot were harvested with a Kincaid plot combine on 10 Jul 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, 2023 (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 18 Oct, 2022. All fungicide applications were applied at 15 gal/A and 40 psi using a CO₂ 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 22 May and 23 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 23 May with a spore suspension (50,000 spores/ml) applied at 300 ml/plot with the CO₂ backpack sprayer. Disease ratings were assessed on 10 Jun. The eight center rows of each plot were harvested with a Kincaid plot combine on 10 Jul and yields were adjusted to 13.5% moisture for comparison.

Trial 3. Evaluation of fungicide efficacy for scab management in southwestern Indiana, 2023 (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 17 Oct 2022. All fungicide applications were applied at 15 gal/A and 40 psi using a CO₂ 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 10 May at the Feekes growth stage 10.5.1 and 5 days after on 15 May. All plots were inoculated with a mixture of isolates of *F. graminearum* endemic to Indiana on 10 May with a spore suspension (50,000 spores/ml) applied at 300 ml/plot. Disease ratings were assessed on 30 May. The eight center rows of each plot were harvested with a Kincaid plot combine on 21 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, 2023 (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 17 Oct 2022 wheat cultivars 'P25R40' and 'P25R61' were drilled at 7.5 in. spacing. Fungicides were applied on 10 May at the Feekes growth stage 10.5.1. All fungicide applications were applied at 15 gal/A and 40 psi using a CO₂ 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 10 May. Disease ratings were assessed on 30 May. The eight center rows of each plot were harvested with a Kincaid 8XP combine on 21 Jun and yields were adjusted to 13.5% moisture.

What were the significant results?

In 2023, weather conditions were not favorable for Fusarium head blight (FHB) and leaf blotch diseases in Indiana. Little to no FHB was detected in the trials and low levels of leaf blotch were detected.

Trial 1. Fusarium head blight (FHB) integrated management trial in central Indiana, 2023. In central Indiana UFT trial, no differences were detected for FHB incidence and severity as compared to the nontreated control. FHB index a was reduced by Miravis Ace applied at 10.5.1 and Miravis Ace at 10.5.1 fb Sphaerex at 6 DAT over the nontreated control. The concentration of DON was reduced over the nontreated control by all treatments, except Prosaro applied at 10.5.1. Harvest moisture was higher in all of the fungicide treated plots, except for Prosaro Pro at 10.5.1, as compared to the nontreated control. There was no significant difference in yield of wheat.

Trial 2. Evaluation of foliar fungicides and varieties for fusarium head blight (FHB) management in central Indiana, 2023. No FHB was detected in the trial and low levels of leaf blotch were. No measurable FDK or DON were detected in trial. Harvest moisture was higher for Miravis Ace compared to nontreated control. P25R61 had significantly lower harvest moisture, test weight, and yield as compared to P25R40. No differences were detected between treatments for leaf blotch and FDK.

Trial 3. Evaluation of fungicide efficacy for scab management in southwestern Indiana, 2023. Low levels of FHB were detected in the plots of this trial. FHB incidence and index were significantly reduced by all fungicide applications except Caramba when compared to the nontreated control. FHB incidence was significantly reduced most in plots treated with Miravis Ace, Prosaro Pro, Sphaerex, Miravis Ace followed by Prosaro Pro, Miravis Ace followed by Sphaerex, and Miravis Ace followed by Tebuconazole. DON was significantly reduced by all fungicide applications. There were no significant differences between fungicide applications and the nontreated control for FDK, test weight, weight of 100 kernels, and yield.

Trial 4. Evaluation of foliar fungicides and varieties for scab management in southern Indiana, 2023. Low levels of FHB were detected in this trial. FHB incidence was significantly reduced by Miravis Ace, Prosaro Pro at 10.3 fl oz, and Sphaerex. FHB severity and FHB Index were significantly higher in the non-inoculated, nontreated control than any of the other treatments and the inoculated, nontreated control. Harvest moisture was significantly higher in plots treated with Miravis Ace. The concentration of DON was significantly reduced by planting scab-resistant wheat variety 'P25R61' as compared to the scab-susceptible wheat variety 'P25R40'. DON was significantly reduced the most by applications of Prosaro Pro and Sphaerex. The scab-susceptible wheat variety 'P23R61' resulted in a significantly higher weight of 100 kernels of wheat when compared to plantings of scab-resistant wheat variety 'P25R61'. There were no significant differences between planting of wheat varieties for FHB incidence, FHB severity, FHB index, FDK, test weight, and yield of wheat. There were no significant differences between fungicide applications for FDK, weight of 100 kernels, test weight, and yield of wheat.

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 2023. They were also shared with Indiana wheat stakeholders via the annual Applied Research in Field Crop Pathology for Indiana Extension publication, 2023. In addition, Dr. Telenko presented results to Indiana growers during winter Extension meetings.

https://indianafieldcroppathology.com/wp-content/uploads/2024/03/BP-Extension-Applied-Research-on-Field-Crop-Disease-2023_Final.pdf

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 2023, fungicide applications went out and data is currently being collected to accomplish the goals and objectives.