

**Project FY22-IM-001: Integrated Management of Fusarium Head Blight in Kansas**

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

As a member of the IM-CP, the main objectives of our project in Kansas are the following:

- 1) Evaluate the integrated effects of fungicide treatment and genetic resistance on FHB and DON in hard red winter wheat in Kansas, with emphasis on new combinations of the fungicides, Prosaro Pro, and Sphaerex.
- 2) Compare the efficacy of Prosaro Pro and Sphaerex to Prosaro, Caramba, and Miravis Ace in Kansas.

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

**Obj. 1:** Evaluate the integrated effects of fungicide treatment and genetic resistance on FHB and DON in hard red winter wheat in Kansas, with emphasis on new combinations of the fungicides, Prosaro Pro, and Sphaerex.

**Obj 1. Major activities:**

For **Obj. 1**, field trials were established according to the integrated management standard protocol in two locations in Kansas (Manhattan “North Farm” and Belleville) (**Table 1**). These locations represent two distinct wheat production environments within the state. At each location, the treatments and experimental design followed the standard protocol released by the FHB MGMT-CP. Field experiments were established as a randomized complete block design with a split-plot arrangement with variety as the whole-plot and fungicide treatment as the sub-plot. The experiment included four replications at Manhattan and three replications in Belleville (due to space limitations). Varieties included three hard red winter wheat varieties with a range of reactions to FHB (WB4458 = S; Bob Dole = I; Zenda = MR).

**Table 1.** Summary of planting and harvest dates by environment of this trial. \*The 2022 Manhattan, KS (North Farm) location was abandoned in 2022 due to drought. \*\*The Belleville, KS location was severely impacted by wheat streak mosaic virus (WSMV) in 2024.

Year	Location	Planting Date	Harvest Date
2021-22	Belleville, KS	07 Nov 2021	01 Jul 2022
2021-22	Manhattan, KS (North Farm)	18 Nov 2021	*
2022-23	Belleville, KS	30 Sep 2022	10 Jul 2023
2022-23	Manhattan, KS (North Farm)	10 Oct 2022	03 Jul 2023
2023-24	Belleville, KS	29 Oct 2023	28 Jun 2024**
2023-24	Manhattan, KS (North Farm)	10 Oct 2023	08 Jul 2024

Each location was inoculated with a blend of macroconidia and ascospores (100,000 spores/ml) at Feekes 10.5.1. In each season, at each location, fungicide treatments were applied with a CO2 powered backpack sprayer at a pressure of 30 psi at 20 gal/A. The sprayer was equipped with three flat fan TT110015-VP nozzles 50 cm apart on a 100-cm-long boom. Visual ratings of disease severity (SEV), index (IND), and incidence (INC) were taken by rating four clusters of 10-15 plants per plot (40-60 individual plants per plot). Plots were harvest with a Kincaid 8-XP self-propelled small plot combine. After harvest, sub-samples of grain were visually rated for percent Fusarium-damaged kernels (FDK) and shipped to the

mycotoxin testing laboratory in the Department of Plant Pathology at the University of Minnesota, St. Paul.

**Obj 1. Significant Results:**

Plots for the 2023-24 season were harvested in late June/early July, 2024 (**Table 1**). We are in the process of completing visual FDK ratings and preparing samples to be shipped for DON analysis. Visual FHB symptoms were present in the Manhattan, KS location with data still being summarized. The MR variety, WB4401 had the highest yields across the fungicide treatments (average yield of 63.7 bu/A for WB4401). Within this MR variety, the Prosaro Pro treatment had the highest average yield and the untreated check had the lowest yield, 71.1 and 55.0 bu/A respectively. The location in Belleville, KS was severely impacted by wheat streak mosaic virus and Triticum mosaic virus and thus data from that location will be impacted.

Final data will be reported to the IM-CP leadership in September 2024 after DON results are returned from the University of Minnesota testing lab.

**Obj 1. Key outcomes or other activities:**

In 2023-24 we changed two of the three varieties used in this protocol to better reflect newer varieties available to producers in Kansas. For the “S” variety, ‘WB4458’ was replaced with ‘Greenhammer’. In addition, the MR variety ‘Zenda’ was replaced with ‘WB4401’.

**Obj 2:** Compare the efficacy of Prosaro Pro and Sphaerex to Prosaro, Caramba, and Miravis Ace in Kansas.

**Obj 2. Major activities:**

Field trials were established for the UFT standard protocol in two locations, Manhattan, KS (Rocky Ford Farm) and Ottawa, KS in 2023-24 (**Table 2**). These locations represent two distinct wheat production environments in Kansas. At each location, the treatments and experimental design followed the standard protocol released by the FHB MGMT CP. Each location was planted to the susceptible variety “Green Hammer in 2023-24.

**Table 2.** Summary of planting and harvest dates by environment for the UFT trial in Kansas.

Year	Location	Planting Date	Harvest Date
2021-22	Parsons, KS	5 October 2021	1 July 2022
2021-22	Manhattan, KS (Rocky Ford)	15 October 2021	21 June 2022
2022-23	Parsons, KS	14 October 2022	20 June 2023
2022-23	Manhattan, KS (Rocky Ford)	6 October 2022	22 June 2023
2023-24	Ottawa, KS	11 October 2023	17 June 2024
2023-24	Manhattan, KS (Rocky Ford)	12 October 2023	13 June 2024

Plots were inoculated with *Fusarium graminearum* infested corn spawn (a blend of five isolates) at each location three times for a total rate of 30 g per square meter. Each location was mist irrigated regularly to stimulate perithecia development on corn spawn. Fungicide treatments were applied with a CO2-powered backpack sprayer at a pressure of 30 psi calibrated to 20 gal/A. The sprayer was equipped with three flat fan TT110015-VP nozzles spaced 50 cm apart on a 100 cm boom. Visual ratings of disease severity (index) were evaluated by rating four clusters of 10-15 plants per plot (40-60 individual plants per plot). Plots were harvested with a Kincaid 8-XP small plot combine and yields were adjusted to 13%

moisture. After harvest, sub-samples of grain were visually rated for percent Fusarium damaged kernels (FDK) and shipped to the mycotoxin testing laboratory in the Department of Plant Pathology at the University of Minnesota, St. Paul for DON evaluation.

### **Obj. 2 Significant Results:**

High FHB pressure was observed in the untreated checks in both locations (Ottawa and Rocky Ford) in 2023-24. Visual treatment differences were observed at both locations and incidence and severity data were collected on multiple dates per location. Harvest was successfully completed on time and we are currently completing FDK ratings and will send samples for DON testing shortly. Results will be summarized and sent to IM-CP leadership in September 2024.

### **Obj 2. Key outcomes or other activities:**

In 2023-24 we established a new location (Ottawa, KS) replacing our previous Parsons, KS location. We installed a new pond pump and pipe/mist riser irrigation system and it turned out to be an excellent location for FHB this season. We will continue at this location because of better farm support and because it is slightly closer to campus (2 hours driving).

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

**Dr. Raissa Debacker Moura** (a post-doctoral fellow in PI Andersen Onofre's group) oversaw corn inoculum and macroconidia production, fungicide rate calculations, calibration, and application through the course of this project. She mentored a K-State undergraduate intern, **Ike Bahr**, on inoculum production and Ike took initiative to do additional experiments to optimize macroconidia production in the lab. **Claudio Dias da Silva Jr.** (PhD student with PI Andersen Onofre) was trained and assessed with incidence and severity field ratings, critical skills for plant pathologists. Through the course of this project, three visiting scholars were able to assist and be mentored, learning about field trial design, treatment applications, data collection and data analysis (**Eduardo Vicentin, Maysa de Oliveira, Diogo Reffatti**).

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

#### **Extension and Outreach**

Andersen Onofre, K. FHB Management and DON detection. Pesticide Applicator Training. Salina, KS. Nov. 1, 2023. Talk. Attendees: 55.

Andersen Onofre, K. Fungicides in wheat: hands on activities with a focus on FHB. Colby, KS. December 5<sup>th</sup>, 2023. Attendees: 70.

Andersen Onofre, K. Fungicides in wheat: hands on activities with a focus on FHB. Russel, KS. December 6<sup>th</sup>, 2023. Attendees: 45.

Andersen Onofre, K. Practical management of wheat diseases (20 minutes of talk focused on sharing results from USWBSI trials). Kansas Wheat Rx. March 7<sup>th</sup> 2024, Dodge city.

Andersen Onofre, K. Practical management of wheat diseases (20 minutes of talk focused on sharing results from USWBSI trials). Kansas Wheat Rx. March 8<sup>th</sup> 2024. Wichita.

\*In addition, we shared these results on radio interviews and e-newsletters.

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

In September 2024 we will complete data summary from the field season that has just completed (2023-24) and share it with the IM CP leadership. We will establish both trials in the fall in two locations each (the same locations as 2023-24). Work is ongoing to prepare additional publications. Pre-plant meetings and winter meetings are already scheduled to present these findings to producers in Kansas.