Project FY24-IM-001: Effects of integrated management on Fusarium Head Blight and pathogen evolution

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

   Main objective: Evaluate the effectiveness of integrated use of fungicide treatment and genetic resistance to control Fusarium Head Blight (FHB) and deoxynivalennol (DON) contamination in wheat. This includes a comparison of fungicides across wheat cultivars, with a focus on two new combination fungicides (Prosaro Pro and Sphaerex).

   Underlying goals:
   - Conduct integrated management trials following the IM-CP protocols.
   - Select a highly susceptible and a moderately resistant wheat cultivar.
   - Create experimental design for wheat trials.
   - Plant wheat trails (two locations).
   - Make liquid (spore suspension) and granular *F. graminearum* inoculum.
   - Apply fungicide treatments at Feekes 10.5.1 (early anthesis).
   - Apply liquid and granular inoculum 24-36 hours after fungicide treatment.
   - Collect experimental data.

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

   What were the major activities?

   We utilized a RCBD with a split-plot arrangement for the experimental designs. We prepared seed and planting materials and planted two trials in Champaign County using Dr. Jessica Rutkowski's research plots planter with assistance from her team. We reviewed our laboratory protocols and produced liquid and granular inoculum using Illinois *F. graminearum* strains. The liquid inoculum was produced following the USWBSI "Field Inoculation" protocol (CMC method) with minor modifications. The rate (67 mL/m^2) and concentration ($1X10^5$) of liquid inoculum was adapted from D'Angelo et al. (2014). The granular inoculum was produced on sorghum seed in mushroom bags and the rate (40 g/m^2) for field inoculation was determined from the USWBSI "Corn Inoculum Preparation" protocol. We prepared for fungicide treatments and inoculations by cutting the alleys and staking the plots. Finally, we prepared protocols for collecting data.

   By the end of June 2025 (beyond the reporting period of this report) we have conducted the fungicide applications with a backpack sprayer with support from Dr. Boris Camiletti and his research group. We then applied the inoculum, rated for FHB, and rated for foliar diseases as indicated in the IM-CP protocol. Harvest preparations are underway.

   What were the significant results?

A field trial was planted at the CFAR plots in Urbana on 10/22/24 (Figure 1), and another replication of the experiment was planted on better soils in Champaign County Burwash tract on 10/10/24.

	Range1	Range2	Range3	Range4	Range5	Range6	Range7	Range8	Range9	Range10	
Pass1	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Inoculated check
Pass2	Fill	Fill	Kitchen Seed 423	FS 624	Kitchen Seed 423	FS 624	Kitchen Seed 423	FS 624	Fill	Fill	Non-inoculated check
Pass3	Fill	Fill	Kitchen Seed 423	FS 624	Kitchen Seed 423	FS 624	Kitchen Seed 423	FS 624	Fill	Fill	Prosaro
Pass4	Fill	Fill	FS 624	Kitchen Seed 423	Kitchen Seed 423	FS 624	FS 624	Kitchen Seed 423	Fill	Fill	Miravis Aces
Pass5	Fill	Fill	FS 624	Kitchen Seed 423	Kitchen Seed 423	FS 624	FS 624	Kitchen Seed 423	Fill	Fill	Prosaro Pro
Pass6	Fill	Fill	FS 624	Kitchen Seed 423	FS 624	Kitchen Seed 423	Kitchen Seed 423	FS 624	Fill	Fill	Sphaerex
Pass7	Fill	Fill	FS 624	Kitchen Seed 423	FS 624	Kitchen Seed 423	Kitchen Seed 423	FS 624	Fill	Fill	
Pass8	Fill	Fill	Kitchen Seed 423	FS 624	Kitchen Seed 423	FS 624	FS 624	Kitchen Seed 423	Fill	Fill	
Pass9	Fill	Fill	Kitchen Seed 423	FS 624	Kitchen Seed 423	FS 624	FS 624	Kitchen Seed 423	Fill	Fill	
Pass10	Fill	Fill	Kitchen Seed 423	FS 624	FS 624	Kitchen Seed 423	Kitchen Seed 423	FS 624	Fill	Fill	
Pass11	Fill	Fill	Kitchen Seed 423	FS 624	FS 624	Kitchen Seed 423	Kitchen Seed 423	FS 624	Fill	Fill	
Pass12	Fill	Fill	FS 624	Kitchen Seed 423	Kitchen Seed 423	FS 624	FS 624	Kitchen Seed 423	Fill	Fill	
Pass13	Fill	Fill	FS 624	Kitchen Seed 423	Kitchen Seed 423	FS 624	FS 624	Kitchen Seed 423	Fill	Fill	
Pass14	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	

Figure 1. Field map of the CFAR trial showing the SRWW varieties used. In color are the fungicide and inoculation treatments. Double pass plots were planted to avoid cross contamination by drift of the liquid treatments (fungicide and liquid inoculum). A similar trial (different randomization) was planted at the Burwash tract.

Both field trials had good germination and winter survival. The Burwash tract experiment seemed more vigorous and taller than the CFAR trial and is likely to have higher yield.

A total of 40 L of liquid inoculum with a concentration of $1x10^5$ spores/mL and 20 lb of granular inoculum were prepared. We used the strain 16fg001 of *F. graminearum* that was collected from naturally infected wheat in Illinois. The strain was found to be aggressive on wheat in previous trials and produced high amount of DON during infection (Krone et al., 2024). The liquid and granular inoculum were of high quality. For quality control, before inoculation we plated both inocula on PDA before and it quickly colonized the agar plates with *F. graminearum*.

No data was collected by the end of the reporting period 4/30/25. By the time of writing of this report, both field trials were treated with fungicides on 5/15/25, and inoculated with both liquid and granular inoculum on 5/16/25. FHB ratings were collected on 6/2/25. Both trials presented FHB especially on the inoculated check treatment. We rated for incidence of foliar diseases on 6/13/25, but very little of other diseases were found this year. Preliminary data analysis shows significant differences in FHB between the treatments.

List key outcomes or other achievements.

- Two field trials were planted and maintained
- Fields were prepared for treatments (cutting alleys and staking field)
- High quality granular and liquid inoculum was produced
- Materials and equipment required for fungicide treatments and inoculations were acquired

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

Allowed for training on split-plot field designs and producing large volumes of liquid inoculum.

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

By the end of the performance period of this report there were no results yet collected. However, on 6/6/25 we showcased our field trials as part of the Small Grains Field Day conducted at the University of Illinois South Farms as part of the Agronomy Day Events sponsored by the Department of Crop Sciences. Approximately 50 attendants had the opportunity to walk in the CFAR field trial, look at FHB symptoms, and hear about the IM-CP trial. Questions about fungicide timing of application were addressed at the site.

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

- Fungicide treatments in June 2025
- Inoculations in June 2025
- FHB ratings in June 2025
- Harvest and preparation of samples for DON quantification in June and July 2025
- Data analysis and reporting of results
- Preparing for the next field season (selecting fields, packing seed)
- Plant new field trials in Fall of 2025 and maintain the trials for another round of IM-CP treatments in 2026.