**Project FY22-NW-007:** Use of Traditional and Molecular Breeding to Develop FHB Resistant SRWW for Ohio

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

Goal 1. Breed for resistance to FHB, high yield, test weight, and other traits required for new cultivars

Goal 2. Coordinate and participate in the NWW-CP uniform FHB nursery

Goal 3. Assess SRWW germplasm for resistance to toxin accumulation

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

**What were the major activities?**

Goal 1: Over 800 OSU breeding lines were planted in the 2022-2023 FHB nursery. Unfortunately, we did not get enough visual symptoms to assess FHB Index. We did collect grain samples for FDK and DON assessments. 77 new crosses involving parents with FHB resistance were made: 52 of 77 were made between parents that were both homozygous for resistance at Fhb1. Additional populations were advanced.800 OSU lines were planted in the Fall of 2023 to assess their FHB resistance in June of 2024

A total of 1366 lines were planted in the 2024-2025 FHB nursery including 1062 OSU breeding lines.

In the summer of 2024, we rated 29 lines from the University of Missouri for FHB Index, FDK and DON. The FHB ratings were not useful, but we obtained very good FDK and DON information.

Goal 2: The 2022-2023 P+NUWWSN consisted of 86 lines that were tested for FHB resistance at locations in NE, IL, IN, MI, KY, OH, NY, and VA. OSU assessed this trial in Wooster Ohio. OSU compiled the data from the trial and prepared a report. OSU also coordinated the entry list and seed distribution of the 2023-2024 P+NUWWSN trials. We also had 87 entries from the Ohio Wheat Performance Trial in the 2022-2023 nursery, though we were not able to collect and useful data due to low disease pressure.

We planted 78 lines to establish the 2024-2025 P+NUWWSN FHB trials

Goal 3: Data from three locations, three years and 234 SRWW breeding lines were collected on Index, FDK, DON, and fungal biomass (FB). The data was used to estimate Resistance to Toxin Accumulation (RTA) and to assess the associate among all traits.

**What were the significant results?**

Goal 1: We had low visual symptoms in the 2023 and 2024 FHB nurseries, but FDK and DON values were high. Over 60% of all OSU had lower DON than Truman (Table 1) and >40% had less FDK than Truman. The % of lines with lower DON than Truman increased in 2024 as did the frequency of lines that were homozygous for resistance at Fhb1.

Table 1. Percentage of OSU breeding lines in the 2023 OSU trials with less FDK or DON than the resistance check Truman.

| | % < Truman | | | | % OSU Lines Homozygous for "R" at Fhb1 in 2023 | % OSU Lines Homozygous for "R" at Fhb1 in 2024 |
|---|---|---|---|---|---|---|
| | 2023 | | 2024 | | | |
| | DON | FDK | DON | FDK | | |
| Stage-2 | 91% | | 71% | 35% | | 69% |
| Stage-3 | 66% | 40% | 82% | 96% | 81% | 78% |
| Stage-4 | 76% | 57% | 82% | 35% | 50% | 64% |

All of the 29 University of Missouri lines had lower DON than Truman, and 28 has lower FDK than Truman. On average, the MO lines were significantly more resistant than Truman (Table 2). The seed of the 29 lines was returned to the University of Missouri.

Table 2. Results of the 2023-2024 FHB assessment of 29 lines from the University of Missouri.

| | FDK | DON |
|---|---|---|
| Average of 29 MO Lines | 10.0 | 1.5 |
| TRUMAN | 35.0 | 4.7 |
| FREEDOM | 32.5 | 3.9 |
| PIONEER2545 | 50.0 | 5.6 |

Goal 2: A report was prepared for the 2023 P+NUWWSN and is being prepared for the 2024 nurseries. The 2025 nursery was established.

Goal 3: We determined the association of all traits with DON. We found that FDK was a key predictor of DON along with FB. We noted significant genetic effects and heritability for RTA.

**List key outcomes or other achievements.**

Goal 1: We released 4 new cultivars in 2023-2024. OH18-65-54 (Scioto) had significantly less DON and FDK than Truman (Table 3) and appears to be one of the most resistant SRWW that we have tested. It had the lowest FHB Index value of all lines in the 2025 commercial variety trial

Table 3. FHB assessments of four new OSU releases, expressed as a % of Truman, and three FHB checks

| Name | Release | DON (ppm) | FDK (%) | INDEX (%) |
|---|---|---|---|---|
| TRUMAN "Res" | | 6.3 | 27.9 | 12.4 |
| FREEDOM "MR" | | 11 | 43.8 | 20.3 |
| PIONEER2545 "Sus" | | 14.95 | 56.6 | 43.2 |
| Scioto (OH18-65-54) | Public | 40% | 61% | 95% |
| OH18*104-99 | Licensed | 109% | 98% | 197% |
| OH18*105-13 | Licensed | 34% | 74% | 128% |
| OH18-65-13 | Licensed | 196% | 146% | 147% |
| OH19-67-15 | Licensed | 65% | 123% | 129% |

Goal 2: A report on the 2023-2024 P+NUWWSN trials is being prepared for distribution to all participants. The report will be posted on the USWBSI website.

Goal 3: We determined that some lines repeatedly accumulated low DON despite high FDK or FB. The presence of resistance at FHB1 caused a significant decrease ob Index, FDK, DON, FB, and increased RTA. A publication is being prepared.

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

The project provided direct breeding experience to one PhD student and two MS students. Through FHB rating and FHB nursey work the project has provided training experience for one PhD student and eight visiting scholars in the summer of 2024 and spring of 2025.

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

The results of the P+NUWWSN are disseminated to all participants and are posted on the USWBSI website. The results of the screening of the commercial variety tril is published by The Ohio State University extension service.

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

The next year will see us continue to improve the FHB resistance of SRWW through continued use of traditional and molecular breeding techniques. We are increasing the number of samples rated for FDK and DON as that will create a larger training population that can be used to make genomic selection prediction for these two vital traits.