Project FY22-DU-005: Develop Durum Wheat Resistant to Fusarium Head Blight

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

The relevance of the project's objectives to the goals and research priorities of the USWBSI are as follows:

a) Breeding FHB-resistant durum wheat (Action VDHR goals 1-3 and CP priority 3-4);
b) Screen durum populations/experimental lines for FHB resistance in greenhouses and irrigated field nurseries (Action VDHR goal 2 and CP priority 1);
c) Evaluate experimental lines for DON (Action VDHR goal 2 and CP priority 4);
d) Use marker assisted selection at the USDA-ARS Genotyping Center in Fargo, ND for selection of valuable loci (Action VDHR goal 2-3 and CP priority 2);
e) Evaluate identified FHB resistant lines for quality (Action VDHR goal 2 and CP priority 3-4); and
f) Develop new populations by crossing adapted germplasm to newly identified sources of resistance (Action VDHR goal 1-3 and CP priority 3-4).

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

What were the major activities?

- 6 lines were evaluated in the Uniform Regional Durum Nursery
- 32 lines were evaluated in the Elite Yield Trials
- 49 lines were evaluated in the Elite Advanced Yield Trial
- 98 lines were evaluated in the Advanced Yield Trials
- 1098 lines were evaluated in the Preliminary Yield Trials
- 59 populations evaluated as F_4's
- 71 populations evaluated as F_3's
- 49 populations evaluated as F_2's
- 84 populations were screened in the field and greenhouses
- 50 new populations were developed
- 4,300 lines were evaluated in the FHB nursery in Prosper, ND
- 2,200 lines were evaluated in the FHB nurseries at Langdon, ND
- 1,220 lines were tested for DON
- 49 populations with a total of 2,181 rows/lines were advanced in the winter nursery in New Zealand.

What were the significant results?

- All material listed in major activities above was successfully screened in FHB field irrigated nurseries and the greenhouse.
- All experimental lines in yield trials were evaluated for agronomic and quality traits.
- Several experimental lines from yield trials were evaluated for low cadmium uptake.
- Several experimental lines with moderate resistance combined with low cadmium uptake were selected and advanced for evaluation in 2025.

List key outcomes or other achievements.

In 2017, we released a new moderately resistant cultivar ND Riveland. ND Riveland has the lowest disease severity when compared to all cultivars grown in ND. It also has lower DON than all the cultivars with the exception of Joppa. In 2024, ND Riveland was grown on 44% of the durum acreage in ND because of its high yield potential, excellent quality, lower FHB severity and low cadmium uptake. Divide and Joppa, the moderately FHB-resistant cultivars were grown on 11% of the acreage in ND. Based on FHB resistance, yield advantage, and the current planted acreage, the three cultivars will generate millions of dollars into the state economy.

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

   Two students rated scab nurseries.

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

   Gave presentations at Field Days hosted by NDSU Research Centers and to trade teams through the ND Wheat Commissions.

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

   Continue making crosses, develop new populations, evaluate lines in the greenhouse and the field screening nurseries, genotype lines at the USDA-ARS Genotyping Center in Fargo, ND, evaluate lines for FHB resistance, agronomic traits, and quality traits in yield trials at multiple locations.