

FY22 Performance Progress Report

Due date: July 26, 2023

Cover Page

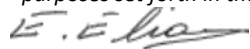
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|-------------------------------------|---|
| USDA-ARS Agreement ID: | 59-0206-2-107 |
| USDA-ARS Agreement Title: | Breeding Durum Wheat for Fusarium Head Blight Resistance |
| Principle Investigator (PI): | Elias Elias |
| Institution: | North Dakota State University |
| Institution UEI: | EZ4WPGRE1RD5 |
| Fiscal Year: | 2022 |
| FY22 USDA-ARS Award Amount: | \$188,120 |
| PI Mailing Address: | North Dakota State University, Department of Plant Sciences NDSU Dept. 7670, PO Box 6050 Fargo, ND 58108-6050 |
| PI E-mail: | elias.elias@ndsu.edu |
| PI Phone: | 701-231-8159 |
| Period of Performance: | May 1, 2022 – April 30, 2026 |
| Reporting Period End Date: | April 30, 2023 |

USWBSI Individual Project(s)

| USWBSI Research Category* | Project Title | ARS Award Amount |
|------------------------------------|---|------------------|
| DUR-CP | Develop Durum Wheat Resistant to Fusarium Head Blight | \$188,120 |
| FY22 Total ARS Award Amount | | \$188,120 |

I am submitting this report as an: Annual Report

I certify to the best of my knowledge and belief that this report is correct and complete for performance of activities for the purposes set forth in the award documents.



7/6/2023

Principal Investigator Signature

Date Report Submitted

† BAR-CP – Barley Coordinated Project
 DUR-CP – Durum Coordinated Project
 EC-HQ – Executive Committee-Headquarters
 FST-R – Food Safety & Toxicology (Research)
 FST-S – Food Safety & Toxicology (Service)
 GDER – Gene Discovery & Engineering Resistance
 HWW-CP – Hard Winter Wheat Coordinated Project

MGMT – FHB Management
 MGMT-IM – FHB Management – Integrated Management Coordinated Project
 PBG – Pathogen Biology & Genetics
 TSCI – Transformational Science
 VDHR – Variety Development & Uniform Nurseries
 NWW – Northern Soft Winter Wheat Region
 SPR – Spring Wheat Region
 SWW – Southern Soft Red Winter Wheat Region

Project 1: Develop Durum Wheat Resistant to Fusarium Head Blight

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.)

a) What were the major activities?

- 2 lines were evaluated in the Uniform Regional Durum Nursery
- 12 lines were evaluated in the EYT
- 44 lines were evaluated in the Elite Advanced Yield Trial
- 90 lines were evaluated in the Advanced Yield Trials
- 1,162 lines were evaluated in the Preliminary Yield Trials
- 30 populations evaluated as F₄'s
- 50 populations evaluated as F₃'s
- 65 populations evaluated as F₂'s
- 73 new populations were developed
- 59 populations were screened in the field and greenhouses
- 1,434 lines were tested for DON
- 4,900 lines were evaluated in the FHB nursery in Prosper, ND
- 2,000 lines were evaluated in the FHB nurseries at Langdon, ND
- 40 populations with a total of 1829 rows/lines were advanced in the winter nursery in New Zealand.

b) 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 2023.

c) 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 2022, ND Riveland was grown on 38.9% 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, continue to rank in the top three in durum planted acreage. In 2022, collectively Divide, Joppa, and ND Riveland were planted on 63.9% of the acreage in North Dakota. 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.

Publications, Conference Papers, and Presentations

Please include a listing of all your publications/presentations about your FHB work that were a result of funding from your FY22 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period** should be included.

Did you publish/submit or present anything during this award period May 1, 2022 – April 30, 2023?

- Yes, I've included the citation reference in listing(s) below.
 No, I have nothing to report.

Journal publications as a result of FY22 award

List peer-reviewed articles or papers appearing in scientific, technical, or professional journals. Include any peer-reviewed publication in the periodically published proceedings of a scientific society, a conference, or the like.

Identify for each publication: Author(s); title; journal; volume: year; page numbers; status of publication (published [include DOI#]; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).

Books or other non-periodical, one-time publications as a result of FY22 award

Report any book, monograph, dissertation, abstract, or the like published as or in a separate publication, rather than a periodical or series. Include any significant publication in the proceedings of a one-time conference or in the report of a one-time study, commission, or the like.

Identify for each one-time publication: Author(s); title; editor; title of collection, if applicable; bibliographic information; year; type of publication (book, thesis, or dissertation, other); status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).

Other publications, conference papers and presentations as a result of FY22 award

Identify any other publications, conference papers and/or presentations not reported above. Specify the status of the publication.

Runhao Wang, Jason Axtman, Evan Salsman, Justin Hegstad, Jason Fiedler, Steven Xu, Shaobin Zhong, Elias Elias, and Xuehui Li. (2022). Recurrent Selection for Fusarium Head Blight Resistance in a Durum Wheat Population. Proceedings of the 2022 National Fusarium Head Blight Forum; Tampa, FL. December 4-6, 2022. Retrieved from: <https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf>

Status: Abstract Published and poster presented.

Acknowledgment of Federal Support: YES