USDA-ARS | U.S. Wheat and Barley Scab Initiative

FY21 FINAL Performance Progress Report

Due date: July 26, 2023

Cover Page

USDA-ARS Agreement ID:	59-0206-0-136
USDA-ARS Agreement Title:	New Sources of Resistance to FHB and DON in Wheat
Principle Investigator (PI):	Bernd Friebe
Institution:	Kansas State University
Institution UEI:	CFMMM5JM7HJ9
Fiscal Year:	2021
FY21 USDA-ARS Award Amount:	$33,763
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Period of Performance:	5/26/21 - 5/25/23
Reporting Period End Date:	5/25/2023

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
HWW-CP	New Sources of Resistance to FHB and DON	$33,763
	FY21 Total ARS Award Amount	$33,763

I am submitting this report as a: ☒ FINAL 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.

_____ May 25, 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: New Sources of Resistance to FHB and DON

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

There are only a few sources of resistance to FHB available for wheat improvement. The proposed research is aimed at identifying new sources of FHB resistance in wild relatives of wheat and using directed chromosome engineering to produce agronomically useful compensating wheat-alien translocations, which are then being transferred into adapted winter wheat cultivars. We have previously identified novel sources of FHB resistance derived from *Leymus racemosus, Fhb3, and Elymus tsukushiensis, Fhb6.* In addition, we are continuing to evaluate wheat-alien introgression lines for the presence of novel sources of FHB resistance.

We have transferred *Fhb6* present in WGRC6 into the adapted winter wheat cultivars Lyman and Overland which have native FHB resistance. Whereas Fhb6 in Lyman background did not significantly decrease FHB incidence and DON content a significant decrease in both FHB incidence and DON content was observed in Overland background. This reduction was consistent and observed in multiple years. The results were presented during the national Fusarium head blight forum and seed samples of the best introgression lines were distributed to national breeding programs upon request, and the results were presented during the national Fusarium head blight forum.

Objective: New sources of FHB resistance are constantly being sought. In cooperation with Dr. Yanming Zhang from the Laboratory of molecular cytogenetics and genetic breeding, Harbin Normal University, China, who was a visiting scholar at the Wheat Genetics Resource Center, we have identified a potential new source of type-2 FHB resistance derived from *Thinopyrum intermedium,* designated as HSD2-32 (TA5117) and we are characterizing this new source of resistance using GISH and molecular marker.

2. What was accomplished under these goals or objectives?

Line HSD2-32 was produced at Harbin Normal University and is an F_7 derivative of the cross between Ganmei8 (trielytrigia, 2n=56, AABBDDEE) and *Th. intermedium* (2n=42, JJJ^sJ^sSS). Line HSD2-32 has 2n=42 chromosomes but its chromosome constitution remains to be established. Previous field evaluation at Harbin Normal University and greenhouse evaluation at Kansas State University revealed that line HSD2-32 is resistant to FHB.

a) What were the major activities?

We have crossed line HSD2-32 with Chinese Spring and have phenotyped the derived F_2 plants for FHB incidence and also genotyped these plants. We are presently phenotyping and genotyping the derived F_3 plants, which will allow us to validate the novel FHB resistant QTLs. This will be useful for chromosome engineering aimed at making this novel source of FHB resistance available for wheat improvement.

b) What were the significant results?

Fhb6 has been transferred to adapted winter wheat cultivars and the results show that in the right genetic background it can significantly reduce FHB incidence and DON content.

Seed samples of the best introgression lines have been provided to national breeding programs. A novel source of FHB resistance has been identified and is being characterized to make it accessible to wheat improvement.

c) List key outcomes or other achievements.

Fhb6 has been transferred to adapted winter wheat cultivars and the results show that in the right genetic background it can significantly reduce FHB incidence and DON content. Seed samples of the best introgression lines have been provided to national breeding programs. A novel source of FHB resistance has been identified and is being characterized to make it accessible to wheat improvement.

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

Dr. Yanming Zhang was visiting the Wheat Genetics Resource Center for one year and received training in state-of-the-art molecular cytogenetic techniques. In addition, a graduate student, Yoonha Ju, and a postdoc fellow Sathish Rajendran were partly supported by this project.

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

The results were presented at the 2020 National Fusarium Head Blight Forum and advance FHB introgression lines with *FHB6* have been distributed to the breeding community.

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 FY21 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?

☐ Yes, I've included the citation reference in listing(s) below.

x No, I have nothing to report.

Journal publications as a result of FY21 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).

n/a

Books or other non-periodical, one-time publications as a result of FY21 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).

n/a

Other publications, conference papers and presentations as a result of FY21 award

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

n/a

In addition to the required inclusion in this report, to increase the visibility of your work we encourage you to also submit your publications in the new USWBSI ScabSource Publication Database, an open-access resource for all FHB researchers to reference.