

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY19 Final Performance Progress Report
Due date: July 29, 2021**

Cover Page

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Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0206-8-188
USDA-ARS Agreement Title:	New Sources of Resistance to FHB and DON in Wheat
FY19 USDA-ARS Award Amount:	\$ 24,250
Recipient Organization:	Kansas State University 10 Anderson Hall Manhattan, KS 66506
DUNS Number:	929773554
EIN:	48-0771751
Recipient Identifying Number or Account Number:	AR9805 / GAPP005089
Project/Grant Reporting Period:	5/26/19 - 5/25/21
Reporting Period End Date:	5/25/2021

USWBSI Individual Project(s)

USWBSI Research Category *	Project Title	ARS Award Amount
HWW-CP	New sources of Resistance to FHB and DON in Wheat	\$ 24,250
FY19 Total ARS Award Amount		\$ 24,250



June 30, 2021

Principal Investigator

Date

* MGMT – FHB Management
 FST – Food Safety & Toxicology
 R – Research
 S – Service (DON Testing Lab)
 GDER – Gene Discovery & Engineering Resistance
 PBG – Pathogen Biology & Genetics
 EC-HQ – Executive Committee-Headquarters
 BAR-CP – Barley Coordinated Project
 DUR-CP – Durum Coordinated Project
 HWW-CP – Hard Winter Wheat Coordinated Project
 VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
 SPR – Spring Wheat Region
 NWW – Northern Soft Winter Wheat Region
 SWW – Southern Soft Red Winter Wheat Region

Project 1: New sources of Resistance to FHB and DON in Wheat

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.

Objective 1: Transfer of *Fhb6* present in WGRC61 into adapted winter wheat cultivars Everest, Lyman, and Overland, with native FHB resistance and use molecular markers, genomic in situ hybridization (GISH) analysis, and field evaluations to recover the recurrent wheat genotype with the *Fhb6* gene.

Objective 2: 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. Once the homoeology and genomic affinity of the introgressed chromosomes have been determined we will use directed chromosome engineering to develop agronomically useful wheat-alien recombinant chromosomes and introgress them into hard winter wheat cultivars.

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?

Objective 1: We have transferred *Fhb6* into adapted winter wheat cultivars Lyman and Overland (the transfer to Everest was unsuccessful because of marker inconsistencies).

Objective 2): Line HSD2-32 was produced at Harbin Normal University and is an F₇ derivative of the cross between Ganmei8 (trilelytrigia, 2n=56, AABBDDDEE) 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 suggested that line HSD2-32 is resistant to FHB. We reevaluated the FHB resistance of this line after point inoculation in the greenhouse using the cultivars Overlay as susceptible and Everest as moderate resistant checks. A minimum of seven plants per line with three heads per plant were evaluated 14 to 17 days after point

inoculation. Whereas 75.9% of the spikes of Overley were infected, 47.9% of the spikes of Everest were infected but only 10.7% of the spikes of line HSD2-32 were infected.

b) What were the significant results?

Objective 1: Fhb6/Overland and Fhb6/Lyman derivatives were evaluated for their FHB resistance and DON accumulation under field condition in the 2019 growing season.

Objective 2: We have used in situ hybridization to further characterize germplasm HSD2-32. GISH analysis using total genomic *Th. intermedium* DNA as a probe failed to detect *Th. intermedium* chromatin. GISH analysis using total genomic A-genome and B-genome DNA as probes further revealed that this germplasm has 7 pairs of A-, B-, and D-genome chromosomes, and FISH using GAA as a probe also could not detect any chromosome abnormalities. Summarizing, molecular cytogenetic analysis failed to detect any alien chromatin in this germplasm, suggesting that the introgression may be either cryptic and smaller than the detectability of GISH (30 Mbp) or that the introgression was not derived from *Th. intermedium*.

c) List key outcomes or other achievements.

Objective 1: Novel winter wheat germplasms with improved FHB resistance and reduced DON content have been produced by combining native resistance with Fhb6 resistance derived from *Elymus tsukushiensis*.

Objective 2: A novel source of FHB resistance has been identified and is being characterized that may have significance in further improving FHB resistance in wheat.

3. Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns and/or restrictions, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.

Yes, because of the covid-19 pandemic the laboratories were closed and, thus, the molecular cytogenetic analyses were halted but luckily the greenhouse and field evaluations could be accomplished.

4. 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.

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

The results were presented at the 2020 National Fusarium Head Blight Forum and will be published in peer-reviewed international scientific journals.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the **FY19 award period (5/26/19 - 5/25/21)**. The term “support” below includes any level of benefit to the student, ranging from full stipend plus tuition to the situation where the student’s stipend was paid from other funds, but who learned how to rate scab in a misted nursery paid for by the USWBSI, and anything in between.

1. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their MS degree during the FY19 award period?**

Yes No

If yes, how many? [Click to enter number here.](#)

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY19 award period?**

Yes No

If yes, how many? [Click to enter number here.](#)

3. **Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

Yes No

If yes, how many? [Click to enter number here.](#)

4. **Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**

Yes No

If yes, how many? [Click to enter number here.](#)

Release of Germplasm/Cultivars

Instructions: In the table below, list all germplasm and/or cultivars released with full or partial support through the USWBSI during the **FY19 award period (5/26/19 - 5/25/21)**. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations.

NOTE: Leave blank if you have nothing to report or if your grant did NOT include any VDHR-related projects.

Name of Germplasm/Cultivar	Grain Class	FHB Resistance	FHB Rating (0-9)	Year Released
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
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Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year

NOTE: List the associated release notice or publication under the appropriate sub-section in the 'Publications' section of the FPR.

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Publications, Conference Papers, and Presentations

Instructions: Refer to the FPR_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY19 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (5/26/19 - 5/25/21)** should be included. If you did not publish/submit or present anything, state 'Nothing to Report' directly above the Journal publications section.

NOTE: Directly below each citation, you **must** indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in the publication/presentation. See example below for a poster presentation with an abstract:

Z.J. Winn, R. Acharya, J. Lyerly, G. Brown-Guedira, C. Cowger, C. Griffey, J. Fitzgerald, R.E. Mason and J.P. Murphy. 2020. "Mapping of Fusarium Head Blight Resistance in NC13-20076 Soft Red Winter Wheat." In: S. Canty, A. Hoffstetter, and R. Dill-Macky (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum* (p. 12.), Virtual; December 7-11. Online: https://scabusa.org/pdfs/NFHF20_Proceedings.pdf.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Journal publications.

Nothing to report

Books or other non-periodical, one-time publications.

Nothing to report

Other publications, conference papers and presentations.

Nothing to report