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

FY21 Performance Progress Report

Due date: July 26, 2022

Cover Page

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Phone:	701-412-3246
Fiscal Year:	2021
USDA-ARS Agreement ID:	N/A
USDA-ARS Agreement Title:	Improving the Genomic Resources of Fusarium Resistance in Spring and Durum Wheat
FY20 USDA-ARS Award Amount:	$235,315
Recipient Organization:	USDA-ARS Edward T. Schafer Agricultural Research Center 1616 Albrecht Blvd North, Fargo, ND 58102-2765
DUNS Number:	N/A
EIN:	N/A
Project/Grant Period:	5/1/21 - 4/30/22
Reporting Period End Date:	4/30/2022

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
DUR-CP	Identity Novel Haplotypes in Durum with Superior Scab Resistance and Performance	$22,292
VDHR-SPR	A Pan-Genome of Scab Resistance Sources in Wheat: Uncovering Hidden Information in the Sequences	$213,023
	FY21 Total ARS Award Amount	$235,315

I am submitting this report as an: ☒ Annual Report ☐ 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.

JASON FIEDLER

Digitally signed by JASON FIEDLER
Date: 2022.07.22 13:05:38 -05'00'

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: Identity Novel Haplotypes in Durum with Superior Scab Resistance and Performance

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

   The major objective of this project is to identify haplotypes in important durum germplasm with deep sequencing and genotyping and apply these to identify new and better defined genomic loci that that determine resistance and performance.

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?**
   - Lines were collected and genetic purity was determined (purified if necessary)
   - One round of GH FHB screening was performed
   - Lines have been sequenced to 10x coverage with short read sequencing and mapped to new genome reference sequences
   - Two long read sequencing techniques have been piloted.
   - New imaging metrics for FDK were obtained.

   b) **What were the significant results?**
   - FHB reaction in a combined experiment was conducted to obtain relevant disease scores.
   - SNPs called on Sumai3 genome sequence reference.
   - FDK is not well correlated with disease rating.

   c) **List key outcomes or other achievements.**
   - Targeted long read enrichment techniques were not efficient methods of targeted sequencing.

3. **What opportunities for training and professional development has the project provided?**
   Nothing to Report

4. **How have the results been disseminated to communities of interest?**
   Nothing to Report

Project 2: A Pan-Genome of Scab Resistance Sources in Wheat: Uncovering Hidden Information in the Sequences

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

   The goal of this project is to build reference-quality assemblies of three HRSW with FHB resistance and have been widely used as sources of resistance for wheat breeding germplasm and combine this with short read sequencing of related lines for the development of a pan-genome of FHB resistance sources.

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?**
   - Lines were collected and genetic purity was determined (purified if necessary)
   - One round of GH FHB screening was performed
   - PacBio sequencing of 3 reference lines
   - IsoSeq sequencing for annotation.
   - Other pangenome lines ines have been sequenced to 10x coverage with short read sequencing and mapped to new genome reference sequences
   - Two long read sequencing techniques have been piloted.
   - Pipelines to build a practical haplotype graph (PHG) have been established.

   b) **What were the significant results?**
   - Sumai3 reference assembly is complete
   - Short read sequencing of all other lines has been completed.
   - A PHG of HRSW with exome capture skim sequencing has been developed and evaluated.

   c) **List key outcomes or other achievements.**
   - Targeted long read enrichment techniques were not efficient methods of targeted sequencing.
   - Seed increased of difficult lines to enable joint disease evaluation

3. **What opportunities for training and professional development has the project provided?**
   The postdoc has greatly improved bioinformatic skills through the one-on-one mentoring with PHG experts

4. **How have the results been disseminated to communities of interest?**
   The results have been disseminated through publications and presentations at various workshops and seminars and communications with collaborators.

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.

☐ No, I have nothing to report.

Journal publications as a result of FY21 grant 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 FY21 grant 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 FY21 grant award

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

Poudel, B; Jordan, KW; Bradbury, PJ; Fiedler, JD. 2021. A Wheat Practical Haplotype Graph to Facilitate FHB Resistance Mapping. *Proceedings of the 2021 National Fusarium Head Blight Forum*; Virtual. December 6-7, 2021. Retrieved from: https://scabusa.org/forum/2021/2021NFHBForumProceedings.pdf

Poudel, B. 2022, A wheat practical haplotype graph to facilitate FHB resistance mapping. Presented to: NAPA 2022 3rd Biennial International Scientific Conference May 27-29, Atlanta, GA.