

FY21 Performance Progress Report

Due date: July 26, 2022

Cover Page

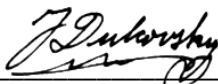
Principle Investigator (PI):	Jorge Dubcovsky
Institution:	University of California-Davis
E-mail:	jdubcovsky@ucdavis.edu
Phone:	530-752-5159
Fiscal Year:	2021
USDA-ARS Agreement ID:	59-0206-0-171
USDA-ARS Agreement Title:	Preparing Barley for FHB in California
FY20 USDA-ARS Award Amount:	\$35,680
Recipient Organization:	University of California-Davis Department of Plant Sciences One Shields Ave, Davis, CA 95616
DUNS Number:	04-712-0084
EIN:	94-6036494
Recipient Identifying Number or Account Number, if any:	25D22
Project/Grant Period:	5/15/21 - 5/14/23
Reporting Period End Date:	5/14/2022

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
BAR-CP	Preparing Barley for FHB in California	\$35,680
FY21 Total ARS Award Amount		\$35,680

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.



Principal Investigator Signature

June 28, 2022

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: Preparing Barley for FHB in California

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

The project goals are to characterize variation in resistance to FHB in the University of California (UC) barley germplasm, to identify any novel sources of resistance, and to develop FHB-resistant barley germplasm adapted to California growing conditions. The objectives are to 1) Screen UC germplasm in an FHB nursery 2) genotype material to improve selection of FHB resistant material and identify any genomic regions of interest and 3) develop CA adapted varieties with FHB resistance.

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?

Based on the initial FHB screening of UC germplasm in 2019 (100 lines x 3 reps), 100 lines were selected for screening in an FHB nursery in 2021 (100 lines x 1 rep). Severity (%) and DON (ppm) data were collected for these lines. A 2022 nursery is currently evaluating 100 lines. In this nursery, several lines that have the potential as FHB resistance parents are replicated. Over 1000 lines were genotyped for ~50K SNPs, including those in the FHB nurseries in 2019 and 2021. Six F₃ populations from crosses made between UC germplasm and lines with known FHB resistance were evaluated in Davis in 2021 and selected for advancement into F₄ head rows. These will be selected for testing in an FHB nursery.

A hundred new crosses were made in 2021-2022 to parents with good resistance to FHB and good agronomic performance, such as B9K62; and five to non-adapted parents but resistant to FHB according to the literature. A double-haploid population with our best line for FHB resistance to severity (B9K62) as one of the parents was created and increased during 2021/22. This DH population will be genotyped and included in next disease screening at MN.

b) What were the significant results?

The 2021 nursery had less disease pressure than the 2019 disease nursery and showed overall less severity and DON accumulation in the grain (Figure 1). There was a 37% correlation between 2019 and 2021 DON (ppm) and 42% correlation between 2019 and 2021 Severity (%). A genome wide association study (GWAS) using a mixed linear model (MLM) identified a minor QTL on Chromosome 1H with a LOD score of 4.1 for the 2019 DON data (Figure 2). The SNP underlying this QTL has a significant effect on DON accumulation in both 2019 and 2021 DON data (Figure 3). No QTL have previously been reported on CHR 1H for DON or FHB severity. More data are needed to validate the effects of this SNP.

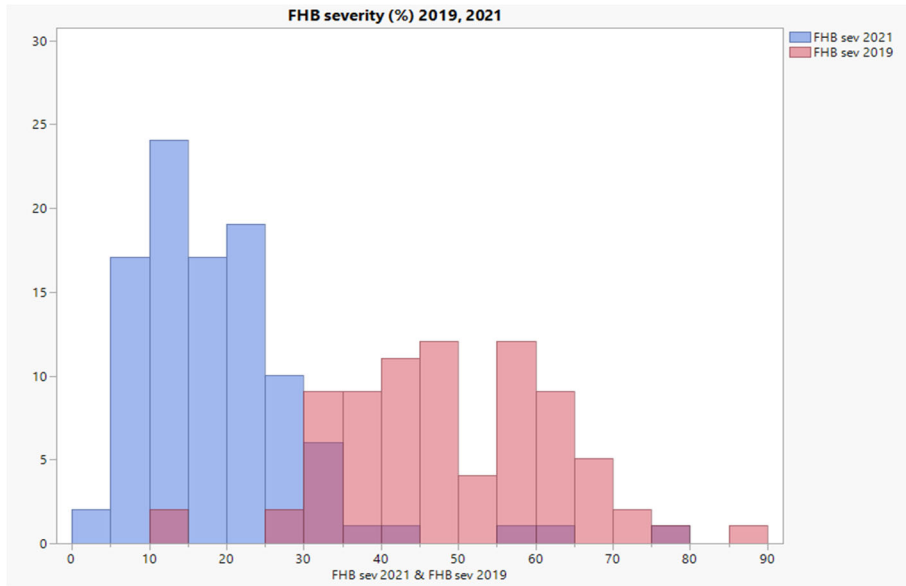


Figure 1. FHB severity 2019 and 2021

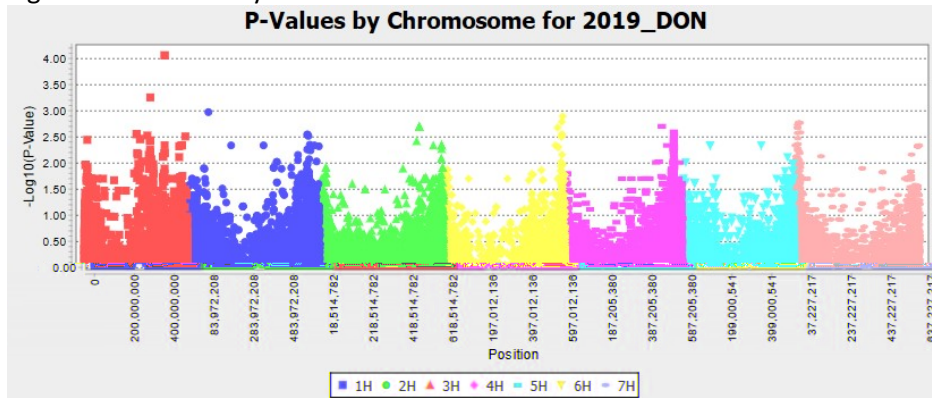


Figure 2. Manhattan plot for 2019 DON MLM GWAS

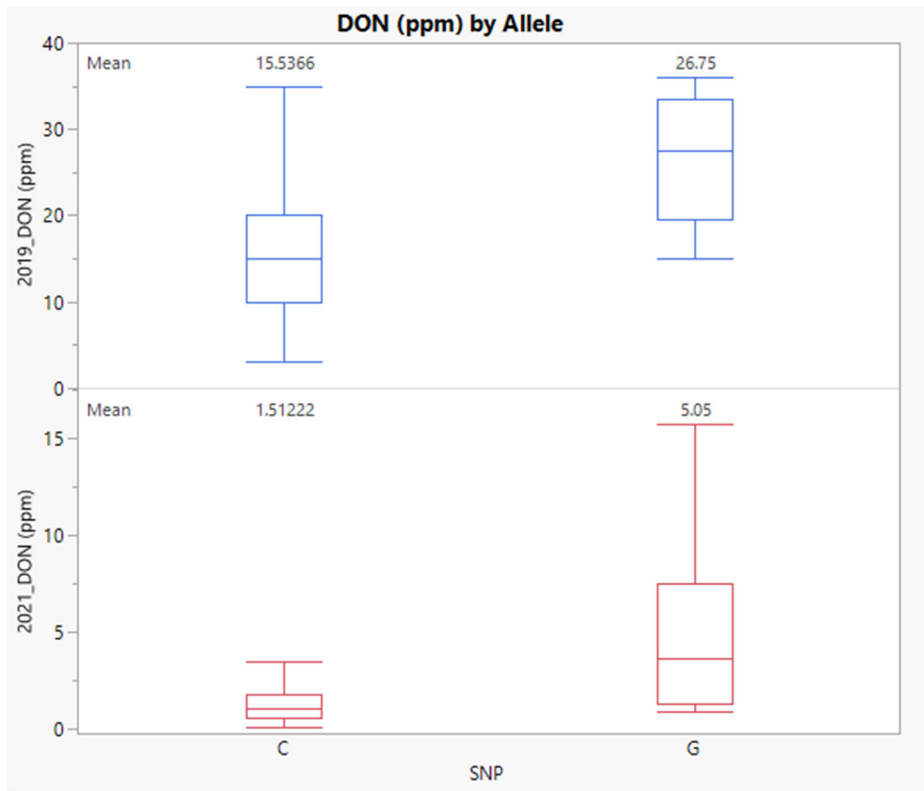


Figure 3. SNP effect on DON accumulation in 2019 and 2021 data.

c) List key outcomes or other achievements.

During 2021 we produced foundation seed of the line B9K62 which has one of the best resistances to FHB among our lines and good agronomic performance, and we are preparing its release as UC-Gallagher. This will be the first California variety with some resistance to FHB.

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

Two undergraduate students and one visiting PhD student benefited from participation in this project.

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

The new FHB resistant variety UC-Gallagher was presented to barley growers and the malting industry representatives during field days. We also have meeting with Admiral malts and Sierra Nevada where UC-Gallagher and other UC varieties were discussed.

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).

No current publications. A cultivar release for line B9K62 (UC-Gallagher) FHB resistant line is in preparation and will be completed after PVPV release.

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.