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

FY22 Performance Progress Report

Due date: July 26, 2023

Cover Page

USDA-ARS Agreement ID:	59-0206-2-110
USDA-ARS Agreement Title:	Barley Cultivars for California with Improved Fusarium Head Blight (FHB) Resistance
Principle Investigator (PI):	Jorge Dubcovsky
Institution:	University of California-Davis
Institution UEI:	TX2DAGQPENZ5
Fiscal Year:	2022
FY22 USDA-ARS Award Amount:	$29,987
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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
BAR-CP	Developing FHB Resistant Barley Cultivars for California	$29,987
	FY22 Total ARS Award Amount	$29,987

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.

Principal Investigator Signature — Date Report Submitted: 07/23/2023

[‡] 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: Developing FHB Resistant Barley Cultivars for California

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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?

We have screened UC Barley germplasm in MN FHB nurseries for four years (2019, 2021, 2022 and 2023). The 2023 nursery had a late planting date and data have not yet been collected. 630 more lines have been genotyped with a total of more than 1000 barley lines genotyped. These data will be used for selection of new lines to test and for identification of any QTL associated with our germplasm. New crosses incorporating FHB resistance were made during the winter of 2022 with a focus on naked barley types. The most advanced breeding material developed specifically for introduction of FHB resistance from known resistant germplasm, has been narrowed down to six populations. Between 50-100 $F_{3:4}$ head-rows from each of these six populations were planted this season (2022-2023). Selections harvested from these head rows will be advanced to $F_{3:5}$ single evaluation plots in Davis and send for evaluation in Dr. Steffensons' MN FHB nursery in 2024.

b) What were the significant results?

We selected four UC 2R elite lines that have good agronomic and quality traits and show potential for improved resistant to FHB (based on 3 years of data), to use as parents in the barley breeding programs to incorporate more FHB resistance into the germplasm (Figure 1). We will continue to test these lines along with others in the FHB nursery. One of these lines (tested as B9K62) was released in 2022 as UC Alameda. This variety has better FHB resistance than previously released 2R malting varieties (UC Butta12, UC Tahoe and UC Capay).

Most of the lines tested in previous FHB nurseries were 2R covered barley types (Figure 2). Since we have identified several 2R lines with better FHB resistance, we are now focusing efforts on finding and transferring that resistance to naked barley lines. As part of a naked barley collaboration led by OSU, which includes several other naked barley breeding programs throughout the US in regions of greater FHB susceptibility, it is important to have resistant material for regional testing or sharing with other locations. The 2023 nursery has more 2R and 6R naked barley lines. UC Tamalpais, the only naked variety that has been released from UC, is very susceptible to FHB and accumulates high levels of DON. Several naked barley lines that have been screened head too late in MN to

be accurately scored for FHB, so we are working on identifying lines with MN heading dates between July 7-16th to have more accurate FHB reporting.

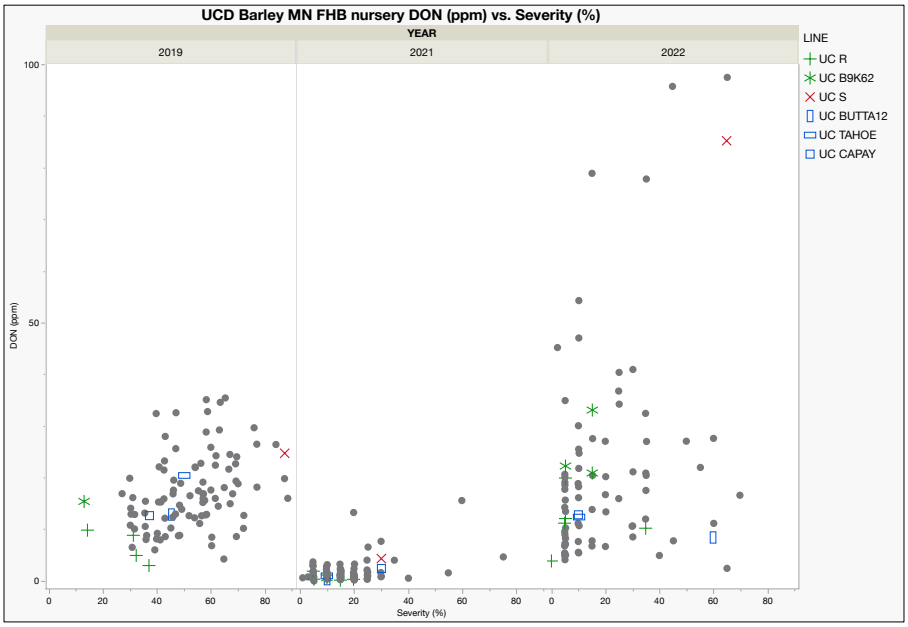

Figure 1. FHB severity (%) vs DON (ppm) for years 2019, 2021 and 2022. Several elite UC lines (green) were chosen as parents for incorporation of better FHB resistance, including a 2R malting line (B9K62) released as UC Alameda in 2023. Blue boxes indicate other UC 2R malting varieties (UC Butta12, UC Tahoe and UC Capay). The Red X indicates a 6R variety (Ishi) that was chosen as a UC susceptible check.

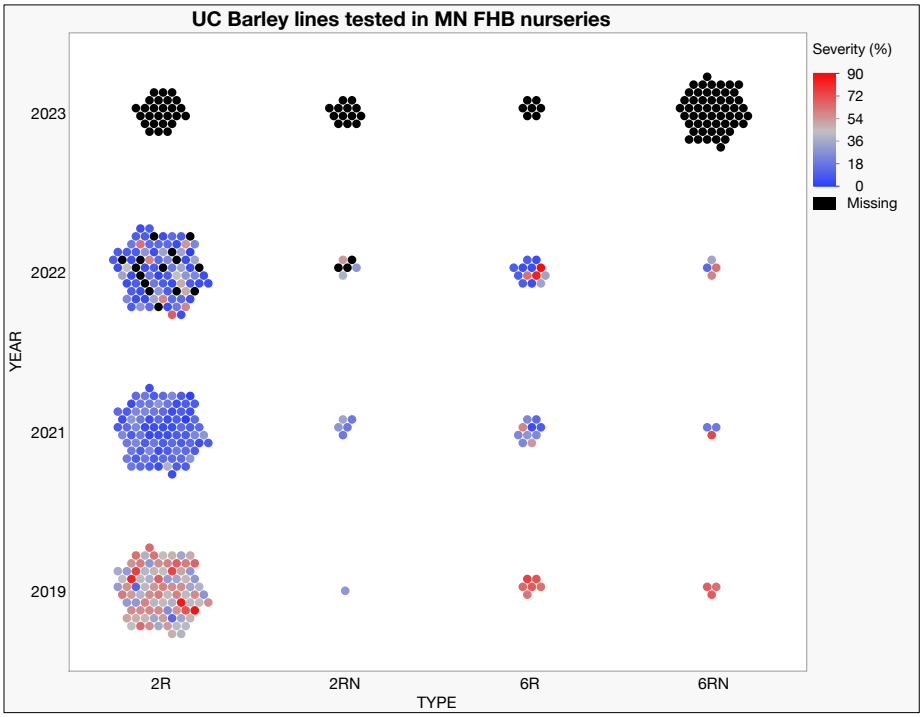

Figure 2. Types of barley lines screened in MN FHB nurseries. 2R and 6R are covered types. 2RN and 6RN are naked barley types. We are focusing our efforts on ideitfying and developing more naked barley with FHB resistance.

c) List key outcomes or other achievements.

UC-Alameda (tested as B9K62) was released in 2022. This variety shows some of the best resistance to FHB in our material across all years, has very good agronomic performance and malting quality. This will be the first California 2R malting variety with some resistance to FHB.

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

Two undergraduate students have benefited from participation in this project during this period

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

The new FHB resistant variety UC-Alameda was presented to barely growers and the malting industry representatives during field days. Admiral Maltings in Alameda, CA will be testing this variety for production at their malthouse, with potential for use in craft breweries throughout California.

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.