USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY20 Annual Performance Progress Report
Due date: July 29, 2021

Cover Page

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Fiscal Year:	2020
USDA-ARS Agreement ID:	59-0206-0-172
USDA-ARS Agreement Title:	Developing FHB-resistant Winter Wheat for Texas and the Southern U.S.
FY20 USDA-ARS Award Amount:	$ 66,574
Recipient Organization:	Texas A&M Agrilife Research Ssponsored Research Services 2147 TAMJ College Station, TX 77843-0001
DUNS Number:	84-720-5713
EIN:	746000541
Recipient Identifying Number or Account Number:	06-506196
Project/Grant Reporting Period:	5/15/20 - 5/14/21
Reporting Period End Date:	5/14/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
HWW-CP	Developing FHB-resistant Hard Red Winter Wheat for Texas and the S. Great Plains	$ 38,958
VDHR-SWW	Developing FHB-resistant Soft Red Winter Wheat for Texas and the Gulf-Atlantic Region	$ 27,616
	FY20 Total ARS Award Amount	**$ 66,574**

Amir Ibrahim 7/26/2021

Principal Investigator Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
R- Research
S – Service (DON Testing Labs)
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: *Developing FHB-resistant Hard Red Winter Wheat for Texas and the S. Great Plains*

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

The overarching goal of this proposal is to use traditional breeding techniques and marker-assisted selection (MAS) to develop FHB-resistant HRW cultivars adapted to Texas and the Southern Great Plains. Our specific objectives are to: 1) develop, screen, and release HRW that combine superior yield and end-use quality with tagged or native FHB resistance, 2) use MAS to complement traditional breeding methods and improve gain from selection, and 3) enter promising FHB-resistant lines into regional nurseries to facilitate development of resistant cultivars. New FHB-resistant HRW cultivars with high yield, tolerance to other stresses, and superior quality will provide effective means of resistance not only in Texas but also in other areas of the central and southern Great Plains where TAM wheat is adapted and where FHB levels require adequate host plant 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?

A mist-irrigated FHB evaluation nursery was successfully established at the main campus for evaluating incidence and disease severity. We have specifically evaluated the Southern Regional Germplasm Nursery (SRPN), Northern Regional Germplasm Nursery (NRPN), the Southern Scab Nursery in addition to Texas advanced yield trials. Another nursery was used at Dumas, TX. Both nurseries had heavy scab infection.

b) What were the significant results?

During our first ever year of testing in the scab misted nursery at College Station, we had excellent uniform symptoms. The FHB index ranged from 1.4 to 8, based on a scale of 0 - 9 in the Southern Scab Nursery and the *Fusarium* damaged kernels (FDK) ranged from 20% - 67% in the same nursery. The FHB index and FDK were highly correlated ($r = 0.8$, $P < 0.01$). The best performers were lines possessing the *Fhb1* gene.

c) List key outcomes or other achievements.

Our first ever nursery showed that we can produce and apply inoculum appropriately, mist irrigate, establish symptoms, and take good readings of wheat head scab. The correlation between FHB index and heading was - 0.6 ($P < 0.01$), which indicates that the later lines had lower FHB symptoms. This indicates that we need to have better grouping of entries by heading for symptom evaluation. This also indicates that we need to apply the corn spawn earlier right at the beginning of stem elongation next

year. The other scab nursery at Dumas, TX was heavily infected with both WSMV and FHB.

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.**

Our research and breeding efforts were not impacted by COVID-19.

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

Two technicians and several undergraduate students were trained in symptom rating, including, disease incidence, severity, and FDK, as part of this project.

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

So far, data of regional nurseries has been shared with colleagues in the HRW region. Results will be communicated in producers' meeting and field days. Any future significant outcomes of this project will also be highlighted in popular press articles. Furthermore, results will be communicated to scientific peers via peer-reviewed scientific journals upon the release of current candidates screened during 2021.

Project 2: *Developing FHB-resistant Soft Red Winter Wheat for Texas and the Gulf-Atlantic Region*

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

The overarching goal of this proposal is to use traditional breeding techniques, a misted-nursery, and MAS to develop FHB resistant SRWW cultivars and to share germplasm with other Southern U.S. programs. Our specific objectives are to: 1) develop, screen, and release SRWW that combine superior yield and end-use quality with tagged or native FHB resistance, 2) use MAS to complement traditional breeding methods and improve gain from selection, and 3) enter promising FHB-resistant lines into Southeastern University Grains (SunGrains) scab nurseries to facilitate development of resistant cultivars. New FHB-resistant SRWW cultivars with high yield potential, tolerance to other biotic and abiotic stresses, and superior end-use quality will provide effective means of resistance not only in Texas but also in other areas in the Southern U.S. where TAM wheat is adapted and where FHB levels require adequate host plant 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?

A mist-irrigated FHB evaluation nursery was established at the main campus for evaluating incidence and disease severity. We have specifically evaluated the Texas Soft Uniform Variety Trial (SUVT), Uniform Southern SRWW Nursery (USSRWWN), and the Southern Uniform Winter Wheat Scab Nursery (SUWWSN) in 2020 – 2021, and we will continue to do the same during the 2021 – 2022, 2022 – 2023, 2023 – 2024, and 2024 – 2025 wheat growing seasons. We will harvest seed for scabby kernel evaluation, and we will send the seed to Minnesota for DON evaluation.

b) What were the significant results?

During the first ever year of testing in the scab misted nursery, we had excellent uniform symptoms. The FHB index ranged from 1 to 6.5, based on a scale of 0 - 9 in the Southern Scab Nursery and the FDK ranged from 15% - 60% in the same nursery. The FHB index and FDK were correlated ($r = 0.6$, $P < 0.01$). The best performers were lines possessing the Fhb1 gene.

c) List key outcomes or other achievements.

Our first ever nursery showed that we can produce and apply inoculum appropriately, mist irrigate, establish symptoms, and take good readings of wheat head scab. The correlation between FHB index and heading was - 0.7 ($P < 0.01$), which indicates that the later lines had lower FHB symptoms. This indicates that we need to have better grouping

of entries by heading for symptom evaluation. This also indicates that we need to apply the corn spawn earlier right at the beginning of stem elongation next year. There is an increase in the *Fhb1* frequency in our germplasm; thanks to the USWBSI efforts. We expect to release this type of resistance in about two years from now.

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.

Our research and breeding efforts were not impacted by COVID-19.

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

Two technicians and several undergraduate students were trained in symptom rating, including, disease incidence, severity, and FDK, as part of this project.

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

So far, data of regional nurseries has been shared widely with colleagues in the SunGrains and HRW groups. Results will be communicated in producers' meeting and field days. Any future significant outcomes of this project will also be highlighted in popular press articles. Furthermore, results will be communicated to scientific peers via peer-reviewed scientific journals upon the release of current candidates screened during 2021.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY20 award period (5/15/20 - 5/14/21). 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 FY20 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 FY20 award period?**
   ☐Yes ☒No
   If yes, how many? Click to enter number here.

3. **Have any post docs who worked for you during the FY20 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 FY20 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 FY20 award period (5/15/20 - 5/14/21). 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
Nothing to report.	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
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
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
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.

Publications, Conference Papers, and Presentations

Instructions: Refer to the PR_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY20 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (5/15/20 - 5/14/21**) 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:

> Winn, Z.J., Acharya, R., Lyerly, J., Brown-Guedira, G., Cowger, C., Griffey, C., Fitzgerald, J., Mason R.E., and Murphy, J.P. (2020, Dec 7-11). Mapping of Fusarium Head Blight Resistance in NC13-20076 Soft Red Winter Wheat (p. 12). In: Canty, S., Hoffstetter, A. and Dill-Macky, R. (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum*. https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf.
> Status: Abstract Published and Poster Presented
> Acknowledgement of Federal Support: YES (Abstract and Poster)

Journal publications.

None

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

None

Other publications, conference papers and presentations.

None