USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY15 Final Performance Report
Due date: July 15, 2016

Cover Page

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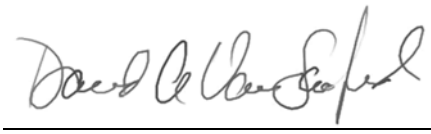
Fiscal Year:	2015
USDA-ARS Agreement ID:	59-0206-4-002
USDA-ARS Agreement Title:	Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties.
FY15 USDA-ARS Award Amount:	$ 61,171
Recipient Organization:	University of Kentucky Research Foundation University Station Lexington, KY 40506-0057
DUNS Number:	939017877
EIN:	61-6033693
Recipient Identifying Number or Account Number:	304811 1385
Project/Grant Reporting Period:	04/06/15-04/05/16
Reporting Period End Date:	04/05/16

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-NWW	Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties.	$ 56,749
VDHR-NWW	Male Sterile Facilitated Recurrent Selection for FHB Resistance (MPI-5).	$ 680
VDHR-NWW	Coordinated Phenotyping of Uniform Nurseries and Official Variety Trials.	$ 3,742
	FY15 Total ARS Award Amount	**$ 61,171**



7/11/16

Principal Investigator Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
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: *Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties.*

1. **What are the major goals and objectives of the project?** The goal of this project is to release high yielding, scab resistant SRW wheat varieties that are adapted to KY and the southern corn-belt. To meet our overall goal, our project activities fall into four areas, each of which has a set of sub-objectives (1) screening: accurately characterizing resistance in existing cultivars, advanced breeding lines and populations by evaluating them under a range of disease pressures at two locations; (2) breeding: choosing parents, crossing them and selecting resistant progeny based on phenotype as well as genotype; (3) collaboration: growing and screening collaborative nurseries to facilitate germplasm exchange, broaden the diversity of sources used in the breeding program, and provide excellent pre-release multi-location data for candidate varieties; and (4) outreach: through collaboration with our grains extension specialist and extension plant pathologist, we will screen a set of varieties and elite breeding lines in scab nurseries at two KY locations with and without fungicides.

2. **What was accomplished under these goals?**
   1) Major activities: More than 3500 experimental units were screened in the scab nursery at Lexington, KY, including breeding lines, released cultivars, segregating populations and genetic studies.
   2) Approximately 450 crosses were made during FY15, all of which involved at least one scab resistant parent. Breeding populations from F2 through F5 were selected for advancement; in some cases natural scab infection occurred so we were able to select for resistance.

   3) Specific objectives
      (1) screening
      (2) breeding
      (3) collaboration
      (4) outreach

   4) Significant results
      - A scab epidemic was created in the screening nursery which allowed us to distinguish resistant genotypes for advancement.
      - Natural scab infection in F5 headrows allowed resistance selection in a generation that we normally do not include in the scab nursery because there are too many lines.
      - Good scab and DON data allowed us to provide valuable information for other breeding programs with respect to collaborative nurseries like the Mason Dixon.
      - We discussed FHB alerts at the winter grower meeting and the field day.

   4) Key outcomes or other achievements: In FY15 we released the resistant soft red winter wheat cultivar Pembroke 2016 which has the gene *Fhb1*.

3. **What opportunities for training and professional development has the project provided?**
   PhD student Lisa Tessman has learned how to screen material for scab resistance and how to put together an irrigated scab nursery. She attended the National Fusarium Head Blight Forum, heard talks and networked.

4. **How have the results been disseminated to communities of interest?**
   At field days, in written reports and on our website.

Project 2: *Male Sterile Facilitated Recurrent Selection for FHB Resistance (MPI-5).*

1. **What are the major goals and objectives of the project?** The goal is for this project to further develop several pools of adapted breeding lines with genes for FHB resistance derived from multiples sources.

2. **What was accomplished under these goals?**
   1) Major activities: Intermating among male sterile and male fertile plants occurred.
   2) Specific objectives: Allow intermating of diverse sources of resistance.
   3) Sgnificant results: Another cycle of recurrent selection occurred.
   4) Key outcomes or other achievements: Resistant plants were identified.

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

   PhD student Lisa Tessman learned about recurrent selection.

4. **How have the results been disseminated to communities of interest?**
   Results are too preliminary to have been disseminated yet.

Project 3: *Coordinated Phenotyping of Uniform Nurseries and Official Variety Trials.*

1. **What are the major goals and objectives of the project?** The objectives of this project are to phenotype advanced breeding lines that are candidates for release, place FHB and other agronomic, disease resistance, and quality data in a database and report on purification and seed increase of the best lines.

2. **What was accomplished under these goals?**
   1) Major activities – FHB screening
      Accomplishment: We completed FHB evaluation of the three regional uniform scab nurseries that we grow along with our advanced and regional nurseries. In each case detailed observations on incidence, severity, FDK, ISK and DON were recorded.

   2) Specific objectives: create a functional screening environment.
   3) Significant results: An epidemic was created, allowing identification of resistant lines.
   4) Key outcomes or other achievements: Uniform nursery data that provided breeders with assessments of their lines in multiple screening environments.

3. **What opportunities for training and professional development has the project provided?**
   PhD student Lisa Tessman collected screening data for the uniform scab nurseries.

4. **How have the results been disseminated to communities of interest?**
   Results communicated via written reports, web based reports, and data posted to the breeders online database.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY15 award period. 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 FY15 award period?** No

   If yes, how many?

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY15 award period?** No

   If yes, how many?

3. **Have any post docs who worked for you during the FY15 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?** No

   If yes, how many?

4. **Have any post docs who worked for you during the FY15 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?** No

   If yes, how many?

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 FY15 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations. *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** (S, MS, MR, R, where R represents your most resistant check)	**FHB Rating** (0-9)	**Year Released**
Pembroke 2016	SRW	R	1-2	2015

Add rows if needed.

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

Abbreviations for Grain Classes

Barley - BAR
Durum - DUR
Hard Red Winter - HRW
Hard White Winter - HWW
Hard Red Spring - HRS
Soft Red Winter - SRW
Soft White Winter - SWW

Publications, Conference Papers, and Presentations

Refer to the FY15-FPR_Instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY15 grant. If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

Journal publications.

Islam, Md Sariful, Gina Brown-Guedira; David Van Sanford; Yanhong Dong; Anne L McKendry. 2015. Novel QTL associated with the Fusarium head blight resistance in Truman soft red winter wheat. Euphytica (2016) 207:571-592 DOI 10.1007/s10681-015-1550-9.
Status: Published
Acknowledgement of Federal Support: Refer to McKendry's FY15 FPR for agreement 59-0206-4-025.

Cabrera, A., Guttieri, M., Smith, N., Souza, E., Sturbaum, A., Hua, D., Griffey, C., Barnett, M., Murphy, P., Ohm, H., Uphaus, J., Sorrells, M., Heffner, E., Brown-Guedira, G., Van Sanford, D. and Sneller, C. 2015. Identification of milling and baking quality QTL in multiple soft wheat mapping populations. Theor. Appl. Genet. 128: DOI 10.1007/s00122-015-2580-3.
Status: Published
Acknowledgement of Federal Support: No

Clark, Anthony J., Daniela Sarti-Dvorjak, Gina Brown-Guedira, Yanhong Dong, Byung-Kee Baik and David A. Van Sanford. 2016. Identifying rare FHB-resistant transgressive segregants in intransigent backcross and F_2 winter wheat populations. Front. Microbiol.7:277. doi: 10.3389/fmicb.2016.00277.
Status: Published
Acknowledgement of Federal Support: Yes

Huang, Mao, Antonio Cabrera, Amber Hoffstetter, Carl Griffey, David Van Sanford, José Costa, Anne McKendry, Shiaoman Chao, and Clay Sneller. 2016. Genomic selection for wheat traits and trait stability. Theor. Appl. Genet. (doi:10.1007/s00122-016-2733-z).
Status: Published
Acknowledgement of Federal Support: No

Other publications, conference papers and presentations.

Cabrera, A., J. Isedro, E. Olson, B. Brisco, F. Kolb., E.A. Brucker, A. Krill, M.P. Arruda, M. Sorrels, D. Van Sanford, A. Clark, A. McKendry and C. Sneller. 2015. "Utilizing Genomic Selection to Accelerate the Pace of Developing Resistant Varieties." In: S. Canty, A. Clark, S. Vukasovich and D. Van Sanford (Eds.), *Proceedings of the 2015 National Fusarium Head Blight Forum.* East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 80.
Status: Talk presented with associated published Abstract
Acknowledgement of Federal Support: No

Malla, S., C. Griffey, J.P. Murphy, E. Milus, A. Clark, D. Van Sanford, J. Costa, N. McMaster, D. Schmale III, S. Chao and G. Brown-Guedira. 2015. "Characterization of FHB Resistance QTL in SRW Wheat Cultivar Tribute." In: S. Canty, A. Clark, S. Vukasovich and D. Van Sanford (Eds.), *Proceedings of the 2015 National Fusarium Head Blight Forum.* East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 94.
Status: Abstract Published and poster presented
Acknowledgement of Federal Support: Not applicable to this agreement.

Ulrich, J., S. Malla, C. Griffey, W. Brooks, D. Van Sanford, A. Clark, P. Murphy, R. Brueggeman, C. Cowger, N. McMaster, D. Schmale III, S. Chao and G. Brown-Guedira. 2015. "Identification of Quantitative Trait Loci for Resistance to Fusarium Head Blight In Winter Barley Cultivar Eve." In: S. Canty, A. Clark, S. Vukasovich and D. Van Sanford (Eds.), *Proceedings of the 2015 National Fusarium Head Blight Forum.* East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 113.
Acknowledgement of Federal Support: Not applicable to this agreement.