

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY14 Final Performance Report
July 15, 2015**

Cover Page

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Fiscal Year:	FY14
USDA-ARS Agreement ID:	59-0200-3-007
USDA-ARS Agreement Title:	Developing Double Haploids to Expedite Mapping and Enhance FHB Resistance in SRWW.
FY14 USDA-ARS Award Amount:	\$ 66,342

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SWW	Development of FHB-Resistant Wheat Cultivars for the Midsouth.	\$ 60,311
VDHR-SWW	Developing Doubled Haploids to Expedite Variety Development in SRWW.	\$ 6,031
	FY14 Total ARS Award Amount	\$ 66,342



Principal Investigator

7/14/15

Date

* MGMT – FHB Management

FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain

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

WES-CP – Western 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: *Development of FHB-Resistant Wheat Cultivars for the Midsouth.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

The major problem is to combine moderate to high levels of FHB resistance with acceptable levels of yield, quality and resistance to other important diseases. In order to resolve this problem, a large number of crosses are made each year between lines with FHB resistance and varieties that are high yielding and adapted to the Mid-South region. Historically, FHB resistance has come from unadapted sources, which made it difficult to combine resistance with acceptable yield. However, lines developed and screened through the Southern Uniform Scab Nursery combine both a high level of resistance and adaptation to the region, which has expedited the development of breeding lines that have potential as competitive varieties. Both phenotypic and marker assisted breeding are used to advance only lines with acceptable FHB resistance for yield testing. In FY14, 275 breeding lines derived from FHB-resistant parents were yield tested and this will increase each season as the amount of adapted, resistant material continues to increase.

In addition, we are collaborating with other breeding programs in the Southern Soft Wheat CP, especially the Louisiana program with which we have been exchanging lines and populations for FHB and other trait evaluations for more than 10 years. We evaluate lines in the Southern Uniform Scab Nursery, the Uniform Southern Nursery, Uniform Eastern Nursery, GAWN and SUNWHEAT in inoculated and misted nurseries at two locations. We have been collaborating on phenotyping double haploid derived germplasm, including lines received from the LA, VA and NC programs. A graduate student started in summer 2015 to carry out association analysis and genomic selection for FHB severity, FDK and DON in the Arkansas breeding program.

2. List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:

Accomplishment:

In FY14, resistant germplasm and potential varieties continued to be developed. AR00343-5-1 with moderate resistance to FHB went into foundation seed production. AR01040-4-1 and AR05094-4-1 were in breeder's seed production. AR05094-4-1 (*TerralTV8450/Beretta*) was the top yielding line in preliminary yield testing in 3 locations in 2012-2013 and is being tested in the Uniform Eastern Nursery and in the Arkansas Official Variety Test. ARGE07-1347-6-7-9 ranked second in incidence, severity, and ISK index in the 2013-2014 USSRWWSN and although it does not have the yield potential to be a variety, it has been a useful parent for multiple breeding programs. There were 300 lines exchanged with LA and evaluated for FHB resistance in Arkansas.

Impact:

Lines developed by the Arkansas program have been used as parents in other breeding programs, especially for the southern states. Three lines with moderate FHB resistance and competitive yield are close to release as varieties. Future work will focus on releasing identified lines and a more targeted focus on introgression and pyramiding of genes and quantitative trait loci for FHB resistance for continued development of resistant germplasm and cultivars.

Project 2: *Developing Doubled Haploids to Expedite Variety Development in SRWW.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

Developing wheat varieties that combine resistance to FHB with the yield potential of currently grown varieties remains a bottleneck for plant breeders. Through the work of the USWBSI, breeding lines are now available which are adapted, have competitive yield and contain known genes for resistance to FHB. Utilizing double haploids for wheat inbred line production can reduce the breeding process by 5-7 years compared to traditional inbreeding. With respect to the USWBSI, utilizing double haploids allows for combining multiple resistance genes together in an adapted background in the shortest amount of time possible, resulting in the highest probability for developing FHB resistant varieties.

2. List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:

Accomplishment:

Double haploid seed for 360 lines was received from Heartland Plant Innovations (Manhattan, KS):

Female	Pedigree	Female Parent Traits	Male	Pedigree	Male Parent Traits
MD08-26-H2-7-12-9	SS8641//McCormick*2/Ning7840	Rht2, Photo-Insens, Qyrva.vt-2AS, Lr37, Sr24/Lr24, Fhb1, FHB5AS, FHB2DL, SBMV, 2+12	GA041323-11E63	GA961565-2E46 / GA961591-3E42	Rht2, Photo-Insens, Qyrva.vt-2AS, Lr37, Yr5, Het_H13, SBMV, Ax2, 2+12
MDC07027-12-24	SS8641//McCormick*2/Ning7840	Rht2, Photo-Insens, Qyrva.vt-2AS, Lr37, Sr24/Lr24, Fhb1, FHB5AS, FHB2DL, SBMV, 2+12	KY04C-2004-1-2-1	Roane / Allegiance	Rht2, Photo-Insens, Qyrva.vt-4BL, Qyrva.vt-2AS, Lr46, Yr5, SBMV, Ax2, 2+12

The female parents both contained the gene Fhb1 and QTL FHB5AS, and FHB2DL for FHB resistance and were combined with adapted lines containing complimentary genes and QTL for other importance agronomic and resistance traits. Lines with less than 10 seed are being increased in the greenhouse and all lines will be evaluated in misted nurseries. In addition, 181 FHB resistant double haploids pre-screened by the VA and LSU programs were evaluated in Arkansas. Thirty lines were selected for yield testing.

Impact:

Double haploid technology can decrease variety development time by up to five years. Lines developed from these and other crosses within the USWBSI will be cooperatively phenotyped throughout the region in order to identify those lines having a combination of FHB resistance and high yield potential that can be released as varieties or used as parental germplasm.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY14 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 FY14 award period?**

Yes

If yes, how many? Two students:

Maria Nelly Arguello
Christopher Addison

- 2. Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY14 award period? No**

If yes, how many?

- 3. Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

None

If yes, how many?

- 4. Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**

None

If yes, how many?

FY14 (approx. May 14 – May 15)

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USDA-ARS Agreement #: 59-0200-3-007

Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI during the FY14 award period. List the release notice or publication. Briefly describe the level of FHB resistance. *If not applicable because your grant did NOT include any VDHR-related projects, enter N/A below.*

Nothing released during FY14

Include below a list of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles written about your work that resulted from all of the projects included in the FY14 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Mason R.E. *, Miller R.G. †, Bond R.D., Milus, E.A., Kelly J.P. 2014. Arkansas Wheat Cultivar Performance Tests 2013-2014. Arkansas Agriculture Experiment Station Research Series 619.