

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY13 Final Performance Report
July 15, 2014**

Cover Page

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Fiscal Year:	FY13
USDA-ARS Agreement ID:	59-0206-9-082
USDA-ARS Agreement Title:	Managing Fusarium Head Blight of Wheat in Arkansas.
FY13 USDA-ARS Award Amount:	\$ 72,425

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Evaluation of Fungicides for Efficacy against FHB of Wheat in Arkansas.	\$ 6,407
MGMT	Integrated Management of FHB of Wheat in Arkansas.	\$ 7,303
VDHR-SWW	Developing FHB-Resistant Wheat Varieties for the Midsouth.	\$ 58,715
	FY13 Total ARS Award Amount	\$ 72,425

Principal Investigator

Date

* MGMT – FHB Management
 FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
 GDER – Gene Discovery & Engineering Resistance
 PBG – Pathogen Biology & Genetics
 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: *Evaluation of Fungicides for Efficacy against FHB of Wheat in Arkansas.*

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

Fungicides are an important component for managing FHB, but even the best fungicides are only partially effective. This project evaluates new fungicides that have shown efficacy against FHB in preliminary tests and evaluates different application timings for the most effective fungicides. These evaluations are done across multiple states and market classes of wheat to validate the results.

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:

Prosaro® and Caramba® fungicides were identified as the most effective fungicides. Applications of Prosaro or Caramba at flowering or a few days after flowering were found to give similar levels of efficacy. Strobilurin fungicides were found to increase DON levels in grain. Different generic formulation of tebuconazole had significantly different levels of suppression in the Arkansas test.

Impact:

Prosaro and Caramba are now used to manage FHB across the US. Growers are cautioned to use strobilurin fungicides after heading because of the risk of higher DON levels. The window for timely application of Prosaro and Caramba is wider than originally believed, and this makes it easier to apply the fungicides in a timely manner. If generic tebuconazole formulations performed similarly to the Arkansas results across other locations, recommendations will be made to use particular generic formulations and not others.

Project 2: *Integrated Management of FHB of Wheat in Arkansas.*

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

FHB has been difficult to manage using only one management practice. A collaborative project across several states investigated the effects of combining moderately resistant cultivars with the most effective fungicide to achieve a higher level of control than with either management practice individually

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:

Analysis of data across several locations and years determined that the effects of cultivar resistance and fungicide efficacy were additive.

Impact:

Knowing that the effects of resistance and fungicide are additive simplifies management recommendations for FHB and DON, makes it easier to explain FHB management to growers, and eliminates the need to evaluate each cultivar with each fungicide to determine the effects on FHB and DON.

Project 3: *Developing FHB-Resistant Wheat Varieties 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 FY13, 250 breeding lines derived from FHB-resistant parents are being 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 and the Uniform Southern Nursery in inoculated and misted nurseries at two locations. We have been collaborating on phenotyping lines in the Jamestown and Tribute mapping populations. A graduate student conducted research on the effects of rainfall on DON levels in grain to determine if rainfall near maturity leaches DON disproportionately from susceptible and moderately resistant varieties and changes the rankings of lines for DON level in grain. Understanding the effects of rainfall on DON levels in grain should improve the selection of lines with low DON levels.

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 FY13, two lines with moderate resistance to FHB (AR00343-5-1 and AR01040-4-1) were put into breeder's seed production as potential varieties. In addition, 83 lines in advanced replicated yield testing were found to have a severity rating of less than 10% in the Fayetteville inoculated nursery and 25 of these have been advanced for further yield testing in 2013-2014 based on overall performance. AR00179-2-2 (*IL94-6727/Roane*) had a severity rating of 2% and was entered into the Uniform Eastern Soft Red Winter Wheat Nursery and the Uniform Southern Scab nursery. AR05094-4-1 (*TerralTV8450/Beretta*) was the top yielding line in preliminary yield testing in 3 locations and was highly resistant to FHB, with a severity rating of 3% in Fayetteville and 25% under extremely high pressure in the Newport inoculated nursery. We have also continued to develop lines that have

performed well in the Southern Uniform Scab Nursery, including lines that combine resistance from Catbird and native sources. ARGE07-1339-10-5-8 ranked 2nd for incidence and 1st for severity in the 2012-2013 Uniform Southern Scab nursery.

Impact:

Lines developed by the Arkansas program have been used as parents in other breeding programs, especially for the southern states. Two 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.

Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI during the FY13 award period. List the release notice or publication. Briefly describe the level of FHB resistance.

Nothing to report

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 FY13 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. Arkansas Wheat Cultivar Performance Tests 2012-2013. Arkansas Agriculture Experiment Station Research Series 611.

Kelley, J.P., Mason, E., Miller, R., Milus, E.A., Moon, D., and Rohman, P. 2013. Wheat Update 2013. U of A Cooperative Extension Service Publication. 16 pages.

Milus, E. A., Moon, D., and Rohman, P. 2013. Evaluations for FHB severity, Fusarium-damaged kernels, grain yield and seed quality, DON content, stripe rust severity and powdery mildew severity. Pages 8, 12, 14, 15, and 21, respectively, in: 2013 Southern Uniform Winter Wheat Scab Nursery Report. J.P. Murphy and R.A. Navarro, editors.

Pun, M., Dong, Y., and Milus, E. A. 2013. Effect of rain and simulated rain events on deoxynivalenol levels in grain from winter wheat affected by Fusarium head blight. *Phytopathology* 103 (Suppl. 2):S2.97.

Pun, M., Dong, Y., and Milus, E. A. 2013. Effects of late-season rain/simulated rain and grain drying on selection for low DON concentration in wheat grain. Page 40 in: Proceedings of the 2013 National Fusarium Head Blight Forum. Milwaukee, WI.

Malla, S., Griffey, C., Milus, E., Murphy, J. P., Clark, A., Van Sanford, D., Costa, J., McMaster, N., and Schmale, D. 2013. Mapping FHB resistance in native SRW wheat cultivar Tribute. Page 25 in: Proceedings of the 2013 National Fusarium Head Blight Forum. Milwaukee, WI.

Wright, E., Griffey, C., Malla, S., Van Sanford, D. Harrison, S., Murphy, J. P., Costa, J. Milus, E., Johnson, J., McKendry, A., Schmale, D., Clark, A., and McMaster, N. 2013. Characterization of FHB resistance in SRW Roane and Jamestown NAM populations. Page 45-46 in: Proceedings of the 2013 National Fusarium Head Blight Forum. Milwaukee, WI.