USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY12 Final Performance Report
July 16, 2013

Cover Page

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Fiscal Year:	FY12
USDA-ARS Agreement ID:	59-0206-9-082
USDA-ARS Agreement Title:	Managing Fusarium Head Blight of Wheat in Arkansas.
FY12 USDA-ARS Award Amount:	$ 72,495*

USWBSI Individual Project(s)

USWBSI Research Category**	Project Title	ARS Award Amount
MGMT	Integrated Management of FHB of Wheat in Arkansas.	$ 7,310
MGMT	Evaluation of Fungicides for Efficacy against FHB of Wheat in Arkansas.	$ 6,413
VDHR-SWW	Developing FHB-Resistant Wheat Varieties for the Midsouth.	$ 58,772
	Total ARS Award Amount	**$ 72,495**

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Principal Investigator Date

* Award Amount does not include additional funding awarded in September of 2012 earmarked for other PIs at same institution

** 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: *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 accomplishment and its impact (i.e. how is it 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 2: *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 accomplishment and its impact (i.e. how is it 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.

   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.

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. Currently, 150-200 breeding lines derived from FHB-resistant parentsare 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 is conducting 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 accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):**

   <u>Accomplishment:</u>

   We developed several lines that have performed well in the Southern Uniform Scab Nursery, including lines that combine resistance from Catbird and native sources.

   <u>Impact:</u>

   Lines developed by the Arkansas program have been used as parents in other breeding programs.

Accomplishment:

Phenotyping for resistance to FHB and other important diseases has helped other breeding programs select resistant lines.

Impact:

We are contributing to the development of FHB-resistant varieties by other programs.

Accomplishment:

A collaborative nursery comprised of 25 Jamestown derived FHB-resistant breeding lines was yield tested in both Arkansas and Louisiana.

Impact:

Identified lines that are both FHB-resistant and have competitive yield to currently grown susceptible cultivars will be targeted for further testing and future release as varieties.

Accomplishment:

Several lines in the advanced yield testing stage continue to be resistant to FHB and yield equal to or better than varieties currently grown in Arkansas.

Impact:

Arkansas breeding lines are getting closer to having all of the necessary traits for release as varieties.

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

Nothing to report at this time

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 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Willyerd, K. T., Li, C., Madden, L. V., Bradley, C. A., Bergstrom G. C., Sweets, L. E., McMullen, M., Ransom, J. K., Grybauskas, A., Osborne, L., Wegulo, S. N., Hershman, D. E.,

Wise, K., Bockus, W. W., Groth, D., Dill-Macky, R., **Milus, E**., Esker, Waxman, K. D., P. D., Adee, E. A., Ebelhar, S. E., Young, B. G., and Paul, P. A. 2012. Efficacy and stability of integrating fungicide and cultivar resistance to manage Fusarium head blight and deoxynivalenol in wheat. Plant Dis. 96:957-697.

Kelley, J.P., **Mason, E**., Miller, R., **Milus, E.A**., Moon, D., and Rohman, P. 2012. Wheat Update 2012. U of A Cooperative Extension Service Publication. 16 pages. (includes scab ratings for cultivars).

Milus, E. A., Moon, D., and Rohman, P. 2012. Evaluations for FHB severity, Fusarium-damaged kernels, grain yield, DON content, stripe rust severity and Septoria leaf blotch severity. Pages 8, 12, 14, 15, and 21, respectively, in: 2012 Southern Uniform Winter Wheat Scab Nursery Report. J.P. Murphy and R.A. Navarro, editors.

Milus, E. A., Harrison, S. A., and **Mason, R. E**. 2012. Catbird as a source of resistance to Fusarium head blight. Page 16 in: Proceedings of the 4th International Symposium on *Fusarium* Head Blight. Nanjing, China.

Wright, E., Griffey, C., Malla, S., Harrison, S., **Milus, G**., Johnson, J., Schmale III, D., and McMaster, N. 2012. Mapping Fusarium head blight resistance QTL in the soft red winter wheat cultivar Jamestown. ASA-CSSA-SSSA International Annual Meeting, Cincinnati, OH.

McMullen, M., Friskop, A., Jordahl, J., Meyer, S., Bergstrom, G., Bradley, C., Dill-Macky, R., Smith, M., Wiersma, J., Halley, S., Arens, A., **Milus, G**., Ruden, K., and Schatz, B. 2012. Uniform fungicide trial results for management of FHB and DON, 2012. Page 19 in: Proceedings of the 2012 National Fusarium Head Blight Forum. Orlando, FL.

Milus, G., Moon, D., and Rohman, P. 2012. Trends in FHB resistance among wheat cultivars in Arkansas and entries in the USSRWWSN: 2008-2012. Page 81 in: Proceedings of the 2012 National Fusarium Head Blight Forum. Orlando, FL.

Wright, E., Griffey, C., Malla, S., Van Sanford, D., Harrison, S., Murphy, J. P., Costa, J., **Milus, G**., Johnson, J., McKendry, A., Schmale III, D., Clark, A., and McMaster, N. 2012. Mapping FHB resistance in SRW wheat cultivar Jamestown. Page 108 in: Proceedings of the 2012 National Fusarium Head Blight Forum. Orlando, FL.

Milus, G. 2012. Gleanings from the 4th International Symposium on Fusarium Head Blight, Nanjing, China. Page 158 in: Proceedings of the 2012 National Fusarium Head Blight Forum. Orlando, FL.