USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY11 Final Performance Report
July 13, 2012

Cover Page

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Fiscal Year:	FY11
USDA-ARS Agreement ID:	59-0206-9-082
USDA-ARS Agreement Title:	Managing Fusarium Head Blight of Wheat in Arkansas.
FY11 USDA-ARS Award Amount:	$ 78,849

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Integrated Management of FHB in Arkansas.	$ 7,805
MGMT	Efficacy of Fungicides against NIV Chemotypes of Fusarium graminearum.	$ 6,420
VDHR-SWW	Development of FHB-resistant Wheat Cultivars for the Midsouth.	$ 64,624
	Total ARS Award Amount	**$ 78,849**

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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: *Integrated Management of FHB 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. These results were published in a peer-reviewed journal.

   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: *Efficacy of Fungicides against NIV Chemotypes of Fusarium graminearum.*

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

   NIV chemotype isolates of *Fusarium graminearum* are common in Arkansas, Louisiana and other southern states, but fungicides were never tested for efficacy against these isolates.

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: It was determined that fungicides effective against DON chemotype isolates also are effective against NIV chemotype isolates and that NIV isolates are less aggressive for causing FHB than DON isolates.

   Impact: Knowing that NIV isolates are less aggressive and controlled by the same fungicides as DON isolates simplifies the management of these isolates and the evaluation of fungicides for efficacy. That is, fungicide management should continue to focus on DON isolates, and whatever works against DON isolates should work against NIV isolates.

Project 3: *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 FHB resistance lines and varieties that are moderately resistant, 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 FHB resistant lines 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 mapping population. We have been using the male-sterile population developed in Ohio to develop a recurrent selection program for combining multiple traits. A graduate student is conducting research on the effects of rainfall/misting on DON levels in grain to determine if rainfall/misting 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 or misting 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):**

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

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

   Accomplishment: Several lines were identified this year that are 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.

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.

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.

Horevaj, P., Milus, E.A., and Bluhm, B. 2011. A real-time qPCR assay to quantify *Fusarium graminearum* biomass in wheat kernels. Journal of Applied Microbiology 111:396-406.

Horevaj, P., Brown-Guedira, G., and Milus, E. A. 2012. Resistance in winter wheat lines to deoxynivalenol applied into florets at flowering stage and tolerance to phytotoxic effects on yield. Plant Pathology Doi:10.1111/j.1365-3059.2011.02568.x.

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.

Milus, E. A., Moon, D., and Rohman, P. 2011. Evaluations for FHB severity, FHB index, Fusarium-damaged kernels, grain yield, DON content, types I and II resistance in the greenhouse, and powdery mildew resistance. Pages 8, 11,12, 14, 15, 16 and 21, respectively, in: 2011 Southern Uniform Winter Wheat Scab Nursery Report. J.P. Murphy and R.A. Navarro, editors.

Kelley, J.P., Sheets, S., Mason, E., Miller, R., Milus, E.A., Moon, D., and Rohman, P. 2011. Wheat Update 2011. U of A Cooperative Extension Service Publication. 16 pages.

Horevaj, P., Brown-Guedira, G., Moon, D. E., and Milus, E. A. 2011. Resistance to DON applied into wheat florets and tolerance to effects on yield. Page 26 in: Proceedings of the 2011 National Fusarium Head Blight Forum.

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., and McMaster, N. 2011. Family-based mapping of Fusarium head blight resistance in soft wheat cultivars Roane and Jamestown. Page 60 in: Proceedings of the 2011 National Fusarium Head Blight Forum.

Bradley, C. A., Adee, E. A., Ebelhar, S. A., Bergstrom, G. C., Dill-Macky, R., Wiersma, J. J., Grybauskas, A. P., Kirk, W. W., McMullen, M. P., Hally, S., Milus, E. A., Osborne, L. E., Ruden, K. R., and Wise, K. A. 2011. Effects of triazole, strobilurin, and triazole + strobilurin fungicides on Fusarium head blight and associated mycotoxins. Pages 125-126 in: Proceedings of the 2011 National Fusarium Head Blight Forum.

Willyerd, K., Bergstrom, G., Bradley, C., Dill-Macky, R., Gross, P., Grybauskas, A., Hally, S., Hershman, D., Madden, L., McMullen, M., Milus, G., Osborne, L., Ruden, K., Saldago, J. D., Swets, L., Wegulo, S., Waxman, K., Wise, K., and Paul, P. 2011. Uniform Fusarium head blight integrated management trials: A 2011 update. Pages 161-166 in: Proceedings of the 2011 National Fusarium Head Blight Forum.

Gale, L. R., Milus, E. A., Stangeland, S. K., Haas, M. W., and Kistler, H. C. 2011. Two newly detected populations of *Fusarium graminearum* in the United States. Phytopathology 101: S57.

Milus, E. A. 2011. What is head scab and how can it be managed? North Alabama Wheat Symposium, Belle Mina, AL. (invited presentation)

Milus, E. A. 2012. Integrated management of foliar diseases and scab. Arkansas Crop Management Symposium. Little Rock, AR. (invited presentation)

Milus, E. A., van Sanford, D., and Hershman, D. 2012. DON panel discussion. Midsouth Association of Wheat Scientists. Madison, AL.