U.S. Wheat and Barley Scab Initiative
FY02 Final Performance Report (approx. May 02 – April 03)
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Cover Page

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Grant Number:	**59-0790-9-054**
Grant Title:	**Fusarium Head Blight Research**
FY02 ARS Award Amount:	**$ 58,718**

Project

Program Area	Project Title	USWBSI Recommended Amount
CBC	Chemical and Biological Control of FHB on Wheat in Arkansas.	$7,000
VDUN	Developing FHB-Resistant Wheat Cultivars for the Midsouth.	$53,186
	Total Amount Recommended	**$60,186**

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Principal Investigator Date

Project 1: Chemical and Biological Control of FHB on Wheat in Arkansas.

1. What major problem or issue is being resolved and how are you resolving it?

The objective is to identify fungicides, biological control agents (BCAs) and application techniques that are effective against FHB of wheat. To resolve this objective we are participating in the Uniform Fungicide and BCA Test coordinated by the Chemical and Biocontrol Committee. We also evaluate additional treatments and analyze results of the Uniform Fungicide and BCA Test across locations that test products on wheat for presentation at the Scab Forum.

2. What were the most significant accomplishments?

In the fungicide and BCA test conducted in Arkansas, all fungicides tested significantly reduced plot severity and increased test weight compared to the nontreated control, but the two BCAs did not. However, there were no significant differences among the fungicides. Plots treated with fungicides had numerically greater yields that the non-treated check or plots treated with biologicals, but differences were not significant at the 5% level of confidence because of variability among plots of the same treatment. Based on quantification of inoculum of the BCAs, their poor performance did not appear to be due to low numbers of viable cells in the suspension applied to the plots. The fungicide AMS 21619A applied in 10 gal / acre appeared to have greater efficacy than at 20 gal / acre, but the difference was not statistically significant.

When data for the uniform fungicide and BCA treatments were summarized across all winter wheat locations, treatments involving AMS 21619A were clearly superior to all other treatments and neither BCA tested provided control of FHB. Folicur or BAS 505 were not as effective as AMS 21619A, but they were superior to both BCAs. When data for the uniform fungicide and BCA treatments were summarized across all spring wheat locations, all fungicide treatments performed more or less similarly, and the two BCA's were generally ineffective in managing FHB. Overall, fungicides reduced FHB symptoms on heads better than they reduced FHB damage to grain.

Project 2: Developing FHB-Resistant Wheat Cultivars for the Midsouth.

1. What major problem or issue is being resolved and how are you resolving it?

The major problem is that nearly all wheat cultivars adapted to the Midsouth are susceptible to head blight. A few cultivars have some FHB resistance, but these are not widely grown because they lack other essential characteristics. We are attempting to transfer FHB resistance into adapted genotypes using short-term and long-term approaches. The short-term approach is to cross sources of resistance with adapted lines and identify progeny with resistance and high yield. The long-term approach is to cross or backcross sources of resistance to each of two adapted cultivars with wide adaptation, identify resistant lines, and then intercross resistant lines to obtain higher levels of resistance. We screen wheat breeding lines from the northern and southern uniform scab nurseries for resistance in the field at two locations and for type 2 resistance in a greenhouse. We developed a recurrent selection program for combining resistances from the most resistant and adapted lines that were identified and developed partial diallel populations involving six of the most resistant lines developed in Arkansas.

2. What were the most significant accomplishments?

Yield plots harvested in June at Stuttgart and Marianna, AR indicated several high-yielding lines in the scab resistance nursery. These yield trials (WSO) were grown under inoculated conditions. Yields for the 28 lines ranged from 73.9 to 56.6 bu/A across two locations. The recently released cultivar 'Pat' topped the tests. This line has also shown good scab resistance in some trials and has shown to have the 194 bp SSR marker similar to the one found in Ning. AR93035-4-1 which was similar in yield to Pat (-3.2 bu/A) in the WSO tests was tested last year in the 2002-03 Uniform Southern Scab Nursery. Across all locations it was not significantly different than 'Ernie' for FHB Incidence, FHB Severity, FHB Index, % Scabby Seed, or Vomitoxin. This year the line was also tested in the Uniform Southern Soft Red Winter Wheat Nursery (regional yield trial) and 160 headrows were grown at Fayetteville to purify for type. Lines from the Germplasm Enhancement effort were yield tested for the first time in the WSO trials in 2002-03. Several of the lines appear to have good agronomic potential; two lines, ARGE971043-6a-5 and ARGE97-1033-10-2, did not differ significantly from Pat across the two locations. Of the 175 crosses made in the greenhouse this spring, about a third utilized a resistant parent, 15 of which involved new sources of resistance from Dr. Buerstmayr in Austria.

In the germplasm enhancement portion of the project, 13 lines from eight sources of FHB resistance were selected based on their resistance in inoculated and misted screening nurseries during the 2002 season. These F_7, backcross F_6 and topcross F_6 lines also were resistant to contemporary races of the leaf rust, stripe rust, and leaf blotch pathogens, and have good plant type, maturity, and visual grain quality. Five of the lines were evaluated in the 2003 Southern Winter Wheat Scab Nursery. All 13 lines were planted as males in a male-sterile crossing block to combines genes for resistance and made available to breeders for crossing. Entries from the Northern and Southern Winter Wheat Scab Nurseries were evaluated in the greenhouse for type 2 resistance and in field nurseries at Fayetteville and Kibler. Forty BCF_2 populations developed for FHB resistance were advanced and selected in the field.

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.

Bacon, R.K., Milus, E.A., Kelly, J.T., Weight, C.T., and Rohman, P.C. 2000. Development of FHB-Resistant Cultivars for the Mid-South. Page 244 in: Proceedings of the 2000 Fusarium Head Blight Forum.

Hershman, D. E., and Milus, E. A. 2002. Analysis of the 2002 uniform wheat fungicide and biocontrol trials across locations, Pages 82-87 in Proceedings of the 2002 National Fusarium Head Blight Forum.

Kelly, J., R. Bacon, and G. Milus. 2001. Breeding for head scab resistance in the Mid-South. Page 24 in: Abstracts of the Fourth National Wheat Industry Research Forum.

McMullen, M., and Milus E. A. 2002. History and accomplishments of the USWBSI uniform fungicide and biological control trials, 1998-2002. Page 96 in Proceedings of the 2002 National Fusarium Head Blight Forum.

Milus, E. A. 2002. The Scab Initiative: What's being done for soft red winter wheat. Midsouth Association of Wheat Scientists Annual Meeting, Olive Branch, MS.

Milus, E. A. Bacon, R., Harrison, S., Rohman, P., Markell, S., and Kelly, J. 2002. Developing FHB-resistant cultivars and germplasm for the Mid South. Pages 249-252 in Proceedings of the 2002 National Fusarium Head Blight Forum.

Milus, E.A., Bacon, R.K., Prom, L.K, and Weight, C.T. 1999. Developing FHB-resistant wheat cultivars for the Midsouth. Page 180 in: Proceedings of the 1999 Fusarium Head Blight Forum.

Milus, E.A. and McMullen, M. 2000. Analysis of the 2000 Uniform Wheat Fungicide Trials Across Locations. Pages 100-104 in: Proceedings of the 2000 Fusarium Head Blight Forum.

Milus, E.A., Weight, C.T., and Rohman, P.C. 2000. Accumulating genes for resistance to head blight and foliar diseases in soft red winter wheat. Page 85 in: Proceedings of the Durable Disease Resistance Symposium, Wageningen, The Netherlands.

Milus, E. A., Rohman, P., and Markell, S. 2002. Efficacy of fungicides and biocontrols against FHB on wheat in Arkansas in 2002. Pages 106-108 in Proceedings of the 2002 National Fusarium Head Blight Forum.

Milus, E.A., Rohman, P.C., and Weight, C.T. 2001. Efficacy of fungicides and biocontrols against Fusarium head blight in Arkansas, 2001. Pages 80-81 in Proceedings of the 2001 Fusarium Head Blight Forum.

Milus, E.A., Rohman, P.C., Weight, C.T., Harrison S.A., and Finney, P. 2001. Transferring FHB resistance to southern soft red winter wheat. Pages 260-263 in Proceedings of the 2001 Fusarium Head Blight Forum.

McMullen, M., Milus, E.A., and Prom, L.K. 1999. Uniform Fungicide trials to identify products effective against Fusarium head blight in wheat. Pages 64-68 in: Proceedings of the 1999 Fusarium Head Blight Forum.

Prom, L.K., Milus, E.A., and Weight, C.T. 2000. Efficacy of fungicides for control of Fusarium head blight of wheat in Arkansas, 1999. Fungicide and Nematicide Tests 54:336.