U.S. Wheat and Barley Scab Initiative
FY01 Final Performance Report (approx. May 01 – April 02)
July 15, 2002

Cover Page

PI:	**Eugene A. Milus**
Institution:	**University of Arkansas**
Address:	**Dept. of Plant Pathology** **217 Plant Science Bldg.** **Fayetteville, AR 72701**
Email:	**gmilus@comp.uark.edu**
Phone:	**501-575-2676**
Fax:	**501-575-7601**
Year:	**FY2001 (approx. May 01 – April 02)**
Grant Number:	**59-0790-9-054**
Grant Title:	**Fusarium Head Blight Research**
FY01 ARS Award Amount:	**$ 54,484**

Project

Program Area	Project Title	Requested Amount
Chem/Bio	Chemical and Biological Control of FHB on Wheat in Arkansas	$ 5,000
Variety/Uniform	Developing FHB-resistant wheat cultivars for the Midsouth	$ 49,969
	Total Amount Requested	**$ 54,969**

_____

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 fungicide treatments and analyze results of the Uniform Fungicide and BCA Test across locations that test products on wheat.

2. What were the most significant accomplishments?

In the Uniform Test conducted in Arkansas in 2001, there were no differences among treatments for FHB plot severity, but plots treated with OH 182.9 had significantly lower levels of scabby grain and DON than the nontreated check. Another biological treatment, TrigoCor 1448, also resulted in a significantly lower DON level and a low level of scabby grain that was close to being significantly lower than the check. Fungicide treatments were similar to the nontreated check except that the two treatments with BAS 505 had significantly higher DON levels than the check. The higher levels of DON in the BAS 505 treatments support previous reports that strobilurin fungicides cause higher DON levels. The two biological treatments may have performed better than the fungicides because of some unusual conditions: 1) treatments were applied in the late afternoon to help the biological agents establish, 2) frequent mist cycles may have allowed populations of the biological agents to increase and colonize before head blight infection occurred, and 3) disease developed late because inoculum did not produce ascospores until 7-10 days after flowering. The late disease development would favor the biological agents because they had time to increase and colonize the head before infection, whereas this situation would be unfavorable for the fungicides because some of their activity likely was lost before infection occurred.

To determine the efficacy of fungicide and biological treatments across a broad range of environments, data from 17 tests on wheat in 11 states were analyzed together. Only the variables field severity, percentage of Fusarium-damaged kernels, and DON level were analyzed because these are directly related FHB. All biologicals and fungicides significantly reduced field severity at low levels of disease, and all fungicides significantly reduced field severity at moderate levels of disease. The best treatments reduced field severity by about 50% compared to the nontreated check. There were no significant differences among treatments for percentage of Fusarium-damaged kernels, but the best treatments reduced the reduced the percentage of damaged kernels by about half when compared to the nontreated check. Likewise, there were no significant differences among treatments for DON level, but the best treatments reduced the level to about half that of the nontreated check. In conclusion, all of the treatments had some efficacy against FHB. Fungicides were more effective than biologicals. The most efficacious treatments reduced the FHB variables by about 50% compared to the nontreated check.

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 also screen wheat breeding lines from the northern and southern uniform scab nurseries for resistance in the field and greenhouse.

2. What were the most significant accomplishments?

Yield plots harvested in June at Stuttgart, AR indicated several high-yielding lines in the scab resistance nursery. Yields for the 70 lines ranged from 84.9 to 39.0 bu/A. These lines were also screened in the greenhouse for FHB and leaf rust, as well as rated for % scabby seed and % infected florets. Four of the lines, AR93095-4-1, AR93035-4-2, AR93035-7-1, and AR922-5-1, were selected for testing in the 2001-02 Uniform Southern Scab Nursery. The yields of these 4 lines were 84.9, 78.1, 76.8, and 61.5 bu/A compared to 74.4 bu/A for the newly-released Arkansas cultivar 'Sabbe'. Percent infected florets for these 4 lines were 5.0, 5.0, 6.7 and 1.7 compared to 15% for Sabbe. During the winter and early spring, lines from this nursery were crossed in the greenhouse to other high yielding genotypes as well as using lines obtained from Dr. Buerstmayr in Austria as new sources of resistance. A total of 44 different crosses were made specifically for FHB.

Eighty-four lines from 16 sources of FHB resistance were selected based on their resistance in inoculated and misted screening nurseries during the2001 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. The lines were evaluated for type 2 resistance in the greenhouse where seven had a lower percentage of diseased florets than Ernie, which has a high level of type 2 resistance. The lines were planted as males in a male-sterile crossing block to combines genes for resistance and for FHB evaluations in inoculated and misted nurseries at Fayetteville and Kibler, AR and at Baton Rouge and Winnsboro, LA. The best of these lines will be made available to breeders for crossing and entered into the Southern Winter Wheat Scab Nursery for further evaluations. Entries from the Northern and Southern Winter Wheat Scab Nurseries were evaluated in the greenhouse for type 2 resistance and in the screening nurseries at Fayetteville and Kibler. Ten sources of resistance from Eastern Europe and ten sources from CIMMYT were backcrossed to Mason and Pioneer 2684.

Publications/Presentations

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.

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.

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.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.