U.S. Wheat and Barley Scab Initiative
Annual Progress Report
September 18, 2000

Cover Page

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Year:	**FY2000**
Grant Number:	**59-0790-9-065**
Grant Title:	**Fusarium Head Blight Research**
Amount Granted:	**$93,012.00**

Project

Program Area	Objective	Requested Amount
Epidemiology	To develop a scab forecast system by monitoring the environment and pathogens.	$48,368.00
Chemical & Biological Control	Identify safe fungicides that are most effective against FHB and evaluate across wheat classes and varieties, barley varieties, and environments.	$4,783.00
Germplam Introduction & Enhancement	Identify safe fungicides that are most effective against FHB and evaluate across wheat classes and varieties, barley varieties, and environments.	$39,861.00
	Requested Total	$93,012.00

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Principal Investigator Date

(Form – PR1)

Project 1: To develop a scab forecast system by monitoring the environment and pathogens.

1. What major problem or issue is being resolved and how are you resolving it?
Effective management of scab requires a thorough understanding of the relation between weather and inoculum production, inoculum dispersal, and disease development. This information can be used to develop disease forecasts, which can be used to assess risks of scab in various regions, for making decisions about whether and when to use fungicides, and for decisions about marketing and utilizing grain. Understanding these relations will permit creation of conditions that permit effective selection for resistance in the field, or for evaluation of experimental fungicides or other control measures.

1. Please provide a comparison of the actual accomplishments with the objectives established.
Data on inoculum abundance and Fusarium head blight intensity were collected in two fields near Lafayette, IN. Inoculum was directly assessed using two Burkard volumetric spore samplers. It was also quantified by washing spores from wheat heads collected daily, from spike emergence through mid dough development of grain. Detailed weather data were collected at the site with a Campbell weather station. Disease incidence and severity data were collected in each trial. Data from these trials will be pooled with similar data from other states to develop a weather-based model for predicting inoculum levels and disease incidence.

2. What were the reasons established objectives were not met, if applicable?
To develop an accurate model relating weather to disease, it is necessary to have data sets that cover a wide range of disease intensity. The low intensity at Lafayette this year will provide useful insights into conditions that are not favorable for scab. More years of data must be collected to provide the necessary range in disease intensity.

3. What were the most significant accomplishments this past year?
We were able to acquire and deploy the spore samplers and the weather station early in the spring. Data were collected with these instruments throughout the period of inoculum formation, dispersal, and infection.

Project 2: Identify safe fungicides that are most effective against FHB and evaluate across wheat classes and varieties, barley varieties, and environments.

1. What major problem or issue is being resolved and how are you resolving it?
Scab has become a serious disease of wheat and barley in many areas of the US. Although resistance will be an important component of a disease management strategy, fungicides may be required to augment resistance under conditions highly favorable for scab, and may be required for cultivars that lack effective resistance.

2. Please provide a comparison of the actual accomplishments with the objectives established.
Several experimental fungicides were evaluated for efficacy against scab at two locations in Indiana. Wheat was sown in the fall of 1999 into corn residue. At both locations, scab development was light. At the southeast Indiana location there was no significant difference among treatments for scab incidence, wheat yield, and test weight. In the Lafayette trial, several fungicides applied at the beginning of flowering had less scab than the unsprayed control. One treatment yielded significantly more than the control.

3. What were the reasons established objectives were not met? if applicable.
The intensity of the scab epidemic was not severe enough to provide a critical test of the fungicides.

What were the most significant accomplishments this past year?
Several fungicide treatments appear promising for control of scab, at least under the disease pressure of these trials.

Project 3: Find and characterize other sources of resistance to Fusaium graminearum

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

Scab has become a serious disease of wheat and barley in many areas of the US. Resistant cultivars will be an important component of an integrated disease management strategy. Most wheat breeding programs are utilizing resistance from Sumai 3 or the closely related cultivar Ning 7840. Both are spring wheats from China. While this resistance appears to be the best available, and reasonably effective, it does not totally prevent disease development. There is also concern when wheat breeding programs over a wide area all rely on the same source of resistance. If any of the *Fusarium* species capable of causing scab were to adapt to this resistance, millions of hectares of wheat could become vulnerable to the disease. This project is designed to find other sources of resistance to scab, with two objectives: to provide genetic diversity for resistance and to enhance the degree of resistance conferred by the Sumai 3 source of resistance.

2. Please provide a comparison of the actual accomplishments with the objectives established.
Obj. 1. Characterize selections from original accessions for both type I and type II resistance to *Fusarium graminearum*: We have shown that several wheat accessions have Type I or Type II resistance to *Fusarium graminearum* in response to inoculation in the greenhouse. Initially, these accessions were heterogeneous for resistance, so several cycles of reselection were conducted to obtain lines with a consistent degree of resistance. Several of the selected lines show a high degree of resistance.
Obj. 2. Undertake genetic studies with the most resistant selections to determine the number of genes for resistance and their uniqueness: Crosses were made last spring between several of the resistant accessions and susceptible cultivars, to develop populations for genetic studies
Obj. 3. Investigate interactions among genes that enhance the expression of resistance beyond what is found in any germplasm presently known: Resistant accessions were crossed to Sumai 3 and Ning 7840, sources of known resistance, to determine if genes in these accessions are unique, and if so, if they complement resistant genes in the Chinese wheats.
Obj. 4. Make seed of selected and characterized lines available to both spring and winter wheat breeders: Seed of the resistant selections will be multiplied in the greenhouse and field this year, in order to have enough to share with other breeders.

3. What were the reasons established objectives were not met? If applicable. Not applicable.

4. What were the most significant accomplishments this past year?
Detection of new sources of resistance that appear to be of the same or greater degree than found in Sumai 3 and Ning 7840.

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.

Bai, G., Kolb, F., Shaner, G., and Domier, L. 1999. Amplified fragment length polymorphism markers linked to a major quantitative trait locus controlling scab resistance in wheat. Phytopathology 89:343-348.

Bai, G., Plattner, R., Shaner, G., Kolb, F. 2000. A QTL for deoxynivalenol tolerance in wheat. (Abstr.) Phytopathology 90:S4, Pub. No. P-2000-0024-AMA

Buechley, G. and Shaner, G. 1999. Resistance in wheat cultivar Chokwang to *Fusarium graminearum*, p. 123-126, in Wagester, J., Ward, R., Hart, O. P., Hazen, S. P., Lewis, J., and Borden, H. eds. Proc. of the 1999 National Fusarium Head Blight Forum.

Francl, L., Shaner, G., Bergstrom, G. Gilbert, J., Pedersen, W., Dill-Macky, R., Sweets, L., Corwin, B., Jin, Y., Dallenberg, D., and Wiersma, J. 1999. Daily inoculum levels of *Gibberella zeae* on wheat spikes. Plant Dis. 83:662-666.

Thomas, D., Buechley, G., Shaner, G. 1999. Epidemiology of Fusarium head blight of wheat in Indiana, 1999, p. 100-104 in Wagester, J., Ward, R., Hart, O. P., Hazen, S. P., Lewis, J., and Borden, H. eds. Proc. of the 1999 National Fusarium Head Blight Forum.