U.S. Wheat and Barley Scab Initiative
FY00 Final Performance Report (approx. May 00 – April 01)
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Cover Page

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Year:	**FY2000 (approx. May 00 – April 01)**
Grant Number:	**59-0790-9-045**
Grant Title:	**Fusarium Head Blight Research**
2000 ARS Award Amount:	**$121,912**

Project

Program Area	Project Title	Requested Amount
Epidemiology & Disease Management	Alternative hosts, moisture effects on inoculum, and ascospore survival.	$51,538.00
Germplasm Introduction & Enhancement	Maintaining spring wheat scab resistant germplasm center.	$73,422.00
	Requested Total	$124,960.00[1]

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Principal Investigator Date

[1] Note: The Requested Total and the Award Amount are not equal.

Project 1: Alternative hosts, moisture effects on inoculum, and ascospore survival.

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

The overall goal of the project is to understand the sources, production, and survival of scab (Fusarium Head Blight) inoculum to provide a knowledge base for the development of accurate disease forecasting systems and comprehensive disease management strategies. We initiated research to address questions concerning scab inoculum production and survival, specifically effects of environmental conditions on inoculum production, and inoculum (ascospores) survival and accumulation on plant surface.

2. What were the most significant accomplishments?

Investigating the relationship of scab and environmental conditions may lead to a better understanding of FHB epidemiology. Local disease forecasting systems may then be developed to enable producers to make improved management decisions. As part of a multi-state collaboration, environmental conditions and disease development were monitored in plots in eastern South Dakota in 2000 to relate certain environmental factors to inoculum production and disease progress. Airborne inoculum levels were strongly correlated to infection sites on wheat spikes over the following two to four days. Inoculum levels were correlated with precipitation events and soil surface wetness.

The levels of moisture/wetness on the soil surface may have the most direct impact on scab inoculum production because this environmental factor directly interfaces with plant residues on which perithecia of the pathogen are developed. However, we could not measure this important environmental parameter previously because there was a lack of proper instruments. In 2000, we focused on the development of a sensor capable of measuring soil surface wetness. A resistive sensor was constructed and tested for measuring moisture on the soil surface. The sensor has been integrated into the CR10X datalogger system and distributed to cooperators in several states. The data on wetness duration monitored by this sensor, in conjunction with the automatic data logging system, would be able to provide critical environmental data for the development of epidemiological models.

Gibberella zeae ascospores, produced on infected crop residues, are considered to be the primary inoculum for infecting wheat and barley, thereby inciting scab in these crops. Freshly discharged ascospores have an adhesive coating, and are likely to be trapped on plant surfaces. These spores may play an important role in the epidemiology of the disease by increasing the effective inoculum load, provided they remain viable and infective. Experiments were conducted to monitor the viability of ascospores over time. Although germination rate of ascospores declined rapidly, ascospores remained infectious for various periods of time, depending upon incubation conditions. These results indicated that a certain portion of the ascospores remain viable for an extended period of time, and may serve as a source of inoculum for infecting hosts.

Project 2: Maintaining spring wheat scab resistant germplasm center.

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

The use of resistant cultivars will be one of the major components in managing scab disease in wheat. Known sources of resistance to scab in wheat are very limited. The widespread use of a few resistant sources will create a genetic uniformity of large magnitude that may lead to potential genetic vulnerability. Identification of additional sources of resistance and incorporation of these new resistances are critical for enhancing the level of resistance and for diversifying the current resistance gene pool. This project confronts the issue of finding additional or new sources of scab resistance in spring wheat, maintaining and characterizing the resistance, and facilitating the utilization. Spring wheat germplasm from targeted regions of the world are evaluated to identify new sources of resistance. After discovery, the new resistances are distributed to breeders for introgressing into adapted materials to improve the level of scab resistance available in the current U.S. wheat germplasm.

2. What were the most significant accomplishments?

A system of evaluating germplasm through multiple nurseries was fully implemented in the project period. Spring wheat germplasm from targeted regions of the world are evaluated in a non-replicated Preliminary Screening Nursery (PSN) in the field. Selections from the PSN are re-evaluated in the greenhouse to make further selections. Field and greenhouse selections are used as test entries for a replicated field Elite Germplasm Nursery (EGN). Elite selections are integrated into the Uniform Regional Scab Nursery (URSN) system for testing at multiple locations and for direct access and utilization by users.

In the 2000 season, 1200 accessions of spring wheat, 150 accessions of Triticale, and 37 accessions of spelta wheat were evaluated in the PSN in field and 152 selections were made for further testing. Selections (224 lines) from the 1998 and 1999's PSN were evaluated in the greenhouse with point-inoculation and spray-inoculation to derive entries for 2000's EGN. One hundred twenty selections were tested in the 2000's EGN. Five elite selections from the 2000's EGN were entered into the 2001's URSN for spring wheat. Evaluation data of entries from PSN in 1998, 1999 and 2000 have been posted in the GRIN database (USDA-ARS, National Genetic Resources Program, Germplasm Resources Information Network).

Critical evaluations of materials in PSN and EGN were achieved because of high and relatively consistent scab pressure during the field evaluation period. Additional criteria, i.e. % scabby seed, test weight, and yield, were used in the evaluation of EGN materials, resulting in more complete information on scab reaction of the selections. Evaluation data of elite selections have been posted in the National Scab Initiative website. Selections were increased in an off-season nursery (New Zealand) for prompt seed distributions. Resistance from several elite selections is being introgressed into adapted germplasm.

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.

De Wolf, E., L. Francl, P. Lipps, L. Madden, L. Osborne, and Y. Jin. 2000. Factors affecting the development of wheat Fusarium head blight. Pages 137-140 *In:* 2000 National Fusarium Head Blight Forum. Dec. 10-12, 2000, Erlanger, KY.

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

Jin, Y. and J. Rudd. 2000. Method and progress in scab resistance screening and introgression in spring wheat. A presentation to South Dakota Crop Improvement Association and South Dakota Wheat Commission. June 21-22, 2000, Brookings, SD.

Jin, Y. and X. Zhang. 1998. Mass production of ascospores of *Gibberella zeae*. Phytopathology 88:S44.

Jin, Y. and X. Zhang. 1999. Viability of *Gibberella zeae* ascospores on wheat plant surface. (A poster presentation) *In*: 1999 National Fusarium Head Blight Forum, The U.S. Wheat and Barley Scab Initiative. Dec. 5-6, 1999. Sioux Falls, SD.

Jin, Y., X. Zhang, and J. Rudd. 2000. Spring wheat scab evaluation data from Brookings (SD) in 1998, 1999 and 2000. USDA-ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN): www.ars-grin.gov/usr/local/apache/cgi-bin/npgs/html/desc.pl?65066.

Jin, Y., X. Zhang, R. Rudd, and J. Rudd. 1999. A point inoculation method for evaluating scab resistance in wheat. Page 128 *In*: 1999 National Fusarium Head Blight Forum, The U.S. Wheat and Barley Scab Initiative. Dec. 5-6, 1999. Sioux Falls, SD.

Osborne, L. and Y. Jin. 2000. A Sensor for Monitoring Wetness at the Soil-Air Interface. Pages 169-172 *In:* 2000 National Fusarium Head Blight Forum. Dec. 10-12, 2000, Erlanger, KY.

Osborne, L., Y. Jin, and R. Kohl. 2000. Fusarium Head Blight: Inoculum Detection, Disease Progress, and Environmental Influences. Pages 163-168 *In:* 2000 National Fusarium Head Blight Forum. Dec. 10-12, 2000, Erlanger, KY.

Zhang, X. and J. Rudd. 2000. Germplasm evaluation and pre-breeding for scab resistance in spring wheat. A presentation to Monsanto wheat improvement scientists. July 27, 2000, Brookings, SD.

Zhang, X., Y. Jin, and J. Rudd. 2000. Inheritance of scab resistance in Sappora Haru Komugi Jugo. pp. 98-99. *In*: Proc. Int. Symp. Wheat Impr. Scab Resistance. May 5-11, 2000, Suzhou and Nanjing, China.

Zhang, X., Y. Jin, R. Rudd, J. Rudd, and H. Bockelman. 1999. Screening of spring wheat scab resistance from the USDA germplasm collection. pp 140-142. *In*: National Fusarium Head Blight Forum, The U.S. Wheat and Barley Scab Initiative. Dec. 5-7, 1999, Sioux Falls, SD.

Zhang, X. Y. Jin, R. Rudd, T. Hall, J. Rudd, and H. Bockelman. 2000. Fusarium Head Blight Resistant Sources of Spring Wheat Identified from the USDA Collection. Pages 228-233 *In:*. 2000 National Fusarium Head Blight Forum. Dec. 10-12, 2000, Erlanger, KY.

Zhang, X., Y. Jin, R. Rudd, J. Rudd, and H. Bockelman. 2000. Geographical Distribution and Pedigree Analysis of Fusarium Head Blight Resistant Selections from the USDA Spring Wheat Germplasm Collection. Pages 234-238 *In:* 2000 National Fusarium Head Blight Forum. Dec. 10-12, 2000, Erlanger, KY.