U.S. Wheat and Barley Scab Initiative
FY02 Final Performance Report (approx. May 02 – April 03)
July 15, 2003

Cover Page

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Year:	**FY2002 (approx. May 02– April 03)**
Grant Number:	**59-0790-9-027**
Grant Title:	**Fusarium Head Blight Research**
FY02 ARS Award Amount:	**$ 45,183**

Project

Program Area	Project Title	USWBSI Recommended Amount
CBC	Fungicide/Bioprotectant Trials for Control of Fusarium Head Blight (New York).	$11,313
EDM	Airborne Propagules of Gibberella zeae: Their Function in Fusarium Head Blight.	$35,000
	Total Amount Recommended	**$46,313**

__Gary C. Bergstrom_____July 10, 2003_____
Principal Investigator Date

Project 1: Fungicide/Bioprotectant Trials for Control of Fusarium Head Blight (New York).

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

At present, there are no means to adequately control the infection of wheat and barley by *Gibberella zeae* that are both highly effective and widely regarded as safe. The objective was to evaluate a uniform set of fungicide treatments across a number of locations and crops, to achieve more information on potentially useful fungicides and bioprotectants to control FHB. We provided a New York site for the Uniform Fungicide and Biocontrol Tests on soft white winter wheat in 2002. In addition, we assessed additional biological control agents on winter wheat at two locations.

2. What were the most significant accomplishments?

We were able to evaluate synthetic foliar fungicides and microbial antagonists under epidemic conditions in 2002. Of all of the fungicides, bioprotectants, and combinations tested, only AMS21619A showed great promise for control of Fusarium head blight. None of the treatments reduced deoxynivalenol (DON) contamination to levels acceptable to the grain trade, though AMS21619 reduced DON significantly. The performance of the three synthetic fungicides was not increased in combination with the bioprotectant TrigoCor 1448. Further testing of AMS21619A is certainly warranted.

Project 2: Airborne Propagules of Gibberella zeae: Their Function in Fusarium Head Blight.

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

In order to better understand the epidemiology of Fusarium head blight, we are attempting to answer three fundamental, building-block questions about the aerobiology of *Gibberella zeae*: 1) Can ascospores or conidia become airborne in sufficient numbers to provide long-distance inoculum? 2) Can ascospores or conidia survive in air for periods of time sufficient for distance dispersal, and 3) Are there sufficient numbers of viable propagules being deposited on wheat spikes from atmospheric populations to contribute inoculum for Fusarium head blight. Work was conducted on all three objectives in FY02, with support of USWBSI for objectives 1 & 3. Environmentally-controlled wind tunnels were constructed and used to assess the potential for propagules to become airborne in turbulent air under a variety of environmental conditions. To estimate propagule survival in air, viable propagules were applied to wheat spikes and solid substrates and were placed in natural environments for varying durations before washing off spores and quantifying them and assessing their viability. We observed spatial and temporal patterns of viable spore deposition of *G. zeae* over two wheat fields, 0.5 km apart, in Aurora, NY in May/June 2002. Petri plates bearing Fusarium selective medium were used to trap viable propagules of *G. zeae* above wheat canopies. Propagules of *G. zeae* were also trapped on agar plates via the use of remote- controlled airplanes traveling at 200 to 600 feet above the ground, and colonies were rendered from wheat heads selectively exposed to natural inocula before, during, and after flowering. We are using DNA-fingerprinting technologies to analyze the genetic diversity of airborne populations of *G. zeae* present before, during, and after wheat flowering.

2. What were the most significant accomplishments?

In preliminary experiments, ascospore discharge and distant movement in turbulent air currents occurred between 10 and 30 C with peak discharge and movement at 25 C. In preliminary experiments on propagule survival we documented significant ascospore and macroconidia viability following 3 days of exposure to natural environments. Significant progress was made in understanding the dynamics of spore deposition above natural wheat canopies. More than 88,000 colonies of *G. zeae* were collected over 20 consecutive dates (40 day/night sampling periods) on a total of 3,840 Petri plates with selective medium placed 30 cm above wheat spikes. Viable spores were deposited at every sampling period spanning spike emergence through kernel milk stages of local wheat. More than 94 percent of the colonies were collected at night (sunset to sunrise). Seven major deposition events (>50 colonies, on average, per plate) occurred concurrently in the two fields, all at night, and three of these were coincident with rainfall. Cumulative exposure of wheat spikes to viable, airborne spores and the deposition of those spores mainly at night should be considered in the development of risk models and management strategies for Fusarium head blight.

List of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles:

Publications (peer-reviewed)

Kawamoto, S.O., C.A. Stockwell, G.C. Bergstrom, W.J. Cox, and D.J. Otis. 2002. Evaluation of foliar fungicides and bioprotectants for control of Fusarium head blight of winter wheat in New York, 2001. *Fungicide and Nematicide Tests* 57:CF17.

Kawamoto, S.O., C.A. Stockwell, G.C. Bergstrom, W.J. Cox, and D.J. Otis. 2003. Evaluation of foliar fungicides and bioprotectants for control of Fusarium head blight of winter wheat in New York, 2002. *Fungicide and Nematicide Tests* 58:CF017.

Luz, W.C. da, C.A. Stockwell, and G.C. Bergstrom. 2003. Biological control of *Fusarium graminearum*. Pages 381-394 in: K.J. Leonard and W.R. Bushnell ed, *Fusarium Head Blight of Wheat and Barley*, APS Press, St. Paul, MN.

Schmale, D.M. III, and G.C. Bergstrom. 2003. Fusarium head blight. Plant Disease Lesson. *The Plant Health Instructor*. DOI:10.1094/PHI-I-2003-0612-01. [Includes section on aerobiology and epidemiology]

Schmale, D.M. III, E.J. Shields, and G.C. Bergstrom. 2003. Night-time spore deposition of the Fusarium head blight pathogen, *Gibberella zeae*. *Phytopathology* (submitted and in review)

Stockwell, C.A., S.O. Kawamoto, G.C. Bergstrom, D. Benscher, and M.E. Sorrells. 2002. Evaluation of bioprotectants for control of Fusarium head blight of winter wheat in New York, 2001. *Biological and Cultural Tests for Control of Plant Diseases* 17:S14.

Publications (not peer-reviewed)

Bergstrom, G.C. and E.J. Shields. 2002. Atmospheric spore dispersal and regional epidemiology of the Fusarium head blight fungus. *Phytopathology* 92:S93.

Kawamoto, S.O., C.A. Stockwell, D.J. Otis, W.J. Cox, M.E. Sorrells, and G.C. Bergstrom. 2002. Evaluation of foliar fungicides and bioprotectants for control of Fusarium head blight of winter wheat in New York in 2002. Pages 92-95 in: *Proc. 2002 National Fusarium Head Blight Forum*, Holiday Inn Cincinnati Airport, Erlanger, KY December 7-9, 2002.

Schmale, D.G. III, E.J. Shields, and G.C. Bergstrom. 2002. Airborne populations of *Gibberella zeae*: Spatial and temporal dynamics of spore deposition in a localized Fusarium head blight epidemic. Page 178 in: *Proc. 2002 National Fusarium Head Blight Forum*, Holiday Inn Cincinnati Airport, Erlanger, KY December 7-9, 2002.

Schmale, D.M.III, E.J. Shields, and G.C. Bergstrom. 2003. Night-time spore deposition of the Fusarium head blight pathogen, *Gibberella zeae*. *Phytopathology* 93:S77.

Presentations

Presentations made by Gary C. Bergstrom on Fusarium head blight research and management:

- Small Grains Management Field Day, Aurora, NY. (6/6/02).
- Seed Growers Field Day, Ithaca, NY. (7/2/02).
- Small Grains Seed Committee, Waterloo, NY. (3/17/03).