USDA-ARS / USWBSI
FY03 Final Performance Report (approx. May 03 – April 04)
July 15, 2004

Cover Page

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Year:	**FY2003 (approx. May 03 – April 04)**
FY03 ARS Agreement ID:	**59-0790-9-027**
FY03 ARS Agreement Title:	**FY03 Scab Research in New York by Gary C. Bergstrom**
FY03 ARS Award Amount:	**$ 43,696**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
CBC	Fungicide/Bioprotectant Trial for Control of Fusarium Head Blight (New York).	$ 9,549
EDM	Airborne Propagules of Gibberella zeae: Their Genetic Diversity and Contribution to Fusarium Head Blight.	$ 34,146
	Total Amount Recommended	**$ 43,696**

Gary C. Bergstrom
Principal Investigator

July 12, 2004
Date

* BIO – Biotechnology
CBC – Chemical & Biological Control
EDM – Epidemiology & Disease Management
FSTU – Food Safety, Toxicology, & Utilization
GIE – Germplasm Introduction & Enhancement
VDUN – Variety Development & Uniform Nurseries

(Form – FPR03)

Project 1: ***Fungicide/Bioprotectant Trial 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 2003. At the New York site we included additional evaluation of the biocontrol bacterium TrigoCor 1448, alone and in combination with fungicides. We also examined the utility of the kaolin-based coating product, Surround, alone and in combination with other products.

2. What were the most significant accomplishments?

We were able to evaluate synthetic foliar fungicides and the microbial antagonist *Bacillus subtilis* TrigoCor 1448 under a moderate natural epidemic in 2003. Though most treatments showed some improvement over the mean performance of nontreated plots, no treatment resulted in a statistically significant increase in yield or decrease in Fusarium head blight at the 95% confidence level. Several treatments resulted in modest decreases in deoxynivalenol (DON), Fusarium damaged kernels, seedborne *Gibberella zeae*, and increased test weight. Only the combined treatment with the biocontrol bacterium TrigoCor1448 and the fungicide JAU6476 480SC (5 fl oz) plus Induce 0.125% reduced DON below the advisory level of 2 ppm that is acceptable to the grain trade. The kaolin-based foliar coating product, Surround WP, applied at 32.7 lb/A, reduced Fusarium head blight on a par with synthetic fungicides and warrants further investigation as a useful adjuvant in application of fungicides and biocontrol agents for the control of Fusarium head blight.

Project 2: ***Airborne Propagules of Gibberella zeae: Their Genetic Diversity and Contribution to Fusarium Head Blight.***

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

The multi-year goal of this project is to determine where inoculum for Fusarium head blight comes from and how far it travels. We are attempting to answer three fundamental, building-block questions about the aerobiology of *Gibberella zeae*: 1) What is the genetic diversity of populations of *G. zeae* in the air? 2) What is the contribution of airborne propagules of *G. zeae* to FHB in wheat? and 3) What is the contribution of local sources of *G.zeae* inoculum to spatial patterns of FHB? Work was conducted on all of the objectives in FY03, with support of USWBSI funds. We added hundreds of additional airborne isolates of *G. zeae* to our collection. We used a series of Random Amplified Polymorphic DNA (RAPD) primers to characterize airborne populations of *G. zeae* over a number of different wheat fields. We investigated spatial patterns of spore deposition over wheat and corn fields in Aurora, NY. We are continuing to use DNA-fingerprinting technologies to analyze the genetic diversity of airborne populations of *G. zeae*.

2. What were the most significant accomplishments?

Airborne populations of *G. zeae* collected over fields of wheat are genetically diverse as are populations collected from infected wheat spikes in individual fields. A clonal isolate released in area sources of infected corn kernels in a local wheat field was not recaptured at a high frequency among isolates from infected spikes or from the air above spikes in local fields. The implication is that much of the inoculum deposited in wheat fields originates from sources external to wheat fields. If inocula are aerially transported long distances (kilometers rather than meters) it would suggest that new variants of the fungus with altered virulence or mycotoxin profiles could be introduced into previously unexposed wheat production regions. Significant long-range dispersal would also suggest that local management of over-wintered inoculum (e.g., tillage, spraying of debris, etc.) would have negligible impact unless performed over extensive production areas. Spatial patterns of spore deposition of *G. zeae* were investigated over fields of wheat and corn. Spatial patterns were unique during every day or night spore collection period. Patterns revealed that random deposition occurred during the day, and aggregated deposition occurred during the night. Spatial patterns and diurnal fluctuations in spore deposition should be considered carefully in the acquisition of aerial spore concentration data and their potential application to FHB risk assessment.

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 your grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Publications (peer-reviewed)

Del Ponte, E.M., D.A. Shah, and G.C. Bergstrom. 2003. Spatial patterns of Fusarium head blight in New York wheat fields suggest role of airborne inoculum. Online. *Plant Health Progress* DOI: 10.1094/PHP-2003-0418-01-RS.

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.

Kawamoto, S.O., G.C. Bergstrom, W.J. Cox, and D.J. Otis. 2004. Evaluation of foliar fungicides and bioprotectants for control of Fusarium head blight of winter wheat in New York, 2003. *Fungicide and Nematicide Tests* 59:CF007.

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.G. III, and G.C. Bergstrom. 2004. Spore deposition of the ear rot pathogen, *Gibberella zeae*, inside corn canopies. *Canadian Journal of Plant Pathology*. *In press*.

Schmale, D.G. III, D.A. Shah, and G.C. Bergstrom. 2004. Spatial patterns of viable spore deposition of *Gibberella zeae* in wheat and corn fields. *Phytopathology*. (submitted and in review).

Schmale, D.M. III, E.J. Shields, and G.C. Bergstrom. 2004. Night-time spore deposition of the Fusarium head blight pathogen, *Gibberella zeae*. *Phytopathology* (submitted and in review).

Publications (not peer-reviewed)

Del Ponte, E.M., J.M.C. Fernandes, and G.C. Bergstrom. 2003. Fusarium head blight and deoxynivalenol accumulation in wheat inoculated at developmental stages from flowering through grain maturation. Pages 129-132 in: Proc. 2003 National Fusarium Head Blight Forum, Holiday Inn Select, Bloomington, MN, December 13-15, 2003.

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.

Schmale, D.G. III, and G.C. Bergstrom. 2003. Airborne propagules of *Gibberella zeae*: Techniques for monitoring spore release and viability. Page 175 in: Proc. 2003 National Fusarium Head Blight Forum, Holiday Inn Select, Bloomington, MN, December 13-15, 2003.

Yuen, G.Y., C.C. Jochum, B.H. Bleakley, K.R. Ruden, M.A. Draper, D.A. Schisler, S. Zhang, M.J. Boehm, P.E. Lipps, and G.C. Bergstrom. 2003. Cooperative multistate field tests of Biological control agents for control of Fusarium head blight in wheat and barley. Pages 113-117 in: Proc. 2003 National Fusarium Head Blight Forum, Holiday Inn Select, Bloomington, MN, December 13-15, 2003.

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

- Small Grains Management Field Day, Aurora, NY. (6/5/03).
- Seed Growers Field Day, Ithaca, NY. (7/8/03).
- Small Grains Seed Committee, Waterloo, NY. (3/15/04).