

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY07 Final Performance Report (approx. May 07 – April 08)
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Cover Page

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Fiscal Year:	2007
USDA-ARS Agreement ID:	59-0790-4-093
USDA-ARS Agreement Title:	Developing Technologies to Enhance Utility for B. Subtilis Against Wheat Scab.
FY07 ARS Award Amount:	\$ 60,488

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
CBCC	Evaluation of Integrated Management Strategies for FHB in New York.	\$20,488
EEDF	Relative Contribution of within-Field Inoculum to FHB Infection of Wheat.	\$ 40,000
	Total Award Amount	\$ 60,488

Gary C. Bergstrom

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Principal Investigator

Date

* CBCC – Chemical, Biological & Cultural Control
EEDF – Etiology, Epidemiology & Disease Forecasting
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GET – Genetic Engineering & Transformation
HGR – Host Genetics Resources
HGG – Host Genetics & Genomics
IIR – Integrated/Interdisciplinary Research
PGG – Pathogen Genetics & Genomics
VDUN – Variety Development & Uniform Nurseries

Project 1: *Evaluation of Integrated Management Strategies for FHB in New York.*

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

This research in New York was part of a multi-state, multi-year field study aimed at demonstrating that integrated management is the most efficacious and economical approach to management of Fusarium head blight and DON. The individual and combined effects of cultivar resistance (four wheat cultivars varying in resistance to FHB) and fungicide (Prosaro at initiation of flowering) were assessed for their effects on FHB, DON, and grain yield. In New York we conducted two separate experiments in 2007, one in wheat planted no-till into corn stubble and one planted after conventional tillage following soybean harvest. Central New York experienced one of the driest May-July periods on record such that FHB symptoms were not observed in the plots. And yet, detectable levels of DON were recorded for some plots as a result of infection later during grain development. There were no significant effects of treatment except that the FHB susceptible cultivar Caledonia outyielded the other cultivars in the conventional tillage environment following soybean in the virtual absence of wheat fungal diseases.

**2. List the most important accomplishment and its impact (how is it being used?).
Complete all three sections (repeat sections for each major accomplishment):**

Accomplishment:

We demonstrated that DON can result from late infections with no associated symptoms and that this late DON accumulation may not be reduced by fungicide application at initiation of flowering.

Impact:

The detection of DON in grain from plants that exhibited no visual symptoms of FHB is a reminder that successful integrated management must also address late infections resulting in DON. FHB management should not end at the initiation of flowering.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:

It is unlikely that fungicide application past the initiation of flowering will be available as a solution to late infections that result in DON accumulation. But resistant cultivars and applications of biocontrol agents during grain formation should be assessed for extension of FHB management through the grain filling period.

Project 2: *Relative Contribution of within-Field Inoculum to FHB Infection of Wheat.*

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

Knowledge of the relative contribution of within-field inoculum sources (i.e., corn and small grain crop debris) of *Gibberella zeae* to infection of local wheat is important for developing and/or excluding strategies for managing FHB. We utilized a marked isolate, release-recapture approach to assess relative contribution of spores from corn stalks to infection of wheat heads at the corn stalk source and at 10 foot and 20 foot radii from the corn stalk sources as well as in more distant portions of the fields. The 2007 experiment was conducted in commercial scale wheat fields in New York and Virginia that lacked corn or cereal residues. Isolates of *G. zeae* from wheat heads were scored for AFLP haplotype and were categorized for identity or non-identity with released clonal isolates possessing unique AFLP haplotypes.

2. List the most important accomplishment and its impact (how is it being used?).

Complete all three sections (repeat sections for each major accomplishment):

Accomplishment:

We provided the first direct (genetic) evidence of the relative contribution of local inoculum to local infection of wheat heads by *Gibberella zeae*. Both within-field, infected corn stalks and background atmospheric sources provided significant levels of inoculum for infection of local wheat heads in a non-epidemic environment in New York and in a moderate FHB epidemic environment in Virginia in 2007. Yet, in both cases, local corn stalk isolates of *G. zeae* contributed less than half of the spores resulting in wheat head infection immediately above the corn stalks and a small fraction of the spores resulting in head infection at 10 foot or greater distances from the corn stalks. A small number of isolates of the released clones were recovered in distant portions of the fields indicating a contribution of corn stalk-derived spores to the mixed atmospheric population of the fungus.

Impact:

The strong implication of these first year findings is that within-field corn or cereal debris contributes less spores for infection of local wheat or barley heads than does the regional atmospheric population of fungal spores. That is not to say that within-field sources are not important or that they should not be reduced as a component of integrated management of FHB. But our findings suggest strongly that debris management in single fields achieved through tillage, crop sequence, or the application of fungicides or biocontrol agents to stubble is unlikely, by itself, to result in large reductions of FHB or DON.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:

The wheat and barley community now has a more realistic idea of the relative contributions of within-field and area atmospheric sources of inoculum for FHB. The largest vulnerability is from regional populations of spores in the atmosphere. The localized benefits of debris management may be less than some have expected. Protection of cereals with resistant varieties, fungicides, and biocontrol agents should result in benefits whether spores come from within-field or regional sources.

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.

Publications (peer reviewed):

Schmale, D.G. III and G.C. Bergstrom. 2007. The aerobiology and population structure of *Gibberella zae*. *Plant Health Progress* DOI:10.1094/PHP-2007-0726-04-RV.

Pryor, S.W., D.M. Gibson, G.C. Bergstrom, and L.P. Walker. 2007. Minimization of between-well sample variance of antifungal activity using a high-throughput screening microplate bioassay. *Biotechniques* 42:168-172.

Publications (not peer reviewed):

Bergstrom, G.C., and D.G. Schmale. 2007. Aerobiology of *Gibberella zae*: Whence come the spores for Fusarium head blight? Pages 70-71 in Proc. 2007 National Fusarium Head Blight Forum, The Westin Crown Center, Kansas City, Missouri, December 2-4, 2007.

Keller, M.D., K.D. Duttweiler, D.G. Schmale, and G.C. Bergstrom. 2007. Contribution of within-field inoculum sources to Fusarium head blight in wheat. Page 98 in Proc. 2007 National Fusarium Head Blight Forum, The Westin Crown Center, Kansas City, Missouri, December 2-4, 2007.

Presentations for Scientific/Professional Audiences:

Bergstrom, G.C. and D. G. Schmale. Aerobiology, regional epidemiology and population genetic structure of *Gibberella zae*. 62nd Northeastern Corn Improvement Conference, Boyce Thompson Institute, Cornell University, Ithaca, NY, February 15-16, 2007

Bergstrom, G.C., and D.G. Schmale. Aerobiology of *Gibberella zae*: Whence come the spores for Fusarium head blight? 2007 National Fusarium Head Blight Forum, The Westin Crown Center, Kansas City, Missouri, December 2-4, 2007.

Extension presentations by Gary C. Bergstrom in 2007-08 that included updates on Fusarium head blight research:

Seed Growers Field Day. Ithaca, NY. Small grain and forage crop disease update; Fusarium head blight (ca. 65 persons) (7/8/08)

Small Grains Management Field Day. Aurora, NY. Integrated management of Fusarium head blight. (ca. 100 persons) (6/5/08)

North Country Crop Congress, Carthage, NY. Field crop disease update. (ca. 50 persons) (3/13/08)

North Country Crop Congress, Madrid, NY. Field crop disease update. (ca. 50 persons) (3/12/08)

Monroe Tractor Spray Clinic. Auburn, NY. Plant disease update. (ca. 200 persons) (3/11/08)

New York State Small Grains Seed Committee. Waterloo, NY. Cereal disease research and extension update. (12 persons) (3/4/08)

Seneca County Crop and Dairy Day. Romulus, NY. Field crop disease update. (ca. 25 persons) (2/20/08)

Madison County Crop Congress. Cazenovia, NY. Disease and mycotoxin threats to New York crops. (ca. 50 persons) (1/23/08)

Cornell Nutrition Conference For Feed Manufacturers. East Syracuse, NY. Field practices that reduce mycotoxins. (ca. 400 persons) (10/25/07)

Field Crop Dealer Meeting. Auburn, NY. An update on disease and mycotoxin threats to New York field crops. (ca. 60 persons) (10/26/07)

Field Crop Dealer Meeting. Batavia, NY. An update on disease and mycotoxin threats to New York field crops. (ca. 60 persons) (10/25/07)

Field Crop Dealer Meeting. New Hartford, NY. An update on disease and mycotoxin threats to New York field crops. (ca. 60 persons) (10/24/07)

Field Crop Dealer Meeting. Clifton Park, NY. An update on disease and mycotoxin threats to New York field crops. (ca. 60 persons) (10/23/07)

Seed Growers Field Day. Ithaca, NY. Field crop disease update. (ca. 50 persons) (7/5/05)

Small Grains Management Field Day. Aurora, NY. (ca. 75 persons) (6/7/07)

Vermont Crops n' Critters Conference, Bridport, VT. Sustainable wheat health management for the Northeast. (ca. 50 persons) (3/20/07)

Steuben County Crop Symposium, Bath, NY. Field crop disease update. (ca. 120 persons) (2/27/07)

Finger Lakes Soybean and Small Grains Congress, Waterloo, NY. Best management practices for Fusarium head blight. (ca. 100 persons) (2/8/07)

Western New York Soybean and Small Grains Congress, Batavia, NY. Best management practices for Fusarium head blight. (ca. 100 persons) (2/7/07)