U.S. Wheat and Barley Scab Initiative
FY00 Final Performance Report (approx. May 00 – April 01)
July 30, 2001

Cover Page

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Year:	**FY2000 (approx. May 00 – April 01)**
Grant Number:	**59-0790-9-027**
Grant Title:	**Fusarium Head Blight Research**
2000 ARS Award Amount:	**$56,049**

Project

Program Area	Project Title	Requested Amount
Chemical & Biological Control	Uniform fungicide trials to identify safe products that are effective against FHB.	$5,000.00
Chemical & Biological Control	Biological control of Fusarium graminearum	$40,000.00
Chemical & Biological Control	Factors affecting release of Gibberella zeae ascospores	$12,450.00
	Requested Total	$57,450.00[1]

__Gary C. Bergstrom_____July 21, 2001_____
Principal Investigator Date

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

(Form – FPR00)

Project 1: Uniform fungicide trials to identify safe products that are effective against FHB.

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. Background and description of the Uniform Fungicide Trial is provided in the Final Performance report by Marcia McMullen.

2. What were the most significant accomplishments?

We were able to evaluate foliar fungicides and bacterial antagonists under a natural epidemic in which the major impact of the disease was on test weight and vomitoxin contamination rather than grain yield. These are conditions frequently encountered in the soft winter wheat production areas. Since there was no significant foliar disease during early grain development, it can be inferred that spray effects were directly attributable to Fusarium head blight suppression. Several treatments produced statistically significant reductions in disease incidence and Fusarium damaged kernels. Yet, despite excellent spray coverage and nearly perfect spray timing, based on previous research, no treatment reduced scab dramatically as hoped. No treatment resulted in a yield increase that was significantly better at the 95% confidence level than the nontreated control.

Folicur 3.6F (at 4 fl oz, at 6 fl oz, and at 2 fl oz plus 6.2 fl oz BAS 500F) produced the largest (ca. 6 bu) increases in yield. Two treatments, Folicur 3.6F at 6 fl oz, and Folicur 3.6F at 4 fl oz plus the bioprotectant TrigoCor 1448, significantly increased test weight. The most important potential effect of scab fungicides from a New York producer viewpoint is vomitoxin (DON) reduction. Of the synthetic fungicides included in this trial, Folicur 3.6F (4 fl oz) gave the greatest reduction of DON contamination (16 % reduction compared to the untreated control). The bioprotectant TrigoCor 1448 alone and in combination with Folicur 3.6F (4 fl oz) reduced DON 23% and 25%, respectively, compared to the untreated control.

Project 2: Biological Control of Fusarium graminearum

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

There is a need for safe, affordable and efficacious biological and bio-compatible protectants in the integrated management of FHB. This project, like the development of any effective biological control, follows a pattern of step-wise advancement from laboratory to greenhouse and finally to the field. Emphasis was placed upon the selection of organisms, which are likely to be robust under harsh field conditions. Candidate agents were evaluated for use as a heading time field spray, seed treatment, or residue treatment.

2. What were the most significant accomplishments?

Glasshouse evaluation of biocontrol isolates
a) Timing- Incubation of wheat plants for 48 hours in a mist chamber following inoculation with a spore suspension (10^5 cfu/ml) of *Fusarium graminearum* macroconidia resulted in both good incidence of infection (75% and 96%) and adequate seed set. Treatment of the wheat with TrigoCor 1448 24 hours prior to inoculation with the spore suspension, reduced scab by 15 and 22% in the two experiments and increased 100-seed weight by 13.1 % and 45%. TrigoCor 1448 was included as a benchmark in subsequent glasshouse evaluations of other candidate biological control organisms.
b) Isolate evaluation- Treatment with TrigoCor 1448 and TrigoCor 4712 consistently, with only one exception, resulted in decreased disease incidence and increased 100-seed weight when compared to the untreated control. Furthermore, the biocontrol isolate TrigoCor 4712 had the highest 100 seed weight of any treatment in each of the four trials in which it was included. Several other isolates showed promising results as well. Treatment with TrigoCor 1448 and TrigoCor 4712 reduced the DON toxin contamination of the seed by 26.8 % and 71.2 % respectively compared to that present in the non-treated control.

Debris treatment- Treatment of the stem pieces containing nodes with 5% acetic acid was the only treatment that resulted in the complete absence of perithecia and therefore spore discharge. All other treatments resulted in higher numbers of perithecia and ascospore discharge than the control (water). Internode stem pieces and kernels which were collected from the field site at later dates were in more advanced states of decomposition, but the 5% acetic acid treatment also did not produce any perithecia when incubated under favorable laboratory conditions.

Anthesis-time spray- Two of the three bacterial isolates (TrigoCor 1448 and TrigoCor 4712) tested in the Uniform Fungicide trial at the New York location gave slight reductions in the % incidence of scabby heads and % fusarium damaged kernels (%fdk), although test weight and yield were not significantly different. When Folicur (4 fl oz) was added to the TrigoCor 1448 treatment, % incidence of scabby heads and % fdk and DON contamination were the lowest and test weight the highest of any of the treatments included in the trial. Conversely, the biocompatible fungicide HI 2036 SR had a far greater scab incidence and a lower test weight than any other treatment.

Project 3: Factors affecting release of Gibberella zeae ascospores

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

One critical yet unknown aspect of the aerobiology and epidemiology of *Gibberella zeae* is the effect of environmental parameters on the release of ascospores from mature perithecia. This knowledge is a necessary component of scab advisory and forecast systems. Our goal is to pinpoint environmental triggers that initiate ascospore release and affect the duration of release events. We are accomplishing this by two experimental approaches. Time course ascospore-capture from ascocarp-bearing corn stalk tissues is being conducted with a volumetric spore trap in a natural environment where weather variables are monitored. Also we are utilizing a controlled environment chamber to study ascospore release under variable conditions.

2. What were the most significant accomplishments

Protocols for conducting the ascospore release experiments were refined. Preliminary evidence suggested that under natural conditions major events of ascospore release occur predominantly during daylight hours when turbulence in the lower atmosphere is greatest. Major release events were not correlated with any single factor such as hours after rainfall, or change in temperature or relative humidity. In controlled climate chambers held at constant 20 C, with a 14 hour photoperiod and fluctuating relative humidity, ascospore discharge appeared random and of low magnitude compared to the natural setting. Daily rewetting of the substrate appeared to stimulate discrete daily discharge events in the early hours of light for about three days following the second day of wetting the corn stalks.

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. 2000. Effects of foliar fungicides and seed health of winter wheat in New York, 1999. *Fungicide and Nematicide Tests* 55: 336.

Kawamoto, S.O., C.A. Stockwell, G.C. Bergstrom, W.J. Cox and D.J. Otis. 2001. Evaluation of foliar fungicides and bioprotectants for control of Fusarium head blight of winter wheat in New York, 2000. *Fungicide and Nematicide Tests* 56: in press.

Publications (not peer-reviewed)

Maldonado-Ramirez, S.L. and G.C. Bergstrom. 2000. Temporal patterns of ascospore discharge by *Gibberella zeae* from colonized corn stalks under natural conditions. Pages 159-161 in *Proc. 2000 National Fusarium Head Blight Forum*.

Shah, D.A. and G.C. Bergstrom. 2000. Influence of local versus regional factors on incidence of seed infection by *Fusarium*. Pages 176-177 in *Proc. 2000 National Fusarium Head Blight Forum*.

Shah, D.A. and G.C. Bergstrom. 2000. The beta-binomial distribution describes the incidence of seed infection by *Fusarium graminearum* among seedlots in a region. Pages 178-181 in *Proc. 2000 National Fusarium Head Blight Forum*.

Shah., D.A., C.A. Stockwell, S.O. Kawamoto, and G.C. Bergstrom. 2000. Spatial patterns of Fusarium head blight in New York wheat fields during the epidemic of 2000. Pages 174-175 in *Proc. 2000 National Fusarium Head Blight Forum*.

Stockwell, C.A., G.C. Bergstrom, and W.C. da Luz. 2000. Identification of bioprotectants for control of *Gibberella zeae*. Pages 114-117 in *Proc. 2000 National Fusarium Head Blight Forum*.

Presentations

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

- Small Grains Management Field Day, Aurora. (6/13/00)
- Cornell Seed Growers Field Day, Ithaca. (7/6/00)
- Musgrave Research Farm Field Day, Aurora. Fungicides and biocontrol bacteria for management of wheat scab and foliar diseases. (7/7/00)
- Otsego County Mycotoxin Meeting, Cooperstown. (8/30/00)
- Mowhawk Valley Mycotoxin Meeting. Herkimer. (8/30/00)
- Chenango County Mycotoxin Meeting. Norwich. (8/31/00)
- Western New York Soybean and Small Grains Congress, Batavia. (2/15/01).
- Finger Lakes Soybean and Small Grains Congress, Waterloo. (2/16/01).
- New York Cerified Organic Growers Meeting, Geneva. Disease management in organic field crop production. 3/22/01
- Small Grains Committee, New York Seed Improvement Cooperative. Waterloo. (3/28/01)