

**U.S. Wheat and Barley Scab Initiative  
 FY01 Final Performance Report (approx. May 01 – April 02)  
 July 15, 2002**

**Cover Page**

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<b>Year:</b>	<b>FY2001 (approx. May 01 – April 02)</b>
<b>Grant Number:</b>	<b>N/A</b>
<b>Grant Title:</b>	<b>Fusarium Head Blight Research</b>
<b>FY01 ARS Award Amount:</b>	<b>\$ 29,204</b>

**Project**

<b>Program Area</b>	<b>Project Title</b>	<b>Requested Amount</b>
Chem/Bio	Scale-Up of Biomass Production and Field Testing of Biocontrol Agents of FHB	\$ 42,300
	<b>Total Amount Requested</b>	<b>\$ 42,300</b>

\_\_\_\_\_  
Principal Investigator

\_\_\_\_\_  
Date

## **Project 1: Scale-Up of Biomass Production and Field Testing of Biocontrol Agents of FHB**

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

Fusarium head blight (FHB), incited predominantly by *Gibberella zaeae*, can be a devastating disease of wheat and barley in humid and semi-humid regions of the world. Control measures available for combating this disease are limited. In previous research, funded in part by the FHB NRI, we have demonstrated the potential of seven biological control agents, discovered in collaborative research with the Ohio State University, to significantly reduce the severity of FHB in greenhouse and field environments. A critical step in producing a commercially available biocontrol product is devising economically feasible procedures for large-scale, liquid culture production of biomass of the biological agent. Antagonist strains considered for commercial development must also be able to survive cell preservation techniques and maintain high counts of effective cells over time. We are conducting studies to determine the growth potential of candidate biocontrol strains, in shake flasks and 100-L fermentors, in order to determine which strains have the greatest potential for commercial development. Additionally, media and fermentation protocol optimization, inoculum processing, and inoculum preservation studies are conducted to assess the commercial development potential of FHB biocontrol strains. Information gathered is then utilized to mass-produce biomass of a superior FHB biocontrol candidate for field testing in the Uniform Wheat Fungicide and Biocontrol Trial (UWFBT) of the U.S. Wheat and Barley Scab Initiative.

### 2. What were the most significant accomplishments?

Based on superior performance in various liquid culture growth environments, antagonist *Cryptococcus nodaensis* OH 182.9 was selected over our other biocontrol antagonists for large-scale field testing in the UWFBT. Protocols for producing biomass of OH 182.9 were developed from research results. Biomass was produced in 30 and 100-L fermentors, concentrated by centrifugation, resuspended in buffer, frozen, and sent frozen to participants in the 2001 UWFBT. This pre-commercial product significantly reduced FHB disease compared to untreated wheat when averaged over all test sites.

Results that led to these accomplishments included the discovery that biomass production by FHB antagonists *Cryptococcus* sp OH 181.1 and *C. nodaensis* OH 182.9 was not deleteriously affected by autoclaving all components of a semidefined complete liquid medium (SDCL) together demonstrating the utility of a form of the medium that would be most advantageous for commercial use. Antagonist OH 182.9 produced more CFU/ml than did OH 181.1 in every comparison of like medium and production vessel. A linear relationship described CFU/ml over time for frozen OH 182.9 cells resuspended in buffer or in spent broth. Biomass viability of OH 182.9 decayed more rapidly for cells that were resuspended in spent broth before freezing than for cells resuspended in buffer, demonstrating the necessity of separating biomass from spent broth after completing biomass production in liquid culture.

*C. nodaensis* OH 182.9 was chosen over *Cryptococcus* sp. OH 181.1 for use in the 2001 UWFBT due to OH 182.9 obtaining higher maximum CFU/ml and obtaining CFU<sub>max</sub> in less time than OH 181.1. The efficacy of the frozen biomass of both antagonists in reducing FHB severity was similar in greenhouse trials.

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.

### **Publications**

Khan, N.I., Schisler, D.A., Boehm, M.J., Slininger, P.J., and Bothast, R.J. 2001. Selection and evaluation of microorganisms for biocontrol of Fusarium head blight of wheat incited by *Gibberella zeae*. Plant Dis. 85:1253-1258.

\*Schisler, D.A., Khan, N.I., Iten, L.B., and Boehm, M.J. 2001. USDA-ARS, Ohio State University cooperative research on biologically controlling Fusarium head blight:pilot-plant-scale production and processing of biomass of yeast antagonists. Proceedings of the 2001 National Fusarium Head Blight Forum, Erlanger, KY.

\*Schisler, D.A., Khan, N.I, and Boehm, M.J. 2002. Biological control of Fusarium head blight of wheat and deoxynivalenol levels in grain via use of microbial antagonists. Pages 53-69 in: Mycotoxins and Food Safety. J.W. DeVries, M.W. Trucksess, and L.S. Jackson, eds., Kluwer Academic/Plenum Publishers, New York.

### **Abstracts of presentations**

Khan, N.I., Schisler, D.A., Boehm, M.J. Biocontrol of Fusarium head blight of wheat:effect of Tween-80, culture age of antagonist and combining antagonists on disease suppression. Phytopathology. 2001. v. 91:6 (suppl.):Abstract p. S48.

Schisler, D.A., Khan, N.I., Iten, L.B., Boehm, M.J. Scale-up of biomass production, processing and storage for two yeast antagonists of *Gibberella zeae*. Phytopathology. 2001. v 91:6 (suppl.):Abstract p. S80.

\*Schisler, D.A., Jackson, M.A., and Slininger, P.J. Discovering, developing and deploying biological control agents. 223<sup>rd</sup> ACS National Meeting, Orland, Florida, April 7-11, 2002.

### **Popular press articles/interviews**

“Yeast debuts in test on controlling wheat scab”, Agricultural Research Magazine, USDA-ARS, June 2001.

“Aarfusarium ligt wereldwijd onder vuur”, Boerderij/Akkerbouw (Farm and Crops), June 12, 2001. Netherlands.

Radio interview on biologically controlling wheat scab, WMBD with Peoria agri-business personality Colleen Callahan, 3/1/01.

\* Invited oral presentations accompanied these articles