

**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: | NA |
| Grant Title: | Fusarium Head Blight Research |
| FY02 ARS Award Amount: | \$ 87,805 |

Project

| Program Area | Project Title | USWBSI Recommended Amount |
|---------------------|---|----------------------------------|
| CBC | Drying, formulation and field testing of a yeast product for biocontrol of FHB. | \$90,000 |
| | Total Amount Recommended | \$90,000 |

Principal Investigator

Date

Project 1: Drying, formulation and field testing of a yeast product for biocontrol of FHB.

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

The overall goal of our research team is to develop strategies and microorganisms to play a key role in the integrated management of FHB. The transition of effective biological control agents from laboratory discovery to commercial products for the agricultural market is a complex process. In critical steps towards completing this transition, we have discovered, utilized and successfully field tested commercially feasible, large-scale biomass production protocols to create a frozen liquid product composed of our best biocontrol agent, *Cryptococcus nodaensis* OH 182.9, that is effective in reducing Fusarium head blight (FHB). An equally important step in making this transition is the development of drying and formulation techniques that maintain biocontrol strain viability and efficacy since dry formulated biocontrol products are easier and more economical to transport, store and handle. Specific goals for research conducted under the current grant were to discover osmo- or cryoprotectant compounds and develop liquid culture fermentation protocols to foster the production of a dried product that maintains superior levels of viability and efficacy over time. The dried product resulting from this research was then to be field tested in the USWBSI's Uniform Wheat Fungicide and Biocontrol Trial (UWFBT).

2. What were the most significant accomplishments?

The trisaccharide melezitose was characterized, for the first time, as an effective cryoprotectant for microbial biomass. Melezitose and turanose enhanced the survival of freeze-dried biomass of FHB antagonist *C. nodaensis* OH 182.9 by more than 4 orders of magnitude after storing dried biomass at room temperature for 37 days compared to six other cryoprotectants found to be effective when drying biomass of other microorganisms.

Melezitose was effective in extending the shelf-life of OH 182.9 at 100 mM and 50 mM concentrations but was not at concentrations of 10 mM and lower. Amending biomass of OH 182.9 with 10% skim milk was effective in combination with melezitose or alone in extending OH 182.9 shelf-life.

More than 500 liters of OH 182.9 was prepared, freeze-dried, and vacuum packed using a precommercial process of producing OH 182.9 biomass in 100-L fermentors, separating cells from broth using a tubular bowl centrifuge, resuspending the biomass in a solution containing 25 mM melezitose and 1% skim milk, and freeze-drying the product in a 24-L tray freeze-drier. Collaborators field tested the product at over 20 sites in 12 states. The product lost more than a log unit of colony forming units (CFU's) during processing and freeze-drying but then maintained nearly constant CFU's over the next five weeks.

Though cell survival of the precommercial product was satisfactory after freeze-drying, the biocontrol efficacy of this product was less than that of similar concentrations of freshly produced OH 182.9 cells in greenhouse bioassays with high disease pressure. The freeze-dried product containing melezitose and skim milk was not effective in the UWFBT in 2002, in contrast to the success of a frozen OH 182.9 concentrate product in the 2001 UWFBT. A portion of the failure of the freeze-dried product to control disease appears to be due to 25 mM melezitose and 1% skim milk promoting pathogen growth. Alternative biomass production and drying methodologies will be required to produce a dried OH 182.9 biocontrol product that maintains biocontrol efficacy.

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

Schisler, D.A., VanCauwenberge, J.E., and Boehm, M.J. 2002. USDA-ARS, Ohio State University cooperative research on biologically controlling Fusarium head blight 1: Discovery and scale-up of a freeze-drying protocol for biomass of antagonist *Cryptococcus nodaensis* OH 182.9 (NRRL Y-30216). Proceedings of the 2002 National Fusarium Head Blight Forum, Kinko's, Okemos, MI. pp. 115-118.

Schisler, D.A., Boehm, M.J., Hicks, T.E., and Lipps, P.E. 2002. USDA-ARS, Ohio State University cooperative research on biologically controlling Fusarium head blight 2: 2002 field tests of antagonist and antagonist/fungicide mixtures. Proceedings of the 2002 National Fusarium Head Blight Forum, Kinko's, Okemos, MI. pp. 119-122.

Schisler, D.A., Khan, N.I., Boehm, M.J., and Slininger, P.J. 2002. Greenhouse and field evaluation of biological control of Fusarium head blight on durum wheat. Plant Disease 86:1350-1356.

Abstracts*

Core, A.B., Schisler, D.A., Hicks, T.E., Lipps, P.E., and Boehm, M.J. 2002. Population dynamics in the field of a biocontrol agent for Fusarium head blight of wheat. Proceedings of the 2002 National Fusarium Head Blight Forum, Kinko's, Okemos, MI. pg 61.

Schisler, D.A., and VanCauwenberge, J.E. 2002. Discovery and scale-up of freeze drying protocols fro biomass of Fusarium head blight antagonist *Cryptococcus nodaensis* OH 182.9 (NRRL Y-30216). Phytopathology 92:S73.

Schisler, D.A., Khan, N.I., Boehm, M.J., Van Cauwenberge, J.E., and Slininger, P.J. 2003. Discovery, pilot-plant production, and efficacy of antagonists of Fusarium head blight (scab) of wheat. Proceedings of the 8th International Congress of Plant Pathology, paper # 3.85.

* Poster or oral presentations of research results were associated with each of these abstracts.