USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY05 Final Performance Report (approx. May 05 – April 06)
July 14, 2006

Cover Page

PI:	**David Schisler**
Institution:	**USDA-ARS**
Address:	**National Center for Agricultural Utilization Research** **1815 North University Street** **Peoria, IL 61604-3999**
E-mail:	**schislda@ncaur.usda.gov**
Phone:	**309-681-6284**
Fax:	**309-681-6693**
Fiscal Year:	**2005**
FY05 ARS Agreement ID:	**NA**
Agreement Title:	**Formulation and Multiplexing of Yeast OH 182.9 with New FHB Biocontrol Strains.**
FY05 ARS Award Amount:	**$ 35,000**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
CBC	Formulation and Multiplexing of Yeast OH 182.9 with New FHB Biocontrol Strains.	$ 35,000
	Total Award Amount	**$ 35,000**

_____

Principal Investigator 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

Project 1: *Formulation and Multiplexing of Yeast OH 182.9 with New FHB Biocontrol Strains.*

1. What major problem or issue is being resolved and how are you resolving it?
The integration of diverse control measures is now widely considered to offer the greatest opportunity for limiting the impact of Fusarium head blight (FHB). New biological control techniques and strains need to be developed to enhance the great potential of biocontrol for contributing to the integrated control of FHB. Considerable experimental evidence suggests wheat anthers and specifically the compounds choline and betaine in anthers impact FHB disease development. Previously, we isolated 738 strains from wheat anthers, determined 16.5% were able to metabolize choline as a sole carbon source, and found that several strains reduced FHB disease parameters in greenhouse and field tests. We have demonstrated the potential of several antagonists including *Cryptococcus nodaensis* nomen nudum OH 182.9 (NRRL Y-30216) to significantly reduce the severity of FHB in field environments when biomass was produced in laboratory and pilot-scale quantities in liquid culture. Combinations of biological control strains potentially increase the efficacy and consistency of biocontrol. The objective of this study was to determine if combinations of strain OH 182.9 and choline metabolizing strains (CMS) could be identified to enhance biocontrol compared to that obtained with individual strains.

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 combinations of CMS with OH 182.9 frequently reduced FHB disease severity compared to the untreated control in greenhouse tests on spring wheat and field tests on Freedom wheat in Wooster, Ohio, though reductions were only marginally greater than that obtained with strain OH 182.9 used alone. The best disease control (40% reduction in severity compared to the untreated control) was obtained by combining the use of the resistant cultivar Freedom with antagonist combination treatments such as yeast OH 182.9 and Pseudomonas sp. AS 64.4 or OH 182.9 combined with all three CMS. A similar level of control was obtained using Folicur 3.6F. The fungicide and microbial treatments only occasionally reduced (and sometimes increased) FHB on the susceptible cultivar Elkhart.

Impact:
We demonstrated the successful, practical application of integrating diverse taxa of biological control agents with a moderately resistant wheat cultivar (Freedom) to obtain substantial reduction in FHB severity compared to untreated, susceptible wheat cultivars. As microbial mixtures are optimized to consider ecological and metabolically compatible combinations and the components of mixtures are improved through medium optimization, directed selection of strains resistant to fungicides and formulation research, further improvement in the effectiveness and reliability of FHB control can be anticipated.

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?:
Results offer proof of the success and necessity of utilizing and strengthening all available tools in the integrated management of FHB. Production, agricultural and scientific communities have additional evidence of their obligation to promote collaborative research on improving and integrating all available tools for reducing FHB.

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.

Peer-reviewed journal publications

Zhang, S., Schisler, D.A., Jackson, M.A., Boehm, M.J., Slininger, P.J., and Liu, Z.L. 2006. Cold shock during liquid production increases storage shelf-life of *Cryptococcus nodaensis* OH 182.9 after air-drying. Biocontrol Sci. and Technol. (in press).

Invited presentations:

Schisler, D.A. Flowering wheat heads as novel colonization sites for *Gibberella zeae* and introduced antagonists. Phytopathology 95:S129. 2005*.

Schisler, D.A. Fermentation and formulation:crucial focus areas for expediting the development of biocontrol products. Proceedings of the 2005 National Fusarium Head Blight Forum, Office Max Print and Document Services, Okemos, MI. p. 231. 2005**.

Schisler, D.A. Flowering wheat heads as novel colonization sites for FHB pathogen *Gibberella zeae* and introduced antagonists. Assembled faculty and staff of the State Research Center for Applied Microbiology, Obolensk, Russia, September 18, 2005.

* Invited presentation at the Annual Meeting of the American Phytopathological Society, Austin, Texas.
** Invited presentation at the 2005 National Fusarium Head Blight Forum, Milwaukee, Wisconsin.

Symposium Publications:

Schisler, D.A., Boehm, M.J., Lipps, P.E., and Slininger, P.J. USDA-ARS and The Ohio State University cooperative research: greenhouse and field tests of combinations of choline metabolizing strains and antagonist *Cryptococcus nodaensis* OH 182.9 for reducing FHB of wheat. Proceedings of the 2005 National Fusarium Head Blight Forum, Office Max Print and Document Services, Okemos, MI. pp. 232-235. 2005.

Meeting abstracts:

Schisler, D.A., Boehm, M.J., and Slininger, P.J. Dosage requirements and combinations of choline metabolizing strains and antagonist *Cryptococcus nodaensis* OH 182.9 for reducing FHB of wheat. Phytopathology 95:S93. 2005.

Zhang, S., Schisler, D.A., and Boehm, M.J. Evaluation of chemical SAR inducers in combination with *Cryptococcus nodaensis* OH 182.9 for FHB control in wheat. Phytopathology 95:S117. 2005.