U.S. Wheat and Barley Scab Initiative
FY02 Final Performance Report (approx. May 02 – April 03)
July 15, 2003

Cover Page

PI:	**William Bushnell**
Institution:	**USDA-ARS**
Address:	**Cereal Disease Laboratory** **University of Minnesota** **1551 Lindig St.** **St. Paul, MN 55108**
E-mail:	**billb@umn.edu**
Phone:	**612-625-7781**
Fax:	**612-649-5054**
Year:	**FY2002 (approx. May 02– April 03)**
Grant Number:	**NA**
Grant Title:	**Fusarium Head Blight Research**
FY02 ARS Award Amount:	**$ 59,268**

Project

Program Area	Project Title	USWBSI Recommended Amount
EDM	Pathways of Infection and Pathogenesis in Fusarium Head Blight.	$60,750
	Total Amount Recommended	**$60,750**

W. R. Bushnell 7/10/03

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Principal Investigator Date

Project 1: Pathways of Infection and Pathogenesis in Fusarium Head Blight.

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

Efforts to control Fusarium head blight with either resistant varieties or improved management practices are limited by incomplete knowledge of infection pathways in wheat and barley heads. Likewise, alterations within head tissues as disease progresses are poorly understood. Therefore, we are investigating head blight of barley caused by *Fusarium graminearum*, using microscope techniques to follow invasion pathways as well as alterations associated with pathogenesis within tissues. As part of this research, we are investigating the effects of the mycotoxin deoxynivalenol (DON) at the tissue and cellular levels. DON is produced in blighted heads and is postulated to have a role in pathogenesis. Understanding infection pathways and pathogenesis at the tissue and cellular levels will impact favorably on virtually all aspects of Fusarium head blight research, including strategies for breeding for resistance and strategies for managing epidemics in the field.

2. What were the most significant accomplishments?

Physiological effects of deoxynivalenol (DON), a toxin produced by the head blight pathogen, *Fusarium graminearum*, were investigated in detached barley leaves. We confirmed that DON induces light dependent bleaching of leaf tissues within 3-4 days, indicating that the tissues lose both chlorophyll and carotenoid chloroplast pigments. The tissues remain green if incubated in the dark. However, in both light and dark, the tissue becomes degenerate as indicated by loss of electrolytes and by degeneration of chloroplasts as viewed by transmission electron microscopy. In preliminary experiments, calcium ions enhanced the effect of DON, in line with the hypothesis that DON kills plant cells by inducing programmed cell death (PCD). This sets the stage for investigation of the role of PCD in both toxin-treated and infected tissues. Understanding the physiological role of DON in pathogenesis (disease development) will help focus research on possible control strategies using molecular manipulation of barley (and wheat) genomes to ameliorate the effects of toxin.

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.

References 7-10-03

Bushnell, W.R. 2002. Designating types of scab resistance: A discussion. Page 200 in: 2002 National Fusarium Head Blight Proceedings. U.S. Wheat and Barley Scab Initiative, Erlanger, KY, Dec. 7-9, 2002.

Bushnell, W.R. and T.M. Seeland. 2002. What part does programmed cell death play in Fusarium head blight? Page 134 in: 2002 National Fusarium Head Blight Proceedings. U.S. Wheat and Barley Scab Initiative, Erlanger, KY, Dec. 7-9, 2002.

Bushnell, W.R., T.M. Seeland and D.E. Kruger. 2002. Light-dependent bleaching of detached barley leaf tissue by deoxynivalenol. Phytopahtology, 92:511.

Leonard, K.J. and W.R. Bushnell, Eds. 2003. *Fusarium Head Blight of Wheat and Barley*. APS Press, St. Paul, MN, 512 pp.

Muehlbaur, G.J. and W.R. Bushnell. 2003. Transgenic approaches to Fusarium head blight resistance. Pages 318-362 in: K.J. Leonard and W. R Bushnell, Eds., *Fusarium Head Blight of Wheat and Barley*. APS Press, St. Paul, MN.

Seeland, T.M., W.R. Bushnell and D.E. Krueger. 2002. Effects of deoxynivalenol on detached barley leaf segments. Proc. North American Barley Researchers Workshop, Sept. 22-25, Fargo, ND.