

**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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Grant Title:	Fusarium Head Blight Research
FY01 ARS Award Amount:	\$ 54514

Project

Program Area	Project Title	Requested Amount
Epid/Dis. Mgt.	Pathogen Development and Pathogenesis in Fusarium Head Blight	\$ 56,000
	Total Amount Requested	\$ 56,000

 Principal Investigator

 Date

Project 1: Pathogen Development 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?

A) We discovered that deoxynivalenol (DON), a toxin produced by the head blight pathogen, *Fusarium graminearum*, has a bleaching effect when applied to uninfected green leaf tissue. The tissue turned white within 3-4 days of treatment, losing the green and yellow pigments of chloroplasts. This bleaching mimics the loss in pigmentation that occurs in lesions in heads infected by the pathogen. Electron microscopy showed that DON produces characteristic changes in the structure of grana within chloroplasts. Furthermore, the bleaching effect is dependent on light; i.e., DON-treated tissue remained bright green when incubated in darkness. The results support the hypothesis that DON produced in diseased heads has an important role in pathogenesis. The results also highlight the chloroplast for further investigation of the effects of DON. Furthermore, the characteristic structural changes induced by DON in chloroplasts potentially provides a way to determine cytologically where and when DON is active in diseased barley head tissues.

B) Crevices between the palea and lemma were shown to be important pathways for entry into barley florets by the head blight fungus under field conditions. The fungus was shown by light microscopy to be able to enter by following the surfaces lining the apical mouth of the floret or on surfaces lining crevices between the palea and lemma near the floret base. As a result, visible lesions tended to develop preferentially near the apex and base of the floret. With these pathways identified, we can now investigate the possibility of reducing susceptibility by making the pathways less vulnerable to fungal entry.

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.

Bushnell, W.R. 2001. What is known about infection pathways in *Fusarium* head blight? Abstract, p. 105 in 2001 National *Fusarium* Head Blight Forum Proceedings, Erlanger, KY, Dec. 10-12.

Bushnell, W.R., B.E. Hazen and C. Pritsch. 2002. Histology and physiology of *Fusarium* head blight. *In*, *Fusarium* Head Blight of Wheat and Barley, edited by. K.J. Leonard and W.R. Bushnell. APS Press, St. Paul (submitted).

Lewandowski, S. and W.R. Bushnell. 2001. Development of *Fusarium graminearum* on floret surfaces of field-grown barley. Abstract, p.128 in 2001 National Head Blight Forum Proceedings, Erlanger, KY, Dec. 10-12.

Seeland, T. and W.R. Bushnell. 2001. Effects of deoxynivalenol on barley leaf pigmentation. Report, p151-153 in 2001 National *Fusarium* Head Blight Forum Proceedings, Erlanger, KY, Dec. 10-12.