

**faUSDA-ARS / USWBSI
FY04 Final Performance Report
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Cover Page

PI:	Brian Steffenson
Institution:	University of Minnesota
Address:	Department of Plant Pathology 495 Borlaug Hall 1991 Upper Buford circle St. Paul, MN 55108
E-mail:	bsteffen@umn.edu
Phone:	612-625-4735
Fax:	612-625-9728
Year:	FY2004 (approx. May 04 – April 05)
FY04 ARS Agreement ID:	59-0790-1-081
FY04 ARS Agreement Title:	Evaluation of Hordeum Germplasm for Resistance to Fusarium Head Blight.
FY04 ARS Award Amount:	\$ 78,049

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
GIE	Evaluation of Hordeum Germplasm for Resistance to Fusarium Head Blight.	\$ 78,049
	Total ARS Award Amount	\$ 78,049

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: *Evaluation of Hordeum Germplasm for Resistance to Fusarium Head Blight.*

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

FHB threatens the existence of the barley industry in the Upper Midwest. Deployment of resistant cultivars is the most effective and environmentally sound means of managing this disease; however, sources with high levels of resistance to *Fusarium graminearum* and its toxins are lacking. Thus, the primary objective of this research is to identify *Hordeum* germplasm with the highest level of FHB resistance possible. Our specific activities also involve the sourcing of unique *Hordeum* germplasm from foreign genebanks.

2. What were the most significant accomplishments?

Our USWBSI research program is an ongoing effort to systematically evaluate unique *Hordeum* germplasm from the USDA and foreign genebanks for resistance to FHB. The screening of the entire six-rowed spring barley collection (8,100 accessions) from the USDA National Small Grains Collection (NSGC) is complete. Additionally, we have now completed the evaluation of nearly one half of the six-rowed winter barley and wild barley (*Hordeum vulgare* subsp. *spontaneum*) collections of the NSGC. Only 25 accessions with a resistance level similar to that of the historical resistant check Chevron were identified from this work. We have initiated a cooperative project with the N. I. Vavilov All-Russian Scientific Research Institute of Plant Industry (VIR) in St. Petersburg, Russia to source unique *Hordeum* germplasm not present in the USDA collection. In FY04, 283 spring barley accessions from VIR were evaluated for their reaction to FHB at St. Paul and Crookston, Minnesota. The foliar spray (macro-conidia) and grain spawn (ascospores) methods of inoculation were used at these two respective nurseries. Accession 20738 (a six-rowed type) exhibited FHB (2.6%) and DON levels (4.4 ppm) that were lower than those observed on Chevron (3.73% and 8.9 ppm, respectively). One two-rowed type (accession 20733) also exhibited FHB (0.45%) and DON (2.1) levels lower than Chevron.

We are also continuing our efforts to evaluate six-rowed winter and wild barley (*Hordeum vulgare* subsp. *spontaneum*) germplasm for resistance to FHB in China. In 2003-04, we evaluated 616 six-rowed winter and wild barley accessions from the NSGC and VIR. From the NSGC germplasm, 21 winter and 2 wild barley accessions exhibited FHB severities similar to Chevron. Ten winter barley accessions from VIR reacted similar to Chevron with respect to FHB severity.

Accomplishment: Thus, the primary objective of this research is to identify diverse *Hordeum* germplasm with the highest level of FHB resistance possible. We have evaluated over 10,000 *Hordeum* accessions for FHB reaction and identified after repeated phenotyping about 25 that carry useful levels of resistance. These accessions have been distributed to barley breeders for crossing within their FHB resistance-breeding program. Our specific activities also involve the sourcing of unique *Hordeum* germplasm from foreign genebanks. Several thousand *Hordeum* accessions have been acquired over the past several years.

Impact: Resistance to FHB in *Hordeum* is extremely rare. However, this research identified new and unique sources of FHB resistance in barley that can potentially reduce losses due to this devastating disease.

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?:

Barley breeders now have access to new and unique sources of FHB resistance for their programs. Introgression of resistance alleles from these sources into advanced barley cultivars will reduce the detrimental impact of the FHB pathogen and its associated toxins. Moreover, the germplasm we have sourced from foreign genebanks will be accessioned into the USDA National Small Grains Collection for subsequent use by other US scientists.

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 your grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Baluch, S. D., Smith, K. P., Muehlbauer, G. J., Somers, D. A., and Steffenson, B. J. 2004. Investigating FHB QTL associated with the *Vrs1* (row-type) locus on chromosome 2(2H) of *Hordeum vulgare*. In: Canty, S. M., Boring, T., Wardwell, J., and Ward, R. W. (Eds.), Proc. Int. Symp. on Fusarium Head Blight; Incorporating the 8th European Fusarium Seminar; 2004, 11-14 December; Orlando FL, USA. Michigan State University, East Lansing, MI. p. 12.

Franckowiak, J. D., Zhang, B. X., Horsley, R. D., Steffenson, B. J., Smith, K. P., and Neate, S. M. 2004. Evaluation of barley in China for Fusarium head blight resistance. In: Canty, S. M., Boring, T., Wardwell, J., and Ward, R. W. (Eds.), Proc. Int. Symp. on Fusarium Head Blight; Incorporating the 8th European Fusarium Seminar; 2004, 11-14 December; Orlando FL, USA. Michigan State University, East Lansing, MI. p. 58.

Steffenson, B., and Dahl, S. 2004. Assessment of disease spread in barley spikes after single floret inoculation with *Fusarium graminearum*. In: Canty, S. M., Boring, T., Wardwell, J., and Ward, R. W. (Eds.), Proc. Int. Symp. on Fusarium Head Blight; Incorporating the 8th European Fusarium Seminar; 2004, 11-14 December; Orlando FL, USA. Michigan State University, East Lansing, MI. pp. 179-182.

Steffenson, B. J., Dahl, S., Rosengren, E., and Szinyei, T. 2004. Digital disease images for estimating Fusarium head blight severity in barley. In: Canty, S. M., Boring, T., Wardwell, J., and Ward, R. W. (Eds.), Proc. Int. Symp. on Fusarium Head Blight; Incorporating the 8th European Fusarium Seminar; 2004, 11-14 December; Orlando FL, USA. Michigan State University, East Lansing, MI. pp. 183-186.

Hill, N. S., Schwarz, P., Horsley, R., Neate, S., Steffenson, B., Dahleen, L., Cooper, B., Kittle, B., and Jones, A. 2004. Simple and rapid immunoquantification of *Fusarium* in barley and its relationship with DON and FHB scores. In: Canty, S. M., Boring, T., Wardwell, J., and Ward, R. W. (Eds.), Proc. Int. Symp. on Fusarium Head Blight; Incorporating the 8th European Fusarium Seminar; 2004, 11-14 December; Orlando FL, USA. Michigan State University, East Lansing, MI. p. 403.