USDA-ARS / USWBSI
FY03 Final Performance Report (approx. May 03 – April 04)
July 15, 2004

Cover Page

PI:	**Jerome D. Franckowiak**
Institution:	**North Dakota State University**
Address:	**Department of Plant Sciences** **Loftgard Hall 166** **Box 5051** **Fargo, ND 58105-5051**
E-mail:	**jfrancko@badlands.nodak.edu**
Phone:	**701-231-7540**
Fax:	**701-231-8474**
Year:	**FY2003 (approx. May 03 – April 04)**
FY03 ARS Agreement ID:	**59-0790-9-034**
FY03 ARS Agreement Title:	**Enhanced resistance to Fusarium in two-rowed barley.**
FY03 ARS Award Amount:	**$ 70,754**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
VDUN	Enhanced resistance to Fusarium in two-rowed barley.	$ 70,754
	Total Amount Recommended	**$ 70,754**

_____
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: ***Enhanced resistance to Fusarium in two-rowed barley.***

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

This research is designed to improve resistance to Fusarium head blight (FHB), incited primarily by *Fusarium graminearum*, in two-rowed spring malting barley (*Hordeum vulgare*) cultivars for the Upper Midwest. Malting barley growers and their consumers want cultivars that accumulate little or no deoxynivalenol (DON). Many years of breeding are required to achieve this goal; thus, intermediate goals include: 1) identifying good selections from crosses to FHB resistant accessions, 2) improving FHB resistance in locally adapted cultivars by crossing among elite lines, and 3) studying genetic mechanisms that retard incorporation of FHB resistance into locally adapted cultivars. Accessions previously identified as partially resistant to FHB were crossed again to elite breeding lines. The F_5 lines from these crosses were evaluated in FHB screening nurseries near Hangzhou, China and Osnabrock, North Dakota (ND). Advanced lines with low grain protein and good agronomic traits were tested for FHB reactions.

Initial breeding efforts produced few two-rowed barley lines with improved FHB resistance. The best ones were taller and later than adapted cultivars. Genetic studies of quantitative trait loci (QTL) for FHB resistance have demonstrated that several are located in chromosome 2H near loci that control spike type, plant height, and photoperiod response. Linkage distances between marker genes in centromeric region of chromosome 2H are being estimated to better define the problem. FHB resistant progeny from crosses to Chinese barley cultivars will be needed to improve the level FHB resistance in two-rowed barley. Such crosses have been made and the progeny are being tested. Utilization of the plant height and maturity genes from Chinese cultivars may provide an alternative to recombination in chromosome 2H.

2. What were the most significant accomplishments?

Research continues to show that the two-rowed malting cultivar Conlon accumulates less DON than other cultivars recommended for ND. Conlon was planted on 11.8% of the ND barley area in 2003. Evaluations of F_5 lines from crosses between Chinese and ND cultivars showed that some lines have lower FHB incidences than either parent. Testing of the Morex-Harrington doubled haploid lines for FHB response identified QTLs for resistance in chromosomes 2HL and 4HS. The most FHB resistant Chinese cultivars, Shenmai 3, Zhaori 19, and Guan 78-101, were crossed to elite breeding lines and initial FHB tests suggest that large progenies with be required to identify lines with parental levels of FHB resistance. A few breeding lines were identified that have both improved FHB resistance and acceptable agronomic traits. The accumulated results suggest that both adverse linkage and the large number of FHB genes have limited breeding success. The array of maturity and plant height genes present in Chinese cultivars restrict effective evaluation of segregates for FHB reactions. At least eight genes are involved in photoperiod response. These genes interacting with each other and with plant height genes. A new gene for reduced plant height was identified in several Chinese cultivars. Examination of progenies indicates that this semi-dwarf gene may be quite valuable in barley adapted to ND.

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.

Dahleen, L.S., H.A. Agrama, R.D. Horsley, B.J. Steffenson, P.B. Schwarz, A. Mesfin, and J.D. Franckowiak. 2003. Identification of QTLs associated with Fusarium head blight resistance in Zhedar 2 barley. Theor. Appl. Genet. 108:95-104.

Franckowiak, J.D. 2003. Coordinator's report: Chromosome 2H. Barley Genet. Newsl. 33: 108-109.

Franckowiak, J.D., and N.N. Krasheninnik. 2004. Modifying two-rowed spring barley for production in North Dakota. p 349-350. *In* D. Bedoshvili (ed.) International Caucasian Conference on Cereals and Food Legumes. 14-17 June 2004; CIMMYT, Tbilisi, Georgia. (Abstract)

Franckowiak, J.D., N.N. Krasheninnik, and G.T. Yu. 2004. Identifying genes controlling heading date in spring barley. Czech J. Genet. Plant Breed. 40 (Special Issue):44. (Abstract, 9th Internal. Barley Genet. Symp. 20-26 June 2004; Brno, Czech Republic)

Franckowiak, J.D., B.X. Zhang, R.D. Horsley, B.J. Steffenson, K.P. Smith, and S.M. Neate. 2004. Off-season testing of barley in China for Fusarium head blight. Czech J. Genet. Plant Breed. 40 (Special Issue):144. (Abstract, 9th Internal. Barley Genet. Symp. 20-26 June 2004; Brno, Czech Republic)

Krasheninnik, N.N., and J.D. Franckowiak. 2003. Identification of QTLs in the Harrington/Morex barley population for FHB reaction, maturity, and plant height. p. 260-263. *In* S. Canty, J. Lewis, and R.W. Ward (eds.) Proc. National Fusarium Head Blight Forum, 13-15 Dec. 2003; Bloomington, MN. Michigan State University, East Lansing.

Krasheninnik, N.N., and J.D. Franckowiak. 2004. Genetic associations of FHB reaction and morphological traits in barley. Czech J. Genet. Plant Breed. 40 (Special Issue):152. (Abstract, 9th Internal. Barley Genet. Symp. 20-26 June 2004; Brno, Czech Republic)