U.S. Wheat and Barley Scab Initiative
FY00 Final Performance Report (approx. May 00 – April 01)
July 30, 2001

Cover Page

PI:	**Jerome Franckowiak**
Institution:	**North Dakota State University**
Address:	**Dept. of Plant Sciences** **Bolley Drive, Bldg. 78** **Fargo, ND 58105**
Email:	**J_Franckowiak@ndsu.nodak.edu**
Phone:	**701-231-7540**
Fax:	**701-231-8474**
Year:	**FY2000 (approx. May 00 – April 01)**
Grant Number:	**59-0790-9-034**
Grant Title:	**Fusarium Head Blight Research**
2000 ARS Award Amount:	**$63,415**

Project

Program Area	Project Title	Requested Amount
Variety Development & Uniform Nurseries	Enhance resistance to Fusarium in 2-row barley.	$65,000.00
	Requested Total	$65,000.00[1]

_____

Principal Investigator Date

[1] Note: The Requested Total and the Award Amount are not equal.

Project 1: Enhance resistance to Fusarium in 2-row barley.

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

This research effort is designed to generate two-rowed spring malting barley (*Hordeum vulgare*) cultivars suitable for production in the Upper Midwest of the USA that have good resistance to Fusarium head blight (FHB), incited primarily by *Fusarium graminearum*. Because several years of research are required to achieve this goal, intermediate goals include: 1) identifying FHB resistant breeding lines from crosses to FHB resistant accessions, 2) improving FHB resistance in locally adapted cultivars by crossing elite lines to FHB resistant selections, and 3) accumulating FHB resistance genes in a male-sterile facilitated recurrent population. Adapted cultivars and breeding lines were crossed to accessions previously identified as partially resistant to FHB. Selections were made in the F_3 to F_5 generations and were evaluated in FHB screening nurseries at Hangzhou, China and Osnabrock, North Dakota (ND). Selections from the regular breeding program were also tested for FHB response because two-rowed barley cultivars have some resistance to FHB. The best selections were tested in ND for agronomic performance, reactions to other barley diseases, and malt quality parameters.

Unfortunately, lines resulting from the initial breeding effort are not promising as new cultivars. They are taller and later than two-rowed cultivars recommended for production in ND. These agronomic deficiencies are caused by in part by adverse linkages between genes controlling culm length and photoperiod response and genes for FHB resistance in chromosomes 2HL, 4HS, and possibly 7HS. Because several genes affect the expression of each trait, the probability of identifying desirable recombinants is very low. Studies on genetic control of plant height in Midwest barley cultivars and maturity in FHB resistant cultivars from China and Japan are being conducted to identify alternative genes for control of plant height and maturity.

2. What were the most significant accomplishments?

In May 2000, the two-rowed cultivar Conlon, which has a moderate level of FHB resistance, was recommended as a malting barley for the Upper Midwest. It was planted on 5.7% of the ND barley area in 2001. ND18172 was identified as the most promising line from the FHB breeding program. Some Chinese and Japanese barley cultivars with FHB resistance have the semidwarf 1 (*sdw1*) gene for reduced plant height and the *Eam1* and *eam9* genes for early maturity. The short culm 1 (*hcm1*) and *Eam6* genes control plant height and maturity, respectively, in Midwest two-rowed barley. Midwest six-rowed barley has genes for short plant height (*hcm2* and *Zeo3*) and six-rowed spike type (*vrs1* and *Int-c*). The *Eam6*, *hcm1*, *hcm2*, and *vrs1* loci are in the centromeric region of chromosome 2H near two QTLs for FHB resistance, while the *eam9*, *Int-c*, and *Zeo3* loci are in 4HS near a QTL for FHB response. Using 'Bowman' backcross-derived lines, initial FHB results from the Hangzhou nursery indicate that the association between tall, late plants and FHB resistance is caused primarily by linkage. If the *Eam1* gene for long-day response is removed, material from East Asia can be evaluated for FHB response in China and ND. Although the short-day response of *eam9* lines is not observed in ND, the *eam9* gene may interact the *sdw1* gene to prevent late maturity.

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.

Franckowiak, J.D. 2000. Coordinator's report: Chromosome 2H. Barley Genet. Newsl. 30: http://wheat.pw.usda.gov/ggpages/bgn/30/UL1txt_and_figs.htm#barley2.

Franckowiak, J.D. 2000. Coordinator's report: Semidwarf genes. Barley Genet. Newsl. 30: http://wheat.pw.usda.gov/ggpages/bgn/30/UL1txt_and_figs.htm#barley20.

Franckowiak, J.D. 2000. Notes on plant height in six-rowed barley and FHB resistance. p. 107-109. *In* S. Logue (ed.) Volume II, Proc. Eight Int. Barley Genet. Symp., Adelaide University, Glen Osmond, South Australia.

Horsley, R.D., and J.D. Franckowiak. 2000. Barley variety improvement at North Dakota State University. p. 18-23. *In* M. Davis (ed.) Proc. Red River Valley Barley Day, Grand Forks, ND. 6 Jan 2000. American Malting Barley Association, Inc., Milwaukee, WI.