

**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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<b>Year:</b>	<b>FY2001 (approx. May 01 – April 02)</b>
<b>Grant Number:</b>	<b>59-0790-9-033</b>
<b>Grant Title:</b>	<b>Fusarium Head Blight Research</b>
<b>FY01 ARS Award Amount:</b>	<b>\$ 112,130</b>

**Project**

<b>Program Area</b>	<b>Project Title</b>	<b>Requested Amount</b>
Germplasm	Identify sources of resistance to Fusarium head blight in durum wheat	\$ 33,128
Variety/Uniform	Development of durum wheat resistant to Fusarium head blight	\$ 82,058
	<b>Total Amount Requested</b>	<b>\$ 115,186</b>

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Principal Investigator

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Date

**Project 1: Identify sources of resistance to Fusarium head blight in durum wheat**

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

Durum Wheat is very susceptible to Fusarium head blight (FHB) caused by the fungus *Fusarium graminearum* Schwabe (teleomorph *Gibberella Zeae* (Schw.) Petch. Sources of resistance to FHB in durum wheat that are equivalent to the Chinese spring wheat Sumai#3 are not available yet. In previous studies we have identified Langdon *Triticum dicoccoides* 3A substitution line to have a moderate level of resistance to FHB. The level of resistance in the 3A substitution line is not adequate to develop highly resistant durum wheat cultivars. Our objective is to identify better sources of resistance that can be utilized by durum plant breeders to develop FHB resistant cultivars. There are 6000 durum wheat accessions at the National small grain Collection, Aberdeen, ID that are available for evaluating for FHB resistance. We are in the process of evaluating these accessions in field nurseries in China and greenhouses in North Dakota.

2. What were the most significant accomplishments?

In 1998-99 and 1999-00 we evaluated a total of 2500 accessions for FHB resistance at the Academy of Agricultural Science, Plant Protection Institute (AASPPI) in Shanghai, China. Thirty accessions were identified to have a moderate level of resistance. The thirty accessions were reevaluated in the spring 2001 greenhouse at NDSU. Of these, only eight accessions maintained their level of resistance and had disease severity ranging from 19 to 37 %. In 2000-2001 we evaluated additional 2000 accessions at AASPPI, of these, only four accessions were identified to have a moderate level of resistance. These accessions were reevaluated in the Fall 2001 greenhouse at NDSU and shown to have a moderate level of resistance. These four accessions also are being evaluated in replicated trials in the 2002 Prosper FHB field screening nursery. From studies in 1999 and 2000 we identified five lines from ICARDA to have a moderate level of resistance to FHB. These lines were successfully increased at the winter nursery in New Zealand and adequate seed supply was obtained for distribution to wheat researchers working on FHB resistance. In addition to the above germplasm, we obtained from CIMMYT durum wheat lines that are resistant to FHB. These lines did not maintain their level of resistance when evaluated in the 2001 Prosper field FHB screening nursery. These lines are being reevaluated in the 2002 Prosper FHB screening nursery. A new set of 1300 accessions are being evaluated for type II resistance in the 2001-02 growing season in the FHB nursery at AASPPI.

**Project 2: Development of durum wheat resistant to Fusarium head blight**

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

Fusarium head blight (FHB) caused by the fungus *Fusarium graminearum* Schwabe (teleomorph *Gibberella zea* (Schwein.) Petch. has been seriously attacking durum wheat. Since 1993, it is estimated that FHB has cost over \$3 billion in direct and indirect losses in North Dakota. Although fungicides may reduce FHB, using genetic resistance is the most environmentally safe and economical way to control the disease. Durum wheat with appropriate combinations of resistant genes could effectively control the disease. Current durum wheat cultivars do not possess resistance to FHB. The search for sources of resistance is essential to insure the development of FHB resistant durum cultivars. The objective of this project is to incorporate identified sources of resistance into the currently susceptible durum wheat germplasm in order to develop resistant cultivars. These cultivars will insure the stability of good quality durum wheat to the durum industry. This is a long term project because developing FHB resistant cultivars requires 10 to 12 years of research.

## 2. What were the most significant accomplishments?

Langdon *Triticum dicoccoides*-3A (LDN(Dic-3)) substitution line, a line from a FHB recurrent selection established in 1995, and a doubled haploid line were identified to have a moderate level of resistance to FHB. Six segregating populations were developed from crossing the three lines to the durum wheat cultivars Maier and Ben. All six populations were evaluated in the 2000 FHB nursery at Prosper, ND and approximately 30% of lines were selected. In the Fall 2001 greenhouse only the F<sub>3</sub> selected lines from the Ben/LDN (DIC-3A) population were evaluated because of space limitation. Eighteen lines had disease severity lower than 18%. These lines are being evaluated for FHB resistance in the Spring 2002 greenhouse. Selected lines will be sent to New Zealand for seed increase to enter in the preliminary yield trials. Since 1990 we have developed several populations using Sumai#3 as a source of resistance to FHB. Twenty lines were identified from FHB evaluations of these populations at the Academy of Agricultural Science, Plant Protection Institute (AASPPI) in Shanghai, China and in the Spring 2000 greenhouse. A third evaluation in the Fall 2000 greenhouse confirmed the resistance of these lines. The twenty lines were successfully increased in the winter nursery in New Zealand and adequate seed was obtained for yield trial evaluations in the 2001 growing season in North Dakota. The best three FHB resistant lines were crossed to different durum cultivars to develop 25 segregating populations with an average population size of 2000 F<sub>2</sub> plants. Only two populations were evaluated as an F<sub>3</sub> lines for FHB in the Fall 2000 and Spring 2001 greenhouse because of space limitations. Very susceptible lines were eliminated and the remaining lines (Approximately 30% ) are being evaluated as F<sub>4</sub>'s in the 2002 Prosper field screening nursery. A third population was sent to AASPPI for evaluations in 2000-01 Season. Forty four F<sub>3</sub> lines were selected and are being evaluated as F<sub>4</sub>'s in the 2002 Prosper field nursery. The remaining populations are being advanced to be evaluated either at AASPPI or greenhouses in North Dakota. These populations also will be screened with the microsattellite *XGWM 533*.

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.

Rudd, J.C., R.D. Horsley, A.L. McKendry, and E.M. Elias. 2001. Host plant resistance genes for Fusarium head blight: sources, mechanism, and utility in conventional breeding system. *Crop Sci.* 41:620-627.

Elias M. Elias. 2001. Durum wheat varieties and research. 2001 Annual International Durum Forum. Minot, ND 13-14 Nov., 2001. Invited speaker.