U.S. Wheat and Barley Scab Initiative
FY02 Final Performance Report (approx. May 02 – April 03)
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Cover Page

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Grant Number:	**59-0790-9-033**
Grant Title:	**Fusarium Head Blight Research**
FY02 ARS Award Amount:	**$ 111,020**

Project

Program Area	Project Title	USWBSI Recommended Amount
GIE	Identify sources of resistance to Fusarium head blight in durum wheat.	$30,975
VDUN	Development of Durum Wheat resistant to Fusarium Head Blight.	$82,821
	Total Amount Recommended	**$113,796**

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Principal Investigator 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. Our objective is to identify 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. In addition to these we are evaluating germplasm from the International Center of Agricultural Research in the Dry Areas (ICARDA) and International Maize and Wheat Improvement Center (CIMMYT).

2. What were the most significant accomplishments?

In the Fall 1999 greenhouse, we evaluated 115 durum wheat lines that were obtained from ICARDA and CIMMYT. Ten percent of these lines had a moderate level of type II resistance. These moderately resistant lines were reevaluated in the Spring 2000 greenhouse. Five of these lines were verified to be moderately resistant. In 2002 we developed nine populations from crossing and backcrossing durum cultivars to the Tunisian lines. Some of these populations were developed using the double haploid breeding system. Part of these populations will be used to determine the inheritance of FHB resistance in the five lines. The other part of these populations are being advanced in New Zealand to be used for screening and developing durum cultivars resistant to FHB.

We obtained five durum experimental lines from CIMMYT that have moderate level of FHB type II resistant. We evaluated these lines for FHB TYP II resistance in the 2002 field screening nursery at Prosper, ND, and 2001-02 nursery in China. At both locations these lines were susceptible. In the meantime, they were crossed to durum wheat cultivars/experimental lines to develop FHB resistant durum wheat cultivars. Since these lines were susceptible, the emphasis of these crosses shifted to genetic diversity rather than breeding FHB resistance. Thirty accessions were identified to have a moderate level of FHB resistance from the 2000-01 China screening nursery. These 30 lines were reevaluated for FHB type II resistance in the Spring 2001 greenhouses to verify their moderate susceptibility. Of these, only eight accessions had disease severity less than 38%. We reevaluated the eight accessions in the 2002 field screening nursery. Six accessions did not survive the growing condition in North Dakota while the other two had 70% Type II disease severity. All eight accessions were reevaluated in 2002 Fall greenhouse and shown to have disease severity higher than 50%.

In 2001-2002 China screening nursery, we evaluated 1500 durum wheat accessions from the world collection. Only five accessions were identified as moderately susceptible to FHB having a response index of 3.8 to 4 (5 being very susceptible). These accessions will be reevaluated in the Fall 2003 greenhouse.

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. 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?

Since 1990 we have developed several populations using Sumai 3 as a source of resistance to FHB. Twenty lines were identified to have good level of resistance to FHB but they lacked good agronomic and quality traits. The best three FHB resistant lines were crossed to different durum cultivars to develop several segregating populations with an average population size of 2000 F_2 plants. Three populations (pop. 134, 135, and 151) were evaluated in the 2002 prosper FHB screening nursery. Selected lines from these populations were reevaluated in the Spring 2003 greenhouse using the injection method and the microsatellite marker *Xgwn*533. In the meantime these lines were sent to New Zealand for seed increase. Based on FHB data, resistant lines will be harvested in New Zealand to obtain adequate seed for yield trials in 2004. Four populations (pop. 138, 139, 158, and 176) were evaluated for FHB type II resistance in the 2002 Spring and Fall greenhouses. Selected lines from these populations were reevaluated in the Spring 2003 greenhouse using the injection method and the microsatellite marker *Xgwn*533. In the meantime these lines were sent to New Zealand for seed increase. Populations 136 and 137 were evaluated by Dr. Stack in the Fall 2001, selected lines were reevaluated in Spring 2002. Selected lines from Spring 2002 were entered into the 2003 prosper FHB screening nursery and in the meantime were sent to New Zealand for seed increase. Populations 149 and 150 were evaluated in the 2002 Prosper FHB screening nursery, selected lines were reevaluated in the 2002 Fall greenhouse using the injection method and the microsatellite marker *Xgwn*533. Selected lines were entered into the 2003 prosper FHB screening nursery. A total of 63 doubled haploids were developed from Crossing the durum cultivars Maier and Ben to the two best sources of resistance from the Sumai 3 parents. These lines were evaluated for Type II resistance in the 2002 field screening nursery. Selected lines were reevaluated in the 2003 Spring greenhouse using the injection method and the microsatellite marker *Xgwm533* and in the meantime were sent to New Zealand for seed increase. We have developed 268 doubled haploid lines from crossing the durum cultivar Ben to the moderately resistant source LDN(DIC-3A). These lines have been evaluated in a similar manner to the above populations using the injection method and the microsatellite marker *Xgwm2*.

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.

Stack, R.W., E.M. Elias, J. Mitchell Fetch, J.D. Miller, and L.R. Joppa. 2002. Fusrium head blight reaction of Langdon durum-*Triticum dicoccoides* chromosome substitution lines. Crop Sci. 42:637-642.