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

Cover Page

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Year:	**FY2003 (approx. May 03 – April 04)**
FY03 ARS Agreement ID:	**59-0790-9-033**
FY03 ARS Agreement Title:	**Identify and develop durum wheat resistant to Fusarium head blight.**
FY03 ARS Award Amount:	**$ 119,541**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
GIE	Identify sources of resistance to Fusarium head blight in durum wheat.	$ 36,615
VDUN	Development of durum wheat resistant to Fusarium head blight.	$ 82,927
	Total Amount Recommended	**$ 119,541**

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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: ***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 1999 Fall 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 identify QTL'(s) associated with FHB resistance in the five lines. In Spring 2004 the Student Melissa Huhn began surveying microsatellite loci for the FHB resistance in these lines. The other parts of these populations were advanced in New Zealand to be used for screening and developing durum cultivars resistant to FHB.

We obtained 14 durum experimental lines from CIMMYT that have moderate level of FHB type II resistant. These lines were grown in the Spring 2003 greenhouse for quarantine. We will evaluate these lines for FHB resistance in the Fall 2004.

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 were reevaluated in the Fall 2003 greenhouse and showed to have 100% type II disease severity. In 2003-04 we sent 1000 accessions to be evaluated for FHB in the China screening nursery. The accessions were held in quarantine because of the presence of Dwarf Bunt (*Tilletia controversa*) spores. The accessions were replanted in the Spring 2004 greenhouse in Fargo to obtain spore free seed to be sent to china for evaluations in 2004-05 growing season.

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. 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.

2. What were the most significant accomplishments?

Since 1990 we have developed several lines that have the Sumai 3 FHB resistance. The best three 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 were harvested in New Zealand to be evaluated in 2004 Prosper FHB screening nursery and in preliminary yield trials (PYT's). 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. Based on FHB data, resistant lines were harvested in New Zealand to be evaluated in 2004 Prosper FHB screening nursery and in PYT's. Populations 136 and 137 were evaluated by Dr. R.W. Stack in the Fall 2001, selected lines were reevaluated in Spring 2002 and in the meantime were sent to NZ for seed increase. Selected lines from Spring 2002 were entered into the 2003 prosper FHB screening nursery and PYT's. Selected lines from the PYT's will be evaluated in 2004 advanced yield trials (AYT's). 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. Selected lines were increased in 2003-04 NZ growing season and will be evaluated in 2004 PYT's and 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. Based on FHB data, resistant lines were harvested in New Zealand to be evaluated in 2004 Prosper FHB screening nursery and in PYT's. 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 doubled haploid populations.

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

Bhamidimarri S., E.M. Elias, J.L. Gonzalez-Hernandez, and S.F. Kianian. 2003. Comparisons of marker assisted selection to phenotypic selection for FHB resistance in durum wheat*In* Agronomy Abstracts. ASA, Madison, WI., CO1- Bhamidimarri: 795209-Oral.