

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY06 Final Performance Report (approx. May 06 – April 07)
July 16, 2007**

Cover Page

PI:	Elias Elias
Institution:	North Dakota State University
Address:	Department of Plant Sciences 166 Loftsgrad Hall Box 5051 Fargo, ND 58105-5051
E-mail:	elias.elias@ndsu.nodak.edu
Phone:	701-231-8159
Fax:	701-231-8474
Fiscal Year:	2006
USDA-ARS Agreement ID:	59-0790-4-098
USDA-ARS Agreement Title:	Identify and Develop Durum Wheat Resistant to Fusarium Head Blight.
FY06 ARS Award Amount:	\$ 130,521

USWBSI Individual Project(s)

USWBSI Research Area *	Project Title	ARS Award Amount
HGR	Identify Sources of Resistance to Fusarium Head Blight in Durum Wheat.	\$ 38,726
VDUN	Development of Durum Wheat Resistant to Fusarium Head Blight.	\$ 91,795
	Total Award Amount	\$ 130,521

Principal Investigator

Date

* CBCC – Chemical, Biological & Cultural Control
EEDF – Etiology, Epidemiology & Disease Forecasting
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GET – Genetic Engineering & Transformation
HGR – Host Genetics Resources
HGG – Host Genetics & Genomics
PGG – Pathogen Genetics & Genomics
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 7,000 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. List the most important accomplishment and its impact (how is it being used?).
Complete all three sections (repeat sections for each major accomplishment):**

Accomplishment:

To date we have evaluated 7,000 accessions from the world collection. Seventy-two of these accessions had disease severity less than 30% and are being reevaluated in the 2007 FHB nursery at Prosper, ND in 2007.

We have identified five Tunisian lines to have resistance to FHB. A diversity study was conducted using 130 markers across the A and B genomes of 20 lines which include the resistant lines as well as susceptible lines from Tunisia and other hexaploid and tetraploid cultivars. The resistant line Tunisian 7 appears to be significantly different from the other Tunisian lines. The remaining resistant lines Tunisian 18, 34, 36, and 108 were in different clusters. The Susceptible Tunisian lines were clustered together with the exception of one line that was clustered with the resistant Tunisian line 36.

We developed nine populations from crossing and backcrossing durum cultivars to the Tunisian lines. We have selected 250 lines from these populations to be evaluated in preliminary yield trials.

We obtained 14 durum experimental lines from CIMMYT that have moderate level of FHB type II resistant. Two lines maintained their resistance when they were evaluated in the Fall 2004. These two lines are being used as parents in the crossing block. We also obtained 85 durum experimental lines from CIMMYT that have moderate level of Type II resistance. We screened these lines in the 2005 and 2006 spring greenhouses. Nine lines had Type II disease severity less than 30%. These lines are being evaluated in preliminary yield trials.

We have obtained 3,000 accessions from ICARDA for FHB evaluations. After one evaluation of 500 accessions in China, 98 accessions with disease severity less than 30% were selected for further evaluations.

Impact:

Any resistant germplasm that is identified above could potentially lead into the development of FHB resistant durum cultivars. Resistant durum cultivars will generate million of dollars to the farm economy in the Midwest and will insure the stability of the durum industry in the United States.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?

The five Tunisian lines that we have identified to have resistance to FHB are being shared with breeders working on developing FHB resistant durum cultivars.

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 (telomorph *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. List the most important accomplishment and its impact (how is it being used?).
Complete all three sections (repeat sections for each major accomplishment):**

Accomplishment:

The cultivar Divide that have some level of resistance to FHB is being increased to be distributed to producers in the Midwest.

● ***Sumai 3 and Wangshuibai sources of resistance:***

- 8 lines were evaluated in the Uniform Regional Nursery
- 44 lines were evaluated in the Elite Advanced Yield Trials
- 185 lines were evaluated in the Advanced Yield Trials
- 481 lines were evaluated in the Preliminary Yield Trials
- 15 populations were screened in the field and greenhouses

Impact:

The above developed material is the only known improved durum germplasm with Fusarium head blight resistance. This germplasm is vital for the survival of the Midwest durum producers. Since the Midwest produces over 75% of the US durum, this germplasm has a major impact on the pasta industry and the US economy. Divide, based on its FHB resistance and yield advantage and if were to replace 30% of the acreage of the current grown cultivars in the Midwest it would

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?

The producers of North Dakota have a durum cultivar (Divide) that has a moderate level of resistance to FHB.

FY06 (approx. May 06 – April 07)

FY06 Final Performance Report

PI: Elias, Elias

USDA-ARS Agreement #: 59-0790-4-098

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.

None