USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY11 Final Performance Report
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Cover Page

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Fiscal Year:	FY11
USDA-ARS Agreement ID:	59-0206-9-061
USDA-ARS Agreement Title:	Identify and Develop Durum Wheat Resistant to Fusarium Head Blight.
FY11 USDA-ARS Award Amount:	$ 128,585

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
DUR-CP	Develop Durum Wheat Resistant to Fusarium Head Blight.	$ 92,488
DUR-CP	Identify and Develop Durum Wheat Resistant to Fusarium Head Blight.	$ 36,097
	Total ARS Award Amount	**$ 128,585**

Principal Investigator Date

* MGMT – FHB Management
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GDER – Gene Discovery & Engineering Resistance
PBG – Pathogen Biology & Genetics
BAR-CP – Barley Coordinated Project
DUR-CP – Durum Coordinated Project
HWW-CP – Hard Winter Wheat Coordinated Project
VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
SPR – Spring Wheat Region
NWW – Northern Soft Winter Wheat Region
SWW – Southern Soft Red Winter Wheat Region

Project 1: *Develop Durum Wheat Resistant to Fusarium Head Blight.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

Fusarium head blight (FHB) is caused by the fungus *Fusarium graminearum* Schwabe (telomorph Gibberella zea (Schwein.) Petch., which 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 (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):

Accomplishment:

- Sumai 3, Wangshuibai, Tunisian, *T. dicoccoides*, *T. dicoccum*, and *T. carthlicum* sources of resistance:

  - 4 lines were evaluated in the Uniform Regional Nursery
  - 19 lines were evaluated in the Elite Advanced Yield Trial
  - 89 lines were evaluated in the Advanced Yield Trials
  - 575 lines were evaluated in the Preliminary Yield Trials
  - 56 populations were screened in the field and greenhouses
  - 89 new populations were developed

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 65% 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 current grown acreage will generate additional millions of dollars into the economy.

Project 2: *Identify and Develop Durum Wheat Resistant to Fusarium Head Blight.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) 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. To date we have screened all the durum wheat accessions in the National small grain Collection, Aberdeen, ID. There are 15,000 durum wheat accessions at the International Center of Agricultural Research in the Dry Areas (ICARDA) and International Maize and Wheat Improvement Center (CIMMYT). We are in the process of evaluating these accessions in field nurseries in China and greenhouses in North Dakota.

2. List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):

Accomplishment:

- To date we have evaluated 4,521 accessions from ICARDA. After several evaluations in the field and greenhouses three accessions maintained disease severity less than 30%. Twenty-seven populations were developed from crossing the three accessions with adapted germplasm.
- Nine-hundred-eighty-five new accessions were sent to China for evaluation.
- Four-hundred-forty-four selected ICARDA accessions from 2010 were reevaluated in the fall 2011 and spring 2012 greenhouse.
- Twenty-three lines from crosses with CIMMYT lines were evaluated in Advanced Yield Trial.
- Seven lines from crosses with Tunisian lines and six lines from crosses with *T. dicoccoides* were evaluated in the Elite Advanced Yield Trial.
- Seventy lines from crosses with CIMMYT lines were evaluated in preliminary yield trials.
- Ten populations were developed from crossing adapted germplasm with Tunisian 7.
- Thirteen populations were developed from crossing adapted germplasm with *Tiriticum dicoccum.*
- Eight populations were developed from crossing adapted lines to *T. dicoccoides*
- Eight populations were developed from crossing adapted lines to *T. Carthilicum*
- Twenty-seven populations were developed from crossing adapted lines to ICARDA's world collection accessions.

Impact:

Any resistant germplasm that is identified above could potentially lead to the development of FHB resistant durum cultivars. Resistant durum cultivars will generate millions of dollars

into the farm economy in the Midwest and will insure the stability of the durum industry in the United States.

Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI. List the release notice or publication. Briefly describe the level of FHB resistance.

None

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.

Melissa R. Huhn, Elias M. Elias, Farhad Ghavami, Shahryar F. Kianian, Shiaoman Chao, Shaobin Zhong, Mohammed S. Alamri, Amor Yahyaoui, and Mohamed Mergoum. 2012. Tetraploid Tunisian Wheat Germplasm as a New Source of Fusarium Head Blight Resistance. Crop Sci. 52:136-145.

Fakhfakh, M.M., A. Yahyaoui, S. Rezgui, E.M. Elias, and A. Daaloul. 2011. Inheritance of Fusarium head blight resistance in a cross involving local and exotic durum wheat cultivars. Crop Sci. 51:2517-2524.

Ghavami, F., E.M. Elias, S. Mamidi, O. Ansari, M. Sargolzaei, T. Adhikari, M. Mergoum, and S.F. Kianian. 2011. Mixed model association mapping for fusarium head blight resistance in Tunisian-derived durum wheat populations. Genes, Genomes, Genetics 1:209-218.

Chenggen, Chu, Zhixia Niu, Shaobin Zhong, Shiaoman Chao, Timothy L. Friesen, Scott Halley, Elias M. Elias, Yanhong Dong, Justin D. Faris, Steven S. Xu. 2011. Identification and molecular mapping of two QTLs with major effects for resistance to Fusarium head blight in wheat. Theor. Appl. Genet. 127:1107-1119.