

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY12 Final Performance Report  
July 16, 2013**

**Cover Page**

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<b>Fiscal Year:</b>	FY12
<b>USDA-ARS Agreement ID:</b>	59-0206-9-061
<b>USDA-ARS Agreement Title:</b>	Identify and Develop Durum Wheat Resistant to Fusarium Head Blight.
<b>FY12 USDA-ARS Award Amount:</b>	\$ 129,812*

**USWBSI Individual Project(s)**

<b>USWBSI Research Category**</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
DUR-CP	Develop Durum Wheat Resistant to Fusarium Head Blight.	\$ 95,174
DUR-CP	Identify Sources of Resistance to Fusarium Head Blight in Durum Wheat.	\$ 34,638
<b>Total ARS Award Amount</b>		<b>\$ 129,812</b>

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Principal Investigator

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Date

\* Partial funding for this research is under ARS agreement # 59-0206-9-062

\*\* 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 zeae* (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:
  - 2 lines were evaluated in the Uniform Regional Nursery
  - 25 lines were evaluated in the Elite Advanced Yield Trial
  - 90 lines were evaluated in the Advanced Yield Trials
  - 439 lines were evaluated in the Preliminary Yield Trials
  - 53 populations were screened in the field and greenhouses
  - 20 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. The new cultivars such as Carpio, Tioga, and Divide, based on their FHB resistance and yield advantage and the current grown acreage of Divide will generate additional millions of dollars into the economy.

**Project 2:** *Identify Sources of Resistance to Fusarium Head Blight in Durum Wheat.*

**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 4,527 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 new accessions were sent to China for evaluation.
- Four-hundred-eight selected ICARDA accessions from 2012 were reevaluated in the fall 2012 greenhouse.
- One line from a cross with CIMMYT line was evaluated in the Elite Durum Advanced Trial
- Four lines from crosses with CIMMYT lines were evaluated in Advanced Yield Trial.
- Nine populations were developed from crossing adapted germplasm with Tunisian 7.
- Four F<sub>4</sub> populations were advanced from crossing adapted germplasm with Tunisian 7.
- Two F<sub>3</sub> populations were advanced from crossing adapted germplasm with *Triticum dicoccum*.
- Twelve F<sub>4</sub> populations were advanced from crossing adapted germplasm with *Triticum dicoccum*.
- Two F<sub>3</sub> populations were advanced from crossing adapted lines to *T. Carthilicum*
- Five F<sub>3</sub> populations were advanced from crossing adapted lines to *T. dicoccoides*
- Six F<sub>3</sub> populations were advanced from crossing adapted lines to ICARDA's world collection accessions.
- Two F<sub>4</sub> populations were advanced 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.**

Elias E.M., and F.A. Manthey. 2013. Registration of ‘Tioga’ Durum Wheat. J. Plant Reg. 2013 7(1): 69-74.