

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY14 Final Performance Report
July 15, 2015**

Cover Page

PI:	Elias Elias
Institution:	North Dakota State University
Address:	Department of Plant Sciences NDSU Dept. 7670 PO Box 6050 Fargo, ND 58108-6050
E-mail:	elias.elias@ndsu.edu
Phone:	701-231-8159
Fax:	701-231-8474
Fiscal Year:	FY14
USDA-ARS Agreement ID:	59-0206-4-010
USDA-ARS Agreement Title:	Identify and Develop Durum Wheat Resistant to Fusarium Head Blight.
FY14 USDA-ARS Award Amount:	\$ 133,018

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
DUR-CP	Develop Durum Wheat Resistant to Fusarium Head Blight.	\$ 100,387
DUR-CP	Identify Sources of Resistance to Fusarium Head Blight in Durum Wheat.	\$ 32,631
	FY14 Total ARS Award Amount	\$ 133,018

Principal Investigator

Date

* MGMT – FHB Management
 FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
 GDER – Gene Discovery & Engineering Resistance
 PBG – Pathogen Biology & Genetics
 EC-HQ – Executive Committee-Headquarters
 BAR-CP – Barley Coordinated Project
 DUR-CP – Durum Coordinated Project
 HWW-CP – Hard Winter Wheat Coordinated Project
 WES-CP – Western 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 accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:

Accomplishment:

- 23 lines were evaluated in the Elite Advanced Yield Trial
- 49 lines were evaluated in the Advanced Yield Trials
- 200 lines were evaluated in the Preliminary Yield Trials
- 73 populations were screened in the field and greenhouses
- 14 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 60% of the US durum, this germplasm has a major impact on the pasta industry and the US economy. The new cultivars such as Carpio and Joppa, 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 zea* (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 accomplishments and their impact (i.e. how are they 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 5,053 accessions from ICARDA. After several evaluations in the field and greenhouses three accessions maintained disease severity less than 30%. Fifteen populations were developed from crossing the three accessions with adapted germplasm.
- Nine-hundred-ninety five new accessions were sent to China for evaluation.
- Three-hundred-twenty five selected ICARDA accessions from 2014 were reevaluated in the fall 2014 greenhouse.
- Nine F₄ populations were advanced from crossing adapted germplasm with Tunisian 7.
- Five F₄ populations were advanced from crossing adapted germplasm with *Triticum dicoccum*.
- Two F₅ populations were advanced from crossing adapted lines to *T. Carthilicum*
- Two F₄ populations were advanced from crossing adapted lines to *T. dicoccoides*
- Fifteen F₃ 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.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY14 award period. The term “support” below includes any level of benefit to the student, ranging from full stipend plus tuition to the situation where the student’s stipend was paid from other funds, but who learned how to rate scab in a misted nursery paid for by the USWBSI, and anything in between.

- 1. Did any graduate students in your research program supported by funding from your USWBSI grant earn their MS degree during the FY14 award period?**

No

If yes, how many?

- 2. Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY14 award period?**

No

If yes, how many?

- 3. Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

None

If yes, how many?

- 4. Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**

None

If yes, how many?

Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI during the FY14 award period. List the release notice or publication. Briefly describe the level of FHB resistance. If not applicable because your grant did NOT include any VDHR-related projects, enter N/A below.

'Joppa' (PI 673106), spring durum wheat (*Triticum turgidum* L. var. *durum* Desf.) was developed by the North Dakota Agricultural Experiment Station in cooperation with USDA-ARS and released on 1 July, 2013. Joppa had numerically lower FHB disease severity in the field compared to all the durum cultivars including Divide, which is known to have some tolerance to the disease.

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 FY14 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Qijun Zhang, Jason E. Axtman, Justin D. Faris, Shiaoman Chao, Zengcui Zhang, Timothy L. Friesen, Shaobin Zhong, Xiwen Cai, Elias M. Elias, Steven. S. Xu*. 2014. Identification and Mapping of Quantitative Trait Loci for Fusarium Head Blight Resistance in Emmer and Durum Wheat. 2014. National Fusarium Head Blight Forum, December 7-9, 2014, St. Louis at the Arch St. Louis, Missouri.

Xianwen Zhu, Shaobin Zhong, Steven Xu, Elias Elias, and Xiwen Cai*. 2014. Effects of Durum Wheat Background on the Expression of Hexaploid Wheat-Derived Fusarium Head Blight Resistance Genes. 2014. National Fusarium Head Blight Forum, December 7-9, 2014, St. Louis at the Arch St. Louis, Missouri.

Ahmed ElFatih, ElDoliefy, James A. Anderson, Karl D. Glover, Ajay Kumar, Elias M. Elias Shiaoman Chao, Mohammed S. Alamri and Mohamed Mergoum*. 2014. 'Parshall': an indigenous and novel resistance source for fusarium head blight with high quality and adapted hard red spring wheat cultivar. 2014. National Fusarium Head Blight Forum, December 7-9, 2014, St. Louis at the Arch St. Louis, Missouri.