

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY13 Final Performance Report  
July 15, 2014**

**Cover Page**

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<b>Fiscal Year:</b>	FY13
<b>USDA-ARS Agreement ID:</b>	NA
<b>USDA-ARS Agreement Title:</b>	Introgression of Scab Resistance from Emmer and Timopheev Wheat into Durum Wheat.
<b>FY13 USDA-ARS Award Amount:</b>	\$ 41,198

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
DUR-CP	Introgression of Scab Resistance from Emmer and Timopheev Wheat into Durum Wheat.	\$ 41,198
	<b>FY13 Total ARS Award Amount</b>	<b>\$ 41,198</b>

July 8, 2014

Principal Investigator

Date

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\* 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: Introgression of Scab Resistance from Emmer and Timopheev Wheat into Durum Wheat.****1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?**

A major problem relevant to Fusarium head blight (FHB) is that the high breeding value durum wheat (*Triticum turgidum* ssp. *durum*) germplasms with a combination of high levels of FHB resistance, superior quality, and good agronomic traits are not available for U.S. durum wheat breeders. FHB is continuously the most serious threat to durum wheat production in the U.S. To resolve this problem, we have been conducting research to develop elite durum germplasms with improved FHB resistance and superior quality and agronomic performance through the introgression of FHB resistance from other tetraploid species such as emmer (*T. dicoccum*), Persian (*T. carthlicum*), and timopheevii (*T. timopheevii*) into the durum cultivars ('Divide', 'Tioga', 'Carpio', and 'Joppa') that were most recently released in North Dakota.

For the development of elite durum germplasm with improved FHB resistance and superior quality and agronomic performance, we previously developed 30 BC<sub>1</sub>-derived advanced lines (BC<sub>1</sub>F<sub>7-10</sub>) and DH lines with improved FHB resistance derived from four *T. dicoccum* accessions (PI 41025, PI 254188, PI 254193, and PI 272527), two *T. carthlicum* accessions (PI 61102 and PI 94748), and the hexaploid wheat line PI 277012. These lines were evaluated in two FHB nurseries (Fargo and Prosper) in the summer of 2013 and 13 of the lines were also evaluated in greenhouses by the collaborators at North Dakota State University, Fargo, ND and USDA-ARS Hard Winter Wheat Genetics Research Unit, Manhattan, KS for independent verification.

Seven of the BC<sub>1</sub>-derived advanced (BC<sub>1</sub>F<sub>7-10</sub>) lines (10FAR2627 and 10FAR2891 from Divide/PI272527//Divide, 08F285 and 08G33 from Ben/PI41025//M, 07F459 from Lebstock/PI94748//Lebstock, and 10Ae564 from Lebsock/PI277012//Lebsock) and a DH line (LP102-14 from Lebsock/PI61102) were previously backcrossed with three new ND cultivars Tioga, Carpio, and Joppa. Approximately 600 BC<sub>1</sub>F<sub>3</sub> progenies were evaluated in two FHB nurseries (Fargo and Prosper, ND) and in the greenhouse in the summer of 2013. Based on the field evaluation, about 324 BC<sub>1</sub>F<sub>4</sub> progenies with low FHB disease severity were selected and evaluated in the greenhouse using a replicated experiment. They are also being evaluated using replicated experiments in two FHB nurseries (Fargo and Prosper, ND) in the summer of 2014.

For introgression of the 5A QTL derived from *T. timopheevii* PI 343447 into ND durum cultivars, the spring wheat line TC67 carrying the 5A QTL from PI 343447 was previously backcrossed with Divide, Tioga, Carpio, and Joppa. A total of 236 BC<sub>1</sub>F<sub>1</sub> plants from these backcrosses were evaluated in the greenhouse in the spring of 2014 and the BC<sub>1</sub>F<sub>2</sub> progenies from 23 BC<sub>1</sub>F<sub>1</sub> plants with low FHB disease severity were selected. To speed up the development of FHB-resistant cultivars through doubled haploids, we have produced about 200 hybrid seeds from a cross between the durum line 10Ae564 and the durum cultivar

Divide (low cadmium genotype). The low cadmium Divide was developed from the backcrosses Divide/Strongfield//6\*Divide. The hybrid seeds will be used for the production of 300 DH lines in the coming season.

- 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:**

The FHB resistance in 12 BC<sub>1</sub>-derived advanced (BC<sub>1</sub>F<sub>7-10</sub>) lines (five, three, one, and three lines derived from Divide/PI272527//Divide, Ben/PI41025//Maier, Lebsock/PI254188/Alkabo, and Lebsock/PI277012//Lebsock, respectively) have been independently verified by the collaborators at North Dakota State University, Fargo, ND and USDA-ARS Hard Winter Wheat Genetics Research Unit in Manhattan, KS. These lines are currently being increased for public releases. They are also being evaluated in a yield and quality trial at two locations (Langdon and Prosper, ND).

Approximately 300 BC<sub>1</sub>F<sub>4</sub> progenies with low FHB disease severity were selected from backcrosses of seven BC<sub>1</sub>-derived advanced lines with three new ND cultivars Tioga, Carpio, and Joppa. Forty-six of the progenies exhibited high levels of FHB resistance and good agronomic traits.

**Impact:**

The durum line 10FAR2778 (10Ae564), which may carry 5AS and 5AL QTLs for FHB resistance derived from the hexaploid wheat line PI 277012, was being used in two durum wheat breeding programs in the U.S.

Several durum lines with high levels of FHB resistance and good agronomic traits are going to be included in the winter nursery of the NDSU durum breeding program in the fall of 2004.

FY13 (approx. May 13 – May 14)

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PI: Xu, Steven S.

USDA-ARS Agreement #: NA

**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 FY13 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.**

None.