**USDA-ARS/**
**U.S. Wheat and Barley Scab Initiative**
**FY11 Final Performance Report**
**July 13, 2012**

# Cover Page

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| **Fiscal Year:** | FY11 |
| **USDA-ARS Agreement ID:** | NA |
| **USDA-ARS Agreement Title:** | Molecular Mapping and Introgression of Scab Resistance derived from Emmer Wheat. |
| **FY11 USDA-ARS Award Amount:** | $ 38,000 |

**USWBSI Individual Project(s)**

| USWBSI Research Category* | Project Title | ARS Award Amount |
|---|---|---|
| DUR-CP | Molecular Mapping and Introgression of Scab Resistance derived from Emmer Wheat. | $ 38,000 |
| | **Total ARS Award Amount** | **$ 38,000** |

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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:** *Molecular Mapping and Introgression of Scab Resistance derived from Emmer Wheat.*

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

   Durum wheat (*Triticum turgidum* L. subsp. *durum*) is an important cereal specialized for making pasta products. Since the mid-1990s, durum wheat production in the U.S. has been seriously threatened by Fusarium head blight (FHB). Compared to bread wheat (*T. aestivum* L.), durum wheat is more vulnerable to FHB because a good source of FHB resistance is not available in durum wheat. Introgression of the FHB resistance from bread wheat and its related species into durum wheat has met with limited success. Thus, the major problem in durum wheat production is that durum cultivars with high levels of FHB resistance are not available for U. S. famers. To resolve this problem, we have been conducting research to identify and transfer FHB resistance from other tetraploid wheat sub-species such as emmer (*T. dicoccum*) and Persian (*T. carthlicum*) wheat to durum cultivars adapted to the Northern Great Plains.

   We previously identified two *T. dicoccum* accessions (PI 41025 and PI 272527), two *T. carthlicum* accessions (PI 61102 and PI 94748), and a hexaploid wheat line (PI 277012) with FHB resistance. Seven BC1-derived advanced lines (10FAR2627 and 10FAR2891 from Divide/PI 272527//Divide, 08F285, 08G33, and 08G105 from Ben/PI 41025//Maier, 07F459 from Lebstock/PI 94748//Lebstock, and 10FAR2778 from Lebsock/PI 277012//Lebsock), and one double haploid (LP102-14 from Lebsock/PI 61102) with improved FHB resistance have been selected based on the evaluations in the greenhouse and field nurseries. These lines have been crossed and backcrossed with the new ND durum cultivar 'Tioga' and two elite durum lines (D03028 and D04581). Approximately 2,000 $BC_1F_1$ plants were evaluated for Type II resistance in the greenhouse in the fall of 2011. Their $BC_1F_2$ progeny are being evaluated in greenhouse and field nurseries in three locations (Fargo, Langdon, and Prosper) during the summer of 2012.

   To map the FHB resistance in *T. dicoccum* accessions PI 41025, the population BP025 (durum 'Ben'/PI 41025) of 200 F2:7 recombinant inbred (RI) lines have been evaluated for Type II resistance in the greenhouse for three seasons using a randomized complete block design (RCBD) with three replications. The population will be genotyped with 90K wheat SNP makers for QTL analysis in the coming season.

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:**
   Twenty-five durum lines ($BC_1F_7$ or $BC_1F_8$) with improved FHB resistance derived from hexaploid wheat PI 277012 and *T. dicoccum* accessions PI 254188, PI 254193, and PI 272527, respectively, were further verified through greenhouse and field evaluations.

**Impact:**

The three new durum lines (10FAR2627, 10FAR2891, and 10FAR2778) with improved FHB resistance are being used to develop elite durum wheat germplasm with FHB resistance in collaboration with NDSU durum wheat breeder.

**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.**

Chu CC, Niu Z, Zhong S, Chao S, Friesen TL, Halley S, Elias EM, Dong YH, Faris JD, Xu SS (2011) Identification and molecular mapping of two QTLs with major effects for resistance to Fusarium head blight in wheat. Theor. Appl. Genet. 123:1107–1119.

Cai X, Elias EM, Xu SS, Kianian S, Zhong S, Faris JD, Chao S (2011) Fusarium head blight resistance in durum wheat – Progress and challenge. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis and D. Van Sanford (Eds.), Proceedings of the 2011 National Fusarium Head Blight Forum ( pp. 12). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Zhong S, Chu CG, Xu SS, Ali S, Puri1 KD, Mergoum M, Chao S (2011) Identification and mapping of QTLs for FHB resistance in a synthetic hexaploid wheat line. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis and D. Van Sanford (Eds.), Proceedings of the 2011 National Fusarium Head Blight Forum ( pp. 64). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.