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

Cover Page

<table>
<thead>
<tr>
<th>PI:</th>
<th>J. Paul Murphy</th>
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<td>Institution:</td>
<td>North Carolina State University</td>
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| Fiscal Year: | FY11                  |
| USDA-ARS Agreement ID: | 59-0206-9-083        |
| USDA-ARS Agreement Title: | Breeding for FHB Resistance in the Southeaster U.S. - Uniform Nursery and Marker Characterization. |
| FY11 USDA-ARS Award Amount: | $ 46,355 |

USWBSI Individual Project(s)

<table>
<thead>
<tr>
<th>USWBSI Research Category*</th>
<th>Project Title</th>
<th>ARS Award Amount</th>
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<tbody>
<tr>
<td>VDHR-SWW</td>
<td>Enhancement of Fusarium Head Blight Resistance in the Southeastern U.S. Germplasm.</td>
<td>$ 46,355</td>
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<td><strong>Total ARS Award Amount</strong></td>
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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:  Enhancement of Fusarium Head Blight Resistance in the Southeastern U.S. Germplasm.

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) became an annual feature of wheat production in North Carolina during the past decade. During the past five seasons, serious FHB loses were observed in the northeast region of the state in 2008, and the Piedmont and northeast in 2009. During the past two seasons, dry conditions around anthesis saved us from measureable damage, but isolated outbreaks were reported by growers. Thus, the major problem being resolved is to increase acreage planted with varieties with improved FHB resistance to reduce DON in the US grain supply.

   I am resolving this problem by:

   1) Conducting variety development research to combine high levels of FHB resistance with overall agronomic and end-use quality in NC State variety releases. We make 500 new crosses annually with the majority containing parents exhibiting moderate levels of FHB resistance. We evaluate 30,000 head rows and several thousand yield plots annually. NC State is a member of the SUNGRAINS breeding cooperative with extensive cooperative testing of advanced lines and sharing of germplasm between the five participant universities. In addition to in-house breeding lines, we evaluate the Gulf Atlantic Nursery and NC Official Variety Test entries in replicated trials in our misted / inoculated scab nursery.

   2) Increasing efficiency of Southern breeding programs to develop and release FHB resistant varieties by coordinating the Uniform Southern Soft Red Winter Wheat Scab Nursery involving 13 cooperators in US and Europe. I solicit entries, mail seed to cooperators, compile results, analyze the data and produce hard copy and web based reports annually.

   3) Developing new breeding technologies to further enhance short term and long term improvement of FHB resistance and to efficiently introgress effective resistance genes into breeding germplasm. One graduate student (Maloney) is mapping native FHB resistance in NC-Neuse. A second graduate student (Peterson) is validating markers for resistance in NC-Neuse and Bess in a DH population. We cooperated with VA-Tech and Univ. of Maryland in graduate student studies to map native resistances in two other parents. Our doubled haploid program, designed to speed the variety development process, resulted in 66 doubled haploid lines entering advanced yield trials in 2012-13. Ten to twenty three-parent and F$_2$ populations are sent to the Genotyping Center annually to undergo marker assisted selection.
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:**
Collected data on 182 RILs from the NC-Neuse / AGS 2000 population at two locations. Second year of data collection. Constructed map of population containing over 1,000 SSR, DArT, and SNP markers. Collected data on 113 DH lines from the cross of NC-Neuse / Bess at two locations. First year of data collection. Collected data in one NC location for graduate student research projects based in VA and MD.

**Impact:**
These are ongoing studies to map resistance in NC-Neuse, and validate resistance QTLs in NC-Neuse and Bess. In the interim we have identified DH lines in the NC-Neuse / Bess population that will be entered into our Wheat Observation Yield Test and our Crossing Block in fall 2012.

**Accomplishment:**
Four NC entries in the 2011-12 Uniform Southern Soft Red Winter Wheat Scab Nursery exhibited among the best levels of FHB resistance in the test. Two lines come from our DH program with one combining *Fhb1* resistance with excellent overall agronomic quality, and adaptation to the southeast. Three other DH lines exhibiting moderate FHB resistance have made it to our in-house Wheat Advanced Test, after making the cut in the SUNGRAINS Preliminary Test in four states.

**Impact:**
Immediate impact is the availability of these lines as parents to the entire breeding community starting in fall 2012. The doubled haploid materials are coming on-line four years earlier than if they were developed using conventional methods.

**Accomplishment:**
Coordinated and developed report for the 2012 Uniform Southern FHB Nursery, and I am in the process of coordinating the 2013 Southern FHB Nursery.

**Impact:**
This nursery is a key component of the overall variety development and germplasm exchange efforts in the southern soft wheat breeding community.
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.

No varieties or germplasms officially released this year.

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.


