# USDA-ARS

## U.S. Wheat and Barley Scab Initiative

**FY18 Performance Report**

**Due date:** September 23, 2019

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### Cover Page

<table>
<thead>
<tr>
<th>Cooperating Principle Investigator (CPI):</th>
<th>David Van Sanford</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Institution:</strong></td>
<td>University of Kentucky</td>
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<tr>
<td><strong>E-mail:</strong></td>
<td><a href="mailto:dvs@uky.edu">dvs@uky.edu</a></td>
</tr>
<tr>
<td><strong>Phone:</strong></td>
<td>859-338-2409</td>
</tr>
<tr>
<td><strong>Fiscal Year:</strong></td>
<td>2018</td>
</tr>
<tr>
<td><strong>USDA-ARS Agreement ID:</strong></td>
<td>58-6070-8-020</td>
</tr>
<tr>
<td><strong>USDA-ARS Agreement Title:</strong></td>
<td>Accelerate the Development of FHB-Resistant Soft Red Winter Wheat Varieties.</td>
</tr>
<tr>
<td><strong>FY18 USDA-ARS Award Amount:</strong></td>
<td>$ 74,424</td>
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</tbody>
</table>
| **Recipient Organization:**              | University of Kentucky Research Foundation  
University Station  
Lexington, KY 40506-0057 |
| **DUNS Number:**                        | 939017877 |
| **EIN:**                                 | 61-6033693 |
| **Recipient Identifying Number or Account Number:** | 3200002116 |
| **Agency PI:**                           | Gina Brown-Guedira |
| **Project/Grant Reporting Period:**      | 8/1/18 - 7/31/19 |
| **Reporting Period End Date:**           | 07/31/19 |

### USWBSI Individual Project(s)

<table>
<thead>
<tr>
<th>USWBSI Research Category*</th>
<th>Project Title</th>
<th>ARS Award Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDHR-NWW</td>
<td>Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties.</td>
<td>$ 69,915</td>
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<tr>
<td>VDHR-NWW</td>
<td>Male Sterile Facilitated Recurrent Selection for FHB Resistance.</td>
<td>$ 953</td>
</tr>
<tr>
<td>VDHR-NWW</td>
<td>Coordinated Phenotyping of Uniform Nurseries and Official Variety Trials.</td>
<td>$ 3,556</td>
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</tbody>
</table>

**FY18 Total ARS Award Amount**

$ 74,424

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* MGMT – FHB Management  
FST – Food Safety & Toxicology  
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  
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
FY18 Performance Report
PI: Van Sanford, David
USDA-ARS Agreement #: 58-6070-8-020
Reporting Period: 8/1/18 - 7/31/19

**Project 1:** Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties.

1. **What are the major goals and objectives of the project?**
   1) Develop and release improved scab resistant varieties; 2) Develop and release improved scab resistant germplasm; 3) generate new knowledge on the inheritance of FHB resistance to expedite the breeding process and 4) communicate the importance of BMP to growers, crop consultants, extension agents and other stakeholders in the soft wheat industry.

2. **What was accomplished under these goals?** *Address items 1-4) below for each goal or objective.*
   1) major activities- OBJ.1,2,3: More than approximately 3500 individual headrows were screened in the scab nursery at Lexington, KY. Material screened included breeding lines, uniform scab nurseries, other cooperative nurseries, released cultivars, segregating populations and genetic studies. Approximately 470 crosses were made during FY17, all of which involved at least one scab resistant parent. Breeding populations from F2 through F5 were selected for advancement.

   2) specific objectives
      (1) screening – as described above
      (2) breeding – crossing and population advancement as noted above
      (3) collaboration – grew uniform scab nurseries, other collaborative nurseries and participated in male sterile project
      (4) outreach – communicated findings to stakeholders through newsletters, web and at meetings and field days

   3) significant results
      - The scab nursery was successful in providing an excellent environment for identifying resistant vs susceptible phenotypes. This was helpful to the breeding effort in that it allowed us to collect high quality data so that our selection of resistant lines was done with confidence. This was also useful for genetic studies such that we were able to assess the effectiveness of minor QTL in managing scab.
      - Some natural scab infection in F4, F5 and doubled haploid headrows allowed us to select for resistance in a generation which we cannot include in the scab nursery because there are too many lines.
      - Our FDK and DON levels were high, but CVs were reasonably low. This allowed us to provide good data to other breeding programs with respect to collaborative nurseries like the Northern, Preliminary Northern and Southern uniform scab nurseries along with the Mason Dixon nursery.
      - FHB alerts and the importance of resistant varieties and well timed fungicides continue to be a familiar refrain at our annual wheat field day and winter wheat grower meeting.

4) key outcomes or other achievements

(Form – PR18)
During this reporting period, we identified several high yielding breeding lines with good scab resistance that includes both native resistance and $Fhb1$ based resistance. In a number of cases, the native resistance has been resolved into specific QTL that the Eastern Regional Genotyping lab has been using in its haplotype analysis the last 2 years.

3. **What opportunities for training and professional development has the project provided?**

Graduate students Lisa Tessman, Virginia Verges and Jesse Carmack all were exposed to excellent training in scab screening and breeding for scab resistance - specifically all gained experience in rating FHB on the plant and in kernels. They organized the scab nursery according to heading date and planned disease scoring accordingly. All presented their work at either the Scab Forum, the ASA meetings, and/or the regional Eastern Wheat Workers meeting in Raleigh in April 2019.

4. **How have the results been disseminated to communities of interest?**

As noted above, results have been shared through newsletters, field days, grower meetings and web delivery of information and data. Data from the 2018 State Variety Trial that was grown in the scab nursery is online in ScabSmart currently, where growers can find DON levels for varieties of interest. This came about through our collaboration with Bill Bruening who runs the small grains variety trials.
**Project 2: Male Sterile Facilitated Recurrent Selection for FHB Resistance.**

1. **What are the major goals and objectives of the project?**
   The goal is for this project to further develop several pools of adapted breeding lines with genes for FHB resistance derived from multiple sources.

2. **What was accomplished under these goals?** *Address items 1-4) below for each goal or objective.*
   1) Major activities: Intermating among male sterile and male fertile plants occurred.
   2) Specific objectives: Allow intermating of diverse sources of resistance.
   3) Significant results: Another cycle of recurrent selection was carried out.
   4) Key outcomes or other achievements: Resistant plants were identified.

3. **What opportunities for training and professional development has the project provided?**
   PhD students Lisa Tessman, Virginia Verges and Jesse Carmack learned about recurrent selection and the use of male sterility in a breeding program.

4. **How have the results been disseminated to communities of interest?**
   To date there have not been outcomes or results suitable for dissemination because this is a long term project in which much time has been spent on intermating and creating new gene combinations. Most or all PI’s have begun to extract lines from the population; these lines will comprise outputs and results that can be disseminated outside the project group.
Project 3: *Coordinated Phenotyping of Uniform Nurseries and Official Variety Trials.*

1. **What are the major goals and objectives of the project?**

   The goals of this project are to: phenotype in multiple environments advanced breeding lines that are candidates for release; generate FHB and agronomic data along with milling and baking quality data that can be stored in T3, an online database.

2. **What was accomplished under these goals?** *Address items 1-4) below for each goal or objective.*

   1) Major activities – FHB screening
   
   Accomplishment: We phenotyped three regional uniform scab nurseries that we grow (Northern, Preliminary Northern and Southern uniform soft wheat scab nurseries) along with our advanced and regional collaborative nurseries and our state variety trial. In some cases detailed observations on incidence, severity, FDK, ISK and DON were recorded; for other nurseries we measured FHB rating (0-9) and FDK and DON. In all nurseries and trials we measured heading date and height.

   2) Specific objectives: create a favorable screening environment.

   3) Significant results: A high level of scab pressure was created which allowed identification of resistant lines.

   4) Key outcomes or other achievements: Uniform and regional nursery data provided breeders with assessments of their lines in multiple screening environments.

3. **What opportunities for training and professional development has the project provided?**

   PhD students Lisa Tessman, Jesse Carmack and Virginia Verges collected screening data for the uniform scab nurseries and the Mason Dixon Nursery as well as the KY Wheat Variety Trial.

4. **How have the results been disseminated to communities of interest?**

   Results communicated via written and web based reports; data was posted to T3, the online database.
Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY18 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 FY18 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 FY18 award period?

   YES
   
   If yes, how many?

   One student, Lisa Tessman graduated.

3. Have any post docs who worked for you during the FY18 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?

   NO
   
   If yes, how many?

4. Have any post docs who worked for you during the FY18 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?

   NO
   
   If yes, how many?
Release of Germplasm/Cultivars

**Instructions:** In the table below, list all germplasm and/or cultivars released with full or partial support through the USWBSI during the FY18 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations.

**NOTE:** Leave blank if you have nothing to report or if your grant did NOT include any VDHR-related projects.

<table>
<thead>
<tr>
<th>Name of Germplasm/Cultivar</th>
<th>Grain Class</th>
<th>FHB Resistance (S, MS, MR, R, where R represents your most resistant check)</th>
<th>FHB Rating (0-9)</th>
<th>Year Released</th>
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Add rows if needed.

**NOTE:** List the associated release notice or publication under the appropriate sub-section in the ‘Publications’ section of the FPR.

**Abbreviations for Grain Classes**
- Barley - BAR
- Durum - DUR
- Hard Red Winter - HRW
- Hard White Winter - HWW
- Hard Red Spring - HRS
- Soft Red Winter - SRW
- Soft White Winter - SWW

(Form – PR18)
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Publications, Conference Papers, and Presentations

Instructions: Refer to the FY18-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY18 grant. Only include citations for publications submitted or presentations given during your award period (8/1/18 - 7/31/19). If you did not have any publications or presentations, state ‘Nothing to Report’ directly above the Journal publications section.

NOTE: Directly below each reference/citation, you must indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in publication/presentation. See example below for a poster presentation with an abstract:

Status: Abstract Published and Poster Presented  
Acknowledgement of Federal Support: YES (poster), NO (abstract)

Journal publications.

Status: Published  
Acknowledgement of Federal Support: YES

Status: Paper Published and Poster Presented  
Acknowledgement of Federal Support: YES (poster), YES (paper)

Status: Paper Published  
Acknowledgement of Federal Support: YES

Status: Paper Published  
Acknowledgement of Federal Support: YES


(Form – PR18)
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winter wheat grown in Virginia. Published 22 Feb 2019 PLOS ONE
https://doi.org/10.1371/journal.pone.0208217
Status: Paper Published
Acknowledgement of Federal Support: YES

Status: Paper Published
Acknowledgement of Federal Support: YES

Status: Published
Acknowledgement of Federal Support: YES

Books or other non-periodical, one-time publications.

NOTHING TO REPORT

Other publications, conference papers and presentations.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES

Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES