USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY17 Final Performance Report
Due date: July 31, 2018

Cover Page

Principle Investigator (PI):	Floyd Dowell
Institution:	USDA-ARS
E-mail:	floyd.dowell@ars.usda.gov
Phone:	785-776-2753
Fiscal Year:	2017
USDA-ARS Agreement ID:	N/A
USDA-ARS Agreement Title:	Single Kernel Sorting Technology for Enhancing Scab Resistance and Grain Quality.
FY17 USDA-ARS Award Amount:	$ 21,600

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
HWW-CP	Single Kernel NIR Sorting Technology for Enhancing Scab Resistance and Grain Quality.	$ 21,600
	FY17 Total ARS Award Amount	**$ 21,600**

_____   _____
Principal Investigator   Date

Project 1: *Single Kernel NIR Sorting Technology for Enhancing Scab Resistance and Grain Quality.*

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

   To develop/improve NIRS techniques for evaluation of DON levels in wheat grains and using those NIR techniques for developing methods to assess FHB resistance components in wheat breeding materials to help streamline development of FHB resistant wheat cultivars.

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

   We studied the influence of variability in moisture content of kernels at the time of analysis on the performance of NIR calibration for estimating DON levels in single wheat kernels.

   We completed a multi-season study using FTNIR spectroscopy to evaluate DON levels in bulk wheat grain samples from FHB nursery trials.

   We developed a NIR technique to evaluate FHB resistance to disease spread and resistance to DON accumulation in wheat germplasm by using artificially inoculated wheat spikes.

   2) specific objectives

   To use automated visible and near-infrared (NIR) spectroscopy instrumentation to sort scab-damaged kernels from asymptomatic kernels, to sort kernels with no measurable DON from this with high DON levels, and sort hard from soft kernels in lines where breeders are attempting to introduce scab resistant traits from soft wheat into hard wheat.

   3) significant results

   Variations in kernel moisture levels should be taken into account when developing NIR calibrations and when those calibrations are used for estimating DON levels in grain samples. Best results are obtained when samples being analyzed have the moisture levels similar to the moisture levels of the calibration samples. NIR spectroscopy can also be used to accurately estimate moisture contents of kernels being analyzed for DON levels concurrently. Therefore, further research is needed to study use of novel statistical methods to remove the effects of moisture variation in kernels on NIR calibration.

   FTNIR DON calibration can be used to rapidly estimate DON levels in bulk grain samples from FHB nursery trials and may be used for prescreening nursery samples by identifying high- and low-DON samples.

   Single kernel DON calibration can be used for evaluation of DON levels in artificially inoculated wheat spikes and this technique can be used for objective assessment of wheat germplasm for FHB resistance to disease spread and resistance to DON accumulation.

4) key outcomes or other achievements

Moisture levels of kernel samples should be considered when using NIR calibrations for DON estimation. Samples should be stabilized to 13-14% moisture levels before using our current DON calibration. The outcome from this research is useful for those developing new instruments/calibrations for estimating DON in cereal grains.

FTNIR DON calibration may be useful for wheat breeders and plant pathologists to prescreen FHB nursery samples. This will allow them to identify the best low-DON lines to advance to the next generation by reducing time and costs associated with DON analysis of all samples using standard laboratory methods.

Plant breeders can use the NIR technique for evaluation of wheat germplasm for FHB resistance to disease spread and resistance to DON accumulation. A PhD student and a MS student have used this technique in their studies for mapping genes responsible for FHB resistance to DON accumulation in selected Kansas wheat cultivars.

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

This project provided training for one postdoctoral research associate and two graduate students to use NIR and IR spectroscopy techniques for evaluation of FHB resistance in wheat.

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

One peer review paper was published in Cereal Chemistry.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY17 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 FY17 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 FY17 award period?** No

   If yes, how many?

3. **Have any post docs who worked for you during the FY17 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 FY17 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 <u>full or partial</u> support through the USWBSI during the <u>FY17 award period</u>. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations. *Leave blank if you have nothing to report or if your grant did NOT include any VDHR-related projects.*

Name of Germplasm/Cultivar	Grain Class	FHB Resistance (S, MS, MR, R, where R represents your most resistant check)	FHB Rating (0-9)	Year Released

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

Publications, Conference Papers, and Presentations

Instructions: Refer to the FY17-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY17 grant. Only include citations for publications submitted or presentations given during your award period. 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.

Nothing to Report. All publications were listed in our report filed in July, 2017, and funding was not received for this FY.

Journal publications.

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

Other publications, conference papers and presentations.

(Form – FPR16)