

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

**Cover Page**

<b>PI:</b>	Floyd Dowell
<b>Institution:</b>	USDA-ARS
<b>Address:</b>	Grain Marketing and Production Research Center (GMPRC) 1515 College Avenue Manhattan, KS 66502
<b>E-mail:</b>	floyd.dowell@ars.usda.gov
<b>Phone:</b>	785-776-2753
<b>Fax:</b>	786-537-5550
<b>Fiscal Year:</b>	FY13
<b>USDA-ARS Agreement ID:</b>	NA
<b>USDA-ARS Agreement Title:</b>	Single Kernel Sorting Technology for Enhancing Scab Resistance and Grain Quality.
<b>FY13 USDA-ARS Award Amount:</b>	\$ 24,400

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
HWW-CP	Single Kernel Sorting Technology for Enhancing Scab Resistance and Grain Quality.	\$ 24,400
	<b>FY13 Total ARS Award Amount</b>	<b>\$ 24,400</b>

\_\_\_\_\_  
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:** *Single Kernel Sorting Technology for Enhancing Scab Resistance and Grain Quality.***1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?**

Availability of rapid, non destructive and objective FHB resistance screening methods can enhance the FHB resistant wheat cultivar development process by allowing plant breeders and plant pathologists to screen large number of wheat germplasm in a short period of time. The major focus of our research program is to develop novel FHB resistance screening techniques using near infrared spectroscopy (NIRS) to enable comprehensive and rapid evaluation of FHB resistance of wheat. Our research also aims to demonstrate the ability of NIRS to detect DON in single wheat kernels.

We developed techniques to determine FHB damage and DON levels in single wheat kernels using our Single Kernel Near-infrared (SKNIR) instrument. Now we are conducting studies to nondestructively determine bulk DON levels in small grain samples and distribution of DON levels among kernels in small kernel samples. We also study single kernel DON variation among kernels along infected wheat spikes using our SKNIR single kernel DON estimation technique.

We are also investigating the use of Fourier Transform Near-infrared Spectroscopy (FTNIR) to determine DON levels and moisture content (MC) of bulk grain samples from FHB nursery trials. These scab nursery samples, especially those from FHB susceptible cultivars, usually have high DON contents as those are grown under heavy disease pressure. This will allow us to estimate bulk DON and MC of grain samples in about 30 seconds and to classify those samples as high or low DON samples at a given moisture content.

We will continue those studies to improve those single kernel and FTNIR bulk DON estimation techniques for comprehensive evaluation of wheat for FHB resistance.

**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:**

We developed a method to estimate the bulk deoxynivalenol (DON) content of wheat grain samples with the single-kernel DON levels estimated by our SKNIR system combined with single-kernel weights. The method estimated the bulk DON levels in 90% of 160 grain samples to within 6.7 ppm of DON when compared with the DON content determined with the gas chromatography–mass spectrometry method. The single-kernel DON analysis showed that the DON content among DON-containing kernels (DCKs) varied considerably.

**Impact:**

The analysis of the distribution of DON levels among all kernels and among the DCKs of grain samples is helpful for the in-depth evaluation of the effect of varieties or fungicides on FHB reactions. The SKNIR DON analysis and estimation of the single-kernel DON distribution patterns may be helpful for wheat breeders to evaluate the FHB resistance of varieties in relation to their resistance to the spread of the disease and resistance to DON accumulation.

**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.**

Peiris, K.H.S., Y. Dong, W.W. Bockus, and F.E. Dowell. 2014. Single kernel NIR analysis for evaluating wheat samples for *Fusarium* head blight resistance. *Cereal Chem.* 91(1):35-40.

Wegulo, S. N., Bockus, W. W., Hernandez Nopsa, J. F., Peiris, K. H. S., and Dowell, F. E. 2013. Integration of fungicide application and cultivar resistance to manage *Fusarium* head blight in wheat. Pages 35-54 in: *Fungicides - Showcases of Integrated Plant Disease Management from Around the World*. M. Nita, Ed. InTech, Rijeka, Croatia.

Jin, F., G. Bai, D. Zhang, Y. Dong, L. Ma, W. Bockus, and F. Dowell. *Fusarium* damaged kernels and deoxynivalenol in *fusarium*-infected U.S. Winter Wheat. *Phytopathology*. 104(5): 472-478. <http://dx.doi.org/10.1094/PHYTO-07-13-0187-R>.

Peiris, K.H.S., Dong, Y., Bockus, W.W., and Dowell F.E. 2013. Estimation of bulk deoxynivalenol and moisture content of wheat grain samples by FT-NIR spectroscopy. (ABSTRACT – Presentation at ASABE annual meeting).

Peiris, K.H.S., Dong, Y., Bockus, W.W., and Dowell F.E. 2013. Estimation of bulk DON content of small grain samples for comprehensive evaluation of *Fusarium* head blight resistance in wheat. (ABSTRACT – Presentation at ASABE annual meeting).