Cover Page

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Fiscal Year:	FY13
USDA-ARS Agreement ID:	NA
USDA-ARS Agreement Title:	Single Kernel Sorting Technology for Enhancing Scab Resistance and Grain Quality.
FY13 USDA-ARS Award Amount:	$ 24,400

USWBSI Individual Project(s)

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

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Principal Investigator   Date

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* 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:**

    <u>Accomplishment:</u>

    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).