USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY07 Final Performance Report (approx. May 07 – April 08)
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Cover Page

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Fiscal Year:	2007
USDA-ARS Agreement ID:	NA
USDA-ARS Agreement Title:	Single Kernel Sorting Technology for Enhancing Scab Resistance.
FY07 ARS Award Amount:	$ 25,000

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
VDUN	Single Kernel Sorting Technology for Enhancing Scab Resistance and Grain Quality.	$25,000
	Total Award Amount	**$ 25,000**

__Floyd Dowell_____7/11/08_____
Principal Investigator   Date

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* CBCC – Chemical, Biological & Cultural Control
  EEDF – Etiology, Epidemiology & Disease Forecasting
  FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
  GET – Genetic Engineering & Transformation
  HGR – Host Genetics Resources
  HGG – Host Genetics & Genomics
  IIR – Integrated/Interdisciplinary Research
  PGG – Pathogen Genetics & Genomics
  VDUN – Variety Development & Uniform Nurseries

(Form FPR07)

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

1. What major problem or issue is being resolved and how are you resolving it?

Wheat scab caused by fungi of *Fusarium spp* has become a major constraint in the wheat industry by affecting crop yields and quality of grain products. Development of Fusarium resistant/tolerant wheat varieties is a cost effective and safe way to address this critical issue facing the wheat industry.

Objective identification of scabby, or Fusarium Damaged Kernels (FDKs) and estimation of the DON levels of FDKs are two important things needed in evaluating varieties for scab resistance or for assessing grain samples for quality. At present, visual methods are used to classify FDKs from sound kernels. However, it is possible for visually-sound kernels to have higher DON levels while visually-scabby kernels can be free from DON.

Visual methods alone are not adequate to identify FDKs. Estimation of DON levels is expensive, requires numerous chemicals for extracting and assaying DON, and is also difficult to perform on single kernels. Near Infrared Spectroscopy (NIRS) can be used as a rapid and non destructive method to identify FDKs and to estimate DON levels of single kernels rapidly. Hence we are developing NIRS techniques to identify FDKs and estimate DON levels in single wheat kernels in order to facilitate evaluation of germplasm for varietal improvement.

Single kernel scab and DON calibrations were developed using an automated single kernel NIR system for classification of sound and FDKs and to estimate DON levels of single wheat kernels. Attempts are now being made to minimize error levels in single kernel DON estimation.

2. List the most important accomplishment and its impact (how is it being used?). Complete all three sections (repeat sections for each major accomplishment):

<u>Accomplishment:</u>

In sorting 108 wheat samples from NDSU using the scab calibration for sorting FDKs from sound kernels, our NIR technique sorted visibly sound kernels with a high accuracy (98.75 %). Samples were sorted into fractions with: 1) sound kernels {No detectable DON or low DON levels}; 2) FDKs with medium DON levels; and 3) FDK with high DON levels. Further detailed DON analysis of the sorted fractions of 23 scabby wheat samples from NDSU indicated that sorted sound fraction contained 0 – 5.3 ppm DON (Mean= 0.8 STD=1.8) while FDK with medium DON fractions had 25.5 - 233.2 ppm DON (Mean=98.2 STD=58.3) and the FDK fraction with high DON levels had 421.6 – 1175.0 ppm DON

(Mean=680.1 STD=251.0) showing that NIR technique could separate sound from FDKs successfully and further classify FDKs into groups depending on the DON levels.

Single kernel DON estimation work showed that our NIR technique can sort FDKs from sound kernels and estimate the DON levels of fractions having higher DON levels (>50 ppm) fairly successfully. However, further studies are necessary before it can be used for accurate DON estimation in kernels having low DON levels.

Impact:

This technology can be used to sort sound kernels from FDKs. Further FDKs could be sorted into 2-3 fractions based on the severity of scab/DON levels. Hence it is possible to use this technology to evaluate germplasm for Fusarium resistance and will help breeders evaluate many lines to identify superior breeding materials. This technique can also be used to select single kernels that may have scab resistance.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:

Currently scabby kernels are identified manually and subjectively by trained personal based on visual symptoms. Now an objective method is available for wheat breeders to identify scab damaged kernels based on DON levels. This is a rapid, non destructive and environmentally safe method. Breeders can use the assessed kernels for generation advancement or for other trait analysis.

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.

Peiris, K.H.S, M.O. Pumphrey, Y. Dong and F.E. Dowell 2008. NIRS method for precise identification of *Fusarium* damaged wheat kernels. AACCI Poster, September 21-24, Honolulu, HI.

A poster on the ongoing work in relation to scab sorting presented to the participants of Hard Winter Wheat Working Group meeting held in Manhattan, KS, May 2008.