USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY09 Final Performance Report
July 15, 2010

Cover Page

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Fiscal Year:	2009
USDA-ARS Agreement ID:	59-0206-9-054
USDA-ARS Agreement Title:	Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties.
FY09- USDA-ARS Award Amount:	$ 56,865

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Adjusted Award Amount
VDHR-NWW	Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties.	$ 54,560
VDHR-NWW	Mapping Fusarium Head Blight Resistance in Truman Wheat.	$ 2,305
	Total Award Amount	**$ 56,865**

7/15/10

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 Winter Wheat Region
SWW – Southern Sinter Wheat Region

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

1. **What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?**

   This project addresses the need for FHB resistance in soft red winter wheat varieties adapted to Kentucky. Many varieties grown in our region are susceptible to FHB; thus, Kentucky wheat producers and end users are at risk for severe economic losses as a result of head scab epidemics.

   This breeding process involves: 1) evaluating germplasm and breeding lines as parents for FHB resistance; 2) incorporating known resistance into crosses with elite, high yielding lines and cultivars, and 3) evaluating resistance in the progeny of the crosses. We evaluate early generation populations in inoculated nurseries so that only resistant segregates are brought forward and developed into lines that can be evaluated for the usual array of traits at multiple locations.

   Field evaluation is carried out at two locations: Lexington, under mist irrigation with inoculum provided by the scabby corn method, and at Princeton in a non-irrigated nursery with a combination of conidial spray and scabby corn as inoculum sources.

2. **List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):**

   Accomplishment (1): Approximately 4 single seed descent derived lines homozygous for *Fhb*1 resistance were planted were entered in the state variety trial during the period covered by this grant.

   Impact: These lines will provide breeders with additional germplasm and parental lines to use in crosses for the development of scab resistant germplasm and varieties. The combination of *Fhb*1 and native resistance QTL will be especially useful. If superior performance is demonstrated, one or more of the lines may be released as cultivars.

   Accomplishment (2): Approximately 40 breeding lines and varieties were grown at two locations, Lexington and Princeton in inoculated scab nurseries in the presence and absence of Prosaro® fungicide.

   Impact: There is no more critical decision for growers than the choice of a resistant variety. This must be coupled with the decision to use fungicides when conditions warrant. This study gives KY growers the information they need to implement the best tools we have for fighting FHB.

   Accomplishment (3): Approximately 82 breeding lines in the cooperative Mason Dixon nursery (VA, MD, NC, KY) were grown in a mist irrigated, inoculated scab nursery at Lexington for purposes of FHB phenotyping.

Impact: The data generated from this type of nursery allows breeders to compile a reliable scab profile for their breeding lines and facilitates more informed selection and release decisions.

Accomplishment (4): Approximately 3500 rows including UK breeding lines, varieties, populations, accessions and recombinant inbred lines were grown in a mist irrigated, inoculated scab nursery at Lexington for purposes of FHB phenotyping.

Impact: This procedure allows us to eliminate very susceptible lines from the breeding program early on and allows us to increase resistance in segregating populations prior to line derivation.

Accomplishment (5): Approximately 50 F2 and F3 populations were subjected to recurrent phenotypic selection in the mist irrigated, inoculated scab nursery at Lexington.

Impact: This procedure increases resistance in the population by the time we are ready to derive inbred lines.

Accomplishment (6): Approximately 650 crosses were made in the winter greenhouse. All of them involved at least 1 scab resistant parent.

Impact: These crosses will generate populations and lines with increased and diverse resistance that will benefit other breeding programs as well as our own.

Accomplishment (7): The third backcross of *Fhb1* into seven different recurrent parent backgrounds was completed.

Impact: This effort will combine outstanding yield potential with known, QTL derived resistance. Two of the recurrent parents would have been released but for scab susceptibility. It is possible that scab resistant versions of these lines may be released as varieties.

Project 2: *Mapping Fusarium Head Blight Resistance in Truman Wheat.*

1. **What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?**

   Truman is one of the best examples of native resistance that we have in soft winter wheat. To use it successfully as a parent however, we must be able to recover that resistance in the progeny of crosses with other lines. DNA markers that are linked to the resistance genes would greatly aid the process.

2. **List the most important accomplishment and its impact (i.e. how is it 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 phenotyped approximately 225 recombinant inbred lines from a cross of Truman x a susceptible parent.

   Impact: This phenotypic data will expedite the mapping process and allow us to determine in a relatively short time if there are DNA markers that can be used to tag the resistance genes and thus speed up the breeding process

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.

Peer Reviewed:

Knott, Carrie A., David A. Van Sanford, and Edward J. Souza. 2009. Genetic variation and the effectiveness of early-generation selection for soft winter wheat quality and gluten strength. Crop Sci. 49: 113-119.

Non-Peer Reviewed:

Anthony Clark, Gina Brown-Guedira and David Van Sanford. 2009. "Validation of *Fhb1* in several Soft Red Winter Wheat Breeding Populations." In: Canty, S., A. Clark, J. Mundell, E. Walton, D. Ellis and D. Van Sanford (Eds.). *Proceedings from the National Fusarium Head Blight Forum*, Orlando, FL; 2009 December 7-9. Lexington, KY: University of Kentucky. p. 115.

Jing Kang, Anthony Clark, David Van Sanford Carl Griffey, Gina Brown-Guedira, Yanhong Dong and Jose Costa. 2009. "Evaluation of Exotic Scab Resistance Quantitative Trait Loci (QTL) Effects on Soft Red Winter Wheat." In: Canty, S., A. Clark, J. Mundell, E. Walton, D. Ellis and D. Van Sanford (Eds.). *Proceedings from the National Fusarium Head Blight Forum*, Orlando, FL; 2009 December 7-9. Lexington, KY: University of Kentucky. p. 128.

Shuyu Liu, Marla Hall, Carl Griffey, Anne McKendry, Jianli, Chen, Wynse S. Brooks, Gina Brown-Guedira and David Van Sanford. 2009. "Saturation Mapping QTL for Scab Resistance in a Virginia Wheat Cultivar Massey." In: Canty, S., A. Clark, J. Mundell, E. Walton, D. Ellis and D. Van Sanford (Eds.). *Proceedings from the National Fusarium Head Blight Forum*, Orlando, FL; 2009 December 7-9. Lexington, KY: University of Kentucky. p. 135.

Ed Souza, Jaclyn Mundell, Daniela Sarti, Ana Balut, Yanhong Dong and David Van Sanford. 2009. "Can Host Plant Resistance Protect the Quality of Wheat from Fusarium Head Blight." In: Canty, S., A. Clark, J. Mundell, E. Walton, D. Ellis and D. Van Sanford (Eds.). *Proceedings from the National Fusarium Head Blight Forum*, Orlando, FL; 2009 December 7-9. Lexington, KY: University of Kentucky. p. 154.

Van Sanford, D. 2009. *The 2009 Southern SWW Scab Epidemic: Has the USWBSI Made a Difference?* Posted June 15, 2009 on U.S. Wheat & Barley Scab Initiative's Website: http://scabusa.org/pdfs/s-sww09_epidemic_uswbsi-impact.pdf.

Presentations:

Van Sanford, D. A. 2009. Status of the National Effort to Manage FHB and Reduce Mycotoxins in Wheat. Presented to the Mid South Association of Wheat Scientists, Memphis, TN, August 12, 2009.

Mundell, N., and D. A. Van Sanford. 2009. Scab Smart and the FHB Alert System. Presented to growers at the UK Wheat Science Field Day, Princeton, KY, May 18, 2009.

Van Sanford, D. A., and Bill Bruening. 2009. Review of varieties available to KY growers. Presented to growers at the UK Wheat Science Field Day, Princeton, KY, May 18, 2009.