USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY05 Final Performance Report (approx. May 05 – April 06)
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Cover Page

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Fiscal Year:	**2005**
FY05 ARS Agreement ID:	**59-0790-4-102**
Agreement Title:	**Valication, Fine Mapping, Marker Assisted Selection, and Accelerated Breeding for Resistance in Soft Red Winter Wheat.**
FY05 ARS Award Amount:	**$ 72,544**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
VDUN	Accelerated Breeding for Scab Resistance in Soft Red Winter Wheat and Barley.	$ 72,544
	Total Award Amount	**$ 72,544**

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Principal Investigator Date

* BIO – Biotechnology
CBC – Chemical & Biological Control
EDM – Epidemiology & Disease Management
FSTU – Food Safety, Toxicology, & Utilization
GIE – Germplasm Introduction & Enhancement
VDUN – Variety Development & Uniform Nurseries

Project 1: *Accelerated Breeding for Scab Resistance in Soft Red Winter Wheat and Barley.*

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

The overall project goal is to accelerate development of adapted and commercially viable scab resistant wheat varieties by identifying, incorporating and pyramiding diverse types of resistance into elite genotypes. The specific objectives of this project are to: 1) Incorporate and combine scab resistance genes from the newly-developed scab resistant and/or scab tolerant SRW wheat lines into commercially viable SRW and specialty wheat varieties and; 2) Apply molecular marker assisted selection to accelerate development of scab resistant wheat lines and cultivars.

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

Accomplishment:

To accelerate development of high yielding, scab resistant SRW wheat lines, we have developed adapted FHB resistant SRW wheat lines by deploying a combination of top-cross, doubled haploid, and backcross methods and by integrating DNA marker technology into conventional breeding process. Availability of adapted FHB resistant germplasm and QTL-marker information in our program has accelerated breeding activities in deploying newly-developed lines possessing two major resistance QTL on 3BS and 5AS and implementation of MAS to pyramid these two major QTL for all components of FHB resistance in adapted backgrounds.

Currently, 60 elite lines in the Virginia Scab Advance Test, 85 advanced lines in the Scab Preliminary Test, and 300 lines in Scab Observation nurseries are being evaluated in yield performance trials at two locations. All lines in these nurseries also are being evaluated for scab resistance in replicated disease assessment tests at Blacksburg, VA. An additional 200 SRW wheat genotypes, including entries in the two Uniform Scab Nurseries, and entries from Virginia's State Wheat Test, are being evaluated for scab resistance in replicated disease assessment trials at Blacksburg, VA. In headrow tests, 2,000 topcross and backcross derived lines and 1,000 NILs derived from a genetic study are being evaluated and selected based on agronomic traits and resistance to other prevalent diseases at Warsaw, VA prior to being evaluated for FHB resistance in replicated disease assessment tests the following year at Blacksburg, VA. A set of 180 FHB breeding populations (87 F_2, 28 F_3, 47 F_4, 9 F_5, and 9 F_6) are being evaluated and subsequently selected in 160 ft^2 blocks in an irrigated scab nursery at Mt. Holly, VA. In spring 2006, an additional 323 crosses were made, and nearly 1,629 individuals from the Scab Advance, Scab Preliminary, and Southern Scab Uniform tests were evaluated for type II resistance in greenhouse tests.

Molecular markers for resistance genes located at chromosome 3BS and 5AS regions are being used to assist in the parental selection and improvement of scab resistance in the breeding program. Eight favorable marker alleles including five (Gwm533, Barc133, FHB01, STS3B142, and Gwm493) on 3BS, and three (Barc117, Barc56, and Barc186) on 5AS were identified and deployed for MAS of improved FHB resistance. Haplotypes of the eight marker combinations were used to predict FHB resistance for 56 parents used in crossing and for 145 advanced lines that are being tested in 2006 FHB Advance and Preliminary Tests. Wheat lines having favorable marker alleles for FHB QTLs have provided breeding programs with a source of unique and adapted FHB resistant parents and some of the lines may have potential for release as cultivars and/or germplasm. Such lines include VA00W-38, VA02W-713, VA04W-433, VA04W-474, VA04W-517, VA04W-547, VA04W-563, VA04W-571, VA04W-575. The elite line VA02W-713 is currently being evaluated in the USDA-ARS Uniform Suthern Soft Red Winter Wheat Nursery, and Breeder Seed is being developed in anticipation of its release.

Impact: Markers for the two major QTL have been used in parental selection and in assessment of FHB resistance in advanced breeding lines. This greatly improved the efficiency of selection for FHB resistance. FHB resistant lines with desirable QTL have been identified in our breeding program. Adapted FHB resistant lines developed by our program and having type I, type II, or both types of resistance have been used as parents in other breeding programs.

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?

The newly-developed FHB resistant lines, as well as the MAS protocols, represent an important technology transfer from conventional breeding to molecular-assisted breeding for FHB resistance because wheat genetists, breeders, and farmers will have access to these resources. Virginia Tech Varieties, such as Roane, McCormick and Tribute, possessing moderate FHB resistance have been widely grown, and potential varieties, such as VA02W-713, possessing higher level of FHB resistance likely will be released during the next two years.

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.

Chen, J., C. A. Griffey, M. A. Saghai Maroof, E. L. Stromberg, R. M. Biyashev, W. Zhao, M. R. Chappell, T. H. Pridgen, Y. Dong, and Z. Zeng. 2006. Validation of Two Major QTL for *Fusarium* Head Blight Resistance in Chinese Wheat Line W14. Plant Breeding 125: 99-101.

Chen, J., C. A. Griffey, M.A. Saghai Maroof, J. Fanelli, J. Wilson, T. Pridgen, J. Paling, and D. Nabati. 2006. Validation and Marker-Assisted Selection of Two Major QTL Conditioning Fusarium Head Blight Resistance in Wheat. *P*. 189. *In*: Proceedings of the International Conference on the Status of Plant & Animal Genome Research. Jan. 14-18, 2006. Town & Country Hotel, San Diego, CA, USA.

Chen, J., C. A. Griffey, M.A. Saghai Maroof, J. Fanelli, J. Wilson, T. Pridgen, J. Paling, D. Nabati, and W. Brooks. 2005. Haplotype Selection of Two Major QTL Conditioning Fusarium Head Blight Resistance in Wheat. *P*. 23. *In:* Proceedings of the 2005 National Fusarium Head blight Forum. Dec. 11-13, 2005. Hilton Milwaukee City Center, Milwaukee, Wisconsin. USA. Compiled by Susan M. Candy, Timothy Boring, Jerri Wardwell, Lee Siler, and Richard W. Ward. Office Max Print and Document Service, Okemos, MI.