

USDA-ARS / USWBSI
FY04 Final Performance Report (approx. May 04 – April 05)
July 15, 2005

Cover Page

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Year:	FY2003 (approx. May 03 – April 04)
FY04 ARS Agreement ID:	59-0790-9-079
FY04 ARS Agreement Title:	Winter wheat breeding for scab resistance in South Dakota.
FY04 ARS Award Amount:	\$ 60,165

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
VDUN	Winter wheat breeding for scab resistance in South Dakota.	\$ 60,165
	Total Amount Recommended	\$ 60,165

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: *Winter wheat breeding for scab resistance in South Dakota.*

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

Resistant varieties will be the main component of an integrated strategy to control scab. The development and implementation of resistant varieties is the most economical, sustainable, and long lasting means of control. We will continue to simultaneously select for resistance and desirable agronomic characteristics.

Our long term objective is to use traditional breeding techniques, aided by molecular markers selection, to develop scab resistant hard winter wheat varieties and germplasm with superior agronomic performance and end-use quality characteristics, winterhardiness, and resistance to diseases prevalent in South Dakota and the northern Great Plains (a priority of the U.S. Wheat and Barley Scab Initiative). Our short term objectives are to: 1) characterize scab resistance among local and regional germplasm, in addition to new introduced sources, 2) identify sources with high levels of scab resistance, and develop populations segregating for scab resistance and desirable agronomic traits, and 3) enter promising resistant lines into regional nurseries to facilitate development of varieties with broad adaptation.

We use mist-irrigated field screening nurseries to evaluate the material. Winter wheat would be vernalized in the early spring and then transplanted into the field in April. The program has successfully tested dormant seeding as an alternative to transplanting. All scab material is planted into 5 foot rows in the mist irrigated nursery while a transplanted nursery is used as a backup.

2. What were the most significant accomplishments?

We have been evaluating elite breeding lines, introduced germplasm, regional nurseries, commercial varieties, and segregating populations in our mist-irrigated scab nursery since 1999. Approximately 6000 plants were evaluated for scab resistance during the 1999 season. 1500 of the plants were kept and were planted into the field in 2000 (as $F_{3:4}$ progeny rows). Forty-four lines were selected out of 1500 based on agronomic performance and were planted in 2001 – 2002 season in the early yield trial nursery (as $F_{3:5}$ lines). These lines were also planted in the greenhouse to confirm resistance. Heads were also picked from the best promising $F_{3:4}$ progeny rows and planted in the mist-irrigated nursery to get scab reaction data prior to line entry in the preliminary yield trials the following year. In the 2001 – 2002 growing season, we planted 3631 progeny rows, with resistant sources, under normal winter wheat production practices in Dakota Lakes, SD. These progeny rows were planted into spring wheat stubble with supplementary irrigation. The best 291 lines were advanced to the $F_{3:5}$ yield trials and observation rows of these were evaluated in the mist-irrigated nursery and greenhouse in 2003. Twenty seven of these lines were advanced to the 2004 $F_{3:6}$ yield trials based on disease resistance and agronomic performance. ‘Expedition’ which was released in 2002 possessed good FHB resistance superior to ‘Harding’ and ‘Arapahoe’. Two experimental lines SD97380-2 and SD98102, which have good FHB resistance, excellent leaf and stem rust resistance, in addition to superior and stable agronomic performance, were increased with intention to release

Our program relied on indigenous local resistance in the past. However, with the spread of scab threat, the use of highly resistant sources became paramount. In the 2004 – 2005 season, we planted 36 out of 400 F₃ and 57 out of 423 F₂ bulks that included Sumai3, Ning7840, or their derivatives in three-way crosses (unadapted/adapted//adapted) with local varieties and germplasm. This will enable us to combine the major 3BS and 5AS QTLs with our local indigenous resistance in an adapted background. Seed from these populations will be available for interested programs in the region. Scab-resistant advanced lines from these populations will be entered into regional nurseries to facilitate development of varieties with broad adaptation to the northern Great Plains.

We investigated planting schemes between 2001 and 2004 to determine if direct seeded row materials are affected differently than transplanted hill plots when they are inoculated with FHB. Results showed significant correlations between the two methods. We also used needle inoculation to evaluate resistance under greenhouse conditions in 2002, 2003 and 2004.

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 your grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

1. Ibrahim, A.M.H., S.D. Haley, Y. Jin, M.A.C. Langham, C. Stymiest, J. Rickertsen, S. Kalsbeck, R. Little, O.K. Chung, B.W. Seabourn, and D.V. McVey. 2004. Registration of 'Expedition' wheat. *Crop Sci.* 44:1470.
2. Ibrahim, A.M.H., S. Malla, R. Little, and S. Kalsbeck. 2004. Breeding scab tolerant hard winter wheat in South Dakota. p. 75. *In* 2004 2nd International Symposium on *Fusarium* Head Blight. Orlando, Florida.
3. Malla, S. and A.M.H. Ibrahim. 2004. Diallel analysis of hard winter and spring wheat for *Fusarium graminearum* resistance. p. 101. *In* 2004 2nd International Symposium on *Fusarium* Head Blight. Orlando, Florida.
4. Rickertsen J., A. Ibrahim, B. Hall, and T. Nleya. 2004. 2004 Winter wheat winter wheat variety yield results and production tips. South Dakota Coop. Ext. Serv. *Extension Extra* 8136.
5. Ibrahim, A. 2004. A new wheat of color for South Dakota. Ag Horizons Conference. December 7 - 8, 2004. Pierre, South Dakota.