

**USDA-ARS / USWBSI
FY04 Final Performance Report
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Cover Page

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Year:	FY2004 (approx. May 04 – April 05)
FY04 ARS Agreement ID:	59-0790-4-100
FY04 ARS Agreement Title:	Development of Hard Red Spring Wheat Cultivars Resistant to Scab.
FY04 ARS Award Amount:	\$ 83,297

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
VDUN	Development of Hard Red Spring Wheat Cultivars Resistant to Scab.	\$ 83,297
	Total ARS Award Amount	\$ 83,297

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: *Development of Hard Red Spring Wheat Cultivars Resistant to Scab.*

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

Hard red spring wheat (HRSW), the leading crop in the North-Central plains of the US, plays a major role in the economy of this region. Fusarium Head Blight (FHB) or scab is a major problem for HRSW in North Dakota (ND) and neighboring states. It reduces significantly the grain yield levels and affects negatively the quality characteristics. The disease had tremendous implications on HRSW producers, wheat industry and export market. This problem is being resolved by the development of adapted and superior cultivars. To achieve this goal, elite parental genotypes and lines are used to generate breeding populations that incorporate diverse genetic resistance to FHB with desired agronomic and quality traits. From these populations, ultimately, new HRSW cultivar adapted to ND and neighboring states are released. The combination of several types of genetic resistance to FHB from diverse germplasm sources into adapted cultivars using classical breeding methods and novel robust genetic markers and techniques have been used to provide a strategic long-term solution to the control of FHB in ND and the entire FHB prone region in the US.

2. What were the most significant accomplishments?

Accomplishments:

- a- **‘Glenn’, a new HRSW cultivar with HIGH level of resistance to FHB –better than the NDSU release ‘Alsen’, the dominantly grown HRSW cultivar in the region with moderate FHB resistance- was released for 2005.** Glenn was named after late Prof. Glenn Smith, the wheat breeder who led the NDSU wheat breeding program, prior to Dr Frohberg who released Alsen. Glenn FHB resistance is a combination of Alsen type resistance (‘Sumai3’ derivative) and ‘Steele-ND’ type (a non-Sumai3 type). **Glenn yield and quality attributes are superior to actually grown cultivars in the FHB prone region.**
- b- Seed of the **HRSW breeding line ND 800** with the same level of resistance and origin than Steele-ND (resistance from non-Sumai3 source) and pre-released in 2004 is being increased. ND 800 is also a very high yielding and good quality line.
- c- **One breeding line ND 803** selected from a cross involving Sumai3 with FHB resistance was pre-released in 2005.
- d- Superior elite HRSW breeding lines derived from populations combining different sources/types of resistance to FHB were screened and evaluated (in field and greenhouse) for their resistance to FHB and agronomic traits (Grain yield and quality).
- e- Advanced HRSW lines and newly generated populations combining sources from Chinese (Alsen, Glenn, ND 751...) and non-Chinese (Steele-ND and ND 800) resistance to FHB are being evaluated in the field under artificial FHB inoculation.
- f- New crosses and populations to combine different sources of FHB resistance, high quality attributes that meet wheat industry and export market requirements, and high yield were made.

Impact: *Glenn is the third HRSW cultivar released by NDSU HRSW breeding program with FHB resistance. Glenn followed the release of Steele-ND and Alsen released by the NDSU HRSW program in 2004 and 2000, respectively. Glenn and Steele-ND are expected to cover millions of wheat acres –as did Alsen in the last 4 years- in the region, impacting tremendously the economy of farmers, wheat industry, and export market. On average, Alsen was grown on more than 2 millions (about 30%) acres in the last 3 years saving millions of dollars to the producers and users. Therefore, the impact of developing genetically FHB resistant HRSW cultivars at NDSU is rewarding. All the three NDSU cultivars were developed using classical breeding methodologies.*

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.

Refereed Journal:

Mergoum, M., R. C. Frohberg, J. D. Miller, and R. W. Stack. 2005. Registration of 'Steele-ND' wheat. *Crop Sci.* 45:1163-1164.

Mergoum, M., R. C. Frohberg, J. D. Miller, J. B. Rasmussen, and R. W. Stack. 2005. Registration of spring wheat germplasm ND 744 resistant to Fusarium head blight leaf and stem rusts. *Crop Sci.* 45:430-431.

Mergoum, M., R. C. Frohberg, J. D. Miller, T. Olson, and J. B. Rasmussen. 2005. Registration of 'Dapps' wheat. *Crop Sci.* 45:420-421.

Frohberg, R. C., R. W. Stack, and **M. Mergoum**. 2004. Registration of spring wheat germplasm ND 2710 resistant to Fusarium head blight. *Crop Sci.* 44:1498-1499.

Proceedings:

Mergoum M., R. C. Frohberg, and R. W. Stack. 2004. "Steele-ND": A new hard red spring wheat cultivar with novel source of resistance to Fusarium head blight. p. 111-114. *In* S. M. Canty et al. (ed.) Proc. of the 2nd Int. Symp. on Fusarium Head Blight; incorporating the 8th European Fusarium Seminar; 11-15 Dec. 2004; Orlando, FL. USA. Michigan State Univ., East Lansing, MI.

Zhang, G., **M. Mergoum**, and R. W. Stack. 2004. Grain shattering and its relationship with Fusarium head blight in spring wheat. p. 224-226. *In* S. M. Canty et al. (ed.) Proc. of the 2nd Int. Symp. on Fusarium Head Blight; incorporating the 8th European Fusarium Seminar; 11-15 Dec. 2004; Orlando, FL. USA. Michigan State Univ., East Lansing, MI.

Kadariya, M., K. Glover, **M. Mergoum**, and M. L. Peterson. 2004. Correlation of seed size to DON accumulation in spring wheat grain. p. 465. *In* S. M. Canty et al. (ed.) Proc. of the 2nd Int. Symp. on Fusarium Head Blight; incorporating the 8th European Fusarium Seminar; 11-15 Dec. 2004; Orlando, FL. USA. Michigan State Univ., East Lansing, MI.

Kadariya, M., L. Peterson, **M. Mergoum**, R. Stack and K. Glover. 2004. Progress from five years of selecting for resistance to Fusarium head blight in spring wheat. p. 83. *In* S. M. Canty et al. (ed.) Proc. of the 2nd Int. Symp. on Fusarium Head Blight; incorporating the 8th European Fusarium Seminar; 11-15 Dec. 2004; Orlando, FL. USA. Michigan State Univ., East Lansing, MI.

Hansen, J. M., R. W. Stack, E. Elias, and **M. Mergoum**. 2004. Effect of application of a sublethal dosage of Glyphosate on FHB severity in spring wheat and durum. p. 311-314. *In* S. M. Canty et al. (ed.) Proc. of the 2nd Int. Symp. on Fusarium Head Blight; incorporating the 8th European Fusarium Seminar; 11-15 Dec. 2004; Orlando, FL. USA. Michigan State Univ., East Lansing, MI.