USDA-ARS / USWBSI
FY03 Final Performance Report (approx. May 03 – April 04)
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Cover Page

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Year:	**FY2003 (approx. May 03 – April 04)**
FY03 ARS Agreement ID:	**59-0790-9-045**
FY03 ARS Agreement Title:	**Germplasm and Epidemiological Research in Scab.**
FY03 ARS Award Amount:	**$ 139,955**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
EDM	FHB forecasting and environmental effects on inoculum in Eastern South Dakota.	$ 58,537
GIE	Maintain a germplasm center of scab resistant spring wheat.	$ 81,419
	Total Amount Recommended	**$139,955**

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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: ***FHB forecasting and environmental effects on inoculum in Eastern South Dakota.***

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

We are addressing the issues related to the epidemiology of scab on spring wheat in South Dakota. Specific objectives addressed were: 1) to study the influence of crop residues and weather on FHB inoculum and disease; 2) to develop risk assessment and forecast models pertinent to spring wheat disease management; and 3) to examine reproductive (perithecial) development under controlled and field conditions using local isolates of the causal agent. Objective 1 was studied in collaboration with researchers at North Dakota State, Ohio State, and Purdue University. Coordinated field plots were established to monitor disease development over time, in conjunction with environmental (weather), and inoculum monitoring. Corn residue was added to plots to establish three levels of inoculum potential within the study – low, medium, and high. Five additional locations across South Dakota were established for inoculum and environmental monitoring to provide model validation data. Objective 2 was addressed through continued assessment of numerous location-years and compiling a strong data set for model development and validation. Objective 3 was addressed through controlled environment experiments specifically looking at precipitative wetness versus soil wetness.

2. What were the most significant accomplishments?

Environmental parameters, airborne inoculum, and disease levels were assessed over a range of planting dates, and geographical locations from producers' fields in eastern SD. Spore traps were deployed at five locations across the northeast part of South Dakota. Hourly levels of airborne ascospores and Fusarium-type conidia were noted over the course of the heading and seed development stages for spring wheat. Weather data from nearby weather stations were also collected. These data will greatly advance the forecasting effort for South Dakota's spring wheat growing areas. Intensive sampling from each location will be highly valuable for validating predictive models and for elucidating new models. Additionally, greenhouse experiments showed the importance of precipitative wetness on perithecial development on residues. Without any moisture from above, residues were poorly colonized with reproductive structures, whereas those residues receiving moisture in a mist, or fine spray were highly colonized.

Project 2: ***Maintain a germplasm center of scab resistant spring wheat.***

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

The use of resistant cultivars will be one of the major components in managing scab (or Fusarium head blight) in small grain cereals. The development of scab resistant cultivars will depend upon the availability of germplasm possessing effective levels of resistance. Identifying and utilizing additional sources of resistance will be critical for enhancing the level of scab resistance and diversifying the current resistance gene pool. This project confronts the issue of finding additional or new sources of scab resistance in spring wheat, maintaining and characterizing the resistance, and facilitating the utilization. We also focused on the development of techniques and process for germplasm evaluation and of systems for facilitating the distribution and utilization of resistant germplasm. A system of evaluating germplasm through multiple screening nurseries was used. Artificial inoculations and mist-irrigation were used to generate high disease pressure in the nurseries. Spring wheat germplasm from targeted regions of the world are planted in non-replicated row plots and evaluated for scab reaction in the Preliminary Screening Nursery (PSN) in the field. Selections from the PSN are re-evaluated in the greenhouse to make further selections. Field and greenhouse selections are used as test entries in a replicated field Elite Germplasm Nursery (EGN) for further evaluation for at least three consecutive years. Elite selections are integrated into the Uniform Regional Scab Nursery (URSN) system for testing at multiple locations and for direct access and utilization by breeders and other researchers.

2. What were the most significant accomplishments?

The 2003 field nursery was planted in Brookings, South Dakota. A total of 500 accessions of spring wheat mainly from west Asia and Russia were introduced from USDA wheat germplasm collection into the Preliminary Screening Nursery (PSN). Based on field visual disease level, and the kernel damage, 85 accessions were selected as potential resistant sources. These selections were planted in winter nursery in Christchurch, NZ along with the Wheat Breeding nursery of the University of Minnesota. This winter nursery served as a location for seed multiplication and observation of agronomic traits. The 2003 Elite Germplasm Nursery (EGN) consisted of 330 accessions, 104 of which had passed two consecutive years' replicated trials in the field nurseries and greenhouse testing. In the 2003 field season critical evaluations of materials were achieved because we maintained high and relatively consistent disease pressure throughout the season. Additional criteria, i.e. % Fusarium damaged kernel, test weight, yield, and DON concentration were used in the evaluation of advanced EGN materials. Data on plant types, maturity were collected to facilitate the utilizations. Five lines, PI 233203, PI 168716, PI 292975, PI 344454, and PI 113949, were entered into the URSN for testing at multiple locations and for direct access/utilization by breeders. Greenhouse evaluations of selections were conducted in greenhouse experiments in the University of Minnesota and USDA-ARS Cereal Disease Laboratory. Mapping populations developed from Tokai 66 have been advanced into F6 derived lines, and phenotyping of scab responses in another elite line (Abura) was conducted in one greenhouse season. Lines with low disease level and excellent agronomic trait were identified for potential release as new FHB resistant germplasm.

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

Osborne, L.E., and Y. Jin. 2004. Development of a resistance-based sensor for detection of wetness at the soil-air interface. Agronomy J. 96:845-852.

Osborne, L.E. 2004. *Fusarium graminearum* mycotoxin levels in spring wheat with varying amounts of corn residue. Phytopathology 94:S79

Molinaros, J.E., L. Madden, P. Lipps, G. Shaner, **L. Osborne**, L. Francl, and E.D. De Wolf. 2004. Comparison of forecasting methods for Fusarium head blight. Phytopathology 94:S72

Osborne, L., 2003. Epidemiological Studies on Fusarium Head Blight of Wheat in South Dakota for 2003. *In:* Proc. 2003 National Fusarium Head Blight Forum. Dec. 10-13, 2003. Minneapolis, MN.

Osborne, L.E. 2003. Spatial relation of DON contamination to corn residues in spring wheat. *In:* Proc. 2003 National Fusarium Head Blight Forum, Minneapolis, MN.

Osborne, L.E. and M. Draper. 2003. FHB Risk Advisory for Spring Wheat in South Dakota, 2003. *In:* Proc. 2003 National Fusarium Head Blight Forum, Minneapolis, MN.

Osborne, L., and Y. Jin. 2003. Spring wheat disease. p. 31-34 *In:* 2002 Annual Progress Report Northeast Research Station, Watertown, SD. Plant Science Pamphlet No. 11. South Dakota State University, Brookings, SD.

Oliver, R.E., X. Chen, S.S. Xu, **Y. Jin**, and X. Cai. 2003. Identification of novel sources of Fusarium head blight resistance from relatives of wheat. *In:* Proc. 2003 National Fusarium Head Blight Forum. Dec. 13-17, 2003, Minneapolis, MN.

Zhang, X. and **Y. Jin**. 2003. Diversity of resistance to Fusarium head blight in the US spring wheat germplasm collection. Page 204. *In:* Proc. 8th International Congress Plant Patholgoy, Vol. 2. Feb 2-7, 2003, Christchurch, New Zealand.

Zhang, X. and **Y. Jin**. 2003. Evaluation of spring wheat germplasm for Fusarium head blight resistance. Pages 238-241. *In:* Proc. 2003 National Fusarium Head Blight Forum. Dec. 13-15, 2003, Bloomington, MN.