**USDA-ARS / USWBSI**
**FY04 Final Performance Report**
**July 15, 2005**

**Cover Page**

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| **Year:** | **FY2004** (approx. May 04 – April 05) |
| **FY04 ARS Agreement ID:** | **59-0790-4-111** |
| **FY04 ARS Agreement Title:** | **Development of Scab Resistant Soft Red Winter Wheat Varieties.** |
| **FY04 ARS Award Amount:** | **$ 78,099** |

**USWBSI Individual Project(s)**

| USWBSI Research Area* | Project Title | ARS Adjusted Award Amount |
|---|---|---|
| VDUN | Development of Scab Resistant Soft Red Winter Wheat Varieties. | $ 78,099 |
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| | **Total ARS Award Amount** | **$ 78,099** |

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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:** ***Development of Scab Resistant Soft Red Winter Wheat Varieties.***

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

The major issue is that producers need varieties with high levels of scab resistance. We have lines with very good levels of scab resistance; however, many lines with excellent scab resistance are poor for other traits such as grain yield, milling and baking quality, standability, or resistance to other diseases. This problem is not resolved, but we are working on the development of high-yielding, well-adapted, scab resistant lines. We are continuing to select and evaluate as many breeding lines as possible. In addition, as more lines with good scab resistance are identified we are using these parents in crosses, so that in many crosses both parents, or two parents out of three in a three-way cross, are scab resistant. We also believe that it is important to combine several types of resistance rather than rely solely on Type II resistance. We are addressing this by using the ISK index to select breeding lines with high levels of scab resistance. Development of varieties with low DON levels is also important, therefore, all breeding lines are evaluated for DON level.

2. **What were the most significant accomplishments?**

- Five lines from the Illinois program were entered into the 2004 Northern Uniform Winter Wheat Scab Nursery. Four of the University of Illinois lines were among the most scab resistant lines in the nursery. These lines were made available to other breeders by entering them into the NUWWSN. The availability of these lines as scab resistant parents will contribute to the development of scab resistant wheat varieties.
- In 2004, about 400 breeding lines from the University of Illinois wheat breeding program were evaluated in replicated rows in the misted, inoculated scab evaluation field nursery. We also evaluated about 300 varieties, germplasm lines, and breeding lines from other programs in the scab evaluation field nursery, including several cooperative nurseries, and a germplasm evaluation trial. In addition, 1820 entries from single plots and 28 doubled haploid lines were evaluated. Scab resistant lines were evaluated for many additional traits including grain yield, milling and baking quality, standability, and resistance to other diseases. Sustained annual selection for scab resistance in the inoculated, misted field nursery has significant long-term impact by assuring that newly released varieties will be scab resistant.
- Heads were selected from 36 $F_3$ bulk populations grown in the field scab nursery, and headrows from these selections are being grown in 2005. Several recurrent selection populations were grown in the scab evaluation nursery for another cycle of selection. Well-filled kernels are selected from bulk-harvested seed samples of these populations. Selection of individual heads from segregating populations under heavy scab pressure should increase the frequency of scab resistant breeding lines.
- In 2004 about 165 single crosses and 125 three-way crosses were made with one or more scab resistant parents in each cross.
- Varieties from the University of Illinois Wheat Variety Trial were evaluated for scab resistance in the misted, inoculated field nursery. Scab resistance information for about 50 current soft red winter wheat varieties was made available to producers based on 2003 and 2004 evaluations, and a summary table over two years. This information was presented at producer meetings and made available through the University of Illinois Variety Trial report and website. This information allows producers to use scab resistance as a factor in variety selection and has a significant impact by helping producers avoid scab susceptible varieties.

**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.**

**Peer-reviewed Publications**

Zhou, W-C, F.L. Kolb, J-B Yu, G-H Bai, L. K. Boze, and L.L. Domier. 2004. Molecular characterization of Fusarium head blight resistance in Wangshuibai with simple sequence repeat and amplified fragment length polymorphism markers. Genome 47: 1137-1143.

Browne, R.A., Murphy, J.P., Cooke, B.M., Devaney, D., Walsh, E.J., Griffey, C.A., Hancock, J.A., Harrison, S.A., Hart, L.P., Kolb, F.L., McKendry, A.L., Milus, E.A., Sneller, C., and Van Sanford, D.A. 2005. Evaluation of Fusarium head blight resistance in U.S. soft red winter wheat germplasm using a detached leaf assay. Browne, R. 2004. Evaluation of Fusarium head blight resistance in soft red winter wheat germplasm using a detached leaf assay. Plant Dis. 89:404-411.

Zhou, W.C., F.L. Kolb, and D.E. Riechers. 2004. Identification of proteins produced in response to Fusarium head blight infection in hexaploid wheat (*Triticum aestivum*). Genome (accepted and revised).

**Non-refereed bulletins, reports and publications**

Malvick, D. and F. L. Kolb, 2004. Is wheat scab an emerging threat or a recurring villain? 2004 Agronomy Day Booklet, August 19, 2004. p.19-20. (presentation also)

F.L. Kolb, 2004 Fusarium head scab evaluation of variety trial entries at Urbana, Illinois. Tables of data prepared for field days, variety trial report, and posted on Variety Trial website.

**Abstracts**

Browne, R.A., Murphy, J.P., Cooke, B.M., Devaney, D., Walsh, E.J., Griffey, C.A., Hancock, J.A., Harrison, S.A., Hart, L.P., Kolb, F.L., McKendry, A.L., Milus, E.A., Sneller, C., and Van Sanford, D.A. 2004. Evaluation of Fusarium head blight resistance in U.S. soft red winter wheat germplasm using a detached leaf assay. Proceedings of the 2nd International Symposium on Fusarium Head Blight. December 11-15, 2004, Orlando, FL., P. 22 (vol. 1).

Wilson, A.D., Kolb, F.L., McCartney, C.A., Brucker, E.A., and Somers, D.J. 2004. Evaluation of molecular markers associated with FHB resistance QTL in soft red winter wheat breeding lines. Proceedings of the 2nd International Symposium on Fusarium Head Blight. December 11-15, 2004, Orlando, FL., P. 210 (vol. 1).

Yu, J.B., Bai, G.H., Zhou, W.C., Kolb, F.L., Dong, Y.H., and Hart, P. 2004. Fine mapping of wheat QTL for resistance to FHB and DON in Chinese Landrace Wangshuibai. Proceedings of the 2nd International Symposium on Fusarium Head Blight. December 11-15, 2004, Orlando, FL., P. 218 (vol. 1).

Zhou, W.C. Kolb, F.L., and Riechers, D.E. 2004. Identification of proteins induced by Fusarium head blight infection in the spikes of hexaploid wheat (*Triticum aestivum*). Proceedings of the 2nd International Symposium on Fusarium Head Blight. December 11-15, 2004, Orlando, FL., P. 233 (vol. 1).

Brucker, E.A. and F. L. Kolb, 2005. Comparison of Deoxynivalenol (DON) analysis on wheat milled with different grinders. Proceedings of the Eastern Wheat Workers and Southern Small Grains Workers Conference, May 9-12, 2005, Bowling Green, KY, p. 89.