U.S. Wheat and Barley Scab Initiative
Annual Progress Report
September 18, 2000

Cover Page

PI:	**James Anderson**
Institution:	**University of Minnesota**
Address:	**439 Borlaug Hall** **St. Paul, MN 55108**
Email:	**ander319@tc.umn.edu**
Phone:	**612-625-9763**
Fax:	**612-625-1268**
Year:	**FY2000**
Grant Number:	**59-0790-9-025**
Grant Title:	**Fusarium Head Blight Research**
Amount Granted:	**$95,610.00**

Project

Program Area	Objective	Requested Amount
Biotechnology	Create saturated molecular marker maps near FHB resistance QTL and develop of breeder-friendly markers.	$30,000.00
Variety Development & Uniform Nurseries	To enhance variety development of scab resistant varieties.	$70,000.00
	To enhance variety development of scab resistant varieties.	
	Requested Total	$100,000.00[1]

_____

Principal Investigator Date

[1] Note: The Requested Total and the Amount Granted are not equal.

Project 1: Create saturated molecular marker maps near FHB resistance QTL and develop of breeder-friendly markers.

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

DNA markers for FHB resistance may be useful in speeding the process of breeding for resistance. We are using SSR markers to saturate genomic regions known to contain FHB resistance genes. The two objectives of this project are to i) increase marker density near QTLs and determine the utility of these DNA markers on additional populations segregating for FHB resistance; and ii) develop breeder-friendly markers for the Sumai 3 scab resistance gene on chromosome 3BS.

2. Please provide a comparison of the actual accomplishments with the objectives established.

New SSR markers were mapped in each of two populations previously characterized for their FHB resistance. Markers in the 3BS QTL region (*Qfhs.ndsu-3BS*) alone explain 41.6 and 24.8% of the resistance to FHB in the Sumai 3/Stoa and ND2603/Butte 86 populations, respectively. These markers were adapted for use in a high-throughput screening system using a newly purchased Li-Cor DNA sequence analyzer.

71 lines including Minnesota experimental lines and FHB resistance sources were screened for their allele type at 3 SSR loci that encompass an FHB QTL on chromosome 3BS. This information was used to decide which breeding populations were suitable for marker-assisted selection (see Project 2. below).

3. What were the reasons established objectives were not met? If applicable.

The objectives of this grant have been met.

4. What were the most significant accomplishments this past year?

We identified SSR markers that bracket the major QTL for FHB resistance in two segregating populations. These markers were adapted for use in a high-throughput marker screening system.

Project 2: To enhance variety development of scab resistant varieties.

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

Scab resistant varieties are necessary to reduce the impacts of this disease. We are developing scab resistance hard red spring wheat lines adapted to the Northern Great Plains, especially wheat-growing areas in Minnesota. Techniques include conventional breeding procedures of crossing, selection, and multilocation testing of germplasm. Scab resistance is assessed by greenhouse screenings and three field nurseries each year, and also marker-assisted selection.

2. Please provide a comparison of the actual accomplishments with the objectives established.

120 lines in advanced yield trials and approximately 280 lines in preliminary yield trials were screened in inoculated, misted FHB screening nurseries at either three or two locations, respectively. Six experimental lines were entered into the 2000 Uniform Regional Scab Nursery. These lines were identified in 1998 and 1999 as having improved levels of FHB resistance. Approximately 1,000 lines were screened during 1999/2000 in the greenhouse for reaction to FHB inoculation. An additional 4,000 plots containing FHB resistance sources and segregating populations were screened in an inoculated, misted field nursery in St. Paul. Marker-assisted selection using the markers for the QTL on chromosome 3BS (identified in Project 1 above) was used to screen approximately 800 F4 lines for the presence of the Sumai-derived allele at this locus.

3. What were the reasons established objectives were not met? If applicable.

We are making expected progress in our breeding and germplasm development for FHB resistant spring wheat.

4. What were the most significant accomplishments this past year?

More than 8,000 plots in field nurseries were assessed for FHB resistance during the 2000 growing season. Marker-assisted selection for a FHB resistance QTL was used to screen more than 800 F4 lines.

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.

Peer-reviewed Articles:

Anderson, J.A., R.W. Stack, S. Liu, B.L. Waldron, A.D. Fjeld, C. Coyne, B. Moreno-Sevilla, J. Mitchell Fetch, Q.J. Song, and R.C. Frohberg. 200X. DNA markers for Fusarium head blight resistance QTLs in two wheat populations. submitted to Theoretical and Applied Genetics.

Kolb, F.L., G.-H. Bai, G.J. Muehlbauer, J.A. Anderson, K.P. Smith, and G. Fedak. 200X. Host plant resistance genes for Fusarium head blight: mapping and manipulation with molecular markers. submitted to Crop Science.

Van Sanford, D., J. Anderson, K. Campbell, J. Costa, P. Cregan, C. Griffey, P. Hayes, and R. Ward. 200X. Discovery and deployment of molecular markers linked to FHB resistance: An integrated system for wheat and barley. submitted to Crop Science.

Abstracts:

Kolb, F.L., G.H. Bai, G.J. Muehlbauer, J.A. Anderson, K.P. Smith, and G. Fedak. 1999. Host plant resistance genes for FHB: mapping and manipulation with molecular markers. p. 83 *In* Agronomy abstracts. ASA, Salt Lake City, UT.

Van Sanford, D., J. Anderson, K. Campbell, J. Costa, P. Cregan, C. Griffey, P. Hayes, and R. Ward. 1999. Discovering, validating, and developing molecular markers: an integrated system for wheat and barley. p. 84 *In* Agronomy abstracts. ASA, Salt Lake City, UT.

Proceedings:

Anderson, J.A., B.L. Waldron, R.W. Stack, and R.C. Frohberg. 1999. Update on DNA markers for Fusarium head blight resistance QTL in two wheat populations. pp. 19-21 in *Proceedings of The 1999 National Fusarium Head Blight Forum*, edited by J.A. Wagester et al., University Printing, East Lansing, MI.

Hu, C.C., R. Dill-Macky, J.A. Anderson, and R.H. Busch. 1999. Screening for scab resistance of wheat in the greenhouse. pp. 176-179 in *Proceedings of The 1999 National Fusarium Head Blight Forum*, edited by J.A. Wagester et al., University Printing, East Lansing, MI.

Anderson, J.A., B.L. Waldron, B. Moreno-Sevilla, R.W. Stack, and R.C. Frohberg. 2000. DNA markers for Fusarium head blight resistance QTLs in two wheat populations. pp. 105-110 in *Proceedings of the International Symposium on Wheat Improvement for Scab Resistance*, edited by W.J. Raupp, Z. Ma, P. Chen, and D. Liu, KSU Printing Services, Manhattan, KS.

Hu, C.C., R. Dill-Macky, J.A. Anderson, and R.H. Busch. 2000. Screening for scab resistance of wheat in the greenhouse. pp. 180-183 in *Proceedings of the International Symposium on Wheat Improvement for Scab Resistance*, edited by W.J. Raupp, Z. Ma, P. Chen, and D. Liu, KSU Printing Services, Manhattan, KS.

Reports:

Anderson, J., R. Busch, J. Wiersma, D. McVey, and R. Dill-Macky. 1999. Wheat. *In* Preliminary Report 24; 1999 Wheat, Barley and Oat Variety Performance in Minnesota, Preliminary Report, Edited by Jochum Wiersma.

Anderson, J., R. Busch, G. Linkert, L. Matthiesen, E. Wennerlind, A. Procopiuk, H. Mickelson, S. Liu, and K. McGowan. 2000. Wheat production, breeding, and scab screening. Ann. Wheat Newsletter 46:230-231.

Anderson, J.A., R.H. Busch, G. Linkert, and L. Matthiesen. 1999. Wheat. *In* Minnesota Varietal Trials Results, University of Minnesota Extension Service.