

**U.S. Wheat and Barley Scab Initiative  
 FY02 Final Performance Report (approx. May 02 – April 03)  
 July 15, 2003**

**Cover Page**

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<b>Grant Number:</b>	<b>59-0790-9-061</b>
<b>Grant Title:</b>	<b>Fusarium Head Blight Research</b>
<b>FY02 ARS Award Amount:</b>	<b>\$ 128,500</b>

**Project**

<b>Program Area</b>	<b>Project Title</b>	<b>USWBSI Recommended Amount</b>
BIO	Developing marker information for genetic diversity and FHB resistance in barley.	\$52,000
VDUN	Accelerated Development of Fusarium Resistant Barley Varieties.	\$79,712
	<b>Total Amount Recommended</b>	<b>\$131,712</b>

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 Principal Investigator

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 Date

**Project 1: Developing marker information for genetic diversity and FHB resistance in barley.**

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

Developing malting barley varieties with useful levels of resistance to FHB will require the accumulation of multiple genes from several sources of resistance. Our program is focused on identifying useful genes from diverse sources of resistance using molecular markers and developing strategies to employ marker assisted selection (MAS) to improve FHB resistance. We are using marker and phenotypic data to identify promising sources of resistance, map and validate QTL for FHB, fine map important regions, and test MAS strategies.

2. What were the most significant accomplishments?

Obj. 1: Continue fine mapping QTL regions identified on chromosome 2 and chromosome 6 in Chevron x M69 mapping population. We have developed a fine mapping population for the chromosome 2 QTL consisting of 532 lines and have identified 44 recombinants in the target mapping region that will be used for mapping. These lines are currently being evaluated in two FHB trials this summer. Fine map construction is underway. We have another set of recombinants to add to this population that are one generation behind this current set and they will be added to increase the resolution of the map.

Obj. 2: Develop near-isogenic lines (NILs) for FHB and DON resistance QTL identified in Frederickson x Stander mapping population. We have continued our marker backcrossing program to isolate Frederickson alleles at two QTL regions on chromosome 2. We were unable to conduct greenhouse FHB screens on the BC isogenic lines due to demolition of University greenhouses that are currently being replaced, however we are evaluating the lines in the field this summer.

Obj. 3: Continue mapping FHB resistance in the Atahualpa x M81 population. We have complete linkage maps for chromosomes 1 and 2, and are working simultaneously on completing the other five chromosomes. We have completed a FHB evaluation of the population in China this year and are currently collecting data from another FHB trial in Crookston Minnesota. This will provide one greenhouse and three field evaluations of this population for QTL mapping. A preliminary QTL analysis will be presented at this years forum.

Obj. 4: Construct a high resolution map of the region of chromosome 2 containing the v-locus. We made crosses with near isogenic lines for the v-locus region this fall and grew up the F1's in this winters greenhouse. Approximately 3,500 F2 plants are growing in a summer greenhouse for fine map construction. We have identified several additional markers for the target region and have begun screening the F2's with flanking markers to identify recombinants. We anticipate identifying at least 200 recombinants in the 20 cM region that will be used for fine mapping. We will present a preliminary fine map at this years forum.

**Project 2: Accelerated Development of Fusarium Resistant Barley Varieties.**

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

Resistant barley varieties will play an important role in the management of FHB.

Developing malting barley varieties that are adapted to the Upper Midwest with useful levels of resistance to FHB will require extensive testing for resistance in FHB screening nurseries.

2. What were the most significant accomplishments?

Five expected results were outlined in the proposal.

- 1) We screened ~1900 F5 lines in replicated scab trials at Crookston and St. Paul. In total over 10,000 rows were evaluated in misted or unmisted inoculated nurseries.

- 2) We completed second year screens of 140 lines in 2 location, 3 rep trials. We have selected 60 of these lines to go into 2003 preliminary yield trials.

- 3) We complete third year screen of 28 lines in 3 location 3 rep trials.

- 4) We used markers to select for the Chevron alleles at the QTL on chromosome 6 in two breeding populations. These lines are now being evaluated in our 2003 summer FHB nurseries.

- 5) We identified resistant barley lines and made ~150 crosses to improve FHB resistance in last years fall greenhouse.

We entered one variety candidate from our FHB resistance breeding program into first-year industry pilot-scale malting tests. This line, M114, was derived from the resistant source Atahualpa. While M114 was not rated satisfactory in this evaluation, it was within industry specifications for most malt parameters. This gave us encouragement that breeding lines derived from “exotic” resistant sources like Atahualpa, can meet industry standards.

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.

Canci, P. C., L.M. Nduulu, R. Dill-Macky, G.J. Muehlbauer, D.C. Rasmusson, and K.P. Smith. 2003. The genetic relationship between kernel discoloration and grain protein concentration in barley. *Crop Sci* 43:(in press).

Mesfin, A., K.P. Smith, R. Dill-Macky, C.K. Evans, R. Waugh, C.D. Gustus, and G.J. Muehlbauer. 2003. Quantitative trait loci for Fusarium head blight resistance in barley detected in a two-rowed by six-rowed population. *Crop Sci*. 43:307-318.

Smith, K. P. 2003. The Fusarium Head Blight Experience: Research update from the US Wheat and Barley Scab Initiative. In *Proceedings of the 34<sup>th</sup> Barley Improvement Conference*. San Francisco, CA., Jan. 7-9, 2003, p.7.

Belina, K.M., W.J. Wingbermuehle, and K.P. Smith. 2002. Genetic Diversity Of New Fusarium Head Blight Resistant Barley Sources. In: *Proceedings of the 2002 National Fusarium Head Blight Forum*. Erlanger, KY 12/7/02 - 12/9/02.

Nduulu, L.M., A. Mesfin, G.J. Muehlbauer, and K.P. Smith. 2002. Effect of Chevron alleles at two Fusarium head blight resistance QTL determined using near-isogenic lines. In: *Proceedings of the 2002 National Fusarium Head Blight Forum*. Erlanger, KY 12/7/02 - 12/9/02.

Nduulu, L.M., A. Mesfin, G.J. Muehlbauer, and K.P. Smith. 2002. Evaluation of near-isogenic lines for Fusarium Head Blight resistance QTL in barley. In: *Proceedings of the 17<sup>th</sup> Triennial North American Barley Researchers Workshop*. Fargo ND, Sep 22 - 25, 2002. p. 31.