

**U.S. Wheat and Barley Scab Initiative  
 FY01 Final Performance Report (approx. May 01 – April 02)  
 July 15, 2002**

**Cover Page**

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<b>Year:</b>	<b>FY2001 (approx. May 01 – April 02)</b>
<b>Grant Number:</b>	<b>59-0790-9-061</b>
<b>Grant Title:</b>	<b>Fusarium Head Blight Research</b>
<b>FY01 ARS Award Amount:</b>	<b>\$ 138,458</b>

**Project**

<b>Program Area</b>	<b>Project Title</b>	<b>Requested Amount</b>
Biotech	Developing marker information for genetic diversity and FHB resistance in barley	\$ 57,882
Variety/Uniform	Accelerated Development of Fusarium Resistant Barley Varieties	\$ 87,232
	<b>Total Amount Requested</b>	<b>\$ 145,114</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?

Resistant barley varieties will play an important role in the management of FHB. 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 focussed 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, mapping and validating QTL for FHB, fine mapping important regions, and testing MAS strategies.

2. What were the most significant accomplishments?

**Obj. 1) Identify markers associated with FHB resistance from new resistant sources in breeding populations.** We evaluated 11 breeding populations segregating for FHB resistance using a selective genotyping method to test whether SSR markers, previously linked to FHB resistance in other mapping studies, accounted for variation in FHB resistance in the breeding populations. We identified three sources of resistance that we hypothesize carry FHB resistance alleles at novel loci. Based on these results, we have selected Atahualpa as a new source of resistance to initiate a full-scale mapping project. Our FY02 grant from the USWBSI is supporting that effort.

**Obj. 2) Use MAS to breed for FHB resistance, fine map QTL regions, and develop near-isogenic lines (NILs) for FHB and DON resistance QTL.** We completed the first year of a trial to evaluate MAS for resistant alleles, derived from the variety Chevron, at two QTL for FHB resistance. The results of this study indicate that the gains made by MAS are consistent with predictions that were made based on the results of the initial QTL mapping work. Traits that were coincident with FHB resistance (later heading and higher protein) were also modified through MAS. We are repeating the experiment in the summer of 2002. We have completed development of NILs for "Chevron" FHB QTL regions. We are continuing the develop NIL for "Frederickson" FHB QTL. We have made the crosses to develop the fine mapping populations for two Chevron FHB QTL regions.

**Obj. 3) Assess genetic diversity of putative sources of resistance to FHB in barley and develop an SSR database for barley germplasm.** We have nearly completed a genetic diversity analysis of 19 new sources of resistance identified by Dr. Brian Steffenson in a project to screen the world collection of six-row spring barley. The preliminary analysis indicates three major clusters and suggests some of these new sources are not closely related to other resistant sources that have already been exploited in breeding programs and are therefore worthy of further study.

## **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 with useful levels of resistance to FHB will require extensive testing for resistance in FHB screening nurseries.

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

Three "Expected Results" were outlined in the proposal:

#### **1) Further describe the genetic basis of resistance to accumulation of DON in barley.**

We have identified Frederickson and Stander as two varieties that differ in accumulation of deoxynivalenol (DON) 72 h. after point inoculation with *Fusarium graminearum*. We have completed two greenhouse evaluations of DON accumulation in the Frederickson x Stander mapping population and have mapped the position of a major QTL for DON accumulation

#### **2) Test the utility of early generation selection for FHB resistance.**

We evaluated F2 single plant selection for FHB resistance in two populations in 2001. We found no difference between lines developed from F2 plants selected as being FHB resistant and those from F2 plants selected at random. We are evaluating the lines for a second year, but thus far conclude little gain can be made from F2 generation selection for FHB resistance in barley.

#### **3) Identify resistant barley lines that can be used as parents in advanced cycle crosses and identify resistant barley lines with good agronomic and malting quality characteristics that can be identified as variety candidates**

We screened over 1600 lines replicated and in two locations for resistance to FHB. We identified seventy lines from this evaluation that will be evaluated in preliminary yield trials in the summer of 2002. Three and five FHB resistant lines were selected for evaluation in our intermediate and advanced yield trials. We have designated one new variety candidate that has moderate resistance to FHB. Depending on data from 2002 this line will enter industry malting evaluation with the 2002 crop.

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.

Kolb, F.L., G-H. Bai, G.J. Muehlbauer, J.A. Anderson, K.P. Smith, and G. Fedak. 2001. Host Plant Resistance Genes for Fusarium Head Blight: Mapping and Manipulation with Molecular Markers. *Crop Sci* 41: 611-619.

Wingbermuehle, W. J. and Smith, K. P. 2002. Screening Potential Sources of FHB Resistance for New FHB Resistance Genes. 2002 Plant and Animal Genome Meeting, San Diego, CA. 1/12/01 - 1/16/01.

Gustus, C. and K. P. Smith. 2001. Evaluating Phenotypic and Marker Assisted Selection in the F<sub>2</sub> Generation for Chevron-derived FHB Resistance in Barley. Proceedings of the 2001 National Fusarium Head Blight Forum. Erlanger, KY 12/8/01 - 12/10/01.

Wingbermuehle, W. J., K.M. Belina, and K.P. Smith. 2001. Assessing the Genetic Diversity of Fusarium Head Blight Resistant Sources in Barley. Proceedings of the 2001 National Fusarium Head Blight Forum. Erlanger, KY 12/8/01 - 12/10/01.

Smith, K. P. 2001. Variety Development and Uniform Nurseries: FHB Resistance in Barley. Proceedings of the 2001 National Fusarium Head Blight Forum. Erlanger, KY 12/8/01 - 12/10/01.