U.S. Wheat and Barley Scab Initiative
Annual Progress Report
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Cover Page

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Year:	**FY1999**
Grant Number:	**59-0790-9-055**
Grant Title:	**Fusarium Head Blight Research**
Amount Granted:	**$53,659.00**

Project

Program Area	Objective	Requested Amount
Biotechnology	Enhance scab resistance in wheat and barley germplasm by plant transformation.	$35,000
Biotechnology	Use mapping scab QTL in barley and development of scab QTL near-isogenic lines.	$20,000
	Requested Total	$55,000[1]

Principle Investigator Date

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

Project 1: Enhance scab resistance in wheat and barley germplasm by plant transformation.

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

   Fusarium head blight (FHB or scab) is a disease that can devastate wheat and barley. The objectives of the grant are to transform wheat and barley with antifungal protein genes, and to develop and test the transgenic plants for resistance to FHB.

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

   The established objectives were to develop wheat and barley carrying antifungal protein genes, characterize the plants at the molecular level and test them for resistance to FHB.

   We have met the objective of developing transgenic wheat and barley carrying antifungal protein genes. We developed wheat plants that carry a wheat thionin antifungal protein gene. We are in the process of characterizing these plants at the molecular level. In barley, we have transgenic plants carrying a wheat thaumatin-like protein gene. In addition, we are in the process of developing transgenic wheat plants carrying a barley glucanase and ribosome inactivating protein, and the *Fusarium graminearum tril101* Don-detoxifying gene. We have not tested any of our transgenic plants for resistance to FHB.

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

   We have met the objectives of developing wheat and barley plants carrying antifungal protein genes. Currently, we are characterizing these plants. We have not had enough time to get to the point of testing the transgenic plants for resistance to FHB.

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

   We have developed transgenic wheat plants that carry a thionin antifungal protein gene that may provide enhanced resistance to FHB. We also have transgenic barley plants carrying a wheat thaumatin-like protein gene that may provide enhanced resistance to FHB.

Project 2: Use mapping scab QTL in barley and development of scab QTL near-isogenic lines.

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

   Fusarium head blight (FHB or scab) is a disease that can devastate wheat an barley. We are developing the molecular tools to conduct marker assisted selection (MAS) for resistance to FHB and deoxynivalenol (DON) accumulation. In addition, we are developing barley genetic stocks that carry QTL associated with resistance to FHB and DON accumulation.

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

   Objective 1. Verify QTL associated with resistance to FHB and DON accumulation.
   In our Chevron/M69 mapping work (de le Pena et al., 1999), we identified QTL that are associated with resistance to FHB and DON accumulation. Therefore, our initial mapping efforts have focused on these regions in the MNS93/Stander population. QTL analysis of these chromosomes indicates that at least one region (located on chromosome 2) identified in the original Chevron/M69 population is associated with FHB resistance in the MNS93/Stander population. These results indicate that we have verified one region identified in the Chevron/M69 population that is associated with FHB resistance.

   Objective 2. Map FHB resistance QTL from two-rowed barleys.
   We have decided to focus our mapping efforts on a Fredrickson/Stander RIL population. Fredrickson is a two-rowed barley carrying resistance to FHB. Stander is a six-rowed malting variety that is susceptible to FHB. Disease evaluations on the Fredrickson/Stander population were conducted in the summer of 1999 and this population exhibits significant variation to justify a continued mapping and breeding effort. We have identified 65 RFLP and 35 SSR markers that exhibit polymorphism between the two parents. Twelve RFLP markers have been genotyped on the population. The Fredrickson/M81/Stander BC_1F_3 population was evaluated at two locations in Minnesota during the summers of 1998 and 1999. There is significant variation for FHB within this population to justify a continued breeding effort. The main purpose for this population will be for verifying the QTL identified in the Fredrickson/Stander RIL population.

   Objective 3. Use MSU to select and develop NILs for specific QTL regions.
   We have decided to examine one QTL that is associated with resistance to FHB and DON accumulation that was identified in the Chevron/M69 population (de la Pena et al., 1999). We have focused on the chromosome 2 region that is associated with resistance to FHB and DON accumulation. We have made two backcrosses to M69 to develop NIL for this region. Genotyping of the lines will be conducted in the near future.

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

We are meeting the objectives of the grant.

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

We verified a major QTL on chromosome 2 associated with resistance to FHB and DON accumulation that was previously identified in the Chevron/M69 population. We initiated mapping QTL for resistance in the Fredrickson/Stander population and we are in the process of developing the genetic stocks for the NIL development.

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.

Publication:

de la Pena, R.C., K. Smith, F. Capettini, G.J. Muehlbauer, M. Gallo-Meagher, R. Dill-Macky, D.A. Somers and D.C. Rasmusson. 1999. Quantitative trait loci associated with resistance to Fusarium head blight and kernel discoloration in barley. *Theor. Appl. Genet.* 99:561-569.

Abstracts:

G.J. Muehlbauer and L. Smith. 1999. Developing transgenic barley carrying antifungal protein genes. Barley Workers Meeting, Idaho Falls, ID.

Canci, P.C., K. Smith, R. Dill-Macky, G.J. Muehlbauer and D.C. Rasmusson. 1999. Genetic relationship between Fusarium head blight, kernel discoloration, and grain protein. 16th American Barley Researchers Workshop, p. 18.