PI: James Anderson
PI's E-mail: ander319@umn.edu

Project ID: 0506-AN-007
FY04 ARS Agreement #: 59-0790-4-091

Research Area: GIE
Duration of Award: 1 Year

Project Title: A Germplasm Center of Fusarium Head Blight Resistant Spring Wheat.

PROJECT 1 ABSTRACT
(1 Page Limit)

The use of resistant cultivars will be one of the major components in managing Fusarium head blight (FHB) in wheat. The availability of diverse resistance sources is essential for success in developing and maintaining a high level of resistance in commercial cultivars. This project confronts the issues of finding additional or new sources of resistance in spring wheat, characterizing the resistance, and facilitating the deployment of the resistance into breeding projects.

In the past a few years, the spring wheat germplasm screening project funded by the U.S. Wheat and Barley Scab Initiative has developed a successful germplasm evaluation and enhancement system while maintaining the efficiency of screening and information/germplasm distribution. Components of this system are: 1) a large number of spring wheat lines with diverse origins are evaluated for FHB resistance under high-disease pressure conditions in the field in a Preliminary Screening Nursery (PSN); 2) selections from PSN are evaluated in the greenhouse to characterize the types and levels of resistance and further evaluated in an Elite Germplasm Nursery (EGN); 3) five of the most resistant selections are entered into the Uniform Regional Scab Nursery (URSN) for spring wheat to be evaluated at multiple locations; 4) data and seed are promptly distributed to interested parties; and 5) the most elite resistant selections are used to develop populations for introgression of resistance into adapted backgrounds, and for genetic studies. Lines with introgressed resistance will be released as new germplasm. During this funding period, we will continue to follow this research scheme but shift our major emphasis from identification of additional resistance to the characterization of new resistance sources identified by this project, and to the introgression of resistance into an adapted background.

The objectives of the proposal encompass the research priorities of the GIE. The accomplishment of the proposed research objectives will significantly contribute to the national wheat improvement efforts for FHB resistance and successful management of this disease.

PI: James Anderson
PI's E-mail: ander319@umn.edu
Project ID: 0506-AN-008
FY04 ARS Agreement #: 59-0790-4-091
Research Area: VDUN
Duration of Award: 1 Year
Project Title: Breeding Fusarium Head Blight Resistant Spring Wheat.

PROJECT 2 ABSTRACT
(1 Page Limit)

Wheat varieties with greater resistance to *Fusarium* head blight (FHB) would make a substantial contribution to reducing the losses from this devastating disease. These objectives of this proposal are:

1) Develop Fusarium head blight resistant wheat germplasm and varieties adapted for commercial production in Minnesota and the surrounding region and characterize the level of FHB resistance of all wheat varieties grown in the region.

2) Determine the effect of chromosome 5AS and 5BL FHB QTLs on grain yield and quality, resistance to other diseases, and other agronomic characteristics using near-isogenic line pairs.

Crosses will be made between and among FHB resistance sources and regionally adapted germplasm. Field and greenhouse screening of materials will be used to characterize levels of FHB resistance. Approximately 2,000 breeding lines will be evaluated in as many as three inoculated, misted field nurseries. In addition, we will evaluate the Uniform Regional Scab Nursery for Spring Wheat Parents and Uniform Regional Nursery (variety candidates) for FHB reaction at two locations. Superior germplasm will be released as improved varieties, resistant germplasm, or made available upon request.

Although numerous QTLs for FHB resistance have been documented, few have been carefully studied to determine if they cause a linkage drag (e.g. lower grain yield) or adversely affect resistance to other diseases or grain quality. As part of a current USWBSI proposal, we are characterizing the effect of two QTLs, on chromosomes 5AS and 5BL, for their effect on FHB, using near-isogenic line pairs. These materials, currently 11 NIL pairs, will be tested in field nurseries in 2005 for comparison of grain yield, resistance to leaf and stem rust, grain quality, agronomic characteristics, and other diseases.

PI: James Anderson
PI's E-mail: ander319@umn.edu

Project ID: 0506-AN-129
FY04 ARS Agreement #: 59-0790-4-091
Research Area: VDUN
Duration of Award: 1 Year

Project Title: Development of Spring Wheat Varieties with Fusarium Head Blight Resistance using DNA Markers and Retrospective Breeding.

PROJECT 3 ABSTRACT
(1 Page Limit)

Wheat varieties with greater resistance to *Fusarium* head blight (FHB) would make a substantial contribution to reducing the losses from this devastating disease. Given i) the ongoing need for FHB resistant wheat varieties; ii) the current knowledge regarding the inheritance of FHB resistance and the number of quantitative trait loci (QTLs) that have been tagged with markers; and iii) the establishment of the USDA-ARS Small Grains Genotyping Centers, now is the time to employ our expertise and resources to address this issue. The objectives of this proposal are to:

1) Develop Fusarium head blight resistant wheat varieties adapted for commercial production in Minnesota and the surrounding region using DNA markers to enrich selected populations for their frequency of major FHB QTLs.

2) Characterize the relative FHB resistance of different combinations of FHB QTLs.

This proposal will utilize retrospective breeding to identify populations likely to produce variety candidates and contain multiple FHB QTLs. These populations will be enriched for FHB QTLs by selecting for linked DNA markers in the F_2 and F_3 generations. Enriched populations will be larger than normal breeding populations and undergo phenotypic selection for FHB resistance, and other yield, disease resistance, and end-quality use testing necessary to produce variety candidates. Twenty new F_2 populations per year will be entered into this marker-enrichment program. Three FHB nurseries per year will be utilized in order to speed the identification of the most FHB resistant lines that are suitable variety release candidates.