U.S. Wheat and Barley Scab Initiative
FY02 Final Performance Report (approx. May 02 – April 03)
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Cover Page

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Project

Program Area	Project Title	USWBSI Recommended Amount
GIE	Facilitate international germplasm and information exchange through CIMMYT.	$140,000
	Total Amount Recommended	**$140,000**

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Principal Investigator Date

Project 1: Facilitate international germplasm and information exchange through CIMMYT.

1. What major problem or issue is being resolved and how are you resolving it?
Major US commercial bread wheat, durum wheat and barley varieties proved highly susceptible to FHB in the northern States during the 1990's. The USWBSI in this project aims to broaden the genetic base of resistance. CIMMYT has regular access to new FHB resistant spring and winter bread and durum wheats plus barleys, from FHB-prone regions including Brazil, Argentina, China, Japan and Romania. CIMMYT staff visits countries in these regions once to several times a year. Locally based CIMMYT staff in respective regions (e.g. He Zhonghu in China; D. Tanner in Ethiopia) or our national program colleagues ship us resistant materials identified by them and regional breeding programs. The best lines are sent to USWBSI.
CIMMYT distributes an international Scab Resistance Screening Nursery since the mid 1980's, whenever a sufficiently large number of new lines are available for international testing. Ouir cooperators use these materials for their own crossing, and are requested to return data. Since FHB is not a necessarily annually reoccurring disease even in FHB-prone countries, disease data is not always returned. The data that is returned is shared with USWBSI.
The recent inclusion of barley parents with malting quality in the FHB resistant barley populations aims at combining both key sets of traits. These objectives are being reached through the combinations of parents from diverse global sources and shuttle breeding of the derived populations within Mexico and outside.
Since the1980's synthetic wheats (now more than 900) were developed at CIMMYT based on elite durum wheats and international *Aegilops tauschii* accessions. By the late 1990's several of these synthetics proved to express high Type I and Type II resistance to FHB. Work aims to introgress resistance from 11 resistant (under Mexican conditions) synthetics into five northern US wheats (Ivan, Reeder, Russ, Verde, and Wheaton) through simple- and backcrossing, application of one or more rounds of selection for FHB in Mexico, with resulting resistant lines/populations sent to USWBSI.

2. What were the most significant accomplishments?
A total of 1348+1701+1686 bread wheats (42,480+8526 spikes inoculated), 237 wide cross derivatives (mostly synthetic derivatives; almost 10,000 spikes), 284 durum wheat (>12,000 spikes) and 1168 barley (>31,000 spikes) lines were screened in Toluca in 2002, for resistance Type I and/or II. The most resistant entries will be evaluated for FHB again in Toluca 2003 to confirm the resistance. Lines with the highest levels of resistance for two-three years in a row were sent to USWBSI in late 2002. These included genotypes that have yielded well in Toluca (8-9 t/ha) and are resistant to prevalent leaf, stripe and tem rust races plus *Septoria tritici*, besides simple or multiple gene accumulation for FHB from diverse sources. 15 synthetic derivatives were identified with multiple disease resistance. 37 spring and 33 winter bread wheats from Mexico (both common wheat and synthetic derivatives), Uruguay, China, South Africa, Brazil, and Hungary were shipped. Identification of resistance in durum wheat is very new. We shipped ten lines with less than 75% of the mean of trial Type I resistance and two types of measurements of Type II resistance. These materials are now being tested in Uruguay. FHB resistance in barley found in Mexico was confirmed in the US, Canada, China and South

America. Eight resistant barley entries entered into the north-American NABSEN nursery. The best barley 60 lines were included in the 2002-03 China nursery and the best 79 lines were sent to USWBSI. Lines derived from crosses with US malting barley germplasm ('Legacy' and 'Merit') were tested in Toluca 2002 and are being confirmed in the present 2003 cycle. Lines expected to be resistant to stripe rust, scald and BYDV will be evaluated for FHB again in Toluca 2003 and the aim is to identify resistant germplasm with acceptable malting quality.
The same entries, received from others and from our own pre-breeding and breeding programs, that enter into the international Scab Resistance Screening Nursery (SRSN), are also annually being shipped to USWBSI. FHB response data on five non-common sites for the 4th SRSN, 5th SRSN, and 6th SRSN are available in Excel files to USWBSI.
117 F6 lines from backcrosses of FHB resistance from synthetic wheats into five US varieties are being increased under fungicide control for shipment to USWBSI in November 2003. The original F4 lines were ready for shipment at the end of 2002, but the new breeder in at NDSU informed us to delay shipment by one year given a lack of greenhouse space. Additional backcross populations are being screened for FHB resistance presently and the best will be readied for shipment next year. During the December 2002 USWBSI meetings we were asked to also use FHB resistant winter wheats in crosses to selected US varieties and in general to lower the priority in this effort. Those winter wheat resistance sources are presently being reconfirmed following a first screen in 2002, of which the best 33 materials were sent to the USWBSI. Once confirmed these winter wheats will be crossed to US varieties, as specified by USWBSI.
Three advanced synthetic derivatives, with Type I, III and IV levels of resistance determined by independent evaluations from our collaborators, have been used as the source of generating molecular mapping populations of which one with the pedigree Mayoor//TK SN1081/*Ae. tauschii* (222) was crossed with Flycatcher to generate 171 double haploids that have become the basis of phenotyping in Mexico and genotyping in Michigan State. Also DH mapping populations are being developed on 8 populations from Missouri. *Thinopyrum bessarabicum* translocations are being produced from FHB resistant accessions. 148 A/B accessions from *T. monococcum*, *T. urartu*, *T. boeoticum* and *Ae. speltoides* were tested for FHB resistance but at least these derivatives did not express promising levels. *Ae. tauschii* sources are being identified for cytogentic manipulation to move resistance to durums.
We identified four genes for resistance to FHB Type II in F8s of crosses involving three high-yielding spring bread wheat parents that are good combiners in crosses. A manuscript was submitted to a refereed journal. Presently we are studying these populations to identify markers. These lines are recommended for use in breeding programs (BAU/MILAN, GOV/AZ//MUS/3/DODO/4/BOW and CATBIRD) and have been shared with USWBSI. Five new doubled haploid marker populations were developed using three sources of FHB resistance (BCN*2//CROC_1/AE.SQUARROSA (886), SHA3/CBRD, and GOV/AZ//MUS/3/DODO/4/BOW) during 2002/2003.
Two DH barley populations were developed in collaboration with Oregon State University. The best lines were used as resistant sources in crosses. Germplasm collections from different regions of the world including from the US were tested for resistance to *F. graminearum* and *F. avenaceum*. A *Fusarium* species x genotype interaction was found in the severity readings. In the same work *F. avenaceum* was confirmed as the main causal agent of FHB in Mexico. Six barley researchers from North Dakota, Minnesota and BARI visited and selected in our barley plots.

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.

1. Cano, S., R. Delgado, and A. Mujeeb-Kazi. 2002. Contribution of alien germplasm for Fusarium head scab resistance in wheat. Agronomy Abstracts. American Society of Agronomy. CD ROM.
2. Gilchrist, L. 2001. Perspectives on Fusarium Head Blight resistance in barley. Pp 61-71 In: Breeding Barley in the New Millenium. Proceedings of an International Symposium. H.E. Vivar and A. McNab (eds.). Mexico, D.F.: CIMMYT.
3. Gilchrist, L., M. van Ginkel, R. Trethowan, and E. Hernandez. 2002. Genes with major effects on FHB resistance promise easy marker application. Pp. 239-241. Proceedings 2002 National Fusarium Head Blight Forum. Holiday Inn Cincinnati-Airport, Erlanger, Kentucky, December 7-9, 2002.
4. Lianfa, S., Z. Jumei, S.Qingjie, Z. Yanbin, L.I. Gilchrist and A. Mujeeb–Kazi. 2002. Scab resistance of some partial amphiploid derivatives of bread wheat/ *Thinopyrum intermedium*. Annual Wheat Newsletter. 48:104.
5. Mujeeb-Kazi, A., and R. Delgado. 2002. D genome contribution Fusarium type II resistance in synthetic hexaploid wheats (SH; 2n=6x-42, AABBDD). Annual Wheat Newsletter. 48:94-96.
6. Mujeeb-Kazi, A., and R. Delgado. 2002. Free threshing bread wheat/synthetic hexaploids derivatives resistant to *Fusarium graminearum*. Annual Wheat Newsletter. 48:93-94.
7. Van Ginkel, M. and L. Gilchrist. 2002. How to make intelligent crosses to accumulate Fusarium head blight resistance genes based on knowledge of the underlying resistance mechanisms. Pp. 268- 272. Proceedings 2002 National Fusarium Head Blight Forum. Holiday Inn Cincinnati-Airport, Erlanger, Kentucky, December 7-9, 2002.
8. Van Ginkel, M. L. Gilchrist, R.M. Trethowan and E. Hernandez. 2003 (submitted). Determination of the inheritance of Fusarium Head Blight resistance in bread wheat.
9. Zaharieva, M., K. Suenaga, H.M. William, and A. Mujeeb-Kazi. 2003 (in press). Genetic diversity of synthetic hexaploids (SH) with enhanced levels of resistance to Fusarium head scab. Annual Wheat Newsletter.
10. Ramirez- Marchand, Cesar. 2003. La Fusariosis de la espiga de la cebada : Especies, Distribucion, Danos , Toxinas y perspectivas de manejo en los Valles Altos de Mexico. Tesis de maestria en Proteccion Vegetal. Main advisor: Lucy Gilchrist. Universidad Autonoma de Chapingo Chapingo, Estado de Mexico