USDA-ARS / USWBSI
FY03 Final Performance Report (approx. May 03 – April 04)
July 15, 2004

Cover Page

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Year:	**FY2003 (approx. May 03 – April 04)**
FY03 ARS Agreement ID:	**59-0790-9-056**
FY03 ARS Agreement Title:	**Enhancement of Fusarium Head Blight Resistance in the Southeastern U.S. Germplasm Pool.**
FY03 ARS Award Amount:	**$ 30,063**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
GIE	Evaluation of diploid wheat relatives and intergeneric hybrids for Fusarium head blight resistance.	$ 8,507
VDUN	Development of Fusarium Head Blight-resistant wheat for the Southeastern United States.	$ 21,556
	Total Amount Recommended	**$ 30,063**

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Principal Investigator Date

* BIO – Biotechnology
CBC – Chemical & Biological Control
EDM – Epidemiology & Disease Management
FSTU – Food Safety, Toxicology, & Utilization
GIE – Germplasm Introduction & Enhancement
VDUN – Variety Development & Uniform Nurseries

Project 1: ***Evaluation of diploid wheat relatives and intergeneric hybrids for Fusarium head blight resistance.***

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

We are seeking potentially novel sources of resistance to Fusarium Head Blight in wild and cultivated relatives of wheat (A and D genome diploids) and in the Sando collection of intergeneric hybrids (*Triticum aestivum x Lophopyrum elongatum).* The A and D genome diploids were collected from regions of Turkey and Iran where FHB is reported to occur. Four plants in each of 262 accessions were evaluated for Type II resistance in the greenhouse and for resistance to Fusarium damage to the grain post-harvest. Plants were inoculated by injecting a single floret with 10 microlitres of a spore suspension containing a mixture of isolates at a concentration of 50,000 spores per milliliter. Type II resistance was evaluated at 21 days post inoculation. Mature seeds harvested from inoculated heads were rated on a scale of 0-5 that reflected the percentage of Fusarium damaged kernels.

2. What were the most significant accomplishments?

The best Type II resistance and kernel quality was observed among seventy accessions of intergeneric hybrids in the Sando collection. Almost 50% (32 accessions) were selected for re-evaluation in greenhouse and field in 2004-05. If the materials appear to have FHB resistance and overall adaptation to the southeastern US in field evaluations in 2005, a limited number will be entered in the Southern Uniform FHB nursery following seed increase. The high and consistent levels of resistance observed in four accessions (PI 611899, PI 611928, PI 611937 and PI 611939) prompted us to take the unusual step of making crosses to cultivated North Carolina germplasm based on a single season of evaluation.

Nineteen out of 144 *T. monococcum (*A genome*)* accessions were selected for re-evaluation in 2004-05 in the greenhouse (PI 427443, PI 47668, PI 427671, PI 427803, PI 427947, PI 554516, PI 554560, PI 560869, PI 575589, PI 167611, PI 167627, PI 254195, PI 355519, PI 428160, PI 428168, PI 428171, PI 428172, PI 538722 and PI 573525). The overall level of resistance in the *T. monococcum* accessions was moderate to poor and none of the selected accessions had resistance levels equal to the best material in the Sando collection.

None of the 48 *Aegilops tauschii* (D genome) accessions expressed resistance in our evaluations and none were chosen for re-evaluation in 2004-05.

Project 2: ***Development of Fusarium Head Blight-resistant wheat for the Southeastern United States.***

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

The Fusarium Head Blight (FHB) epidemic of 2002-03 left one-half of the North Carolina wheat crop unsuitable for human consumption. We are resolving this problem by developing southeastern adapted cultivars with high levels of FHB resistance combined with superior productivity, disease and insect resistance and end-use quality that the wheat community expects. We are infusing North Carolina wheat breeding populations with FHB resistance genes from a diverse array of adapted and exotic sources. We expanded our greenhouse and field FHB screening nurseries as more segregating populations advance to later generations. We initiated in-house SSR assisted selection in populations containing the 3BS resistance. To provide breeding programs with solid, independent data on resistance in advanced generation lines the fourth Uniform Southern Soft Red Winter Wheat Fusarium Head Blight Nursery was coordinated by North Carolina State University during the 2003-04 growing season.

2. What were the most significant accomplishments?

Twenty two $F_{6:8}$ lines of FHB resistant Chinese parentage combined with North Carolina adapted germplasm were identified for entry into advanced yield testing in 2004-05. These lines exhibited FHB resistance combined with overall agronomic adaptation to North Carolina. Eighteen $F_{5:7}$ lines containing the 3BS QTL identified in SSR screening were selected to enter preliminary yield testing in 2004-05. Over 560 $F_{4:5}$ and 1120 $F_{3:4}$ head rows were evaluated in an inoculated field nursery. Of these, 88 $F_{3:4}$ head rows and 61 $F_{4:5}$ head rows were selected for evaluation in 2004-05. Eight thousand heads in the F_3 generation were selected from 100 bulk populations segregating for FHB resistance. These will be evaluated in 8,000 $F_{3:4}$ head rows in 2004-05 for overall adaptation, disease and insect resistance. Over 8,000 F_2 heads were selected from 84 bulk populations segregating for FHB resistance. These will be advanced as 84 F_3 bulk populations in 2004-05. One hundred nineteen 2- and 3-way F_1's segregating for FHB resistance were advanced to the F_2 generation for bulk propagation. One hundred thirty six 2- and 3-way F_1's were made in the greenhouse with FHB resistant parents. Liu and Anderson (Crop Sci., 43:760-766) identified lines distinct from Sumai 3 based on allelic content at five SSR loci. Crosses were made with 16 of these to initiate a backcross program to introgress diverse FHB resistance into North Carolina adapted germplasm. The Uniform Nursery program was improved by the inclusion of international cooperators during 2002-03. Thirty elite breeding lines submitted by seven public and private breeding programs were distributed to 14 cooperators in the US and Europe. Twelve cooperators (10 US and one each in Romania and Hungary) returned greenhouse and/or field nursery data. One cooperator returned SSR data and one cooperator (Ireland) returned detached leaf evaluation data. The data were summarized in a nursery report distributed to wheat breeders and pathologists in Dec 2003. A manuscript on the efficacy of the detached leaf technique for identification of FHB resistant lines, co-authored by the US and Irish nursery cooperators, and based on the nursery data was accepted for publication. The fifth Uniform Nursery was distributed in Fall 2003 to 13 public and private cooperators in the US and two cooperators in Europe. This nursery contained three entries from Romania and represented the first time international cooperators made comtemporary elite materials available to US breeders in this nursery.

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 you grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Murphy, J.P., R.A. Navarro and D.A. Van Sanford. 2003. Uniform Southern Soft Red Winter Wheat Fusarium Head Blight Screening Nursery. Dept. of Crop Science, N.C. State Univ. 28 pp.

Browne, R. A., J. P. Murphy, and 12 co-authors. 2005. Evaluation of Fusarium Head Blight resistance in soft red winter wheat germplasm using a detached leaf assay. Plant Dis. (accepted).