

**U.S. Wheat and Barley Scab Initiative
Annual Progress Report
September 18, 2000**

Cover Page

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Year:	FY2000
Grant Number:	59-0790-9-056
Grant Title:	Fusarium Head Blight Research
Amount Granted:	\$53,000.00

Project

Program Area	Objective	Requested Amount
Germplasm	Maintain a germplasm center.	\$19,960.00
Variety Development & Uniform Nurseries	To enhance variety development of scab resistant varieties.	\$14,513.00
Variety Development	To enhance variety development of scab resistant varieties.	\$9,784.00
	Requested Total	\$44,257.00¹

Principal Investigator

Date

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

Project 1: Maintain a germplasm center.

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

Southeastern U.S. wheat breeders, producers and end-users are anxious that pro-active measures be taken to avoid a repeat of the Northern Soft Winter and Hard Spring Wheat experiences with Fusarium Head Blight (FHB) during the 1990s. Almost all varieties currently grown in the Southeast are very susceptible. The problem that is being resolved is to find new and diverse sources of resistance to FHB that plant breeders can utilize in their variety development programs. Southeastern breeders have primarily utilized Chinese spring wheat germplasm as their resistance source during the past two years. A basic tenet of breeding for host resistance is to avoid the use of a single, or few, sources of resistance. In addition, the Chinese germplasm has very poor agronomic characteristics for the Southeastern U.S.; thus, it is timely to try to find additional sources of FHB resistance, particularly in a winter background. We are resolving this problem by evaluating cultivated winter wheats from The Balkans where resistance has previously been identified. In addition, we are evaluating synthetic wheats (Durum x goatgrass) and diploid and tetraploid wheat relatives *T. monococcum* and *T. dicoccoides* to try to identify potentially novel sources of resistance not present in the cultivated background.

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

We obtained Type 2 and Type 3 resistance data on 239 cultivated wheats from The Balkans, 30 from the Southeastern U.S., 31 synthetics from CIMMYT in Mexico, and 18 accessions of diploid and tetraploid accessions in the greenhouse during the 1999-2000 season. The actual number of Balkan lines on which complete data were obtained was approximately one-half that desired. No field data on the Balkan materials were obtained.

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

Greenhouse: Approximately 25% of the Balkan lines either failed to germinate or were insufficiently vernalized by our 7-week treatment. Another 25% exhibited reduced germination and we obtained data on fewer than three plants, the minimum deemed acceptable. Field: An overwhelming number of the Balkan accessions failed to head out in our Kinston nursery in a timely manner, if at all. The North Carolina Coastal Plain environment is unsuitable for such evaluations.

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

The Balkan materials were evaluated simultaneously at the University of Missouri by Dr. Anne McKendry and data summarization is not complete, but approximately 10% of lines evaluated appeared to have good Type 2 resistance and with good Type 3 resistances. Most of the resistant materials were landraces and came from diverse geographical regions of Serbia. Two diploid *T. monococcum* lines

Year: 2000
PI: Paul Murphy
Grant: 59-0790-9-056

Progress Report

were identified as having Type 2 resistance. Three synthetic wheats were identified as having good Type 2 resistance and fair Type 3 resistance.

Project 2: To enhance variety development of scab resistant varieties.

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

Southeastern U.S. wheat breeders, producers and end-users are anxious that pro-active measures be taken to avoid a repeat of the Northern Soft Winter and Hard Spring Wheat experiences with Fusarium Head Blight (FHB) during the 1990s. Almost all varieties currently grown in the Southeast are very susceptible. The problem that is being resolved is to infuse southeastern wheat breeding populations with resistance genes from a diverse array of exotic sources to increase the overall levels of FHB resistance in southeastern varieties. We are resolving this problem by developing breeding populations containing approximately 12.5 to 25% FHB-resistant exotic germplasm and 75 to 87.5% soft red winter wheat germplasm. The populations are advanced to the F₃ generation when they undergo selection in field nurseries inoculated with scabby corn under a mist irrigation system.

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

Overall, the actual accomplishments fulfilled the objectives established. Field nursery: 2400 F_{2:3} lines from crosses to two Chinese sources were evaluated during the 1999-2000 season. 560 were selected. 36 F₂ bulks from crosses involving seven additional Chinese, Virginia and Ohio sources were advanced to the F₃ generation. Greenhouse: 38 three-way and 132 two-way F₁s involving 19 additional sources of Chinese, CIMMYT, Italian, Serbian and U.S. origins were obtained. F₁ hybrids obtained with three accessions of *Thinopyrum*, and BC₁F₁ seed obtained with one accession of *Thinopyrum*. F₁ seed obtained with two synthetic wheats of CIMMYT origin.

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

The only objective not met was to find and cross to *Triticum dicoccoides* accessions exhibiting resistance. Unfortunately, we did not find the accessions we evaluated to contain sufficient levels of resistance to warrant making crosses.

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

Field: 560 F_{2:3} lines containing approximately 25% Ning 7405 or Ning 7804 germplasm were selected from a total of 2400. The overall agronomic quality of these materials was acceptable and selected lines appeared to exhibit Type 1 and Type 2 resistance, although FHB pressure in this nursery was low. I am optimistic about the F_{3:4} lines derived from this material to be evaluated in the 2000-01 season. Greenhouse: 170 new two- and three-way hybrids were produced with 19 different sources of resistance. I believe we have reached a 'critical mass' or level at which we need to be operating to insure a reasonable probability of success in developing FHB-resistant varieties.

Project 3: To screen varieties for scab resistance in a uniform nursery.

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

Southeastern U.S. wheat breeders, producers and millers are anxious that pro-active measures be taken to avoid a repeat of the Northern Soft Winter and Hard Spring Wheat experiences with Fusarium Head Blight (FHB) during the 1990s. Almost all of the current varieties adapted to the Southeast are very susceptible. There is little or no information available to breeders with respect to levels of FHB resistance in their elite, advanced generation breeding lines which would assist them in releasing varieties to growers with improved levels of FHB resistance. To resolve this situation, the First Uniform Southern Soft Red Winter Wheat Fusarium Head Blight Nursery was coordinated out of North Carolina State University during the 1999-2000 growing season. Twenty-two elite breeding lines and varieties submitted by five public and private breeding programs were distributed to nine states for evaluation. Six states returned greenhouse and/or field nursery data. These data have been summarized in a nursery report which is being distributed to wheat breeders and pathologists. An added benefit of this nursery is the free exchange of breeding materials between variety development programs. All materials can be utilized in subsequent breeding efforts by any scientist engaged in evaluation of the nursery.

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

Overall, the actual accomplishments fulfilled the objectives established. Although FHB can be a difficult fungus to work with initially, fully 66% of all cooperators provided greenhouse and/or field data. We strongly recommended that the nursery be grown only if irrigation/misting systems were in place and this advice was followed by cooperators. The cooperators that failed to initiate field epidemics noted that very hot and dry weather accompanied flowering. The nursery report provides southeastern breeders with a comprehensive set of solid data on the performance of their elite breeding materials in the presence of FHB epidemics and identifies adapted materials with reasonable levels of resistance that can be used as parents in trait improvement.

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

Not applicable.

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

Significant variation was observed in both greenhouse and field nursery estimates of resistance to FHB among these varieties and elite breeding lines adapted to the Southeast. For example, the two varieties Roane and Coker 9474 and the North Carolina elite line NC96-13965 compared favorably to the most resistant soft wheat standard, Ernie (Don analysis has not been completed at writing). This is valuable information for the grower wishing to choose varieties for a FHB-prone environment and for the breeder when choosing parents in the development of breeding populations for future variety development.

Year: 2000
PI: Paul Murphy
Grant: 59-0790-9-056

Progress Report

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.

Murphy, J. P., R. A. Navarro, and S. Leath. 1999. Evaluation of diploid, tetraploid, hexaploid and synthetic wheats for Type II resistance to Fusarium Head Blight. Proc. Nat. Fusarium Head Blight Forum, Sioux Falls, SD, 5-7 Dec., pp. 133-135.