

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY06 Final Performance Report (approx. May 06 – April 07)
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Cover Page

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Fiscal Year:	2006
USDA-ARS Agreement ID:	59-0790-4-101
USDA-ARS Agreement Title:	Uniform Nursery for SRWW and Breeding Scab Resistant Varieties for Ohio.
FY06 ARS Award Amount:	\$ 89,412

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Award Amount
HGG	Genetics of FHB Resistance in Soft Red Winter Wheat.	\$ 24,391
VDUN	Uniform Nursery for SRWW and Development of Scab Resistance Varieties for Ohio.	\$ 65,021
	Total Award Amount	\$ 89,412

Principal Investigator

Date

* CBCC – Chemical, Biological & Cultural Control
EEDF – Etiology, Epidemiology & Disease Forecasting
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GET – Genetic Engineering & Transformation
HGR – Host Genetics Resources
HGG – Host Genetics & Genomics
PGG – Pathogen Genetics & Genomics
VDUN – Variety Development & Uniform Nurseries

Project 1: *Genetics of FHB Resistance in Soft Red Winter Wheat.*

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

Breeding for FHB resistance is slow in part due to the incomplete knowledge of the genes involved in resistance. The SRWW gene pool has considerable resistance and the study will develop information on the genes that confer this resistance. We are assessing the role of key chromosome segments in a broad-based SRWW population. We will use association mapping techniques to determine if these segments are important.

2. List the most important accomplishment and its impact (how is it being used?).

Complete all three sections (repeat sections for each major accomplishment):

Accomplishment 1:

We have completed the third and final year of phenotyping on a population consisting of 115 RILs from Hopewell/Ernie. The average FHB index was 13.3 with a range of RIL values from 2.7 to 36.7. Forty-five RILs were more resistant than Freedom and 11 were more resistant than Truman. We have isolated DNA from each and the parents have been genotyped with 68 markers from 2DL, 3BS, 3BC, 4B, 5A, and 6BS. Polymorphism was noted for all regions

Impact 1:

The phenotypic and genotypic segregation in this population will allow us to determine if these key regions are affecting FHB resistance. This will verify the value of the Ernie genes and perhaps identify new genes from Hopewell.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?

The study shows that Ernie and Hopewell have different genes for FHB resistance and that recombination can produce significantly better FHB resistance than either parent. More novel information will be available from the mapping study.

Accomplishment 2:

We have completed the second year of phenotyping on a population consisting of 112 RILs from Hopewell/OH599. The average FHB index was 19.2 with a range of RIL values from 1.8 to 56.7. Eighteen RILs were more resistant than Freedom and four were more resistant than Truman. We have isolated DNA from each and the parents have been genotyped with 68 markers from 2DL, 3BS, 3BC, 4B, 5A, and 6BS. Polymorphism was noted for all regions

Impact 2:

The phenotypic and genotypic segregation in this population will allow us to determine if these key regions are affecting FHB resistance. This will verify the value of the Hopewell genes and perhaps identify new genes from Hopewell.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?

The study shows that OH599 and Hopewell have different genes for FHB resistance and that recombination can produce significantly better FHB resistance than either parent. More novel information will be available from the mapping study

Accomplishment 3:

We have completed the third and fourth years of phenotyping on a population consisting of 200 RILs derived from Hopewell and various other SRWW. The average FHB index was 122% of the index of Freedom with a range of RIL values from 19.4 to 490% of Freedom. One hundred and sixteen RILs were more resistant than Freedom and nine were more resistant than Truman. We have isolated DNA from each and the parents have been genotyped with 68 markers from 2DL, 3BS, 3BC, 4B, 5A, and 6BS. Polymorphism was noted for all regions

Impact 3:

The phenotypic and genotypic segregation in this complex population. That indicates that many SRWW cultivars have different FHB resistance genes. The results show that recurrent selection would be effective in the SRWW gene pool. Association mapping will allow us to determine if the key regions are affecting FHB resistance. This will verify the value of the Hopewell genes and perhaps identify new genes from Hopewell as well as the other SRWW parents.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?

The study indicates that the FHB resistance alleles in different SRWW differ from one another. The results indicate the rapid recurrent selection may be very effective at recombining these alleles and improving FHB resistance.

Project 2: *Uniform Nursery for SRWW and Development of Scab Resistance Varieties for Ohio.*

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

Host resistance is a key component for reducing FHB infection and DON. The major hurdle is combining host resistance with yield and the other traits that growers and processors most want. There are many ways to develop host resistance and the OSU program is using many of these including crossing among adapted SRWW cultivars and crossing with exotic sources. We also use field screening and marker-assisted selection.

2. List the most important accomplishment and its impact (how is it being used?).

Complete all three sections (repeat sections for each major accomplishment):

Accomplishment 1:

The OSU program has developed germplasm with high levels of FHB resistance. OH904 has been released as FHB resistant germplasm as it was the most resistant entry in the 2005-06 Northern Uniform Scab Nursery and was second best in 2004-05. In the 2006 test, three of the nine most resistant entries came from OSU. This includes two lines (OH02-7217, OH02-12686) that have been increased for potential commercial release. In the 2005 test, the two best entries were from OSU. Two additional OSU lines have been identified with good FHB resistance (OH02-12678, OH02-13567) and have been increased for potential commercial release. Over all tests of OSU germplasm, 23% of the entries had FHB index that was numerically less than the index of Freedom. This was considerably less than past years because Freedom had a very low index in 2006 due to low disease pressure. Preliminary analysis of OSU germplasm in 2007 indicates 50% had an index < Freedom and 20% had an index < Truman.

Impact 1:

The discovery of germplasm with good FHB resistance and yield is essential for the success of wheat production in regions that are affected by FHB. The OSU program produced ~40 bushels of four breeding lines with good yield and FHB resistance. If data continues to support release, we will have a great start on getting seed of the releases into commercial production in the next 2-3 years.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?

The data from 2006 alone must be confirmed in the next years. But we have identified several line that have good yield and FHB resistance. These may be release to growers and will also serve as excellent parents.

Accomplishment 2:

The 2005-06 NUWWSN and PNUWWSN consisted of 58 and 39 entries respectively from 14 breeding programs. The tests were conducted in 15 and 10 field locations and 2 and 3 greenhouses, respectively. Entries with good FHB resistance were identified in each test.

Impact 2:

The NUWWSN and PNUWWSN provided the most robust assessment of FHB resistance possible for breeders in the region. The entries come from 14 programs including one private company. This information can also be made available to growers to assist them in selecting FHB resistant cultivars. The breeders can make annual selections using this data as they are assured of getting reliable FHB rating from several of the possible location even if their own FHB nursery fails.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?

The tests provide an extensive, unbiased, replicated evaluation of FHB resistance of the most advanced breeding lines. This information is not available from any other source.

Accomplishment 3:

We initiated or continued backcrossing FHB QTL into 12, moderately resistant, elite SRWW genetic backgrounds, involving 33 BC populations. Marker-assisted selection was used in 14 populations for QTL on 3BS, 5A, and 6BS.

Impact 3:

Backcrossing known FHB resistance QTL into multiple, moderately resistant, genetic background enhances the FHB resistance of elite germplasm and can lead to release of a commercial cultivar with very good FHB resistance. In addition, the program creates multiple parents with FHB QTLs. Crossing among these diverse parents will create populations that are fixed for major genes for FHB resistance, do not require MAS, but will vary for minor genes and therefore allow for efficient selection of lines with high resistance.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?

We are creating a diverse population of elite SRWW that will all have the major QTL alleles for FHB resistance. This is a unique set that will complement similar lines being generated by other SRWW programs.

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FY06 Final Performance 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.

Sneller, C., P. Paul, L. Herlad, B. Sugerman, A. Johnston. 2006. Report on the 2005-06 Preliminary (PNUWWSN) and Advanced (NUWWSN) Northern Uniform Winter Wheat Scab Nursery. Ohio State University.