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:	59-0790-4-118
USDA-ARS Agreement Title:	Breeding Soft Winter Wheat with Multiple FHB Resistance.
FY06 ARS Award Amount:	$ 106,454

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Award Amount
HGR	Introgression of Fusarium Head Blight Resistance of Thinopyrum into Wheat.	$ 29,958
VDUN	Improvement of Soft Winter Wheat for Fusarium Head Blight Resistance.	$ 76,496
	Total Award Amount	**$ 106,454**

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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: *Introgression of Fusarium Head Blight Resistance of Thinopyrum into Wheat.*

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

There is great need to identify and introgress into useful common wheat germplasm lines, new effective FHB resistance genes, because known resistance genes each result in only partial resistance. The goal of this project is to introgress a resistance gene with strong effect from *Thinopyrum ponticum* into the spring wheat cultivar Alsen, which has *Fhb1* and into winter wheat lines that have partial resistance from common wheat. We had developed a translocation line, line 275-4, with this resistance on 7DS.7DL-7el$_2$L that has the gene and the 7E segment replaced about 1/3 of the distal part of the long arm of chromosome 7D, sufficiently short so that the translocation line has an excellent common wheat phenotype.

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: We developed an F_2 plant population from Alsen*3/275-4, point inoculated the plants in the field with *F. graminearum* and genotyped the plants with co-segregating markers, respectively for *Fhb1* and the resistance QTL from *Th. ponticum*. We are in process of evaluating inoculated spikes; tentatively, disease spread in spikes of plants with both resistance QTL average 1 diseased spikelet, spikes with *Fhb1* average 2.5 diseased spikelets. We have made the second backcross into winter wheat lines and will phenotype and genotype progeny lines during the next year. We will increase seed of the Alsen backcross line with *Fhb1* and the *Th. ponticum* QTL in the greenhouse in 2007-2008 and make a formal release of the germplasm line in the next year.

Impact: Commercial impact is yet to be realized. However, the effect of the FHB resistance QTL that we identified in *Th. ponticum* el$_2$ is at least as strong as that of *Fhb1*, and FHB severity is significantly reduced in plants with both resistance factors, compared to plants with one or the other (Shen and Ohm. 2007. Plant Breed. 125:424-429).

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?

Availability of wheat germplasm lines with the 7el$_2$ resistance QTL will enable wheat breeders to develop wheat cultivars with significantly enhanced FHB resistance.

Project 2: *Improvement of Soft Winter Wheat for Fusarium Head Blight Resistance.*

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

Some wheat producers currently use wheat cultivars that are susceptible to FHB, partially because these cultivars yield higher and have resistance to other important diseases in seasons in which FHB is negligible, and partially because other available cultivars are only partially resistant and typically are not as high yielding as susceptible cultivars. We are developing new cultivars in which more than one FHB resistance QTL are combined, and that have resistance to other important diseases and yield comparable to FHB susceptible cultivars.

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: We released the cultivar INW0731, which has FHB resistance of its parent lines Fundulea 201R and Freedom. INW0731 is only partially resistant to FHB, although FHB severity of INW0731 is less than that of either F201R or Freedom, but it has effective resistance to yellow dwarf, soilborne mosaic, Stagonospora nodorum blotch, wheat spindle streak mosaic and moderate resistance to leaf rust - all important diseases in Indiana and surrounding regions. It also has excellent soft wheat milling and baking qualities. But also importantly, it has a large root volume (Crowley NA, J Uphaus, and H Ohm, presentation 10-4, ASA-CSSA-SSSA International Annual Meeting, November 12-16, Indianapolis, IN). The effects of large root volume were especially apparent in performance tests in Indiana and tests in other states by AgAlumni Seed Co. in 2007, an unusually dry year for this region, in which performance of INW0731 was consistently high compared to other entries in the tests.

Impact: We released cultivars INW0411 and INW0412 two years ago, both having partial resistance to FHB. Both cultivars were grown for commercial production for the first time in 2006-07. Farmers in Indiana that I have visited with are pleased with their performance, even though FHB was not significant in 2007 in Indiana. Acreage of these cultivars is expected to increase significantly.

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? All of these three cultivars not only have partial resistance to FHB, but they have other important production traits, disease resistance, and utilization qualities, all of which are important for their adoption.

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.

Shen X and H Ohm. 2007. Molecular mapping of *Thinopyrum*-derived Fusarium head blight resistance in common wheat. Mol Breeding DOI 10.1007/s11032-007-9079-9.

Kong L, H Ohm and J Anderson. 2007. Expression analysis of defense-related genes in wheat in response to infection by *Fusarium graminearum*. Genome (in press).

Zila, C, X Shen and H Ohm. 2006. Haplotyping wheat lines for FHB resistance. Poster No. 1605b, session No. 26. ASA-CSSA-SSSA International Annual Meeting, November 12-16, Indianapolis, IN.