USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY08 Final Performance Report (approx. May 08 – April 09)
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Cover Page

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Fiscal Year:	2008
USDA-ARS Agreement ID:	59-0790-8-065
USDA-ARS Agreement Title:	Molecular Marker Evaluation of International Fusarium Spring Wheat Nurseries.
FY08 USDA-ARS Award Amount:	$ 8,719

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Adjusted Award Amount
VDHR-SPR	Development, Evaluation and Distribution of International Fusarium Spring Wheat Nurseries.	$8,719
	Total Award Amount	**$ 8,719**

Principal Investigator E. Duveiller Date: 06-24-2009

* MGMT – FHB Management
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GDER – Gene Discovery & Engineering Resistance
PBG – Pathogen Biology & Genetics
BAR-CP – Barley Coordinated Project
HWW-CP – Hard Winter Wheat Coordinated Project
VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
SPR – Spring Wheat Region
NWW – Northern Winter Wheat Region
SWW – Southern Sinter Wheat Region

Project 1: ***Development, Evaluation and Distribution of International Fusarium Spring Wheat Nurseries.***

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

Scab continues to be a major biotic stress in spring wheat worldwide. Field resistance still relies largely on Sumai-3 and the concern for growing varieties showing low deoxynivalenol (DON) toxin content at harvest is increasing everywhere. There is a need to obtain more varieties with sources of resistance other than that of Sumai-3 (3BS). Using reliable molecular markers can contribute to the identification of these new sources of resistance with a view of pyramiding them in breeding programs.

Through an international collaboration network and through CIMMYT, US breeders benefit in two ways: they can access spring wheat materials with improved resistance from collaborators around the world and they have the possibility of testing their lines in Mexico and other countries. This can correlate results obtained at different locations.

Two nurseries were assembled to make promising materials for Fusarium Head Blight (FHB) available:

1) Fusarium International Elite Spring Wheat Nursery (FIESWN). The nursery includes elite FHB resistant spring wheat lines (registered or near-registered resistant cultivars) that have performed well in regional FHB nurseries.
2) Fusarium International Preliminary Spring Wheat Nursery (FIPSWN). Entries for this nursery are proposed by the contributor and can include any material which addresses the objectives listed above, including NILs of FHB QTLs, parents of mapping populations, etc.

Candidate genotypes submitted for the nurseries are selected based on a preliminary evaluation in Mexico and low DON content. In the first year, nurseries are distributed and sown in countries where quarantine regulations do not require multiplication in the greenhouse, like in the USA. Collaboration with USDA-ARS Fargo allows the haplotyping of FHB QTLs in both nurseries and of the candidate genotypes of the next year. Altogether, 18 DNA markers located on chromosomes 2D, 3A, 3B, 4B, 5A and 6B are used for genotyping.

2. List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):

Accomplishment:
Two international spring wheat nurseries, 1st Fusarium International Elite Spring Wheat Nursery (FIESWN) and 1st Fusarium International Preliminary Spring Wheat Nursery (FIPSWN) were prepared and distributed to 13 collaborators in 2008. Of the 188 entries initially received, 28 were included in the FIPSWN and 50 in the FIESWN based on the field performance and DON content evaluation in Mexico during 2007.

DNA samples of nursery entries and other candidate genotypes submitted to CIMMYT have been extracted at CIMMYT and sent to the collaborating USDA-ARS laboratory (Fargo, North Dakota) for haplotype analysis. Field results were generated within the same year (2008) for Mexico (El Batan) and Austria (Tulln) and the results shared at the USWBSI forum in Indianapolis (Dec. 2008).

In the FIPSWN, 10 lines out of 28 scored below 10% and two lines from CIMMYT's Fusarium program, EMB16/CBRD//CBRD and SABUF/3/BCN//CETA/AE.SQUARROSA (895)*2/4/BCN, scored around 2.5% FHB index. In Austria, seven lines out of 28 scored below 10% FHB index. Sumai 3 resistance was confirmed and was comparable in both locations, confirming the suitability of screening for FHB resistance at the CIMMYT El Batan station. EMB16/CBRD//CBRD ranked among the 10 best entries in both locations.

In the FIESWN, 19 out 50 lines scored below 10% FHB index. Line MN00274-2-6 (USA) was the best at FHB index below 1%; five CIMMYT lines (two of them selected in the Caspian Sea region), nine USA (MSU and MN) and five Canada-submitted lines were in this group. In Austria, there was a clear-cut separation between resistant (< 15% FHB index) and susceptible lines (from 15 to 75% FHB index); 89% of the best 19 lines in Mexico were in the <15%FHB index group in Austria.

Impact:
The collection and dynamic evaluation of the most elite as well as potentially novel sources of FHB resistance on a global level gives the U.S. access to international germplasm that it may not otherwise have. Since much of the germplasm is elite in the country of origin, it is likely to possess other traits of value, such as resistance to other diseases, insect pests and abiotic stresses. The first results confirmed the resistance of lines selected by collaborators in North America, South America and the Caspian Sea region in Mexico and Austria.

Effective and timely collaboration between with USDA-ARS Fargo and CIMMYT showed that combining information on known QTLs using molecular markers with field evaluations for scab in Mexico allows distribution of more diverse germplasm with low to moderate FHB index and low DON accumulation. Consequently, CIMMYT is taking action to acquire validated molecular markers and use them in combination with field screening to organize future Scab Resistance Screening Nurseries.

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.

Mezzalama, M., Buerstmayr, H., Dreisigacker, S. and Duveiller, E. 2008. Development and evaluation of the first Fusarium International Elite Spring Wheat Nursery (FIESWN) and the first Fusarium International Preliminary Spring Wheat Nursery (FIPSWN): preliminary results from Mexico and Europe. Proc. of the 2008 National Fusarium Head Blight Forum, Indianapolis, Indiana, 2 - 4 Dec. 2008, 187-188.

If your FY08 USDA-ARS Grant contained a VDHR-related project, include below a list all germplasm or cultivars released with full or partial support of the USWBSI. List the release notice or publication. Briefly describe the level of FHB resistance. If this is not applicable (i.e. no VDHR-related project) to your FY08 grant, please insert 'Not Applicable' below.

CIMMYT does not release materials but shares germplasm with collaborators.

Table 1 shows the materials in the 1st FIESWN with FHB index results from Mexico and Austria. It also shows the QTLs detected in these materials with help from Dr. Shiaoman Chao (USDA-ARS Fargo). As shown, several materials harbor low to moderate resistance to FHB. Several of these genotypes do not include Sumai-3 QTLs.

Table 1. Result of the 1st Fusarium International Elite Spring Wheat Nursery (FIESWN). Statistical analysis was performed for each country (Mexico, LSD (0.05%) = 15.24; Austria, LSD (0.05%) = 20.91) and across countries, LSD (0.05%) = 12.779. Entries shaded in gray scored FHB indexes below 10% and are not statistically different in Mexico. Entries scoring FHB indexes below 15% and not statistically different in Austria are underlined. Entries in bold scored FHB indexes are not statistically different in Mexico and in Austria.

						QTL									
						Sumai 3			Frontana		Wuhan 1		CJ9306	T. dicoccoides	
No.	Cross	Origin	FHB Index Mexico %	FHB Index Austria %	DON ppm BV-07	3B	5A	6B	3A	5A	2D	4B	2D	3A	7A
1	**BW 346**	**Canada**	**2.61**	**10.50**	0.893										
2	BW 357	Canada	16.16	8.00	1.3								X		
3	CDC TEAL	Canada	17.37	75.00	0.863								X		
4	AC BARRIE	Canada	14.35	29.00	0.68										
5	**CJ W14**	**MSU**	**2.42**	**2.00**	0.718	X		X			X	X			
6	**CJ 9306**	**MSU**	**6.21**	**0.55**	0.014*	X		X			X	X			
7	CJ 9403	MSU	8.01	12.50	0.735					X			X		
8	**CJ 9815**	**MSU**	**8.18**	**10.50**	0.134*					X					
9	**CJ 8809**	**MSU**	**6.06**	**8.00**	0.977	X	X	X			X		X		
10	**N-84-18**	**Iran**	**2.77**	**8.00**	0.962										
11	226	Iran	57.95	30.00	1.9						X				
12	N-78-14	Iran	6.80	15.00	2.7										
13	422	Iran	17.29	45.00	9.2*	X			X	X	X				
14	N-84-11	Iran	15.71	55.00	0.809						X				
15	N-84-19	Iran	16.45	35.00	1.3						X				
16	N-84-6	Iran	14.84	12.50	1.7										
17	N-84-14	Iran	31.19	15.00	3.3						X				
18	N-84-17	Iran	18.61	45.00	1.8						X				
19	INIA CHURRINCHE	Uruguay	11.05	17.50	1.7						X				
20	INIA TERO	Uruguay	20.93	15.00	4.1										
21	INIA BOYERO	Uruguay	16.88	15.00	2.3						X				X
22	INMIR/CBRD	Uruguay	13.21	15.00	2.8					X					
23	CBRD/3/INIA BOYERO//CLEO/INIA66	Uruguay	15.48	7.50	2.3					X	X		X		
24	BACUP	MN	23.78	32.50	0.512										

(Form – FPR08)

						QTL									
						Sumai 3			Frontana		Wuhan 1		CJ9306	T. dicoccoides	
No.	Cross	Origin	FHB Index Mexico %	FHB Index Austria %	DON ppm BV-07	3B	5A	6B	3A	5A	2D	4B	2D	3A	7A
25	WHEATON	MN	30.48	75.00	1.9								X		
26	MN00269	MN	26.74	87.50	1.3						X		X		
27	**MN99112-10-2**	**MN**	**3.16**	**6.50**	0.284										
28	MN99192-10-3-7	MN	13.35	3.50	0.44	X	X						X		
29	MN99322-5-3-1	MN	13.37	0.60	0.506			X			X				
30	MN00209-3-1	NM	14.63	12.50	0.325	X	X								
31	MN00274-2-6`	MN	0.55	13.50	0.229	X									
32	**MN01NIL84-5-5-15-1**	**MN**	**9.60**	**7.00**	0.812				X						
33	**MN02306-2**	**MN**	**3.19**	**7.00**	0.2643										
34	E3-71_T	Austria	14.74	55.00	0.685				X	X			X		
35	**HC 450**	**Canada**	**1.76**	**0.55**	0.049*	X							X		
36	HC 1123	Canada	16.48	4.50	1.2	X									
37	**HY 644**	**Canada**	**6.74**	**10.00**	0.332	X									
38	**L662-27-9**	**Canada**	**5.02**	**7.50**	0.286				X						
39	L662-43-8	Canada	2.31	12.50	0.325				X		X		X		
40	SUNCO/FRAME//PASTOR	Turkey	37.07	40.00	4.1						X				
41	QT4118	Turkey	34.87	60.00	4.1	X				X					
42	SABUF/7/ALTAR 84/AE.SQUARROSA (224)//YACO/6/CROC_1/AE.SQUARROSA (205)/5/BR12*3/4/IAS55*4/CI14123/3/IAS55*4/EG,AUS//IAS55*4/ALD	Turkey	14.26	11.50	1.5				X*	X					
43	CROC_1/AE.SQUARROSA (224)//OPATA	Turkey	19.45	12.50	3.4		X				X				
44	BUCK 75 ANIVERSARIO	Argentina	18.38	14.50	0.079*					X					
45	EYP 240542 ????	Argentina	21.54	18.00	1.3				X				X		
46	ATTILA/TNMU//TNMU	Mexico	21.49	32.50	1.2						X				X
47	**SHA5/WEAVER//80456/YANGMAI 5**	**Mexico**	**1.68**	**2.00**	0.491										
48	CROC_1/AE.SQUARROSA (205)//KAUZ/3/PRL/SARA//TSI/VEE#5	Mexico	7.69	40.00	1.6										X

No.	Cross	Origin	FHB Index Mexico %	FHB Index Austria %	DON ppm BV-07	QTL									
						Sumai 3			Frontana		Wuhan 1		CJ9306	T. dicoccoides	
						3B	5A	6B	3A	5A	2D	4B	2D	3A	7A
49	PBW343/WBLL1//PANDION	Mexico	21.91	67.50	2.3						X				
50	HEILO	Check	7.66	55.00	1.6						X				