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

PI:	Alan Dyer
Institution:	Montana State University
Address:	Dept. of Plant Sciences and Plant Pathology 119 Ag Bioscience Facility Bozeman, MT 59717-3150
E-mail:	adyer@montana.edu
Phone:	406-994-6535
Fax:	406-994-7600
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USDA-ARS Agreement ID:	59-0790-6-059
USDA-ARS Agreement Title:	Responding to Montana's Head Scab Epidemic.
FY06 ARS Award Amount:	$ 23,905

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Award Amount
VDUN	Responding to Montana's Head Scab Epidemic.	$ 23,905
	Total Award Amount	**$ 23,905**

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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: *Responding to Montana's Head Scab Epidemic.*

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

First reported on limited irrigated acreage four years ago, today, we estimate Fusarium head blight (FHB) impacts in excess of 250,000 acres with more than 150,000 irrigated acres being impacted or potentially impacted. This irrigated acreage amounts to approximately $50 million in wheat production. The preferred variety for Montana's western irrigated acreage, Hank, was selected for high yield, high protein and short stature (lodge resistance). Unfortunately, Hank has proven highly susceptible to the *F. graminearum* and Fusarium head blight (FHB). FHB resistant varieties are taller than Hank and under irrigation have a greater tendency to lodge. FHB is also an issue for producers in eastern Montana, as well. Yield potential in eastern Montana is lower and thus short semi-dwarf varieties are not required. FHB-resistant varieties from surrounding states are suitable for production. However, none of the scab-resistant varieties have performed as well as susceptible varieties, McNeal and Reeder, which tend to dominate the acreage in eastern Montana. Additionally, some growers in this part of the state require solid-stemmed varieties such as Choteau to control the wheat stem sawfly (*Cephus cinctus*). No locally adapted, solid-stemmed, FHB-resistant varieties are currently available. Thus, development of FHB-resistant spring wheat varieties for western valleys and for irrigated fields in eastern Montana would be significant contributions to Montana agriculture.

In the first year of this study, we established an independent, variety nursery with leading varieties from WestBred LLC and AgriPro, Inc., as well as the public breeding programs at North Dakota State University and Montana State University. The MSU Scab Nursery was the first trial for comparison of variety responses to FHB while growing the crop under grower conditions (high imput, irrigated production). Information was immediately provided through extension outlets for the variety agronomic performance, grain quality including DON levels, seed analysis and germination, and levels of disease in terms of symptoms and incidence. A field tour of the nursery hosted by WestBred was attended by over 65 growers during the busy growing season. Attendees were able to observe the FHB symptoms in the field and communicate with 10 MSU faculty and extension scientists. In the winter season 2007, MSU and AgriPro Inc. distributed data from this nursery to the seed trade associates, clients and producers.

A primary focus of the breeding efforts has been a backcrossing program to incorporate Sumai 3-derived tolerance into Choteau and other current high-yielding varieties and lines. MT550 was used as the source of scab tolerance in the field trials in 2006. Choteau is the recurrent parent because it has solid stems and is widely grown in sawfly-infested areas of Montana. Additionally, Choteau is becoming popular in the irrigated western valleys due to its relatively short stature and high yield potential under irrigation. The crosses to Choteau are BC_4F_3 families selected to be homozygous for the 3BS QTL and are ready for initial field-testing in the summer of 2008. Finally, we have made crosses of our 3BS lines with the variety Howard, with contains a QTL for scab resistance derived from *T. dicoccoides* (Mergoum et al., 2006). Howard has shown good performance in Montana yield trials, and a modest level of scab tolerance in our 2006 trial.

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: Producers are convinced that FHB is an economic threat to production and marketing of grain. In addition, MSU, WestBred LLC and AgriPro, Inc. are actively breeding for FHB resistance in the western MT irrigated spring wheat regions. Development of a semi-dwarf variety with FHB resistance will be the framework to build an integrated management program for FHB. MSU has incorporated the Sumai3 into widely adapted germplasm using marker assisted selection and 3 generations per year. The backcross F3 families using Choteau as the recurrent parent will be field tested in the summer of 2008.

Impact: Producers, seed distributors, breeding companies and pathologists alike recognized the importance of Scab disease in the irrigated spring wheat areas of southwest Montana following the information obtained from this study in 2006. The highly susceptible varieties were finally recognized as a major contributors to the scab disease over the past 4 years. New certified seed fields of the resistant varieties were sown in 2007 for commercial sales in 2008. Resistant varieties from AgriPro, WestBred and North Dakota State University were made available by several local seed companies.

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 importance of recognizing that Scab disease can be devastating in any region that has sprinkler irrigation and continuous wheat. Wheat residues that are infected by *F. graminearum* and overwinter on the soil surface can be an inoculum source of macroconidia. It is not known what role perithecia and ascospores play, if any, in this region of Montana. Furthermore, Ergot (*Claviceps purpurea*) was prevalent in those varieties with Sumai3 resistance. It is not known if the susceptibility to ergot is associated with the Sumai3 genes or if ergot disease has been overlooked in the irrigated agriculture in southwest Montana.

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.

References:

Lanning, S. K., G. R. Carlson, D. Nash, D. M. Wichman, K. D. Kephart, R. N. Stougaard, G. D. Kushnak, J. L. Eckhoff, W. E. Grey and L. E. Talbert. 2004. Registration of Choteau wheat. Crop Sci. 44:2264-2265.

Presentations:

Grey, W., A. Dyer, J. Riesselman, M. Burrows, and R. Carlstrom. Field Tour of MT Scab Nursery. Amsterdam, MT August 2, 2006. 2.5 hrs 63 participants.

Dyer, A. Scab in Gallatin's Wheat. Willow Creek, MT Jan 2006. 1.0 hr 105 participants.