Cover Page

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Fiscal Year:	FY11
USDA-ARS Agreement ID:	59-0206-1-115
USDA-ARS Agreement Title:	Breeding and Genetics of Fusarium Head Blight Resistance in Barley.
FY11 USDA-ARS Award Amount:	$ 14,634

USWBSI Individual Project(s)

USWBSI Research Category[*]	Project Title	ARS Award Amount
BAR-CP	Genomic Selection for FHB Resistance in Midwest Six-row Barley.	$ 14,634
	Total ARS Award Amount	**$ 14,634**

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Principal Investigator   Date

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[*] 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
DUR-CP – Durum Coordinated Project
HWW-CP – Hard Winter Wheat Coordinated Project
VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
    SPR – Spring Wheat Region
    NWW – Northern Soft Winter Wheat Region
    SWW – Southern Soft Red Winter Wheat Region

Project 1: *Genomic Selection for FHB Resistance in Midwest Six-row Barley.*

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

    Breeding new barley cultivars with resistance to FHB infection is expensive and laborious. It would be desirable to use molecular markers to predict the level of resistance of breeding progenies without the need for disease nurseries and visual screening. Unfortunately it appears that resistance to this disease is genetically complex, being controlled by many genes of small effect. Advances in marker technologies have made markers less expensive and more abundant, allowing breeders to saturate the genome with markers for less cost than screening an individual line. Also, better uses of statistical modeling have produced far more accurate predictions. This form of marker-based selection is referred to as genomic selection. We are in the process of actually carrying out genomic selection for FHB resistance in a breeding program. Many questions regarding its optimal implementation remain, and we believe this case study will produce a rich source of information. Besides potentially directly resulting in new barley cultivars with greater levels of resistant, this project will help future barley breeding programs more effectively incorporate next-generation marker and DNA sequencing technologies so that more productive and resistant varieties are developed.

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):**

    <u>**Accomplishment:**</u>

    We carried out two cycles of genomic selection for FHB resistance.

    <u>**Impact:**</u>

    1) A population of barley progenies with a greater average resistance to FHB than the starting population. We validated this be comparing the original population to the new population.
    2) Generation of new knowledge on how to handle the logistics of a genomic selection program. This has not been performed in wheat and barley before.
    3) A valuable dataset that will allow us and future researchers to learn how to build the best genomic selection model. For example, to what extent does the inclusion of breeding progenies from different populations benefit accuracies of prediction of genetic value for different, but related, populations? Answers to such questions will maximize the likelihood superior barley cultivars resistant to FHB will be released in the future.

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.

Publications:

No publications have directly resulted from this work to date. We are in the process of preparing two manuscripts that will be submitted before Dec 2012.

Presentations:

Lorenz, A.J. 2011. Potential and optimization of genomic selection for Fusarium head blight resistance in six-row barley. University of Illinois, Oct 26. Champaign, IL.

Lorenz, A.J. 2011. Exploring genomic selection for resistance to Fusarium head blight in six-row barley. Biodiagnostics, Sept 8. River Falls, WI.

Lorenz, A.J. 2011. Development of a genomic selection program for Fusarium head blight resistance in barley. Noble Foundation, Apr 7. Ardmore, OK.