USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY11 Final Performance Report
July 13, 2012

Cover Page

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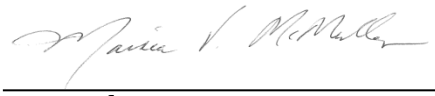
Fiscal Year:	FY11
USDA-ARS Agreement ID:	59-0206-9-064
USDA-ARS Agreement Title:	Studies on Management Strategies and Environmental Factors Affecting FHB and DON in Multiple Grain Classes, ND.
FY11 USDA-ARS Award Amount:	$ 67,583

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Greenhouse Studies of DON in Durum Wheat as Influenced by Infection Timing and F.G. Isolate.	$ 19,512
MGMT	Studies on Integrated Management of Fusarium Head Blight in North Dakota.	$ 39,024
MGMT	Uniform Fungicide Trials in ND.	$ 9,047
	Total ARS Award Amount	**$ 67,583**



6/18/2012

Principal Investigator Date

* 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: *Greenhouse Studies of DON in Durum Wheat as Influenced by Infection Timing and F.G. Isolate.*

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

   NDSU has gathered considerable data on infection timing effects on DON accumulation in spring wheat and needs similar information on durum wheat, a grain class in which resistance to FHB is not as available as in newer spring wheat cultivars. Durum appears to have a longer duration of susceptibility, and differences in durum cultivars needs to be defined, as well as determine if there is an interaction among durum cultivars and *Fusarium graminearum* isolate genotype. These studies with inoculation timing and inoculum chemotype in the greenhouse and subsequent evaluation of DON levels in the durum grain indicated that durum wheat has a wide period of vulnerability to infection, from early flowering to 7-10 days post flowering, and DON accumulation is dependent on stage of infection and isolate type.

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: The results gave us a better understanding of the infection process in durum wheat, with little infection prior to flowering, and little after soft dough stage, but potential for severe disease up to dough stage development. The chemotype component showed that 3ADON isolates resulted in more DON in the more susceptible variety Monroe, but did not result in more DON production than the 15ADON isolate in the more resistant variety Divide.

   Impact: The results indicate that durum has a wide window of vulnerability to infection, and disease forecasting and fungicide use will have to consider this wide window; if favorable weather is occurring immediately post-flowering, fungicides may be necessary if the pre-harvest interval can be followed. Also, the results indicate that all screening of breeding lines should be done with mixed cultures, including both 3ADON and 15ADON isolates.

Project 2: *Studies on Integrated Management of Fusarium Head Blight in North Dakota.*

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

No single management strategy has been fully effective against FHB and DON. The effects of fungicide, genetic resistance, and residue management (crop rotation or tillage) are highly variable and strongly influenced by the environment. Under favorable conditions, moderately resistant cultivars may become infected, and DON contamination may still exceed critical threshold levels. In the case of fungicides, even when standard protocols are used, efficacy varies from one trial to another, with overall mean percent control below 55% for index and below 50% for DON. Fungicides are generally most effective against FHB and DON under moderate disease pressure and when applied to moderately resistant cultivars than to susceptible cultivars. The purpose of these integrated projects is to demonstrate that an integrated approach to managing FHB is most consistent and reliable across grain classes and environments. In ND, these tests were done at four locations and across durum wheat, hard red spring wheat, winter wheat, and spring barley.

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: The 2011 results indicated again the value of integrating host resistance and fungicides for improved reductions in FHB, and two sites also had previous crop in the integrated trial, indicating value of having rotational crops. The studies were done across four grain classes and multiple environments, which provides needed information on all grain classes grown in ND, and spreads the risk of environmental problems across locations, to improve data results. Results were published in the Proceedings of the USWBSI Forum and also on-line through NDSU.

Impact: These trials give visibility to the research on FHB management being done in ND, with a number of field days at the sites of the research trials. The overall impact is that we have better management of FHB in the state with use of integrated approaches, as evidenced in a survey of farmers in the region (see publication list).

Project 3: *Uniform Fungicide Trials in ND.*

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

   Fungicides continue to be an important tool for managing FHB, as true variety resistance is not available, and a combination of the best fungicides and best varieties provide better suppression of the disease than either strategy alone. The hope is to find fungicides that have better efficacy than current products or to find timings or combinations of fungicides that provide improved FHB control as well as control of other important diseases. The uniform trial project tests experimental products (A9232d by Syngenta in 2011) plus looks at timing of products for efficacy and strobilurin timing applications to make sure products applied to small grains for any disease don't increase DON levels in harvested grain, such as heading application timings of strobiluring products.

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: The uniform fungicide protocol was tested on barley, hard red spring, and durum grain classes at several locations in ND. The results indicated the effect of the experimental fungicide in reducing FHB and DON, and also showed the impact of using strobilurin containing fungicides on small grain DON content at various growth stages. The experimental fungicide was not as effective as the best registered products, and, in some cases, the strobilurin containing products did increase DON even when applied pre-heading.

   Impact: The impact of these studies is that they provided data on the lack of efficacy of a possible new product, showed that strobilurin containing fungicides are not good for small grain disease control if applied too close to flowering, and that combination products of triazoles and strobilurins are not as efficacious as triazoles alone in reducing FHB.

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:

Bradley, C.A., Adee, E.A., Ebelhar, S.A., Bergstrom, G.C., Dill-Macky, R., Wiersma, J.J., Grybauskas, A.P., Kirk, W.W., McMullen, M.P., Halley, S., Milus, E.A. Osborne, L.E., Ruden, K.R., and Wise, K.A. 2011. Effects of triazole, strobilurin, and triazole+ strobilurin fungicides on Fusarium head blight and associated mycotoxins. Pages 125-126 in: S. Canty, A. Clark, A. Anderson-Scully, and D. Van Sanford (Eds), Proc. 2011 National Fusarium Head Blight Forum, Dec. 4-6, 2011. St. Louis, MO. University of Kentucky, Lexington, KY.

Gross, P. and Brueggeman, R. 2011. Integrated management of FHB in barley. Page 15 in: Compilation of 2011 NDSU Small Grain Fungicide Field Trials. Link to publication found in publication box at: http://www.ag.ndsu.edu/extplantpath/.

Halley, S., Horsley, R., Misek, K., and Neate, S. 2011. Managing Fusarium head blight in barley with cultivar resistance, fungicide chemistry and sequential applications. Page 139 in: S. Canty, A. Clark, A. Anderson-Scully, and D. Van Sanford (Eds), Proc. 2011 National Fusarium Head Blight Forum, Dec. 4-6, 2011. St. Louis, MO. University of Kentucky, Lexington, KY.

Halley, S. 2011. Integrated management of FHB and Uniform fungicide studies in durum wheat. Pages 27, and 31 in: Compilation of 2011 NDSU Small Grain Fungicide Field Trials. Link to publication found in publication box at: http://www.ag.ndsu.edu/extplantpath/.

McMullen, M. 2011. Integrated management of Fusarium head blight – research and outreach. Presented at the 6th Canadian Workshop of Fusarium Head Blight. Published in: Can. J. Plant Pathology 33:248.

McMullen, M. 2011. Uniform fungicide results in HRSW. Page 53 in: Compilation of 2011 NDSU Small Grain Fungicide Field Trials. Link to publication found at: http://www.ag.ndsu.edu/extplantpath/.

McMullen, M., Meyer, S., and Jordahl, J. 2011. Integrated management of FHB in hard red spring wheat, Fargo, ND 2011. Page 142 in: S. Canty, A. Clark, A. Anderson-Scully, and D. Van Sanford (Eds), Proc. 2011 National Fusarium Head Blight Forum, Dec. 4-6, 2011. St. Louis, MO. University of Kentucky, Lexington, KY.

Ransom, J. 2011. Integrated management of FHB in winter wheat. Pages 77 and 88 in: Compilation of 2011 NDSU Small Grain Fungicide Field Trials. Link to publication found in publication box at: http://www.ag.ndsu.edu/extplantpath/.

Ransom, J. 2011. Integrated management of FHB in spring wheat. Page 57 in: Compilation of 2011 NDSU Small Grain Fungicide Field Trials. Link to publication found in publication box at: http://www.ag.ndsu.edu/extplantpath/.

Ransom, J., McKee, G., and McMullen, M. 2011. Impact of information sources on FHB control strategies adopted by spring wheat growers. Page 143 in: S. Canty, A. Clark, A. Anderson-Scully, and D. Van Sanford (Eds), Proc. 2011 National Fusarium Head Blight Forum, Dec. 4-6, 2011. St. Louis, MO. University of Kentucky, Lexington, KY.

Willyerd, K.T., Li, C., Madden, L., Bradley, C.A., Bergstrom, G.A., Sweets, L., McMullen, M.P., Ransom, J., Grybauskas, A., Osborne, L.E., Wegulo, S., Hershman, D.E., Wise, K.A., Bockus, W.W., Groth, D., Dill-Macky, R., Milus, E.A., Esker, P., Waxman, K., Adee, E.A., Ebelhar, S., Young, B.G., and Paul, P.A. 2012. Efficacy and Stability of Integrating Fungicide and Cultivar Resistance to Manage Fusarium Head Blight and Deoxynivalenol in Wheat. Plant Dis. 96: 957-967.

Presentations:

McMullen, M. 2011. Integrated management of Fusarium head blight – research and outreach. Presented at the 6th Canadian Workshop of Fusarium Head Blight, Nov. 28, 2011, Winnipeg, Manitoba.

McMullen gave 32 Extension Presentations in ND and MN that related to wheat and barley diseases and integrated management of FHB.