USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY12 Final Performance Report
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Cover Page

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Fiscal Year:	FY12
USDA-ARS Agreement ID:	59-0206-9-050
USDA-ARS Agreement Title:	Integrated FHB Management Research - South Dakota.
FY12 USDA-ARS Award Amount:	$ 34,113*

USWBSI Individual Project(s)

USWBSI Research Category**	Project Title	ARS Award Amount
MGMT	Evaluation of Integrated Management Strategies against FHB and DON in South Dakota.	$ 19,493
MGMT	Uniform Fungicide and Biological Control Trials for Management of Fusarium Head Blight in South Dakota.	$ 14,620
	Total ARS Award Amount	**$ 34,113**

Bruce Bleakley 07/15/13

Principal Investigator Date

* Partial funding for this research is under ARS agreement # 59-0206-9-052

** 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: *Evaluation of Integrated Management Strategies against FHB and DON in South Dakota.*

1. **What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?**
   We have been investigating when and how to incorporate different management strategies (including varietal selections, fungicide, and crop rotation) for suppression of Fusarium head blight (FHB) and DON under different environmental conditions. The hope is to identify a combination of these strategies that will help the producer gain an edge against FHB and DON when he/she is thinking about planting small grains, and to help assure that the producer is maximizing potential profit margins on the wheat acres grown.

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:

   By using an integrated management strategy in South Dakota, it has been shown that choosing a moderately resistant variety planted on a non- host crop (i.e. soybeans), paired with a timely fungicide application when the conditions are conducive to Fusarium head blight, shows the highest percent of control for FHB and DON. This study has also shown producers that by making the right choices in their cropping systems, significant improvement of FHB suppression can be seen. In South Dakota, this integrated management strategy is very important, since most of the producers are no-tilling which leaves residue on the top of the fields, providing a ready source of FHB inoculum.

   Impact:

   Understanding the disease cycle, the effects of cropping systems and what tools can be used to develop an integrated management program is increasing producer knowledge about preventing/suppressing FHB. This is ultimately leading to an improved profit per acre of wheat grown in South Dakota.

Project 2: *Uniform Fungicide and Biological Control Trials for Management of Fusarium Head Blight in South Dakota.*

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

Fusarium head blight can only be managed by a combination of cultural and chemical means. In many cases, producers have had to compromise on cultural approaches for disease management and become reliant on chemical control. We have been investigating different fungicides and different application timings to see what the most effective products from the chemical industry are, and how the different application timings affect Fusarium head blight and DON levels. Use of *Bacillus* biological control agents (BCAs) alone or in combination with fungicides was studied, to estimate their usefulness in reducing FHB disease parameters. In 2012 for the uniform biological control trial, the Novozyme commercial product Taegro (*Bacillus subtilis* strain) was applied at field sites in the three participating states (New York, Nebraska, and South Dakota). Optimizing efficacy of this commercially available BCA will provide growers with information about a BCA product that they can obtain and apply in their own fields, if they think it is valuable.

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:

Success has been seen in using the uniform trials by demonstrating to producers, crop consultants, etc. that there is a difference in fungicide efficacy and more importantly that in general, fungicides can be very successful tools for FHB suppression. In some areas of the region it has been shown that if a fungicide is applied a little later in the flowering period but within the pre-harvest interval that is listed on the chemical label, those fungicides can still be effective against FHB and DON.

A uniform set of eight biological or biological plus fungicide treatments were compared to an untreated check for evaluation of control of Fusarium Head blight (FHB) and DON (deoxynivalenol) in wheat. Taegro biological fungicide (*Bacillus subtilis*) was the test BCA, applied either alone or in combination with triazole fungicides, and with or without canola oil as an adjuvant. Treatments were tested on soft red winter wheat, hard red winter wheat, and hard red spring wheat in three states, New York, Nebraska (two separate sites), and South Dakota, respectively. Disease levels were low at the four sites in 2012, because of the occurrence of high temperatures and drought, although each site had either natural inoculum, infested grain spawn, or sprayed inoculum to increase disease potential. FHB Index (% field severity) values were determined at three of the four sites, and were non-significant among treatments at the two NE sites, and generally not significantly different than the untreated check at the SD site. Fusarium damaged kernels (FDK) values were not different among treatments. DON levels were below detectable levels at the two NE sites, and less than one

ppm for all treatments at the NY and SD sites. Results in NY and SD indicated that DON levels generally were significantly reduced with the biological product only when applied in combination with a triazole fungicide. Yield impacts were non-significant at three locations. At the SD site, yield was lowest in the untreated check, and significantly improved with several fungicide or Taegro plus fungicide treatments.

In addition to the uniform biological trial, an extra trial was conducted in Brookings, South Dakota and Langdon, North Dakota to analyze the efficacy of selected *Bacillus* strains (South Dakota isolates) in biological control of FHB. Spray applications of *Bacillus* BCAs alone or in combination with Prosaro (fungicide) and/ or Induce NIS (non-ionic surfactant) and/ or colloidal chitin were done on Durum and Briggs spring wheat heads at Feekes 10.51. In the Brookings spring wheat trial, the combination of strain 1BA, plant oil and Prosaro reduced the FHB incidence to 5.5%, which was less than the FHB incidence observed for Prosaro alone (6.5%) or Untreated control (16.5%). Treatments of strain 1BA with plant oil and Prosaro reduced the disease index to 0.76%, while the treatment with strain 1D3 + plant oil + colloidal chitin + Prosaro® reduced it to 0.74%. Treatment of Prosaro alone reduced the FHB disease index to 0.93%, while for the untreated control it was observed to be 2.74%. Treatment differences were observed for Disease DON (deoxynivalenol), Disease FDK and Disease Protein as well. In the Langdon durum wheat trial, treatment differences were observed for FHB incidence, severity, index, yield and test weight. This trial demonstrated that *Bacillus* strains 1BA or 1D3 in combination with Prosaro and/or colloidal chitin can reduce FHB incidence and FHB disease index in wheat, more than a single application of Prosaro.

Impact:

In our research trials, testing has been done using different timings of spraying fungicides, and we have found out that an application later than early flowering but within the pre-harvest interval of that fungicide, still provides protection against FHB. Being armed with this knowledge has helped producers; so when they have wet and rainy conditions and are unable to get into their fields, they are then able to spray at a later date and still have some protection against FHB.

Disease levels were low at the field sites, so estimation of efficacy of the fungicides and BCAs was problematic for this year. However, the potential use of BCAs to control FHB continues to show promise in reducing some FHB parameters.

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.

Bleakley, B.H., K.R. Ruden, N. Srinivasa Murthy, A. Arens and S. Halley. 2012. "2012 Trial of the Performance of Selected Biological Control Agents for the Suppression of Fusarium Head Blight in South Dakota and North Dakota." In: S. Canty, A. Clark, A. Anderson-Scully and D. Van Sanford (Eds.), Proceedings of the 2012 National Fusarium Head Blight Forum (p. 7). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Fanning, R., C. Strunk and K. Ruden. 2012. "South Dakota Wheat Fungicide Recommendations. SDSU Extension Service-iGrow. 24 p. Online at http://igrow.org/up/resources/03-3008-2012.pdf .

McMullen, M., A. Friskop, J. Jordahl, S. Meyer, G. Bergstrom, C.A. Bradley, R. Dill-Macky, M. Smith, J. Wiersma, S. Halley, A. Arens, G. Milus, K. Ruden and B. Schatz. 2012. "Uniform Fungicide Trial Results for Management of FHB and DON, 2012." In: S. Canty, A. Clark, A. Anderson-Scully and D. Van Sanford (Eds.), Proceedings of the 2012 National Fusarium Head Blight Forum (pp. 19-20). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

McMullen, M., G. Bergstrom, J. Cummings, C. Jochum, G. Yuen, B.H. Bleakley, N.K.S. Murthy and K. Ruden. 2012. "Uniform Tests of Biological Control Agents for Management of FHB and DON, 2012. In: S. Canty, A. Clark, A. Anderson-Scully and D. Van Sanford (Eds.), Proceedings of the 2012 National Fusarium Head Blight Forum (p. 21). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Murthy, N.K.S., B.H. Bleakley, and K. Ruden. 2012. Field Plot Trial for Biological Control of Fusarium Head Blight in South Dakota using *Bacillus amyloliquefaciens* Strains. Poster abstract (p 29). In: 72nd Annual Meeting: North Central Branch of the American Society for Microbiology (October 12-13). North Dakota State University, Fargo, ND.

Ruden, K., Fanning, B., and Strunk, C. 2013 "Updated National Fusarium Head Blight (Scab) Prediction Center." SDSU Extension Service-iGrow. 1p. Online at http://igrow.org/agronomy/wheat/updated-national-fusarium-head-blight-scab-prediction-center/

Ruden, K.R., and G.S. Redenius. 2013. 2012 Field Plot Summaries: Plant Disease and Fungicide Trials. SDSU Extension Service-iGrow. 84p. Online at igrow.org/up/resources/03-7001-2013.pdf.

Ruden, K.R., G.S. Redenius, K.D. Glover and J.L. Kleinjan. 2012. "2012 Uniform Fungicide Performance Trials for the Suppression of Fusarium Head Blight in South Dakota." In: S. Canty, A. Clark, A. Anderson-Scully and D. Van Sanford (Eds.), Proceedings of the 2011

National Fusarium Head Blight Forum (pp. 23-24). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Willyerd, K., Ames, K. Bergstrom, G., Bradley, C., Cumming, J., Gross, P., Madden, L., Ransom, J., Ruden, K., Salgado, J.D., Sweets, L., Wise, K., and Paul, P. 2012. "Uniform FHB Integrated Management Trials: A Summary from 2012." In: S. Canty, A. Clark, A. Anderson-Scully and D. Van Sanford (Eds.), Proceedings of the 2012 National Fusarium Head Blight Forum (pp. 29-33). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.