

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY13 Final Performance Report
July 15, 2014**

Cover Page

PI:	Emmanuel Byamukama
Institution:	South Dakota State University
Address:	Plant Science Dept. Plant Science-Box 2108 Brookings, SD 57007
E-mail:	emmanuel.byamukama@sdstate.edu
Phone:	605-688-4521
Fax:	605-688-4024
Fiscal Year:	FY13
USDA-ARS Agreement ID:	59-0206-9-050
USDA-ARS Agreement Title:	Integrated FHB Management Research - South Dakota.
FY13 USDA-ARS Award Amount:	\$ 27,507

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Uniform Fungicide and Biological Control Trials for Management of Fusarium Head Blight in South Dakota.	\$ 11,780
MGMT	Evaluation of Integrated Management Strategies against FHB and DON in South Dakota.	\$ 15,727
	FY13 Total ARS Award Amount	\$ 27,507

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: *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?

Foliar fungicide applications are one component in an integrated system to manage Fusarium head blight (FHB) and deoxynivalenol (DON). We have been comparing fungicides and fungicide combinations applied at Feekes 10.51 to see if there was any differences in the efficacy between the fungicides and those combinations of fungicides. We have also been investigating to see what the efficacy of Prosaro and Caramba on FHB and DON is when applied 3-7 days after flowering (anthesis) since sometimes farmers cannot get into their field right at flowering if the weather is poor due to rain or wind.

The use of *Bacillus* biological control agents (BCAs) alone or in combination with Prosaro was studied to estimate their usefulness in reducing FHB disease parameters. In 2013 for the uniform biological trial, we again used the Novozyme commercial product Taegro, (*Bacillus subtilis* strain) with and without selected amendments. Taegro was also applied 5-7 days after chemical fungicides to see if we had any improvements in using the combination of a fungicide at Feekes 10.51 plus Taegro at 5-7 days after Feekes 10.51 over the fungicide applied alone.

2. List the most important accomplishments and their impact (i.e. how are they 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 establishing the uniform trials in South Dakota, we have been able to help producers determine which fungicide products are the most useful in the fight against FHB and also that we can use these fungicide products from flowering (Feekes 10.51) to 3-6 days after flowering and still have some effect in protecting the wheat heads against FHB. This is another tool in the toolbox that producers can use against FHB.

A uniform set of eight biological or biological plus fungicide treatments were compared to an untreated check for evaluation of control of FHB and DON in wheat again this year. This trial was conducted in three states; Nebraska, New York and South Dakota. This year in Nebraska, it was found that the addition of Taegro with or without additional amendments resulted in no significant treatments compared to just chemical fungicide alone. In the New York trial, FHB developed in moderately low levels but there was significant differences among the treatments for FHB incidence and FHB disease index. The addition of Prosaro or Tebuconazole with the biocontrols did not enhance nor did it diminish the fungicide's ability to suppress FHB, FDK or DON. In the South Dakota trial, there were no significant differences for FHB incidence, severity and disease index compared to the untreated control due to low levels of FHB in the trial this year. However, there were some treatments that did have significant yield in comparison to the untreated control with one of the treatments being

Taegro combined with Prosaro and also with nutritional amendments added to help stimulate the biological control agent.

In addition to the uniform biological trial, an extra trial was conducted in Volga, South Dakota to help analyze the efficacy of South Dakota's isolates of *Bacillus amyloliquefaciens* strains 1BA and 1D3 in the control of FHB. The South Dakota isolates were sprayed alone or were applied in combination with Prosaro, Induce NIS, plant oil or colloidal chitin. For FHB incidence, severity and disease index, there were no significant treatments. When looking at the treatments across the board, the combination of *Bacillus* 1BA, plant oil, colloidal chitin and Prosaro reduced the FHB incidence level to 3.2% which was better than spraying Prosaro alone at 5.9% and also better when compared to the untreated control which was 17.1%. In FHB severity, the combination of *Bacillus* strains 1BA, 1D3 along with plant oil, colloidal chitin and Prosaro reduced the FHB level to 3.64% compared to Prosaro alone at 7.81% and the untreated control which was 17.1%. This shows that we have some level of control when using the biological control agents in combination with fungicides and other amendments.

Impact: In our trials here in South Dakota and across the country, we have shown that by using fungicides at Feekes 10.51 and a few days after flowering, we can get control of FHB in wheat. The findings show that even if we are a few days late that we still will have a percentage of control compared to not spraying after Feekes 10.51. This helps the producer in case the weather is not conducive to spraying at the time of flowering

The potential of using biological control agents to control FHB continues to show some promise in reducing FHB if used in conjunction with fungicides and amendments. The continued study in this area will help us to better understand their efficacy.

Project 2: *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 continuing to investigate how to incorporate different management strategies which include varietal selections, fungicide and crop rotation for the suppression of Fusarium head blight (FHB) and DON under different environmental conditions and across the many different growing conditions across the United States. With the information gathered across the country, we hope to identify a combination of these management strategies that can help the producer gain an edge against FHB and DON.

2. List the most important accomplishments and their impact (i.e. how are they 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 repeating this investigation over many years, different kinds of weather, different cropping systems, it has been shown that at least in South Dakota that by choosing a moderately resistant variety planted on a non-host crop residue and also paired with a fungicide application when the conditions are conducive to FHB shows the highest percentage of control for FHB and DON.

Impact: By using this type of integrated management for FHB, a producer is able to maximize his/her profit from the wheat crop by understanding what he/she has to consider before planting, at planting time and at the time to spray to have the best “tools” available to help combat FHB and have a higher profit than those producers who do not follow these management practices.

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 FY13 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Bradley, C., E. Milus, M. Smith, G. Bergstrom, J. Cummings, A. Friskop, P. Paul, E. Byamukama, K. Ruden and D. Smith. 2013 “Report on the USWBSI-Supported- Uniform Fungicide Tests conducted in 2013. Online at http://www.scabusa.org/pdfs_dbupload/UFT_2013-Report.pdf .

Bleakley, B.H., N.K.S. Murthy, E. Byamukama, G. Redenius, K. Ruden, G.C. Bergstrom, J. Cummings, G.Y. Yuen and C. Jochum. 2013. “Uniform Tests of Biological Control Agents for Management of FHB and Don, 2013. In: S. Canty, A. Clark, Y. Salat and D. VanSanford (EDS.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (pp. 97-98). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Murthy, N.K.S., B.H. Bleakley, E. Byamukama, G. Redenius and K. Ruden. 2013. “2013 Field Plot Trial for Biological Control of Fusarium Head Blight in South Dakota using *Bacillus amyloliquefaciens* Strains. In: S. Canty, A. Clark, Y. Salat and D. VanSanford (EDS.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (p. 108). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Paul, P.A., G. Bergstrom, C. Bradley, E. Byamukama, J.A. Cummings, A. Grybauskas, L. Madden, G. Milus, K. Ruden, J.D. Salgado, L. Sweets, S. Wegulo and K. Wise. 2013. “FHB Integrated Management: A 2013 Update.” In: S. Canty, A. Clark, Y. Salat and D. VanSanford (EDS.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (pp. 110-111). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

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., G. S. Redenius, K.D. Glover, J.L. Kleinjan, B. H. Bleakley and E, Byamukama. 2013. “2013 Uniform Fungicide Performance Trials for the Suppression of Fusarium Head Blight in South Dakota in Hard Red Spring Wheat.” In: S. Canty, A. Clark, Y. Salat and D. VanSanford (EDS.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (pp. 113-114). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.