USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY15 Final Performance Report
Due date: July 15, 2016

Cover Page

Principle Investigator (PI):	Emmanuel Byamukama
Institution:	South Dakota State University
E-mail:	emmanuel.byamukama@sdstate.edu
Phone:	605-688-4521
Fiscal Year:	2015
USDA-ARS Agreement ID:	59-0206-4-005
USDA-ARS Agreement Title:	Integrated Management of Fusarium Head Blight in Small Grains for South Dakota.
FY15 USDA-ARS Award Amount:	$ 29,349
Recipient Organization:	South Dakota State University SAD 133, Box 2201 Brookings, SD 57007
DUNS Number:	929929743
EIN:	46-6000364
Recipient Identifying Number or Account Number:	SA1400628
Project/Grant Reporting Period:	04/06/15-04/05/16
Reporting Period End Date:	04/05/16

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Integrated Management of FHB and DON in Wheat for South Dakota.	$ 19,436
MGMT	Uniform Fungicide and Biological Control Trials for Management of FHB in South Dakota.	$ 9,913
	FY15 Total ARS Award Amount	**$ 29,349**

7/12/2016

Principal Investigator Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
GDER – Gene Discovery & Engineering Resistance
PBG – Pathogen Biology & Genetics
EC-HQ – Executive Committee-Headquarters
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: *Integrated Management of FHB and DON in Wheat for South Dakota.*

1. What are the major goals and objectives of the project?

The objectives of this project were to:

1) Evaluate the integrated effects of fungicide and genetic resistance on FHB and DON in winter and spring wheat, with emphasis on different application timings and new genotypes;
2) Conduct an economic analysis of the integrated effects of fungicide and resistance on FHB/DON;
3) Generate data to advance the FHB and DON risk prediction effort.

2. What was accomplished under these goals?

1) Major activities

This project evaluated the effectiveness of a triazole fungicide and cultivar resistance in managing Fusarium head blight and DON. The fungicide Prosaro® 421 SC was applied at anthesis, 2, 4, and 6 days after anthesis to three hard red spring wheat cultivars: Brick, Prevail, and Samson with varying resistances to FHB. All our winter wheat plots were lost due to moisture stress in fall and winter kill. Spring wheat trials were planted at Volga and at the Northeast Research Farm near South Shore, SD. The plots at the Volga location were misted beginning at heading to increase FHB pressure. The plots at this location additionally had infected corn kernels (100g per plot) scattered within each plot to increase the FHB pressure. The experiment was set up as a randomized complete block design with a split-plot arrangement, where the fungicide was the main plot and cultivar the sub-plot. Treatments were replicated four times and plot size was 5 ft x 15 ft. at all locations. A CO2-pressurized backpack sprayer (40 psi) with three nozzles (Twin Jet TJ-60 8002) spaced 15" apart on a boom was used to deliver Prosaro fungicide at a spray volume of 18.6 gal/A. Twenty-one days following treatment, plots were evaluated for FHB incidence, FHB head severity, and FHB field severity. Fusarium damaged kernels (FDK), DON content, and grain yield were assessed post-harvest

2) Specific objectives
   i) Evaluate the effectiveness of a triazole fungicide timing in different genotypes in the management of Fusarium head blight and DON
   ii) Provide the generated data to FHB modeling team.

3) Significant results: The 2015 wheat growing season had slightly greater than average rainfall in most parts of the state. As a result, scab susceptible wheat cultivars such as Samson had elevated levels of scab. Untreated Samson had the highest FHB index (55%) compared to Prevail (resistant to FHB) (27%) or Brick (10%) at the Volga location. Prosaro application at anthesis, 2, 4, or 6 days after anthesis reduced FHB index significantly compared to non-treated only in the susceptible cultivar Samson. Treatments also significantly reduced DON content in the susceptible cultivar Samson compared to non-treated control, however, the longer the Prosaro application was delayed, the more DON content was observed.

The South Shore location was relatively dry when wheat was flowering hence this location had low scab pressure compared to the Volga location. Nevertheless, a similar trend was observed, with the untreated susceptible cultivar, Samson, having the highest FHB index (26%) compared to Prevail (3%) and Brick (4%). The highest reduction in FHB index occurred when Prosaro was applied at flowering.

Profitable yield (yield above break-even point) was observed in the susceptible cultivar Samson only.

4) Key outcomes or other achievements: Application of Prosaro at anthesis, 2, 4, or 6 days reduced FHB in the susceptible cultivar. These data show that producers can apply a fungicide to manage FHB up to six days without losing much efficacy of the fungicide, however, the best application timing was at anthesis. These data also show that use of resistant cultivars and applying a triazole fungicide remain the most effective approaches to managing FHB and DON.

3. What opportunities for training and professional development has the project provided?

This project provided training of a postdoctoral research associate in FHB inoculum production and FHB rating.

4. How have the results been disseminated to communities of interest?

The results from these trials were summarized and published in various grower-based media outlets including newsletters, grower meetings, radio news, etc.

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

1. What are the major goals and objectives of the project?

The objectives of this project were to:

1) Evaluate the effects of fungicides on FHB and DON in spring and winter wheat, with emphasis on different commercially available generic tiazole fungicides;
2) Evaluate efficacies of biological products on the management of FHB and DON, and
3) Conduct an economic analysis of the integrated effects of fungicide and resistance on FHB/DON

What was accomplished under these goals?

1) Major activities

Spring wheat was planted at two locations: Volga (near Brookings), and at the Northeast Research Station (near South Shore, SD), All our winter wheat plots were lost due to winter kill. Spring wheat cultivar Samson (susceptible to FHB) were planted at the two locations. Trials were planted in randomized block design with four replications at all locations. Twenty fungicide treatments (9 triazole generics and a combination of Prosaro and biological control agents, and Prosaro/Caramba + Fungi-Phite) were applied at the beginning of antheis. At the soft dough stage of crop development, plots were evaluated for FHB incidence, FHB head severity, and FHB field severity, whereas Fusarium damaged kernels (FDK), deoxynivalenol (DON), grain yield, test weight, and protein data were collected after harvest.

2) Specific objectives
   a. Evaluate the efficacy of nine triazole generic fungicides in the management of FHB and DON
   b. Evaluate four biological control agents in the management of FHB and DON

3) Significant results

Spring wheat at the Volga location had moderate FHB pressure (38% FHB index in the untreated plots) and several products significantly reduced FHB. However Prosaro and Caramba fungicides reduced FHB and DON accumulation the most at this location. The addition of the biological control agents or Fungi-Phite to Prosaro or Caramba did not have significant difference from Prosaro or Caramba alone. Only Toledo fungicide had significantly lower FHB index than untreated control but was still higher compared to Prosaro or Caramba. At South Shore location, FHB pressure was low (19% in the untreated), however, treatments containing Prosaro or Caramba had the lowest FHB index and DON. As at Volga location, adding biological control or Fungi-Phite treatments to Prosaro or Caramba did not further reduce FHB index or DON at the South Shore location.

Based on the yield increase due to fungicide application, profitable yield and reduction in FHB index and DON had positive return in the susceptible cultivar, Samson.

4) Key outcomes or other achievements

Nine triazole fungicide generics and four biological control agents were tested at two locations in order to determine whether these generic fungicides and biological control agents can be effective in controlling FHB. We demonstrated that Prosaro and Caramba were superior in reducing FHB and DON compared to generic triazoles and biological control agents.

2. What opportunities for training and professional development has the project provided?

A postdoctoral research associate was trained on rating for scab

3. How have the results been disseminated to communities of interest?

Results from this trial have been posted on the university extension website and also presented at various grower and crop consultants meetings. Also results from these trials have been forwarded to the modeling team.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY15 award period. The term "support" below includes any level of benefit to the student, ranging from full stipend plus tuition to the situation where the student's stipend was paid from other funds, but who learned how to rate scab in a misted nursery paid for by the USWBSI, and anything in between.

1. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their MS degree during the FY15 award period?** NO

   If yes, how many?

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY15 award period?** NO

   If yes, how many?

3. **Have any post docs who worked for you during the FY15 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?** YES

   If yes, how many? One

4. **Have any post docs who worked for you during the FY15 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?** NO

   If yes, how many?

Release of Germplasm/Cultivars

Instructions: In the table below, list all germplasm and/or cultivars released with full or partial support through the USWBSI during the FY15 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations. *Leave blank if you have nothing to report or if your grant did NOT include any VDHR-related projects.*

Name of Germplasm/Cultivar	**Grain Class**	**FHB Resistance** (S, MS, MR, R, where R represents your most resistant check)	**FHB Rating** (0-9)	**Year Released**

Add rows if needed.

NOTE: List the associated release notice or publication under the appropriate sub-section in the 'Publications' section of the FPR.

Abbreviations for Grain Classes

Barley - BAR
Durum - DUR
Hard Red Winter - HRW
Hard White Winter - HWW
Hard Red Spring - HRS
Soft Red Winter - SRW
Soft White Winter - SWW

Publications, Conference Papers, and Presentations

Refer to the FY15-FPR_Instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY15 grant. If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

Journal publications.

Ruden, K., Redenius, G. S., and Byamukama E. 2015. Management of Fusarium head blight with fungicides in spring wheat in South Dakota 2014. PDMR: 9 CF31.
Status: Published
Acknowledgement of Federal Support: No

Books or other non-periodical, one-time publications.

Nothing to report.

Other publications, conference papers and presentations.

Salgado, J.D., K. Ames, G. Bergstrom, C. Bradley, E. Byamukama, J. Cummings, V. Chapara, M. Chilvers, R. Dill-Macky, A. Friskop, P. Gautam, N. Kleczewski, L.V. Madden, E. Milus, M. Nagelkirk, J. Ransom, K. Ruden, J. Stevens, S. Wegulo, K. Wise, D. Yabwalo and P.A. Paul. 2015. Robust Management Programs to Minimize Losses due to FHB and DON: A Multi-state Coordinated Project. In: S. Canty, Clark, S. Vukasovich and D. Van Sanford (Eds.), *Proceedings of the 2015 National Fusarium Head Blight Forum*. East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. pp. 24-29.
Status: Paper Published and Poster Presented
Acknowledgement of Federal Support: Yes, but not for this agreement.

Murthy, N. K. S., Bleakley, B. H., Yabwalo, D. N., and Byamukama, E. 2015. 2014 and 2015 filed plot trials for biological control of Fusarium head blight in South Dakota using *Bacillus anyloliquefaciens* strains. In: S. Canty, Clark, S. Vukasovich and D. Van Sanford (Eds.), *Proceedings of the 2015 National Fusarium Head Blight Forum*. East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 21-22.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: Yes – Abstract and Poster

Smith, M.J., A. Friskop A. Arends, V. Chapara, S. Meyer, B. Schatz, G.C. Bergstrom, J.A. Cummings, E. Byamukama, D. Yabwalo, B. Bleakley, N. Murthy, K. Ruden, C.A. Bradley, K. Ames, J. Pike, and R. Bellm. 2015. Uniform fungicide trial results for management of FHB and DON, 2015. In: S. Canty, Clark, S. Vukasovich and D. Van Sanford (Eds.), *Proceedings of the 2015 National Fusarium Head Blight Forum*. East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 33.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: Yes – Abstract and Poster

Yabwalo D., K.Ruden, S. Ali, R. Geppert, K. Glover, B. Bleakley, and E. Byamukama**.** 2015. Spring wheat cultivar performance against Fusarium head blight in natural infestation. In: S. Canty, Clark, S. Vukasovich and D. Van Sanford (Eds.), *Proceedings of the 2015 National Fusarium Head Blight Forum*. East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 34.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: Abstract-NO, Poster-YES

Presentations

Byamukama, E. Wheat diseases update. Independent Crop Consultant Workshop. Brookings, SD 4/11/2015
Status: Presented
Acknowledgement of Federal Support: Yes

Byamukama, E. Timing for wheat diseases management. AG Horizon Conference, Pierre, SD. 12/1/2015
Status: Presented
Acknowledgement of Federal Support: Yes

Extension publications

Byamukama, E. and Strunk, C. 2015. Predicting Fusarium head blight in small grains. Published 5/28/2015. Online http://igrow.org/agronomy/wheat/predicting-fusarium-head-blight-in-small-grains/
Status: Published
Acknowledgement of Federal Support: Yes

Strunk, C. and Byamukama, E**.** 2015 SDSU Extension wheat walk recap. Published 6/5/2015. Online http://igrow.org/agronomy/wheat/2015-sdsu-extension-wheat-walk-recap/
Status: Published
Acknowledgement of Federal Support: No

Byamukama, E**.** and Strunk, C. Wheat diseases update. Published 6/19/2015. Online http://igrow.org/agronomy/wheat/wheat-diseases-update/
Status: Published
Acknowledgement of Federal Support: Yes

Byamukama, E. Assess for Fusarium head blight (scab) in winter wheat. Published 7/9/2015. Online http://igrow.org/agronomy/wheat/assess-for-fusarium-head-blight-scab-in-winter-wheat/
Status: Published
Acknowledgement of Federal Support: No