USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY17 Final Performance Report – NCE for FY18
Due date: July 12, 2019

Cover Page

Principle Investigator (PI):	Emmanuel Byamukama
Institution:	South Dakota State University
E-mail:	emmanuel.byamukama@sdstate.edu
Phone:	605-688-4521
Fiscal Year:	2017 (NCE for FY18)
USDA-ARS Agreement ID:	59-0206-4-005
USDA-ARS Agreement Title:	Integrated Management of Fusarium Head Blight in Small Grains for South Dakota.
FY17 USDA-ARS Award Amount:	$ 23,870
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:	4/6/18 - 4/5/19
Reporting Period End Date:	04/05/19

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Integrated Management of FHB and DON in Wheat in South Dakota.	$ 23,870
	FY17 Total ARS Award Amount	$ 23,870

7/10/2019
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

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Project 1: *Integrated Management of FHB and DON in Wheat in South Dakota.*

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

i) Evaluate the integrated effects of a post-anthesis fungicide application and genetic resistance on FHB and DON in winter and spring wheat.
ii) Conduct an economic analysis of the integrated effects of fungicide and resistance on FHB/DON.
iii) Generate data to advance the FHB and DON risk prediction effort.

2. What was accomplished under these goals? *Address items 1-4) below for each goal or objective.*

i) Evaluate the integrated effects of a post-anthesis fungicide application and genetic resistance on FHB and DON in winter and spring wheat.

1) Major activities:
To determine the integrated effects of genetic resistance to FHB and post anthesis fungicide application, three hard red winter wheat cultivars: Lyman (moderately resistant), Redfield (moderately susceptible), and Wesley (susceptible) and three hard red spring wheat cultivars: Brick (moderately resistant), Prevail (moderately susceptible), and Samson (susceptible) were planted. Planting was done at two locations: SDSU Northeast Research Farm (NERF) and SDSU Volga research Farm. The cultivars were treated with the following fungicide programs: Prosaro alone at flowering (Feekes 10.5.1); Prosaro at flowering followed by Caramba 4 days after flowering; Caramba at flowering followed by Folicur 4 days after flowering, Folicur alone, and Folicur followed by Proline four days after flowering. Plots at Volga were inoculated with *Fusarium graminearum* and misted to increase FHB pressure. Non-inoculated non treated plots were the check. All plots were assessed for FHB incidence and severity and foliar diseases severity. FHB index was derived by multiplying FHB incidence and severity.

2) Specific objective: To evaluate the integrated effects of a post-anthesis fungicide application and genetic resistance on FHB and DON in winter and spring wheat

3) Significant results
Winter wheat. At the NERF location, FHB index was very low across winter wheat cultivars and treatments and no significant treatment differences were detected for FHB index. However all fungicide treated plots yielded higher than untreated plots, implying fungicides applied for managing FHB were also effective against fungal leaf diseases such as leaf rust and tan spot that developed at this location.

The Volga location had slightly higher FHB index compared to the NERF location. The moderately resistant cultivar, Lyman, had the lowest FHB index where as Wesley, a susceptible cultivar, had the highest FHB index. No statistical differences were observed

between fungicide programs across the three cultivars for all variables measured at this location, implying that a single fungicide at flowering or plus an application four days after flowering had comparable yield and FHB index.

Spring wheat.
Spring wheat developed significant FHB at the NERF location and low FHB at the Volga location. All fungicides and timings significantly reduced FHB index in the susceptible cultivar Samson but were not significantly different from each other for Brick and Prevail cultivars at the NERF location. The best fungicide and timing combination on the susceptible cultivar had still higher FHB index compared to untreated moderately resistant cultivar, indicating that combining cultivar resistance and fungicide application gives the most effective FHB control.

Although spring wheat at Volga location had low FHB index, similar patterns as at NERF were observed with the susceptible cultivar, Samson, having the highest index and all fungicides and timings reducing significantly FHB index compared to the untreated check.

4) Key outcomes or other achievements – The results from our experiments showed that the combination of cultivar resistance to FHB and an application of fungicide at flowering is the best option for managing FHB. A second fungicide application after four days was not significantly different from single application at flowering.

ii) Conduct an economic analysis of the integrated effects of fungicide and resistance on FHB/DON

1) Major activities- Yield and FHB data from untreated plots were compared with treated plots for various fungicides and timing.

2) Specific objectives – Determine the economic benefit of second fungicide application four days after flowering on FHB control as well as yield loss protection.

3) Significant results – Results from objective one above indicated no statistical difference within various fungicide programs.

4) Key outcomes or other achievements
Our results indicated limited benefits of a second fungicide application four days after flowering. Therefore a single well timed fungicide at flowering on a moderately resistant cultivar is sufficient to manage FHB.

iii) Generate data to advance the FHB and DON risk prediction effort.

1) Major activities- Yield and FHB data collected in objective one were shared with the CP PI, Dr. Pierce Paul.

2) Specific objectives – Contribute data to advance FHB and DON risk prediction effort.

3) Significant results – Data from our trials were included in FHB forecasting model refinement.

4) Key outcomes or other achievements
A modified FHB forecasting system is anticipated.

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

Undergraduate students and a summer intern were trained in FHB assessment and inoculum preparation.

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

Outcomes from this research were communicated to growers, agronomists, crop consultants, and other stakeholders through newsletter articles, wheat walks, grower meetings, field days, IPM field school, social media (Twitter and Facebook) and pesticide applicator trainings.

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

Professional networking

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

Same as in #4 above.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY17-NCE 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 FY17-NCE 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 FY17-NCE period?**

   No

   If yes, how many?

3. **Have any post docs who worked for you during the FY17-NCE period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

   No

   If yes, how many?

4. **Have any post docs who worked for you during the FY17-NCE 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 FY17-NCE period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations.

NOTE: 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

Instructions: Refer to the FY17-NCE_FPR-Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY17-NCE grant period. Only include citations for publications submitted or presentations given during your award period (4/6/18 - 4/5/19). If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

NOTE: Directly below each reference/citation, you must indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in publication/ presentation. See example below for a poster presented at the FHB Forum:

> Conley, E.J., and J.A. Anderson. 2018. Accuracy of Genome-Wide Prediction for Fusarium Head Blight Associated Traits in a Spring Wheat Breeding Program. In: Proceedings of the XXIV International Plant & Animal Genome Conference, San Diego, CA.
> Status: Abstract Published and Poster Presented
> Acknowledgement of Federal Support: YES (poster), NO (abstract)

Journal publications.

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

Other publications, conference papers and presentations.