USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY14 Final Performance Report
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Cover Page

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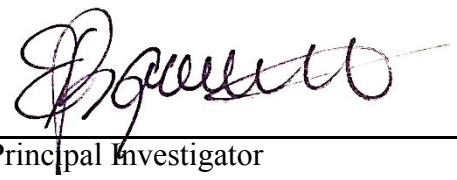
Fiscal Year:	FY14
USDA-ARS Agreement ID:	59-0206-4-005
USDA-ARS Agreement Title:	Integrated Management of Fusarium Head Blight in Small Grains for South Dakota.
FY14 USDA-ARS Award Amount:	$ 29,377

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Integrated Management of FHB and DON in Wheat and Barley for South Dakota.	$ 19,455
MGMT	Uniform Fungicide and Biological Control Trials for Management of FHB in South Dakota.	$ 9,922
	FY14 Total ARS Award Amount	**$ 29,377**



7/14/15

Principal Investigator Date

* MGMT – FHB Management
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
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
WES-CP – Western 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 and Barley for 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 (FHB) and the mycotixins associated with it, mainly Deoxynivalenol (DON), is a major small grains production constraint in South Dakota. Not only does scabby grain weigh less, but scabby grain may also be rejected at the elevator if it has high DON. Management of FHB requires an integrated approach, using cultivars that are resistant or moderately resistant to FHB and applying fungicides.

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 winter wheat cultivars (Overland, Wesley, and Alice) and three hard red spring wheat cultivars (Brick, Prevail, and Samson) with varying resistances to FHB. Winter wheat trials were planted at Volga (near Brookings) while 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 design was split-plot, where the fungicide was the main plot and cultivar the sub-plot. Treatments were replicated six 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) and grain yield were assessed post-harvest.

In winter wheat, cv. Alice (susceptible to FHB) had the highest FHB index (19%) compared to Wesley (15%) and Overland (5%). In the FHB susceptible cultivar, Alice, Prosaro application reduced FHB index for all treatments (applied at anthesis, 2, 4, and 6 days after anthesis) compared to non-treated. However, Prosaro applied at 2 and 4 days after anthesis had the lowest FHB index. In the FHB moderately resistant cultivar, Overland, all Prosaro treatments reduced FHB index significantly irrespective of the days after anthesis Proaso was applied.

In spring wheat, Samson (susceptible to FHB) had the highest FHB index (43%) compared to Prevail (resistant to FHB) (12%) 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.

At South Shore location, FHB pressure was relatively low compared to Volga location, however, a similar trend was observed, with the susceptible cultivar, Samson, having the highest FHB index (16%) compared to Prevail (3%) and Brick (2%). Similarly, Prosaro

application at anthesis, 2, 4, or 6 days after anthesis reduced FHB index significantly compared to non-treated only in the susceptible cultivar at the South Shore location.

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:

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 the efficacy of the fungicide. These data also show that use of resistant cultivars and applying a triazole fungicide remain the most effective approaches to managing FHB and DON.

Impact:

Information from these data will helpful to producers and crop managers regarding the timing of fungicide application in the management of FHB and DON.

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

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

Fungicides are a major component of FHB management. Because several new generics are on the market, there is a need to evaluate effectiveness of these products on FHB in South Dakota. This project evaluated 14 fungicides in the management of FHB in hard red winter and spring wheat in South Dakota.

Hard red winter wheat was planted at Volga (near Brookings) and at the Northeast Research Station, (near South Shore, SD). Spring wheat was planted at three locations: Volga (near Brookings), at the Northeast Research Station (near South Shore, SD), and in a cooperator's field near Groton, SD. For winter wheat, a susceptible cultivar Wesley was planted at both locations. For spring wheat cultivars Brick (resistant to FHB) and Samson (susceptible to FHB) were planted at the three locations. Trials were planted in randomized block design with six replications at all locations. Fourteen fungicide treatments (including a combination of Prosaro and Taegro®) 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.

Winter wheat at the Volga location had moderate FHB pressure and several products significantly reduced FHB. However Prosaro and Caramba® fungicides reduced FHB the most at this location. The addition of Taegro (the biological control agent) to Prosaro did not have significant difference from Prosaro alone. Orius and Tebustar fungicides had numerically less FHB index but not significantly different from non-treated control. However, these two products significantly reduced DON.

Winter wheat at the South Shore location had low FHB pressure and this may have led to no significant differences between fungicide treated and non-treated for FHB index and DON.

Spring wheat at Volga location had moderate FHB pressure in the susceptible cultivar Samson. Prosaro, caramba, and Monsoon reduced FHB index in Samson, however, none of the fungicide products reduced DON in this cultivar at Volga. Brick had minimal FHB pressure and no differences between different products were detected in this cultivar. Similar trend as at Volga was at the Groton location.

At South Shore, however, DON levels were high (12 ppm) in the susceptible cultivar than at other locations. At this locations, all fungicides except Muscle reduced 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:

Prosaro and Caramba fungicides consistently reduced FHB index and DON in both winter wheat and spring wheat. New generics like Monsoon, Orius, and Tebustar were effective in reducing FHB and DON but as good as Prosaro or Caramba.

Data summaries from the field experiments has been published online for producers, crop consultants, co-ops, agronomists, and other stakeholders to have access to these data.

Impact:

Producers have now information on the effectiveness of recent fungicide generics on FHB management. Promising fungicide products may be alternative to the traditional fungicides Prosaro and Caramba.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY14 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 FY14 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 FY14 award period?**

   YES

   If yes, how many? 1 (one)

3. **Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

   None

   If yes, how many?

4. **Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**

   None

   If yes, how many?

Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI during the FY14 award period. List the release notice or publication. Briefly describe the level of FHB resistance. *If not applicable because your grant did NOT include any VDHR-related projects, enter N/A below.*

N/A

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 FY14 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Abstracts:

M.J. Smith, J. Wiersma, A. Friskop, Blaine Schatz, P. Gautam, G.C. Bergstrom, J.A. Cummings, **E. Byamukama,** K. Ruden, B.H. Bleakley, C.A. Bradley, K. Ames, J. Pike, R. Bellm and G. Milus. 2014. Uniform Fungicide Trial Results for Management of FHB and DON, 2014. USWBSI Forum, Manhatan, KS.

Murthy, K. S., Bleakley, B. H., **Byamukama, E**., Redenius, G. and Ruden, K. 2013 and 2014 Field plot trials for biological control of Fusarium head blight in South Dakota using Bacillus amyloliquefaciens strains. USWBSI Forum, Manhatan, KS.

Ruden, K. R., Redenius, G., Ali S., and **Byamukama, E**. 2014. Evaluation of HRWW and HRSW Cultivars for FHB Management in South Dakota. USWBSI Forum, Manhatan, KS.

J.D. Salgado, K. Ames, G. Bergstrom, C. Bradley, **E. Byamukama**, J. Cummings, R. Dill-Macky, A. Friskop, P. Gautam, N. Kleczewski, L. Madden, E. Milus, M. Nagelkirk, J. Ransom, K. Ruden, S. Wegulo, K. Wise and P.A. Paul. 2014. Best FHB Management Practices: A 2014 Multi-State Project Update. USWBSI Forum, Manhatan, KS.

Presentations:

Weather patterns and disease patterns: implications for plant disease management. Presented at the Ag Horizons, Pierre, SD. December 2, 2014.

Disease management decisions: Plan ahead. Presented at the Private Pesticide Applicator Training. Redfield, SD. 2/6/2014

Disease management decisions: Plan ahead. Presented at the Commercial Pesticide Applicator Training. Watertown, SD. 1/5/2014

Disease management decisions: Plan ahead. Presented at the Commercial Pesticide Applicator Training. Sioux Falls, SD. 2/4/2014

Disease management decisions: Plan ahead. Presented at the Commercial Pesticide Applicator Training. Aberdeen, SD. 2/11/2014.

Extension publications:

Byamukama, E., Todey, D., and Ali, S. The Small Grains Disease Forecasting System Could Save Producers Money. Published 5/15/2014. Online http://igrow.org/agronomy/wheat/the-small-grains-disease-forecasting-system-could-save-producers-money/

Byamukama, E. Wheat head diseases beginning to develop. Published 6/19/2014. Online http://igrow.org/agronomy/wheat/wheat-head-diseases-beginning-to-develop/

Fanning, B. and **Byamukama, E**. Harvesting Scab (FHB) infected wheat. Published 7/17/2014. Online http://igrow.org/agronomy/wheat/harvesting-scab-fhb-infected-wheat/

Byamukama, E. and Fanning, B. Winter wheat diseases update: Scout for fungal diseases. Published 6/5/2014. Online http://igrow.org/agronomy/wheat/winter-wheat-diseases-update-scout-for-fungal-diseases/

Byamukama, E. The National Fusarium Prediction Center is up and running. Published 6/19/2014. Online http://igrow.org/agronomy/wheat/the-national-fusarium-prediction-center-is-up-and-running/

K. Ruden, G. Redenius, E. Byamukama, K. Glover, and J. Kleinjan, and **E. Byamukama**. 2014 Spring Wheat Fungicide Trials Report.