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

Cover Page

<table>
<thead>
<tr>
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| 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)

<table>
<thead>
<tr>
<th>USWBSI Research Category*</th>
<th>Project Title</th>
<th>ARS Award Amount</th>
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<tbody>
<tr>
<td>MGMT</td>
<td>Uniform Fungicide and Biological Control Trials for Management of Fusarium Head Blight in South Dakota.</td>
<td>$ 11,780</td>
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<td>MGMT</td>
<td>Evaluation of Integrated Management Strategies against FHB and DON in South Dakota.</td>
<td>$ 15,727</td>
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<td><strong>FY13 Total ARS Award Amount</strong></td>
<td><strong>$ 27,507</strong></td>
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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

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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.


