**USDA-ARS/**
**U.S. Wheat and Barley Scab Initiative**
**FY09 Final Performance Report**
**July 15, 2010**

# Cover Page

| | |
|---|---|
| **PI:** | Scott Halley |
| **Institution:** | North Dakota State University |
| **Address:** | Langdon Research Extension Center<br>9280 107th Ave NE<br>Langdon, ND 58249 |
| **E-mail:** | Scott.Halley@ndsu.edu |
| **Phone:** | 701-256-2582 |
| **Fax:** | 701-256-2580 |
| **Fiscal Year:** | 2009 |
| **USDA-ARS Agreement ID:** | 59-0790-8-069 |
| **USDA-ARS Agreement Title:** | Developing Managing Strategies to Reduce Effects of FHB in the Great Plains. |
| **FY09- USDA-ARS Award Amount:** | $ 50,353 |

**USWBSI Individual Project(s)**

| USWBSI Research Category* | Project Title | ARS Adjusted Award Amount |
|---|---|---|
| BAR-CP | Grower Demonstration of Integration of Genetics and Fungicide Application. | $ 5,913 |
| BAR-CP | Sequential Fungicide Applications and Improved Genetics to Control FHB. | $ 9,757 |
| BAR-CP | Spray Application Technology Evaluations for Enhanced Fungicide Efficacy. | $ 10,379 |
| MGMT | Fungicide Delivery Defined and Integrated with Genetics for FHB Management. | $ 13,658 |
| MGMT | Uniform Fungicide Biocontrol Tests for Fusarium Head Blight Management Proposal. | $ 4,366 |
| VDHR-SPR | Regional Uniform Scab Nursery - Langdon Location. | $ 6,280 |
| | **Total Award Amount** | **$ 50,353** |

_____
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 Winter Wheat Region
SWW – Southern Sinter Wheat Region

**Project 1:** *Grower Demonstration of Integration of Genetics and Fungicide Application.*

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

   Improved resistance, critical fungicide application timing and critical spray application techniques have individually been identified for improvement in reduction of the effects of scab of spring barley. This study demonstrated the additive value of combining the aforementioned methods. A study was conduct at the Langdon Research Extension Center over two seasons to demonstrate this value.

2. **List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):**

   **Accomplishment:** The spray application technique and the study protocol was presented and demonstrated at our summer field day. Results from the study were presented to growers at the North Dakota State Barley Show and have been made available on the Langdon web site at http://www.ag.ndsu.edu/langdon/09data/barley%20demo%20summary%2008&09.pdf

   **Impact:** Several growers have called to inquire about components to convert their crop sprayers to apply fungicides using the techniques demonstrated at field day. The use of these techniques greatly improves the efficacy of fungicide for controlling FHB compared to other techniques. The improved genetics evaluated are not yet available for producers to use but represent promising new lines. The timing component further demonstrates the value of timely application of fungicide and the reduction in the toxin deoxynivalenol in the grain.

**Project 2:** *Sequential Fungicide Applications and Improved Genetics to Control FHB.*

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

   Applying single fungicide treatments to control scab on barley has been inconsistent at times and sometimes cost ineffective. As a result many producers in this region have discontinued the production of barley. This study identified some of the causes of the inconsistency and possible solutions to this problem.

2. **List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):**

   **Accomplishment:** Small grains head over an extended period of time. Recommended fungicide applications are very effective in reducing the accumulation of the toxin deoxynivalenol in the grain when the treatments are applied to grain heads at the proper stage of growth. This study showed the benefit of applying a second sequential fungicide application after the tillers have also reached this important growth stage. The second fungicide application was additive to the improved resistance characteristics of the experimental barley line.

   **Impact:** Additional study will be needed to determine the overall contribution of a sequential fungicide treatment to the overall reduction in deoxynivalenol accumulation in the grain. The contribution of tillers is environmentally affected and can vary greatly from year to year. Efforts may be necessary in the future to secure alternates to a second fungicide treatment or institute a change in current labels.

**Project 3:** *Spray Application Technology Evaluations for Enhanced Fungicide Efficacy.*

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

   Air assist sprayers are being market to growers for applying pesticides to crops. The sprayers offer a wide range of application parameters (air stream speed, drop size and air orifice angle) to apply these pesticides. Growers have indicated that no recommendations have been provided by the manufacturer to show the effect these parameter adjustments have on the efficacy and performance of fungicides for controlling scab.

2. **List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):**

   **Accomplishment:** Twenty seven combinations of spray parameters have been evaluated on barley for their effect on fungicide efficacy and head coverage. Combinations of parameters have been identified as improving the efficacy of fungicide and overall head coverage.

   **Impact:** An extension publication has been published soon and made available to growers and commercial fungicide applicators that provide direction for applying fungicide with this spray system.

**Project 4:** *Fungicide Delivery Defined and Integrated with Genetics for FHB Management.*

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

   Air assist sprayers are being market to growers for applying pesticides to crops. The sprayers offer a wide range of parameters (air stream speed, drop size and air orifice angle) to apply these pesticides. Growers have indicated that no recommendations have been provided to show the effect these parameter adjustments have on the efficacy and performance of fungicides for controlling scab.

2. **List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):**

   **Accomplishment:** Twenty seven combinations of spray parameters have been evaluated on hard red spring wheat for their effect on fungicide efficacy and head coverage. Combinations of parameters have been identified that improve the efficacy of fungicide and overall coverage.

   **Impact:** An extension publication has been published and made available to growers and commercial fungicide applicators that provide direction for applying fungicide with this spray system.

**Project 5:** ***Uniform Fungicide Biocontrol Tests for Fusarium Head Blight Management Proposal.***

1. **What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?** Biological alternative are being evaluated as an alternative to fungicide for reducing the effects of scab on hard red spring wheat and as a component of a fungicide and biological management system. Only one application of fungicide to protect against head scab is permitted under current pesticide labels and the protection from a single fungicide application are limited to about 10 days.

2. **List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):**

   **Accomplishment:** Biological compounds did not reduce the effects of scab on hard red spring wheat compared to a single fungicide treatment. Biological compounds applied with fungicide as a sequential treatment did improve the performance of fungicide and offer alternative management options to producers.

   **Impact:** More research effort is needed to document the advantage of the use of sequential application. At this point the biological compounds tested are in the early stages of being produced at a level that would provide quantities large enough for producers to use.

**Project 6:** *Regional Uniform Scab Nursery - Langdon Location.*

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

   Scab still negatively affects the quality of spring wheat and potentially the health of consumers. The preferred method to control scab outbreaks is genetic resistance to the disease. Evaluation of improved lines at multiple locations is a very effective tool in facilitating this process.

2. **List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):**

   **Accomplishment:** Several lines have been identified at this location as having improved resistance compared to controls. Langdon is a very consistent environment and facility for obtaining information about the levels of resistance to scab.

   **Impact:** Each individual breeding program provides new material resistance to scab as it becomes available to growers.

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

Halley, S., Hofman, V., Van Ee, G., and K. Misek. 2010. Best methods for applying fungicide to grain heads using air-assist sprayers. North Dakota State University Extension Report AE-1480 4 p.

Halley, S., Van Ee, G., Hofman, V., Horsley, R., Neate, S., and K. Misek. 2009. Integrating resistance, best application timing and best fungicide delivery technique for improved efficacy on barley, Langdon, 2009. Proceedings of the 2009 National *Fusarium* Head Blight Forum. U.S. Wheat and Barley Scab Initiative. Orlando, Florida. p. 50-55.

Halley, S., Misek, K. and K. Kinzer. 2009 Evaluation of biological alternatives for single treatment fungicide on hard red spring wheat for controlling Fusarium head blight. Proceedings of the 2009 National *Fusarium* Head Blight Forum. U.S. Wheat and Barley Scab Initiative. Orlando, Florida. Abstract.

Yuen, G., Jochum, C., Halley, S., Misek, K., Sweets, L., Kirk, W., and D. Schisler. 2009. Results of 2009 uniform biological control studies. Proceedings of the 2009 National *Fusarium* Head Blight Forum. U.S. Wheat and Barley Scab Initiative. Orlando, Florida. p. 101-105.

Halley, S. 2008. How application technology for FHB has changed over the decade. Proceedings of the 2008 National *Fusarium* Head Blight Forum. U.S. Wheat and Barley Scab Initiative. Indianapolis, Indiana. Abstract for Invited Talk.

Jochum, C., Yuen, G., Ruden, K., Bleakley, B., Morgan, J., Osbourne, L., Sweets, L., Halley, S. and K. Kinzer. 2008. 2008 results from the uniform evaluation of biological agents for the control of Fusarium head blight on wheat and barley. Proceedings of the 2008 National *Fusarium* Head Blight Forum. U.S. Wheat and Barley Scab Initiative. Indianapolis, Indiana. p. 32-35.