USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY11 Final Performance Report
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Cover Page

PI:	Arvydas Grybauskas
Institution:	University of Maryland
Address:	Dept. of Plant Science and Landscape Architecture 2102 Plant Sci. Bldg. 036 College Park, MD 20742-4452
E-mail:	arvydas@umd.edu
Phone:	301-405-1602
Fax:	301-314-9308
Fiscal Year:	FY11
USDA-ARS Agreement ID:	59-0206-9-053
USDA-ARS Agreement Title:	Management of Fusarium Head Blight of Wheat in Maryland.
FY11 USDA-ARS Award Amount:	$ 23,129

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Integration of Tactics for Fusarium Head Blight and Vomitoxin Reduction in MD.	$ 15,812
MGMT	Effect of Fungicides on Scab and Vomitoxin in Soft Red Winter Wheat in Maryland.	$ 7,317
	Total ARS Award Amount	**$ 23,129**

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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

Project 1: *Integration of Tactics for Fusarium Head Blight and Vomitoxin Reduction in MD.*

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

   The search for management tactics that can protect producers from the losses in yield and mycotoxin contamination associated with Fusarium head blight has taken great strides forward with the development of cultivars with moderate resistance and the registration of two triazole fungicides, Prosaro and Caramba. However, neither resistance nor fungicide application independently, has proved to be adequate in seasons highly favorable for disease development. Furthermore, some of the more highly resistant cultivars have had lower yield potentials than other highly adapted but susceptible cultivars and thus lose favor among producers after seasons with low disease development. The effectiveness of the best available fungicides has been primarily tested with highly susceptible varieties and disease-conducive environments. Thus their overall contribution to and possible interaction as a management package is not adequately understood. An integrated approach primarily testing cultivars ranging from highly susceptible to moderately resistant combined with the best available fungicide is being tested and demonstrated in this project under various debris management and rotation schemes. We also included artificial inoculation as a separate factor at some locations in order to ensure that disease development occurs at a sufficient level to test the strategy even if natural disease development is limited.

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 environmental conditions were favorable for natural disease development at one location, and artificial inoculation was successful in providing good test conditions at other locations. In general, disease reductions were accomplished by both management tactics, resistance and fungicides. At moderate to low disease pressure the highest level of resistance was sufficient in reducing disease and vomitoxin levels without the addition of the fungicide tactic. Fungicides reduced disease and vomitoxin levels most dramatically on highly susceptible cultivars. However, the vomitoxin levels on highly susceptible cultivars regardless of fungicide use were too high and would typically be rejected at elevators and mills. The integration of fungicides with moderate resistance provided the greatest reduction of disease. A greater range of available cultivars based on degree of resistance to scab can produce a marketable yield with the proper use of fungicides.

   Impact:

   The combination of resistance and fungicide treatment is currently necessary to manage FHB outbreaks to produce a saleable product. The management research, testing these

combinations, has been instrumental in demonstrating and providing hard evidence that neither tactic alone is adequate in a severe epidemic year. Best management of FHB will require a pre-season decision to select a cultivar with resistance to FHB and an in-season fungicide treatment based on disease potential and disease-conducive weather.

Project 2: *Effect of Fungicides on Scab and Vomitoxin in Soft Red Winter Wheat in Maryland.*

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

Management of Fusarium head blight with the best available fungicides has been demonstrated by the coordinated uniform fungicide trial of the USWBSI to reduce DON by an average 40-45%. This is a great improvement over the 12-23% reductions achieved with first generation products registered in some states under section 18 for scab suppression. However, in seasons when untreated fields are averaging as low as 2-3 ppm DON, a 45% reduction will not produce a crop that would pass the 1 ppm FDA advisory limit and could still be rejected. New products and combinations need to be tested to improve upon the DON reduction. Research conducted to date has demonstrated that the optimum timing for first generation materials was at initial flowering for wheat based on visual symptom reduction. The optimum timing of newer materials and combinations needs to be confirmed and DON reduction should be the primary criteria. Furthermore, at the end-user level it is operationally impossible for all fields that need a fungicide application to be treated exactly at initial flowering, and when the environment is conducive for disease development rainfall will prohibit application or have the potential to greatly reduce efficacy. The effective window of application needs to be determined so that the best management practices are clearly defined and delimited. Finally, there is increasing evidence that the strobilurin class of fungicides when used for management of other diseases of wheat may increase DON in the event of a subsequent scab outbreak. Therefore the impact of fungicides used for management of other wheat diseases on scab and DON development in particular needs to be considered, and recommendations on their use as they affect DON be incorporated in best management practices for scab. Trials under the FY11 funding were conducted to address these additional concerns by expanding upon the basic uniform fungicide trial by including a combination of the best fungicides, a range of application dates including 5 days after early flowering, and several products applied pre-flowering to determine their effect on DON.

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:

Fusarium head blight (FHB) developed from natural sources and from artificial inoculation to a moderately severe level. Leaf rust also developed to moderate levels. The incidence of FHB was significantly reduced by 4 treatments that were applied at full heading (3 days before flowering). These were 6.2 fl oz/A of Quadris, 4 fl oz/A of Stratego YLD, 4 fl oz/A of Priaxor and the EC formulation of Headline applied at 6 fl oz/A. Prosaro at 6.5 fl oz/A significantly reduced FHB

incidence when applied at initial flower and 4 days later but not when applied at heading or 7 days after initial flower. Caramba at 14 fl oz also reduced FHB incidence when applied at initial flower and 4 days later but not when applied at heading. The treatment 6 fl oz/A of Headline SC applied at flag leaf followed by 14 fl oz/A of Caramba at initial flowering significantly reduced FHB incidence. This treatment effect is clearly due to the Caramba component, as Headline alone at FGS 9 had no effect on FHB incidence. Syngenta A9232D (Cogito) at 7 fl oz/A significantly reduced FHB incidence when applied 4 days after initial flower but not at initial flower or at heading. FHB severity in comparison to the untreated control was significantly reduced by all but two treatments, 6 fl oz/A of Headline SC applied at FGS 9 and Quilt at 10.5 fl oz/A applied at FGS 10.5. Vomitoxin was significantly reduced by treatments applied at flowering, 4d after and 7d after flowering. Priaxor at 4 fl oz/A applied at heading was the only treatment that significantly increased vomitoxin. Leaf rust was significantly reduced when compared to the untreated control by all treatments. They were 6.2 fl oz/A of Quadris applied at heading and 7 fl oz/A of A9232D applied at 4 days after initial flower. Considering A9232D reduced leaf rust to very low levels when applied earlier, it appears that it is best used as a preventative than curative material. The triazole products applied at heading produced the highest level of leaf rust control that was only matched by the triazole/strobilurin blend, Twinline at the 9 fl oz/A rate. All other strobilurin, strobilurin blends and carboxamide products tested were somewhat less effective at reducing leaf rust symptoms. Only two treatments did not significantly increase yield over the untreated control. They were Headline SC at 6 fl oz/A when applied at the flag leaf stage and 3 fl oz of Approach when applied at heading. The Headline treatment at flag leaf had no effect on scab. All treatments significantly improved test weight. Both diseases had an effect on lowering test weight, but treatments that reduced FHB the greatest produced the largest improvements in test weight.

Impact:

The multi-state cooperative trials have proved to be the most successful way to obtain fungicide efficacy data on FHB management. No new products were identified that may provide additional options for producers. One of new products tested, Priaxor, has multiple active ingredients including a different class of chemistry than all other effective products, which may provide some utility as a fungicide resistance management option. However, the continued evidence that products containing strobilurin chemistry as an active ingredient may increase DON in the event of FHB development has significant implications regarding best crop management practices. Priaxor is such a product. The effective window for fungicide application for reduction of DON is from initial flower to about 7 days after. The effective window is based on a single inoculation at early flowering in this trial. Further research is needed to determine the effect of secondary infection periods on the effective window.

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.

Willyerd, K. T., Li, C., Madden, L. V., Bradley, C. A., Bergstrom, G. C., Sweets, L. E., McMullen, M., Ransom, J. K., Grybauskas, A., Osborne, L., Wegulo, S. N., Hershman, D. E., Wise, K., Bockus, W. W., Groth, D., Dill-Macky, R., Milus, E., Esker, P. D., Waxman, K. D., Adee, E. A., Ebelhar, S. E., Young, B. G., and Paul, P. A. 2012. Efficacy and stability of integrating fungicide and cultivar resistance to manage Fusarium head blight and deoxynivalenol in wheat. Plant Dis. 96:957-967.

Grybauskas, A. P. and E. Reed. 2011. Effectiveness of fungicides to suppress Fusarium head bight and leaf rust in Maryland, 2011. Plant Disease Management Reports. Report No. 6:CF017. DOI:10.1094/PDMR06. The American Phytopathological Society, St. Paul, MN.

Bradley, C.A., E.A. Adee, S.A. Ebelhar, G.C. Bergstrom, R. Dill-Macky, J.J. Wiersma, A.P. Grybauskas, W.W. Kirk, M. P. McMullen, S. Halley, E.A. Milus, L.E. Osborne, K.R. Ruden, and K.A. Wise. Effect of triazole, strobilurin and triazole + strobilurin mixture fungicides on Fusarium head blight and associated mycotoins. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis and D. Van Sanford (Eds.), Proceedings of the 2011 National Fusarium Head Blight Forum, (p. 125). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Willyerd, K. G. Bergstrom, C. Bradley, R. Dill-Macky, P. Gross, A. Grybauskas, S. Halley, D. Hershman, L. Madden, M.McMullen, G. Milus, L. Osborne, K. Ruden, J.D. Salgado, L. Sweets, S. Wegulo, K. Waxman, K. Wise and P. Paul. 2011. Uniform Fusarium head blight integrated management trials: A 2011 update. Proceedings of the 2011 National Fusarium Head Blight Forum, (p. 161). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Grybauskas, A.P. 2011. Mycotoxin mitigation in Mid-Atlantic Corn and Wheat. Professional Crop Producers conference, February 15, Grantville, PA.

Grybauskas, A.P. 2011. Mycotoxins in field crops and their mitigation. Tri-State No-till conference, February 1, West Middlesex, PA.

Grybauskas, A.P. 2011. Mycotoxins in field crops and their mitigation. Southwest Regional PA No-till conference, February 2, Latrobe, PA.

Grybauskas, A.P. 2011. Field Crop Fungicide Update: an overview of fungicides and general recommendations for their use in soybeans, corn and small grains. Pennsylvania Agronomic Education Conference, January 18-19, State College, PA.

Field crop disease management update. Baltimore Agronomic Crops Conference, Upperco, MD, 8 December, 2011.

Field crop disease management update. Southern Maryland Crops Conference, Baden, MD, 1 December, 2011.

Wheat diseases and their management. Mercer's Seed Dealers, Frederick, MD 27 July 2011.

Wheat diseases and their management. 2011 Wheat Seed Research Twilight tour, Frederick, MD, May 26, 2011.

Mycotoxins in field crops. Washington County Agronomy Day, Keedysville, MD, March 18, 2011.

An overview of fungicides and general recommendations for their use in soybeans, corn and small grains. Queen Anne's County Agronomy Day, March 4, Queenstown, MD.

Toxins and scab in wheat. Caroline County Agronomy meeting. February 16, 2011, Denton, MD.

An overview of fungicides and general recommendations for their use in soybeans, corn and small grains. Pesticide Conference February 10, 2011, Denton, MD.

An overview of fungicides and general recommendations for their use in soybeans, corn and small grains. Pesticide Conference February 8, 2011, Frederick, MD.

Fusarium head blight management research. Maryland Crop Improvement Association Annual Meeting, Ruthsburg, MD, January 26, 2011.

Mycotoxins in field crops. Lower Shore Agronomy Day, Pocomoke City, MD, January 25, 2011.

Mycotoxins in field crops. Dorchester county Agronomy meeting, Cambridge, MD, January 18, 2011.

2012 Disease and Fungicide update, Queen Anne's County Agronomy Day, March 2, 2012, Queenstown, MD.

Field crop disease update, Montgomery, Howard & Frederick County Agronomy Update, February 29, 2012, Frederick, MD.

Field crop disease update, Carroll County Mid-Winter Meeting, February 22, 2012, Westminster, MD.

Field crop diseases and fungicide update. Caroline County Agronomy Meeting, February 15, 2012, Denton, MD.

Field Crop Disease Issues: 1) New soybean virus; 2) Fungicides & timing in small grains and 3) An update on scab vomitoxin reduction. Harford County Midwinter Educational meeting, February 9, 2012, Cambridge MD.

Field Crop Disease Issues: 1) New soybean virus; 2) Fungicides & timing in small grains and 3) An update on scab vomitoxin reduction. Dorchester Agronomy meeting, January 31, 2012 Cambridge MD.

Field crop disease management issues: Including a small grain vomitoxin update. Lower Shore Agronomy Day, January 25, 2012, Salisbury, MD.

Field crop disease management issues: Including a small grain vomitoxin update. Cecil County Agronomy Day, January 24, 2012, Rising Sun, MD.

Diseases affecting seed production. Maryland Crop Improvement Association Annual meeting, Ruthsburg, MD, January 17, 2012.