USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY10 Final Performance Report
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Cover Page

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Fiscal Year:	FY10
USDA-ARS Agreement ID:	59-0206-9-089
USDA-ARS Agreement Title:	Uniform Fungicide and Biocontrol Agent Testes for Control of Fusarium Head Blight and Deoxynivalenol.
FY10 USDA-ARS Award Amount:	$ 8,270

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Uniform Fungicide and Biocontrol Agents Test for Control of Fusarium Head Blight and Deoxynivalenol.	$ 8,270
	Total ARS Award Amount	**$ 8,270**

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: *Uniform Fungicide and Biocontrol Agents Test for Control of Fusarium Head Blight and Deoxynivalenol.*

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) epidemics continue to be responsible for enormous yield and quality losses of wheat resulting in financial damage to producers, and risk to the safety of food supplies as a result of the production of mycotoxins by the causal organism e.g. deoxynivalenol (DON). FHB is sporadic in MI necessitating the advised use of fungicides that are effective against FHB. Fungicide management is the key to reducing yield and quality losses from Fusarium head blight (FHB). Although, under heavy disease pressure, a single strategy has proven inadequate to control the disease and mycotoxins to a level accepted by industry the timing and dose rate studies are still necessary across a wide range of environments to assess their benefits. Nationally, Michigan ranks 14th in production of wheat has a unique temperate climate and therefore merits inclusion in such an environmental interaction study.

The effect of fungicides on Fusarium head blight (FHB) and deoxynivalenol (DON) levels was evaluated in Michigan on soft white wheat at Clarksville Horticultural Research Station in irrigated plots. To help ensure development of FHB, plots were planted into fields that were previously cropped to a FHB-susceptible crop and/or *Fusarium graminearum* spawn (*F. graminearum* growing on a substrate; i.e. sterile corn or sorghum kernels) was spread throughout the plots. Irrigation during head development through soft dough (Feekes 11.2) supplemented natural rainfall to provide a favorable environment for *F. graminearum* infection and disease development. The experimental design was a randomized complete block with 4 replications. Plots were 10 ft wide × 30 ft long. Fungicide treatments were applied with a spray boom equipped with forward- and backward-facing nozzles (30° from the horizontal). The specific fungicide treatments evaluated were determined Fusarium Head Blight Forums. There were 10 uniform treatments applied across replicates at each location. Although the major thrust of the experiment were to evaluate new fungicide chemistry and mixtures, standard treatments were included for comparison purposes (i.e. Prosaro, Caramba, etc.).

At soft dough (Feekes 11.2), FHB incidence and severity was assessed for each plot by examining 20 heads at 5 arbitrarily selected locations per plot, and FHB index was calculated. Additionally, incidence and severity of foliar diseases were assessed on the flag leaves at the same time. Plots were harvested to determine yield, and grain samples from each plot were evaluated for percentage Fusarium-damaged kernels. Grain samples from each plot were not sent to the USWBSI-funded DON testing laboratories for DON analysis due to an experimental sampling error.

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 trials were completed successfully and harvested with moderate FHB development. Moderately dry conditions during flowering and grain development favored some Fusarium head blight development due to frequent irrigation, moderately cool temperatures and wet conditions during and 1-wk following anthesis. Fusarium head blight developed in the trial and all treatments reduced the severity index in comparison with the untreated control. Weather conditions were conducive for the development of wheat rust and stem rust in 2010. Stagonospora also developed but was overwhelmed in the untreated plots by other diseases and all treatments significantly controlled the disease in comparison to the untreated control. All treatments had significantly less wheat rust on the flag leaf in comparison to the untreated control (72.5%). Stem rust developed toward the end of the season and all treatments suppressed the development of the disease in comparison to the untreated control. Treatments with greater than 48.7 bu/A had significantly higher yield than the non-treated control (42.7 bu/A). Based on analysis of variance, no treatments were significantly different in terms of test weight or 1000-grain weight. In 2010, samples from the trial were accidentally lost after moisture testing and percent kernels affected by Fusarium and DON were not assessed. No phytotoxicity was observed in any of the treatments.

	Fusarium Head Scab (%)								
Treatment and rate of application/A	Incidence	Severity	Severity Index[z]	Stagono-spora[y] (%) 1 Jul	Wheat rust[x] (%) 1 Jul	Stem rust[w] (%) 6 Jul	Yield (bu/A) 13 Jul	TW[v]	1000 kernal weight (oz)
Prosaro 421 SC 6.5 fl oz + NIS 0.25% (C[u])…	4.1gh[t]	1.9def	0.1b	6.8c-g	23.8bc	10.3cd	50.8ab	54.2	1.6
Prosaro 421 SC 6.5 fl oz + NIS 0.25% (D)….	5.3gh	2.2c-f	0.1b	3.5fg	8.8efg	4.8ef	51.4ab	54.3	1.7
Prosaro 421 SC 6.5 fl oz + NIS 0.25% (E)…..	12.5d	3.0b-f	0.4b	4.8efg	16.3c-f	7.8def	48.4abc	54.2	1.6
Caramba 0.75SL 13.5 fl oz + NIS 0.25% (C)..	13.1cd	3.5b-f	0.5b	8.8cde	27.5b	9.5cde	45.1bc	54.0	1.5
Caramba 0.75SL 13.5 fl oz + NIS 0.25% (D)..	5.9fg	2.1c-f	0.1b	6.3d-g	22.5bc	11.3bcd	48.7abc	54.4	1.6
Caramba 0.75SL 13.5 fl oz + NIS 0.25% (E)..	15.6c	5.0b-e	0.9b	6.0d-g	17.5cde	12.5bcd	53.5a	54.9	1.7
Headline 2.09EC 6 fl oz + NIS 0.25% (B)…..	6.3fg	2.1c-f	0.1b	6.8c-g	21.3bc	16.3b	51.7ab	55.3	1.6
Headline 2.09EC 6 fl oz + NIS 0.25% (C)…..	12.8cd	4.1b-f	0.5b	7.5c-f	20.0bcd	12.8bcd	54.5a	55.1	1.6
Headline 2.09EC 6 fl oz + NIS 0.25% (A)…..	12.8cd	3.3b-f	0.4b	10.0bcd	20.0bcd	13.3bc	54.5a	54.8	1.8
Proline 480SC 4.3 fl oz + NIS 0.25% (D)…..	9.4e	2.5b-f	0.3b	8.8cde	10.0efg	5.0ef	43.9c	53.6	1.6
Stratego Pro 500SC 2 fl oz + NIS 0.25% (A)..	15.6c	5.4bcd	0.9b	11.3bc	21.3bc	10.3cd	52.0a	53.2	1.6
Stratego Pro 500SC 2 fl oz + NIS 0.25% (A); Prosaro 421SC 6.5 fl oz (D).....	19.4b	6.1b	1.2b	10.0bcd	9.0efg	4.0f	53.8a	54.4	1.6
Untreated……..	58.1a	20.3a	12.0a	25.0a	72.5a	32.5a	42.7c	53.8	1.6
Tukey's HSD (P=0.05)	2.98	3.69	1.80	4.77	9.93	5.10	6.90	1.35	0.12

[z] Mean Fusarium head blight index = (FHB incidence * FHB severity)/100 on four sub-samples of 20 heads of wheat per plot on 13 Jul (264 days after planting at Feekes 11.4)
[y] Stagonospora leaf and glume blotch caused by *Stagonospora nodorum* percent severity over whole plant on 1 Jul (252 DAP at Feekes 11.1).
[x] Wheat leaf rust caused by *Puccinia triticina*; percent severity on flag leaf on 1 Jul (252 DAP at Feekes 11.1)
[w] Stem rust leaf caused by *Puccinia graminis* f. sp. *tritici* percent severity over the stem on 7 Jul (257 DAP at Feekes 11.1)
[v] Test weight lb/bu at 13% moisture
[u] Fungicides were applied on A= 18 May (GS 5), B= 28 May (GS 9), C= 2 Jun (GS 10.5), D= 4 Jun (GS 10.5.1), E= 8 Jun (GS 10.5.5)
[t] Values followed by the same letter are not significantly different at P = 0.05 (Tukey Multiple Comparison)

A biological fungicide control trial was also conducted successfully but Dr. Yuen will report those results in his report.

Impact:

The results of the project have been disseminated through MSU extension by email to stakeholders and presented at extension meetings by Mr. Nagelkirk. In 2010/11 I was unable to present to the results due to ill health. Since then, Nagelkirk and Kirk focusing on the use of fungicides for the control FHB have produced several extension bulletins jointly. The impact is that more growers are aware of head scab specifically and wheat diseases generally and the effect that they can have on the yield and quality of the crop. According to some chemical distributor representatives and agrochemical manufacturer industry personnel more wheat acres in Michigan are reported to now being scouted and protected with fungicides against diseases for the first time. This may be in part to the increasing value of wheat and the improved yield potential of new varieties.

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.

1. Bradley, C. A., Adee, E. A., Ebelhar, S. A., Dill-Macky, R., Wiersma, J. J., Grybauskas, A. P., Kirk, W. W., McMullen, M. P., Halley, S., Milus, E. A., Osborne, L. E., Ruden, K. R., and Young, B. G. 2010. Multi-state uniform fungicide evaluations for control of Fusarium head blight and associated mycotoxins. Proceedings of the National Fusarium Head Blight Forum, Milwaukee, WI, p. 74.
2. Yuen, G.Y., C.C. Jochum, S.A. Halley, K. Misek, L.E. Sweets, W. Kirk and D.A. Schisler. 2009. Results of 2009 Uniform Biological Control Trials. In: S. Canty, A. Clark, J. Mundell, E. Walton, D. Ellis and D. Van Sanford (Eds.), Proceedings of the National Fusarium Head Blight Forum; 2009 Dec 7-9; Orlando, FL. Lexington, KY: University of Kentucky. pp. 101-105.
3. Kirk, W.W., R.L. Schafer, P. Tumbalam. 2010. Evaluation of foliar fungicides treatments for control of winter wheat foliar diseases, St. Johns MI, 2009. 4:CF021
4. Kirk, W.W., R.L. Schafer, P. Tumbalam. 2010. Evaluation of foliar fungicides treatments for control of winter wheat foliar diseases, Clarksville MI, 2008/09. 4:CF022
5. Kirk, W.W., R.L. Schafer, P. Tumbalam. 2010. Evaluation of foliar fungicides treatments for control of winter wheat foliar diseases, ST. Johns MI, 2008. 4:CF023