USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY07 Final Performance Report (approx. May 07 – April 08)
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Cover Page

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Fiscal Year:	2007
USDA-ARS Agreement ID:	**59-0790-7-078**
USDA-ARS Agreement Title:	**Contribution of Local Inoculum Sources to Regional Atmospheric Populations of *G. zeae*.**
FY07 ARS Award Amount:	$ **24,390**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
EEDF	Contribution of Local Inoculum Sources to Regional Atmospheric Populations of *G. zeae*.	$24,390
	Total Award Amount	**$ 24,390**

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Principal Investigator Date

* CBCC – Chemical, Biological & Cultural Control
EEDF – Etiology, Epidemiology & Disease Forecasting
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GET – Genetic Engineering & Transformation
HGR – Host Genetics Resources
HGG – Host Genetics & Genomics
IIR – Integrated/Interdisciplinary Research
PGG – Pathogen Genetics & Genomics
VDUN – Variety Development & Uniform Nurseries

Project 1: *Contribution of Local Inoculum Sources to Regional Atmospheric Populations of G. zeae.*

1. What major problem or issue is being resolved and how are you resolving it?
Epidemics of FHB may be initiated by regional atmospheric sources of inoculum of *G. zeae*, but little is known about the contribution of local inoculum sources to regional atmospheric populations of the pathogen and how far inoculum may travel from its source. The ability to predict the regional transport of *G. zeae* from local inoculum sources may help refine risk models for FHB. The ultimate goals of our research efforts are to determine where inoculum for FHB comes from and how far it travels. We used unmanned aerial vehicles (UAVs), DNA fingerprinting, and the atmospheric transport model HYSPLIT to predict and track the movement of *G. zeae* in the atmosphere.

2. List the most important accomplishment and its impact (how is it being used?). Complete all three sections (repeat sections for each major accomplishment):

Accomplishment: Little is known about the contribution of local inoculum sources to regional atmospheric populations of the *G. zeae* and how far inoculum may travel from its source. We inoculated a portion of a tilled field with corn kernels colonized with a single clonal isolate of *G. zeae*, and we conducted 35 autonomous UAV sampling flights for the *G. zeae* 100 m above our inoculum source. Isolates of *G. zeae* were cultured from the sampling plates, and a DNA fingerprinting technique known as Amplified Fragment Length Polymorphisms (AFLPs) was used to track the released isolate in our atmospheric collections. The atmospheric transport model HYSPLIT was used to forecast the long-distance transport of *G. zeae* from our inoculum source. Thirty three percent of our isolates were collected on two different flights on May 1, 2007. Runs with HYSPLIT for these collection times suggested that our inoculum source was transported at least a kilometer away from the ground surface within an hour. The high number of colonies recovered during this time period, coupled with data from AFLP analyses, is consistent with HYSPLIT model predictions of spore transport.

Impact: This is the first study to track the movement of *G. zeae* in the atmosphere from a clonal inoculum source, and the first body of work to predict the long-distance transport of G. zeae over broad geographical regions. This project has developed new and improved tools (e.g., autonomous UAVs) necessary for studying regional atmospheric populations of *G. zeae*, and has assisted in predicting the distribution and spread of *G. zeae* in the atmosphere. Our work continues to aid in developing and/or excluding strategies for managing FHB, and should help researchers refine forecasting/risk assessment models for regional FHB epidemics.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:
Knowledge of the long-distance transport of *G. zeae* from local inoculum sources is an important step toward developing an early warning system for FHB and practical management strategies for FHB epidemics. Since spores of *G. zeae* may move over kilometer distances in the atmosphere, management strategies for FHB should be considered on a regional (i.e. county or state) basis. Forecasting and risk assessment models for FHB epidemics could benefit from the inclusion of information on atmospheric inoculum dynamics.

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.

Presentations

Schmale, D.G. 2007. Use of autonomous unmanned aircraft to validate and improve long distance pathogen transport models. Phytopathology 97: S147.

Bergstrom, G.C., and Schmale, D.G. 2007. The aerobiology of *Gibberella zeae*: whence come the spores for Fusarium head blight? Pages: 70-72 in Proc. 2007 National Fusarium Head Blight Forum, Kansas City, MO.

Schmale, D.G. 2007. Bridging engineering and agriculture at Virginia Tech's Kentland Farm. Field Day in association with the2 007 Potomac Division Meeting of the American Phytopathological Society.

Peer-reviewed articles

Schmale, D.G., Dingus, B.R., and Reinholtz, C. 2008. Development and application of an autonomous unmanned aerial vehicle for precise aerobiological sampling above agricultural fields. Journal of Field Robotics 25: 133-147.

Wang J., Patel V., Woolsey C.A., Hovakimyan N., and Schmale D.G. 2007. L1 adaptive control of a UAV for aerobiological sampling. American Control Conference, 4660-4665.

Non peer-reviewed articles

Schmale, D. G., Dingus, B.R., Wood-Jones, A. K., Khatibi, P, and Reinholtz, C. 2007. Diversity of the fungal genus *Fusarium* one hundred meters above the surface of the earth. Page 46 in: 2007 Dean's Forum on the Environment, Virginia Tech, Blacksburg, VA.

Keller, M., Duttweiler, K., Schmale, D.G., and Bergstrom, G.C. 2007. Contribution of within-field inoculum sources to Fusarium Head Blight in wheat. Page 98 in Proc. 2007 National Fusarium Head Blight Forum, Kansas City, MO.

Schmale, D.G., Dingus, B.R., Keller, M., and Wood-Jones, A.K. 2007. Contribution of local inoculum sources to regional atmospheric populations of *Gibberella zeae*. Page 139 in Proc. 2007 National Fusarium Head Blight Forum, Kansas City, MO.