USDA-ARS / USWBSI
FY03 Final Performance Report (April 12, 2003 – April 11, 2005)
July 15, 2005

Cover Page

PI:	**Thomas Scherer**
Institution:	**North Dakota State University**
Address:	**Agricultural & Biosystems Engineering Department** **Box 5626** **Fargo, ND 58105**
E-mail:	**tscherer@ndsuext.nodak.edu**
Phone:	**701-231-7239**
Fax:	**701-231-1008**
Year:	**FY2003 (approx. May 03 – April 04)**
FY03 ARS Agreement ID:	**59-0790-2-085**
FY03 ARS Agreement Title:	**Automated Cntrol of a Misting System for FHB Field Research.**
FY03 ARS Award Amount:	**$ 2,561**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
CBC	Automated Control of a Misting System for FHB Field Research.	$ 2,561
	Total Amount Recommended	**$ 2,561**

_____

Principal Investigator Date

* BIO – Biotechnology
CBC – Chemical & Biological Control
EDM – Epidemiology & Disease Management
FSTU – Food Safety, Toxicology, & Utilization
GIE – Germplasm Introduction & Enhancement
VDUN – Variety Development & Uniform Nurseries

Project 1: ***Automated Control of a Misting System for FHB Field Research.***

1. What major problem or issue is being resolved and how are you resolving it?
Misting systems are used to create the proper microclimate to consistently encourage FHB disease pressure in research plots. Misting systems are designed to keep the wheat and barley heads wet but not apply so much water as to make it difficult to move around in the research plots. However, because misting systems are operated on a continuous basis, they use large quantities of water that can be expensive. Often, during the critical FHB infection period, natural weather conditions are favorable to FHB growth and the misting system doesn't need to be on. To balance natural weather conditions with induced misting and not apply too much water, we controlled the misting system at Fargo with a feedback control system during the 2002, 2003 and 2004 growing seasons. Combination temperature and relative humidity sensors enclosed in weather shields were placed at flag leaf height in two untreated check plots. They were connected to a datalogger and monitored continuously and the readings were stored every 10 minutes. If the average RH readings were less than 90% the research plots were misted for 7 minutes each hour during the night starting at 8 pm. The system operated as designed and there was significant differences of FHB field severity levels between untreated check plots and plots applied with fungicides all three years.

2. **What were the most significant accomplishments?**
We verified that the misting system protocol that we have developed produces the right conditions for FHB development. In 2002, the average FHB field severity value for the dryland inoculated plots was 0.6% which is much less than the 10.2% for the inoculated untreated check plots under the misting system. In 2004, the inoculated untreated check plots that were misted averaged 24.5% FHB severity and 9.4 ppm DON (deoxynivalenol). The dryland inoculated plots had 5.4% FHB severity and 2.0 DON.

Analysis of the leaf wetness sensor data shows that these relatively inexpensive devices could be used to control the misting system with the right decision protocols. Instead of expensive and hard to calibrate relative humidity sensors, the leaf wetness sensors would make a more robust and reliable sensor for controlling the misting system. The decision protocol would be based on monitoring the status of the leaf wetness sensor at a particular time (say at the beginning of the hour) and if it is dry then turn on the misting system. If the leaf wetness sensor reads below a certain resistance value (wet range), then don't turn on the misting system. The six passive sensor stations that measured air temperature and RH within the plant canopy provided very valuable information. Each station measured temperature and RH at 6, 18 and 30 inches above ground level in the wheat and barley canopies. They demonstrated http://www.ag.ndsu.nodak.edu/abeng/ humidity stratification in both the misted and dryland plots. Six inches above the soil, the relative humidity was greater than 90% more than 75% of the time in the misted plots and around 60% for the dryland plots during the infection period. At the top of the canopy (where the wheat heads are located) the relative humidity in both the misted and dryland plots was greater than 90% about half the time during the infection period.

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

Technical Papers

Scherer, T.F., V.H. Hofman and M.P. McMullen, 2000. Design of a microsprinkler system for Fusarium Head Blight (scab) research on wheat and barley. Paper No. RRV00-203, ASAE/CSAE North Central Region Intersectional Meeting, Moorhead, MN, Sept. 29-30. 8 pgs.

Scherer, T.F., D. Kirkpatrick and M.P. McMullen, 2002. Automated control of a watering system for Fusarium Head Blight (scab) research. Paper MBSK02-305, North Central Region Intersectional Meeting of the ASAE/CSAE, Saskatoon, SK, Canada, Sept. 27-28. 11 pgs.

Scherer, T.F. 2005. Design and control of sprinkler systems for crop disease research. Paper 05-2182, ASAE International Meeting, Tampa, FL, July 17-20. 11 pgs.

Presentations

Poster: Automated Control of a Misting System for Scab Research, 2002 National Fusarium Head Blight Forum, Cincinnati, OH, Dec 6-7.

PowerPoint presentation: Design of a microsprinkler system for FHB research on wheat and barley, ASAE/CSAE Meeting, Moorhead, MN, Sept 29-30, 2000

PowerPoint presentation: Automated control of a watering system for FHB research, ASAE/CSAE Meeting, Saskatoon, SK Canada, Sept. 27-28, 2002

PowerPoint presentation: Design and control of sprinkler systems for crop disease research, ASAE Meeting, Tampa, FL, July 19, 2005.