U.S. Wheat and Barley Scab Initiative
FY00 Final Performance Report (approx. May 00 – April 01)
July 30, 2001

Cover Page

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Year:	**FY2000 (approx. May 00 – April 01)**
Grant Number:	**59-0790-9-035**
Grant Title:	**Fusarium Head Blight Research**
2000 ARS Award Amount:	**$87,317**

Project

Program Area	Project Title	Requested Amount
Epidemiology & Disease Management	A forecasting system for FHB in the Northern Great Plains.	$106,000.00
	Requested Total	$106,000.00[1]

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Principal Investigator Date

[1] Note: The Requested Total and the Award Amount are not equal.

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Project 1: A forecasting system for FHB in the Northern Great Plains.

1. What major problem or issue is being resolved and how are you resolving it?

Current management options for Fusarium head blight (FHB) are inadequate and disease outbreaks continue to disrupt the small grain industries in the US. In particular, our understanding of the component events of FHB is insufficient to predict disease onset with confidence. Research on the epidemiology of FHB is crucial because it creates a foundation for scientific disease management strategies. In the meantime, forecasts of FHB with the present knowledge base can provide immediate, pragmatic advice to growers.

This research addresses the delivery and continuing development of forecasting systems for FHB of wheat, durum and barley. Further, FHB forecasting is being linked with the optimum timing for fungicide application to maximize disease control.

Disease progress is being researched in cooperation with other FHB researchers in the US Midwest and Canada. A common protocol calls for daily disease assay from field-grown plants, inoculum and airborne spore measurements, and monitoring the environment on-site. Patterns conducive to disease are being identified and catalogued for the development of a model based on first principles of epidemiology. Meanwhile, a similar pattern analysis of past epidemics can reveal important environmental indicators of disease onset; so too, can airborne spores of *Gibberella zeae* suggest a precondition for infection has been satisfied.

Fungicide timing trials are being conducted routinely in field plots in close proximity to the disease progress research. Once critical events in disease development are identified, optimization of fungicide timing should follow.

2. What were the most significant accomplishments?

A regionally-specific forecasting system for three wheat leaf diseases and FHB of wheat and barley has been deployed in North Dakota and Minnesota. Volumetric air samplers were placed in 2001 near 18 weather stations of the ND Agricultural Weather Network. A heuristic FHB forecast is being based on spore level, wetness duration, relative humidity and temperature.

Adoption of the system by growers and their advisors has been rapid and feedback has been positive. About 18% of surveyed growers had used the system by the end of the second year of operation and the Internet site averaged more than 200 requests per day for information during the third year. A study of the collection efficiency of the Burkard air sampler has resulted in important modifications to the spore sampling protocol.

A detailed aerobiological study has shown that both asexual and sexual spore types serve as inoculum. Ascospore release and dispersal is closely related to precipitation within the past 24 h and exhibits diurnal periodicity. A model of inoculation was developed and can be linked to an infection model to predict disease onset.

Disease progress research so far has produced 12 epidemic histories at the Fargo site. When combined with cooperating sites, there are now or soon will be a sufficient number of patterns for analysis.

A retrospective analysis of FHB epidemics in the US has provided three predictive models that need to be tested in specific regions of the country.

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.

Buttke, C. and Francl, L. 2001. Evaluation of Burkard cyclonic spore sampler efficiency. Phytopathology 91:S175.

De Wolf, E.D., Francl, L., Lipps, P., Madden, L., Osborne, L. and Jin, Y. 2000. Factors affecting the development of wheat fusarium head blight. Pp. 137-140 in Proc. 2000 National Fusarium Head Blight Forum.

Francl, L.J. 2000. Implementation of a regional wheat disease forecasting system. Pp. 231-232 in Proc. 14th Conference on Biometeorology and Aerobiology, Davis, CA.

Francl, L.J. 2001. Monitoring Fusarium head blight temporal progress. Phytopathology 91:S177.

Francl, L.J., Markell, S., Ali, S. and Friesen, T.L. 2000. *Gibberella zeae* population dynamics: A progress report. Pp. 144-146 in Proc. 2000 National Fusarium Head Blight Forum.

Francl, L.J., Larson, C., and De Wolf, E.D. 2000. Description and evaluation of the NDSU regional wheat disease forecasting system. Pp. 147-152 in Proc. 2000 National Fusarium Head Blight Forum.

Larson, C.L. 2001. An evaluation of the NDSU wheat disease forecasting system. MS thesis. North Dakota State University.

Larson, C.L., Francl, L.J., and Friesen, T.L. 2001. Evaluation of the Burkard cyclonic spore sampler for collection efficiency of ascospores. Plant Disease (in press).

Markell, S. and Francl, L. 2001. Dynamics of *Gibberella zeae* ascospore dispersal. Phytopathology 91:S58.

Markell, S. and Francl, L. 2001. Relationships among environmental variables, ascospore dispersal, and inoculum of *Gibberella zeae*. Phytopathology 91:S179.