U.S. Wheat and Barley Scab Initiative
FY00 Final Performance Report
(June 20, 2000 – December 31, 2001)
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Cover Page

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Year:	**FY2000 (approx. May 00 – April 01)**
Grant Number:	**59-0790-0-067**
Grant Title:	**Fusarium Head Blight Research**
2000 ARS Award Amount:	**$29,268**

Project

Program Area	Project Title	Requested Amount
Food Safety, Toxicology, & Utilization	Determination of DON and scab in barley using near-infrared and neural network.	$114,686.00
	Requested Total	$114,686.00[1]

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Principal Investigator Date

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

Project 1: Determination of DON and scab in barley using near-infrared and neural network.

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

FDA has established DON advisory levels in food and feed. Because of the near-zero tolerance of DON in barley imposed by the malting industry, measurement of DON of barley becomes especially important in quality control in this industry. DON is commonly measured using TLC (Thin Layer Chromatography), ELISA (Enzyme Linked Immunosorbant Assay), HPLC (High Performance Liquid Chromatography), GCMS (Gas Chromatography and Mass Spectroscopy), black light and minicolumn. These methods are either expensive, time-consuming, and require significant training, or are only suitable for qualitative and screening analysis. Scabbed barley kernels, especially lightly scabbed kernels, do not show apparent visual symptoms, and therefore are hard to pick compared with wheat kernels. The goal of this proposed project is to develop a rapid, simple, and economical method for DON measurement and scab estimation in barley. In the proposed research, inexpensive and easy-to-operate near-infrared (NIR) spectrometer will be used to acquire spectral data at many different wavelengths from large barley samples (instead of single kernel), and neural networks (NN) technique (instead of statistics) will be used for calibration and determination.

2. What were the most significant accomplishments?

A procedure for obtaining NIR spectra of barley samples for NN development was set up. The NIR spectra of 188 barley samples with DON level between 0.3 to 50.8 ppm were determined using the FOSS NIR Systems 6500 Near Infrared Spectrometer. The DON levels were measured with GC/mass spectrometry (GC/MS). With the NIR spectra as input variable and GC/mass measured DON as output variable, neural networks were developed and trained to predict DON levels. The prediction accuracy of the models was tested using the randomly selected production sets, which had not been seen by the models. The effects of wavelength interval and ranges on the prediction accuracy of models were also examined. The results demonstrate that the combination of neural networks and NIR spectra can be conveniently used to determine DON levels in barley.

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.

Ruan, R. Y. Li, X. Lin and P. Chen. 2002. Non-destructive Determination of Deoxynivalenol (DON) Levels Using Near-Infrared Spectroscopy: Neural Network Calibration. *Engineering Application in Agriculture. (accepted)*

Ruan, R. 2001. Application of Near Infrared, Machine Vision, and Neural Networks in Scab Research. Second International Wheat Quality Conference, Manhattan, KS.