



Fusarium Focus

Volume 5 • Issue 2

Fall 2003

National FHB Forum in Twin Cities December 13-15

The 2003 National Fusarium Head Blight Forum will take place on Saturday, Dec. 13 through Monday, Dec. 15, at the Holiday Inn Select, located near the Minneapolis-St. Paul International Airport (MSP) and the Mall of America (Bloomington, MN).

The Forum is an integral component of the U.S. Wheat & Barley Scab Initiative. Growers and grower group representatives, millers and other food processors, consumers, and scientists (public and private) are all encouraged to attend.

The Forum will be organized into six sessions: Biotechnology; Chemical and Biological Control; Epidemiology and Disease Management; Food Safety; Toxicology and Utilization; Germplasm Introduction and Enhancement; and Variety Development and Uniform Nurseries. Each of the six sessions will be comprised of a poster session,

speakers, and open or panel discussions.

The full program agenda can be found on the USWBSI's web site, www.scabusa.org, under the link, "2003 National Fusarium Head Blight Forum."

Participants Urged to Register Online

Advanced registration for the Forum is required, and participants are encouraged to register online at www.scabusa.org. Credit cards can be used for online registration. The conference registration fee (\$130 after Nov. 3) includes reception/dinner; Sunday breakfast, lunch and dinner; Monday breakfast; refreshment breaks and conference materials including one copy of the Forum proceedings.

The deadline for submission of posters and abstracts for the Forum proceedings is Nov. 10; see the

USWBSI's web site for more details.

Forum participants are responsible for their own lodging arrangements. A block of rooms has been reserved at the Holiday Inn Select in Bloomington, MN (952-854-9000) at a rate of \$72.95+tax/per night (single and double).

Direct any questions regarding the 2003 Forum to the USWBSI Networking and Facilitation Office at (517) 355-2236 or scabusa@scabusa.org. ■

Key Forum dates:

Nov. 10 Deadline for submission of posters and abstracts/papers for Forum proceedings

Nov. 21 Last day to receive partial refund

Dec. 1 Last day to reserve hotel at guaranteed availability

FHB Plagues Wheat in Eastern U.S.

While the Northern Plains was enjoying its best wheat and barley crops in years, scab and DON plagued wheat crops east of the Mississippi.

Large amounts of rainfall was the main culprit behind North Carolina's worst wheat production in 17 years. About half of the wheat produced in North Carolina this year is unsuitable for human consumption, according to Paul Murphy, professor of crop science at North Carolina State

University.

FHB not only wreaked havoc on wheat yields, Murphy says, but also resulted in various levels of deoxynivalenol (DON) or vomitoxin. While DON in large doses can be detrimental to animal and human health, Murphy stresses that there is no danger to the food supply, since there are strict guidelines on the amount of allowable DON—essentially less than two parts per million for human consumption and five ppm

for animal feed. These guidelines set by the federal government are monitored by mills that process wheat into flour.

Still, FHB damage to farmers and millers in North Carolina this year was unprecedented. "Yields were off by about 20% and harvested wheat has terribly poor quality," Murphy says. While wheat doesn't command the attention or acreage of tobacco or corn in North Carolina, it is still big

Continued on Next Page

Eastern U.S. • from page 1

business for scores of farmers and millers. North Carolina produces the largest amount of wheat in the southeast U.S.; the crop is worth anywhere from \$50 to \$80 million each year. Most wheat grown in the state is soft red winter wheat, planted in October and harvested in June.

According to Mike Pate, Mid-States Mills in Newton, N.C., area mills are being forced this year to haul winter wheat from a variety of sources across the Southeast, costing mills more money in freight charges.

Pate says that Mid-States Mills operates on fixed contracts with cake, pastry, cookie and doughnut producers, who pay for a specific amount of flour. If the supply of quality wheat is insufficient, mills must find wheat from other regions to produce enough flour to hold up their end of the contract.

Murphy points out that one miller, who transferred operations to North Carolina from the Red River Valley region about five years ago, said that the impact on his operation was worse in North Carolina this year than in the spring wheat region epidemics of the early 1990s. "I understand this to be a reflection of the better infrastructure with respect to the supply chain in the Northern Plains," he says.

Murphy and Randy Weisz, NC State associate professor of crop science and small grains extension specialist, put together a management fact sheet for area wheat farmers to help ward off another wheat scab epidemic next year. Better varieties will help; Murphy and researchers at Virginia Tech University have produced a number of moderately resistant varieties of soft red winter wheat.

This and other FHB research, such as screening germplasm and varieties for FHB resistance, is funded in part by the U.S. Wheat and Barley Scab



A field of soft red winter wheat near Queenstown, Maryland, damaged by scab; photo was taken in June, 2003.

Initiative. "Our 'moderately' resistant varieties are only a small step in the right direction," Murphy says, pointing out that a multi-faceted approach is needed to bring FHB under control.

"The only positive footnote from this epidemic was the confirmation that several varieties (NC-Neuse, Roane, Tribute and McCormick), previously identified in USWBSI funded screening nurseries, exhibited moderate levels of FHB resistance in commercial production," says Murphy.

In Indiana, FHB incidence in most fields ranged between 10 and 70%, according to Purdue agronomist Herb Ohm. Spread of the disease after infection was delayed due to unusually cool day and night temperatures, but about 3 weeks after flowering temperatures became higher (normal) and the disease did spread significantly, late in grain fill. "Certainly, Fusarium was the most significant disease (this year) in wheat in Indiana," says Ohm.

Rainy, humid weather during grain flowering also caused FHB problems in Pennsylvania. Scab incidence in Pennsylvania soft red winter wheat fields averaged about 30%, and many producers in the state struggled with DON, leaving them with grain that

could not be marketed, according to Erick DeWolf, plant pathologist at Penn State. Scab also affected barley grown in the state.

Laura Sweets, University of Missouri Department of Plant Microbiology and Pathology, says there were some localized areas of the state where FHB was severe, but overall, the problem was not serious. "Much of the state did have rain as the wheat crop was flowering, but temperatures were also cooler than normal. We did see scab symptoms in fields throughout the state, but we did not see the extensive colonization of kernels by the scab fungus, the problem which is so severe east of the Mississippi this year," says Sweets. "Our wheat harvest actually went quite well and we had a new record average state yield."

Erik Stromberg, small grains pathologist at Virginia Tech, reports various levels of DON in Virginia wheat fields this year. He had grain samples of 25 entries in Virginia Tech's 2003 State Wheat Test from 5 locations evaluated for DON. Over 25 wheat lines, the average DON concentration was 0.4 ppm at Painter, VA (range 0.0 - 3.0); 1.0 ppm at Blacksburg, VA (range 0.0 - 1.6 ppm); 1.0 ppm at Orange, VA (range 0.1 - 2.7

Continued on Next Page

ppm); 1.5 ppm at Warsaw, VA (0.1 - 3.1 ppm) and 2.0 ppm in Shenandoah Valley (1.0-3.4 ppm).

Stromberg noted in field notes from June 4 that he diagnosed FHB on 50 acres of wheat (eight different cultivars). The incidence of FHB was virtually 100%, with one-third to the entire head affected. The field was in Chesapeake County, Virginia, planted no-till into a 2002 corn grain crop stubble.

Don Hershman, University of Kentucky extension plant pathologist, says that the FHB situation in

2003 was the worst since the area's FHB disaster in 1991, though the problem this year was nowhere near as widespread and devastating as it was in 1991.

Overall, FHB symptom expression was highly variable, Hershman says. Crop flowering date, as related to variety and planting date, appeared to be a significant variable impacting FHB. There was a two-week window in May during which most of the wheat in Kentucky flowered. The first week was highly favorable to FHB infection; the second week, gener-

ally, was not. The fields hit most with FHB were the ones that flowered during the first week. Those that flowered during the second week had significantly less FHB.

Because of an unusually long grain fill period last spring, many farmers that had significant FHB in their crop still harvested grain with higher than average test weights, Hershman says. Much of this grain, however, had excessive DON accumulation which has seriously impacted the use of Kentucky wheat by millers and certain other end users. ■

A Snapshot of 2003 Eastern U.S. Wheat Quality

ORIGIN	TEST WEIGHT	MOIST.	PRO	FN	DAMAGE/AMT	PROTEIN
OHIO						
Northwest OH	59.4	13.40	9.72	303	DON ave 0.7	8.00
N. Central OH	59.3	13.50			0% damage	Vom = 0.2 - 0.4
Northeast OH	56.0	11.5 - 13.1			1 - 2% damage	Vom = 1.7 - 2.2
Northern OH	58.1	11.5 - 13.1			1 - 2% damage	Vom = 0.2 - 0.6
Southwest OH	58.1	12.90	9.89	314	None	
MISSOURI						
Southwest MO	60.6	13.66	9.68	288		8.40
Missouri	Good Test Weights 60.0	13.40	9.90	340	Very little damage to kernels Vom = 0 - 7.0	8.10
MICHIGAN						
Michigan (White)	59.0	13.70	9.90			
Michigan High Quality	60.5	12.60	11.20	300		
Michigan (White) High Quality	61.0	12.80	10.40	310		8.70
Michigan (White) Low Quality	58.5	14.00	8.80	280		
Southwest MI	60.1	13.46	10.05	348		8.57
Southern MI	59.7	13.68	9.50	344		8.30
Michigan Low Quality	57.5	14.20	9.20	280	Sprout - 0.5%	
ILLINOIS						
Southern IL	59.0	11.90	10.08	338	Head Scab +4%	9.00
SE/Central IL	60.8	13.38	9.05	318	Scab - 2.64 ave.	7.78
Illinois	60.0	13.40	9.60	340	Vom = 0 - 7.0	8.10
KENTUCKY						
Kentucky	59.3	12.99	10.13	250.7	Sprout, scab, mold	8.11
INDIANA						
Northern IN	61.5	13.95	9.55	340	Wheat Vom = 0.4 Wheat Amylo = 318	7.90
Southern IN	59.0	11.90	10.08	338	Head Scab +4%	9.00
Southern IN	59.7	12.47	10.04			8.71

Every year, Jan Levenhagen, director of quality assurance for the Ohio-based Mennel Milling Company, sends a questionnaire to all of the soft wheat millers in the eastern U.S. inquiring about new crop quality. As indicated in the soft wheat report (with some technical aspects of the report relating to baking quality omitted) many millers included comments concerning DON and scab incidence. "Pro" refers to wheat protein. "FN" refers to falling number; a falling numbers test is used to detect sprout damage. The lower the falling number, the greater the sprout damage. Generally speaking, falling numbers above 300 indicate no sprout damage; falling numbers between 200 and 300 indicate some sprouting; and falling numbers below 200 indicate severe damage.

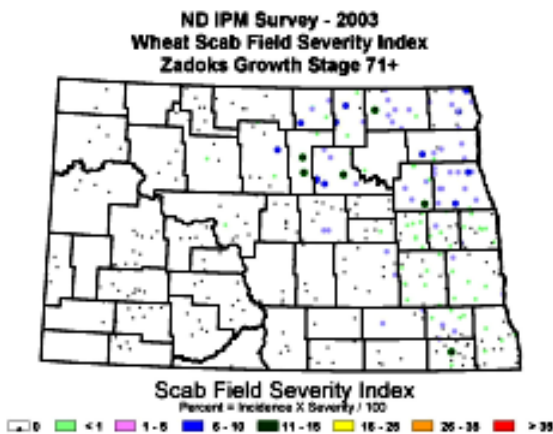


Better Conditions in Northern Plains

While FHB was a problem east of the Mississippi River, drier weather conditions set up wheat and barley crops which generally yielded well with good quality.

Levels of FHB in the Canadian prairies this year were lower than they have been for over 20 years, with growers in western Canada harvesting a high quality crop in 2003, according to Randall Clear, mycologist with the Canadian Grain Commission's Grain Research Laboratory.

Across the border in North Dakota, the level of FHB in wheat was the lowest observed since 1992, according to Marcia McMullen, NDSU extension plant pathologist. The disease was observed in 35% (129 out of the 370) of wheat fields that were surveyed in the state past the flowering stage. However, the average field severity was only 2.3%



in those symptomatic fields. The majority of fields with symptoms were in the northeast part of the state. Overall, wheat fields surveyed past the flowering stage (including those without symptoms), the average field severity was only 0.8%, according to McMullen.

Shaukat Ali of NDSU coordinated a small grains disease forecasting system, online at www.ag.ndsu

nodak.edu/cropdisease.

Marty Draper, South Dakota State University plant pathologist, says that leaf diseases (rusts, tan spot, septoria blotch) appeared to be prevalent across southeastern S.D., and high levels of precipitation with periods of warm weather also encouraged the growth

and development of the scab pathogen, *Fusarium graminearum*. Drier conditions later in the growing season improved the chances for a quick harvest, and high quality grain, Draper says. Draper coordinated a wheat scab risk advisory web site this year (plantsci.sdstate.edu/wheatpath/riskadvisory.html) covering a number of southeastern S.D. counties. ■

ND IPM Survey Finds Scant FHB, DON in Barley

The scab severity index was determined in 215 samples from the 2003 crop in North Dakota, as part of the annual IPM barley crop pest and disease. Incidence of infected heads, average percentage of head infected and scab index (incidence x percentage of head infected) was determined in all crops sampled past the kernel watery ripe stage. The survey is conducted by the Barley Pathology Laboratory in the Department of Plant Pathology at NDSU. The SBARE Malting Barley for Western North Dakota project and the American Malting Barley Association provide financial support for the survey, and sample collection is conducted by crop scouts at the Dickinson Research and Extension Center, North Central Research and Extension Center and at Fargo.

Only 22 of 215 crops sampled in 2003 showed symptoms of FHB. The mean scab index of the infected crops was 1.6 and the mean over all crops was 0.16. This is a very low mean scab index over all crops.

The regions in which infected crops were found varied over the season and possibly reflect climatic conditions during ripening in those regions. One early and severely infected crop was found in southwest N.D. As the season progressed, no more infected fields were found in the southwest but infected fields were found in the north east and east central regions of N.D. In the latest maturing crops, infected fields were found in the northeast and north central regions of the state.

DON levels were determined in 317 samples from the 2003 crop in North Dakota, Minnesota and South

Dakota, as part of the annual barley crop survey. The survey is conducted by the barley quality laboratory in the Department of Plant Sciences at NDSU. The North Dakota Barley Council and the American Malting Barley Association provide financial support for the survey, and sample collection is conducted by the ND Agricultural Statistics Service. The USWBSI provides financial support for the analysis of DON.

The average DON level of the 2003 crop was 0.4 ppm (mg/kg) and approximately 73% of all samples were below 0.5 ppm. This is the lowest regional DON level that has been observed since DON analysis was incorporated into the survey in 1993. DON levels averaged over 2.0 ppm in 2001, 2000, and 1993-1998. As
Continued on Next Page

FHB Risk High with Wheat-Corn Rotation

Some crop producers are learning the hard way how crop rotation can influence FHB.

University of Nebraska agronomist P. Stephen Baenziger says that in 2003, there was an “intensification” of cropping rotations in Nebraska where irrigated seed corn producers (a sizeable industry in Nebraska due to irrigation capabilities) are attempting the novel rotation of seed corn production (harvested usually by September 15), followed by winter barley or winter wheat production (no-till planted in late September, harvested by the end of June or the first week of July), followed by relayed or under-sown cropped soybeans (planted into standing wheat in May and allowed to grow under the wheat canopy until wheat harvest, before becoming the predominant crop in the field). “FHB was present in every wheat and barley field where this rotation was attempted in 2003,” says Baenziger.



Phil Needham, who represents a private crop consulting company called Opti-Crop, based in Kentucky, says that Opti-Crop is a strong advocate of no-till within its inten-

sive wheat management system, as it has shown to provide higher yields with lower associated input costs.

“We do strongly encourage our producers to no-till small grains into soybean residue, however, and not corn stalks. Because we can double-crop soybeans after wheat harvest, most producers want to plant wheat after corn, so this poses a huge threat to small grains with regards to FHB potential.”

Needham says this year was a good example of that. “We had heavy rain and high humidity levels during wheat flowering. For producers that no-tilled into cornstalks, the scab was often severe (see photo above of infected field in Kentucky as an example), taking yields from 75-100 bu/ac down to 30-60/ac. To compound the problem, no fungicides are labeled for FHB reduction in small grains in the state of Kentucky to help control the problem, not even a Section 18.”

FHB significantly drops germination percentage of the seed, he adds; most fields with high FHB have subsequently resulted in only a 20-40% germination rate. ■

DON in Barley • from page 4

Little as 16% of the barley crop was DON free (<0.5 ppm) in some of these years.

The 2003 crop represents a slight improvement over 2002 when the regional barley crop averaged 0.7 mg/kg DON, with 69% of the crop below 0.5 ppm. However, in 2002 approximately 30% of the regional crop exhibited pre-harvest sprouting, and overall grain quality was poor. In 2003 the low DON occurrence, coupled with excellent crop quality, has been a boon to regional growers and the malting, brewing and feed industries.

The highest single occurrence of DON in 2003 was 5.6 ppm, which compares to maximum levels in excess of 20 ppm in previous years.

Little to no DON was observed in barley samples collected from the 3 western districts of North Dakota, south central North Dakota and northeastern South Dakota. DON was found, albeit at low levels, in eastern North Dakota, central to north central North Dakota, and the two western districts of Minnesota. These are the regions where occurrence of FHB has historically been the highest. Overall, the greatest incidence of DON was seen in east central North Dakota and western Minnesota, where 50-80% of samples collected tested at >0.5 ppm. ■

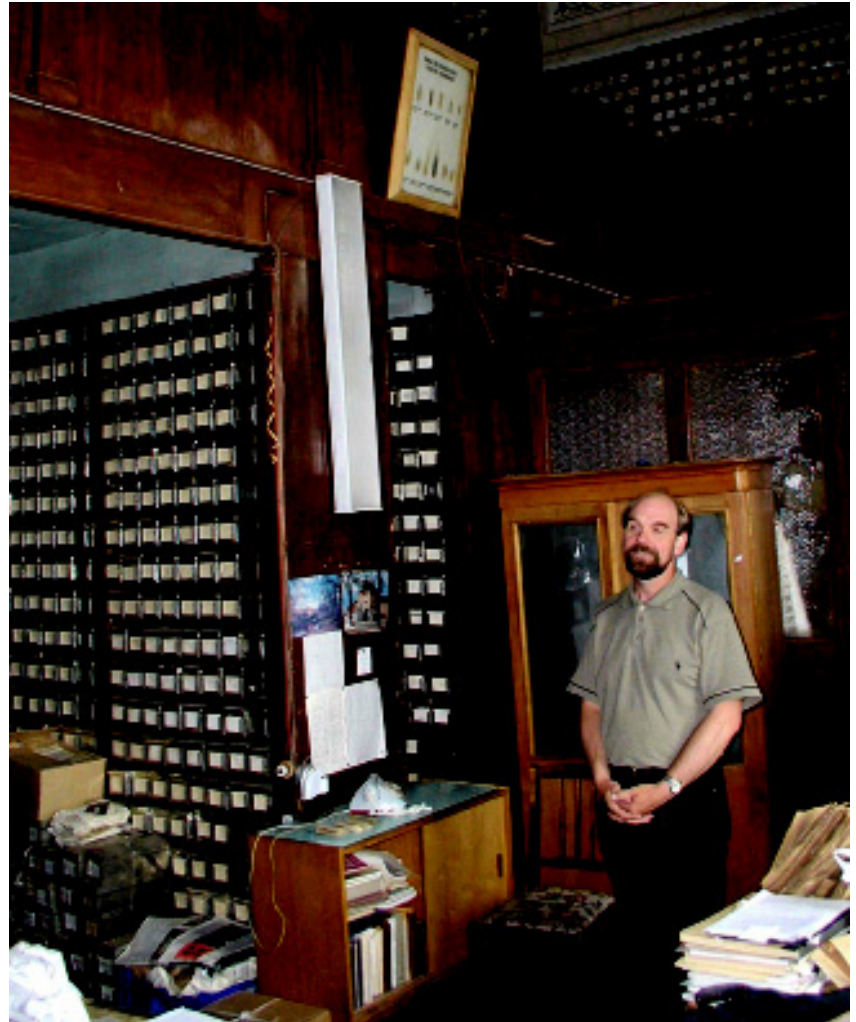
—*Stephen Neate, plant pathologist; and Paul Schwarz, plant scientist, North Dakota State University*

U of M Scientist Initiates Research Collaboration with Russia's Vavilov Institute

As part of an ongoing investigation to identify resistance to FHB in barley, University of Minnesota cereal pathologist Brian Steffenson has initiated a cooperative research project with the N. I. Vavilov All-Russian Scientific Research Institute of Plant Industry (in Russian, the Vsesoyuzny Institut Rastenievodstva or VIR), which houses one of the largest gene banks of economic plants in the world.

VIR is named after geneticist N.I. Vavilov, who formulated important theories on plant genetic resources and traveled the world collecting samples of economically important crops and their wild ancestors.

Steffenson says the institute has endured many hardships, including "Lysenkoism" (named after T. D. Lysenko, who discredited Vavilov's ideas by promoting his own pseudoscience during the Stalin era), the 900-day siege of Leningrad by the Germans during World War II, in which seven staff members died of starvation protecting the valuable germplasm; and more recently the shortage of adequate cold rooms to



Igor Loskotov, curator of rye, barley and oat, in the room that houses the barley collection at the Vavilov Institute in St. Petersburg, Russia. U of M cereal pathologist Brian Steffenson is collaborating with Loskotov to test 500 accessions of cultivated and wild barley from the institute for resistance to FHB.

Canadian FHB Workshop Dec 9-12

The 3rd Canadian Workshop on Fusarium Head Blight will take place in Winnipeg from Dec. 9-12, immediately prior to the USWBSI meeting. Information on the Canadian meeting can be found on the Internet:

www.graincanada.gc.ca/cdngrain/fusarium/workshop03-e.htm

preserve germplasm.

Steffenson visited St. Petersburg in July 2002 and September 2003 to establish the collaboration with VIR scientists. Steffenson's joint project is with Igor Loskotov, the institute's rye, barley, and oat curator. The institute's barley collection contains over 20,000 accessions, comprising 24 different *Hordeum* species.

As part of a USWBSI research project, Steffenson will test 500 accessions of cultivated and wild

barley from VIR for resistance to FHB in 2004. "The barley collection at VIR is very diverse, and contains accessions from regions not represented in the USDA National Small Grains Collection," says Steffenson. "FHB is a serious disease problem on barley and wheat in Russia, especially in the Far East and the Krasnodar region. The identification of resistant barleys from these evaluations will help breeding efforts in both countries." ■

2003 Cereal Rust Summary

The USDA-ARS Cereal Disease Lab in St. Paul issued the following summary of cereal rust in the U.S. in 2003:

- Stem rust was found throughout the northern Great Plains on wheat, barley and oat, but developed too late to cause any yield loss.
- Wheat leaf rust was widespread and severe in some areas of the U.S.
- Wheat stripe rust developed early and was more severe than usual throughout the U.S.
- Oat stem and crown rust severities were light this year.
- Stem rust infection on barberry in Minnesota was the most severe in the last 40 years.

A complete report can be found online at www.cdl.umn.edu. ■

Yue Jin Joins CDL Staff

Earlier this year, Yue Jin joined the CDL staff as research plant pathologist. At the CDL, his research will focus on the biology of cereal rusts, and host resistance to cereal rusts in wheat and barley. Jin, previously a plant pathology researcher at South Dakota State University, has been active in USWBSI research efforts. Jin may be contacted by phone at (612) 625-5291 and by email yuejin@umn.edu. ■

Fungicide Continues to Perform Well

In NDSU fungicide field trials this year, under mist and artificial inoculation, there was a 72% reduction in FHB with Folicur (applied at the labeled rate of 4 fl oz/ac), though FHB levels were low compared to previous years, with only a 10.2% field severity, according to NDSU extension plant pathologist Marcia McMullen. In the absence of severe FHB, Folicur did a good job on leaf diseases, which were severe in test plots and in many commercial fields, she notes.

Blaine Schatz at the NDSU Carrington Research Extension

Center, saw a 13.5 bu/acre increase over the untreated check with a Folicur treatment on spring wheat and a 10.8 bu/acre increase with Folicur treatment on durum. Commercial spring wheat producers in the Valley City area documented 13.6 bu/acre yield increase with Folicur treatment, (their treated fields averaged 88.5 bu/acre) although their untreated check still yielded a whopping 74.9 bu/ac. Thus, in eastern N.D., many growers had excellent yields this year, but some did even better with a fungicide treatment. ■

New U Missouri Release “Truman” Shows Good FHB Tolerance

The University of Missouri Agricultural Experiment Station recently announced the release of “Truman” soft red winter wheat (experimental breeding line MO 980525). Truman was derived from the cross MO 11769/Madison which was made in 1990. Truman is being released for its excellent yield potential, test weight and broad-based resistance to Fusarium head blight (scab). The line is named for Harry S. Truman, a farmer from Lamar, Missouri who went on to become the 33rd President of the United States.

Across 14 location-years of testing in the Missouri Winter Wheat Performance Tests (2002-2003), Truman was the top yielding variety in the test, averaging 70.4 bu/acre.

In two years of testing in the U.S. Northern Winter Wheat Fusarium Head Blight Nursery, Truman was among the most resistant winter wheats tested. It was superior to both the early and late resistant checks, Ernie and Freedom, respectively. Under inoculation, Truman had excellent type I and type II resistance as well as good kernel

quality and low deoxynivalenol (DON) in the harvested grain. Of 49 lines evaluated in 2001, Truman was one of only 2 lines with low ratings in all 7 categories of resistance measured.

Truman is resistant to stripe rust but is considered susceptible to both leaf and stem rust in the Missouri field environment. It is considered to have above average resistance to Septoria leaf blotch. Based on evaluations conducted at the USDA-ARS Soft Wheat Quality Laboratory in Wooster, OH, both milling and baking quality of Truman are similar to Ernie.

The variety has broad adaptation across Northern Corn Belt states including Illinois, Indiana, Ohio, Michigan and Wisconsin. It is also adapted in western Ontario, Canada. Development of this line was partially supported by funds from the U.S. Wheat and Barley Scab Initiative. A more complete background on the description and performance of Truman can be found on the USWBSI web site, www.scabusa.org. ■



U.S. Wheat and Barley Scab Initiative Fusarium Focus

This newsletter is made possible by the U.S. Wheat and Barley Scab Initiative. For more information about the Initiative, or to submit news items for consideration in this quarterly publication, contact Sue Canty, U.S. Wheat & Barley Scab Initiative, Networking & Facilitation Office, 380 Plant & Soil Sciences Building, East Lansing, MI 48824-1325 Phone: (517) 355-2236 FAX: (517) 353-3955 E-mail: scabusa@msu.edu.

This newsletter contains an update on only a sampling of research funded by the USDA-ARS and facilitated by the U.S. Wheat and Barley Scab Initiative. For more information on scab research in the U.S., and projects funded by the USWBSI, see the Initiative's website, www.scabusa.org.

Fusarium Focus is compiled by Prairie Ag Communications, 2607 Wheat Drive, Red Lake Falls, MN 56750.



U.S. Wheat & Barley Scab Initiative

Networking & Facilitation Office
380 Plant & Soil Sciences Building
East Lansing, MI 48824-1325