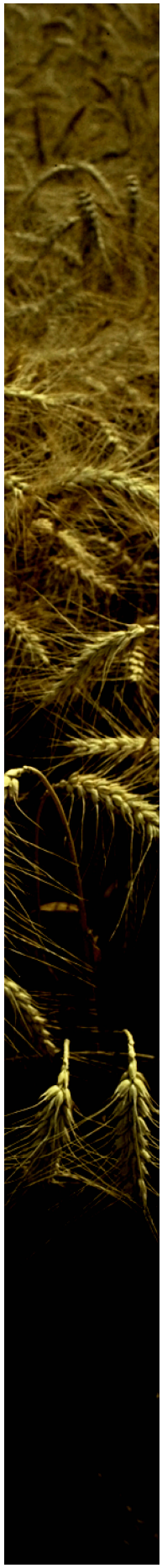


U. S. Wheat & Barley Scab Initiative

Scab News

Volume 3 • Issue 1 Spring 2001

U.S. Wheat and Barley Scab Initiative Special Report:

An Overview of FHB Research Advancements—Thus Far

The U.S. Wheat and Barley Scab Initiative has only been underway for about three years. The multi-disciplinary and multi-institutional effort to research Fusarium head blight across the nation was first proposed in 1997, and got underway with limited federal funding in FY1998. Most facets of the Initiative's coordinated research plan have been in place only since FY1999.

Still, progress has been made. That is evident by FHB research advancements made in the last few years, summarized recently by chairs of the six program areas of the Initiative: Variety Development and Uniform Nurseries; Epidemiology and Disease Management; Food Safety, Toxicology, and Utilization; Biotechnology; Chemical and Biological Control; and Germplasm Introduction and Evaluation.

This spring, Rick Ward, a wheat breeder at Michigan State University and co-chair of the Initiative, presented an overview of these FHB research advancements at a meeting of the North American Millers Association, and in a separate meeting, the Warren E. Kronstad Symposium sponsored by the International Maize and Wheat Improvement Center (CIMMYT).

In this issue of *Scab News* are research summaries under the six program areas of the Initiative. Note that the summaries provide only a general overview of FHB research advancements, and that results from other completed and ongoing research projects supported by the Initiative are not included. More details on all research supported by the USWBSI can be found online, www.scabusa.org. ■

Crop Scientists Report Research Headway at FHB Forum

Over 175 crop scientists from around the world and leaders of the U.S. wheat and barley industry met in Cincinnati last December in a national forum to discuss advancements in the research of FHB, commonly called scab. The fungal disease has plagued wheat and barley production in many areas of the U.S. since the early 1990s, resulting in farm losses in at least 18 states valued conservatively at over $2 billion, according to university and industry estimates.

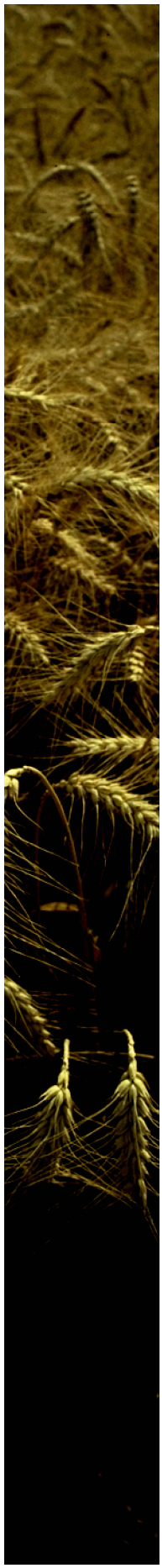
A concerted national research initiative to solve FHB in wheat and barley got underway three years ago. The $4.3 million national research initiative in the 2000 federal fiscal year involved 73 scientists working on 104 projects, carried out in 23 states at 22 land grant universities and the USDA's Agricultural Research Service, which funds the Initiative.

At the Cincinnati research forum, scientists reported advancements in

Continued on Page 2

2001 FHB Forum Dec. 8-10 in Cincinnati

The USWBSI Steering and Executive Committees have approved the location and tentative dates for the 2001 FHB Forum. Due to overwhelmingly positive feedback from participants, the Forum will again be held at the Holiday Inn--Cincinnati Airport. This year, however, plans are to shift the start of the Forum forward by one day, and start on Saturday at 1 p.m. instead of Sunday. This change was prompted by interest of many participants in benefiting from the Saturday stay-over price savings that many airlines offer. The tentative dates for the Forum are Saturday, Dec. 8 through Monday, Dec. 10, 2001. The Steering Committee will tentatively meet on the morning of that Saturday. More details will be announced as the 2001 Forum approaches. ■



FHB RESEARCH ADVANCEMENTS:

Variety Development and Uniform Nurseries

By Herb Ohm, Purdue University

❖ Many sources of resistance from around the world have been identified. Inheritance studies have been done for some sources and studies are in progress for others. We already know that there are several unique resistance genes represented in these resistance source lines. (Principal Investigators: Pat Lipps, Ohio State U; Anne McKendry, U of Missouri; Jim Anderson, U of Minn; Carl Griffey, Virginia Tech).

❖ DNA markers have been identified for several resistance genes and markers are in development for other resistance genes (Anderson, Guihua Bai, Oklahoma State U; Fred Kolb, U of Illinois).

❖ DNA markers are already being used in breeding programs to more efficiently select for resistant wheat lines (Anderson).

❖ Several breeding programs have already developed advanced wheat lines that have effective resistance. Resistance in these lines limits disease spread to 10 to 20% or less of infected spikes, compared to 80-100% of infected spikes of susceptible cultivars. A number of these lines will be released in a year or two.

❖ Most breeding programs have progressed significantly in developing efficient methods for testing and selection for Fusarium resistance in breeding nurseries. (Lipps, Anderson, Ohm, Kolb).

Kevin Smith, University of Minnesota barley breeder

❖ Effective networking among breeding programs and regional cooperative nurseries for Fusarium testing have been developed (Paul Murphy, North Carolina State U; Rich Horsley, North Dakota State U; Anderson; Elias Elias, NDSU).

❖ A two-rowed barley cultivar, Conlon, which has a moderate level of FHB resistance, has been recommended by the American Malting Barley Association as a malting barley (Jerome Franckowiak, NDSU).

❖ A hard red spring wheat cultivar, Alsen, was released by North Dakota State University. Alsen has FHB resistance derived from Sumai 3 (Richard Frohberg, NDSU).

❖ Breeding programs are being structured (winter nurseries, greenhouse generations) to evaluate lines and advance inbreeding on an accelerated basis to reduce time from last cross to cultivar release. (Includes breeders of most spring wheat and barley programs, as well as Ohm (winter wheat) and Kolb (doubled haploids). ■

FHB Forum • *from page 1*

six distinct program areas of the initiative: Variety Development and Uniform Nurseries; Epidemiology (how scab develops, spreads) and Disease Management; Food Safety, Toxicology, and Utilization; Biotechnology; Chemical and Biological Control; and Germplasm Introduction and Evaluation.

Tine Kuiper-Goodman, a leading scientist with Health Canada, was a guest speaker at the Cincinnati forum, briefing participants on efforts to harmonize international standards for assessing the health risk of deoxynivalenol (DON), a contaminant produced by the scab fungus.

Kuiper-Goodman

Kuiper-Goodman said that no human deaths have been attributed to DON, but other acute symptoms have been documented, including nausea, diarrhea, headache, dizziness, and fever. Between 1961 and 1985, China has documented 35 poisonings with 7,818 victims due to DON in corn (between 4 and 93 parts per million) and DON in wheat (1 and

Continued on Page 3

FHB RESEARCH ADVANCEMENTS:

Chemical and Biological Control

By Marcia McMullen, North Dakota State University

The Chemical and Biological Control Area is looking at the efficacy of fungicides and biological agents for the control of FHB. We are also examining application methods to improve the efficacy of products and increase coverage and retention on the grain heads. Some of our successes include:

❖ Establishing a core set of fungicide treatments across multiple states (15 in 2000, 13 in 2001) to identify which registered and experimental fungicide products are most efficacious against FHB over a number of environments.

❖ Providing a large database that is needed for registration of new fungicides that are more effective in controlling FHB and reducing DON. Example: Section 18 requests for Folicur fungicide have been granted based on efficacy data in these trials.

❖ Identifying spray techniques such as nozzle configurations, adjuvants, and timing of application that result in improved control with fungicides. Examples include forward/backward nozzle configurations, high pressure sprayers, use of silcone based and non-ionic surfactants, and timing of application at early flowering.

❖ Identification of some promising biological agents that may be used in an Integrated Pest Management approach to controlling FHB. These biologicals have been tested in the lab, greenhouse, and field, and several will be included in the core treatments of the Uniform fungicide and biological trials in 2001 in 13 states. Cornell University and the USDA at Peoria are heading the biological efforts, but SD and Nebraska also have some biologicals that will be tested in 2001.

The following cooperators were involved in fungicide uniform trials in 2000: Pat Hart, Michigan State U; Pat Lipps, Ohio State U; Roger Jones, U of Minn; Gene Milus, U of Arkansas; Greg Shaner, Purdue; Laura Sweets, U of Missouri; Marcia McMullen, NDSU; Marty Draper, SDSU; Arvydas Grybauskas, U of Maryland; Don Hershman, U of Kentucky; Erik Stromberg, Virginia Tech; Gary Bergstrom, Cornell; Gary Munkvold, Iowa State U; Steve Leath, North Carolina State U; Wayne Pederson, U of Illinois.

Cooperators in the areas of application technology: Pat Hart and Gary Van Ee, Michigan State U; Marcia McMullen, NDSU.

Cooperators involved in leading biocontrol research: Gary Bergstrom, Cornell; Dave Schisler, USDA, Peoria; Mike Boehm, Ohio State U; Bruce Bleakely, SDSU; Gary Yuen, U of Nebraska (for 2001). ■

FHB Forum • *from page 2*

40 ppm). In 1987, a sickness affecting close to 50,000 people occurred in India, with DON from moisture-damaged wheat implicated.

Ongoing discussions are being held on the establishment of international harmonization of standards governing DON tolerances in food for human consumption, she said. This will help assure food safety, and also help prevent DON from being used as an artificial trade barrier. Uniform standards may be established through Codex (Codex Alimentarius. The U.S. Codex office on the web: www.fsis.usda.gov/OA/codex/) Codex is a multi-national body that sets food standards, and helps develop recommendations relating to compliance with those standards.

Also keynoting the forum was Wilmar da Luz, of the Brazilian research agency Embrapa Trigo, who has spent over a decade researching ways to control scab biologically, or through natural microorganisms that attack and break down Fusarium. Brazil lost half of its wheat crop to scab in 1994.

Screening of microorganisms to control FHB was initiated in Brazil in the 1980s, and thousands of microorganisms including bacteria and yeasts have been tested. *Bacillus megaterium, Bacillus subtilis,* and *Paenibacillus macerans* are among microorganism species that have shown the best activity against FHB, diminishing disease incidence and severity by about 50% or more. Biocontrol methods appear to be less effective under epidemic FHB conditions, however.

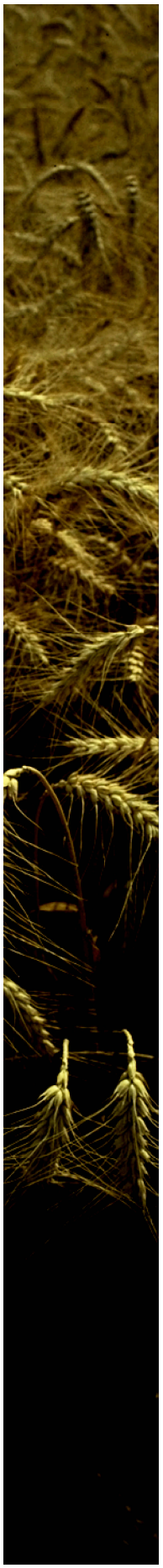
Wilmar da Luz

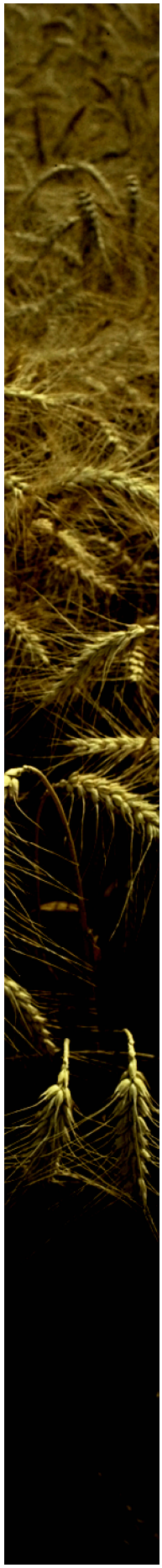
Label registration should be easier to achieve for biocontrol products than chemical fungicides, but there are still constraints to commercialization of biocontrol products in need of further development, including storage and product shelf life.

Much of the research on biocontrol still focuses on evaluating efficacy, so toxicology or environmental safety of biocontrol products also needs more study, said da Luz.

Biocontrol research is also being conducted in the U.S., with support by the USWBSI. One study being planned by Ohio State University and USDA-ARS Peoria will look at whether biocontrol products may be tank-mixed with fungicides.

A full report of research conducted under the USWBSI and discussed at the Forum in Cincinnati are available in the 2000 National FHB Forum Proceedings on the Internet at: www.scabusa.org. ■





FHB RESEARCH ADVANCEMENTS:

Epidemiology and Disease Management

By Pat Lipps, Ohio State University

❖ Using a strain of *Fusarium graminearum* containing a gene for green flourescent protein (GFP) which can be seen by epifluorescence microscopy, W.R. Bushnell's group (USDA/ARS, St. Paul) has investigated colonization of the wheat host. In separate experiments they have followed the development of the fungus for four days as it progressed from intercellular and intracellular hyphae. They are investigating the pathways of infection.

❖ Using historic epidemic information from Ohio, North Dakota, Missouri and Kansas, a FHB Risk Assessment was developed based on temperature, precipitation and relative humidity data from seven days prior to flowering and 10 days after flowering. The risk model proved to have a prediction accuracy of 84%. (Principal Investigators: Erick De Wolf, Larry Madden and Pat Lipps, Ohio State U)

❖ Len Francl of NDSU has implemented a wheat disease forecasting system in the North Central Region for three leaf diseases and head scab. Forecasts for head blight were based on airborne spore samples as well as temperature and wetness data. Information was delivered to growers via the Internet and a toll-free number. The system correctly predicted epidemics in 1999 and 2000.

❖ Bob Bowden's group (Kansas State U) has constructed a genetic linkage map for *Gibberrella zeae* by crossing nitrate nonutilizing mutant strains from Japan and the U.S. The total map length of the genome was 1036 centimorgans with an average interval of 3.2 map units between loci. This linkage map will be useful in population genetic studies, map-based cloning, quantitative trait loci (QTL) analysis and comparisons with related species.

❖ Gary Bergstrom and his students at Cornell are characterizing temporal patterns of ascospore discharge by *G. zeae*. from mature perithecia on corn stalk tissues under natural conditions. The number of ascospores released from corn stalks bearing perithecia ranged from 0 to 3862 per hour. During the evaluation period there were six major ascospore release events characterized by counts of more than 1000 spores per hour. It appears that a decrease in relative humidity following periods of high relative humidity are associated with discharge of ascospores.

❖ Ruth Dill-Macky, U of Minn and Robert Todd, NDSU, are determining the relationship between crop residue decomposition and survival of *F. graminearum*. Buried residues decomposed substantially faster than residue left on the soil surface which translates into less inoculum potential in tilled fields.

❖ In research headed by H. Corby Kistler, USDA/ARS, St. Paul, isolates of *F. graminearum* representing eight genetic lineages were tested for their ability to cause disease and accumulate mycotoxins in inoculated wheat heads. Research demonstrated variability among the isolates within and across groups indicating the high degree of variability within this "species complex."

❖ A multi-state cooperative effort is ongoing to monitor weather

Continued on Page 7

Federal Lawmakers Boost FY2001 FHB Research

Federal lawmakers increased funding for FHB research by $800,000 in FY2001, bringing the total earmarked for federal scab research grants in FY01 to about $5 million. The FY01 total did not include baseline budget additions for scab research conducted at USDA-ARS labs in Fargo, ND; Peoria, IL; Albany, CA; St. Paul, MN; and Beltsville, MD. Funding for scab research at these five federal research locations was included in the Initiative, but allocated separately from competitive grants issued under the Initiative.

The FY2002 budget, as it is proposed at this writing (late April), does not include the $800,000 funding increase put in place for FY01. Lawmakers are currently debating the federal budget for the next fiscal year, which begins October 1.

Congress first appropriated $500,000 to boost national scab research efforts in FY1998. This funding allowed initial phases of the U.S. Wheat and Barley Scab Initiative to begin. An additional $3 million appropriated in FY1999 enabled more facets of the Initiative's scab research plan to be activated. In FY2000, funding for the Initiative was boosted by the U.S. Congress to about $4.3 million. The research grant period for the Initiative supported by FY00 funding extends from May, 2000 to April, 2001. Research supported by the USWBSI in FY2000 involved 104 projects carried out in 23 states by over 70 scientists from 22 land grant universities and the USDA-ARS.■

FHB RESEARCH ADVANCEMENTS:

Germplasm Introduction and Enhancement

By Anne McKendry, University of Missouri

The objectives of the National Scab Initiative Germplasm Introduction and Evaluation area:

❖ Conduct an aggressive, worldwide search for resistance through systematic screening of national germplasm collections.

❖ Global acquisition of known scab resistance genes, and global exchange of genes through International Scab Nurseries.

❖ Dissemination of information on resistance through world wide web databases.

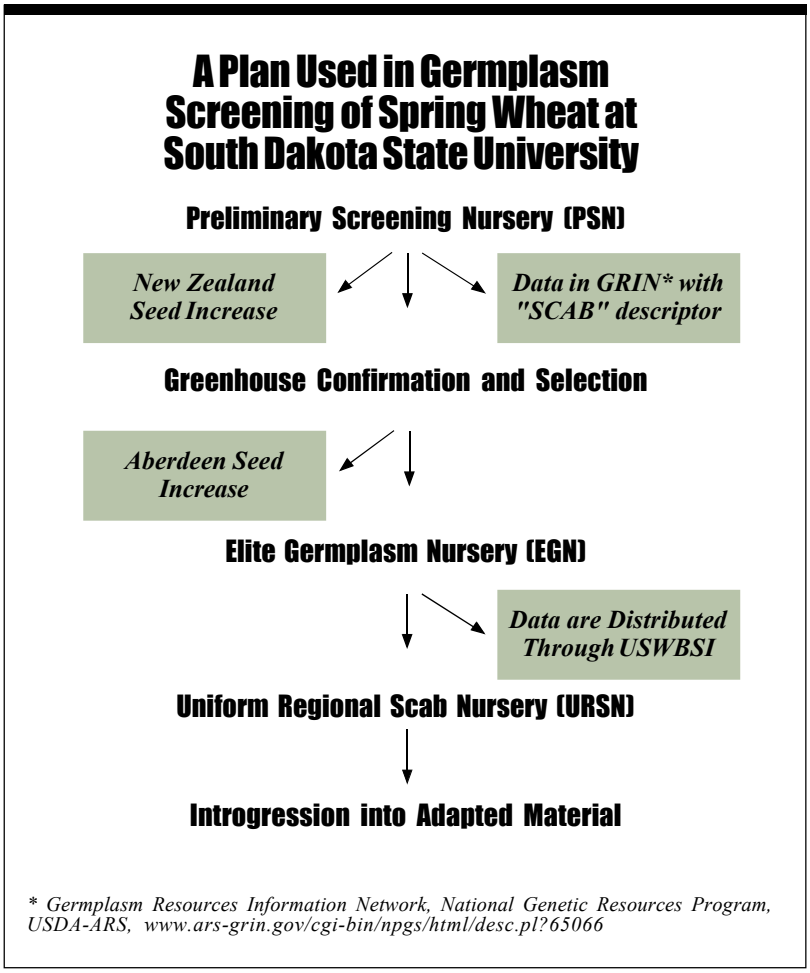
Four programs within the Initiative dedicated to screening targeted accessions for resistance are: Winter wheat – U of Missouri (McKendry); Spring wheat – SDSU (Jin); Durum wheat – NDSU (Elias); and Barley – U of Minn (Steffenson). Screening concentrates on accessions from geographical areas where environmental conditions are conducive to scab development, including China, Japan, Korea, Italy, Brazil, Argentina, Uruguay, and Eastern Europe.

FHB resistance has been identified, but the genetic base of resistance is narrow. One source, Sumai 3 or its derivative, Ning 7840, provides much of the scab resistance in U.S. breeding lines. Frontana (Brazil) and Nobeoka Bozu (Japan) also are widely used in U.S. programs. Winter wheat germplasm from Asia, Brazil, Italy with low scab reactions are also being tested, and winter wheat landraces from Yugoslavia with excellent scab reactions was verified at the University of Missouri last fall.

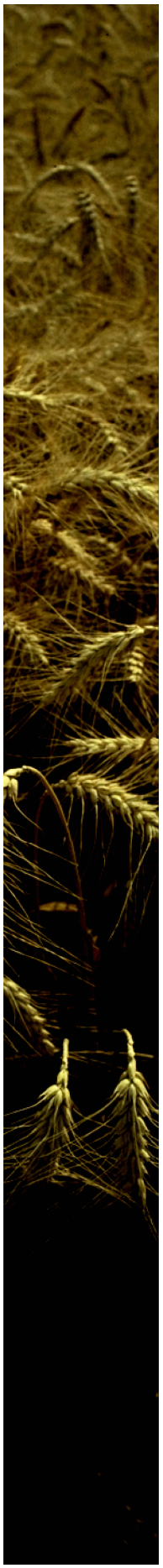
Perhaps the most significant development within the germplasm area in the past year is the collaboration that the USWBSI has established with the International Maize and Wheat Improvement Center (CIMMYT). A major crop research center headquartered in Mexico, CIMMYT is the originator of high-yielding wheats that helped stave off widespread starvation for millions of people in the mid-1960s. The resulting Green Revolution earned the 1970 Nobel Peace Prize for Dr. Norman Borlaug, an early leader in CIMMYT's wheat research.

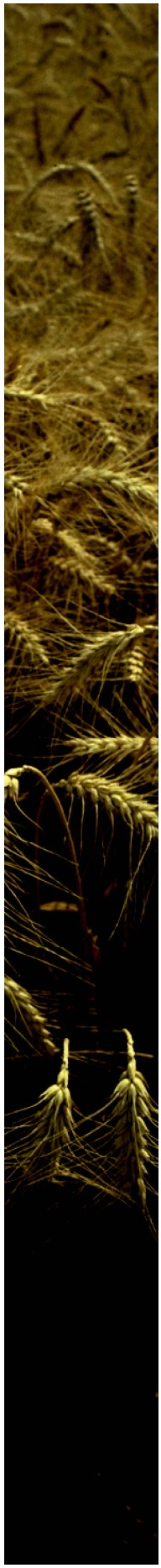
This partnership will facilitate access to CIMMYT germplasm containing genetically different, functional genes for scab resistance, and expedite the identification and acquisition of known genes for different types of resistance worldwide.

The first introduction of FHB-tolerant germplasm from CIMMYT in U.S. wheat and barley breeding programs occurred in November, 2000. The germplasm included 27 CIMMYT bread wheats, 21 synthetic derivatives from CIMMYT, 15 introductions from China, 8 advanced breeding lines from Nanjing Agricultural University in China and 7 lines from Romania. After arriving in the U.S., the various genotypes were quarantined in the greenhouse at several wheat and barley breeding programs and now are being increased in the respective programs. ■



This diagram outlines the process of germplasm screening of spring wheat at South Dakota State University.





NDSU Study: FHB Had $545 Million Direct and Secondary Economic Impact In ND, MN 1998-2000

By Tracy Sayler

Fusarium head blight in hard red spring wheat and durum in North Dakota and Minnesota and barley in North Dakota had a $545 million direct and secondary economic impact from 1998 to 2000 according to preliminary findings of a study at North Dakota State University.The purpose of the study, being conducted by NDSU ag economist William Nganje and supported by the USWBSI, is to quantify more precisely the losses that have occurred in the U.S. due to FHB infections in grain.

Nganje's preliminary report is based on the two major states (North Dakota and Minnesota) which have incurred the greatest scab impacts in the U.S., and builds upon an earlier economic impact study conducted by Demcey Johnson at NDSU in 1998, that estimated losses caused by FHB in the Northern Plains and the East Central U.S. from 1993 to 1997.

The new study by Nganje estimates losses based on grain yields and price ($/bushel) that might have been expected under normal conditions, in the absence of FHB. Precipitation and temperature data are used to estimate 'normal' production. The loss production is then calculated as the difference between actual and normal production. This quantity was then adjusted for acreage abandoned as a result of scab.

The impact of production shortfall on market prices and quality discounts were factored in estimating the impact of FHB on the net price received by producers. Flexibility coefficients or elasticities were estimated for each wheat class and barley using total U.S. wheat and barley supply and the loan rate. The flexibility coefficients were adjusted for imports from Canada and used to estimate supply in the absence of scab. The impact on market prices and quality discounts were then estimated.

Production loss due to FHB decreased substantially for wheat in ND and MN in the last three years, most likely because of better management practices (better crop rotations, less susceptible varieties, increased use and better application of fungicides) as well as less precipitation during the critical grain flowering period. However, barley producers continue to suffer significant losses. Quality shortfall due to FHB accounted for more than 50% of total crop loss in barley in 1998 and about 49.2% in 2000. Preliminary findings in Nganje's study:

❖ Total direct and secondary economic losses from FHB in North Dakota and Minnesota (estimates of losses for barley in Minnesota were not considered due to data limitations) were estimated at $545 million from 1998-2000.

❖ FHB resulted in an estimated $177.2 million loss in producer net revenue from 1998 through 2000. Direct economic impacts (reductions in producer net revenues) from FHB totaled about $58.3 million on hard red spring wheat, and durum about

Continued on Page 8

FHB Research Advancements:

Food Safety, Toxicology, and Utilization

By Patrick Hart, Michigan State University

Approximately 50% of white wheat grown in Michigan in the year 2000 for use in human food products was rejected due to unacceptable levels of DON in the grain at harvest. An economic analysis to determine the cost of importing wheat from other areas was not completed, but based on a 1996 study the costs were potentially substantial.

Also, levels of DON were higher in harvested grain than an assessment of incidence and severity of FHB in up to 80 fields of wheat would have suggested. Even in fields with an average of 8 ppm DON, the harvested grain appeared normal compared to non-scab years. Therefore, an in-field sampling plan suggested that DON levels were randomly distributed, and not associated with a pattern. Validation of these preliminary results could lead to the development of relatively simple in field sampling to estimate average DON levels in fields prior to harvest.

Separately, diagnostic laboratories were established to assist researchers in evaluating grain for DON. DON analyses of grain from fungicide treatments included in the uniform fungicide trials determined that one fungicide, Quadris, consistently increased the levels of DON over the untreated controls, certainly an unwanted response from fungicide use. The reason for this DON increase has not been determined.

Among the four laboratories in Michigan, North Dakota, and Minnesota providing DON diagnosis in 2000-01, about 23,000 samples were processed for about 42 principal investigators in 16 states.■

FHB JOTTINGS

NDSU's Casper Dies

Howard Casper, professor in the Department of Veterinary and Microbiological Sciences, North Dakota State University, died January 13, 2001. Casper was an active participant in the Scab Initiative, involved in diagnostic sampling of DON. NDSU is expected to name a toxicologist to replace Casper later this year.

Scab Forecasting Data Management Meeting Held in Ohio

A meeting to discuss and evaluate the progress toward the development of a scab forecasting model was held at the Ohio Agricultural Research and Development Center, Wooster, OH on March 16, 2001. Meeting participants represented the core of individuals participating in cooperative studies to monitor weather conditions and pathogen population levels from different wheat growing regions of the U.S. A summary of the meeting can be found online the USWBSI web site, www.scabusa.org.

Initiative Steering Committee to Meet May 31

The USWBSI steering committee will meet in Indianapolis on May 31. The meeting is open to the public; contact Sue Canty at the Initiative Office for more details, Ph. (517) 355-2236, E-mail: scabusa@msu.edu.

Reference on grain fungal diseases, mycotoxins online

The USDA's Grain Inspection, Packers and Stockyards Administration (GIPSA) has an excellent reference on grain fungal diseases and mycotoxins on its website, www.usda.gov/gipsa/newsinfo/pubs/pubs.htm. See the Mycotoxin Reference Book, which may be found under the list of Federal Grain Inspection Service Publications. ■

FHB RESEARCH ADVANCEMENTS:

Advancements in Biotechnology

By Lynn Dahleen, USDA-ARS, Fargo, ND

Jim Anderson, University of Minnesota wheat breeder.

Biotechnology advancements include:

❖ SSR markers for Sumai 3 QTL on chromosome 3BS adapted for high throughput screening of lines for FHB resistance (Jim Anderson, U of Minn)

❖ QTL from Chevron validated and linked markers being developed for high throughput screening of barley (Kevin Smith and Gary Muehlbauer, U of Minn)

❖ Greenhouse tests of wheat transformants show some resistance from several different genes (Ann Blechl, USDA-ARS, Albany, CA; Steve Baenziger, U of Nebraska)

❖ Two different antifungal protein genes have been inserted into barley, and these plants are being screened against the scab fungus. (Muehlbauer)

❖ Promoter that targets transgene expression in spike tissues, to inhibit growth of FHB in barley (Ron Skadsen, USDA-ARS, Madison, WI).

❖ Tracking the route of FHB infection using a transformed strain of the fungus containing an expressed gene for green fluorescent protein (GFP), has resulted in new methods and experience needed to learn how the fungus enters and damages heads of wheat and barley. (Skadsen; Bill Bushnell, USDA-ARS, St. Paul)

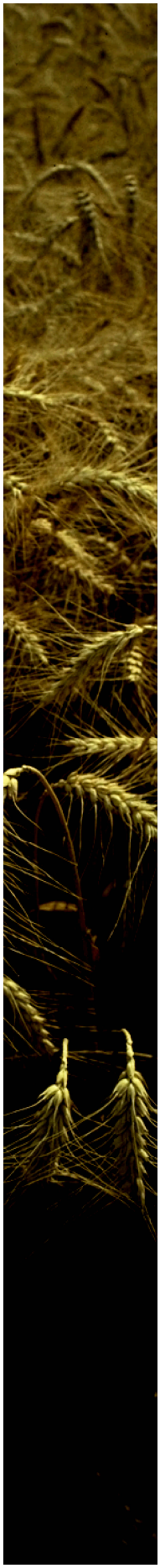
❖ Two rapid, plant cell-based tests for antifungal proteins (APFs) have been developed, thus helping to pretest candidate genes for transformation (Richard Zeyen, U of Minn)

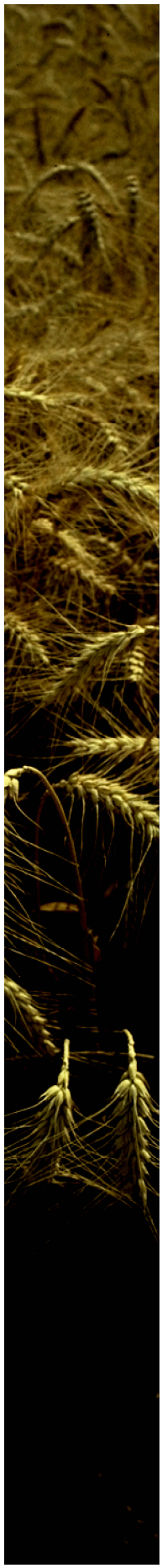
❖ The commercial barley cultivar Conlon has been transformed with the Tri 101 and PDR5 genes with the aim of eliminating/reducing DON (deoxynivalenol) in infected barley. Transgenic plants have been regenerated and research is in progress to determine the expression of the introduced genes. (Dahleen) ■

Epidemiology • *from page 4*

conditions and fungal inoculum over time in order to develop and validate a scab forecasting system. This group is combining data from across the wheat growing regions to help develop a more robust forecasting system that will not be site specific. (Research group includes Len Francl, NDSU; Yue Jin, SDSU; Greg Shaner, Purdue; Pat Lipps, OSU; Erick De Wolf, OSU)

❖ Yue Jin, SDSU, is assessing the importance of ascospore survival, viability and infectivity under differing environmental conditions on plant surfaces. It is likely that ascospores accumulate on wheat tissues during multiple spore release events. This information will contribute to scientists' understanding about inoculum levels and inoculum potentials. ■





Economic Impact • *from page 6*

$16.8 million in North Dakota and Minnesota from 1998-2000. FHB reduced producer net revenue for malting barley in North Dakota by $102.1 million from 1998 to 2000.

❖ For each dollar of lost producer net revenues, about an additional $2.10 is lost in secondary economic activity. The economic sectors most heavily affected by FHB include Households (economy-wide personal income, $230 million), Retail Trade ($110.3 million); Finance, Insurance, and Real Estate ($24.9 million); and Personal, Business, and Professional Services ($23.5 million).

❖ The decline in economic activity also affected employment in the region. In the absence of FHB, North Dakota and Minnesota would have gained an estimated 1,795 full-time equivalent jobs over the 1998 to 2000 period.

❖ Tax revenue was also affected. Total reductions in sales and use, individual income, and corporate income tax collections in North Dakota and Minnesota were estimated at $12.3 million from 1998 through 2000.

Even though FHB caused less financial loss in 1998-2000 compared to 1993-1997 in ND and MN, the losses are still significant, Nganje points out. As a comparison, the reductions in producer net revenues nearly equal the value of all hay production in ND since 1998. Alternatively, losses to FHB in ND alone match the total value of sales in the swine and poultry industries in the state since 1998.

Considering the geographic dispersion of scab, the uncertainty in the magnitude of its occurrence and impact on grain quality, as well as the financial pressures that the disease adds to an already depressed farm economy, the economic consequences of FHB still remain substantial and should not be overlooked, says Nganje.

Nganje has expanded the study to other states impacted by FHB, with some loss estimates that may vary slightly from the preliminary findings, using updated 2000 data. The expanded analysis will be included in the next USWBSI newsletter. ■

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 projects funded by the USWBSI. For more information on scab research in the U.S., and projects funded by the USWBSI, see the Initiative's website, www.scabusa.org.

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

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