U. S. Wheat & Barley Scab Initiative

Scab News

Volume 2 • Issue 2 Fall 1999

1999 National Scab Forum Dec 5-7 in SD

The 1999 National Fusarium Head Blight (Scab) Forum will take place Dec. 5-7 at the Best Western Ramkota Inn in Sioux Falls, S.D.

Tom Anderson, co-chair of the U.S. Wheat and Barley Scab Initiative, says the annual Forum provides a chance for scientists and members of the small grains industry to network with one another and review the latest scab research findings.

Along with a comprehensive overview and update of scab research, the Initiative's research leaders will organize presentations for each of the Initiative's six research areas: Variety Development and Coordinated Screening Nurseries; Epidemiology (How Scab Develops, Spreads) and Disease Management; Food Safety, Toxicology, and Utilization; Biotechnology; Germplasm Introduction and Evaluation; and Chemical and Biological Control. The Forum will also plan research agendas for Fiscal Year 2000.

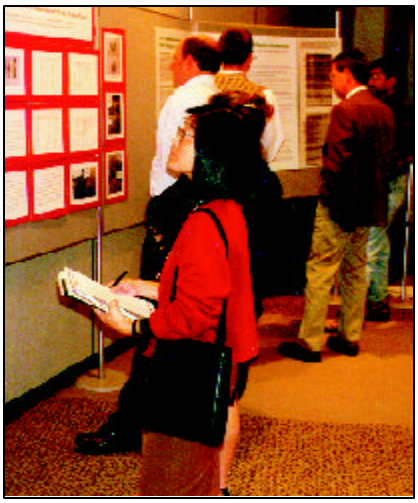
A printed booklet of the Forum proceedings will be prepared beforehand for participants to reference during the sessions. The proceedings are not meant to act as a formal scientific reference, but rather as a means for increasing communication both during and after the Forum. A summary of Initiative recommended and USDA Agricultural Research Service-funded activities from the FY99 budget will be available at the forum. It will include FY99 progress reports submitted by principal investigators of Initiative research projects.

1999 Fusarium Head Blight Forum

December 5-7, 1999

Best Western Ramkota Inn

Sioux Falls South Dakota



The National FHB Forum provides a chance for scientists and members of the small grains industry to network with one another and review the latest scab research findings. (file photo).

A preliminary agenda of the Forum and registration information can be viewed and printed online at www.scabusa.org under Forum '99. More information can also be obtained by contacting the U.S. Wheat and Barley Scab Initiative Networking and Facilitation Office by phone at (517) 355-2236 or by email at scabusa@pilot.msu.edu.

Hotel reservations

A block of rooms has been reserved at the Best Western Ramkota Inn for Forum participants for Saturday, Sunday, and Monday nights. Reserve rooms at the special rates of $59 (plus tax) for a single and $65 (plus tax) for a double. It will be necessary to call the Ramkota Inn directly at (605) 336-0650 and tell them that you are with the National Fusarium Head Blight Forum. Make reservations by Nov. 13, after which rooms held for forum participants will be released at a higher rate.

Getting there by air

Sioux Falls Airport, also known as the Joe Fossfield Airport (FSD), is located 2-3 miles from the Best Western Ramkota Inn. The Inn provides shuttle service, so once your flight arrives call their front desk at (605) 336-0650 and ask for a shuttle to take you to the Inn.

If you're driving

The Best Western Ramkota Inn is located on Russell Street, exit 81 off I-29 and two miles south of I-90.

Registration

The Forum registration fee (including meals and a copy of the proceedings) is $90 for those who register before Nov.8, and $120 after Nov. 8. A tentative agenda, registration form, and poster & manuscript submission form can be found online at www.scabusa.org under Forum '99. More information can also be obtained by contacting Jennifer Wagester at the U.S. Wheat and Barley Scab Initiative Networking and Facilitation Office at (517) 355-2236 or by email at scabusa@pilot.msu.edu.

Dates to remember

Nov. 8 – Last day to register for Forum at lowest rate.

Nov. 8 – Deadline for researchers to submit poster information and written reports for Forum Proceedings.

Nov. 13 – Last day to reserve hotel rooms for the special rate.

N&FO Aims to Facilitate Efficient, Targeted FHB Research

The U.S. Wheat and Barley Scab Initiative's Networking and Facilitation Office (N&FO), headquartered at Michigan State University, was established in the summer of 1999 with a commitment to five primary activities: 1) Management of the annual scab forum; 2)Resources database maintenance; 3) Communication of Initiative research and scab experiences; 4) Providing a center for Initiative accountability; and 5) Providing a rapid response clearing house for scab questions.

Rick Ward, Initiative co-chair who oversees the workings of the N&FO, points out that the high expectations generated by the unique organizational concept of this Initiative must now be matched with equally high levels of accountability. That's the goal of the N&FO: a source for immediate knowledge of the Initiative's activities and integration of the entire wheat and barley scab research community into a single seamless network.

My name is Jennifer Wagester: Rick Ward and the Initiative brought me aboard last June to help facilitate the work of the Initiative. Administrative burdens and communication challenges can be expected from coordinating research activities of over 65 scientists who are located in over 22 states. However, the N&FO is well on its way in helping the USWBSI attain its goal of minimizing the threat of scab to the producers, processors, and consumers of wheat and barley.

This certainly has been a "hit-the-ground-running" experience from the start: coordinating conference calls, providing informational material to Initiative researchers and the general public; planning meetings, and providing administrative support to researchers involved with the Initiative. Basically, I do whatever I can to help those who are involved or interested in the Initiative's activities. At times, this can be challenging because I am still "learning," but everyone has been patient and very kind. I have really appreciated the warm welcome that many people have given to me.

This past summer I have been fortunate to meet with senior Agricultural Research Service officials at USDA, including Dr. Judy St. John and Dr. Roy Gingery, and Undersecretary of Agriculture, Dr. I. Miley Gonzalez. During our meetings we were told that the Initiative serves as a model of how ARS can work together with land grant universities and private industry to accomplish great things. Such a compliment could not have been earned without the efforts of our members, our supporters, and ARS employees. It's exciting for me to be involved with this "prototype" of coordinated research action.

I have met many very wonderful people these past few months, personally and through email and phone conversations. About once or twice a day I am able to meet someone new. This is the best part of my job. I enjoy it when people share their sense of humor, provide insight into an issue, or tell me how something can be improved. Input is probably the greatest thing that anyone can provide because it helps me do my job better.

For example, the 1999 National FHB Forum is around the corner (Dec. 5-7 in Sioux Falls, SD). I would love to know what people liked about last year's forum, whether or not they thought the proceedings were easy to use, if they want to do something different this year, and so on. Some may say that no news is good news, but I prefer input, good or bad, to help the N&FO improve and stay on the right track.

Please, do not hesitate to send me an email message. My new email address is scabusa@pilot.msu.edu and I will be happy to help with any questions, requests, or concerns that you may have. Also please subscribe to the FHB listserver if you haven't done so yet. Go to http://www.scabusa.org and click on "subscribe to the project's listserver." It's easy to do and a great way to keep updated on the Initiative's activities.

Jennifer Wagester
USWBSI Networking and Facilitation Office

U.S. Wheat & Barley Scab Initiative
Scab Research News

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 Jennifer A. Wagester, U.S. Wheat & Barley Scab Initiative, Networking & Facilitation Office, 372 Plant & Soil Sciences Building, East Lansing, MI 48824-1325, Phone: (517) 355-2236, Fax: (517) 353-3955, Website: http://www.scabusa.org. Note the USWBSI's new email address: scabusa@pilot.msu.edu.

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

GERMPLASM INTRODUCTION

Evaluating Sources of Resistance, Even Grasses

Known sources of resistance to scab in small grains are limited, and that's why some crop scientists involved with the Scab Initiative are focusing research attention on identifying potential resistance sources from across the world, including exotic wheat and barley lines, and even wild grasses. Germplasm is evaluated under high scab pressure in regional field nurseries (the Northern Plains, the Corn Belt, and the South).

Selections from the initial field evaluation are re-evaluated through two greenhouse screening cycles to confirm the level and type of resistance. Elite selections will be used as test entries for an elite germplasm nursery evaluated at multiple locations. Introgression of new resistance into adapted germplasm will then be achieved by backcrossing into an adapted cultivar.

In the 1999 crop season, a total of 1,200 spring wheat accessions (germplasm test material), mostly originated from South America, southeastern Europe and eastern Asia, were tested in the spring wheat field screening nursery, says Yue Jin, plant scientist at South Dakota State University. Ninety-four of these accessions were selected for further evaluation based on visual disease assessment and/or seed score.

Selected lines are being grown in the greenhouse for screening cycles this fall and winter and for crossing with adapted germplasm. Elite selections after greenhouse evaluations will be tested in the field next year. An elite germplasm nursery was established at Brookings, S.D. this year using elite selections from the 1998 season. Elite selections were also distributed to other spring wheat breeding programs. Twenty crosses were made to initiate the introgression of resistance using elite selections from the 1998 screening. Jin says progeny evaluation, selection, and backcrossing will be conducted in 2000.

Anne McKendry, University of Missouri winter wheat breeder, is verifying resistances of several lines of winter wheat that appear to have high levels of type II (spread in the head) scab resistance. Along with screening several thousand plants from across the world for scab resistance, McKendry is also screening an additional 1006 Yugoslavian lines in the hunt for resistance. In mid October McKendry traveled to China to discuss germplasm research and hopefully facilitate germplasm exchange with research programs there.

Five hundred winter wheat accessions, primarily from The Balkans, are being evaluated in field and greenhouse environments in the southeast, says Paul Murphy, North Carolina

Continued on page 4

FOOD SAFETY, TOXICOLOGY, AND UTILIZATION

Faster, More Efficient DON Sampling

Pat Hart, cereal scientist at Michigan State University, is researching a peptide or type of amino acid with properties that suggest it may competitively inhibit the toxic activity of deoxynivalenol (DON or vomitoxin, a toxic byproduct of scab). Expressed in plants, this type of amino acid could improve a plant's resistance to scab infection, since DON has been shown to be a virulence factor in wheat.

Another research project of Hart's is to develop sampling and testing protocols to provide reliable estimates of DON in grain at delivery points in the food processing chain. Data from Michigan is currently being analyzed statistically, and probe samples from the Midwest have been collected but not yet analyzed for DON.

MSU also provides diagnostic services to measure DON levels on a regional basis for researchers involved with scab research, regardless of their affiliation with the scab initiative.

During the past year, the Initiative has helped develop protocols to analyze large numbers of grain samples for DON testing. To date in 1999, over 1,400 samples submitted to the Michigan diagnostic laboratory by scab researchers in the winter wheat growing area of the U.S. have been tested.

DON analytical services are also provided at North Dakota State University to seven collaborating researchers at three barley varietal development programs. Approximately 4,500-8,000 samples are received and analyzed each year, according to Paul Schwarz, NDSU cereal scientist. Funds provided by the U.S. Wheat and Barley Scab Initiative have allowed the hiring of additional personnel to speed sample preparation and analysis, and to help reduce the cost of sampling for collaborating scientists. In addition, new quality control and reporting measures have been adopted, which should help to increase confidence in sample analysis, says Schwarz. ■

Fourteen States Participate in Uniform Fungicide Trial

Fourteen states (ND, SD, MN, MO, OH, MI, IN, IL, MD, KY, NY, NC, VA, AR) participated in a uniform fungicide trial that compared nine fungicide treatments to an untreated check, for reducing scab severity and DON (vomitoxin) levels, according to Marcia McMullen, NDSU extension plant pathologist.

Registered products were compared to new chemistries that may soon become registered. Disease severities varied across site, and some states gained little information about fungicide efficacy because of drought conditions that hampered evaluation. This fact helps illustrate the advantage of including a broad range of small grain varieties, environments, and study locations.

All data from the trials are not yet summarized, says McMullen, but some treatments consistently showed better improvement in reducing FHB and DON across environments. Research results from the 1999 growing season will be distributed during fall and winter meetings so that producers can make decisions about fungicide use prior to the year 2000 spray season.

Bioprotectants are being evaluated in the integrated management of FHB as well. In addition to standardized fungicide treatments, a promising bacterial bioprotectant, *Paenibacillus macerans*, and the biocompatable fungicide potassium bicarbonate (Armicarb) were evaluated at Cornell University.

About 120 possible biocontrol organisms, from 70 different sources including agricultural material, wild grasses and sedges, and air-borne samples, as well as 14 promising biocontrol organisms from Brazil, are being evaluated, according to Gary Bergstrom, plant pathologist at Cornell. Research emphasis has been given to biocontrol organisms that would help suppress scab reliably across a range of harsh field conditions.

Drought conditions hampered research in New York. Irrigation equipment would help produce reliable testing results in the future, says Bergstrom. ■

Sources of Resistance • *from page 3*

State University. This is the first year of testing.

Five southeastern breeding programs submitted lines to the first Uniform Southern Soft Red Winter Wheat Fusarium Head Blight Nursery planted in the Fall of 1999. Nine cooperators are participating in the nursery this season, says Murphy.

Elias Elias, NDSU durum breeder, says 500 durum accessions sent to the Academy of Agricultural Sciences, Plant Protection Institute (AASPPI) Shanghai, China have been successfully evaluated. Infection levels varied and a few lines demonstrated a moderate level of resistance to scab. He says 2,000 new durum accessions will be evaluated at AASPPI in the 1999-00 growing season.

A mist irrigated uniform scab screening nursery, called the MinnDak nursery, has been grown at two irrigated sites in Minnesota and two irrigated sites in North Dakota the past four growing seasons to evaluate elite barley germplasm. Rich Horsley, barley breeder at North Dakota State University, says about 28 entries were included in this year's MinnDak nursery. DON data is being collected this fall. ■

FHB Jottings

Canadian FHB Workshop Nov. 28-30

A Canadian Workshop on Fusarium Head Blight will be held in Winnipeg, Manitoba, Nov. 28-30. Sponsored by the Canadian Agri-Food Research Council, the workshop will feature 30 speakers from the research, extension, producer, commodity, exporter, and industry sectors. Summaries of oral and poster presentations, priority concerns and a list of participants will be compiled in a proceedings booklet. More information may be found online at: http://www.cgc.ca/Cdngrain/fusarium/workshop/workshop99.htm.

China to host International Wheat Scab Symposium

An international symposium to exchange information and explore new approaches to develop scab resistance will be held May 5-10, 2000 at the Suzhou Conference Center, Suzhou and Nanjing, Jiangsu Province, China. (Note the change from earlier announcements; this is a combined effort of two meetings previously in the works for next spring).

For more information, contact Dr. Zhengqiang Ma, Cytogenetics Institute, Nanjing Agricultural University, Nanjing, Jiangsu 210095, Email: zqm1@lib.njau.edu.cn, or cinaunj@public1.ptt.js.cn, Ph: +86-25-4396029 Fax: +86-25-4395308

Disease Forecasting Systems Help With Treatment Decisions

The effect of environmental conditions on the development and severity of a scab epidemic are not sufficiently defined to enable either a reliable prognosis of disease or recommendations of management activities. Research being done at Ohio State University includes monitoring inoculum fluctuations, environmental parameters and disease incidence and severity in replicated field plots that will provide valuable information and can be incorporated into a disease forecasting system, says Ohio State University crop scientist Pat Lipps. He says this work is being done in cooperation with researchers in North Dakota and Indiana to assess the affect of regional variation in cropping practices, tillage and climate on inoculum levels and subsequent disease in other wheat producing regions of the U.S.

During the 1999 growing season, management recommendations were made on the Ohio State University Extension's Crop Observation and Recommendation Network (C.O.R.N.), a weekly electronic information source for producers and ag industry personnel, based on current knowledge of FHB epidemiology and fungicide products currently available. The information helped producers make treatment decisions.

Plant pathologist Len Francl of North Dakota State University has developed a similar wheat disease forecasting system to help wheat producers in the Northern Plains make timely treatment decisions.

The forecasting information was made available online during the 1999 growing season at www.ag.ndsu.nodak.edu/cropdisease. The web pages received a total of 7,123 hits from 1,407 distinct hosts. The information was also summarized in recorded updates that wheat producers could access toll-free by phone.

The system measures fungal spores, wheat growth development, and weather conditions to pinpoint in near-real time the potential for scab, tan spot, and Septoria blotch disease infections in wheat.

Francl reports that the system correctly predicted a widespread tan spot epidemic and minor impacts due to stagonospora leaf blotch and scab. However, leaf rust was a major disease problem this year in some wheat cultivars but was not included in the system. Francl hopes to include leaf rust in the disease forecasting system next year.

Plant pathologist Ruth Dill-Macky and other crop scientists at the University of Minnesota are studying how scab inoculum survives on plant residue, particularly straw and small grains head tissues. Residue of infected plants was obtained in 1999 and has been separated into the major components which likely contribute to Fusarium inoculum. Dill-Macky says the plant parts are being examined in greenhouse and laboratory studies to determine the survival and inoculum potential of Fusarium.

University of Minnesota researchers are also planning a study on how burning of residue from small grains crops may affect the survival and inoculum production capacity of scab. Dill-Macky says this study, that would be conducted on large plots situated in commercial fields in the Red River Valley, is being planned for the spring of 2000.

North Dakota State University plant pathologist Len Francl (white shirt and tie) shows John Kostishack, executive director of the St. Paul, MN-based Otto Bremer Foundation, some of the wheat disease spore sampling equipment that Francl and other researchers are using to operate a wheat disease forecasting system to help wheat producers with disease management decisions. The forecasting equipment, located at 17 locations across the Red River Valley and the northern tier of North Dakota, is funded in part by the Otto Bremer Foundation, a private, charitable trust. ***Photo: Tracy Sayler***

Accelerated Research of Tolerant Cultivars Priority for Many

Accelerated development of wheat and barley varieties is now the corner stone of small grains varietal research for many states affected by scab. Breeding programs in the Northern Plains use greenhouses and off-season nurseries to accelerate the breeding effort. Through greenhouse and field nurseries, three generations per year are being screened for scab resistance.

Over the past year, South Dakota State University has increased the number of entries in its field scab-screening nursery from 1,000 to 3,000, and the number of rows in its off-season nurseries from 2,500 to 5,000.

SDSU wheat breeder Jackie Rudd says two lines with scab resistance from Sumai 3 were increased last winter. One of the lines (SD3407) was increased this past summer resulting in about 3,000 bushels of seed available for potential release in 2000. Of the 30 entries in SDSU's 1999 Advanced Yield Trial, all but 4 had scab resistance ratings better than '2375' and 6 were similar in resistance to Sumai 3. All yielded equal to or better than 2375.

At the University of Minnesota,142 lines in advanced yield trials and approximately 450 lines in preliminary yield trials were screened in inoculated, misted FHB screening nurseries and either three or two locations, respectively. Those lines advanced will be screened in a greenhouse inoculation in the spring of 2000, says wheat breeder Jim Anderson.

He says an additional location was added for field screening of scab resistance in the heart of the wheat-growing region of northwest Minnesota. Some lines at this location performed particularly well. Therefore, this may be a valuable new source of resistance. Anderson is also involved in the research of DNA markers for scab resistance that may be useful in speeding the process of breeding for resistance.

Purdue wheat breeder Herb Ohm says the cultivar INW9824, with one gene that conditions type 2 resistance (reduces the rate of disease development after infection) from donor parent, Ning 7840, has been released, along with Goldfield, on which the incidence of scab infection is typically one-fourth that of other cultivars. A nursery has been established in Argentina to accelerate generation advance of breeding populations, says Ohm.

NDSU spring wheat breeder Richard Frohberg says breeding lines have been identified that combine scab resistance and leaf spotting resistance with acceptable breadmaking quality. NDSU durum breeder Elias Elias says selected lines from various crosses screened for scab resistance will be re-evaluated this fall in the greenhouse.

Barley Breeding Efforts Identify Promosing Cultivars

NDSU barley breeder Rich Horsley says entries in NDSU's Preliminary, Intermediate, Advanced, and Varietal Yield Trials were identified that had 50% less FHB than currently grown cultivars. These entries will be evaluated for malting quality this winter by the USDA-ARS Cereal Crops Research Unit in Madison, WI and for DON content by the NDSU Department of Cereal Sciences at NDSU. Horsley says the source of the lower FHB severity levels in these lines does not trace back to Asian or northern European accessions.

Don Rasmusson and Kevin Smith, barley breeders at the University of Minnesota, have evaluated 7 new sources of resistance in barley that are parents of populations that will be grown in scab nurseries next summer. They have expanded their greenhouse screening efforts and have evaluated five first-cycle breeding populations in replicated field trials. These populations are derived from crosses between a new source of resistance to the program and an elite Minnesota breeding line.

Rasmusson and Smith have also evaluated seven second or third cycle breeding populations that involve crosses between a selected scab-resistant progeny from a first or second cycle breeding population and an elite Minnesota breeding line. Progeny from these crosses are more likely to produce an acceptable variety. They have also evaluated 21 lines from advanced cycles of scab resistance breeding in yield trials this past summer to assess their agronomic and malting quality properties.

Boost in FY00 scab funding promising

It appears promising that Congress will boost research efforts of the U.S. Wheat and Barley Scab Initiative by $1.8 million in Fiscal Year 2000. Federal lawmakers included language in the FY00 agricultural spending bill that would boost scab funding under the Initiative to $5.3 million. Research spending at several federal cereal crop research labs may be boosted as well.

Gene Transformation: High-Tech Hope to Solve Scab

Some crop scientists conducting research under the U.S. Wheat and Barley Scab Initiative are employing a high-tech defensive strategy in the fight against scab in wheat and barley, called gene transformation.

Under the same umbrella as biotechnology and genetic engineering, gene transformation is the process of introducing genes into plants by methods which by-pass the sexual seed production process. Essentially, it is a process by which genes (the parts of a cell that provide blueprints for inherited traits) are "cut" from the cells of one organism and "pasted" and integrated into the cells of another organism. Once the cells are transformed, they are grown into new plants capable of "expressing" a desired characteristic.

Biotech efforts in scab research are threefold: 1) identify genes in wheat and barley that are involved in the scab defense response, by mapping scab resistance genes with molecular markers, road signs or tags to mark regions of the plant chromosomes that carry scab resistance genes; 2) identify and insert antifungal genes in wheat and barley from other wheat and barley germplasm or other organisms, including bacteria and fungi; 3) identify and insert genes that can detoxify deoxynivalenol (DON) a contaminating byproduct of scab.

Nancy Alexander, microbiologist at the National Center for Agricultural Utilization Research (NCAUR), the U.S. Department of Agriculture's Agricultural Research Service lab near Peoria, Ill., was involved in the discovery of one promising gene now under study at several research labs across the country.

Patricia Okubara and Anne Blechl, crop scientists at the USDA-ARS Western Regional Research Center, Albany, Calif, are propagating transgenic plants with anti-fusarium genes. Sufficient seed is now ready for planting in greenhouse resistance trials to be conducted by Ruth Dill-Macky and Bob Busch at the University of Minnesota, St. Paul. Okubara and Blechl's WRRC research group is collaborating with U of M researchers including wheat breeder James Anderson and Gary Muehlbauer, molecular geneticist at the U of M, performing genetic crosses to generate germplasms carrying combinations of transgenes.

Lynn Dahleen, research geneticist at the USDA-ARS Northern Crop Science Laboratory in Fargo, N.D., is working on developing anti-fungal and anti-toxin genes that may be inserted into new barley varieties more acceptable to the malting industry. Dahleen's lab began its gene transformation efforts on barley in the fall of 1998.

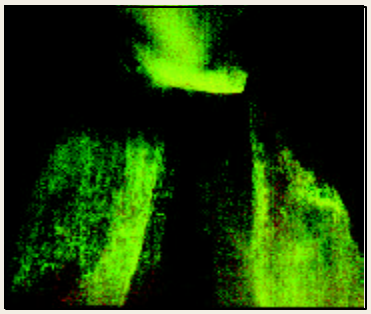
Stephen Baenziger, agronomist at the University of Nebraska-Lincoln, might be described as an intermediary between winter wheat breeding efforts at UNL and molecular scab work at the Plant Transformation Core Facility at the University of Nebraska's Center for Biotechnology. Research work there includes soft red winter wheat, grown in the east central U.S., but studied at UNL because of the biotech facilities there that specialize on winter wheat. With funding from the National Scab Initiative, the UNL is hoping to step up its research of inserting anti-fungal genes into viable winter wheat varieties. ■

Read more on Biotech's role in the Fusarium fight online

A more comprehensive feature on **"Gene Transformation: High-Tech Hope to Solve Scab"** may be found online at the U.S. Wheat and Barley Scab Initiative's web site, www.scabusa.org. The feature may be found under the heading "Scab USA Online's Fusarium Focus."

Scene from "Star Wars?"

Actually, the photo below is the product of collaborative research by Bill Bushnell, USDA-ARS Cereal Disease Lab, St. Paul, Minn., and Ron Skadsen, USDA-ARS Barley and Malt Lab, Madison, Wisc. They are using a genetically transformed strain of *Fusarium graminearum* (the Fusarium head blight fungus) containing a gene for green fluorescent protein (GFP), shown here. The GFP gives a green fluorescence to the fungus when viewed with the microscope under blue light. In preliminary trials, the GFP has greatly improved their ability to trace development of the fungus in infected head tissues. They are now comparing fungus development in inoculated head tissues (the palea and lemma) to development in inoculated leaf and coleoptile tissues. Their ultimate objective is to determine the principal pathways of infection in head tissues of wheat and barley. The GFP mutant was developed by Dr. Thomas Hohn, formerly of the National Center for Agricultural Utilization Research lab, USDA-ARS, Peoria, IL. ■



Barley (Morex) floret heavily infected with gfp/Fusarium (Fusarium transformed with the gene for jellyfish green fluorescent protein). It is illuminated with a shortwave blue light, which causes the protein to fluoresce green.

Less Scab in 1999, But Hot Spots Remain

The incidence and severity of scab were generally minor and sporadic during the 1999 growing season, although there were infection hot spots.

Sprout damage and rust were bigger problems than scab for small grain producers in the Northern Plains this year. In North Dakota, scab yield losses in hard red spring wheat averaged between 1% and 3%, and barley, 1% to 2%, with some fields at higher levels, says Marcia McMullen, extension plant pathologist at North Dakota State University. Scab was more prevalent in durum; partly because of its increased susceptibility to the disease but also because some late-planted durum fields flowered during environmental conditions that favored infection.

Scab was a problem this year for some wheat in eastern Kansas, says Bob Bowden, Kansas State University plant pathologist. Wet weather prevented some wheat fields in eastern KS from being planted this year, and what was planted suffered from some disease problems, including scab. Bowden stresses that damage was localized primarily in northeastern Kansas, and that affected acreage was less than one percent of the state's wheat production.

Still, damage was severe for affected farmers, with scab incidence in some fields as high as 50 percent. "It will affect people's willingness to plant wheat there next year," he says. The winter wheat variety 2137 is one susceptible variety that was infected.

Scab seems to affect a small portion of wheat in Kansas every four or five years, says Bowden, with the last noticeable outbreak in 1995. Infections are usually limited to eastern Kansas, which has more moisture and where more corn is grown—variables that increase the potential for scab infections.

The incidence of scab varied considerably in Nebraska, ranging from a trace in the southwest part of the state to as high as 50-plus percent in eastern Nebraska, according to John Watkins and P. Stephen Baenziger, University of Nebraska.

The largest wheat-producing region in Nebraska is its drier panhandle region, where scab is rare except in irrigated fields. There is a growing concern that irrigated wheat may be affected by scab if rains come at flowering, they say.

Scab was present in virtually every field in eastern Nebraska, but in only a few of those fields was the severity high enough to be of concern. Wheat from at least one field in eastern Nebraska was rejected by the elevator because of scabby grain. Weather at flowering played a major role in the incidence and severity of scab this year in Nebraska, they say. In surveys, fields with the highest incidence of scab usually are ones in which the wheat is planted into corn or sorghum residue. Scab is less in wheat that follows soybeans. The other factor that affected scab in eastern Nebraska is that many of the popular lines (2137 and Wesley) seem to be more susceptible to scab than other lines which are not as well adapted, says Watkins and Baenziger.

Scab generally was not a problem in the soft red winter wheat growing area of the eastern Cornbelt. Still, there were areas where it persisted. Herb Ohm, winter wheat breeder at Purdue University, points out that although the disease was not widespread in Indiana in 1999, there were areas of the state in which losses due to scab were as high as 25% in some fields. Further, Rick Seimer of Illinois-based Seimer Milling says virtually every load of wheat that has come into his mill this year has had deoxynivalenol (vomitoxin, or DON) at levels of one to two parts per million. "It's been at low levels, but consistent levels," he says.

Crop scientists Paul Murphy of North Carolina State University; Jerry Johnson of the University of Georgia; and Carl Griffey, Virginia Tech, all report little scab activity in southern wheat growing areas, mostly due to drier conditions. "It was dry during head emergence, down from last year when incidences of scab were inching up in soft red wheat," says Murphy.

Scab was once again detected in most wheat and barley fields surveyed in Manitoba in 1999, says Andy Tekauz, Cereal Research Centre, Agriculture and Agri-Food Canada, Winnipeg. However, he says disease severity was lower than observed in 1996-1998, when a visual FHB Index of 10% in wheat and 5% in barley was calculated province-wide. For 1999, the FHB Index will be about half this level. Still, Tekauz says there were some fields of wheat and barley with FHB Index values of 20 - 40% (which would have resulted in considerable yield loss and DON contamination), attesting to the continuing threat of scab to susceptible cereal genotypes when conditions are favorable for disease.

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