NCERA-184 – MANAGEMENT OF SMALL GRAIN DISEASES

MINUTES OF THE ANNUAL MEETING

Joint sessions with the Eastern Wheat Workers and Southern Small Grain Workers occurred on 4/17, 4/18 (AM), and 4/19. The official meeting for NCERA-184 occurred on 4/18 (afternoon and evening).

April 18:

The meeting was called to order at 1:00 PM by Chair, Stephen Wegulo (University of Nebraska).

The meeting was conducted in two sessions with the first session a discussion of current state production situations and research and extension topics that involve all members of the group. The second session was the formal business meeting, including a call from Marty Draper, USDA-NIFA administrator to be provided an update on the current Federal budget discussions.

State reports: detailed state reports are provided at the end of this document.

Erick De Wolf (Kansas State University) led a discussion about the update to the NCERA-184 fungicide table. During the discussion it was recognized that with some newer products there are gaps in the working knowledge regarding efficacy. There was also a discussion regarding how the industry will market some of these products as well as what the incentive is for growers to use different products when several generic fungicides are very inexpensive. Participants agreed that this table is very useful and can easily be tailored for state specific recommendations.

Marcia McMullen (North Dakota State University) led a discussion about fungicide seed treatments for wheat. The main question was if there was a need or interest to develop a table similar to what has been developed for the foliar fungicides? Currently, much of the data is stand assessments with little information about diseases.

Pierce Paul (Ohio State University) presented a short talk about collaborative research involving NCERA-184 members at Ohio State, Purdue University, the University of Illinois and the University of Wisconsin regarding early fungicide application timings or split application timings. The overall goal of this project is to work towards new disease thresholds for fungicide applications. Preliminary results suggest that the best control occurs with applications made at Feekes 8 or 10 when the target was *Stagonospora nodorum*. Results for yield were more variable in the first year of the trials.

Erick De Wolf (Kansas State University) presented a talk about developing a leaf disease index that is based on the disease ratings for wheat varieties that can then be used to determine if the application of a foliar fungicide will be more cost-effective. Preliminary results suggest that there are two groups, where the threshold is a leaf disease index of 26.

Values >26 indicate that there is moderate vulnerability to more than one disease and that there is a higher probability that a foliar fungicide will provide an economic increase.

Erick De Wolf (Kansas State University) led a discussion about current extension efforts on wheat rust diseases. There are now three publications on risk assessment, differentiating rust diseases, and an identification book. One question that was discussed amongst the group was regarding communication and if the use of a web-based delivery system similar to soybean rust would be valuable for Ug99?

Stephen Wegulo (University of Nebraska) presented a talk about multi-state research on the surveying and screening of wheat viruses, in particular Triticum mosaic virus. Stephen also presented a summary of work led by Mary Burrows (Montana State University) through the Great Plains Diagnostic Network of a survey for wheat diseases in a nine state region. Across the region, wheat streak mosaic virus was the most common virus detected.

Erick De Wolf (Kansas State University) provided a brief update to the group to indicate that the 2011 Fusarium head blight forecasting system was up and running. In 2011, several states in the Gulf Coast region were brought online.

Marcia McMullen (North Dakota State University) provided a brief update on the Scab Smart website. In particular, this site has been transferred over the U.S. Wheat & Barley Scab Initiative website. There were discussions regarding specific questions like "What do we want the Scab Smart to be?" and "Is the current iteration meeting the needs of a web-based information portal and what changes might help make this better used?"

Carl Bradley (University of Illinois) provided a brief talk regarding integrated management trials conducted in Illinois that examined different varieties and fungicide treatments. Results indicated that DON levels followed a pattern of reductions by integrating multiple tactics including rotation, variety selection, and foliar fungicide.

Marty Carson (USDA-ARS-CDL) indicated that when reports are submitted to the Cereal Rust Laboratory, a follow-up request for samples should be expected from those who submit the samples.

The group broke for dinner at 5:30 PM and resumed the meeting at approximately 7:00 PM, at which time the business meeting occurred.

Minutes of the 2010 Meeting: Carl Bradley moved to approve the minutes as written and Kiersten Wise seconded that motion. Erick De Wolf asked is impacts are listed separately and it was discussed that the minutes are a compilation of the meeting, including state reports where impacts and other measures are mentioned. Minutes were approved unanimously.

Marty Draper (USDA-NIFA) called in to the meeting and provided a presentation that discussed USDA-NIFA and the respective institutes as well as the current Federal budget

discussions. Marty indicated that the letter that the NCERA-184 committee composed and submitted to USDA questioning the reasons that mycotoxins were not initially a part of the AFRI call in the Food Safety and Nutrition Institute was very effective and well-received. Marty provided updates regarding the FY2011 and FY2012 budget bills. There are several areas where funding has been reduced or eliminated, especially areas where there is a strong "extension" component. It was also mentioned that there does not appear to be budget gains in the AFRI budget to account for some of the program areas that were cut in the line item cuts. Marty also mentioned that in 2012, the 7th International IPM Symposium will be held from March 27-29 in Memphis, TN, and that the programming committee was very interested in receiving symposium ideas.

Kendall Lamkey (Administrative Advisor) stated that this committee was a committee in good standing as the group functioned well to meet goals. Kendall also pointed out that this is a renewal process year as the committee expires in 2012. Kendall sent out an email to group describing the renewal process and emphasized that a key goal is to highlight how such a committee enables completion of work that cannot be done individually. Also, he reminded the group that it is very important to emphasize impacts and outcomes as part of the renewal process.

Election of new Secretary – Erick De Wolf (Kansas State University) was elected unanimously as Secretary. Paul Esker (University of Wisconsin) will be the Chair for the 2012 meeting.

Writing Committee for Proposal Renewal – the group agreed that there should be a three member writing committee, including Stephen Wegulo (as outgoing Chair), Paul Esker (as incoming Chair) and Erick De Wolf (as incoming Secretary).

Discussion ensued regarding planning for the 2012 meeting. The group agreed that a meeting at the 7th International IPM Symposium in Memphis would work well. Since the meeting, a request has been submitted to the organizers for having this meeting and a symposium topic was also submitted regarding the successes in improving management of Fusarium head blight.

A reminder was made that the American Phytopathological Society is hosting a field crops rust symposium in December 2011 in San Antonio, TX.

The group thanked Stephen Wegulo for putting together the NCERA-184 as well as coordinating activities as part of the joint meeting.

The meeting adjourned at 8:45 PM.

STATE REPORTS

Arkansas:

Personnel: Gene Milus, Professor

David Moon, Program Associate
Peter Rohman, Program Associate (part time)
Peter Horevaj, PhD student, graduated May 2010
Jinita Sthapit, MS student, graduated May 2010
Kevin Lee, MS student

2010 Crop Season in Review:
Farmers in Arkansas harvested approximately 200,000 acres of soft red winter wheat with an average yield of 54 bu/acre. Stripe rust was the most important disease. A new race with virulence on *Yr17* was widespread across the state, but losses were less than in previous epidemics because of suboptimal weather, resistant varieties and fungicides. Some leaf rust and scab developed late in the season, but losses from these were negligible.

Current Wheat Pathology Research Projects:
- Seed treatment evaluation for seedborne Stagonospora
- Foliar fungicide product evaluations for FHB, stem rust and other diseases
- Integrated management of FHB (USWBSI)
- Cultivar evaluation for stripe rust, stem rust, powdery mildew, FHB, and other diseases
- Expression of *Yr17* stripe rust resistance in seedlings and adult plants
- Integrated management of wheat diseases

Illinois:

2011 – Review and Projection of Growing Seasons: Approximately 295,000 acres of soft red winter wheat out of 330,000 acres planted were harvested in Illinois in 2010. This was the lowest wheat acreage on record for the state. The low acreage was due primarily to the late harvest of soybean and corn fields in the state, which prevented timely planting of winter wheat. In addition, high levels of FHB and DON in the 2009 season likely had some impact on the decision of some growers to not plant as many wheat acres in the Fall of 2009. The state average yield was 56 bu/A with a total production of approximately 16.5 million bushels of wheat. The 2010 state average yield was the same as the state average yield for 2009, which was 4 bu/A lower than the 2005-2008 state average yield (62 bu/A). The lower yields observed in 2010 was due primarily to late planting in the Fall of 2009 and some levels of disease in 2010.

Although wheat diseases were likely not the primary reason for lower yields in 2010, they likely did play a role. Fusarium head blight was prevalent in the limited acreage of wheat in central and northern Illinois. In addition, stripe rust and leaf rust likely caused some yield reductions in the state.

For the 2011 season, approximately 740,000 acres of soft red winter wheat were seeded in the Fall of 2010. This is up 124% compared to 2009.

As of April 15, 2011, very few observations of diseases affecting wheat in the state have been reported. Wheat streak mosaic virus was confirmed in a field in southern Illinois,

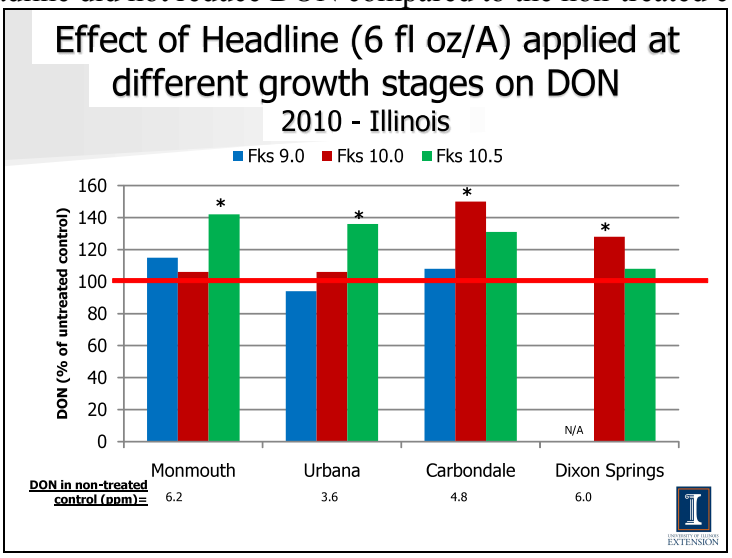
and other reports of wheat fields with virus symptoms have been reported. A wheat virus / bacterial mosaic survey will be conducted in the state for the 2011 growing season.

Research trials

Uniform fungicide trials. Fusarium head blight – uniform fungicide trials were conducted at Dixon Springs, Brownstown, Urbana, Carbondale, and Monmouth. In general, Prosaro and Caramba were the best at reducing FHB and DON at locations with moderate to high FHB pressure. An experimental fungicide from Syngenta (A9232D) also provided some control of FHB and DON.

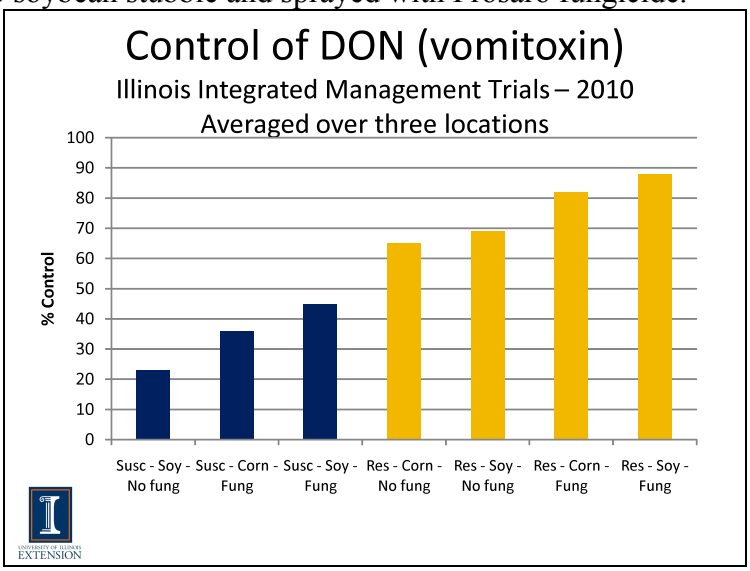
Fungicide timing. As part of the uniform fungicide trial, Prosaro and Caramba were evaluated at different timings (10.5; 10.5.1; and 5 days after 10.5.1) for its control of FHB and DON. In general, applications at 10.5.1 and five days after 10.5.1 provided better control of FHB and DON than applications at 10.5.

Effect of strobilurin fungicides on DON. Headline fungicide was applied at flag leaf, boot, and heading stages to determine its effect on DON at four locations (Monmouth, Urbana, Carbondale, and Dixon Springs). Applications of Headline at flag leaf did not significantly increase DON compared to the non-treated controls at any of the locations. Headline applied at boot stage increased DON compared to the non-treated controls at Carbondale and Dixon Springs. When applied at heading, Headline increased DON compared to the non-treated controls at Monmouth and Urbana. Applications of Headline did not reduce DON compared to the non-treated controls at any locations.



Fungicide x cultivar trial. In collaboration with Dr. Fred Kolb, a fungicide x cultivar trial was conducted at Urbana. The fungicide treatments included Prosaro, Caramba, and an untreated control. These treatments were applied to twelve different winter wheat cultivars that differed in susceptibility to FHB. In general, the combination of Prosaro or Caramba plus a high level of host resistance had the lowest FHB and DON levels and the highest yields.

Integrated management trials. FHB integrated management trials that evaluated previous crop (soybean or corn), cultivar (ranging from S to MR for FHB), and fungicide (Prosaro or untreated) were conducted at Carbondale, Dixon Springs, Urbana, and Monmouth. The highest level of control of DON was achieved when resistant cultivars were planted into soybean stubble and sprayed with Prosaro fungicide.



Indiana:

2010 in Review: Harvested wheat acreage in Indiana in 2010 totaled 230,000 acres (USDA, NASS). Wheat production was down from 450,000 acres in 2009 and 560,000 acres in 2008. Total production was estimated at 13.8 million bushels, with an average yield of 60 bu/A. Wheat diseases were generally at low levels throughout southern Indiana in 2010. Stagonospora leaf blotch/Septoria leaf blight was observed in southern Indiana early, but did not impact yield in most fields. A prolonged period of rainy and humid weather in early May resulted in outbreaks of Fusarium head blight (FHB) throughout central and northern Indiana. Flowering date impacted severity of this disease, with early-flowering varieties exhibiting low incidence and severity, while some fields with later-flowering varieties experiencing moderate to severe yield loss due to the disease. The impact of DON on grain quality was moderate to severe in areas in northern Indiana. Stripe rust and leaf rust were also observed across the state, at low to moderate severity, depending on the variety. Stem rust was observed in far southern Indiana, however all rust diseases arrived too late in the growing season to cause significant yield loss. Several viral diseases of wheat, including wheat streak mosaic virus (WSMV), wheat spindle streak mosaic virus (WSSMV), soil-borne wheat mosaic virus (SBWMV), and barley yellow dwarf virus (BYDV) were confirmed in Indiana.

Projections for 2011: Extremely dry weather in the fall of 2010 impacted wheat tillering for the 2011 crop. Many fields were planted below optimum moisture, and had poor stands and tillering in the spring. Some fields in northern Indiana were torn under due to winter kill and poor tillering. The impact on yield is yet to be seen. Wheat viral diseases have been confirmed throughout Indiana in 2011.

Impact: Research activities in 2010 focused on evaluating integrated management strategies for control of FHB. The results of these research projects indicate that a well-timed fungicide application can significantly reduce the impact of FHB and DON in wheat varieties, and increase yields in most varieties. This information is of primary importance to growers and is presented in extension programs and summarized in extension articles to aid growers in managing wheat diseases, especially FHB. Indiana also contributed periodic commentary to the USWBSI FHB forecasting tool and disseminated information about risk of FHB and other wheat diseases via Extension newsletter articles.

Collaborative research with others in the Midwest examined the impact of early fungicide applications on wheat. This work demonstrates that early applications do not always result in increased yield, and that foliar diseases like Stagonospora/Septoria leaf blight are still best managed in Indiana with a fungicide application at the standard FGS 8-9 timing. In 2011, the first Wheat Production Workshops were held in Indiana in Vincennes, IN, and Bluffton IN. These workshops focused on updating wheat producers on the latest research on wheat management, and were attended by over 100 people across the state.

Research is also conducted on foliar and seed fungicide treatment efficacy for wheat disease management.

Kansas:

Personnel news: Dr. Xiaoyan Tang has resigned her position in the Dept. of Plant Pathology to take a position with a private company in China.

Wheat progress and potential for diseases in 2011: As of April 15, 2011, the wheat in Kansas is at the jointing stages of growth in most areas of the state. In general, this growing season has been characterized by dry weather, but rains today are bringing some relief to many areas of the state. Despite the dry conditions, leaf rust was reported in Saline county (Central Kansas) this week. The disease was still at low levels (less than 5% incidence) and in the lower third of the canopy. The varieties affected included Protection and AP503CL2, which are both known to be susceptible to leaf rust. It is too early to tell how much of a threat leaf rust will be to wheat production in Kansas this year. The majority of the wheat acres in the state are planted with varieties that have moderate levels of resistance to the disease suggesting the impact of the disease should be lower than a few years ago when the most common varieties were susceptible to leaf rust. It is early for leaf rust to be found this far north in Kansas, and growers should be monitoring fields for signs of disease. Fields planted to varieties known to be susceptible to leaf rust including Jagger, Jagalene, and Overley should be top priories for scouting. Powdery mildew and Septoria tritici blotch have also been observed at multiple locations,

but not in all varieties. Wheat streak mosaic has been observed at higher levels than in the past 3 years. We will continue to survey for WSM and other viral diseases so that we can better determine their distribution.

Disease loss estimates for 2010: Data are from: Appel, J. A., De Wolf, E., Bockus, W. W., Todd, T. and Bowden, R. L. 2010. Preliminary 2010 Kansas Wheat Disease Loss Estimates. Kansas Cooperative Plant Disease Survey Report. (http://www.ksda.gov/includes/document_center/plant_protection/Plant_Disease_Reports/2010KSWheatDiseaseLossEstimates.pdf)

Disease	Loss in 2007	Loss in 2008	Loss in 2009	Loss in 2010	20-yr avg.
Leaf rust	13.9	4.72	1.37	1.0	3.78
Stripe rust	0.2	0.01	0.01	10.3	2.14
Septoria complex	1.8	0.5	1.0	1.1	1.14
Wheat streak mosaic	0.01	0.02	0.001	0.02	1.12
Barley yellow dwarf	0.2	0.01	0.44	0.34	1.07
Tan spot	1.3	0.45	0.26	0.2	0.95
Fusarium head blight	0.2	1.9	0.9	0.3	0.49
Soilborne mosaic	0.01	0.001	0.001	0.1	0.22
Take-all	0.001	0.001	0.01	0.001	0.17
Powdery mildew	0.2	0.03	0.02	0.1	0.13
Root and crown rot	0.01	0.001	0.001	0.01	0.07
Stem rust	0	0.001	0.001	0.001	0.06
Strawbreaker	0	0	0	0	0.02
Bunt and loose smut	0.02	0.01	0.04	0.03	0.02
Bacterial leaf blight	0.001	0.03	0.04	0	0.01
Total	17.9	7.7	4.1	13.5	11.38*

* Equivalent to about 40 million bushels or $302 million dollars at current cash grain prices ($7.55, April 11, 2011).

Wheat diseases were an important factor influencing wheat production in Kansas this past year. Moderate temperatures and frequent precipitation in May favored development of several diseases. The most important diseases in 2010 included stripe rust, Septoria tritici blotch, barley yellow dwarf, and Fusarium head blight. Stripe rust caused significant yield losses throughout the state. The population of the fungus that causes stripe rust changed this year, rendering the genetic resistance of many varieties ineffective. Many popular varieties were vulnerable to the new population of stripe rust including Fuller, PostRock, Art, Santa Fe, and Jagalene. All of these varieties derived their stripe rust resistance from the variety Jagger, which has been used widely as a parent in the Great Plains region. Barley yellow dwarf was also very common in central Kansas this year. Symptoms of barley yellow dwarf did not become readily apparent until later than normal this year, suggesting that moderate temperatures may have slowed progress of the disease. Septoria tritici blotch (speckled leaf blotch) was a persistent problem in northwestern Kansas, and Fusarium head blight caused moderate damage in the northeastern region of the state.

Accomplishments:

1. Disease phenotypes were determined in the greenhouse for numerous wheat accessions of importance to breeders, geneticists, and extension specialists. Phenotypes were determined for reaction to tan spot, Stagonospora nodorum blotch, Septoria tritici blotch, and Fusarium head blight. 18 field experiments were completed including wheat disease phenotyping nurseries (foliar disease complex, barley yellow dwarf, and Fusarium head blight), fungicide efficacy trials (foliar and seed-treatment for control of tan spot/leaf rust, Fusarium head blight, Cephalosporium stripe, take-all, Fusarium-damaged kernels, barley yellow dwarf, and common bunt), and epidemiological studies.

2. Coordinated the update of cooperative fungicide efficacy tables for wheat disease management.

3. Cooperative development and deployment of disease prediction models for Fusarium head blight in 25 states where this disease has been a serious production problem. Included new technologies to communicate disease risk and timely management information to wheat and barely producers throughout the region.

4. Organized workshops to coordinate the preparations for potential arrival of Ug99 stem rust in North America. Includes development of multi-state publications targeting identification and management of stem rust and other rust diseases of wheat and barley.

Impacts:

1. Discussions among participants of the WERA-184 meetings have helped in the efficiency and accuracy of applied disease research efforts on winter wheat in Kansas. The following types of experiments were aided by these meetings: 1. determining the reactions of breeding lines and commercial winter wheat cultivars to various diseases; 2. dissemination of disease-reaction data of cultivars to wheat producers; 3. the effect of seed-treatment and foliar fungicides on wheat diseases; and, 4. the effect of cultivar mixtures, tillage practices, crop rotations, and epidemic age on foliar disease development. Progress toward identifying resistance to wheat pathogens has helped in the development of new, resistant wheat cultivars.

2. Determining the impact of fungicides on wheat diseases is necessary to develop accurate chemical control recommendations.

3. The web-based prediction models for Fusarium head blight received over 9,115 visits during the period when wheat is actively growing in the 24 states (April – August). A user survey conducted in 2010 included 356 respondents indicated that 58% of these users were either farm advisors or farmers. Other users of the system included university extension personnel and members of the grain marketing and milling industries. The survey also indicated that 64% of the users applied the information provided by the prediction system for direct on-farm

management decisions, or providing recommendations for disease management. In 2010, 93% of the users considered the information to be of high or moderate value for their farm operations or organization. The estimated net value of the disease prediction system to U.S. wheat growers exceeds $47 million.

4. The publications produced in preparation for the Ug99 stem rust was customized with logos and contact information (generally the NPDN labs) for use in 26 states and 2 Canadian provinces. A national version of the publications (regional hubs of NPDN as contacts) was developed for the USDA-CDL. Over 111,000 printed publications were distributed as part of the project.

Overall impact in Kansas: Quantifying the impact of resistant cultivars, cultivar mixtures, tillage practices, and crop rotations on diseases gives wheat producers multiple options when managing diseases. All of these findings should help to improve management of wheat diseases in Kansas which cause an annual loss of over 40 million bushels. Overall efforts to control wheat diseases in Kansas (including development of resistant cultivars) have resulted in reducing statewide losses from 17% in the 1970's to about 10%, an annual savings of about $60 million.

Kentucky:

Kentucky produces approximately 300,000 to 400,000 acres of wheat year, with the number of acres varying due to wheat prices and suitability of fall conditions for wheat planting and early crop development. Approximately half of Kentucky's wheat acres are treated with a fungicide each year. High crop prices may encourage an even higher percentage of the crop being sprayed in 2011. The primary target for most fungicide applications is Fusarium Head Blight, as well as other late-season foliar and head diseases (leaf and stripe rust, Stagonospora leaf and glume blotch).

Kentucky wheat disease research primarily involves testing new fungicides and timing of treatments to effect the most economical, effective and environmental sustainable fungicide spray decisions. Research projects are developed primarily to test new treatments being evaluated by industry, as well as uniform testing for FHB control where scientists from multiple states implement the same basic protocol.

In 2010, we conducted 2 foliar fungicide efficacy trials aimed at various foliar and head diseases, one fungicide timing study and a test comparing biological products to fungicides, with FHB as the target disease. We also participated in the 2010 Uniform Integrated Trails funded by the U.S. Wheat and Barley Head Scab Initiative.

Michigan:

Production*:* The acreage planted to wheat in Michigan was significantly lower in the fall of 2009 due to a delayed soybean harvest, consternation over quality discounts, and a generally reduced level of confidence in the crop's income potential. NASS estimated the planted acreage to be 530,000, some 100,000 below the previous year and the lowest

acreage since 2002. The industry was particularly concerned about the decline in soft white wheat acreage, as it headed below the 200,000 acre mark. NASS estimated the crop yield to average 70 bushel per acre (three bushels below the record set in 2006) and the total harvested production to be nearly 35 million bushels.

Crop development: Despite most fields being planted relatively late and under unaccommodating weather, there was very little seedling or plant loss prior to green-up, except for some areas in the north central area of the state. In the spring, a relatively warm and dry April led to strong, vigorous, and early maturing stands. Favorable spring conditions also provided for efficient use of fertilizer nitrogen, in contrast to the previous season when excessive rains in April and May caused significant loss in many production areas. Flowering occurred mostly from May 24 to June 6. Harvest started in earnest around July 1 for the southern half of Michigan and the bulk of the state's crop was completed by July 23. This was nearly three weeks earlier than the 2009 harvest.

Diseases: As the crop developed beyond jointing (growth stage 6), powdery mildew became aggressive where there were thick stands of a susceptible variety. Warming temperatures soon curtailed powdery mildew, but encouraged the development of leaf blotch (Stagonospora nodorum) across the entire state. The pathogen thrived under the relatively warm and damp conditions during June and readily made its way up on to the flag leaf. In fact, in some fields it continued to climb to the head causing glume blotch. In addition, there was a sprinkling of leaf rust across the state and isolated cases of striped rust and stem rust. Collectively, foliar diseases likely cost the state's crop at least ten bushels per acre where untreated.

Much of Michigan's wheat began flowering during the week prior to Memorial Day under relatively high temperatures and limited rainfall, prompting many to forego a fungicide treatment for Fusarium head blight. Unfortunately for some, the weather pattern abruptly changed following the May 31 holiday to include above normal rainfall. This opened the door for foliar diseases to progress unchecked and for some late infections of Fusarium head blight.

Industry development: To ensure that Michigan continues to have a viable wheat industry, all segments of the industry attempted to advance the production and utilization of wheat. Grain elevators made strides during the past year to improve the reliability of their falling number tests. They invested in training and equipment, and tightened their testing procedures.

Farm Bureau's Commodity and Marketing Committee continued to assist the industry in multiple ways. Most notably, they were instrumental in a national discussion with the USDA's Risk Management Agency to encourage the recognition of low falling numbers as a peril under national crop insurance. This key initiative was partly successful and will continue to be emphasized in the year to come. The group also began exploring the feasibility of a referendum that would generate money for addressing industry issues. Currently, this state-wide discussion has progressed to the point that a state referendum will be presented to growers for their vote in June, 2011.

Both the Michigan Millers' Association and the Eastern White Wheat Council continued to play supportive roles ion behalf of the wheat industry and to contribute financially to the wheat breeding program at Michigan State University.

Michigan State University Extension, in an effort to stem the decline in resources devoted to the wheat industry, assigned a field Extension Educator to work across the state to help facilitate communication within the industry, and to and disseminate production information to growers. This pilot initiative received financial assistance from Project GREEEN, Michigan Crop Improvement Association and Michigan Millers' Association.

Outlook for the 2010/2011 season: The planted acres in the fall of 2010 jumped to some 700,000 acres due, in part, to strengthened market prices. The acreage split between soft white winter and soft red winter wheat continues at approximately 30/70. Thus far, the winter survival of wheat looks very good.

Missouri:

Missouri Winter Wheat Production for 2009-2010 and 2010-2011

2008-2009: Acres planted to winter wheat in Missouri for the 2009 season decreased to 750,000 acres, down from 1,160,000 acres in 2008. Wet conditions during the fall of 2008 resulted in late soybean harvest and late wheat planting. In some cases wheat did not get planted.

Out of 800,000 acres planted in the fall of 2008 approximately 750,000 were harvested in 2009. The average yield in 2009 was expected to be 51.0 bushels per acre up from 48 bushels per acre in 2008.

2009-2010: Fall seedings for the 2010 winter wheat crop in Missouri totaled 420,000 acres, down 46% from the 2009 seeded acreage and 66% below the level of 2 years ago. This is the lowest winter wheat seeding on record, mainly due to an extremely late harvest for row crops.

Missouri Crop & Livestock Reported for May 2010:
Higher failed acres and a lack of yield potential have combined to bring winter wheat harvested acres to a record low. Excessive rainfall during the planting season delayed planting and hindered the development of the winter wheat crop. At the beginning of May, the crop was rated 26% very poor to poor compared with last year when only 9% fell into these categories.

Missouri production of winter wheat is forecast at 14.3 million bushels, based on conditions as of May 1, 2010, 58% below the 2009 crop and 74% below 2 years ago. This is third lowest production on record. The lowest record occurred in 1942 when 9.04 million bushels were harvested from 695,000 acres. Missouri's largest production occurred in 1981 when 116 million bushels were harvested from 2.75 million acres. Yields in the state are expected to average 46 bushels per acre, down 1 bushel from the

2009 yield and 2 bushels below 2008. Harvested acres are forecast at 310,000 acres, the lowest level since records began in 1909. This is down 58% from the 2009 acreage level and 73% below 2008.

2010-2011: Fall seedings for the 2011 winter wheat crop in Missouri totaled 750,000 acres, an increase of 103 percent from the 2010 seed acreage but 4 percent below the level of 2 years ago. The fall of 2010 was the first dry fall in the state for about 3 years. Harvest was early or average and conditions were favorable for planting winter wheat. Unfortunately the dry conditions continued through late fall resulting in thin stands and poor vigor in much of that state. Areas with the ability to irrigate and fields which were irrigated showed a significant benefit from the fall irrigation.

Winter Wheat Issues and Disease Update

During the 2010 season most of the state received rain as the wheat crop was flowering and conditions were quite favorable for the development of Fusarium head blight or scab. This was the third year in a row that Fusarium head blight or scab has been a statewide problem. Cool conditions for much of the spring and early summer limited the development of most fungal foliage diseases. Septoria leaf blight came in late in the season. Leaf rust and stripe rust were not problems in most of Missouri during the 2010 season. Samples from various regions of the state tested positive for wheat soil-borne mosaic, wheat spindle streak mosaic and barley yellow dwarf; however, virus diseases were not widespread or severe.

Thus far in 2011 the primary winter wheat concerns have been virus diseases. Wheat spindle streak mosaic, wheat soil-borne mosaic, wheat streak mosaic and barley yellow dwarf have all been confirmed in samples submitted to the Plant Diagnostic Laboratory.

Most of the wheat crop in the southern regions of the state is in early flag leaf emergence stages of growth. The crop in the central and northern regions of the state are not yet at flag leaf emergence. Weather conditions have been extremely variable moving from record highs to almost record lows within the same week. Foliage diseases haven't developed to any noticeable level yet.

Winter Wheat Research Projects

The past two years have seen an increase in request for winter wheat seed treatment trials. During the 2011 season, three seed treatment trials are being conducted. Stand establishment was a problem in the fall of 2010 due to dry soil conditions after planting. However stands appear to have overwintered well and results should be valid.

Foliar fungicide trials in 2010 showed little benefit from fungicide application because disease pressure was low and foliage diseases did not become established until well after flowering. Similar results are expected for 2011 trials.

Missouri participated in the Uniform Scab Biologicals Trial during 2008, 2009, 2010 and 2011. Scab was a serious problem in central Missouri during 2008, 2009 and 2010 so results have been very useful. In the 2009 and 2010 Integrated Scab Management Trials, there were significant differences in the DON levels from the two rotations with the wheat in the corn residue having higher DON levels than the wheat in the soybean residue. There were also significant differences between varieties and fungicide treatments. Again, scab appears to be severe in the susceptible variety but lower in the moderately tolerant to tolerant varieties.

Nebraska:

2010: Wheat harvested area was 1.49 million acres, down 8.6% from 2009. Average yield was 43 bu/acre, down 10.4% from 2009. Total production was 64.1 million bushels, down 18% from 2009. The predominant disease in 2010 was stripe rust. It occurred in all wheat growing regions in the state. Fusarium head blight occurred to moderate levels in isolated fields, mainly fields with corn stubble on the ground, irrigation, and highly susceptible cultivars. Fields with significant levels of scab were observed in southeast, south central, and southwest Nebraska. Overall, scab damage was minimal statewide. There were no reports of discounts at elevators due to *Fusarium*-damaged kernels or DON. Leaf spot diseases were mainly tan spot and Septoria tritici blotch. Stagonospora nodorum blotch was also observed. Bacterial leaf streak/black chaff occurred in some fields especially in southwest NE. Leaf rust also occurred at low levels, but its presence was overshadowed by stripe rust. Virus diseases observed were Wheat streak mosaic, Triticum mosaic, wheat soilborne mosaic, and wheat spindle streak mosaic.

2011: As of mid April 2011, wheat was not jointing yet and no major diseases had been observed. Heavy rainfall during the week of April 11 favored development of early season diseases such as tan spot.

Current research: epidemiology and integrated management of Fusarium head blight; regional distribution, etiology, and epidemiology of Triticum mosaic virus.

Accomplishments: In 2010 our program, in collaboration with members of the Wheat Breeding and Genetics Team, screened over 2,000 winter wheat breeding lines for resistance to Fusarium head blight, leaf rust, and stem rust. Releasing wheat cultivars with improved disease resistance will reduce yield loss and increase grower profits.

In 2010, disease intensity-deoxynivalenol (DON) models were developed for the wheat-Fusarium head blight (FHB) pathosystem using data collected from field experiments conducted in 2007-2009. A linear, positive relationship was found between FHB severity and DON concentration. The slope of the regression line representing this relationship varied with wheat cultivar, implying that some cultivars accumulate more DON per unit of FHB severity than others.

Data on Fusarium head blight (FHB), deoxynivalenol (DON, a toxin produced by the Fusarium head blight fungus), and weather data were obtained and furnished to a national FHB and DON model development team.

Differences in FHB intensity and DON accumulation among winter wheat cultivars were demonstrated, with some cultivars having higher FHB intensity and accumulating higher concentrations of DON than others. FHB and DON were found to be higher in years with high precipitation (2007 and 2008) than in years with low precipitation (2009 and 2010) before and during wheat flowering.

In 2010, disease information on field crops was presented in several crop management programs including Crop Production Clinics, Crop Management and Diagnostic Clinics, and Wheat Field Days.

In 2010, wheat disease surveys conducted throughout the state determined the condition of the wheat crop and the diseases and insect pests present during the growing season. The surveys detected multiple diseases including foliar leaf spots, stem rust, leaf rust, stripe rust (the major wheat disease in 2010), powdery mildew, Fusarium head blight, loose smut, wheat streak mosaic virus, Triticum mosaic virus, soilborne mosaic virus, and black chaff.

Impacts: Screening wheat lines for resistance to Fusarium head blight, leaf rust and stem rust early in the breeding program leads to selection of more disease resistant progeny and contributes significantly to development of new, improved wheat cultivars. NH03614 CL, released in 2008 under the name Husker Genetics Brand Settler CL with tolerance to imadazoline herbicide and moderate resistance to stem rust, was first sold to wheat producers in 2010. It sold out everywhere. The certified seed sales were approximately 20,000 bushels and the total cost of the seed was about $175,000. An additional 1000 bu of foundation seed is expected to be sold for a another $30,000 in foundation seed sales. It is being sold in CO, WY, NE, SD, ND, and MN.

Growers will make informed decisions when selecting the wheat cultivars to plant. This will reduce damage from FHB and thereby and increase profits.

FHB, DON, and environmental data gathered will be used to develop prediction models for FHB and DON. Data on cultivar reaction to FHB and DON will enable producers to make informed decisions about the choice of cultivar to plant. Deployment of FHB and DON prediction models and choice of cultivars with the best resistance/tolerance to FHB and DON will reduce losses from FHB and DON and thereby increase profits for producers. Use of information from this research will save Nebraska wheat growers an estimated $15 million annually during years that are favorable to FHB.

UNL Extension-led Crop Production Clinics trained 1,233 agribusiness representatives and producers on profitable crop production techniques, and recertified 789 commercial pesticide applicators. The Mid Summer Public Diagnostic Clinic at the Agricultural

Research and Development Center near Mead impacted 50,514 producer acres and 3.4 million advisor/employee acres.

Information from the wheat disease surveys was used to develop timely CropWatch newsletter articles which were used by growers and crop consultants to implement disease management measures. Growers saved an estimated $12 million that would have been lost to diseases.

New York:

Personnel: Gary C. Bergstrom, Professor
Katrina Waxman, Research Support Specialist
Stanley Kawamoto, Research Support Specialist (part-time)
Julia Crane, Ph.D. Student

2010 Crop Season in Review: The growing season was conducive for excellent yield of winter wheat in New York. State average wheat yield was at a record high 67 bu/A, while many leading producers topped 100 bu/A. State average spring oat yield was estimated at 67 bu/A and spring barley yield at 55 bu/A. Wheat producers generally realized a profitable return on investment in flag leaf to flowering stage fungicide applications due to control of leaf rust and Stagonospora nodorum blotch. Fusarium head blight and deoxynivalenol contamination were a problem primarily in late-planted winter wheat and in spring wheat. Stripe rust was confirmed for the first time in New York in 2010.

Current Wheat Pathology Research Projects:
- Seed treatment product evaluation
- Foliar fungicide product evaluation
- Integrated management of FHB (USWBSI)
- Epidemiology of FHB – contribution of in-field corn debris (USWBSI)
- Biological control of FHB by *Bacillus* (USWBSI)
- Cultivar evaluation for soilborne viruses, FHB, and leaf spots
- Epidemiology of *Phaeosphaeria nodorum*

North Dakota:

2010 Crops: Great crops across the state for all cereal and broadleaf crops, plus high prices = equaled good year in agriculture. Few disease problems, except for an outbreak of stripe rust in some winter wheat and spring wheat cultivars; 5% of surveyed wheat fields showed stripe rust symptoms, estimated loss due to stripe rust < 1% over-all, as well as trace to leaf rust; most frequent disease observed in wheat was tan spot; most frequent observed in barley was net blotch. Losses due to FHB estimated to be small, around $3 million, primarily in NE corner of state.

2011 Crop: Only about 350,000 acres of winter wheat planted. Condition of winter wheat looks good, and no diseases observed. No spring crops planted yet – estimated 9 million acres of spring wheat and durum wheat, 1.2 million acres of barley, < million

acres of oats. The state is currently dealing with river flooding, overland flooding from snow melt, and another storm across much of state today (April 15) , leaving snow or rain. We still hope to get our wheat and barley trials planted first week of May in Fargo.

Impacts of NCERA-184 related activities:

- **Distribution of NCERA Fungicide Efficacy Table for Wheat:** Distributed to ~ 1000 wheat growers at winter meetings. Informed producers of most efficacious products for helping manage important wheat diseases.
- **Distribution of Publication "Identifying Rust Diseases of Wheat and Barley" to all county offices and to Best of the Best meeting attendees:** 800 producers in attendance at four Best of Best meetings and another 200 copies distributed at regional wheat producer meetings. Producers have a good tool to help them distinguish among the important rust diseases of wheat. This publication was developed by NCERA-184 and WERA-97 pathologists.
- **Development and use of SCABSMART:** ScabSmart is a web site (www.scabsmart.org) providing easily accessed information on FHB management to wheat and barley producers. This site, initially developed at NDSU and funded by the US Wheat and Barley Scab Initiative, is a collaborative effort of small grain pathologists associated with NCERA 184. Information provided to this site is updated every year by wheat and barley pathologists and small grain breeders across the county. In addition, FHB alerts also became available in 2010, as a new "push" electronic strategy through the US Wheat and Barley Scab Initiative, to provide information to producers on the risk of FHB, as determined by the FHB forecasting model. Dr. McMullen wrote the ND alerts, which producers, consultants and extension agents accessed on email or their smart phones.
- **ND wheat producers used the information provided on ScabSmart, FHB alerts**, and also from information provided through traditional means, such as the NDSU Crop and Pest Report, county ag alerts, and the AgDakota listserve. They responded when FHB risks were high during the susceptible growth stage of wheat, flowering. In 2010, the most efficacious fungicides were applied to 1.2 million acres, because of risk indicated by forecasting. The average yield response was 15% in 2010, for a yield response between 7.5 and 10 bu/acre. If 9 bu/acre is used as the average, at a moderate price of $7.00/bu, the gross return was $63/acre, the net return was $40/acre on 1.2 million acres, or a total return of $48 million, based on yield response alone.

Ohio:

The 2009-2010 Crop: Approximately 800,000 acres of SRWW were planted in the fall of 2009, down 20% from the previous crop. Late soybean harvest and poor planting conditions led to wheat being planted well after the Hessian fly-safe date in some fields. Planting intentions were up after an excellent crop in 2009, however, the inability to harvest beans interfered with wheat planting, which was either later than desirable or not

at all. In spite of the late planting, however, warm early-winter conditions resulted in very good tiller development and stand establishment.

Spring and early-summer 2010 were wet, with consistent rainfall during the last week of April and throughout the month of May. This lead to moderate to high FHB intensity in some areas, especially fields that reached anthesis between May 19 and 25. Incidence ranged from 3 to 60% and DON contamination from 1 to 18 ppm. This was the biggest scab outbreak since the epidemic of 1996.

Both Stagonospora and powdery mildew were also very severe, with a severity score of 7 out of 10 this year. Temperatures exceeded 90^{o}F on several days in May. Diseases combined with a short grain fill period due to warm temperatures resulted in low to moderate yield and grain quality, with average yield ranging from 40 to 90 bu/acre and test weight from 45 to 60 lb/bu.

Even in areas where the scab levels were high, some of the fields with the lowest levels of vomitoxin, highest yields and test weights were those that received a fungicide application at flowering. However, vomitoxin levels were still higher than 3 ppm in some of the treated fields. Similarly, fields treated for Stagonospora also had better grain yield and quality than fields left untreated. Combining variety resistance with fungicides added a few more bushels to yield and pounds to test weight. Another positive from the 2010 season was the fact that the scab forecasting system did a good job of alerting us about the risk of scab. We did have more scab in 2010 than we had in 2009 and the risk tool clearly indicated that was going to be the case.

The 2010-2011 Crop: This past fall (2010), more than million acres of SRWW were planted. In spite of the relatively poor 2010 wheat season, higher prices were the biggest incentive for planting more wheat. Most of the crop was planted at the recommended time (within the first two weeks after the fly-safe date) due to early soybean harvest, however, dry conditions in late-fall and early-winter, prevented adequate growth and tiller development going into dormancy. This resulted in poor-looking, thin stands going into the winter. However, most of the wheat tilled well after spring top dressing and currently looks good across the state.

Personnel Changes: Dr. Terry Niblack will join the department in the summer of 2011 as the new Chair.

Impact statements: Members of the NCERA-184 were part of a USWBSI-funded coordinated project to develop integrated programs to manage FHB/DON. Researchers at OSU/OARDC also evaluating grain harvesting strategies to reduce DON and Fusarium damages kernels (FDK) in grain harvested from FHB-infected fields. Findings suggested that rotating wheat with soybean (or some other non-host crop), combining the most resistant cultivars with the most effective fungicides, and increasing the speed and volume of the air flowing through the combine during grain harvest provide the greatest reduction in FHB, FDK, and DON. Integrated FHB/DON management recommendations

are being delivered to wheat producers, both locally and nationally, via meetings, workshops, and web-based tools.

In 2010, members of the NCERA-184 successfully completed the first year of a two-year NC-IPM-funded research-extension project to develop disease and economic threshold models to improve foliar disease management in wheat. Beginning in 2009, similar field experiments were conducted in OH, IN, IL, and WI to 1) evaluate the relative disease management, yield, and economic benefits of early-season (pre flag-leaf emergence) foliar fungicide application in soft red winter wheat, 2) evaluate the relevance of existing flag leaf-based foliar fungicide application thresholds and develop novel thresholds based on yield and economic criteria, and 3) Implement training programs for soft red winter wheat production in the North Central region using winter workshops and field demonstrations.

Wisconsin:

Personnel Changes: Dr. Vince Davis, Extension Weed Scientist, joined the Department of Agronomy, commencing on April 1, 2011.

2010 and 2011 Production Statistics: Harvested acres of small grains production (barley, oats, and wheat) in 2010 were down compared to 2009, with a total of approximately 430,000 acres harvested. Crop value, measured as total value, was also down, but still over $100 million combined. The lower harvested acres for wheat were due to reduced acres planted in 2009 because of late corn and soybean harvests in the state (record cool temperatures the entire 2009 growing season).

Yields in 2010 were down from 2009 for all three major small grains. The statewide average for barley was 48 bushels per acre (-11 from 2009), for oats it was 58 bushels per acre (-10 from 2009), and for wheat it was 64 bushels per acre (-4 from 2009).

Looking ahead to the 2011-growing season, acres for our three major small grains are (with change from previous season): barley, 35,000 acres (-10,000), oats, 240,000 acres (-70,000), and wheat, 320,000 (+80,000).

Major Diseases in 2010 Growing Season: Powdery mildew was the most important disease noted throughout the state. At our Chilton Wheat Performance Trial, there was evidence of yield loss with varieties that were susceptible to the disease. The magnitude of this loss was also masked by a delayed harvest of three weeks due to heavy rains. There was evidence of seed shattering at this location.

Rust diseases were low in 2010 in the wheat crops, while Septoria leaf blotch (SLB) was another disease noted. Based on our analyses, there was no evidence of loss due to SLB. In inoculated trials for *Stagonospora nodorum*, our May-June conditions were favorable for disease development (warmer temperatures and more humid than in previous growing seasons). Fusarium head blight (FHB) was noted but incidence and severity were

variable. Nonetheless, there were still reports of dockage due to the FHB, especially in our northeastern production areas.

Current Small Grains Disease Research Activities: Current efforts in WI are focused on the development of disease management recommendations for small grains. To accomplish this goal, research currently encompasses several avenues that link with disease management concepts, including understanding the effect of genotype x environment, chemical management, pathogen biology and yield loss modeling. Multiple projects in WI are multi-state and collaborative with funding from USDA and the USWBSI.

1) Winter Wheat Variety Trials (Arlington, Chilton, Janesville, Lancaster) (Ongoing, Drs. Shawn Conley and Paul Esker)
2) Winter Wheat Fungicide Testing Program (Ongoing, Drs. Shawn Conley and Paul Esker)
3) North Central Integrated Pest Management research on *Stagonospora nodorum* and yield loss in winter wheat (Started 2009, Drs. Paul Esker and Shawn Conley, collaborating with Drs. Pierce Paul (Ohio State U.), Carl Bradley (U. Illinois) and Kiersten Wise (Purdue U.)
4) USWBSI-Integrated Management Trials at Arlington and Lancaster, WI (Started 2009, Drs. Paul Esker and Shawn Conley)
5) HATCH Project – Improved Understanding of *Fusarium* spp. Using Long-Term Rotation Trials in Wisconsin (Started 2010, Drs. Paul Esker, Shawn Conley, and Joe Lauer)
6) New Integrated Management Trials at Arlington, WI (Started 2010, Drs. Paul Esker and Shawn Conley)
7) New Fusarium Head Blight Epidemiology Trials at Arlington, WI (Started 2010, Drs. Paul Esker and Shawn Conley)

Extension Activities: In early 2011, three winter wheat workshops were held at Whitewater, Marshfield, and Kewaunee, WI. A total of 108 participants attended these workshops to learn about wheat growth staging and disease, insect, and weed management. These workshops are currently funded through the NCIPM grant (item 3 listed in research activities). Of the participants who responded to our "clicker" surveys, approximately 70-75% were neutral to agree for wheat growth staging, while there was a bell-shaped distribution with the highest frequency of responses for "neutral" for identifying wheat diseases. Ninety-eight percent of participants either "agreed" or "strongly agreed" that the workshop was valuable, 98% also had similar responses regarding their improvement of both wheat growth stages and wheat diseases and management. Just under 80% of surveyed participants indicated they that would change how they manage their wheat based on this program and 98% indicated that they would recommend the workshop.