**Minutes of the NCERA – 184 Wheat Diseases Technical Committee Meeting**

**March 28, 2017 – Wooster, OH**

**Administrative Advisor**: Dr. Kendall Lamkey, Iowa State University

**Chair**: Dr. Nathan M. Kleczewski, University of Delaware

**Secretary**: Dr. Emmanuel Byamukama, South Dakota State University

**Immediate Past Chair**: Dr. Andrew Friskop, North Dakota State University

**Members and guests in attendance:**

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| Nathan Kleczewski | Delaware |  |
| Terry Spurlock | Arkansas |  |
| Christine Cowger | North Carolina  |  |
| Martin Nagelkirk | Michigan |  |
| Shaukat Ali | South Dakota |  |
| Carl Bradley | Kentucky |  |
| Pierce Paul | Ohio |  |
| Gary Bergstrom | New York |  |
| Ken McClintock | LimaGrain Cereal Seeds |  |
| Joanna Follings | OMAFRA |  |
| Mathew Czeswinski | Grain Farmers of Ontario |  |
| Mack Etienne | Dow AgroSciences |  |
| Dennis Pennington | Michigan |  |
| Erick DeWolf | Kansas |  |
| Madeleine Smith | Minnesota |  |
| Martin Chilvers | Michigan |  |
| Adam Byrne | Michigan |  |
| Mikaela Breunig | Michigan |  |
| Brian Hodge | Ohio |  |
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The 2017 meeting of the NCERA 184 Small Grain Diseases Committee was held at the Ohio State University Research and Development Center (OARDC), Wooster on March 28th. The meeting started at 8:30am with Dr. Larry Madden welcoming everyone to OARDC and giving a brief introduction about OARDC campus. The current NCERA 184 chair, Dr. Nathan Kleczewski also welcomed everyone to the meeting and invited attendants for self-introductions and brief state reports. The notable issues during the 2016 growing season included stripe rust around the region, the southern region had issues with scab, and South Dakota reported ergot issues.

**Topics discussed during the meeting:**

* Dr. Erick DeWolf discussed new stripe rust model based off of soil moisture and temperature. Preliminary results indicate that soil moisture in Texas in Feb seems to be an indicator of stripe rust epidemics in Kansas later in the season. The group discussed experiences in their areas and potential ways to test or improve the model
* Dr. Cristian Cruz gave an overview of wheat blast and concerns about this disease seen globally. Wheat blast can cause sterile heads. Epidemiology of this disease is poorly understood. Fungicides do not seem to be effective. Infection starts in the seed, followed by foliar symptoms. Foliar symptoms are not observed in Brazil where wheat blast is an issue. Up to 100% yield loss can occur in susceptible cultivars. Long and frequent wetness and high temperatures drive epidemics. Data indicate that crop residue influence symptoms on the lower leaves, which translate to head severity. However, the association becomes less clear as the symptoms move to the head. Management- will earlier fungicides be more effective? New breeding strategies need to be developed if the leaf phase is important, because screening typically is directed at the wheat head phase.
* Dr. Christina Cowger raised the issue of Pythium root rot in North Carolina. Issues with heavy rains in the Tidewater region may be increasing the risk for the Pythium root rot. She observed striking issues with varieties and species (oats seemed to not be impacted). Three species of Pythium were identified in areas where Pythium was observed. All were sensitive to mefanoxam and metalaxyl. She added that it was unlikely that Pythium root rots were still having an impact later in the season. It is not known if these are actual pathogens or if this was a one-time occurrence. She mentioned that it was not clear on what was the impact of water logging on Pythium - whether Pythium make the issue worse than hypoxia alone?

**Deoxynivalenol in wheat straw**

Dr. Carl Bradley presented results from studies conducted in Illinois on the impacts of variety, fungicide, and IM on DON in straw, as straw can be used as bedding and also consumed by livestock. Straw is also used as substrate for mushroom production. He reported that QOI did increase DON in the straw and that variety significantly impacted DON in the straw. Moderately resistant variety reduced DON in the straw as well. Fungicides had little impact in reducing the disease. DON was detected 14 days after flowering, and often found at higher concentrations than in the grain. Typically, DON was found near the top of the stem, not at the bottom. Fungus seems to come from the head and move down into the stem. Dr. Gary Bergstrom mentioned that the work he conducted long ago seemed to indicate that the fungus can come in from roots as crown rot and from head as head blight.

**Discussion on Alternaria leaf blight of wheat and barley diseases in New York.**

Dr. Gary Bergstrom discussed Alternaria leaf blight on wheat- a new disease in wheat in the US- first detected in NY. Symptoms appear to be similar to scald in barley. Discussed malting barley issues in NY. Many diseases impact the crop. Issues with protein and quality. Winterkill is also an issue. Noted that comparison on ELISA vs GCMS testing for DON indicates that ELISA tends to overestimate DON. The issue in DON in the grain may not be an issue, as it is removed in the malting process. The major issue is viable *Fusarium graminearum* and development of DON in the germ. Storage of barley grain seems to remove viable *Fusarium graminearum*

**Crown rust in oats discussion**

Dr. Shaukat Ali discussed crown rust on oats. Crown rust is a major issue in oats in SD, MN and ND. It breaks resistance rapidly, and fungicides are not economical in the majority of cases. Buckthorn is the alternate host and is abundant in the area, one of the reasons the disease breaks resistance so readily. The resistant cultivar without a fungicide yielded better than the susceptible or moderately susceptible cultivars with a fungicide. A flag leaf timing gave the best yield response to fungicide application.

**There was a student poster session during lunch.**

**Fungicide Efficacy Table for Wheat Diseases**

* Dr. DeWolf led a discussion on the fungicide efficacy tables
* Fungicides to include this season include are Trivapro and Fortix
* Potential issues with footnotes and recommendations for QoI applications vs vomitoxin were discussed
* Dr. DeWolf will send the group the updated sheet and will ask for suggestions in the near future

**NCERA 184 Business Meeting**

**Call with Administrative Advisor**

* The group called Dr. Kendall Lamkey, administrative advisor for NCERA 184
* The advisor informed the meeting that the NCERA-184 5-year period had been approved.
* He also noted that NCERA-184 is considered to be one of the better of the communities in the region

**Barley fungicide efficacy table**

* Dr. Andrew Friskop is tasked with fungicide efficacy table on the barley. He would like some assistance in determining what diseases. He would also like to do a national barley guide. Needs to know which diseases are most prevalent and would like some images to include in the guide.
* The group discussed integrated management issues for scab in barley. Discussions on harvest restrictions for Quadris and issues with DON were made. Comments and additional efficacy data should be sent to Dr. Friskop

**Wheat fungicide efficacy table**

* Dr. Erick DeWolf discussed the wheat fungicide tables and products. Mentioned that some states may have limits or differences in registered products. The efficacy table was approved by the members.

**2018 FHB Forum ideas for presentation/discussion**

* Efficacy updates on fungicides Miravis.
* Nozzles and research or ag engineer to discuss efficacy and some of these nozzle types.
* Efficacy on head and leaf diseases
* Fusarium head blight and stripe rust. Are there decisions that we are making with FHB that are impacting our integrated management of stripe rust?
* What nozzles are farmers using? Volume air coverage. Nozzle vs volume.
* Fungicide resistance in FHB- Kiersten may have something?
* LAMP assay- potential talk.
* Dr. Gary Bergstron wondered if there is an assay development or screening for resistance. He discussed how we can get better at reaching the growers. Success story on a state that has significantly increased FHB MR varieties. More likely a preproposal needs to be developed to explore extension related means of increasing FHB outreach, etc. Kansas has a great survey that has demonstrated success stories.
* Interest in barley flowering and environment? FHB risk map? Development and next steps?
* Dr. Pierce Paul could present on integrated FHG management project. Maybe if the data is ready- won’t commit yet. He would discuss the recommended variety list and how to organize it.

**Nominations for incoming secretary**

* Dr. Madeleine Smith was nominated by Dr. Kleczewski and was seconded by Dr. Pierce Paul. Dr. Madeleine Smith accepted the nomination. Unanimous vote and Dr. Smith was confirmed the next secretary

**Future Meeting and Location**

Dr. Gary Bergstrom asked about meeting with the Western wheat workers group. GLWW will meet in Michigan. Barley malters are segmented and not likely to be a good group to meet with. Eastern and Southern workers on 3-year cycle. Divisional meeting for APS (NE APS June) SSDW and NCERA 137? Michigan in March 26. Early March is NCERA 137. Perhaps having NCERA 184 on late Monday the 5th and morning of the 6th? Dr. Byamukama will follow up and finalize the meeting venue for 2018.

**Dr. Kleczewski concluded the meeting at 3 pm**

**State Reports and State Based Impact Statements Follow**

**Arkansas**

Terry Spurlock, Assistant Professor and Extension Plant Pathologist

University of Arkansas System Division of Agriculture

**Personnel involved in wheat disease extension and research:** Terry Spurlock, Barry Boney, Mandy Tolbert, Larry Earnest, Linda Martin, Jason Kelly

**2016 wheat production and major diseases**

 According to the USDA National Agricultural Statistics Service, approximately 140,000 acres of wheat were harvested in 2016 with an average yield of 56 bu/acre. Yield was not different from 2015 but acreage was down substantially from the 240,000 acres reported in 2015. This was due in large part to harvest flooding issues and an unseasonably hot and dry fall in 2015 that discouraged planting.

 For the fifth consecutive year, stripe rust was found in early January on tillering wheat. Varieties susceptible to stripe rust were planted in some areas in eastern and far north eastern Arkansas. Many of these fields were not harvested as they were considered total losses prior to maturity. Leaf rust was present in some fields and reported at higher levels in the minor wheat acreage in southwestern Arkansas. Other diseases found were: Septoria tritici blotch and Stagonospora nodorum blotch, wheat soilborne mosaic, loose smut, and Fusarium head blight. These diseases did not appear to substantially impact yield or grain quality. Most observed wheat fields had herbicide damage and there were numerous reports of bird damage due to delayed harvest caused by excessive rainfall. Fields where harvest was delayed often had substantial amounts of sooty head mold.

**Impact statements:**

1.Responded to numerous field calls to determine diseases present and provide management options.

2. Completed multiple foliar fungicide and fungicide x variety trials to provide farmers with current product efficacy data.

**2016 Delaware Report – NCERA 184**

Nathan Kleczewski, Extension Plant Pathologist, University of Delaware

**University of Delaware personnel involved in small grains disease extension and research:** Nathan Kleczewski, Andy Kness, Don Siefrit

**2016 Wheat/Barley Production and Major Diseases in Delaware**

In Delaware a total of 70,000 acres of winter wheat and 37,000 of winter barley were planted, equal to 2015 for wheat and improved by 5000 acres for barley. Statewide averages were 67 and 76 bu / A for wheat and barley, respectively, which was similar to yields from 2015.

2016 started with a very moderate winter, which carried into the spring. Growing conditions stayed cool and rainy throughout the growing period and through flowering for both barley and wheat. Consequently, soil borne viruses such as WSSVM and SSMV were detected in several fields through FGS 8 in several wheat fields. In addition, BYDV was detectable at slightly greater levels, likely due to aphid pressure stemming from the mild winter. Stripe rust was significant in DE and parts of MD where susceptible varieties were planted, and the disease arrived early in the growing season, prior to FGS 8, in several areas. Losses of up to 40 bu/A were observed in some of our fungicide trials as a result of stripe rust. The disease likely overwintered further North as a result of the moderate winter and cool, wet conditions favored disease spread. Suprisingly no significant FHB was detected, despite significant rains during and before the flowering period for wheat. Other diseases observed included Stagonospora leaf blotch, which caused significant (8-10 bu/A) reductions in many fields where a fungicide applied at flowering did not occur.

**Impact Statements**

1. Conducted a survey and small plot research on Fusarium head blight in Delaware. Data were shared with producers and growers at local and regional meetings as well as local publications and websites.
2. Developed a misted nursery to screen commercial varieties for FHB response. Published results online and dispersed at meetings. Grower surveys indicated an annual savings in DE of 1.5 million $US from the misted nursery information.
3. Worked with MS student Phillip Sylvester to develop profitability tool for fungicide use in wheat grown in the Midatlantic.

**Research Publications, Extension Articles, and Videos**

Extension/Outreach publications/blogs/web articles (*Total of 23*)

1. **Kleczewski, N.M.** and K. Everts**.** 2017.2016 Applied Plant Pathology Research Book.
2. **Kleczewski, N.M.** Stripe rust in wheat. University of Delaware Cooperative Extension Factsheet.
3. **Kleczewski, N.M.**, Mehl, H. et al. 2016. Pest Management Guide: Field Crops. Virginia Tech Cooperative Extension (updated annually). (Available online at: <http://pubs.ext.vt.edu/456/456-016/456-016.html>)

Field crops disease management blog – **12 articles** pertaining to small grains disease management located at: <http://extension.udel.edu/fieldcropdisease/>

Weekly Crop Update- **8 articles** pertaining to small grains disease management. Online archives located at: http://extension.udel.edu/weeklycropupdate/

**2016 Illinois Report – NCERA 184**

**Personnel involved in small grains research:** Santiago Mideros and Fred Kolb

**2016 Production and Major Diseases in Illinois**

According to NASS in Illinois, 520,000 acres of winter wheat and 45,000 acres of oats were planted, down 20,000 and up 5,000 acres from last year respectively. Record yield was obtained for wheat with an average of 74 bu/A. Average oat yield was 81 bu/A (also higher than last year). The most significant disease of wheat was stripe rust. Glume blotch was also observed.

**Impact Statements**

1. The University of Illinois’ soft red winter wheat program conducts yearly evaluations of Fusarium head blight resistance on hundreds of materials and has implemented genomic selection for FHB and yield.
2. Experiments have been initiated to map resistance genes to glume blotch and implement genomic selection.
3. Experiments and data analysis continue to identify pathogenesis genes and characterize the populations of *Fusarium graminearum* in Illinois.

**Indiana 2016 State Report for NCERA-184**

**Kiersten Wise, Field Crops Extension Specialist, Purdue University**

**Personnel involved in wheat disease research and extension:**

Kiersten Wise, Gail Ruhl, Mohsen Mohammadi

**2016 in Review**

According to the USDA National Agricultural Statistics Service, approximately 280,000 acres of wheat were harvested in Indiana in 2016, with an average production of 81 bushels/acre, which was an increase in both acreage and yield from 2015. Foliar diseases observed included stripe rust and Stagonospora leaf blotch/Septoria leaf blight. Stripe rust was more severe in 2016 than previously seen for over 10 years. Fusarium head blight (FHB) was observed throughout the state and some fields had high levels of deoxynivalenol present. 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.

**Research Activities and Impact Statements**

Research activities in 2016 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.

Research was also conducted on post-anthesis applications of fungicides in conjunction with timing of inoculum availability. Results indicate that due to prolonged tiller development in soft red winter wheat, applications of fungicide post-anthesis may be equally as effective at reducing FHB and DON as when applied at FGS 10.5.1. 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.

Research is underway to determine the sensitivity of *Fusarium graminearum* to the triazole fungicides metconazole and tebuconazole. We are currently screening isolates from across the United States. This research will help us determine if shifts in sensitivity are occurring to the fungicides recommended for FHB management.

**NCERA-184: Report for Kansas for 2016**

Erick De Wolf and Mark A. Davis

**Short-term outcomes and milestones.** Quantifying the impact of resistant cultivars, planting date, seed-treatment chemicals, and foliar fungicides on diseases gives wheat producers multiple options when managing pathogens. All of these findings should help to improve management of wheat diseases in Kansas that cause an annual loss of about 32 million bushels. However, 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% in the last several years, an annual savings of about $110 million at today’s grain prices.

**Outputs:**

1. Discussions among participants of the NCERA-184 meetings have helped in the efficiency and accuracy of applied disease research efforts on winter wheat in Kansas. The following projects were aided by these meetings:1. determining the reactions of breeding lines and commercial winter wheat cultivars to various diseases (see publications below); 2. dissemination of disease-reaction data of cultivars to wheat producers; and 3. the effect of seed-treatment and foliar fungicides on wheat diseases. 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. Extension publications were developed and refined to help producers make more efficient use of fungicides. We are currently developing web-based tools to deliver this information.
3. A multi-state effort to predict epidemics of Fusarium head blight (FHB) continued during the 2009-2016-growing seasons. This prediction effort includes web-based tools, which display daily estimates of disease risk for 30 states. Commentary developed by a disease specialist in each state is displayed along with the risk maps. Commentary is also distributed via an FHB Alert System that sends email and text messages to mobile devices. The prediction tools received over 7,000 sessions (>14,00 page views) by 4,394 users during the 2016-growing season in the U.S. (April – August). Most of the wheat disease specialists in the 30 states covered by the disease prediction system contributed commentary to the disease prediction effort. A total of 126 commentaries were submitted to date. The FHB Alert System sent commentary more than 900 subscribers in 2016. A survey of participants in the forecasting effort and FHB Alerts estimate the monetary value of the information provided to their farm or business. This survey indicates that the median monetary value of the information provided by the prediction system was $15,000 per user. Combining this figure with use statistics suggests that annual impact of the FHB prediction model exceeds $65 million.

**Publications during 2016:**

Refereed Journal Articles:

1. Grabow, B.S. Shah, D. and De Wolf, E.D. 2016. Environmental conditions associated with stripe rust in Kansas winter wheat. Plant Disease Plant Disease 100:2306-2312.
2. Bockus, W.W., De Wolf, E.D. and Todd, T.C. 2016. Management strategies for barley yellow dwarf on winter wheat in Kansas. Plant Health Progress (doi:10.1094/PHP-RS-15-0050).
3. Rotenberg, D., Bockus, B., Whitfield, A., Hervey, K., Baker, K., Ou, Z., Laney, A., De Wolf, E., and Appel, J. 2016. Occurrence of viruses and associated grain yields of paired and symptomatic and non- symptomatic tillers in Kansas winter wheat fields. Phytopathology 106:202-210.

Plant Disease Management Reports:

1. Bockus, W.W., De Wolf, E. D. and Wegulo, S. N. 2016. Effect of Prosaro fungicide application on Fusarium head blight in seven winter wheat cultivars, 2015. *Plant Disease Management Reports* 10:CF042.
2. Grabow, B. S., Bowden, R. L., Bockus, W. W., and De Wolf, E. D. 2016. Evaluation of foliar fungicides for management of stem rust and Fusarium head blight on winter wheat, 2015. *Plant Disease Management Reports* 10:CF015.
3. Grabow, B. S. and De Wolf, E. D. 2016. Reaction of winter wheat varieties to wheat streak mosaic virus in northwestern Kansas, 2015. *Plant Disease Management Reports* 10:CF014.

Extension and Outreach:

1. De Wolf, E. D., Lolatto, R. and Whitworth, J. R. 2016. Wheat variety disease and insect ratings, 2016. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. Pub. No. MF991.
2. De Wolf, E. D. 2016. Foliar fungicide efficacy ratings for wheat disease management, 2016. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. Pub. No. EP130.
3. Lollato, R., Foster, A. J., Shoup, D., Duncan, S., De Wolf, E., and Haag, L. 2016. Wheat demonstration plots: establishing, conducting, and reporting data. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. Pub. No. MF3317.

Abstracts:

1. **Grabow, B**. De Wolf, E. 2016. Evaluating the association of local weather, soil moisture, climate variables and remotely sensed canopy characteristics with leaf rust epidemics in Kansas. APS Rust Symposium. http://www.apsnet.org/meetings/topicalmeetings/Pages/2016RustAbstracts.aspx.

**2016 Louisiana Report – NCERA 184**

Trey Price, Extension/Research Plant Pathologist, LSU AgCenter

Boyd Padgett, Interim Wheat Specialist, LSU AgCenter

Steve Harrison, Wheat and Oat Breeder, LSU AgCenter

**LSU AgCenter personnel involved in wheat disease extension and research:** Trey Price, Myra Purvis, Paul Washam, Clayton Hollier, Boyd Padgett, Steve Harrison, Rick Mascagni, Brenda Tubana, Kelly Arceneaux

**2016-2017 Louisiana Disease Summary**

It was another tough year for wheat producers in Louisiana. Planting conditions during the Fall of 2016 were very dry; coupled with low commodity prices resulted in the lowest wheat acreage (~16,000 acres) in many years. Most of the producers that were able to achieve a stand were blessed with decent growing conditions throughout the winter; however, mild temperatures resulted in vernalization problems in many varieties. Stripe rust was widespread and moderate during the early spring of 2017, and leaf rust was widespread and severe during the late spring of 2017. During heading and flowering, rainy and warm conditions again resulted in a widespread outbreak of Fusarium head blight in earlier maturing varieties; the third severe outbreak in as many years. Preliminary estimated losses due to scab alone are near 20%. At the time of this report, wheat in the state has not been harvested and some later varieties are beginning to flower as rainy patterns continue. Our field experiments indicate that most fungicides remain effective and economical on stripe rust and leaf rust. In trials with later applications closer to flowering, it appears that we have management options for wheat scab, albeit with limited efficacy (maximum 50%).

Other issues of note during 2016-2017 included: bacterial streak, herbicide drift, stem rust, barley yellow dwarf, loose smut, and Septoria leaf blotch.

**Selected Publications**

Harrison, S., et al. 2016. Small grain performance trials. LAES Research Summary. No. 208. [www.wheat.lsu.edu](http://www.wheat.lsu.edu)

Padgett, B., P. Price, and S. Harrison. 2016 March wheat update. Louisiana Crops Newsletter. 6:3 March 2016.

Padgett, B., S. Harrison, and P. Price. Wheat variety performance and production practices in Louisiana. Louisiana Crops Newsletter. 6:10 October 2016.

Price, T., M. Purvis, B. Padgett, S. Harrison, E. Larson, J. Bibb, J. Buck, M. Mergoum, J. Johnson, and J. Youmans. 2016. Effect of cleaning and fungicide seed treatment on stand establishment in scabby seed lots in the southern U. S. Proc. National Fusarium Headblight Forum. December 6-8, 2016 – St. Louis, MO. 33.

Price, P. and B. Padgett. Wheat and corn pathology update. Louisiana Crops Newsletter. 6:4 April 2016.

Price, P. and B. Padgett. Fusarium head blight of wheat (scab). LACA Turnrow Talk. 23:Winter 2016.

Price, P. and B. Padgett. 2016. Conditions favorable for Fusarium head blight (scab) in wheat again this year. Web blog. Online: [www.louisianacrops.com](http://www.louisianacrops.com)

Price, P. and B. Padgett. 2016. Wheat and corn pathology update. Web blog. Online: [www.louisianacrops.com](http://www.louisianacrops.com)

Price, P., M. A. Purvis, and H. Pruitt. 2016. Effect of selected fungicides applied at F4 and F8 on stripe rust and scab of wheat, 2015. 10:CF003.

Price, P., M. A. Purvis, and H. Pruitt. 2016. Effect of selected fungicides applied at F6, F8, or F10.1 on stripe rust and scab of wheat, 2015. 10:CF004.

Price, P., M. A. Purvis, and H. Pruitt. 2016. Effect of selected fungicides applied at F8 on stripe rust and scab of wheat, 2015. 10:CF005.

Price, P., M. A. Purvis, and H. Pruitt. 2016. Effect of selected seed treatments on wheat stand and yield, 2015. 10:ST016.

“Low prices for wheat, feed grains likely to persist.” By Bruce Schultz. Delta Farm Press – January 27, 2016.

**NCERA 184 Michigan Report, 2016**

*Submitted April, 2017*

Martin Nagelkirk, MSU Extension Educator, Michigan State University

***Personnel:***

Martin Chilvers, Adam Byrnes, Mikaela Breunig and Eric Olson, Plant, Soil and Microbial Sciences, Michigan State University; and Martin Nagelkirk, MSU Extension, Michigan State University

***Small grain disease summary:***

Michigan’s small cereal grain crops consist almost exclusively of soft winter wheat. In 2016, wheat growers harvested 570,000 acres. The acreage represents two subclasses: soft white winter and soft red winter wheat.

During the 2016 season, Stripe rust was found at unprecedented levels. It was first seen at the early jointing stages and by flowering could readily be found in susceptible varieties across the state. In many cases, the disease led to yield losses exceeding 20 percent where susceptible varieties did not have the benefit of protective fungicides. Other foliar diseases commonly seen in MI (Powdery mildew, Septoria and Stagonospora leaf blotch, and leaf rust) remained at low to moderate levels.

As the crop matured, there was little evidence of Fusarium head blight (FHB). In fact, symptoms were negligible in many fields. Consistent with this observation, DON levels in harvested grain were mostly well below 1 ppm.

***Impact addressing risks associated with Fusarium head blight:***

The probability of losses due to FHB has been reduced by at least 30 percent in recent years. University research and Extension efforts have led to the extensive use of fungicides. Currently, approximately 95 percent of the soft white acreage and 60 percent of the soft red acreage receives a recommended fungicide at flowering to combat FHB as well as foliar diseases.

The risk of losses to FHB have also been significantly reduced due to MSU’s research and Extensions initiatives to help growers adopt varieties containing improved resistance to the disease. Comparing grower responses to a [2011 survey](http://fieldcrop.msu.edu/uploads/files/Variety%20use%20in%20MI-1-23-12.pdf) and a [2016 survey](http://fieldcrop.msu.edu/uploads/files/Summary_2016_survey_2.pdf), acreage hosting a fully susceptible soft red variety was reduced from 91 to 30 percent. Further, the acreage of soft red varieties ranked as being moderately resistant to FHB increased from 0 to 22 percent. This progress is not reflected in the use of soft white varieties, but significant improvement is anticipated within the next five-year period as improved resistance is starting to be seen in newer high yielding varieties.

***Impact addressing risks associated with Stripe rust:***

MSU personnel seized the opportunity to address Stripe rust during 2016 epidemic thereby reducing the risk to the existing crop and those in subsequent seasons. Early on during the 2016 season growers were alerted to the risk of Stripe rust and informed of appropriate action using multimedia, newsletters and field meeting presentations. In addition, the emphasis of some field research was diverted to addressing Stripe rust relative to fungicide efficacy, fungicide application timing and varietal response. Further, MSU’s wheat breeding team was able to rank varietal resistance utilizing variety performance trials at two locations. The [summary](http://fieldcrop.msu.edu/uploads/files/strip_rust_2017.pdf) was shared with industry and growers to help confront the immediate threat and to serve as a reference for future seasons.

***Fact sheets, articles and research summaries:***

L Siler et al (2016) Michigan State Wheat Performance Trials. <https://varietytrials.msu.edu/wp-content/uploads/2016/08/2016-MSU-Wheat-Report-Experimental-FINAL-08_01_16.pdf>

M. Breunig, A.M. Byrne, M.I. Chilvers, M. Nagelkirk (2016) Effects of post-flowering applications of fungicides on stripe rust control and performance of winter wheat, 2016. Report 11:CF027 <https://www.plantmanagementnetwork.org/pub/trial/PDMR/volume11/abstracts/CF027.asp>

A.M. Byrne, M.I. Chilvers, M. Breunig, E. Olson, L. Siler Effect of fungicides on the performance of winter wheat in Michigan, 2016.

<https://www.plantmanagementnetwork.org/pub/trial/PDMR/volume11/abstracts/CF028.asp>

M Nagelkirk., M.I Chilvers. (2016) Managing Fusarium Head Blight

<http://fieldcrop.msu.edu/uploads/files/FHB_Sheet_2016_final.pdf>

M Nagelkirk. (2016) Stripe rust susceptibility of Michigan wheat varieties <http://fieldcrop.msu.edu/uploads/files/strip_rust_2017.pdf>

M Nagelkirk, E Olson, D Pennington (2016) Results of a survey of Michigan growers to identify wheat varieties being grown and extent to which genetic resistance to Fusarium head blight is being utilized . <http://fieldcrop.msu.edu/uploads/files/Summary_2016_survey_2.pdf>

***Newsletter and Articles;***

Wheat Update, (7 issues of a newsletter for MI wheat growers, 2016) <http://www.miwheat.org/education/production-articles/>

News releases <http://msue.anr.msu.edu/pages/search_results?query=nagelkirk>

***Presentations to growers related to wheat diseases and management, 2016:***

Wheat field meetings, 2016: Mt Pleasant, May 25; Richville, June 15; Marlette, July 7

Pest and Crop Management Seminars, Chilvers (five locations: East Lansing, Frankenmuth, Peck, Dundee and Alma)

Great Lakes Crop Summit, Nagelkirk & Pennington, Mt Pleasant, MI

Ag Update series, Nagelkirk (five locations: Lapeer, Ubly, Richville, Caro, Sandusky

2017 Minnesota Report - NCERA 184

Madeleine Smith, Ruth Dill-Macky and Jochum Wiersma

**University of Minnesota personnel involved in Small Grains research and extension**\***:** James Anderson, Ruth Dill-Macky, Yanhong Dong, Melania Figueroa, Carol Ishimaru, Yue Jin, Shahryar Kianian, James Kolmer, Pablo Olivera, Matthew Rouse, Kevin Smith, Madeleine Smith\*, Brian Steffenson, Les Szabo, and Jochum Wiersma\*.

**The 2016 Growing Season**

The acreage of small grains in Minnesota decreased substantially from 2015 to 2016 due to projected high prices for corn, a lack of barley and oat contracts and a wet start to the 2016 growing season. The acreage planted to hard red spring wheat dropped from 1.48 million acres in 2015, to 1.31 million acres in 2016. The planted winter wheat acreage dropped from 52,000 acres to 8,000 acres in 2016, making this the smallest winter wheat crop in at least six years. Spring wheat yields, at 59 bu/A, were the second highest ever recorded, being only 1 bu/A below the average highest recorded state yield of 2015. Winter wheat yields for the state averaged 61 bu/A, which was significantly higher than any of the previous four years. There are no official (USDA) statistics available for the area planted to durum wheat in Minnesota. The acreage planted to barley fell from 135,000 acres in 2015 to 95,000 acres in 2016. The average yield of barley in Minnesota for 2015 was 66 bu/A, which was 11 bu/A below the average yield in 2015. At 210,000 acres planted, the acreage planted to oat in the state was over three times that of barley, though this was still a drop from the 2015 crop when 280,000 acres were planted. The average yield for oat in Minnesota was 68 bu/A, down from 78 bu/A in 2015.

The planting of small grains in Minnesota was started by the second week of April in 2016, on par with the 5-year average. A warm and wet start to the season in parts of the state led to the development of root rots, in particular *Fusarium* root and crown rot, which resulted poor stand establishment from seedling mortality and contributed to the appearance of whiteheads later in the season. Stripe rust of wheat appeared in the early part of the season, the result of heavy inoculum pressure from the southern US. Despite the large proportion of acres planted to the stripe rust susceptible wheat varieties Faller and Prosper, stripe rust was not able to take hold or cause significant damage as temperatures warmed quickly soon after the first observations of stripe rust in the state. Leaf rust of wheat and crown rust of oat were generally low across the state. Tan spot was widespread, as were the *Septoria/Stagonospora* blotches, in wheat but these diseases were generally managed effectively by growers with early fungicide applications. Higher than average temperatures and high (≥ 80%) relative humidities, particularly during the period of grain filling, likely contributed to the depressed yields of small grains in 2016. Rainfall events from heading through early grain filling prevented many growers from applying fungicide at the correct timing and resulted in *Fusarium* infections. Heavy *Fusarium* head blight (FHB or scab) infections were reported across the state and the grain was discounted for DON contamination as many of these crops exceeded 2 ppm. The above average moisture also led to the development of bacterial leaf streak (BLS) in both wheat and barley in many parts of the state, although generally the symptoms did not appear until late in the season. In some instances hail exacerbated infections and heavy flag leaf infections likely impacted yield. Rains also delayed harvest for some crops, especially those in the northern Red River Valley, though the crop quality was average to slightly above average across the state.

**Changes in Personnel**

The University of Minnesota has partnered with PepsiCo to revitalize oat improvement efforts in Minnesota. Dr Kevin Smith has taken on the responsibilities for the oat breeding program for the University of Minnesota expanding his responsibilities from barley. A number of plant pathology personnel, notably Dill-Macky, Figueroa, Kianian and Smith, have also become active in oat pathology research through the Oat Rust Initiative and with support of the Stakman-Borlaug Center for Sustainable Plant Health.

**Activities**

Screening of advanced breeding material for Fusarium Head Blight (wheat, barley and oat), leaf rust (wheat), stem rust (wheat), net form net blotch (barley), spot form net blotch (barley), bacterial leaf streak (wheat and barley), loose smut (oat), Septoria speckled leaf blotch (barley), spot blotch (barley), powdery mildew (wheat and barley), scald (barley) was conducted in 2016 in uniform, inoculated field nurseries and/or greenhouse tests. Phenotypic data are used to develop and validate marker assisted selection, genomic selection and in the association mapping of disease resistance. Ultimately this work aids in the development of wheat, barley and oat germplasm with improved resistance to multiple diseases.

Testing of fungicides on wheat and barley for efficacy to Fusarium head blight was conducted as part of a national cooperative effort and recommendations of the best management practices are made available to growers through the US Wheat and Barley Scab Initiative (USWBSI) and MAES websites.

**Outputs**

The reactions of hard red spring wheat, barley and oat varieties to various diseases prevalent in Minnesota were disseminated to small grains producers on the Minnesota Variety Trials Results. This information provides growers with options and aids them in selecting cultivars that are appropriate for their area and risk level for the diseases prevalent in Minnesota.

**Publications**

Winter, M., Samuels, P.L., Dong, Y., and Dill-Macky, R. (2016). Deoxynivalenol (DON) and nivalenol (NIV) play a role as virulence factors for wheat root and stem base infection by *Fusarium culmorum* and *F. graminearum*. In: *Proceedings of the 2016 National Fusarium Head Blight Forum*, St. Louis, Missouri, USA, December 4-6, 2016, pp. 65-66.

Kumar, J., Ghavami, F., Pirseyedi, S.M., Kumar, A., Xu, S., Elias, E.M., Dill-Macky, R., and Kianian, S.F. (2016). Epigenetic control of FHB in durum wheat. In: *Proceedings of the 2016 National Fusarium Head Blight Forum*, St. Louis, Missouri, USA, December 4-6, 2016, p. 82.

Dill-Macky, R. and Van Sanford, D. (2016). (2016). Managing Fusarium head blight: successes and future challenges. In: *Proceedings of the 8th Canadian Workshop on Fusarium Head Blight*, Ottawa CANADA, November 20-22, 2016, p. 34.

Moraes, W.B., Anderson, K.F., Cowger, C., Dill-Macky, R., Madden, L.V., and Paul, P.A. (2016). Effect of pre-anthesis rainfall patterns on Fusarium head blight and deoxynivalenol: a multi-state study. (APS Annual Meetings, Tampa FL, July 30-Aug 3, 2016) *Phytopathology*, **106**: S4.131.

Figueroa, M., Li, F., Omidvar, V., Rottschaefer, S.M., Miller, M.E., Milne, R., Karaoglu H., Singh, D., Ayliffe, M., Upadhyaya, N., Moscou, M., Dill-Macky, R., Lagudah, E., Dodds, P.N., Park, R.F., and Kianian, S.F. (2016). A multi-pronged approach to elucidate the molecular basis of rust virulence and non-host resistance in *Brachypodium distachyon*. In: 2016 ISMPMI Congress Abstracts, S4-2. (2016 International Society for Molecular Plant-Microbe Interactions XVII Congress, Portland OR, July 17-21, 2016.)

Figueroa, M., Rottschaefer, S.M., Miller, M.E., Omidvar, V., Karaoglu H., Li, F., Singh, D., Upadhyaya, N., Dill-Macky, R., Dodds, P.N., Park, R.F., and Kianian, S.F. (2016). Development of genomic and breeding resources to uncover virulence mechanisms in oat crown rust. In: 2016 ISMPMI Congress Abstracts, P17-522. (2016 International Society for Molecular Plant-Microbe Interactions XVII Congress, Portland OR, July 17-21, 2016.)

Adhikari, A., Dill-Macky, R., and Smith, M.J. (2016). Screening Ethiopian and Eritrean barley accessions for resistance to the net form of net blotch. In: *Proceedings of The 12th International Barley Genetics Symposium*, Minneapolis MN, June 26-30, 2016. Poster: 3.

Curland, R.D., Gao, L., Bull, C.T., Vinatzer B.A., Dill-Macky, R., and Ishimaru, C.A. (2016). Differentiation of *Xanthomonas translucens* pathovars in wheat and barley. (APS North Central Division Meeting, St. Paul MN, June 7-9, 2016) *Phytopathology*, **106**: S4.187.

Omidvar, V., Miller, M.E., Rottschaefer, S.M., Karaoglu, H., Li., F., Singh, D., Upadhyaya, N., Dill-Macky, R., Dodds, P.N., Park, R.F., Kianian, S.F., and Figueroa, M. (2016). Building a molecular toolbox to elucidate virulence mechanisms and genomic variability in *Puccinia coronata* f. sp. *avenae.* (APS North Central Division Meeting, St. Paul MN, June 7-9, 2016) *Phytopathology*, **106**: S4.192.

Stanton, J.L., Smith, M.J. and Dill-Macky, R. (2016). Testing field equipment for the application of *Xanthomonas translucens* pv. *undulosa* the causal agent of bacterial leaf streak of wheat. (APS North Central Division Meeting, St. Paul MN, June 7-9, 2016) *Phytopathology*, **106**: S4.193.

Dill-Macky, R. (2016). Pre-harvest management strategies for mycotoxins in cereals in the USA: adapting to change. In: *Book of Abstracts of the 9th conference of the World Mycotoxin Forum and the XIVth IUPAC International Symposium on Mycotoxins*, Winnipeg, CANADA, June 6-9, 2016. p. 54.

Dill-Macky, R., Pereyra, S., Bergstrom, G.C., and Hofgaard, I.S. (2016). The role of cultural practices in the control of Fusarium head blight of wheat and other cereals. In: *Book of Abstracts of the 5th International Symposium on Fusarium Head Blight and the 2nd International Workshop on Wheat Blast*, Florianopolis, BRAZIL, April 6-9, 2016, p. 80.

Paul, P.A., Salgado, J. D., Ames, K., Bergstrom, G.C., Bradley, C., Byamukama,E., Cummings, J., Chilvers, M., Dill-Macky, R., Friskop, A., Gautam, P., Kleczewski, N., Madden, L.V., Nagelkirk, M., Ransom, J., Ruden, K., Wegulo, S., and Wise. K. (2016). More than a decade of coordinated research to develop integrated management programs for Fusarium head blight of wheat. In: *Book of Abstracts of the 5th International Symposium on Fusarium Head Blight and the 2nd International Workshop on Wheat Blast*, Florianopolis, BRAZIL, April 6-9, 2016, p. 81.

**2016 Nebraska Report – NCERA 184**

Stephen Wegulo, Extension Plant Pathologist, University of Nebraska-Lincoln

**University of Nebraska-Lincoln personnel involved in wheat disease extension and research:** Stephen Wegulo, Tony Adesemoye, Janelle Millhouse, Julie Stevens, Ryan Haverkamp

**2016 Wheat Production and Major Diseases in Nebraska**

In Nebraska in 2016, winter wheat harvested was approximately 71 million bushels compared to 46 million bushels in 2015. Area harvested for grain totaled 1.31 million acres compared to 1.21 million acres in 2015. Planted area was 1.37 million acres compared to 1.49 million acres in 2015. Yield was 54 bushels per acre compared to 38 bushels per acre in 2015. The much better production in 2016 compared to 2015 was because there was no Fusarium head blight (FHB) epidemic in 2016 whereas in 2015 the worst FHB epidemic in recent memory occurred. Also, in 2016 the impact of stripe rust was much less than in 2015 when it was very severe and widespread.

During the 2016 wheat growing season, the main disease was stripe rust (estimated to reduce state yields by 7%) which was found widely across Nebraska and adjacent states. Due to a prolonged fall with cool to moderate temperatures and abundant inoculum (spores), stripe rust was widespread across the state in fall-planted wheat. It was most severe in the Panhandle, but moderate to severe levels occurred in localized spots in wheat fields elsewhere in the state. As opposed to previous years and despite the additional costs of fungicides, many fields were sprayed with fungicides to protect yield. Fusarium head blight (FHB) was minimal in all FHB-prone wheat-growing regions of the state.  Both incidence and severity of FHB in individual growers’ fields were trace to low and DON levels were minimal or negligible. Leaf rust developed to moderate levels in some fields that were not sprayed, but was not as widespread as stripe rust. Low to moderate levels of Septoria tritici blotch, tan spot, and powdery mildew were present in some fields that were not sprayed. Moderate to severe levels of bacterial streak and black chaff were present at Mead (southeast Nebraska) in a breeding nursery where susceptible wheat lines were planted. Take-all was present at low levels in some fields especially in the western part of the state. Soilborne pathogens, especially *Fusarium* and *Rhizoctonia* were not as widespread as foliar pathogens but they were a concern in 2016. They caused root and crown rots, uneven stand establishment, and bare patches. Dr. Tony Adesemoye is involved in an ongoing survey of soilborne pathogens in Nebraska wheat coupled with research on the diversity of these pathogens and their impact on wheat production.

**Impact Statements**

1. Participated in and presented at the 2016 Crop Production Clinics. Estimated impact: $26 million to Nebraska Agriculture.

2. Participated in and presented at six wheat field days. Estimated impact: $7 million.

3. Did three Market Journal (MJ) TV interviews. Estimated total MJ impact: over $40 million annually to Nebraska's production agriculture.

5. Did four KRVN radio interviews. KRVN broadcasts agricultural news to Nebraska, Kansas, and parts of four other states. Estimated impact: $6 million.

6. Conducted six wheat disease surveys. Estimated impact: $8 million.

**Research Publications, Book Chapters, and Extension Newsletter Articles**

Research Publications (3 Total):

1. Wosula, E. N., McMechan, A. J., Oliveira-Hofman, C., **Wegulo, S. N.,** and Hein, G. L. **2016.** Differential transmission of two isolates of *Wheat streak mosaic virus* by five wheat curl mite populations. Plant Dis. 100:154-158.

2. Byamukama, E., Tatineni, S., Hein, G. L., McMechan, J. A, and **Wegulo, S. N. 2016.** Incidence of *Wheat streak mosaic virus*, *Triticum mosaic virus,* and *Wheat mosaic virus* in wheat curl mites recovered from maturing winter wheat spikes. *Plant Dis.* 100:318-323.

3. Nguy-Robertson, A. L., Zygielbaum, A. I., McMechan, A. J., Hein, G. L., **Wegulo, S. N.,** Stilwell, A. R., and Smith, T. M. **2016.** Developing the framework for a risk map for mite vectored viruses in wheat resulting from pre-harvest hail damage. *Crop Prot.* 89:21-31.

Book Chapters (1 Total):

2. **Wegulo, S.N. 2016.** Integrated wheat disease management. In: Achieving Sustainable Cultivation of Wheat Vol. I. P. Langridge (Ed.). Burleigh Dodds Science Publishing, Cambridge, UK. 25 pages.

Extension Newsletter Articles (15 Total):

1. **Wegulo, S. 2016.** Wheat disease management tips for 2017. CropWatch. December 9. <http://cropwatch.unl.edu/2016/wheat-disease-management-tips-2017>.

2. **Wegulo, S. 2016.** Stripe, stem, and leaf rust in fall-planted wheat. CropWatch. November 11. <http://cropwatch.unl.edu/2016/stripe-stem-and-leaf-rust-fall-planted-wheat>.

3. **Wegulo, S. 2016.** Fall strategies for managing wheat diseases. CropWatch. September 2. <http://cropwatch.unl.edu/2016/fall-strategies-managing-wheat-diseases>.

4. Klein, R., Werle, R., Creech, C., Bradshaw, J., **Wegulo, S.,** Hein, G. L., Adesemoye, A. O., McMechan, J. **2016.** Control volunteer winter wheat and other weeds now to increase and protect 2017 yields, income. CropWatch. June 23. <http://cropwatch.unl.edu/2016/control-volunteer-winter-wheat-and-other-weeds-now-increase-and-protect-2017-yields-income>.

5. **Wegulo, S. 2016.** Wheat disease update. CropWatch. June 10. <http://cropwatch.unl.edu/2016/wheat-disease-update-1>.

6. **Wegulo, S.,** DeBoer, K., Harveson, R. **2016.** Stripe rust increasing; spray your wheat to protect the flag leaf. CropWatch. June 2. <http://cropwatch.unl.edu/2016/stripe-rust-increasing-protect-flag-leaf>.

7. Wegulo, S. **2016.** Wheat disease update - late May. CropWatch. May 26. <http://cropwatch.unl.edu/2016/wheat-disease-update-late-may>.

8. Wegulo, S. **2016.** Head diseases, barley yellow dwarf in wheat. CropWatch. May 19. <http://cropwatch.unl.edu/2016/head-diseases-barley-yellow-dwarf-wheat>.

9. Wegulo, S. **2016.** Wheat disease update. CropWatch. May 13. <http://cropwatch.unl.edu/2016/wheat-disease-update-0>.

10. **Wegulo, S.,** Klein, R. **2016.** Stripe rust widespread in wheat but mostly at low levels. CropWatch. May 6. <http://cropwatch.unl.edu/2016/stripe-rust-widespread-wheat-mostly-low-levels>.

11. Wegulo, S. **2016.** Conditions favorable to disease growth in wheat. CropWatch. April 29. <http://cropwatch.unl.edu/2016/wheat-disease-update>.

12. **Wegulo, S.,** Harveson, R., Rees, J. **2016.** After rains, some wheat diseases increasing. CropWatch. April 22. <http://cropwatch.unl.edu/2016/after-rains-some-wheat-diseases-increasing>.

13. **Wegulo, S.,** Harveson, R., Wright, R., Rees, J. **2016.** Srtipe rust and aphids confirmed in Nebraska wheat. CropWatch. April 15. <http://cropwatch.unl.edu/2016/stripe-rust-aphids-nebraska-wheat>.

14. **Wegulo, S.,** Rees, J. **2016.** Wheat leaf rust confirmed in Nebraska. CropWatch. March 31. <http://cropwatch.unl.edu/2016/wheat-leaf-rust-confirmed-nebraska>.

15. **Wegulo, S.,** Harveson, R. **2016.** Wheat rust in Kansas; start scouting Nebraska fields. CropWatch. March 22. <http://cropwatch.unl.edu/2016/wheat-rust-kansas-start-scouting-nebraska-fields>.

**2016-17 NCERA-184 State Report – North Dakota**

Andrew Friskop, Cereal Crop Extension Plant Pathologist, North Dakota State University

Scott Meyer, Research Technician, NDSU

Jessica Halvorson, Research Specialist, NDSU

Elizabeth Crane, Research Specialist, NDSU

**Hard Red Spring Wheat**

North Dakota (ND) spring wheat growers seeded 6.0 million acres in 2016 with a crop value exceeding $1.5 billion. Tan spot was the most prevalent disease according to the Integrated Pest Management Survey that is conducted throughout the growing season. Stripe rust was detected on May 23rd in both SW and SE ND. However, the environmental conditions (low occurrences of prolonged moisture periods) experienced in late May and early June hampered stripe rust development. Ergot continues to be problematic in SW ND. Fusarium head blight (FHB) damage was significant in NC and NW ND and DON levels resulted in several rejected truck loads.

**Hard Red Winter Wheat**

Winter wheat acreage continues to decrease in the state of ND and last year only 130,00 acres were seeded. Fungal leaf spots continue to be the most prevalent disease as most wheat is seeded into wheat stubble.

**Durum**

A total of 1.4 million acres of durum were seeded in 2016, which is up from the 2015 growing season. Most of the durum acreage in ND is located in the NC and NW regions of the state. Above average rainfall in late June combined with moderate to high humidity in July created a high risk for FHB. DON levels exceeding 25 ppm were observed at points of sale. Another common occurrence were seed lots with low amounts of Fusarium damaged kernels, yetDON levels exceeded 5 ppm. Planting date heavily influenced differences in DON levels as some of the late planted crop had little to no quality issues.

**Barley**

Barley was seeded on 740,000 acres in 2016 and. The most problematic foliar disease was net blotch (both forms) and in some cases resulted in significant yield losses. FHB and DON was not problematic for most barley growers as they tend to spray for FHB.

**Field Research**

Foliar fungicide efficacy, timing and seed treatment trials were completed on several small grain market classes in 2016. The information is heavily used at winter Extension meetings and field days. The USWBSI integrated management trials were conducted on four small grain market classes at five locations. This information is heavily used by Extension specialists, Extension agents, crop consultants, growers and other agricultural professionals.

**Impacts**

* The NCERA-184 Fungicide Efficacy table was distributed to county agents, growers, and other agricultural professionals in 2016-2017.
* Timely commentary was provided on the national FHB prediction model website and the NDSU Small Grains Disease Forecasting Model.

**Research Publications:**

Paul, P.A., Salgado, J.D., Ames, K., Bergstrom, G., Bradley, C., Byamukama, E., Cummings, J., Chilvers, M., Dill-Macky, R., Friskop, A., Gautam, P., Kleczewski, N., Madden, L.V., Nagelkirk, M., Ransom, J., Ruden, K., Wegulo, S., and Wise, K. More than a decade of coordinated research to develop integrated management programs for Fusarium head blight of wheat. In: Proceedings of 5th International Fusarium Head Blight Symposium - Florianopolis Brazil, 2016 (Poster).

Haugen, S., Fitterer, S., Carruth, D., Halvorson, J., Meyer, S., and Friskop, A. Efficacy of fungicides for the management of oat crown rust (*Puccinia coronata*). In: Proceedings of the American Phytopathological Society 2016 Rust Symposium.  Pensacola Beach, FL, March 7th-9th, 2016 (Poster).

Schuh, C., Jordahl, J. and Friskop, A. Impact of a flag leaf fungicide application in hard red spring wheat on management of stripe rust and protection of yield in greenhouse trials. In: Proceedings of the American Phytopathological Society 2016 Rust Symposium.  Pensacola Beach, FL, March 7th-9th, 2016 (Poster).

Halley, B., Breiland, M., Friskop, A., and Acevedo, M. Evaluation of Northern Great Plains hard red spring wheat genotypes for resistance to the local population of *Puccinia striiformis* (wheat stripe rust). In: Proceedings of the American Phytopathological Society 2016 Rust Symposium.  Pensacola Beach, FL, March 7th-9th, 2016 (Poster).

Gross, P., Chapara, V., Ransom, J., Brueggeman, R., Schatz, B., Kalil, A., Fonseka, D., Deplazes, C., Arens, A., and Friskop, A. 2016. The use of integrated management strategies to lower Fusarium head blight and DON in spring barley. Proceedings of the 2016 National Fusarium Head Blight Forum, Dec. 4-6, 2016, St. Louis, MO.  US Wheat and Barley Scab Initiative publishers, East Lansing, MI/Lexington, KY.

**Extension Publications:**

Friskop, A., Markell, S., and Khan, M. 2016. 2017 North Dakota Field Crop Plant Disease Management Guide. North Dakota Cooperative Extension Service Publication PP-622.

Ransom, J., Green, A., Simsek, S., Friskop, A., Breiland, M., Friesen, T., Liu, Z., Zhong, S., Rickertsen, J., Eriksmoen, E., Hanson, B., Martin, G., Pradhan, G., Ostlie, M. 2016. North Dakota Hard Red Spring Wheat Variety Trial Results for 2016 and Selection Guide. North Dakota Cooperative Extension Service Publication A574-16.

Ransom, J., Elias, E., Friskop, A., Friesen, T., Liu, Z., Manthey, F., Rickertsen, J., Eriksmoen, E., Hanson, B., Pradhan, G., Ostlie, M. 2016. North Dakota Durum Wheat Variety Trial Results for 2016 and Selection Guide. North Dakota Cooperative Extension Service Publication A1067-16.

Ransom, J., Brueggeman, R., Horsley, R., McMullen, M., Schwarz, P., Friskop, A., Schatz, B., Zwinger, S., Ostlie, M., Martin, G., Rickertsen, J., Eriksmoen, E., Hanson, B., and Gautam, P. 2016. North Dakota Barley, Oat and Rye Variety Trial Results for 2016 and Selection Guide. North Dakota Cooperative Extension Service Publication A1049-16.

NDSU Extension Articles

* Friskop, A. Cereal aphids and BYDV. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Early season fungicide applications in wheat. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Small grain virus samples. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Stripe rust found in North Dakota. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Disease Forecasting Models. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Fusarium head blight risk. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Fusarium head blight update. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Stripe rust update and fungicide management. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A and Ransom, J. Key growth stages in wheat. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Fusariu head blight update. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Fungal foliar diseases of barley and fungicide management. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. IPM survey – wheat disease update. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Fusarium head blight risk. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Fusarium head blight update. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Scab risk for late-seeded small grains. 2016. North Dakota State University Crop and Pest Report.
* Friskop, A. Wheat foliar disease update. 2016. North Dakota State University Crop and Pest Report.

**2017 South Dakota State Report – NCERA 184**

**SDSU Personne**l **involved in wheat disease extension and research:** Emmanuel Byamukama, Shaukat Ali, Marie Langham, Connie Strunk, and Connie Tande

**2016 wheat production and major diseases**

Wheat acreage in South Dakota was 2.2 m acres (1.2 m acres winter wheat and 1 m spring wheat) for 2016. This was a 17% decrease in acres compared to 2015. The decrease in wheat acreage in South Dakota is attributed, in part, to low grain prices for wheat and to winter kill in the case of winter wheat acreage. We have also heard some producers mention that wheat requires application of fungicides which reduces profitability of the crop. Winter wheat yields averaged 58 bu/acre (record yield, 14 bu/acre above 2015 average yield) and spring wheat yield average was 45 bu/acre (3 bu/acre below 2015 yield). However, the high winter wheat yield was associated with low protein content which led to dockage at the grain elevators.

The 2016 wheat season in South Dakota was characterized by cool and wet spring that translated later to dry but cool weather towards wheat heading for winter wheat. These conditions were not favorable for most diseases to develop in winter wheat and as a result, there was very low level of Fusarium head blight (FHB) in winter wheat throughout the state. Spring wheat flowering coincided with some level of moisture in some parts of the state and moderate levels of FHB developed in spring wheat. Stripe rust was detected in the state as early as April last year, indicating that it had overwintered in South Dakota. However, stripe rust was only a concern in a few winter wheat fields in southcentral South Dakota. Bacterial leaf streak has continued to be a problem in both spring wheat and winter wheat. Leaf spots (Tan spot, Stagonospora blotch) and powdery mildew also developed owing to the wet spring weather especially in wheat fields planted into wheat stubble. Other minor diseases that developed included ergot, barley yellow dwarf, and leaf rust which came in quite late in the season.

**Impact statements**

1. Disease alerts and progress and advice for disease management information was disseminated to producers and crop consultants.
2. Efficacy of foliar fungicides on Fusarium head blight and leaf diseases was published and disseminated to producers, agronomists, and crop consultants through online and also during grower meetings.
3. Presented wheat disease management information at various producer meetings, research field days, and wheat plot tours.

Extension Publications

Byamukama, E. Beck, R., Ali, S., and Strunk, C. 2016. Stripe Rust: Earlier than normal detection in wheat is concerning. Published on 4/19/2016 <http://igrow.org/agronomy/wheat/stripe-rust-earlier-than-normal-detection-in-wheat-is-concerning/#sthash.023A4tHz.dpuf>

Byamukama, E. 2016. Wheat Diseases: What to watch for this spring. Published on 4/21/2016. <http://igrow.org/agronomy/wheat/wheat-diseases-what-to-watch-for-this-spring/>

Byamukama, E., and Ali, S. 2016. Winter Wheat Diseases: Powdery mildew and tan spot increasing. Published on 5/5/2016 <http://igrow.org/agronomy/wheat/winter-wheat-diseases-powdery-mildew-tan-spot-increasing/#sthash.mnfNzOQu.dpuf>

Byamukama, E. and Yabwalo, D. 2016. Wheat Fungicide Applications: Apply at flag leaf or wait for flowering growth stage? Published on 5/19/2016. <http://igrow.org/agronomy/wheat/wheat-fungicide-applications-apply-at-flag-leaf-or-wait-for-flowering-growt/#sthash.y2FXh162.dpuf>

Byamukama, E., Varenhorst, A., and Backmann, A. 2016. Barley yellow dwarf virus on the increase. Published on 5/26/2016 <http://igrow.org/agronomy/wheat/barley-yellow-dwarf-virus-on-the-increase/>

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**2016 Tennessee State Report – NCERA 184**

**University of Tennessee Personne**l **involved in wheat disease extension and research:** Heather Kelly, Tyson Raper, Jamie Jordan, Wesley Crowder

**2016 wheat production and major diseases**

Planted winter wheat acreage in Tennessee was 400,000 acres for 2015-2016 season. Wheat acreage harvested was 335,000 with an average yield of 73 bu/a at $4.65/bu. This was a 5 bu/a increase in yield compared to the previous year.

The 2016 wheat season in Tennessee was characterized by cool and wet spring and slightly earlier observation of stripe rust, most likely due to inoculum level from the states to the south. Stripe rust developed as early as flag leaf in some fields and therefore fungicide application was advised. Early season powdery mildew was observed in some varieties, but not perceived as a threat to yield and no fungicide application was recommended. Septoria leaf spot and Stagnospora leaf and glume blotch continue to be the most commonly observed diseases.

**Impact statements**

1. Disease alerts/updates and advice for disease management information was disseminated to producers and crop consultants via county production meetings, the newsletter/blog (news.utcrops.com), phone calls, emails, text messages, and field visits.
2. Efficacy of foliar fungicides on Fusarium head blight and leaf diseases was updated and published for producers and crop consultants (available at UTcrops.com).
3. Presented wheat disease management information at various producer meetings and Milan no-till field day.

**2017 Virginia State Report – NCERA 184**

**Virginia Tech Personne**l **involved in wheat disease extension and research:** Hillary Mehl, Linda Byrd-Masters, Steve Byrum

**2016 wheat production and major diseases**

In 2016, wheat was harvested from 18,000 acres in Virginia, which was an increase of 2,000 acres compared to 2015. A total of 10.3 million bushels of winter wheat were harvested with an average yield of 59 bu/acre, a decrease of approximately 7 bu/acre compared to 2015.

The 2015/2016 wheat growing season included a warm winter that encouraged early outbreaks of powdery mildew. Stripe rust was also more widespread and severe than typical, and outbreaks were observed beginning in early April. On certain varieties including Shirley stripe rust was severe and yield was impacted. Rains in late April and early May were favorable for Fusarium head blight (FHB), and high levels of FHB and DON contamination occurred in some areas. Leaf spots (Stagonspora leaf blotch, tan spot) were also observed throughout the state, but in general leaf spots did not progress to the flag leaf until the wheat had started to flower.

**Impact statements**

1. Disease alerts and management recommendations were disseminated to producers, Extension agents, and crop consultants through the Virginia Ag Pest and Crop Advisory and the FHB alert system.
2. Efficacy of foliar fungicides and resistant varieties for management of FHB and foliar diseases was assessed and data were disseminated to growers, Extension agents, and crop consultants.
3. Wheat disease management information was presented at field days and producer meetings throughout the state.

**2016 Wisconsin Report – NCERA 184**

**Wooster, OH; March 2017**

Damon Smith, Extension Plant Pathologist, University of Wisconsin-Madison

**University of Wisconsin-Madison personnel involved in wheat disease extension and research:** Damon Smith, Shawn Conley, Carol Groves, Scott Chapman, Brian Mueller, John Gaska, Adam Roth, Brian Hudelson

**2016 wheat production and major diseases in Wisconsin**

Wisconsin saw an increase in winter wheat acres planted (270,000) in the 2015-2016 growing season compared to the previous year (230,000) with 250,000 acres harvested, compared to 210,000 in 2015. Wheat germinated well and had excellent tiller development prior to winter dormancy. Snow cover was below average, but did not result in much winterkill. Average yield for the 2016 crop was around 79 bu/A, up 5 bu/A from 2015.

Statewide, the major disease of winter wheat in 2016 was stripe rust caused by *Puccinia striiformis*. Stripe rust could be found in every field that was rated for disease. In the variety trials throughout the state, stripe rust hit some varieties very hard, causing significant damage and early defoliation. Varieties with genetic resistance to the disease performed well.

Unlike 2015, Fusarium head blight (FHB or scab) caused by *Fusarium graminearum* was relatively minimal in Wisconsin. In the southern and eastern wheat production areas of the state, low levels of FHB were identified, however, severity was minimal (less than 20%). This is likely due to the fact that the weather was very hot and mostly dry during the anthesis period in this part of the state. Further to the north and closer to Lake Michigan, somewhat higher levels of FHB were identified. Higher levels of FHB in this part of the state likely resulted from more favorable weather conditions for the FHB fungus during anthesis.

Septoria leaf blotch was present in low levels in some fields throughout the state. However, this disease was not yield-limiting in 2016. Powdery mildew was nearly non-existent in the state for the fourth season straight.

Planting in the fall of 2016 was very favorable. Stands were well-established going into the winter of 2016, which was extremely mild. Wheat in the spring of 2017 looked very healthy and was progressing about 2 weeks ahead of schedule.

**Impact Statements**

1. M.S.-level graduate student (Brian Mueller) has completed most of his research objectives on stripe rust and FHB of winter wheat in Wisconsin. Two research papers are forthcoming.
2. Research trials are ongoing to understand the epidemiology of stripe rust in the upper Midwest
3. Research on FHB continued and focused on developing improved fungicide application recommendations for Wisconsin winter wheat growers – research suggests that waiting 5 days after anthesis provides excellent control of FHB and significantly reduces deoxynivalenol (DON) levels in harvested grain compared to applications at anthesis.

**Research Reports**

1. Mueller, B., Smith, D.L., Chapman, S., and Bloomingdale, C. 2016. Evaluation of foliar fungicides for control of Fusarium head blight of wheat in Wisconsin, 2015. PDMR. 10:CF024.
2. Mueller, B., Groves, C., and Smith, D.L. 2016. Evaluation of chemotype, pathogenicity, and aggressiveness of *Fusarium graminearum* isolates of wheat and soybean. Phytopathology 106:S4.31.

**Extension and Outreach Publications**

1. Bradley, C., Chilvers, M., Giesler, Mueller, D., Sisson, A., Smith, D.L., Tenuta, A., Wise, K. 2016. Fact Sheet: CPN4001 – Fungicide resistance in field crops FAQs. Crop Protection Network.
2. Jensen, B., Nice, G., Renz, M., and Smith, D.L. 2016. A3646 – Pest Management in Wisconsin Field Crops. UW Extension - Cooperative Extension Service. University of Wisconsin.
3. Conley, S., Roth, A., Gaska, J., and Smith, D. 2016. A3868 - Wisconsin Winter Wheat Performance Tests. UW Extension - Cooperative Extension Service. University of Wisconsin.
4. Smith, D.L. 2016. 2016 Wisconsin field crops pathology fungicide tests summary. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – December 29.
5. Mueller, B., Smith, D.L., and Conley, S.P. 2016. Start managing stripe rust of winter wheat in 2017 at planting. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – September 8.
6. Conley, S.P. and Smith, D.L. 2016. Start managing for Fusarium head blight now before you plant the 2016/17 crop. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – August 25.
7. Conley, S.P. and Smith, D.L. 2016. Top 8 recommendations for winter wheat establishment in 2016. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – August 25.
8. Smith, D.L. and Mueller, B. 2016. Wisconsin winter wheat disease update – June 29, 2016. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – June 29.
9. Smith, D.L. and Conley, S.P. 2016. Fusarium head blight and Wisconsin winter wheat harvest 2016. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – June 29.
10. Smith, D.L. and Mueller, B. 2016. Wisconsin winter wheat disease update – June 16, 2016. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – June 16.
11. Smith, D.L. and Mueller, B. 2016. Wisconsin winter wheat disease update – June 1, 2016. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – June 1.
12. Smith, D.L. and Mueller, B. 2016. Wisconsin winter wheat disease update – May 24, 2016. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – May 24.
13. Smith, D.L. and Mueller, B. 2016. Wisconsin winter wheat disease update – May 11, 2016. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – May 11.
14. Smith, D.L. and Mueller, B. 2016. Wisconsin winter wheat disease update – May 6, 2016. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – May 6.
15. Smith, D.L. and Mueller, B. 2016. Wisconsin winter wheat disease update – April 13, 2016. Wisconsin Field Crops Pathology Blog/Wisconsin Crop Manager – April 13.

**Extension Presentations**

1. Stripe rust: A re-emerging wheat disease in Wisconsin. 2016 Wisconsin Crop Improvement Association Meeting. November 29, 2016. Madison, WI. *(50 contacts)*
2. Disease Management and diagnostic training. 2016 Wisconsin Pest Management Update Meetings. November 7-11, 2016. Marshfield, Chippewa Falls, Belmont, Fond du Lac, Kimberly, Sparta, and Janesville, WI. (*Total of 7 presentations and 354 contacts*)
3. Field Crops Diseases. 2016 Fox Valley Technical College Crop Scouting Training. January 4-7, 2016. Appleton, WI. *(30 contacts)*

Outreach Videos

1. *Winter Wheat: In-season Disease Management, Part I.* 2016. UW Extension – Cooperative Extension Service. University of Wisconsin. <http://fyi.uwex.edu/fieldcroppathology/videos/>
2. *Winter Wheat: In-season Disease Management, Part II.* 2016. UW Extension – Cooperative Extension Service. University of Wisconsin. <http://fyi.uwex.edu/fieldcroppathology/videos/>
3. *Winter Wheat: In-season Disease Management, Part III.* 2016. UW Extension – Cooperative Extension Service. University of Wisconsin. <http://fyi.uwex.edu/fieldcroppathology/videos/>