MISSISSIPPI SOYBEAN PROMOTION BOARD
PROJECT 15-2016 (CONTINUOUS)
2016 ANNUAL REPORT

Title: Soybean disease monitoring for Mississippi soybean producers

PI and email address: Tom Allen, tallen@drec.msstate.edu

BACKGROUND AND OBJECTIVES

Soybean diseases continue to annually reduce yield in the MS soybean production system. Since the initial observation of soybean rust in 2004, the foliar disease has been one of the most closely monitored plant diseases in the United States.

Sentinel plots have been a valuable tool to aid soybean farmers in making informed management decisions based on the particular economically important disease(s) present in sentinel plots. Mississippi has cooperated at the regional and national level by monitoring for soybean rust with early-planted sentinel plots, typically planted several weeks prior to the commercial soybean crop, to monitor for the presence of soybean rust. The information gained from sentinel plots has been relied on by farmers throughout MS to avoid yield losses as a result of soybean rust and other economically important diseases, or losing money by making an ill-timed fungicide application when disease is not threatening.

Beginning in 2011/2012, MSU faculty and staff emeritus began to use sentinel plots as well as commercial soybean fields to monitor for all economically important soybean diseases, particularly those diseases that could be managed with a timely fungicide application. In addition to monitoring for the presence of economically important foliar diseases (e.g, aerial web blight, Cercospora blight, frogeye leaf spot, soybean rust), we also started to use sentinel plots to monitor for the presence of fungicide resistance within the frogeye leaf spot fungal population in 2013.

During 2012 two counties, Carroll and Coahoma, contained strobilurin-resistant frogeye leaf spot. At that time leaf samples were submitted to the University of Illinois for resistance screening. However, beginning in the 2013 season, leaf samples were screened in Starkville, MS due to some issues encountered while shipping samples. At present, MSU has its own fungicide resistance screening program that is led by Dr. Maria Tomaso-Peterson.

The strobilurin class of fungicides (or QoI fungicides) have been widely used in soybean production systems throughout MS and have provided farmers with a broad-spectrum fungicide that has additional benefits when it comes to enhancing yield in continuous soybean situations. However, the members of this particular class of fungicides have a high risk for developing resistance within fungal populations.

The main objective of the soybean disease monitoring project is to determine where important yield-limiting diseases may be occurring (inclusive of soybean rust) and disseminate pertinent information in the form of management alternatives when necessary using several different media sources so that farmers are aware of a potential threat. Throughout the course of the 2016 season, Billy Moore, Malcolm Broome, and Tom Allen scouted for soybean diseases throughout the state in commercial

soybean fields as well as the 22 sentinel plots that were planted in counties along the edges of the state to serve as an early warning system for important diseases.

REPORT OF PROGRESS/ACTIVITY

OBJECTIVE(S).

Monitor for foliar soybean diseases throughout MS to provide soybean farmers the necessary information to make informed, timely decisions regarding fungicide application(s) as well as product choices depending on the specific disease(s) present (either strobilurin or triazole) in commercial fields.

Soybean sentinel plots, planted earlier than the commercial soybean crop throughout the state, were used to monitor soybean diseases throughout MS during the 2016 season. These plots consisted of MG IV, V, and VII varieties planted in 22 counties (Adams, Amite, Claiborne, Coahoma, Hancock, Harrison, Hinds, Issaquena, Jackson, Jefferson, Monroe, Newton, Noxubee, Pearl River, Tippah, Tishomingo, Walthall, Warren, and Wayne). In addition, five of the locations were surrounded by electrified fencing to reduce deer browsing (Adams, Amite, Jefferson, Wayne, and Wilkinson) since the sentinel plots were deemed to be in extremely important locations.

In addition to scouting sentinel plots on a weekly basis between April and September (or when they reached R8; physiological maturity) more than 450 unique commercial soybean fields as well as and more than 300 kudzu patches were observed during 2016 (see map included as Figure 1) season with the help of Billy Moore and Malcolm Broome as well as Jack Bridgers (Jimmy Sanders, Inc.). In addition to scouting for diseases of economic concern, commercial soybean fields were observed for the presence of important diseases as well as nematode issues (a list of the major disease and nematode observations made during the 2016 season is included below). If a management practice was necessary to reduce the impact of a particular disease, the information was reported to the farmer so that the situation could be addressed.

As a final report for the 2016 soybean season, several economically important diseases were observed in either sentinel plots or commercial soybean fields:

Foliar fungal diseases:
-aerial web blight
-bacterial blight
-brown spot (Septoria leaf blight)
-Cercospora blight
-downy mildew
-frogeye leaf spot
-soybean rust
-target spot

Soilbore diseases:
-charcoal root rot
-Phytophthora root rot
-southern blight
-stem canker
-sudden death syndrome
-taproot decline

Viruses:
-*Bean pod mottle virus*
-*Soybean mosaic virus*
-*Soybean vein necrosis virus*

Nematodes:
-reniform nematode
-root-knot nematode
-soybean cyst nematode

One important note regarding the diseases outlined above. Similar to the disease situation over the past several seasons, soybean viruses were widespread in the MS soybean production system. Normally foliar viruses are a limited occurrence; however, during 2016 foliar viruses were observed on a statewide basis in large part due to extremely large populations of bean leaf beetle, which serve as a vector for several foliar soybean viruses. Virus diseases were observed at approximately the same time (growth stage and month) as they have been in the past. But, with that in mind, determining the potential yield loss as a result of viruses is difficult at best. On an annual basis, virus diseases account for some yield loss; however, an actual number that could be attributed to yield reduction as a result of viruses would be difficult to assess as it is possible that

If the ability arises, determine the most effective fungicide management schemes by conducting efficacy trials specifically for soybean rust (SBR) timing. In addition, if strobilurin-resistant aerial web blight, Cercospora blight or frogeye leaf spot are identified fungicide trial plots could provide valuable information to the soybean industry (if identified early enough to benefit the situation).

During 2016, soybean rust observations were not made until later in the cropping season, typically August and September, when the majority of the soybean grown in the state has reached a growth stage where foliar diseases will not result in a yield reduction. Frogeye leaf spot was one of the most predominant diseases late in the season. Thus, fungicide trials to specifically manage these diseases were not conducted. However, several different types of fungicide trials were conducted to determine the role of "early" fungicide application strategies to manage Cercospora leaf blight as well as frogeye leaf spot in Starkville and Stoneville. Fungicide trials were conducted on the experiment station in Stoneville to determine efficient timing strategies to manage soybean diseases as well as overall yield losses. Reports from those trials will be published in the Plant Disease Management reports journal through the American Phytopathological Society.

Application strategies during 2016 included strobilurin, pre-mix fungicides, and several triazole products. The information obtained from these trials will be used for several blog articles (www.mississippi-crops.com) as well as drafting several Plant Disease Management Reports to be published through APS. Application times for the fungicides used in these trials were:

R2
R3 alone and some sequentials
R3 alone (multiple trials in Stoneville and one trial in Starkville)

Generally speaking, regardless of timing strategy, fungicides did not reduce the observable symptoms from Cercospora blight; however, a tremendous data set was created from the trials conducted to manage frogeye leaf spot, especially in the trials conducted since the fungus was determined to be resistant to the strobilurin fungicides at all locations during 2014.

Continue to monitor the environmental conditions at 3 locations (Eden, Hurley, Pond) where weather stations are present to determine if a specific correlation exists between environmental variables and infection of the local plant material (either kudzu or soybean) by the SBR fungus.

Weather stations continue to be monitored at three key locations (Eden, Hurley, Pond, MS) where soybean rust has been a regular occurrence. The weather stations were upgraded during the 2015/2016 winter and data from each of the weather stations are now available on the internet with the remainder of

the monitoring stations. The cellular uplinks have greatly increased our environmental data gathering capabilities throughout the state. At present a few additional kinks continue to be worked out of the system to maintain the weather stations and provide those data on a regularly basis.

Continue to make weekly radio updates during the soybean growing season for the Mississippi Radio Network (via Mr. Lynn Sheldon and/or Mr. John Winfield) on important topics occurring in soybean pathology or other pathology-related issues (e.g. foliar diseases, nematodes, fungicide application suggestions, presence of particular diseases and their proximity to the major production areas).

During the 2016 season, radio updates regarding pertinent disease information were made to the MS Ag Network. The information that was contained in those reports was also pertinent to disease monitoring as well as structured around providing information that would benefit farmer's management practices regarding important yield-limiting diseases. A list of the specific titles and topics is included in the appendix below.

IMPACTS AND BENEFITS TO MISSISSIPPI SOYBEAN PRODUCERS

Ideally, monitoring for yield limiting diseases throughout MS impacted all of the farmers that managed the approximately 2.3 million acres of soybean in the state. During 2016 the soybean disease monitoring team that included Billy Moore, Tom Allen, and Jack Bridgers with Jimmy Sanders, Inc. observed more soybean acres in MS than any other single entity. Our weekly visits to soybean farms, sentinel plots, and kudzu patches throughout the MS soybean production area provided constant benefit to soybean farmers by showing we are aware of their needs as well as monitoring their crop acres should an issue arise. In locations where soybean rust was confirmed in field situations where a fungicide may have produced a positive benefit we were able to protect yield; however, even though soybean rust made an earlier entrance than normal into MS, we were still able to protect yield and reduce the costs associated with unnecessary fungicide applications by monitoring extensively for the disease. As has been the case over the past several years, we were also able to provide important information for the subsequent soybean season regarding such diseases as red crown rot, stem canker, frogeye leaf spot, and root-knot, reniform, and soybean cyst nematode.

END PRODUCTS–COMPLETED OR FORTHCOMING

Throughout the 2016 season, updates were provided to the farming community through the Mississippi Crop Situation Blog (www.mississippi-crops.com) as well as radio interview/updates on pertinent disease management issues by the Mississippi Radio Network. Funds provided by the MSPB allowed us to spend considerable time throughout the state to determine what diseases were present, where they were located, and provide this information to farmers through several different outlets.

The specific Extension-related outputs are included in the appendix below.

APPENDIX 1

Publications associated with soybean disease monitoring (n=2):

Allen, T. W., Bluhm, B., Conner, K., Doyle, V., Price, T., Sikora, E., Singh, R., Spurlock, T., Tomaso-Peterson, M., and Wilkerson, T. H. 2017. First description of the causal agent of taproot decline of soybean, an emerging disease in the southern United States. Plant Health Progress 18:35-40.

Allen, T. W., Bradley, C. A., Sisson, A. J., Byamukama, E., Chilvers, M. I., Coker, C. M., Collins, A. A., Damicone, J. P., Dorrance, A. E., Dufault, N. S., Esker, P. D., Faske, T. R., Giesler, L. J., Grybauskas, A. P., Hershman, D. E., Hollier, C. A., Isakeit, T., Jardine, D. J., Kemerait, R. C., Kleczewski, N. M., Koenning, S. R., Kurle, J. E., Malvick, D. K., Markell, S. G., Mehl, H. L., Mueller, D. S., Mueller, J. D., Mulrooney, R. P., Nelson, B. D., Newman, M. A., Osborne, L., Overstreet, C., Padgett, G. B., Phipps, P. M., Price, P. P., Sikora, E. J., Smith, D. L., Spurlock, T. N., Tande, C. A., Tenuta, A. U., Wise, K. A., Wrather, J. A., and Young-Kelly, H. 2017. Soybean yield loss estimates due to diseases in the United States and Ontario, Canada from 2010 to 2014. Plant Health Progress 18:19-27.

Technical bulletins (Plant Disease Management Reports; n=2):

Brochard, N., Irby, J. T., Scholtes, A., and **Allen, T. W.** 2017a. Evaluation of R4 fungicide timing to manage foliar disease and preserve yield in eastern Mississippi: Trial 1, 2016. Plant Disease Management Reports 11:FC044.

Brochard, N., Irby, J. T., Scholtes, A., and **Allen, T. W.** 2017b. Evaluation of R4 fungicide timing to manage foliar disease and preserve yield in eastern Mississippi: Trial 2, 2016. Plant Disease Management Reports 11:FC045.

Mississippi Crop Situation Blog updates (n=18)

Allen, T. 2016. 2016 North MS Maturity Group IV and V variety trial report. Mississippi Crop Situation, December 13, 2016.

Irby, T., and **Allen, T.** 2016. 2016 Soybean variety demonstration program summary. Mississippi Crop Situation, November 4, 2016.

Allen, T. 2016. 2016 soybean stem canker variety trial evaluations. Mississippi Crop Situation, November 3, 2016.

Allen, T., and Irby, T. 2016. Soybean disease update: September 7, 2016. Mississippi Crop Situation, September 7, 2016.

Allen, T. 2016. Soybean disease update: August 21, 2016. Mississippi Crop Situation, August 21, 2016.

Irby, T., Orlowski, **Allen, T.**, Bond, J., Catchot, A., Gore, J., Cook, D., Krutz, and Golden, B. 2016. Identifying late season soybean growth stages. Mississippi Crop Situation, August 19, 2016.

Irby, T., Bond, J., Orlowski, J., and **Allen, T.** 2016. Soybean harvest aids. Mississippi Crop Situation, August 19, 2016.

Allen, T. 2016. Soybean root disease update: August 3, 2016. Mississippi Crop Situation, August 3, 2016.

Allen, T., and Irby, T. 2016. Foliar soybean disease update: July 30, 2016. Mississippi Crop Situation, July 30, 2016.

Allen, T. 2016. Soybean disease update: July 16, 2016. Mississippi Crop Situation, July 16, 2016.

Allen, T. 2016. Fungicide-associated phytotoxicity: update following 2015 observations. Mississippi Crop Situation, July 2, 2016.

Allen, T. 2016. 2015 frogeye leaf spot fungicide evaluations. Mississippi Crop Situation, June 19, 2016.

Allen, T. 2016. 2015 root-knot nematode soybean OVT gall ratings and yield. Mississippi Crop Situation, June 18, 2016.

Allen, T. 2016. Soybean disease update: June 18, 2016. Mississippi Crop Situation, June 18, 2016.

Allen, T. 2016. Soybean R3/R4 fungicide selection. Mississippi Crop Situation, June 18, 2016.

Allen, T., and Irby, T. 2016. First soybean rust of 2016 detected in four southwest MS counties. Mississippi Crop Situation, May 25, 2016.

Allen, T. 2016. Updated soybean disease calendars for MG IV and MG V soybean. Mississippi Crop Situation, May 21, 2016.

Allen, T. 2016. 2014 root-knot nematode soybean OVT gall ratings and yield. Mississippi Crop Situation, January 30, 2016.

Soybean educational radio interviews for Mississippi Ag Network (n=12):

Managing soybean diseases: an early-season perspective. Mississippi Radio Network, April 4 2016.

Soybean sentinel plot monitoring efforts and how they impact MS soybean farmers. Mississippi Radio Network, May 4, 2016.

Septoria brown spot as an early-season soybean disease. Mississippi Radio Network, May 26, 2016.

First report of soybean rust in MS, management suggestions for early-season rust. Mississippi Radio Network, June 2, 2016.

General soybean disease update and management considerations. Mississippi Radio Network, June 15, 2016.

General soybean sentinel plot update and disease outlook for the remainder of June. Mississippi Radio Network, July 5, 2016.

General foliar fungicide selection for the R3/R4 application timing. Mississippi Radio Network, July 19, 2016.

General soybean disease situation update for Mississippi soybean production systems. Mississippi Radio Network, July 25, 2016.

Root diseases and disorders in the Mississippi soybean production system. Mississippi Radio Network, August 8, 2016.

Incidence of target spot increasing throughout the production system. Mississippi Radio Network, August 23, 2016.

Soybean rust observed in several additional counties, no cause for concern. Mississippi Radio Network, September 12, 2016.

Sampling for nematodes to manage nematode concerns in the 2017 soybean crop. Soybean sentinel plot monitoring efforts and how they impact MS soybean farmers. Mississippi Radio Network, September 20, 2016.

Proceedings (n=12):

Brochard, N., Tomaso-Peterson, M., and **Allen, T.** 2016. Determining whether fitness costs are associated with QoI-resistant isolates of the frogeye leaf spot pathogen. Phytopathology 106:S2.7.

Mansour, J., Tomaso-Peterson, M., Henn, A., Bond, J., Irby, T., and **Allen, T.** 2016. Agricultural product combinations to reduce fungicide phytotoxicity in Mississippi soybean. Phytopathology 106:S2.11.

Wilkerson, T., Tomaso-Peterson, M., Golden, B., Brown, A., and **Allen, T.** 2016. Reducing *Macrophomina phaseolina* colonization in soybean through secondary nutrition. Phytopathology 106:S2.15.

Allen, T. W., Bradley, C. A., Damicone, J. P., Dufault, N. S., Faske, T. R., Hollier, C. A., Isakeit, T., Kemerait, R. C., Kleczewski, N. M., Koenning, S. R., Mehl, H. L., Mueller, J. D., Overstreet., C. Price, P. P., Sikora, E. J., Spurlock, T. N., and Young, H. 2016. Southern United States soybean disease loss estimates for 2015. Pages 11-15 in: Proceedings of the Southern Soybean Disease Workers, Pensacola Beach, FL, March 9-10, 2016.

Tomaso-Peterson, M., **Allen, T. W.**, Price, P., Singh, R., Spurlock, T. N. 2016. Characterization of taproot decline in southern soybean. Page 19 in: Proceedings of the Southern Soybean Disease Workers, Pensacola Beach, FL, March 9-10, 2016.

Brochard, N., Tomaso-Peterson, M., **Allen, T. W.**, and Melanson, R. A. 2016. Virulence assessment of QoI-sensitive and –resistant isolates of Cercospora sojina, the causal agent of frogeye leaf spot in

soybean. Page 24 in: Proceedings of the Southern Soybean Disease Workers, Pensacola Beach, FL, March 9-10, 2016.

Mansour, W. J., Tomaso-Peterson, M., Henn, A., Bond, J. A., Irby, J. T., and **Allen, T. W.** 2016. Evaluating the physiological impacts of fungicide phytotoxicity in Mississippi soybean. Page 27 in: Proceedings of the Southern Soybean Disease Workers, Pensacola Beach, FL, March 9-10, 2016.

Wilkerson, T. H., Tomaso-Peterson, M., Golden, B. R., Lu, S., Johnson, A. B., and **Allen, T. W.** 2016. Benefit of secondary nutrition in reducing *Macrophomina phaseolina* colonization in Mississippi soybean. Pages 28 in: Proceedings of the Southern Soybean Disease Workers, Pensacola Beach, FL, March 9-10, 2016.

Allen, T. W., Faske, T. R., Hollier, C. A., Price, P., Spurlock, T. N., and Young, H. 2016. Nuts, bolts, frogeye leaf spot, and the UUOT. Page 37 in: Proceedings of the Southern Soybean Disease Workers, Pensacola Beach, FL, March 9-10, 2016.

Wilkerson, T., Tomaso-Peterson, M., Golden, B., Brown, A., and **Allen, T.** 2016. Reduced *Macrophomina phaseolina* colonization of soybean by supplementing with the secondary nutrients calcium and magnesium. Phytopathology 106:S4.78.

Brochard, N., Tomason-Peterson, **Allen, T.**, and Melanson, R. 2016. Assessing potential virulence differences between QoI-sensitive and –resistant *Cercospora sojina* isolates from Mississippi soybean. Phytopathology 106:S4.14.

Mansour, J., Tomaso-Peterson, M., Henn, A., Bond, J., Irby, T., and **Allen, T.** 2016. Managing QoI-resistant *Cercospora sojina* in Mississippi soybean and assessing the physiological impacts of foliar fungicide phytotoxicity. Phytpathology 106:S4.63.

Future plans for output(s) (n=1 refereed publication):

The 2012 season was the last year for the soybean rust hotline. I am in the process of drafting a manuscript regarding the connectedness of the telephone calls made to the hotline and how soybean rust information was disseminated. Much of this information can be used in presentations as well as included on the MSPB website once it has all been completed. However, it may be several months (likely 10-12) before this will be completed.

APPENDIX 2: Graphics/Tables

Figure 1. Map of scouted locations throughout MS that were relied on to gather important disease monitoring information. Red counties indicates a location where soybean rust was detected. During 2016, soybean rust was detected in all 82 counties (n = 35 kudzu and n=47 soybean).