Title: Soybean disease monitoring for Mississippi soybean producers

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BACKGROUND AND OBJECTIVES

Yield-limiting soybean diseases continue to be a concern for MS soybean farmers on an annual basis. Since 2005, soybean rust 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 in monitoring for soybean rust by planting early-planted sentinel plots typically 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 to avoid losing money by making a fungicide application when a particular disease is not threatening.

MSU faculty and staff emeritus began to use sentinel plots as well as commercial soybean fields to monitor for all economically important soybean diseases during 2011/2012, 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 during the 2013 season. During 2012, two counties, Carroll and Coahoma, reported a location with strobilurin-resistant frogeye leaf spot. At that time leaf samples were submitted to the University of Illinois for resistance screening.

Presently, MSU has its own fungicide resistance screening program that is led by Dr. Maria Tomaso-Peterson and a graduate student (Mr. Jeff Standish). 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 2013 season, Billy Moore, Malcolm Broome, and Tom Allen scouted for soybean diseases throughout the state in commercial soybean fields as well as the 23 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 1: 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 (either strobilurin or triazole) depending on the specific disease(s) present in commercial fields.

Soybean sentinel plots were used to monitor soybean diseases throughout MS during the 2014 season. Sentinel plots, consisting of Maturity Group III, IV, V, and VII varieties were planted in 22 counties (Adams, Amite, Claiborne, Coahoma, Hancock, Hinds, Issaquena, Jackson, Jefferson, Monroe, Newton, Noxubee (2), Pearl River, Pike, Tippah, Tishomingo, Walthall, Warren, Washington, Wayne, and Wilkinson). In addition, six of the locations were surrounded by electrified fencing to reduce deer browsing (Adams, Amite, Coahoma, Jefferson, Wayne, and Wilkinson) since the sentinel plots were deemed to be in extremely important locations.

In addition to scouting sentinel plots on an almost weekly basis from April through September (or when they reached R8--physiological maturity), > 500 unique commercial soybean fields as well as > 400 kudzu patches were observed during 2014 (see map included as Figure 1). Commercial soybean fields were monitored for the presence of numerous, economically important disease and nematode issues (a list of the major disease and nematode observations made during the 2014 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 2014 soybean season, the following 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

**Soilborne diseases:**
- charcoal root rot
- Phytophthora root rot
- red crown rot
- southern blight
- stem canker
- sudden death syndrome

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

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

One important note regarding the diseases outlined above. Viruses were widespread in the MS soybean production system. Normally, foliar viruses are a limited occurrence; however, during 2014 (similar to the 2013 season) foliar viruses were observed on an almost statewide basis in large part due to the extremely large populations of bean leaf beetle, which serve as a vector for several foliar soybean viruses. In addition, viruses were observed earlier during the 2014 season, which is similar to past occurrences. With that in mind, determining the potential yield loss as a result of viruses was difficult at best.
OBJECTIVE 2. 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).

Soybean rust was a fairly late disease entry throughout much of MS, and fungicide trials would have been too late even on the latest-planted soybean trials; therefore, fungicide trials to specifically manage soybean rust were not conducted.

Frogeye leaf spot was one of the most predominant diseases, and was again a late entry into the MS soybean production area. Several different types of fungicide trials were conducted to determine the role of “early” fungicide application strategies to manage both Cercospora leaf blight and frogeye leaf spot in Starkville and Stoneville to determine efficient timing strategies to manage these 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 (APS).

Application strategies during 2014 included strobilurin, pre-mix fungicides, 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. Treatments included

- V5 alone both with and without glyphosate/glufosinate
- V5 followed by R5
- R2
- R4
- R5 alone (multiple trials in Stoneville and one trial in Starkville)
- R6 at one location in Stoneville

In addition, trials were conducted on full-season soybean planted in April/May as well as doublecrop soybean planted following wheat.

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 since the fungus in the trials was determined to be resistant to the strobilurin fungicides at all locations during 2014.

OBJECTIVE 3. 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. At present we are working with the weather monitoring group in Stoneville, MS to upgrade the three weather stations with cellular uplinks at these locations. This will increase the environmental data coverage throughout the state and not only provide excellent information for soybean farmers, but also aid in several research projects.
Moreover, the station locations will be slightly moved to fill in gaps in the environmental information provided from MSU.

**OBJECTIVE 4.** 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 2014 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 farmers’ 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 2014 the soybean disease monitoring team that included Dr. Billy Moore, Dr. Tom Allen, and Dr. Malcolm Broome 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 areas 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 and where a fungicide may have produced a positive benefit, we were able to protect yield; however, based on the late entrance of soybean rust disease into MS during in 2014, the use of fungicides was determined not to be necessary to manage just for soybean rust. 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 nematodes.

**END PRODUCTS–COMPLETED OR FORTHCOMING**

Throughout the 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 via the Mississippi Radio Network. Funds provided by the MSPB allowed us to spend considerable time throughout the state to determine what diseases were present and where they were located, and provide this information to farmers through several different outlets. In addition, the funds allowed us to collect numerous frogeye leaf spot infected leaves for a graduate student project (Mr. Jeff Standish) to determine the number of counties in MS that contained strobilurin-resistant frogeye leaf spot (n=73).

Specific Extension-related outputs are included in the appendix below.
APPENDIX 1:

Poster presentations (n=4)


Publications associated with soybean disease monitoring (n=1):


Technical bulletins (Plant Disease Management Reports; n=5):


Mississippi Crop Situation Blog updates (n=20)


**Graduate student presentations (either serving as committee member or advisor, grad student is listed with an asterisk (*)):**


**Oral Presentations (n=24):**


Presentation made to soybean farmers regarding the 2013 disease situation and the development and spread of fungicide resistance within the frogeye leaf spot population. Delta Ag Expo, Cleveland, MS, January 23, 2014.


Managing corn, cotton and soybean diseases in Mississippi for the 2014 season and beyond. Tunica Farmer’s meeting, Tunica, MS, February 19, 2014.

Disease management in corn, cotton, and soybean. Producer’s Advisory Council, Verona, MS, February 20, 2014.

Managing corn and soybean diseases in the Mid-south. MANA Consultant’s Meeting, Memphis, TN, February 26, 2014.

Plant pathology Extension program at Mississippi State University. Ag and Natural Research Training, Starkville, MS, March 18, 2014.

Ag and Natural Resource County Agent Training on wheat diseases, and early-season corn and soybean issues. DREC, Stoneville, MS, April 30, 2014.

Scouting for plant disease in corn, cotton, and soybean. MS Row Crop Scout School, North Mississippi Research and Extension Center, Verona, MS, May 28, 2014.

Scouting for plant disease in corn, cotton, and soybean. MS Row Crop Scout School, Delta Research and Extension Center, Stoneville, MS, May 29, 2014.

Scouting for plant disease in corn, cotton, and soybean. MS Row Crop Scout School, Clay Lyle Entomology Building, Starkville, MS, June 4, 2014.

Scouting for plant disease in corn, cotton, and soybean. MS Row Crop Scout School, Coahoma County Extension Office, Clarksdale, MS, June 5, 2014.

Ag and Natural Resources Training, corn, cotton, and soybean disease identification and management. DREC, Stoneville, MS, June 17, 2014.

Delta Research and Extension Center Soybean disease management and fungicide resistance development within the frogeye leaf spot population in MS. DREC, Stoneville, MS, June 17, 2014.


Ag and Natural Resources Training, corn, cotton, and soybean disease identification and management. DREC, Stoneville, MS, August 13, 2014.

Late-season disease management strategies in soybean production systems. DREC, Stoneville, MS, August 13, 2014.


Overview of fungicide use in MS row crops. Mississippi Agronomy Society of America’s Chapter Meeting, Grenada, MS, November 13, 2014.

Occurrence and management of frogeye leaf spot in soybean. Row Crop Short Course, Starkville, MS, December 3, 2014.

**Soybean educational radio interviews for Mississippi Ag Network (n=22):**


Early-season soybean diseases can be confused with herbicide injury. Mississippi Radio Network, June 12, 2014.


Soybean viruses observed throughout the Mississippi soybean production system during the 2014 season. Mississippi Radio Network, September 3, 2014.

Late season soybean rust observations and what this means for disease management. Mississippi Radio Network, September 10, 2014.


Soybean variety suggestions to management frogeye leaf spot. Mississippi Radio Network, October 1, 2014.

**Proceedings (n=9):**


**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 indicate a location where soybean rust was detected. During 2014, soybean rust was detected in all 82 counties (n = 44 total; n=43 soybean; n = 1 kudzu).
Additional figures regarding the results of fungicide trials.