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Proceedings of the 42nd Annual Meeting, Southern Soybean Disease Workers (March 11-12, 2015, Pensacola Beach, Florida)

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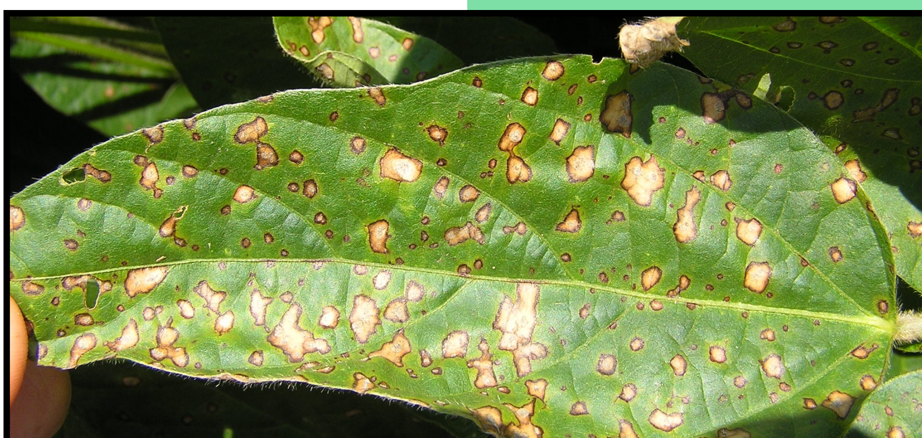
2015

Southern Soybean Disease Workers



42nd Annual Meeting

March 11-12, 2015

Pensacola Beach, Florida

PROCEEDINGS

This meeting was sponsored by generous contributions from the following companies:

PROCEEDINGS OF THE
SOUTHERN SOYBEAN DISEASE WORKERS
42nd ANNUAL MEETING

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42nd Annual Meeting of the Southern Soybean Disease Workers
March 11-12, 2015
Pensacola Beach, Florida

Wednesday, March 11th, 2015

11:30-1:00	**Registration (White Sands)**
1:00-1:15	**Introductions** Craig Rothrock, SSDW President
1:15-3:15	**Graduate Student Competition** Trey Price, Moderator
1:15-1:30	**Effect of Secondary Nutrient Applications on Suppression of Charcoal Rot in Soybean** T. Wilkerson, M. Tomasu-Peterson, B. R. Golden, S. Lu, A. B. Johnson, and T. W. Allen
1:30-1:45	**Molecular Characterization of the G143A Mutation Leading to QoI Fungicide Resistance among Fungal Pathogens Causing Cercospora Leaf Blight and Purple Seed Stain of Soybean** S. Albu, P. Price, V. Doyle, and R. W. Schneider
1:45-2:00	**The Effects of Starter Fertilizer on Soybean Infected with *Fusarium virguliforme* or *Rhizoctonia solani*** J. Miller, C. Vick, A. Vick, and J. Bond
2:00-2:15	**Root-knot Nematodes (*Meloidogyne* spp.) Associated with Soybean in Arkansas** C. Khanal, R. T. Robbins, C. Overstreet, and E. C. McGawley

2:15-2:30	**Tillage, Fungicide, and Cultivar Effects on Frogeye Leaf Spot Severity and Yield in Soybean** J. Jordan, A. Mengistu, H. M. Kelly, N. Bellaloui, P. R. Arelli, K. N. Reddy, and A. J. Wrather
2:30-2:45	**Frogeye Leaf Spot Response to Solo and Combination Fungicides** A. M. Cochran, H. M. Kelly, K. Lamour, and C. Bradley
2:45-3:00	**A New Perspective on Cercospora Leaf Blight Symptoms on Soybean** E. C. Silva, T. G. Garcia, A. V. Lygin, A. K. Chanda, C. L. Robertson, B. M. Ward, and R. W. Schneider
3:00-3:15	**Using a Hill Plot Technique for Evaluating Soybean Varieties for Resistance to Sudden Death Syndrome** J. Padgett, A. Vick, C. Vick, C. Schmidt, and J. Bond
3:15-3:30	**Break (White Sands)**
3:30-4:50	**Contributed Papers** Travis Faske, Moderator
3:30-3:50	**Soybean Disease Management Issues in Louisiana During 2014** P. Price, M. A. Purvis, and H. N. Pruitt
3:50-4:10	**Soybean Vein Necrosis Virus in Mississippi** N. Aboughanem-Sabanadzovic, S. Sabanadzovic, T.W. Allen, W. F. Moore, and R. C. Stephenson.
4:10-4:30	**Monitoring for Soybean Vein Necrosis Virus in Alabama (2014)** E. Sikora, K. Conner, and L. Zhang
4:30-4:50	**Challenges and Opportunities in the Use of Molecular Tools to Detect Strobilurin/QoI Fungicide Resistance: The Case of Frogeye Leaf Spot** H. Kelly and B. Vega

6:00-8:00	**Social and Banquet (Poolside)**

Thursday, March 12th, 2015

7:00-8:15	**Breakfast (Coral Reef)**
7:30-8:30	**Registration**
8:30-10:50	**Graduate Student Competition (continued)** Trey Price, Moderator
8:30-8:45	**Evaluating the Resistance of Some Soybean Varieties/Cultivars on Reniform Isolates from Louisiana** M. T. Kularathna, C. Overstreet, E. C. McGawley, and D. M. Xavier
8:45-9:00	**Investigating Fungicide Sensitivities Beyond the QoIs in *Cercospora sojina* from Mississippi** J. R. Standish, M. Tomaso-Peterson, T. W. Allen, S. Sabanadzovic, and N. Aboughanem-Sabanadzovic
9:00-9:15	**Using Fluopyram as a Seed Treatment to Reduce Sudden Death Syndrome in Resistant and Susceptible Soybean Varieties** D. Esker, C. Vick, A. Vick, and J. Bond
9:15-9:30	**Glyphosate Affects Cercospora Leaf Blight and Brown Spot of Soybean** T. G. Garcia, E. C. Silva, B. M. Ward, C. L. Robertson, R. Levy, and R. W. Schneider
9:30-9:45	**Efficacy of Seed Treatments for Management of *Fusarium virguliforme* and *Heterodera glycines*** N. Frederking, A. Fakhoury, J. Bond
9:45-10:00	**Minor Element Application as a Management Strategy for Soybean Rust and Cercospora Leaf Blight** B. M. Ward, C. L. Robertson, E. C. Silva, T. G. Garcia, and R. W. Schneider

10:00-10:15	**Management of Frogeye Leaf Spot and Determining the Impact of Fungicide Phytotoxicity in Mississippi Soybean** W. J. Mansour, J. T. Irby, B. R. Golden, T. H. Wilkerson, and T. W. Allen
10:15-10:30	***Break*** **(White Sands)**
10:30-2:00	**Contributed Papers (continued)** Heather Kelly, Moderator
10:30-10:50	**An Update of Research on Phomopsis Seed Decay in Soybean** S. Li, J. Rupe, P. Chen, G. Shannon, G. Sciumbato
10:50-11:10	**Assessment of Several Commercially Available Triazole and Premix Fungicides for Management of Frogeye Leaf Spot in Arkansas** T. R. Faske and M. Emerson
11:10-11:30	**ILeVO® Seed Treatment for Control of SDS and Nematodes in Soybeans** C. Graham
11:30-11:50	**Use of Random Point Assignments to Determine the Impact of Sudden Death Syndrome and Other Soilborne Diseases** T. Spurlock and W. Kirkpatrick
11:50-12:10	**Effect of Planting Date, Planting Density, Seed Treatment, and Seed Quality on Soybean Stand and Yield in Arkansas** J. C. Rupe, A. J. Steger, R. T. Holland, C. S. Rothrock, E. E. Gbur, Jr., W. J. Ross, and M. P. Popp
12:10-1:30	**Lunch (on your own)**
1:30-3:00	**Business Meeting**

Southern United States Soybean Disease Loss Estimates for 2014

Allen, T.W.[1], Damicone, J.P.[2], Dufault, N.S.[3], Faske, T.R.[4], Hershman, D.E.[5], Hollier, C.A.[6], Isakeit, T.[7], Kemerait, R.C.[8], Kleczewski, N.M.[9], Koenning, S.R.[10], Mehl, H.L.[11], Mueller, J.D.[12], Overstreet, C.[6], Price, P.[13], Sikora, E.J.[14], and Young, H.[15]

[1]Mississippi State University, Stoneville, MS; [2]Oklahoma State University, Stillwater, OK; [3]University of Florida, Gainesville, FL; [4]University of Arkansas, Lonoke, AR; [5]University of Kentucky, Princeton, KY; [6]Louisiana State University, Baton Rouge, LA; [7]Texas A&M University, College Station, TX; [8]University of Georgia, Tifton, GA; [9]University of Delaware, Newark, DE; [10]North Carolina State University, Raleigh, NC; [11]Virginia Tech, Suffolk, VA; [12]Clemson University, Blackville, SC; [13]Louisiana State University, Winnsboro, LA; [14]Auburn University, Auburn, AL; [15]University of Tennessee, Jackson, TN

Since 1974, soybean disease loss estimates for the southern United States have been published in the annual proceedings of the Southern Soybean Disease Workers (SSDW). Summaries of the results from between 1977 and 2010 have been published in numerous refereed scientific journals (5,7-10,12-19). The most recent disease loss estimates from 2010 to 2014 were published in the SSDW proceeding (1-4,6). In addition, a website through the University of Illinois Extension Service is available and summarizes the yield loss estimates from both the northern and southern U.S. from 1996 through 2013. The website can be accessed at: http://extension.cropsci.illinois.edu/fieldcrops/diseases/yield_reductions.php.

Various methods were used to obtain the disease losses, and most individuals used more than one. The methods employed were: field surveys, plant disease diagnostic clinic samples, variety trials, questionnaires to Cooperative Extension staff, research plots, grower demonstrations, private crop consultant reports, foliar fungicide trials, sentinel plot data, and "pure guess". In the case where individuals have retired (e.g., Arv Grybauskas in MD), another individual was contacted to aid in continuing the disease loss estimates project. The production figures for each state were collected from the USDA/NASS website in mid-January of 2015. Production losses were based on estimates of yield in the absence of disease. The formula used to derive production losses was: potential production without disease loss = actual production ÷ (1-percent loss) (decimal fraction). Rounding errors may occur in the tables provided below, specifically Table 2 and 3, due to the presence of “trace” estimates of disease which were estimated to be approximately 1×10^{-9}. Total losses in the form of percent disease loss by state and total losses in millions of bushels were determined by averaging the loss by state with the inclusion of the trace estimates.

Soybean acreage in the sixteen southern states covered in this report in 2014 increased compared to that reported in 2013 by 6.2% (1). Seven states reported a record yield for the 2014 season. The 2014 average per acre soybean yield was 43.6 bushels per acre, a 10.5% increase in average yield over the 2013 average yield (39 bu/A). In 2014, more than 968 million bushels were harvested from over 20 million acres from 16 southern states accounting for a 19.9% increase in the total harvest from an increase of 6.2% in the total number of acres harvested. The 2014 total acres harvested, average yield in bushels per acre, and total production in each state are presented in Table 1. Percentage loss estimates from each state are specific as to causal organism or the common name of the disease (Table 2). The total average percent disease loss for 2014 was 8.16% which accounted for a 2.8% increase in percent disease loss compared to that reported for 2013 (7.93%). In terms of the disease losses in millions of bushels, the 2014 disease losses accounted for 95.06 million bushels in lost potential production, or a 1.6% increase over the losses incurred during the 2013 production season (93.5 million bushels).

Table 1. Soybean production in 16 southern states in 2014.

State	Acres (1,000's)	Bu/Acre	Yield in Bu (1,000's)
Alabama	475	40	19,000
Arkansas	3,300	50*	165,000
Delaware	183	48*	8,784
Florida	34	43	1,462
Georgia	290	40*	11,600
Kentucky	1,750	48	84,000
Louisiana	1,400	57*	79,800
Maryland	505	46	23,230
Mississippi	2,200	52*	114,400
Missouri	5,600	46.5*	260,400
North Carolina	1,730	40	69,200
Oklahoma	355	29	10,295
South Carolina	440	35	15,400
Tennessee	1,610	46*	74,060
Texas	140	38.5	5,390
Virginia	650	39.5	26,240
TOTAL	**20,662**	**Avg. 43.6**	**968,261**

* Denotes state that set a yield record.

Acknowledgments

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Table 2. Estimated percentage loss of soybean yield due to diseases from 16 southern states during 2014.

	% yield suppression by state																
Disease	**AL[a]**	**AR**	**DE**	**FL**	**GA**	**KY**	**LA**	**MD**	**MS**	**MO**	**NC**	**OK**	**SC**	**TN**	**TX**	**VA**	**TOTAL**
Anthracnose	0.10	0.40	0.00	0.10	0.25	0.10	0.00	0.00	Tr[b]	0.00	0.20	0.10	0.03	0.05	0.00	0.20	**0.12**
Bacterial diseases	0.00	0.05	0.00	0.10	0.00	0.00	0.25	0.00	0.10	0.00	0.20	0.10	Tr	0.00	0.00	0.01	**0.05**
Brown stem rot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	**0.01**
Cercospora leaf blight	2.00	0.02	0.00	0.00	0.00	0.10	1.50	0.00	1.50	0.00	0.20	0.10	0.50	0.05	0.00	1.00	**0.44**
Charcoal rot	0.10	1.70	0.00	0.00	Tr	3.00	0.75	0.00	0.50	0.00	0.10	2.50	0.25	1.00	0.00	0.00	**0.62**
Diaporthe/Phomopsis complex (seed rot)	0.25	0.05	0.00	0.25	0.00	0.0	0.00	0.00	0.01	0.00	0.50	0.10	0.03	1.00	0.00	0.10	**0.17**
Downy mildew	0.00	0.01	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	**0.01**
Frogeye leaf spot	2.00	0.50	0.05	0.50	Tr	0.10	3.00	0.05	3.75	0.25	0.75	0.05	0.03	2.90	0.10	2.00	**1.00**
Fusarium wilt and root rot	0.00	0.03	0.10	0.00	0.00	0.00	0.00	0.10	0.00	0.25	0.00	0.00	Tr	0.01	0.00	0.01	**0.03**
Other diseases[c]	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00	0.00	1.20	0.00	0.03	0.00	0.10	0.00	**0.33**
Phytophthora root and stem rot	0.00	0.03	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.25	0.60	0.05	0.03	0.00	0.00	0.01	**0.09**
Pod and stem blight	Tr	0.07	0.00	0.00	2.00	0.20	0.00	0.00	Tr	0.50	1.00	0.10	Tr	0.00	0.00	0.30	**0.26**
Purple seed stain	0.25	0.01	0.00	0.00	Tr	0.01	0.25	0.00	Tr	0.00	0.10	0.05	0.03	0.05	0.20	0.10	**0.07**
Reniform nematode	0.25	0.00	0.00	0.00	0.25	0.00	2.00	0.00	2.00	0.00	0.10	0.00	1.00	0.01	0.00	0.00	**0.35**
Root-knot nematode	0.25	2.90	1.00	0.00	4.00	0.00	2.00	1.00	2.25	0.25	0.80	0.25	2.00	0.00	0.00	1.00	**1.11**
Soybean cyst nematode	0.25	0.80	2.00	0.00	0.10	3.00	0.00	1.50	1.00	3.50	2.00	2.00	1.00	2.50	0.00	3.00	**1.42**
Other nematodes[d]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.10	2.50	0.00	0.00	0.00	**0.19**
Rhizoctonia aerial blight	0.25	0.05	0.00	0.25	0.00	0.00	0.25	0.00	1.50	0.00	Tr	0.00	Tr	0.00	0.00	0.01	**0.14**
Sclerotinia stem rot (white mold – *Sclerotinia sclerotiorum*)	Tr	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**
Seedling diseases	0.25	0.07	0.03	0.50	0.10	1.00	1.00	0.03	0.50	0.00	0.06	0.20	0.10	1.50	0.10	0.10	**0.35**
Septoria brown spot	Tr	0.02	0.02	0.10	0.00	0.50	0.25	0.02	1.00	0.00	0.15	0.20	0.05	1.25	0.00	0.10	**0.23**
Southern blight	0.05	0.01	0.01	0.50	0.25	0.00	0.25	0.01	0.05	0.00	0.40	0.05	0.03	0.00	0.10	0.00	**0.11**
Soybean rust	0.10	0.00	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.10**
Stem canker	0.25	0.01	0.00	0.10	0.00	0.10	0.25	0.00	0.25	0.00	Tr	0.00	Tr	0.10	0.00	0.50	**0.10**
Sudden death syndrome	0.05	2.30	0.00	0.00	0.00	0.10	0.25	0.00	0.10	3.50	0.50	0.20	0.01	1.75	0.00	1.00	**0.61**
Virus diseases[e]	0.50	0.00	0.50	0.50	0.00	0.50	0.00	0.50	1.20	0.00	0.20	0.10	0.03	0.00	0.00	0.00	**0.25**
Total % disease	**6.90**	**9.03**	**3.75**	**4.50**	**6.95**	**9.71**	**14.00**	**3.25**	**17.81**	**8.50**	**9.56**	**6.25**	**7.62**	**12.62**	**0.60**	**9.55**	**8.16**

[a]Rounding errors may exist
[b]Tr = trace (0.000000001)
[c]Other diseases listed included: Phymatotrichopsis root rot (TX), red crown rot (MS, NC), target spot (MS, NC, SC)
[d]Other nematodes listed included: Columbia lance nematode (NC, SC), sting nematode (NC), stubby root nematode (OK)
[e]Virus diseases listed included: *Bean pod mottle virus* (AL, AR, KY, MS, NC), *Soybean mosaic virus* (AL, AR, KY, MS, NC, SC), *Soybean vein necrosis virus* (AL, DE, KY, MS, OK), *Tobacco ringspot virus* (AR, DE, KY)

Table 3. Estimated suppression of soybean yield (Millions of Bushels) as a result of disease during 2014.

	yield suppression by state (millions of bushels)																
Disease	**AL[a]**	**AR**	**DE**	**FL**	**GA**	**KY**	**LA**	**MD**	**MS**	**MO**	**NC**	**OK**	**SC**	**TN**	**TX**	**VA**	**TOTAL**
Anthracnose	0.02	0.73	0.00	0.00	0.03	0.08	0.00	0.00	0.00	0.00	0.15	0.01	0.00	0.35	0.00	0.06	**1.42**
Bacterial diseases	0.00	0.09	0.00	0.00	0.00	0.00	0.19	0.00	0.12	0.00	0.15	0.01	0.00	0.00	0.00	0.00	**0.56**
Brown stem rot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	**0.03**
Cercospora leaf blight	0.41	0.04	0.00	0.00	0.00	0.08	1.12	0.00	1.81	0.00	0.15	0.01	0.08	0.04	0.00	0.30	**4.02**
Charcoal rot	0.02	3.08	0.00	0.00	0.00	2.33	0.56	0.00	0.60	0.00	0.07	0.14	0.04	0.70	0.00	0.00	**7.55**
Diaporthe/Phomopsis complex (seed rot)	0.05	0.09	0.00	0.00	0.00	0.39	0.00	0.00	0.01	0.00	0.37	0.01	0.00	0.70	0.00	0.03	**1.66**
Downy mildew	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**
Frogeye leaf spot	0.41	0.91	0.00	0.01	0.00	0.08	2.25	0.01	4.52	0.45	0.56	0.00	0.00	2.03	0.00	0.60	**11.84**
Fusarium wilt and root rot	0.00	0.05	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	**0.55**
Other diseases	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00	2.41	0.45	0.90	0.00	0.00	0.00	0.00	0.00	**4.81**
Phytophthora root and stem rot	0.00	0.05	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.90	0.45	0.00	0.00	0.00	0.00	0.00	**1.35**
Pod and stem blight	0.00	0.13	0.00	0.00	0.13	0.16	0.00	0.00	0.00	0.00	0.75	0.01	0.00	0.00	0.00	0.09	**2.26**
Purple seed stain	0.05	0.02	0.00	0.00	0.00	0.01	0.19	0.00	0.00	0.00	0.07	0.00	0.00	0.04	0.01	0.03	**0.42**
Reniform nematode	0.05	0.00	0.00	0.00	0.03	0.00	1.50	0.00	2.41	0.45	0.07	0.00	0.16	0.01	0.00	0.00	**4.23**
Root-knot nematode	0.05	5.26	0.09	0.00	0.46	0.00	1.50	0.25	2.71	6.32	0.60	0.01	0.32	0.00	0.00	0.30	**12.00**
Soybean cyst nematode	0.05	1.45	0.18	0.00	0.01	2.33	0.00	0.37	1.20	0.00	1.49	0.11	0.16	1.75	0.00	0.91	**16.34**
Other nematodes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.01	0.40	0.00	0.00	0.00	**0.78**
Rhizoctonia aerial blight	0.05	0.09	0.00	0.00	0.00	0.00	0.19	0.00	1.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**2.14**
Sclerotinia stem rot (white mold – *Sclerotinia sclerotiorum*)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.13**
Seedling diseases	0.05	0.13	0.00	0.01	0.01	0.78	0.75	0.01	0.60	0.00	0.04	0.01	0.02	1.05	0.00	0.03	**3.49**
Septoria brown spot	0.00	0.04	0.00	0.00	0.00	0.39	0.19	0.01	1.20	0.00	0.11	0.01	0.01	0.88	0.00	0.03	**2.86**
Southern blight	0.01	0.02	0.00	0.01	0.03	0.00	0.19	0.00	0.06	0.00	0.30	0.00	0.00	0.00	0.00	0.00	**0.63**
Soybean rust	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.04**
Stem canker	0.05	0.02	0.00	0.00	0.00	0.08	0.19	0.00	0.30	0.00	0.00	0.00	0.00	0.07	0.00	0.15	**0.86**
Sudden death syndrome	0.01	4.17	0.00	0.00	0.00	0.08	0.19	0.00	0.12	6.32	0.37	0.01	0.00	1.23	0.00	0.30	**12.80**
Virus diseases	0.10	0.01	0.05	0.01	0.00	0.39	0.00	0.12	1.45	0.00	0.15	0.01	0.00	0.00	0.00	0.00	**2.27**
Total disease loss	**1.41**	**16.38**	**0.34**	**0.06**	**0.80**	**7.53**	**10.48**	**0.80**	**21.45**	**15.35**	**7.13**	**0.36**	**1.23**	**8.84**	**0.02**	**2.88**	**95.06**

[a]Rounding errors may exist

Effect of Secondary Nutrient Applications on Suppression of Charcoal Rot in Soybean

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Charcoal rot (Cr) of soybean is a disease that occurs annually and can limit profitable soybean production in some years. Estimated yield losses comparable to sudden death syndrome and seedling disease have been reported over the last 17 years. Approximately 7.5 million bushels of soybean were lost to charcoal rot from 16 southern states in 2013. *Macrophomina phaseolina (*Tassi) Goid (*Mp*), the causal organism of charcoal rot, is a ubiquitous soilborne pathogen that affects over 500 hosts including rotational hosts such as corn, cotton and grain sorghum. CR is typically more devastating in hot dry years in non-irrigated situations, but over the last ten years CR has been reported from irrigated soybean fields in the Mississippi Delta. However, in most situations where CR has been observed in irrigated fields, poor irrigation management practices resulted in plants that appeared to be drought stressed and exhibited signs of *Mp* in excised root samples. The objective of this research is to evaluate the effects of secondary nutrients, specifically calcium (Ca) and magnesium (Mg), on the suppression of CR as well as their effect on Mp colonization of root tissue and toxin production resulting from colonization. In 2014 an inoculated greenhouse rate response trial using a CR-susceptible soybean cultivar evaluated seven rates, 0, 25, 100, 250, 500, 750, and 1,000 lb/A, of Ca and Mg applied alone and in combination at three application timings: at plant, R1, and at plant followed by (fb) R1. Several different variables were measured throughout the trial including: days to emergence, vigor, plant height, number of pods per plant, number of seed per pod, and seed weight. In addition, root samples were collected at specific growth stage timings for observational assessments of infection as well as additional laboratory assessments. A significant increase in seed weight was observed with the 1,000 lb/A rate of Ca + Mg at planting compared to the non-treated. In 2014, non-irrigated field trials were conducted in Stoneville, MS with a susceptible cultivar and with a moderately resistant cultivar. Treatment applications consisted of 1,000 lb/A rate of Ca and Mg alone and in combination at plant, R1, and at plant fb R1 compared with a non-treated. Field plots were inoculated with *Mp* in-furrow at planting in addition to a non-inoculated set of plots (no *Mp* and no secondary nutrients). In- season evaluations, including stand count, vigor, and plant height were taken at V3, R3, R5, R7, and maturity. Yield was collected from all plots and post-harvest evaluations were conducted to determine 100 seed weight and % germination. Mg applied at R1 provided the greatest yield benefit, albeit not significant, over the inoculated non-treated in both trials. Environmental conditions during 2014 were not conducive for CR development. In addition, some treatment combinations may have negatively affected yield. Further research evaluating fungal concentration and associated fungal toxin concentration will be correlated for disease severity levels among treatments and to determine if supplementing secondary nutrient concentrations in plants can reduce disease, fungal propagules in the plant, as well as the toxin concentration.

Molecular Characterization of the G143A Mutation Leading to QoI Fungicide Resistance among Fungal Pathogens Causing Cercospora Leaf Blight and Purple Seed Stain on Soybean

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Cercospora leaf blight (CLB) is one of the most limiting factors for soybean production in the Gulf South. Until recently, CLB has been thought to be caused by the fungus *Cercospora kikuchii*, although a systematic study of a large collection of isolates from several southern states and the Midwest suggests *Cercospora* cf. *flagellaris,* and to a lesser degree, *C*. cf. *sigesbeckiae*, two cosmopolitan lineages frequently reported from many hosts worldwide, are associated with CLB in North America. Recent work has demonstrated the reduced efficacy of quinone outside inhibitor (QoI) fungicides in Louisiana associated with their increased application over the last 15 years. To assess the molecular basis for QoI fungicide resistance among the isolates of *Cercospora* collected during this study, we selected 115 isolates, previously assessed for QoI resistance using fungicide amended media, for molecular characterization. We sequenced a portion of the cytochrome *b* gene containing a single site where a non-synonymous amino acid substitution from glycine to alanine at position 143 (G143A) has been shown to confer resistance in other *Cercospora* species. This mutation was present in fifty-one isolates with EC_{50} values greater than 1 µg ml^{-1} and seven isolates for which EC_{50} values were not determined. The wild-type genotype was observed in fifty-seven sensitive isolates and an additional eighteen not characterized for resistance. The G143A mutation was found in two sensitive isolates and the wild-type genotype was present in one resistant isolate. We also tested the utility of diagnostic molecular markers recently developed to identify QoI sensitive and resistant isolates of *C. beticola*. The efficacy of these diagnostic tools has not yet been tested for other *Cercospora* species. We validated the utility of these primers for detecting the G143A mutation in isolates across a broader taxonomic range, showing that they are able to reliably identify QoI resistance in *C*. cf. *flagellaris, C*. cf *sigesbeckiae* and *C. kikuchii*.

The Effects of Starter Fertilizer on Soybean Infected with *Fusarium virguliforme* or *Rhizoctonia solani*

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Several companies have advocated the use in-furrow starter fertilizers in soybean production. Promoting root growth and emergence are a couple of the touted benefits. One of these products, Nachurs 2%N, 6%P, 16%K (Nachurs Alpine Solutions), is being used by producers. It is unknown if the increased fertility in the root zone may actually increase or decrease the severity or seedling diseases.

Fusarium virguliforme, the fungus that causes sudden death syndrome of soybeans (SDS), is prevalent in most of the soybean production regions throughout the United States. Sudden death syndrome management has been limited to cultural practices and host resistance. *Rhizoctonia solani* is a fungus responsible for pre-emergence and post emergence damping off. Control methods include seed treatments and cultural practices.

An objective of this study is to determine if starter fertilizer (2%N, 6%P, 16%K) HKW6, Nachurs Alpine Solutions) impacts seedling disease caused by *Rhizoctonia solani* and soybean yield. A second objective is to determine if starter-fertilizer influences the incidence and severity of SDS and soybean yield. One trial was infested with *R. solani* at the rate of 0.9 g of inoculum/30.5 centimeters of row. A second trial was infested with *F. virguliforme* at the rate of 2.25 g/30.5 centimeters of row. Inoculum consisted of sterilized white sorghum inoculated with either pathogen. Plots were 3.04 meters wide by 6.1 meters in length with row spacing of 0.76 meters. A randomized complete block design consisted of 4 treatments that were replicated 6 times and planted into 4 row plots. Treatments consisted of treated (metalaxl, fluxapyroxad, pyraclostrobin, and imidacloprid) or non-treated seed (Asgrow 4730) combined with either fertilizer or non-fertilizer. Across both trials, there were no seed treatment and fertilizer rate interactions. In the *R. solani* trial, stand counts were similar between the fertilizer and non-fertilizer treatments. Stand counts were higher when the seed treatment was used. There was no significant difference in soybean yield regardless of treatment. In the *F. virguliforme* trial, stand counts were reduced in the fertilizer treatment when compared the non-fertilizer treatment. Foliar symptoms of SDS and soybean yield were not affected by treatment.

Root-knot Nematodes (*Meloidogyne* spp.) Associated with Soybean in Arkansas

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Root-knot nematodes, *Meloidogyne* spp., are cosmopolitan in distribution and attack a large number of vascular plants on earth. These soil inhabiting plant-root-parasites are responsible for economic losses in most major crops. A survey was conducted to identify *Meloidogyne* spp. present in Arkansas. A total of 79 root-knot nematode positive samples including 25 from soybean were processed to identify root-knot species using a mitochondrial marker. *Meloidogyne incognita* was found in 54 samples including 25 from soybean making it a major root-knot species of soybean in Arkansas. Five different haplotypes of *M. incognita* were found from soybean samples examined. The majority of *M. incognita* sequences were grouped into haplotype *Mi* A. This haplotype was also identified from a cotton sample suggesting *M. incognita* presence in cotton fields and subsequent crops. This survey indicates widespread distribution of *M. incognita* in Arkansas soybean fields. Research efforts directed towards more effective management of root-knot nematodes would aid in reducing yield losses.

Tillage, Fungicide, and Cultivar Effects on Frogeye Leaf Spot Severity and Yield in Soybean

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Frogeye leaf spot (FLS) of soybean, caused by Cercospora sojina, has been a problem in the southern United States for many years but has become an increasing problem in the northern United States more recently, causing significant yield losses. This increase in disease severity in the northern United States has been attributed to increased utilization of no-till planting and changes in climate. A field study was conducted at the University of Tennessee, Research and Education Center in Milan, TN from 2007 to 2010 to determine severity in tilled and no-till plots treated with or without fungicide at R3 and R5 growth stages. Three FLS-susceptible cultivars, one each in Maturity Groups III, IV, and V, were treated with pyraclostrobin (Headline) fungicide. Analysis of variance using the area under the disease progress curve (AUDPC) indicated no significant difference ($P \leq 0.05$) in disease severity between tilled and no-till plots without fungicide. Fungicide did not significantly reduce disease under no-till, but did under tilled plots. This is the first study showing that no-till plots did not reduce or enhance the severity of FLS when no fungicide was applied. Fungicide application significantly reduced ($P \leq 0.05$) disease severity and AUDPC and increased yield in tilled plots. The yield gains in tilled, fungicide-treated plots ranged from 1 to 17%. When fungicide was applied, disease severity was not reduced as significantly in no-till as in treated tilled plots, suggesting that fungicide programs under a notill system may require further study to minimize the risk of FLS severity.

Frogeye Leaf Spot Response to Solo and Combination Fungicides

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In 2010 *Cercospora sojina*, the causal agent of frogeye leaf spot (FLS) disease in soybean, demonstrated resistance to the quinone outside inhibitor (QoI) fungicides. In an effort to understand the efficacy of different fungicides in light of QoI fungicide resistance, field trials were conducted in a randomized complete block design in four locations in Tennessee and one in Illinois during the 2013 and 2014 soybean growing seasons. A minimum of six foliar fungicides comprising QoI, DMI, DMI+QoI, SDHI+QoI, MBC, and chlorothalonil chemical groups were evaluated on a FLS-susceptible soybean variety using a R3 application time. Additional combination-chemical-group fungicides evaluated only in 2014 included: SDHI+QoI+DMI and MBC+DMI products. FLS disease severity (%) and soybean yield (bu/a) were obtained from the center two rows of each plot. The negative correlation between yield and increasing FLS disease severity was demonstrated during both growing seasons. Higher FLS severity was associated with lower yields. In 2013, main effects of fungicide treatment and location and their interaction were significant on FLS severity and yield. In 2014, main effects of fungicide treatment and location and their interaction were significant on FLS severity, but only location was a significant effect on yield. No significant differences were observed in FLS severity between solo-QoI, solo-chlorothalonil, and non-treated plots at 2 of 5 locations in 2013 and at 2 of 4 locations in 2014. Similarly, solo-QoI and solo-chlorothalonil treatment yields were not significantly different than the non-treated check at any location in 2013 or the one location in 2014 that had significant treatment effects on yield. In 2013 DMI+QoI, solo-DMI, and solo-MBC treatments had significantly lower FLS severity at 4 of 5 locations and in 2014 solo-DMI and solo-MBC had significantly lower FLS severity at 3 out of 4 locations and combination-treatments at 2 out of 4 locations. In 2013, solo-DMI, solo-MBC, and QoI+DMI had significantly higher yield than the non-treated check at 2 of 5 locations. In general, combination fungicides were within the top three highest-yielding treatments and conferred the greatest disease control; however, solo-DMI and solo-MBC fungicides also demonstrated adequate FLS disease control and yield protection. Future research will focus on analyzing FLS lesion DNA to analyze QoI-fungicide resistance at each location and how it may have influenced treatments, as well as to assess the pressure exerted by the various fungicides on selection for the G143A mutation conferring QoI-fungicide resistance using qPCR.

A New Perspective on Cercospora Leaf Blight Symptoms on Soybean

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Management of Cercospora leaf blight (CLB), caused by *Cercospora kikuchii*, has been a big challenge in Louisiana and most of the states of the Gulf South of the United States. Two symptoms are associated with CLB: purple leaves (believed to be caused by cercosporin accumulation) and blight. Our findings from previous work showed that there was not a significant correlation between purple and blight symptoms, which suggests that they may be a result of two modes of pathogenesis caused by the same pathogen, or perhaps the purple coloration is a plant reaction to the pathogen. In order to determine if the purple symptom is a plant reaction and blight is the actual disease, we designed an experiment with two objectives: 1) to determine the relationships among fungal biomass in leaves, cercosporin concentration and the two symptoms, and 2) to determine the concentrations of flavonoids in symptomatic leaves. Four soybean cultivars were planted at three locations in Louisiana. Leaves showing different severities of the two symptoms were collected for quantification of anthocyanins, isoflavonoids and cercosporin using HPLC, and fungal colonization using qPCR. In general, *C. kikuchii* was detected in all leaves (including symptomless); however, blighted leaves had three times higher fungal biomass than purple leaves. Cercosporin concentrations also were three times higher in blighted leaves. These results clearly showed that the purple color is not caused by cercosporin. No anthocyanins were not found in any leaves, which suggests that anthocyanins are not the cause of the purple discoloration. The cause still unknown.

Using a Hill Plot Technique for Evaluating Soybean Varieties for Resistance to Sudden Death Syndrome

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Sudden Death Syndrome (SDS), caused by *Fusarium virguliforme,* is one of the most important soybean diseases in the Midwest. Management of this disease is possible by planting varieties with resistance to SDS. Variety evaluations rely on large-scale field-testing, which is labor and time intensive. In addition, many field trials fail due to a lack of sufficient disease pressure. Greenhouse evaluations are used to differentiate between susceptible and resistant varieties, however the results do not always correlate with field ratings of known check varieties. The objective to this study was to evaluate soybean varieties in small-scale, hill plots to determine if results correlate to large-scale field trials. A total of 454 commercial varieties ranging in maturity from 0 to 5 were evaluated with SDS resistant and susceptible check varieties. In each hill plot, 10 seeds and 4 grams of inoculum were planted. The inoculum consisted of sorghum that was infected with *F. virguliforme.* The row spacing for the hill plots was 91 centimeters between rows and 91 centimeters within the row. The varieties were also planted in field trials in three separate geographical locations based on maturity group. Field plots consisted of two rows that were 3.04 meter long. Each plot was infested at the rate of 2.45 grams of inoculum per 30.5 centimeters of row. When plants reached the R1 growth stage, hill plots and field trials were irrigated at the rate of 2.54 centimeters of water per week. Varieties were replicated 3 times in the hill plots and at each of the field locations. The disease incidence (DI) and disease severity (DS) was rated in the hill plots at the growth stage V2 to simulate a greenhouse rating and at the growth stage R6 in both hill plots and field locations. Foliar disease index (DX) was calculated as ((DI x DS)/9) for the field locations. The disease pressure was low in the hill plots, but moderate to severe at the field locations. There was no correlation in the disease ratings of the commercial varieties in the hill plots and field trials. There was also no correlation in disease ratings in the hill plots and field trials for the resistant and check varieties.

Soybean Disease Management Issues in Louisiana during 2014

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In 2014, many seedling, foliar, and root/stem diseases affected Louisiana soybean. Early in the growing season, conditions were favorable for seedling disease development. Cool, wet conditions forced many producers to plant within narrow windows, with many forgoing fungicide seed treatments in a year when they were needed. As a result, seedling diseases were noted throughout soybean producing areas in Louisiana, and *Rhizoctonia solani* seemed to be the most prevalent pathogen causing disease.

Frogeye leaf spot was the most prevalent foliar disease in Louisiana soybean causing significant losses in susceptible varieties. The disease was widespread throughout soybean producing areas in Louisiana with the heaviest pressure in the northeast region of the state. Two fungicide applications were commonplace, and in some cases, management required more. Fungicide trials at the Northeast Research Station (NERS) in St. Joseph and MRRS indicated that products containing only strobilurin fungicides did not effectively manage the disease. These trials also indicated that products containing triazoles were effective against frogeye. Additionally, many samples containing the pathogen were sent to cooperating universities, and all were determined to be resistant to strobilurin fungicides. To date, strobilurin resistance in the frogeye pathogen has been confirmed in 11 parishes. Moderate to heavy disease pressure in the official variety trial at NERS allowed for accurate identification of resistant varieties and provided yield loss estimates up to 18%.

Compared to previous years, Cercospora leaf blight (CLB) was very light in Louisiana during the 2014 growing season. Nevertheless, the disease was present mainly in central and southern parts of the state. Results from trials at Dean Lee Research Station (DLRS) in Alexandria did not indicate any products that were significantly effective against CLB. Research from previous years indicates that the majority (~89%) of this pathogen population is resistant to strobilurin fungicides. About 35% of the pathogen population also is resistant to benzimidazole fungicides. Resistance has not been identified in triazole or SDHI compounds; however, the pathogen population is currently being monitored for changes in sensitivities.

A relatively new malady, currently referred to as “black root rot” or “mystery disease”, was prevalent in Louisiana during 2014. Interveinal chlorosis and necrosis on leaflets was first noticeable during the reproductive stages of soybean, particularly during pod fill. Under closer inspection, adjacent plants in the furrow have died earlier in the season. When excised, soybean roots exhibit a black, rotted appearance, and previous crop debris exhibiting a black color is usually found near affected roots. The causal agent of this malady has yet to be identified. In the northeast region of the state, disease incidence was noted up to 20% in some fields. Anecdotal evidence indicates that the disease is more prevalent where there is no/minimum tillage and soybean monoculture for several years. Rotation to corn may be a management option, and there were indications of varietal tolerance in official variety trials near Alexandria.

Other soybean diseases of note that occurred in Louisiana during 2014 were red crown rot, southern death syndrome, charcoal rot, brown spot, target spot, aerial blight, and anthracnose. Additionally, there were many instances of triazole phytotoxicity noted throughout the season.

Soybean Vein Necrosis Virus in Mississippi

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Soybean vein necrosis virus (SVNV) is a recently described virus and causal of an emerging disease reported from all major soybean-producing states in the USA. A study on this virus in Mississippi (MS) was carried out in 2013 and 2014 in the framework of the project funded by the Mississippi Soybean Promotion Board. The project was designed to better understand SVNV incidence and symptomatology in production fields, as well as population profile of the virus in MS.

For this purpose we carried out extensive field scouting in both years aimed at visual observations of symptoms and sample collection for further, laboratory-based, analyses. In addition to soybean samples, samples of weeds associated with soybean production in MS, were also collected in order to investigate possible alternative hosts for this virus. Besides SVNV collected samples were also tested for the presence of additional 3 viruses (*Bean pod mottle virus*, *Soybean mosaic virus* and *Tobacco ringspot virus*).

Representative samples of SVNV, collected from different counties in MS were selected for the intra-species population study of the virus in MS using genomic RNA2 and RNA3 as templates for comparison.

Several symptomatic soybean samples collected during the survey that resulted negative for SVNV and other viruses tested for in this study (BPMV, SMV and TRSV) were partially characterized, revealing the presence of additional viruses in soybean fields in MS.

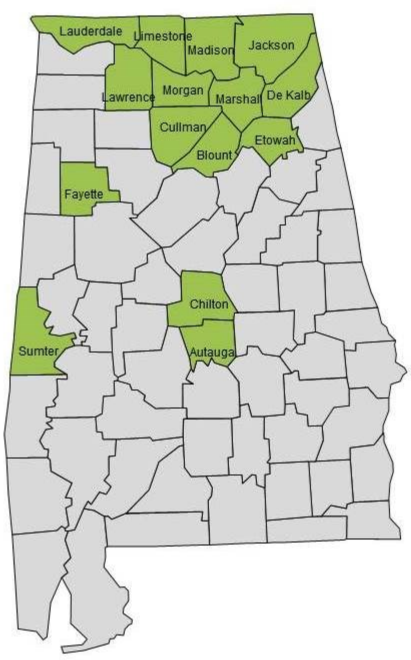
Monitoring for Soybean Vein Necrosis Virus in Alabama (2014)

Edward Sikora, Kassie Conner and Lee Zhang

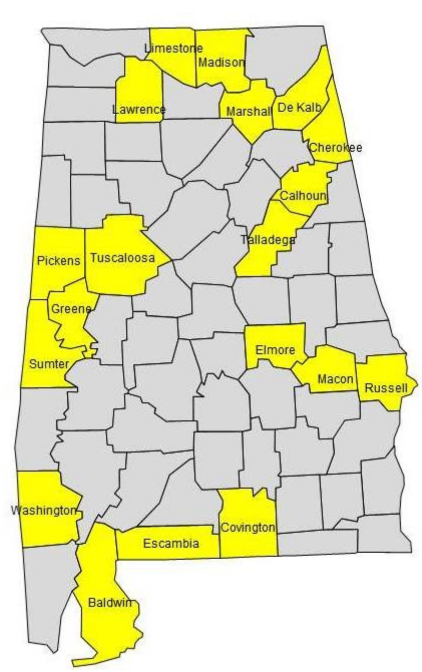
Soybean vein necrosis virus (SVNV) was first detected in Alabama in Limestone County near the Tennessee border in the fall of 2012. Characteristic symptoms of the disease include brown necrotic blotches along major veins of the upper and lower leaf surface, resulting in a scorched appearance of the damaged leaves. In 2013, a multi-year survey was initiated to determine the distribution of SVNV in the state. The survey was initially focused in North Alabama where the disease was known to occur, but also included counties in Central and South Alabama.

Results from the first year of the survey (2013) found SVNV in 14 new counties. The majority of these counties were in North Alabama; however, the disease was also detected in Sumter, Chilton and Autauga counties in Central Alabama. The highest incidence of SVNV was detected in Jackson (56%) and Limestone Counties (54%) but the virus was not detected in South Alabama (Baldwin and Escambia Counties).

In 2014, SVNV was found in an additional 13 counties with many located in Central and South Alabama. Incidence of the disease within a field was highest in North Alabama with some fields near 100% infection. Disease incidence in Central and South Alabama was relatively low compared to the levels in the northern section of the state, with the highest levels in the four southernmost counties reaching 13% in Escambia County. Based on the first two years of the survey, it appears SVNV may be increasing in distribution and intensity in Alabama.



SVNV distribution: 2013



SVNV distribution: 2014

Challenges and Opportunities in the Use of Molecular Tools to Detect Strobilurin/QoI Fungicide Resistance: the Case of Frogeye Leaf Spot

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QoI fungicide resistance in *Cercospora sojina*, the causal agent of frogeye leaf spot (FLS) in soybean, has continued to be reported since it was first discovered in Tennessee in 2010. *C. sojina* collected from field samples have been analyzed using phenotypic and genotypic characterization. Phenotypic characterization conducted includes conidia germination assay using a discriminatory dose of azoxystrobin at 0.1 ppm, calculating EC_{50} values for multiple isolates to azoxystrobin, and analyzing variability in conidia germination. Genotypic characterization conducted includes using a qPCR protocol to quantify the point mutation at position 143 that replaces the amino acid glycine with alanine in the cytochrome b gene resulting in resistance to QoI fungicides. Thirty-one isolates from Tennessee, Alabama, Georgia, Iowa, Mississippi, and Brazil were tested for QoI fungicide resistance using the qPCR protocol. Only 13 of the 31 isolates contained the point mutation to confer QoI resistance, all of which were collected in 2010 or after. Preliminary data from 38 samples of FLS lesions taken from Tennessee fields in 2014 were processed using qPCR and of those 19 were also processed using the discriminatory dose, conidia germination assay and the results from the two tests were correlation and regression analysis was conducted. A greenhouse experiment was conducted using a QoI resistant and sensitive isolate in which $1x10^4$ conidia/ml were used to inoculate soybean cultivar Blackhawk. Different inoculation treatments included, non-inoculated control, only QoI sensitive isolate, only QoI resistant isolate, 1:3 sensitive to resistant isolate, 1:1 sensitive to resistant isolate, and 3:1 sensitive to resistant isolate. The number of leave with FLS symptoms and number of lesions per plant was recorded. The lesions per treatment were also analyzed using the qPCR protocol to detect the proportion of QoI resistance. The same isolates were also compared saprophytically on PDA and V8 media. Based on the preliminary studies both discriminatory dose, conidia germination assay and qPCR protocol can be used to detect approximate proportions of QoI fungicide resistance in *C. sojina* samples. Furthermore, based on the 2 isolates used in the greenhouse and saprophytic studies the resistant isolate was more aggressive and virulent resulting in more lesions and leaves affected compared to the sensitive isolate. Also the majority of the lesions that resulted from the inoculation treatments were over 90% QoI resistant, except for the treatment with only the sensitive isolate. Although, on media the sensitive isolate grew more and had greater sporulation compared to the resistant isolate. These studies will be repeated with other QoI resistant and sensitive isolates and analysis of FLS lesions collected across Tennessee with both genotypic and phenotypic assays will be continued in 2015.

Evaluating the Resistance of Some Soybean Cultivars on Reniform Isolates from Louisiana

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Nematodes pathogenic to soybeans include soybean cyst, root-knot, lesion, lance and reniform. In 2014, loss from these nematodes was estimated at about 3% in the southern soybean producing states. In the resent years, *Rotylenchulus reniformis* has become a predominant species damaging to both cotton and soybeans. The use of resistant soybean varieties is the most economical and environmentally friendly management tactic. In research reported herein, we evaluated the resistance of known soybean cultivars to two isolates of reniform nematode from Louisiana. A single greenhouse and a single field trial were conducted. In the 60-day-duration greenhouse study, ten-day-old seedlings of each of 14 cultivars were inoculated with 10,000 mixed life stages of the nematode. At 60 days, the numbers of nematodes per 500g of soil was determined for each cultivar. Nematode population densities ranged from 953 to 101,120 vermiform life stages. Cultivars supporting the highest population levels were MPG 4714N and R04-1268. Cultivars on which final population density was lower than the infestation level were Dyna Grow 5575, Delta Grow 4940 and S11-20354. The field study was conducted at the LSU AgCenter, North East research station in Tensas parish, Louisiana. In this trial, fumigated (1,3-dichloropropene) and non-fumigated treatments representing 9 cultivars were employed. Nematode population data were collected at-planting, midseason and at-harvest. Application of the nematicide significantly reduced nematode population levels at all three sampling intervals. Similar to the data from the greenhouse trial, at midseason and at harvest, Delta Grow 4940 and S11-20354 had the lowest reniform nematode populations without fumigation. The cultivar R04-1268 produced the highest nematode populations in the absence of fumigation at both midseason and at-harvest. Application of the nematicide reduced nematode population significantly when compared to those without fumigation. In both the presence and absence of the fumigant, lowest yields were observed with R04-1268, MPG 4714N, and Asgrow 4534. Further studies evaluating the host status of these cultivars should be conducted using reniform isolates from multiple geographical locations.

Investigating Fungicide Sensitivities Beyond the QoIs in *Cercospora sojina* from Mississippi

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A survey of Mississippi soybean fields was conducted during the 2013 and 2014 growing seasons to collect leaf samples exhibiting symptoms of frogeye leaf spot (FLS) for isolation of the causal agent *Cercospora sojina* Hara. Symptoms of FLS develop on foliage as circular to angular lesions which may expand and coalesce to form larger, irregular spots. When lesions cover more than 30% of the leaf surface, blighting occurs, which can lead to premature defoliation and yield loss. Foliar fungicides, such as the quinone outside inhibitors (QoIs) have been used to manage FLS across MS, in addition to being applied as a general management practice to improve yield performance by reducing late-season disease pressure following growth- stage timed applications. Resistance to the QoI fungicide class has been confirmed in *C. sojina* from several soybean producing states. More than 600 isolates were collected from MS soybean fields and screened for the G143A substitution associated with QoI-resistance; greater than 90% of the collected isolates were observed to carry the substitution. These results indicate that the QoIs are no longer effective at managing FLS and that additional, non-QoI fungicide chemistries should be utilized. Two fungicide classes that could be applied in place of the QoIs are the demethylation inhibitors (DMIs) and the methyl benzimidazole carbamates (MBCs). The objective of this study was to evaluate the response of *C. sojina* isolates to additional fungicide chemistries using *in vitro* bioassays. A sub-set of 20 *C. sojina* isolates, previously characterized as QoI-sensitive or QoI-resistant, were chosen to determine their sensitivities to a DMI fungicide and a MBC fungicide. Hyphal plugs (5 mm) from each isolate were transferred to potato dextrose agar (PDA) plates amended with various rates of either the DMI fungicide tetraconazole (active ingredient of Domark), or the MBC fungicide thiophanate-methyl (active ingredient of Topsin). Plates were placed in the dark for 14 days before diameter measurements were made. For each respective fungicide, the effective concentration at which mycelial growth was inhibited by 50% (EC_{50}) was estimated for each isolate based on linear regression of probit -transformed relative inhibition on $\log_{10}$-transformed fungicide concentrations. Additionally, a partial fragment of the β-tubulin 2 gene was amplified using primers developed in our laboratory, to confirm the results of the thiophanate-methyl bioassays. The information generated from this study allowed for reference sensitivities to be established for use in future screening.

Using Fluopyram as a Seed Treatment to Reduce Sudden Death Syndrome in Resistant and Susceptible Soybean Varieties

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Fusarium virguliforme is a soilborne fungus that is the causal agent of soybean sudden death syndrome (SDS). The disease has been reported in most soybean-growing regions of the United States and the world. Producers are using host resistance and cultural practices to manage the disease, because fungicide and other control measures have little impact on SDS. Since *F. virguliforme* infects root tissue, there is potential for a seed treatment or an in-furrow fungicide to reduce infection by the pathogen. Recently a SDHI fungicide, fluopyram, has been reported to reduce foliar symptoms of SDS when used as a seed treatment or in-furrow application. The objective of this study was to evaluate the performance of fluopyram across soybean varieties with different levels of resistance to SDS. This trial was conducted at 3 locations. Each plot consisted of 2 rows that were 6.1 meters long. Rows were infested at the rate of 2.45 grams of sorghum per 30.5 centimeters of row. Inoculum consisted of *F. virguliforme* cultured on infected sorghum. When soybean plants reached the R1 growth stage, trials were irrigated with center pivots at the equivalent of 2.54 centimeters per week. Fifteen varieties were selected with varying levels of resistance and were treated with Poncho/Votivo (base fungicide). In addition to the Poncho/Votivo, a low rate (.075 mg/seed) or a high rate (.15 mg/seed) of fluopyram was added to the base fungicide. The experiment was organized in a split-plot design with five replications. Main plots were levels of fluopyram and subplots were variety randomized in main plots. At each site, stand counts, phytotoxicity, weekly SDS ratings and soybean yield were collected. The disease was severe at one of the locations and mild to moderate at the other two locations. Across locations, the high rate of fluopyram decreased the area under the disease progress curve (AUDPC) but the low rate of fluopyram decreased AUDPC when compared to the base fungicide at 2 of the 3 locations. Soybean yield was higher for both rates of fluopyram when compared to the base fungicide at 2 of the 3 locations.

Glyphosate Affects Cercospora Leaf Blight and Brown Spot on Soybeans

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Glyphosate has been the most widely used herbicide in the world since its introduction in the 1970's because of its effectiveness in controlling weeds, but the effects of glyphosate on soybean diseases has not been well documented. In order to test the effects of glyphosate on Cercospora leaf blight (CLB), caused by *Cercospora kikuchii*, and brown spot, caused by *Septoria glycines*, 12 soybean varieties (maturity groups III, early IV, late IV and V) were chosen from a pool that were evaluated in a uniform variety trial. Each variety was planted at two locations in Louisiana, the Dean Lee and Ben Hur Research Stations, located in Alexandria and Baton Rouge, respectively. Each plot consisted of two 20-ft rows. A completely randomized design (CRD) was used with four replications for both treated and nontreated plots. Treatments consisted of foliar applications of a commercial formulation of glyphosate (Roundup Super Concentrate [50.2% glyphosate isopropylamine salt]) applied at two rates at Ben Hur, 22 and 44 fl oz/A at R2 and R3, respectively, and 22 fl oz/A at R3 at Dean Lee. Also, an application prior to planting was done for both locations. Disease assessments were performed at R6 in both locations using previously described scales for CLB and brown spot. CLB was the dominant disease at Dean Lee, and brown spot was dominant at Ben Hur. Data were transformed to percentages and analyzed in SAS 9.4 using PROC MIXED and pdmix800 SAS macro with a Tukey's adjustment ($P<0.05$). Brown spot and CLB severities were lower in the glyphosate treatments for six varieties at Ben Hur and three varieties at Dean Lee, respectively.

Efficacy of Seed Treatments for Management of *Fusarium virguliforme* and *Heterodera glycines*

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Fusarium virguliforme, the causal agent of sudden death syndrome (SDS) in North America, and *Heterodera glycines*, soybean cyst nematode (SCN), are significant threats to the production of soybean. In 2014, two field trials were established to evaluate seed treatments and their efficacy in managing SDS and SCN. The locations were selected because each has a history of SDS and SCN. One location was planted on May 10 in Shawneetown, Illinois and the equivalent of 1 inch of rainfall per week was provided by center pivot irrigation once plants reached the flowering stage. A second location in Ina, IL was planted on May 27 and was not irrigated. Both locations were infested with *F. virguliforme* at planting. Plots were 3.04 meters wide by 6.1 meters in length with row spacing of 0.76 meters. Each plot received 2.45 grams of infested sorghum per 30.5 centimeters of row. At each location, two soybean varieties and ten different seed treatments were tested. Seed treatments were evaluated for phytotoxicity, vigor, stand count, SDS foliar ratings and soybean yield. Soil samples were collected at planting and at harvest to determine SCN reproduction. Root samples were collected from each plot to quantify the amount of *F. virguliforme* DNA using a real-time quantitative polymerase chain reaction (qPCR) protocol. ANOVA and Fisher's LSD Test were used to separate treatment means. Analysis of the qPCR was done by comparing the quantification cycle (Cq) values and separating means using ANOVA. There were significant differences between varieties for soybean yield and disease index. Treatments containing fluopyram had more phytotoxicity than treatments lacking fluopyram at both locations. Several treatments allowed for higher SCN reproduction than treatments with Clariva. At Ina, a fluopyram treatment and one of the Clariva treatments had higher soybean yield than the non-treated control. At Shawneetown, one fluopyram treatment had higher soybean yield than all other treatments. In the qPCR analysis, seed treatments with fluopyram had a lower amount of *F. virguliforme* DNA in the roots than the non-treated control.

Minor Element Application as a Management Strategy for Soybean Rust and Cercospora Leaf Blight

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Soybean rust (SBR), caused by *Phakopsora pachyrhizi*, and Cercospora leaf blight (CLB), caused by *Cercospora kikuchii*, are prevalent foliar diseases of soybean (*Glycine max*) in the southern U.S and other parts of the world. The SBR pathogen has developed widespread resistance to fungicides in Brazil. Similarly, populations of *C. kikuchii* in Louisiana and elsewhere are resistant to commonly used fungicides. In addition, aside from fungicide resistance, CLB has been recalcitrant with respect to disease management with fungicides. With both diseases, the lack of commercially available disease resistant varieties provides an impetus to develop new disease management strategies. Foliar applications of minor elements were made to field plots at the R5 growth stage during the 2012 and 2013 growing seasons in Louisiana. Rates were based on foliar fertilizer treatments where available or on tissue analyses reported in the literature. Disease severity was rated during late R6. *In vitro* tests of minor elements also were conducted with *C. kikuchii* on PDA for effects on growth and production of the toxin cercosporin. Field results indicated a reduction in CLB severity under high iron treatments, which was corroborated by the *in vitro* test for *C. kikuchii*. Certain rates of aluminum, copper, iron and zinc treatments had beneficial effects for both diseases and *in vitro* experiments. Elements that showed no measurable effects on either disease or *C. kikuchii* cultures included calcium, cobalt, manganese, and molybdenum. Disease suppression was not substantial enough for minor element applications to function as stand-alone treatments; however, formulations that enhance foliar uptake of selected minor elements could augment the effects, and combining these applications with existing management strategies could further alleviate disease pressure.

Managing Frogeye Leaf Spot and Determining the Impact of Fungicide Phytotoxicity in Mississippi Soybean

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Frogeye leaf spot (FLS) has become a major foliar disease in the Mississippi soybean production system over the past three seasons. With the observation of fungicide failure as well as identification of Quinone outside inhibitor (QoI)-fungicide resistance throughout MS, alternative chemical management practices need to be explored to effectively manage FLS in susceptible soybean varieties. Trials were conducted during 2013 and 2014 in Starkville and Stoneville to determine fungicide efficacy on QoI-resistant FLS. Plots consisted of four rows, on either 38 or 40 inch centers, and were generally 20, 30, or 40 feet in length. Several different fungicide modes of action were considered alone and in combination in several different application timing strategies. The fungicides selected were grouped into different classes: QoI, DMI, QoI + DMI, QoI + SDHI, QoI + SDHI + DMI, DMI + chloronitrile, copper-based fungicide, MBC, and MBC + DMI. Applications were timed to include early, R2 to R3, and late-season timings, R5 to R5.5. Fungicide applications were targeted to manage FLS on a popular susceptible soybean variety, Armor DK 4744. All fungicides were applied with 0.25% of a non-ionic surfactant (as Induce) and applied at a rate of 15 gallons per acre. Observations of FLS severity and more specifically phytotoxicity as a result of the application of specific fungicide active ingredients were observed between before application and several times post-application. Ratings were conducted on disease using a 0-9 scale where 0=no disease and 9 was characterized as approximately 90% of leaf tissue covered by disease symptoms. One of the major drawbacks of applying some fungicide products is the result of foliar phytotoxicity. Certain chemical compounds can produce an injury, or phytotoxic response, when they are applied to certain soybean varieties. Phytotoxicity was rated in entire plots on a scale of 0 to 100% of affected foliage. Data analyses were conducted in SAS to determine the significance of fungicide application on yield, FLS severity, and phytotoxicity. Significant differences were observed between specific fungicides and the non-treated check as well as between some specific products at both locations. In general, analyses revealed that even in situations where a severe phytotoxic response was observed, the resulting yield proved to be greater than the average; however, this may not true of all fungicides producing phytotoxicity. Scatter plots of yield vs. phytotoxicity suggest there is no relationship between yield and phytotoxicity, at least in the 2013 and 2014 trials. Inferences can be made that the fungicides containing a dual mode of action were the best in combating FLS and therefore would providing optimal yield protection for farmers especially in situations where QoI-resistant FLS is present.

An Update of Research on Phomopsis Seed Decay in Soybean

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Phomopsis seed decay (PSD) is one of the most important soybean diseases that causes poor seed quality and further poor germination/vigor in most soybean production areas, especially in southern states. Very few soybean cultivars currently available for planting have resistance to PSD. To identify new sources of resistance to PSD, a multistate and multiyear research project on "Screening germplasm and breeding for resistance to Phomopsis seed decay" was funded by the United Soybean Board from 2009 to 2014. A total of 135 germplasm lines collected from 28 countries were field screened in Arkansas, Mississippi, and Missouri. Fifteen accessions (six MG III, four MG IV, and five MG V) had significantly ($P \leq 0.05$) lower Phomopsis seed infection than the susceptible checks across years and locations. Another study funded by the Mississippi Soybean Promotion Board, evaluated commercial cultivars for resistance to PSD with inoculated and non-inoculated treatments and two harvest times (on-time vs. delayed). Several cultivars were identified with low disease incidence and good seed quality. Our current research is focused on development of high-yielding soybean lines with PSD resistance. Over 20 new breeding populations have been developed to incorporate resistance genes into high yielding cultivars or breeding lines, including four mapping populations to identify and map the PSD resistance genes. Analysis of these populations will help us develop high yielding lines with PSD resistance and understand the genetics of PSD resistance. In addition, the genomes of four isolates of *Phomopsis longicolla* that cause PSD have been sequenced. The genome sequences of the pathogen will be valuable for investigating the genetic base of fungal virulence factors and understanding the mechanism of infection.

Assessment of Several Commercially Available Triazole and Premix Fungicides for Management of Frogeye Leaf Spot in Arkansas

T. R. Faske and M. Emerson

University of Arkansas, Lonoke Research and Extension Center, Lonoke, AR.

Frogeye leaf spot (FLS) caused by *Cercospora sojina* is an important foliar disease affecting soybean production in the southern United States. In 2012, isolates of *C. sojina* collected in Arkansas were confirmed to be resistant to quinone outside inhibitor (QoI) fungicides. Given the recent detection, few studies have investigated the efficacy of commercially available triazole and premix fungicides to control these new fungicide-resistant strains of FLS. The objective of this study was to evaluate triazole and premix fungicides to control QoI-resistant FLS in three experiments; solo triazole fungicides at high rates, solo triazole fungicides at a similar rate of ai/ac, and premix fungicides at low rates. All trials were conducted at the Newport Extension Station in Newport in a field with a history of QoI-resistant FLS. For each trial soybean cv. 'Armor 48R40' was planted in four, 27-ft-long rows spaced 30-in apart. The experimental design was a RCBD with four replications separated by a 3-ft alley. Fungicides were applied at R4 growth stage with ~1% disease severity of FLS. The severity of FLS in all trials was similar between Quadris and the non-treated control (NTC). Final severity ratings were near 40% on the NTC at the end of the season. High rates of the triazole fungicides, Proline, Topguard, Alto, Domark, and Tilt had a lower ($P = 0.05$) FLS severity than the NTC, which contributed to a numerically higher yield than the NTC. Similar application rates (30 mg ai/ac) of triazole fungicides; Topguard, Alto and Domark had lower ($P = 0.05$) FLS severity than Tilt, Muscle and NTC. Of the triazoles applied at a similar rate only Alto, Domark and Muscle contributed to a higher numeric yield than the average yield across all triazoles in this experiment. Premix fungicides applied at low rates that contributed to lower ($P = 0.05$) disease severity of FLS consisted of Quadris Top, Topsin XTR, Affiance, Fortix, and Quilt Xcel compared to Evito T, Custodia, Priaxor, and NTC. A higher numeric yield was observed for all premix fungicides plots harvested compared to the NTC. Generally, fungicides containing the triazoles that preformed best in these field trials were also effective in a premix at suppressing QoI-resistant FLS and protecting yield potential of a highly susceptible soybean cultivar.

ILeVO® Seed Treatment for Control of SDS and Nematodes in Soybeans

Charles Graham, Bayer CropScience, Grenada, MS

ILeVO® seed treatment is the only solution for Sudden Death Syndrome (SDS) that has activity against nematodes. It protects the soybean root system against the SDS fungus, and it has activity against nematodes in the seed zone, producing healthier plants for higher yield potential. SDS continues to be a major issue in soybean-growing regions. The causal agent of SDS is *Fusarium virguliforme (*or *Fusarium solani* f. sp. *glycines)*, a soilborne fungus. Once present in a field, the fungus does not go away and can be spread by soil movement to neighboring fields.

Initial infections of SDS occur on the roots and crowns of young soybean seedlings, resulting in Fusarium root rot. Later in the season, the fungus can produce toxins which cause visual symptoms including leaf drop, reduced pod fill, aborted pods and, ultimately, yield loss.

First seen in Arkansas in 1971, this deadly disease now has been documented in nearly every state where soybeans grow. From 2009 to 2011, average losses in the United States were estimated at 42 million bushels per year. With the use of ILeVO, growers see an average yield increase of two bushels per acre even when there are no visual symptoms of SDS. In fields that have been infected with SDS, ILeVO has been shown to be effective in minimizing the impact of the disease on yield loss. Compared to untreated fields, growers see a yield increase of 2 to 10 bushels per acre depending on disease severity.

In addition to managing the impact of SDS on the plant, ILeVO® provides activity against nematodes in the seed zone. Combining ILeVO with Poncho®/VOTiVO® gives growers three modes of action for unmatched root and plant protection against the SDS fungus, insects and nematodes. The payoff is a healthier plant with maximum yield potential.

Nematodes cause significant yield loss every year across all soybean-producing geographies. Soybean Cyst Nematode (SCN) causes more yield loss in soybeans year after year than any other pest. The practice of growing resistant soybean varieties is considered the most effective tool for the management of SCN, but it is far from a complete solution. Complementing resistant soybeans with ILeVO and Poncho/VOTiVO adds another defensive tool for soybean growers that can result in less nematode damage and yield loss.

Use of Random Point Assignments to Determine the Impact of Sudden Death Syndrome and Other Soilborne Diseases

Terry N. Spurlock[1] and Wes Kirkpatrick[2]

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Sudden death syndrome of soybean (SDS) is caused by the fungus *Fusarium virguliforme*. The fungus infects and initially causes deterioration of the crown and upper taproot. As the plants enter the reproductive stages of development, foliar symptoms are often observed where reddish brown lesions form on the leaves and defoliation occurs after significant leaf damage. A severely affected field will have exposed petioles where defoliation has occurred and yield will be greatly reduced. In 2014, a field near Dumas, AR and a field near Yancopin, AR were confirmed to have SDS. At R5, aerial imagery was obtained by flying a Cessna 172 with a Geovantage Geoscanner sensor package having a 4-band multispectral unit utilizing blue, green and red light wavelengths in the visible part of the spectrum and near-infrared (NIR) beyond the red visible light bands. The near infrared imagery was georeferenced and added as a layer to a .mxd file in ArcGIS 10.2. Yield data was collected on a John Deere 9870 combine with a factory installed yield monitor and stored as a georeferenced .shp file for the field near Yancopin. Soil EC was collected for both fields with a Veris 3150 soil EC mapping system on 12 ft centers and stored as a georeferenced .shp file. The yield and soil EC data were added to the same .mxd as the NIR aerial imagery. A field boundary was digitized in ARCMap and 5000 random points assigned within the boundary using the random points tool in ArcToolbox. The NIR, yield, and soil EC were sampled at each random point using the spatial join tool in ArcToolbox and stored as a new .dbf associated with a .shp file projected to WGS 1984 Web Mercator Auxiliary Sphere. Data were then analyzed using *Moran's I* to determine spatial autocorrelation and distribution and spatial regression to determine spatial dependence and relationships in GeoDa 1.6.6. In both fields, NIR revealed severe localized defoliation. Spatial regression analysis indicated a significant ($P=0.05$) relationship between soil texture and defoliation where the majority of the disease was correlated with soil EC readings in the 20-35 ds/m range. Yield data was only obtained and analyzed for one field with yield correlating negatively to both soil texture and defoliation. The evidence suggests SDS could be managed site specifically. This method could be applied to determine the distributions of other soilborne diseases or potential interactions with SDS.

Effect of Planting Date, Planting Density, Seed Treatment, and Seed Quality on Soybean Stand and Yield in Arkansas

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Low seed vigor and seedling diseases can significantly reduce soybean stands and yields. Growers could respond by increasing seeding rates and using seed treatments. To determine how effective these measures are across planting dates commonly used in Arkansas, high and low quality seed lots of a maturity group (MG) IV and MG V cultivars were planted in April, May and June at Keiser, AR, from 2008 to 2011 and at Stuttgart, AR, and Rohwer, AR in 2011. Armor Seed, LLC, Weiner, AR, provided high and low quality seed lots of the same cultivar for the maturity groups each year, but cultivars varied from year to year. Each seed lot was either not treated, or treated with ApronMaxxRTA plus Dynasty (mefenoxam, fludioxinil, azoxystrobin) at 44.4 and 8.9 ml per 45.4 kg seed, respectively. Seed were planted at a high density (444,600 seed/ha), medium density (333,450 seed/ha), or low density (222,300 seed/ha) at each planting date. The tests were furrow irrigated. Stands were determined four weeks after planting and yields were taken at the end of the season. Data were analyzed across years and locations with PROC MIXED (SAS Institute, Cary, NC).

With MG IV cultivars, there were significant seed quality (SQ) by planting density (PDY) and seed treatment (ST) by PDY interactions for stands. For both interactions, stands reflected planting densities. Low seed quality generally resulted in lower stands with the medium and low planting densities, but not the high planting density. Treated seed had significantly higher stands than the non-treated seed at all planting densities. PD did not significantly affect stand. There was a PD by SQ by ST by PDY interaction for yield. Yields were highest in May plantings and there were no significant differences due to SQ, ST or PDY. April and June plantings had significantly lower yields compared with May plantings. The lowest yields occurred in plots with non-treated high quality seed planted at high and low densities and the treated high quality seed in the medium density in April.

With MG V cultivars, there was a significant PD by SQ by ST interaction for stand. With both high and low quality seed, higher stands occurred in May and June plantings relative to April plantings. Stands were greatest for the high quality, treated seed followed by the high quality, non-treated seed. The low quality treated seed and low quality non-treated seed resulted in the lowest stands. The lowest stands occurred in April with the low quality, non-treated seed. Stands were higher with treated than non-treated seed and reflected planting densities. Yields were significantly higher in May than in April or June plantings (3,373 vs 3,023 and 2,963 kg/ha, respectively). High quality seed resulted in significantly higher yields than low quality seed (3,191 vs 3,044 kg/ha, respectively), high and medium planting densities had significantly higher yields than low planting densities (3,232 and 3171 vs 2,950 kg/ha, respectively), and treated seed had significantly higher yields than non-treated seed (3,165 vs 3,070 kg/ha, respectively).

Overall, SQ and ST both affected stands and yields especially with April and June plantings. ST improved stands and yields of both high and low quality seed. Yields were generally higher with medium and high than with low PDY.

SOUTHERN SOYBEAN DISEASE WORKERS FY 2014 TREASURY REPORT	
Operational Account #42958 Union Bank, Monticello, AR	

Receipt Summary - 2014	
Interest on Operational Account	$0.00
2014 Meeting Registration Receipts	$3,225.00
2014 Industry Support	$2,500.00
Total Receipts	**$5,725.00**

Disbursement Summary - 2014	
Printing Fees	$71.61
Web Site Build Fee	$270.33
2014 Annual Meeting Costs	$7,029.65
Association Awards - Student Papers	$1,100.00
Association Awards - Plaques Account Fees	$89.88
Total Disbursements	**$8,561.47**

SSDW Assets – December 31, 2014	
Beginning Balance – 1/01/14	**$ 5,847.80**
Receipts	**$ 5,725.00**
Disbursements	**$8,561.47**
Net Assets – 12/31/14	**$ 3,011.33**
Balance of Operational Account	**$ 3,011.33**

Myra Purvis

12/31/14

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