3-2013

# Proceedings of the 40th Annual Meeting, Southern Soybean Disease Workers (March 13-14, 2013, Pensacola Beach, Florida)

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# PROCEEDINGS OF THE SOUTHERN SOYBEAN DISEASE WORKERS

## 40th ANNUAL MEETING

**March 13-14, 2013 Pensacola Beach, Florida**

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Proceedings of the Southern Soybean Disease Workers are published annually by the Southern Soybean Disease Workers.

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# 40th Annual Meeting of the Southern Soybean Disease Workers

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**Wednesday, March 13, 2013**

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| **11:30-1:00** | **Registration for SSDW**<br>**-outside of Royal Palm** |
| **1:00-5:00** | **Southern Soybean Disease Workers Meeting** |
| **1:00-1:15** | **Introductions**<br>Clayton Hollier – President SSDW |
| **1:15-1:35** | **Update on Detection and Management of QoI Fungicide Resistant *Cercospora sojina*, the Causal Agent of Frogeye Leaf Spot in Soybean.**<br>C. Bradley, G. Zhang, V. Chapara, R. Ming, F. Zeng, H. Young Kelly, and M. Newman |
| **1:35-1:55** | **Identification of Soybean Genotypes to *Cercopsora sojina* by Field Screening and Molecular Markers.**<br>A. Mengistu, and R. Mian |
| **1:55-2:15** | **Soybean Vein Necrosis Virus**<br>D. Hershman |
| **2:15-2:35** | **Single Applications of Triazole Fungicides at R1 for Management of Cercospora Leaf Blight and Rust in Soybean.**<br>R. W. Schneider, C. L. Robertson, B. M. Ward, and E. C. Silva |
| **2:35-2:55** | **Observations on soybean rust management in Alabama in 2012.**<br>E. J. Sikora, D. Delaney, and M. Delaney |
| **2:55-3:15** | **BREAK** |
| **3:15-5:00** | **Graduate Student Paper Competition**<br>Clayton Hollier, Moderator |
| **3:20-3:40** | **Logical Areas of Collection: A Precision Concept for Management of *Rhizoctonia solani* AG1-IA.**<br>T. N. Spurlock, C. S. Rothrock, and W. S. Monfort, |

| | |
|---|---|
| **3:40-4:00** | **Screening of Soybean Recombinant Inbred Lines against *Phakopsora pachyrhizi*.**<br>M. Ganiger, D. R. Walker, and Z. Y. Chen |
| **4:00-4:20** | **Effects of Minor Element Nutrition on Cercospora Leaf Blight of Soybean.**<br>B. M. Ward, C. L. Robertson, R. W. Schneider and E. C. Silva |
| **4:20-4:40** | **Sensitivity of *Cercospora kikuchii* Populations to Methyl Benzimidazole, Carbamate, Quinone Outside Inhibitor, and Demethylation Inhibitor Fungicides.**<br>P. Price, M. A. Purvis, C. L. Robertson, G. B. Padgett, and R. W. Schneider |
| **4:40-5:00** | **Effect of Foliar Application of Micronutrients on Severity of Rust in Soybean.**<br>E. C. Silva, B. M. Ward, C. L. Robertson, and R. W. Schneider |
| **5:00-5:30** | **Break and SSDW Business Meeting**<br>-Old Business<br>-New Business<br>-Committee Reports<br>-Treasury Report<br>-Graduate Student Competition judges meet |
| **5:30** | **Adjourn with dinner on your own** |

**Thursday, 14 March 2013**

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| **7:00-8:00** | **Breakfast - Royal Palm** |
| **8:00-8:30** | **Registration** |
| **8:10-12:00** | **Southern Soybean Disease Workers Paper Session**<br>Tom Allen; Moderator |
| **8:10-8:30** | **History of Reniform Nematode in the South.**<br>R. T. Robbins |
| **8:30-8:50** | **Role of Seed Quality, Planting Date, and Seed Treatment on Soybean Stand and Yield.**<br>J. C. Rupe, R. Holland, A. Steger, S. Goeke, E. E.Gbur, W.J. Ross, M.Wyss, J. McCoy, and R. Cingolani |
| **8:50-9:10** | **Screening Soybean Germplasm and Commercial Varieties for Resistance to Phomopsis Seed Decay: Results from 2012 Trials.**<br>S. Li, G. Sciumbato, P. Chen, S. Sun, J. Rupe, R. Holland, and A. Steger |

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|---|---|
| **9:10-9:30** | **A Novel Seed Treatment with Activity against SDS in Soybeans.**<br>C. Graham |
| **9:30-9:55** | **BREAK** |
| **10:00-10:20** | **Adenosylhomocysteinase (AHCY) is essential for Virulence of *Cercospora kikuchii* in soybeans.**<br>A. K. Chanda, R. W. Schneider, and Z. -Y. Chen |
| **10:20-10:40** | **Fungicide Timing Strategies: Targeting Yield Enhancement in Mississippi Soybean**<br>T. W. Allen, D. Cook, A. Catchot, J. Gore, and N. Buehring |
| **10:40-11:00** | **Update from the United Soybean Board.**<br>K. Whiting |
| **11:00-11:30** | **Industry Pest Information Platform for Extension and Education (iPiPE).**<br>S. Isard, R. Magarey, J. Golod, and J. Russo |
| **11:30-12:00** | -Present student paper competition awards<br>-Vice President elections<br>-Election of Treasurer<br>-Select location for 2014 SSDW meeting |
| **12:00-1:00** | Lunch on your own |
| **1:00-3:00** | SSDW subcommittee meetings |

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# Southern United States Soybean Disease Loss Estimate for 2012

Compiled by S. R. Koenning Extension Specialist, Department of Plant Pathology, Campus Box 7616, North Carolina State University, Raleigh, NC 27695-7616

Since 1974, soybean disease loss estimates for the Southern United States have been published in the Southern Soybean Disease Workers Proceedings. Summaries of the results from 1977 (10), 1985 and 1986 (6), 1987 (7), 1988 to 1991 (9), 1992 to 1993 (12), 1994 to 1996 (8) have been published. A summary of the results from 1974 to 1994 for the Southern United States was published (11) in 1995, and soybean losses from disease for the top ten producing countries of 1994 was published in 1997 (13). An estimate of soybean losses to disease in the US from 1996-1998 was published in 2001, and a summary of losses from 1999-2002 was published online in 2003 (14, 15). In 2005, a summary of disease losses for the US from 1996-2004 was published electronically (16) in 2006 a summary of 2003 to 2005 was published in the Journal of Nematology (17), a 2009 summary of losses from 1996-2007 (14), a 2010 summary focusing on soybean rust was published on line in Plant Health Progress (4). The 2011 disease loss estimates were published in the SSDW proceeding in 2012(1). Tables 2 and 3 from the 2011 estimates that were published in 2012 (1) contains several errors for which I apologize. The corrected tables are published here as errata, (Tables 2A, and 2B) at the end of this paper.

The loss estimates for 2012 published here were solicited from: Edward Sikora in Alabama, Travis Fiske in Arkansas, Nancy Griffin in Delaware, Nicholas Dufualt in Florida, Bob Kemerait in Georgia, Don Hershman in Kentucky, Clayton Hollier and Boyd Padgett in Louisiana, Arvydas Grybauskas in Maryland, Tom Allen in Mississippi, Allen Wrather in Missouri, Steve Koenning in North Carolina, John Damicone in Oklahoma, John Mueller in South Carolina, Heather Young, in Tennessee, Tom Isakeit in Texas, and Patrick Phipps in Virginia. Please note that a number of people have retired and estimates are being submitted by new personnel notably: Nancy Griffin, Delaware, Travis Faske, Arkansas, and Heather Young in Tennessee. Various methods were used to obtain the disease losses, and most individuals used more than one. The methods used were: field surveys, plant disease diagnostic clinic samples, variety trials, and questionnaires to Cooperative Extension staff, research plots, grower demonstrations, private crop consultant reports, foliar fungicide trials, sentinel plot data, and "pure guess". The production figures for each state were taken from the USDA/NASS website in mid-January of 2013. Production losses were based on estimates of yield in the absence of disease. The formula was: potential production without disease loss = actual production ÷ (1-percent loss) (decimal fraction).

Soybean acreage in the sixteen southern states covered in this report in 2012 was increased compared to that reported in 2011 (1). The 2012 average per acre soybean yield was 38 averaged on a per state basis and the weighted average was 38 due in large part to late season rain. In 2012, 694 million bushels were harvested from over 18 million acres in 16 Southern states. The overall average (weighted for acreage) for the 16 reporting states was 38.0 bushels/acre in 2012 while the overall average reported in 2010 was 36.0

bushels/acre (Table 1). The 2011 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 2012 was 6.48 % or 50.7 million bushels in potential production.

Table1. Soybean production for 16 Southern states in 2012.

| State | Harvested acres | Yield/A (bu) | Total production (bu) |
|---|---|---|---|
| Alabama | 335,000 | 45 | 15,075,000 |
| Arkansas | 3,160,000 | 43 | 135,880,000 |
| Delaware | 168,000 | 42.5 | 7,140,000 |
| Florida | 20,000 | 39 | 780,000 |
| Georgia | 215,000 | 37 | 7,955,000 |
| Kentucky | 1,470,000 | 40 | 58,800,000 |
| Louisiana | 1,115,000 | 46 | 51,290,000 |
| Maryland | 475,000 | 47 | 22,325,000 |
| Mississippi | 1,950,000 | 45 | 87,750,000 |
| Missouri | 5,260,000 | 29.5 | 155,170,000 |
| North Carolina | 1,580,000 | 39 | 61,620,000 |
| Oklahoma | 260,000 | 15 | 3,900,000 |
| South Carolina | 370,000 | 34 | 12,580,000 |
| Tennessee | 1,230,000 | 38 | 46,740,000 |
| Texas | 110,000 | 26 | 2,860,000 |
| Virginia | 580,000 | 42 | 24,360,000 |
| Total | 18,298,000 | 38 bu/a; Wt. avg 38 bu/a | 694,225,000 |

**References:**


1. Koenning, S.R. 2013. Southern United States soybean disease loss estimate for 2012. Proceedings of the Southern Soybean Disease Workers, Thirty Seventh Annual Meeting, Pennsacola, FL. Pp. 1-5.

2. Koenning, S.R. 2012. Southern United States soybean disease loss estimate for 2011. Proceedings of the Southern Soybean Disease Workers, Thirty Seventh Annual Meeting, Pennsacola, FL. Pp. 1-5.

3. Koenning, S.R. 2011. Southern United States soybean disease loss estimate for 2010. Proceedings of the Southern Soybean Disease Workers, Thirty Seventh Annual Meeting, Pennsacola, FL. Pp. 1-5.

4. Koenning, S. R., and Wrather, J. A. 2010. Suppression of soybean yield potential in the Continental United States by plant diseases from 2006 to 2009. Plant Health Progress doi:10.1094-2010-1122-01-RS.

5. Koenning, S.R. 2010. Southern United States soybean disease loss estimate for 2009. Proceedings of the Southern Soybean Disease Workers, Thirty Sixth Annual Meeting, Pennsacola, FL. Pp. 1-5.

6. Mulrooney, R. P. 1988. Soybean disease loss estimate for Southern United States in 1985 and 1986. Plant Disease 72:364-365.

7. Mulrooney, R. P. 1988. Soybean disease loss estimate for Southern United States in 1987. Plant Disease 72:915.

8. Pratt, P. W., and A. J. Wrather. 1998. Soybean disease loss estimates for the Southern United States during 1994-1996. Plant Disease 82:114-116.

9. Sciumbato, G. L. 1993. Soybean disease loss estimate for the Southern United States during 1988-1991. Plant Disease 77:954-956.

10. Whitney, G. 1978. Southern states soybean disease loss estimates-1977. Plant Disease Reporter 62:1078-1079.

11. Wrather, J. Allen, A. Y. Chambers, J. A. Fox, W. F. Moore, and G. L. Sciumbato. 1995. Soybean disease loss estimates for the southern United States, 1974 to 1994. Plant Disease 79:1076-1079.

12. Wrather, J. Allen and G. L. Sciumbato. 1995. Soybean disease loss estimates for the Southern United States during 1992-1993. Plant Disease 79:84-85.

13. Wrather, J. Allen, T. R. Anderson, D. M. Arsyad, J. Gai, L. D. Ploper, A. Porta-Puglia, H. H. Ram, and J. T. Yorinori. 1997. Soybean Disease Loss Estimates for the Top 10 Soybean Producing Countries in 1994. Plant Disease 81:107-110.

14. Wrather, J. A., W. C. Stienstra, and S. R. Koenning. 2001. Soybean disease loss estimates for the United States from 1996-1998. Canadian Journal of Plant Pathology 23:122-131.

15. Wrather, J. A., S. R. Koenning, and T. Anderson. 2003. Effect of diseases on soybean yields in the United States and Ontario 1999-2002. Online. Plant Health Progress doi: 10.1094/PHP-2003-0325-01-RV.

16. Wrather, J. A. and Koenning, S. R. 2005. Soybean disease loss estimates for the United States 1996-2004. http://aes.missouri.edu/delta/research/soyloss.stm

17. Wrather, J. A., and S. R. Koenning. 2006. Estimates of disease effects on soybean yields in the United States 2003-2005. Journal of Nematology 38:173-180.

18. Wrather, J.A., and S. R. Koenning. 2009. Effects of diseases on soybean yields in the United States 1996 to 2007. Plant Health Progress doi10:1094/PHP-2009-0401-01-RS.

Table 2. Estimated percentage loss of soybean yield due to diseases for 16 southern states during 2012.

| Disease | AL | AR | DE | FL | GA | KY | LA | MD | MS | MO | NC | OK | SC | TN | TX | VA | Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Anthracnose | 0.25 | 0.30 | Tr | 0.25 | 0.25 | 0.01 | 0.50 | Tr | 0.25 | Tr | 0.01 | 0.00 | 0.10 | 0.50 | 0.00 | 0.20 | 0.20 |
| Bacterial diseases | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.10 | 0.08 | 0.00 | 0.00 | 0.01 | 0.03 |
| Brown leaf spot | Tr | 0.00 | 0.00 | 0.00 | Tr | 0.10 | 0.00 | 0.10 | 0.50 | 0.00 | 0.10 | 0.10 | 0.10 | 0.50 | 0.00 | 0.01 | 0.11 |
| Brown stem rot | 0.00 | 0.00 | 0.00 | 0.00 | Tr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Charcoal rot | 0.10 | 4.80 | 1.00 | 0.25 | 0.25 | 3.00 | 0.10 | Tr | 1.00 | 0.50 | 0.06 | 3.50 | 0.07 | 5.00 | 0.00 | 0.01 | 1.31 |
| Diaporthe/Phomopsis | 1.00 | 0.00 | 0.00 | 0.25 | 0.50 | 1.00 | 1.00 | 0.00 | Tr | Tr | 0.50 | Tr | 0.15 | 1.00 | 0.00 | 0.00 | 0.42 |
| Downy mildew | 0.00 | 0.00 | Tr | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.01 |
| Frogeye | 0.25 | 0.05 | 0.00 | 1.00 | Tr | 0.01 | 0.10 | 0.00 | 1.25 | 0.10 | 0.00 | Tr | 0.15 | 2.00 | 0.00 | 0.00 | 0.35 |
| Fusarium wilt and rot | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | Tr | 0.00 | 0.00 | 0.00 | 0.05 |
| Other diseases b | 0.00 | 0.00 | Tr | 0.00 | 0.00 | 0.00 |  | 0.00 | 1.50 | 0.00 | 0.20 | 0.00 | 0.06 | 0.00 | 0.50 | 1.50 | 0.27 |
| Phytophthora rot | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.50 | 0.03 | Tr | Tr | 0.00 | 0.00 | 0.00 | 0.04 |
| Pod & stem blight | Tr | 0.05 | 1.00 | 0.50 | 1.50 | 0.30 | 0.50 | 0.01 | Tr | Tr | 0.60 | 0.20 | 0.10 | 0.01 | 0.00 | 0.10 | 0.37 |
| Purple seed stain | Tr | 0.08 | Tr | 0.00 | Tr | 0.00 | 3.00 | 0.01 | Tr | Tr | 0.10 | 0.10 | 0.10 | 0.10 | 0.00 | 0.20 | 0.34 |
| Soybean cyst nematode | 0.25 | 0.90 | 3.00 | 0.00 | Tr | 2.50 | 0.00 | 1.10 | Tr | 2.00 | 2.00 | 1.00 | 1.50 | 2.50 | 0.00 | 3.00 | 1.41 |
| Root-knot nematode | 0.50 | 2.70 | 1.50 | 0.00 | 3.50 | 0.00 | 1.00 | 0.60 | 0.25 | Tr | 0.80 | Tr | 2.50 | 0.01 | 0.00 | 1.50 | 1.06 |
| Other nematodes c | 0.25 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 1.00 | 0.00 | 0.25 | 0.00 | 0.50 | Tr | 3.00 | 0.01 | 0.00 | 0.50 | 0.47 |
| Rhizoctonia aerial blight | 0.25 | 0.01 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.25 | 0.00 | Tr | 0.00 | Tr | 0.01 | 0.00 | 0.00 | 0.18 |
| Sclerotinia | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Tr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Seedling diseases | 0.50 | 0.02 | Tr | 0.25 | 0.10 | 0.01 | 0.00 | 0.00 | 0.50 | Tr | 0.30 | 0.20 | 0.10 | 1.00 | 0.00 | 0.30 | 0.23 |
| Southern blight | 0.50 | 0.02 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.20 | Tr | 0.15 | 0.00 | 0.10 | 0.01 | 0.15 |
| Soybean rust | 2.00 | 0.01 | 0.00 | 1.00 | Tr | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | Tr | 0.00 | Tr | 0.00 | 0.10 | 0.00 | 0.25 |
| Stem Canker | Tr | 0.00 | 0.00 | 0.25 | 0.00 | 0.01 | 0.10 | 0.00 | Tr | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.01 | 0.10 |
| Sudden death syndrome | Tr | 0.01 | Tr | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | Tr | Tr | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.02 | 0.01 |
| Virus d | 0.25 | 0.00 | Tr | 0.00 | 0.00 | 0.01 | 0.00 | Tr | 0.25 | 0.00 | 0.20 | Tr | 0.20 | 0.00 | 0.00 | 0.02 | 0.07 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total disease % | 6.10 | 8.96 | 6.50 | 5.35 | 8.10 | 6.97 | 8.30 | 1.82 | 7.35 | 3.10 | 5.70 | 5.20 | 8.41 | 13.74 | 0.70 | 7.40 | 6.48 |

a Rounding errors present. Tr indicates Trace.

b Other diseases listed were: Cylindrocladium parasiticum, Cercospora blight ; black root rot and Neocomospora .

c Other nematodes listed were: Stubby root, Sting, Columbia lance, and Reniform.

d Viruses were identified as: SVNV, SMV, BPMV , PMV.

Table 3. Estimated suppression of soybean yield (Millions of Bushels) as a result of disease during 2012.

| Disease | AL | AR | DE | FL | GA | KY | LA | MD | MS | MO | NC | OK | SC | TN | TX | VA | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Anthracnose | 0.04 | 0.45 | 0.00 | 0.00 | 0.02 | 0.01 | 0.22 | 0.00 | 0.24 | 0.00 | 0.01 | 0.00 | 0.01 | 0.27 | 0.00 | 0.05 | 1.32 |
| Bacterial diseases | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.09 |
| Brown leaf spot | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.06 | 0.00 | 0.02 | 0.47 | 0.00 | 0.07 | 0.00 | 0.01 | 0.27 | 0.00 | 0.00 | 1.00 |
| Brown stem rot | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 |
| Charcoal rot | 0.02 | 7.17 | 0.08 | 0.00 | 0.02 | 1.90 | 0.04 | 0.00 | 0.95 | 0.80 | 0.04 | 0.14 | 0.01 | 2.71 | 0.00 | 0.00 | 13.88 |
| Diaporthe/Phomopsis | 0.16 | 0.00 | 0.00 | 0.00 | 0.04 | 0.63 | 0.45 | 0.00 | 0.00 | 0.00 | 0.33 | 0.00 | 0.02 | 0.54 | 0.00 | 0.00 | 2.18 |
| Downy mildew | 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 | 0.00 | 0.00 | 0.00 | 0.01 |
| Frogeye | 0.04 | 0.07 | 0.00 | 0.01 | 0.00 | 0.01 | 0.04 | 0.00 | 1.18 | 0.16 | 0.00 | 0.00 | 0.02 | 1.08 | 0.00 | 0.00 | 2.62 |
| Fusarium wilt and rot | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.48 |
| Other diseases b | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.42 | 0.00 | 0.13 | 0.00 | 0.01 | 0.00 | 0.00 | 0.39 | 1.96 |
| Phytophthora rot | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.80 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.83 |
| Pod & stem blight | 0.00 | 0.07 | 0.08 | 0.00 | 0.13 | 0.19 | 0.22 | 0.00 | 0.00 | 0.00 | 0.39 | 0.01 | 0.01 | 0.01 | 0.00 | 0.03 | 1.15 |
| Purple seed stain | 0.00 | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 | 1.35 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.01 | 0.05 | 0.00 | 0.05 | 1.66 |
| Soybean cyst nematode | 0.04 | 1.34 | 0.23 | 0.00 | 0.00 | 1.58 | 0.00 | 0.25 | 0.00 | 3.20 | 1.31 | 0.04 | 0.21 | 1.35 | 0.00 | 0.79 | 10.34 |
| Root-knot nematode | 0.08 | 4.03 | 0.11 | 0.00 | 0.30 | 0.00 | 0.45 | 0.14 | 0.24 | 0.00 | 0.52 | 0.00 | 0.34 | 0.01 | 0.00 | 0.39 | 6.62 |
| Other nematodes c | 0.04 | 0.00 | 0.00 | 0.00 | 0.13 | 0.00 | 0.45 | 0.00 | 0.24 | 0.00 | 0.33 | 0.00 | 0.41 | 0.01 | 0.00 | 0.13 | 1.73 |
| Rhizoctonia aerial blight | 0.04 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.45 | 0.00 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.76 |
| Sclerotinia | 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 | 0.00 | 0.00 |
| Seedling diseases | 0.08 | 0.03 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.47 | 0.00 | 0.20 | 0.01 | 0.01 | 0.54 | 0.00 | 0.08 | 1.44 |
| Southern blight | 0.08 | 0.03 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.71 | 0.00 | 0.13 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 1.01 |
| Soybean rust | 0.32 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.44 |
| Stem Canker | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.54 | 0.00 | 0.00 | 0.60 |
| Sudden death syndrome | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.01 | 0.08 |
| Virus d | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.24 | 0.00 | 0.13 | 0.00 | 0.03 | 0.00 | 0.00 | 0.01 | 0.45 |
| Total disease loss | 0.98 | 13.38 | 0.50 | 0.04 | 0.70 | 4.41 | 3.73 | 0.41 | 6.96 | 4.96 | 3.72 | 0.21 | 1.16 | 7.45 | 0.00 | 1.95 | 50.56 |

**Table 2b. ERRATA REPLACES 2011. Estimated percentage loss of soybean yield due to diseases for 16 southern states during 2011.**

| Disease | AL | AR | DE | FL | GA | KY | LA | MD | MS | MO | NC | OK | SC | TN | TX | VA | Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Anthracnose | 0.50 | 0.30 | 0.30 | 0.00 | 0.25 | 0.20 | 0.10 | 0.00 | 0.00 | 0.00 | 0.01 | tr | 0.10 | 1.00 | 0.00 | 0.20 | 0.20 |
| Bacterial diseases | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.10 | 0.05 | 0.00 | 0.00 | 0.01 | 0.04 |
| Brown leaf spot | 0.00 | 0.00 | 0.00 | 0.00 | tr | 0.30 | 0.00 | 0.01 | 0.05 | 0.00 | 0.30 | tr | 0.15 | 2.00 | 0.00 | 0.20 | 0.22 |
| Brown stem rot | 0.00 | 0.00 | 0.00 | 0.00 | tr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.01 |
| Charcoal rot | 2.50 | 4.50 | 4.50 | 0.50 | 0.25 | 1.20 | 2.00 | 0.05 | 3.00 | 0.50 | 0.50 | 3.00 | 0.10 | 4.00 | 0.00 | 0.01 | 1.66 |
| Diaporthe/Phomopsis | 0.50 | 0.00 | 0.00 | 0.50 | 0.50 | 0.30 | 0.10 | 0.00 | 0.05 | 0.00 | 0.05 | 0.00 | 0.30 | 1.00 | 0.00 | 0.10 | 0.21 |
| Downy mildew | 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 | 0.00 | 0.00 | 0.00 | 0.01 |
| Frogeye | 0.00 | 0.03 | 0.03 | 1.00 | tr | 0.01 | 0.10 | 0.00 | 0.10 | 0.20 | 0.00 | 0.00 | 0.20 | 3.00 | 0.00 | 0.00 | 0.31 |
| Fusarium wilt and rot | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | tr | 0.00 | 0.00 | 0.00 | 0.03 |
| Other diseases b | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.20 | 0.00 | 0.10 | 0.00 | 0.00 | 0.50 | 0.30 |
| Phytophthora rot | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.10 | 0.00 | 0.00 | 1.50 | 0.03 | tr | tr | 0.00 | 0.00 | 0.00 | 0.12 |
| Pod & stem blight | tr | 0.05 | 0.05 | 0.50 | 1.50 | 0.60 | 0.10 | 0.02 | 0.03 | 0.00 | 0.60 | 0.10 | 0.15 | 0.01 | 0.00 | 0.10 | 0.25 |
| Purple seed stain | 1.00 | 0.10 | 0.10 | 0.00 | tr | 0.01 | 0.30 | 0.10 | 0.10 | 0.00 | 0.10 | 0.00 | 0.30 | 0.10 | 0.00 | 0.50 | 0.18 |
| Soybean cyst nematode | 0.50 | 1.80 | 1.80 | 0.00 | tr | 2.00 | 0.10 | 1.00 | 0.10 | 2.50 | 2.00 | 1.00 | 1.00 | 2.00 | 0.00 | 3.00 | 1.25 |
| Root-knot nematode | 0.50 | 1.80 | 1.80 | 0.00 | 3.50 | 0.00 | 2.00 | 0.50 | 0.10 | 0.05 | 0.30 | tr | 0.00 | 0.01 | 0.00 | 0.50 | 0.74 |
| Other nematodes c | 0.25 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 1.00 | 0.00 | 0.20 | 0.00 | 0.20 | tr | 0.10 | 0.01 | 0.00 | 0.30 | 0.24 |
| Rhizoctonia aerial blight | 0.50 | 0.23 | 0.23 | 1.00 | 0.00 | 0.00 | 0.10 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.01 | 0.38 |
| Sclerotinia | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| Seedling diseases | 0.50 | 0.01 | 0.01 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.10 | 0.50 | 0.30 | 0.50 | 0.11 | 1.00 | 0.00 | 0.30 | 0.21 |
| Southern blight | 0.25 | 0.02 | 0.02 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.10 | tr | 2.50 | 0.00 | 0.00 | 0.01 | 0.23 |
| Soybean rust | 0.00 | 0.00 | 0.00 | 0.25 | tr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| Stem Canker | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.01 | 0.00 | 0.00 | 0.10 | 0.00 | tr | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 |
| Sudden death syndrome | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | 0.01 | 0.03 |
| Virus d | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | tr | 0.20 | 0.00 | 0.00 | 0.10 | 0.05 |
| | | | | | | | | | | | | | | | | | |
| Total disease % | 7.25 | 8.88 | 8.88 | 5.00 | 8.10 | 4.69 | 6.00 | 1.68 | 9.05 | 5.35 | 5.09 | 4.70 | 8.46 | 14.33 | 0.00 | 5.96 | 6.46 |

a Rounding errors present. Tr indicates Trace.

b Other diseases listed were: Cylindrocladium parasiticum in NC, GA, SC, and VA, Cercospora blight MS,VA; black root rot and Neocomospora in AR.

c Other nematodes listed were: Stubby root and Sting in VA; Sting in GA, NC, and OK; Columbia lance in NC, SC, and Georgia; and Reniform in AL,AR,GA,LA,MS, NC, SC, and TN.

d Viruses were identified as: Vein Necrosis in MD; SMV in AL, AR, GA, MS, NC, OK,SC, and VA; BPMV AL AR,DE,MS,NC,OK, and VA; TobRSV in AR; and PMV in VA

**Table 3 B 2011.ERRATA REPLACES 2011 Estimated suppression of soybean yield (Millions of Bushels) as a result of disease during 2011.**

| Disease | AL | AR | DE | FL | GA | KY | LA | MD | MS | MO | NC | OK | SC | TN | TX | VA | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Anthracnose | 0.05 | 0.41 | 0.02 | 0.00 | 0.01 | 0.12 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.47 | 0.00 | 0.05 | 1.18 |
| Bacterial diseases | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 |
| Brown leaf spot | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.04 | 0.00 | 0.13 | 0.00 | 0.01 | 0.93 | 0.00 | 0.05 | 1.35 |
| 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 | 0.02 | 0.02 |
| Charcoal rot | 0.26 | 6.14 | 1.61 | 0.00 | 0.01 | 0.72 | 0.73 | 0.01 | 2.32 | 1.00 | 0.22 | 0.11 | 0.01 | 1.87 | 0.00 | 0.00 | 15.01 |
| Diaporthe/Phomopsis | 0.05 | 0.00 | 0.00 | 0.00 | 0.02 | 0.18 | 0.04 | 0.00 | 0.04 | 0.00 | 0.02 | 0.00 | 0.03 | 0.47 | 0.00 | 0.02 | 0.87 |
| Downy mildew | 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 | 0.00 | 0.00 | 0.00 | 0.01 |
| Frogeye | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.01 | 0.04 | 0.00 | 0.08 | 0.40 | 0.00 | 0.00 | 0.02 | 1.40 | 0.00 | 0.00 | 1.99 |
| Fusarium wilt and rot | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Other diseases b | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.09 | 0.00 | 0.09 | 0.00 | 0.01 | 0.00 | 0.00 | 0.11 | 3.33 |
| Phytophthora rot | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.04 | 0.00 | 0.00 | 3.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.06 |
| Pod & stem blight | 0.00 | 0.07 | 0.00 | 0.00 | 0.05 | 0.36 | 0.04 | 0.00 | 0.02 | 0.00 | 0.26 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.85 |
| Purple seed stain | 0.10 | 0.14 | 0.01 | 0.00 | 0.00 | 0.01 | 0.11 | 0.02 | 0.08 | 0.00 | 0.04 | 0.00 | 0.03 | 0.00 | 0.00 | 0.11 | 0.66 |
| Soybean cyst nematode | 0.05 | 2.45 | 0.13 | 0.00 | 0.00 | 1.21 | 0.04 | 0.18 | 0.08 | 5.01 | 0.87 | 0.04 | 0.10 | 0.93 | 0.00 | 0.68 | 11.77 |
| Root-knot nematode | 0.05 | 2.45 | 0.13 | 0.00 | 0.11 | 0.00 | 0.73 | 0.09 | 0.08 | 0.10 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 4.00 |
| Other nematodes c | 0.03 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.36 | 0.00 | 0.15 | 0.00 | 0.09 | 0.00 | 0.01 | 0.00 | 0.00 | 0.07 | 0.76 |
| Rhizoctonia aerial blight | 0.05 | 0.32 | 0.02 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.77 | 0.00 | 0.00 | 0.00 | 0.30 | 0.00 | 0.00 | 0.00 | 1.50 |
| Sclerotinia | 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 | 0.00 | 0.00 |
| Seedling diseases | 0.05 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 1.00 | 0.13 | 0.02 | 0.01 | 0.47 | 0.00 | 0.07 | 1.84 |
| Southern blight | 0.03 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.04 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.37 |
| Soybean rust | 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 | 0.00 | 0.00 |
| Stem Canker | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 |
| Sudden death syndrome | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.08 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| Virus d | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.14 |
| Total disease loss | 0.76 | 12.10 | 1.92 | 0.02 | 0.26 | 2.83 | 2.19 | 0.31 | 6.99 | 10.73 | 2.21 | 0.17 | 0.81 | 6.55 | 0.00 | 1.36 | 49.21 |
| | | | Rounding errors present | | | | | | | | | | | | | | |

# Update on Detection and Management of QoI Fungicide Resistant *Cercospora sojina*, the Causal Agent of Frogeye Leaf Spot in Soybean

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Frogeye leaf spot (FLS) caused by *Cercospora sojina* Hara is a common foliar pathogen of soybean in the southern United States and regularly present in parts of the Midwestern United States. Since 1999, increased severity and prevalence of FLS have been reported in some north central areas of the United States (Cruz and Dorrance, 2009; Mengistu et al., 2002; Wrather et al., 2003; Yang et al., 2001). Warmer winter temperatures, susceptible soybean germplasm, and conservation tillage practices have been proposed as potential causes for these resent outbreaks of FLS (Grau et al., 2004). In years when conditions are favorable, FLS can prematurely defoliate soybean plants, causing up to 50 percent yield loss on susceptible varieties. Practices recommended for managing frogeye leaf spot include crop rotation, tillage of affected soybean residue, use of resistant cultivars, and foliar fungicide application. Soybean producers use all of these practices to manage frogeye leaf spot and other diseases, but the practice of applying foliar fungicides has increased dramatically since the mid-2000s in the U.S. The primary class of fungicides being promoted for use in field crops is the strobilurin (quinone outside inhibitor; QoI) group. This group of fungicides is considered to be "high risk" for target fungi developing resistance to them.

In 2010, isolates of *C. sojina* that were highly resistant to strobilurin fungicides were identified in Illinois, Kentucky, and Tennessee. Strobilurin fungicide-resistant isolates were identified in new areas of Illinois, Kentucky, and Tennessee in 2011 and 2012 as well as in the additional states of Alabama, Arkansas, Mississippi, Missouri, and Louisiana. Characterization of these strobilurin fungicide-resistant isolates revealed that they contain the "G143A" mutation in the *cytochrome b* gene that causes an amino acid substitution of alanine for glycine at position 143, and conditions resistance to strobilurin fungicides. Field and greenhouse studies were conducted to evaluate alternative fungicide groups for their efficacy in controlling frogeye leaf spot caused by strobilurin fungicide-resistant *C. sojina*. Results of these studies indicate that fungicides in the triazole (demethylation inhibitor; DMI) and benzimidazole (methyl benzimidazole carbamate; MBC) classes are effective in controlling frogeye leaf spot caused by strobilurin fungicide-resistant *C. sojina*.

**References:**

Cruz, C. D., and Dorrance, A. E. 2009. Characterization and survival of *Cercospora sojina* in Ohio. Online. Plant Health Progress doi:10.1094/PHP-2009-0512-03-RS.

Grau, C. R., Dorrance, A. E., Bond, J., and Russin, J. S. 2004. Fungal diseases. Pages 732-734 in: Soybeans: Improvement, Production, and Uses, 3rd Ed. Boerma, H. R. and Specht, J. E., ed. Monogr. 16. Am. Soc. Of Agron., Madison, WI.

Mengistu, A., Kurtzweil, N. C., and Grau, C. R. 2002. First report of frogeye leaf spot *Cercospora sojina* in Wisconsin. Plant Dis. 86:1272.

Wrather, J. A., Koenning, S. R., and Anderson, T. R. 2003. Effect of diseases on soybean yields in the United States and Ontario (1999-2002). Online. Plant Health Progress. doi:10.1094/PHP-2003-0325-01-RV.

Yang, X. B., Uphoff, M. D., and Sanogo, S. 2001. Outbreaks of soybean frogeye leaf spot in Iowa. Plant Dis. 85:443.

# Identification of Soybean Genotypes Resistant to C*ercospora sojina* by Field Screening and Molecular Markers

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Frogeye leaf spot (FLS) of soybean [*Glycinemax* (L.) Merr.], caused by *Cercospora sojina* K. Hara, has been a problem in the southern United States for many years. Cultivars resistant to FLS have been developed for planting in this area, and resistance in many of these cultivars is conditioned by the *Rcs3* allele at the *Rcs3* locus, which provides immunity to all known races of the pathogen. Frogeye leaf spot has recently become a greater problem in the northern United States, and few *C. sojina* resistant cultivars and breeding lines adapted to this area have been identified. The objectives of this study were to (i) identify maturity group (MG) 00 to VII accessions resistant to *C. sojina* by field screening at multiple locations over years and (ii) determine if FLS resistance in these accessions is likely to be conditioned by the *Rcs3* allele. A total of 780 accessions were evaluated and 104 of these accessions did not produce FLS symptoms. These were subsequently tested for the possible presence of *Rcs3* using five molecular markers located within 2 cM of the gene. Of these 104 accessions, only three accessions namely, PI 437726, PI 438302B, and PI 494851 had the *Rcs3* haplotype of the cultivar Davis, the source of *Rcs3*. The soybean accessions predicted not to have the *Rcs3* allele with no FLS symptoms in field trials may contain novel loci for FLS resistance and may be used to broaden the base for developing soybean cultivars with frogeye leaf spot resistance. (Crop Sci. 51:1101–1109, 2011 and PHP doi:10.1094/PHP-2012-0521-02-RS.)

# Soybean Vein Necrosis Virus

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Soybean Vein Necrosis Virus (SVNV) was first identified from samples collected in Tennessee in 2008[1], but symptoms similar to those caused by SVNV have been seen for at least a decade in Kentucky and Tennessee. SVNV has now been confirmed in 16 states (AR, DE, IA, IL, IN, KS, KY, MD, MI, MO, NY, OH, PA, TN, VA, WI) and Ontario, CN. The virus was widespread in the Midwest and Mid-Atlantic States during 2012. SVNV is a new[2] tospovirus (family Bunyaviridae), and is one of several tospoviruses known to infect field-grown soybean in different parts of the world (Tomato spotted wilt virus, Tomato yellow ring virus, Groundnut ringspot virus, and Groundnut bud necrosis virus). However, SVNV has not been reported outside of North America. SVNV has been shown to be efficiently transmitted to soybean by soybean thrips (*Sericothrips variabilis*) and this may be the primary vector of SVNV, along with other commonly occurring thrips (e.g., flower and/or tobacco thrips; *Frankliniella* spp.). The virus is persistent and circulative within thrips and is acquired and transmitted primarily by the first two of four larval stages. Transmission of SVNV by seed is unknown, but unlikely based on the virus type and the fact that SVNV is NOT systemic in soybean (i.e., symptom is a hypersensitive response). Limited host range studies[3] indicate that morning glory (*Ipomoea* spp.) is a likely reservoir host in the field, but the virus also infects other potential reservoir hosts, such as *Chrysanthemum* spp., cucumber and pumpkin (SVNV is asymptomatic in these hosts). SVNV can be mechanically transmitted and maintained in *Nicotiana benthamiana* for up to 1 month, which may facilitate working with the virus experimentally. SVNV also goes systemic when mechanically transmitted to *N. glutinosa* and *N. tabacum.* Positive diagnosis of SVNV is now possible by PCR, ELISA and immunoblot assays. Research to date does not support the existence of strains of SVNV, based on a comparison of 37 virus isolates collected from eight states[3]. In the field, initial symptoms of the virus tend to become evident during the early- to mid-reproductive stages, usually in the upper 1/3 of the canopy. Symptoms are most prominent in full season soybeans (compared to doublecrop soybean). Cultivars appear to differ in susceptibility to SVNV, or at least symptom expression varies; many breeder accessions are hyper-susceptible. Potential yield/quality effects have not been determined and this is, perhaps, the most critical research that needs to be done at this time.

**References:**

Tzanetakis, I. E.,Wen, R.-H., Newman, M., & Hajimorad, M. R. (2009). Soybean vein necrosis virus: a new threat to soybean production in Southeastern United States. Phytopathology 99:S131.

Zhou, J., Kantartzi, S. K., Wen, R.-H., Newman, M., Hajimorad, M. R., Rupe, J. C., Tzanetakis, E. E., 2011. Virus Gene. 43:289-295.

Zhou, J., and Tzanetakis, I. E.. 2012. Epidemiology of Soybean Vein Necrosis-Associated Virus. Phytopathology 102:S4.144

# Optimization of Fungicide Applications for Management of Cercospora Leaf Blight and Rust in Soybean

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Cercospora leaf blight (CLB), caused *by Cercospora kikuchii*, is considered to be the most serious disease affecting soybean production in Louisiana. Not only does the disease cause direct yield losses, it also is associated with the green stem disorder, which causes stems to remain green and supple even though pods mature normally. Harvest aids such as paraquat are generally ineffective in ameliorating this disorder. To further complicate the situation, disease resistance is not durable, and there are significant time and location interactions with regard to disease reactions. Furthermore, the pathogen population exhibits a very high level of genetic diversity to the extent that the existence of a sexual stage has been invoked. For these reasons, producers are forced to rely upon fungicide applications to manage this disease. However, fungicide efficacy trials have been less than satisfactory.

Previous work, in which latent infection was monitored using real-time PCR protocols, showed that infection occurred during vegetative growth stages even though symptoms were usually not observed until late reproductive stages (mid R5). We reasoned that if latent infection could be curtailed, it should be possible to reduce disease severity later in the season. The purpose of this study was to evaluate rates and application timings of several fungicides but especially a demethylation inhibitor fungicide (flutriafol) because of its long residual activity and results from previous years. Several application protocols with this fungicide at up to 14 oz/A were assessed including first applications at first flower (R1) continuing through late pod fill (R6). In addition, multiple applications with below-label rates were assessed. Plots were rated for disease severity at mid-R6. Findings indicated that an early application with at least 7 oz/A, applied no later than R1, will be required for effective control of CLB. Rates of less than 7 oz/A were ineffective, regardless of when they were applied or the number of applications. Applications of flutriafol at higher rates beginning at R3, even when applied at both R3 and R5, were not as effective as single applications at R1. In addition, multiple applications at lower rates beginning at R1 were not effective. Apparently there is a sharp cut-off in rate of application close to the recommended rate of 7 oz/A, and we suggest that at least 10 oz/A be applied at R1 in order to provide a positive cost:benefit return for the producer.
These protocols were repeated and expanded in 2012. However, soybean rust (SBR) progressed to very high severity levels in these field plots, and this unexpected development allowed us to test these CLB protocols against SBR. Results for both diseases will be presented and discussed.

# Observations on Soybean Rust Management in Alabama in 2012

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Soybean rust (SBR) was a major problem in Alabama in 2012. At least 500 acres of poorly-protected soybeans in Baldwin County near the Gulf Coast suffered up to 60% losses in yield due to the disease. These fields were harvested approximately a month earlier than the normal crop for the area and were either sprayed too late with a fungicide or were not sprayed. Estimated yield losses were based on conversations with the growers and yield data collected from a fungicide strip test located in the immediate area.

We suspect yield losses from SBR occurred throughout the southern half of the state on double-cropped soybeans that were not sprayed with a fungicide. This is based on field observations from multiple commercial fields plus yield-loss data collected from a fungicide strip test conducted in central Alabama on late-planted soybeans.

SBR was detected in all 67 counties in the state in 2012. The disease was not detected in Alabama in 2011, though scouting was terminated in mid-October that year. The pathogen likely moved into the state by the end of 2011 as it was found on kudzu in Baldwin County in January of 2012.

Large-scale fungicide strip tests were conducted at multiple sites in the state. SBR was a significant problem at the Fairhope location in Baldwin County. Treatments consisting of Headline (6oz) or Headline (6 oz) + Topguard (7 oz) applied at R3 followed by an application of Topguard (7oz) 28 days later, increased yields nearly 40% compared to the unsprayed control. SBR defoliated the unsprayed strips/replications weeks in advance of the fungicide protected treatments.

In 2012 to improve out SBR scouting efficiency, we began testing kudzu population for their resistance/susceptibility to SBR. Of 36 kudzu sites tested, over 27% were resistant to the disease. This type of information will allow us to target only known SBR-susceptible sites when scouting for SBR making the monitoring process more efficient and cost effective.

# Logical Areas of Collection: A Precision Concept for Management of *Rhizoctonia solani* AG1-IA

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*Rhizoctonia solani* AG1-IA causes sheath blight in rice and aerial blight in soybean. In Arkansas, sheath blight has become the most important disease of rice. In some areas, rice is rotated annually with soybean. This rotation facilitates a continuous source of *R. solani* AG1-IA inoculum from one year to the next. This has resulted in aerial blight increasing in frequency and importance. Aerial blight, however, is problematic in that a severe epidemic often goes unnoticed until significant yield loss has occurred. Aerial blight is a two stage disease where colonization of the plant occurs during the early vegetative growth stages and aerial blight occurs during the reproductive growth stages after canopy closure. When the canopy is closed, the damage to seed pods is not visible unless the field is being regularly scouted beneath the canopy. The objective of this work was to determine the distribution of early season soil inoculum potential and plant colonization of *R. solani* AG1-IA and aerial blight. In 2009, spatial sampling of fields undergoing rice and soybean rotation was initiated. Samples were collected from GPS positions placed intermittent of the rice levee system from the previous year. Soil was assayed using a modified toothpick baiting procedure to assess the inoculum potential and soybeans were sampled at growth stage V3 at each position. Aerial blight was assessed spatially by position. Spatial analyses were used to determine the spatial aggregation and dependency of soil inoculum potential, plant colonization, and disease. In a field near Stuttgart, AR in 2009, the soil inoculum potential of *R. solani* AG1-IA was aggregated and correlated with *R. solani* AG1-IA isolated from plants. Aerial blight was severe and did not correlate spatially with soil inoculum potential or *R. solani* AG1-IA from plants; however, the same general areas of the field were affected. Soil inoculum potential was aggregated in a field near Hazen, AR sampled in 2011 but was uncorrelated with *R. solani* AG1-IA recovered from plants. Sampling of the same field near Stuttgart, AR in 2011 resulted in the soil inoculum potential and plant recovery of *R. solani* AG1-IA being correlated but not aggregated. Trend surface models were created in ArcGIS 10.1 from modeling semi-variograms for each sampling or disease assessment. While the distributions and relationships between soil inoculum potential and plant colonization were somewhat inconsistent, visual comparison of all surface models indicated an agreement with the levee system that was utilized from the prior year's rice crop. The soil inoculum potential and plant recovery of *R. solani* AG1-IA indicates that distribution is controlled by the levee system from the previous year and *R. solani* AG1-IA behaves as a typical soil-borne pathogen with an additional strategy for dissemination (possibly floating sclerotia). Therefore, disease scouting at or near points in a soybean field that correspond to "logical areas of collection" from the levee system utilized the year before should result in a more efficient scouting methodology to manage aerial blight.

# Screening of Soybean Recombinant Inbred Lines against *Phakopsora pachyrhizi*

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The fungus *Phakopsora pachyrhizi* is the causal agent of Asian soybean rust (ASR) disease. It was first discovered in continental U.S. in late 2004. *P. pachyrhizi* has the potential to cause severe yield losses, as all U.S. commercial soybean varieties are susceptible. In this study, ten recombinant inbred line (RIL) derived sister lines of two different populations (RN06-32-2 and RN06-16-1) were evaluated for differences in resistance to infection by *P. pachyrhizi* (Louisiana isolates). These lines, which had previously been evaluated against Florida soybean rust isolates, were evaluated using in both detached leaf and greenhouse *in planta* assays. For each line, sixteen plants were evaluated at R1 stage through inoculation with 200 µl of rust spore suspension ($3 \times 10^4$ spores/ml) per leaf on the upper surface. For the detached leaf assay, soybean leaves at R1 stage were inoculated in the same manner. Fifteen days after inoculation, plants in the greenhouse and the detached leaves in growth chamber were evaluated for lesion appearance, pustule formation, and pustule eruption and density. Significant differences were observed among sister lines in their responses to *P. pachyrhizi* infection under both conditions. The lines 15-b and 16-c of population RN06-16-1 and 94-c line of RN06-32-2 population, which showed immune reaction to Florida rust isolates, exhibited the resistant response against Louisiana rust isolates. Whereas, the 8-a, 8-b and 8-c lines of population RN06-32-2 have shown immune and susceptible response to Louisiana rust isolates, the same reaction as to Florida rust isolates. Lines 15-c and 16-b of population RN06-16-1 showed moderately resistant response. Similarly, 94-a and 94-b lines of population RN06-32-2 showed similar susceptible and resistant response, respectively, against Louisiana rust isolates as that to the Florida rust isolates. Based upon the evaluation, two lines, one immune (8-a) and one susceptible (8-c) to rust, are being compared for protein profile differences to better understand the compatible and incompatible host-pathogen interactions at the molecular level using proteomics.

# Effects of Minor Element Nutrition on Cercospora Leaf Blight of Soybean

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*Cercospora kikuchii* is the causal agent of both Cercospora leaf blight (CLB) and purple seed stain in soybean. CLB is considered to be the most serious disease of soybean in Louisiana. CLB appears late in the season and is exacerbated by high temperatures. The disease is currently managed by early planting and fungicide applications. Fungicide protocols are still being evaluated with regard to the most efficacious materials and times of application. In addition, the pathogen is developing resistance to many of the currently used fungicides (Price, et al.). Disease resistant varieties often succumb to the disease after a few years. Previous research showed that the pathogen population is extremely diverse, and there are significant location-by- year interactions in disease reactions. Several minor elements at different rates were tested as foliar sprays on field grown soybeans and evaluated based on visual disease ratings. Elements also were tested *in vitro* for their effects on radial growth and pigment production with several isolates of *C. kikuchii*. The concentrations of elements used in these tests were chosen based on published tissue analyses and on recommended rates of application for correcting minor element deficiencies in soybean. The isolates were grown under conditions conducive for synthesis of cercosporin; the photoactivated toxin produced by *C. kikuchii*. Growth rates and pigment production of the isolates were recorded at 7 and 14 days after plating. Elements tested included iron, aluminum, zinc, boron, manganese, magnesium, molybdenum, and others. Of particular interest were the elements aluminum and iron for their inhibitory effects on fungal growth and cercosporin production and manganese for its exacerbation of disease in the field.

# Sensitivity of *Cercospora kikuchii* Populations to Methyl Benzimidazole Carbamate, Quinone Outside Inhibitor, and Demethylation Inhibitor Fungicides

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Purple seed stain and Cercospora leaf blight, caused by *Cercospora kikuchii*, are major diseases of soybean worldwide and have become increasingly difficult to manage in Louisiana. Therefore, to determine if resistance to fungicides has occurred in *C. kikuchii*, evaluations were conducted using Louisiana populations from 2000, 2011, and 2012.

Because isolates were either sensitive or resistant to thiophanate-methyl, a methyl benzimidazole carbamate (MBC) fungicide, a discriminatory dose of 5 µg/ml was used to determine the percentages of resistant isolates for 2000, 2011, and 2012. Baseline fungicide sensitivities, as determined by calculating $EC_{50}$ values from radial growth assays, of *C. kikuchii* isolates from 2000 were determined for quinone outside inhibitor (QoI) and demethylation inhibitor (DMI) fungicides. This population likely had not been exposed to QoI fungicides; however, exposure to MBC and DMI fungicides is unknown. After baseline establishment, fungicide sensitivities were calculated to monitor shifts in populations.

After screening 176, 134, and 70 isolates from 2000, 2011, and 2012, it was determined that 23.3, 44.8, and 35.7 percent were resistant to thiophanate-methyl, respectively. Baseline sensitivities to the QoI fungicides: azoxystrobin, pyraclostrobin, and trifloxystrobin had mean $EC_{50}$ values of 0.10, 0.02, and 0.02 µg/ml, respectively. For 2011, respective mean $EC_{50}$ values were 32.60, 10.98, and 22.02 µg/ml indicating a significant shift in sensitivities. In 2012, respective mean $EC_{50}$ values of 52.67 and 13.83 for azoxystrobin and pyraclostrobin were also significantly higher than the baseline. Sensitivities of isolates from 2012 to trifloxystrobin are being summarized. Baseline sensitivities to the DMI fungicides: flutriafol, propiconazole, and tetraconazole averaged 0.58, 0.18, and 1.70 µg/ml, respectively. For 2011, respective mean $EC_{50}$ values were essentially unchanged at 0.40, 0.46, and 0.96 µg/ml. In 2012, respective mean $EC_{50}$ values of 0.83 and 0.44 were determined for flutriafol and propiconazole. Sensitivities of isolates from 2012 to tetraconazole are being summarized. Based on these results, MBC and QoI fungicide resistance has occurred in *C. kikuchii* since 2000.

# Effects of Foliar Applications of Micronutrients on Severity of Rust in Soybean

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Soybean rust (SBR), caused by *Phakopsora pachyrhizi*, is one of the most serious diseases of this crop with yield losses of up to 80% in many countries. We have confirmed yield losses of more than 40% in south Louisiana. Because there are no resistant varieties, management of this disease typically involves the use of fungicides. However, there is precedent for the use of foliar applied micronutrients in ameliorating disease severity in numerous host:pathogen systems. The objective of this work was to evaluate selected commercially available minor element formulations for their effects on disease severity.

This study was conducted at the LSU Ben Hur Research Farm during the 2012 growing season. The cultivar Pioneer 95Y80 was planted on July 18$^{th}$ and treatments were arranged in a randomized complete block design with four replications. Each plot was four rows wide on 30 inch centers by 40 feet long. The center two rows of each plot were rated quantitatively for disease development and harvested for yield determinations. Standard weed and insect control protocols were followed. Micronutrient solutions were applied with a boom sprayer at the R3 and R5 growth stages. Commercial products were obtained from Brandt Consolidated, Inc. that contained Fe, Mo, Mn, B, Zn and Al, and these products were applied at two rates. Disease severity was significantly reduced with the high rates of B, B plus Mo, and Mn. There were strong correlations between disease severity and leaf tissue concentrations of B, Fe and Mg. Although other minor elements, such as Cd, Ca, Cu, Mg and Ni, were not applied as foliar sprays, there were significant correlations between disease severity and tissue concentrations of these micronutrients.

# History of the Reniform Nematode in the South

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The reniform nematode was described from cowpeas in a pineapple field in Hawaii in 1940 by Lindford and Olivera. It was found later that year in Georgia by A. L. Taylor on cotton. In 1941 it was found on cotton in Louisiana by A. L. Smith & A. L. Taylor. In 1942 it was reported from Florida by G. Steiner on tomato. It was not then reported outside these states until 1959 when it was reported from Alabama and Texas, then in North Carolina in 1961 and South Carolina in 1965. It was first found in Arkansas in 1979, found in 1968 but not reported until 1990 in Mississippi, reported from Tennessee and Missouri in 1992 and Virginia in 2002. In the South most early reports were from cotton or from cotton growing areas. Its damage to cotton is normally greater than that on soybean. It is reported to have in excess of 300 hosts, mostly dicots. During the 1960's, 1970's and early 1980's the reniform nematode was studied extensively. Its infection histology on soybean and sweet potato was demonstrated as was its life cycle and its ability to survive at least two years in dry soil. This nematode's life cycle is unusual in that the infective stage is the female. The life cycle is completed in as little as 3 weeks. The juveniles and males do not feed. The female enters the root cortex perpendicular to the root with its posterior still in the soil and establishes a feeding site termed a syncytium and forms by the fusion of cells. It is similar to the syncytium of the Soybean Cyst Nematode (SCN) in appearance and function. It is much different that the giant cells of Root-Knot Nematode. The mature female exudes a protective gelatinous matrix into which it lays many eggs. The reniform and SCN had been shown have linked resistance in soybean. Anand and Gallo tested the known soybean PI's and found 45 with resistance to the soybean cyst. In 1996 I tested reproduction of the 45 SCN resistant lines and found 16 were as resistant as Forrest which had been designated in earlier works as reniform resistant. I also tested the 4 differentials and base Lee 74 used to determine SCN race and found 'Pickett', 'Peking', and PI 90763 to be resistant while PI 88788 and Lee 74 were susceptible. PI 88788 is also susceptible to the Southern Root-knot nematode. Since 1999 I have tested the new entries into the Arkansas Soybean Variety Testing Program. This is a total of 2,225 lines tested, of these 68 commercial lines showed practical level of resistance. Since 2004 I have tested several hundred lines for Southern Public Soybean Breeders. In 2005 Agudelo et. al reported that there were no differences found in the ITS1 region among 19 sexually reproducing populations from the southern states, Hawaii, Brazil, Columbia, Hondurus, and Japan. At present I am continuing the reniform testing of new lines and public breeder requests. I am cooperating with the University of Missouri in looking for genetic markers for Reniform resistance similar to that I have done with the University of Georgia.

# Role of Seed Quality, Planting Date, and Seed Treatment on Soybean Stand and Yield

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Stand establishment is the first step in producing a soybean crop and can be affected by seed vigor and seedling pathogens. Faced with increasing costs of seed and possible differences in seed vigor (year and cultivar dependent), growers need to know how to manage their seed to optimize yield. The main factors affecting soybean stand establishment are the impacts of planting density (PD), seed vigor (SV), seedling pathogens, maturity group and planting date alone or in combination were tested at the Northwest Research and Extension center from 2008 to 2011 and at the Rice Research and Extension Center, Stuttgart, AR, and the Southeast Branch Station, Rohwer, AR in 2011. Each year, a MG IV and a MG V cultivar were tested and each cultivar had a high and a low SV seed lot: accelerated aging above 73% or below 68%, respectively. The seed lots were provided by Armor Seed, LLC Weiner, AR. Seed were planted in mid-April, mid-May, and mid-June. Planting densities were high (400,000 seed/ha), medium (300,000 seed/ha), and low (200,000seed/ha). Seed were either treated with ApronMaxx + Dynasty or not treated. The tests were furrow irrigated as needed. Four week stands and yields were determined in the center two rows. The maturity groups were tested separately. Treatments in each planting date were arranged in a randomized complete block design, plots were 6 m long, four rows wide on 75 cm centers. Years and locations were treated as random effects in the analysis.

**Maturity group IV:** There were significant SV by PD and seed treatment (ST) by PD interactions for stands. Stands were lower for low SV seed than high at medium and low PD. Seed treatment improved stands at all PD. Yields were higher in May than in April or June. There were no effects of PD, SV, or ST in May. In April, the highest yields were with treated, high SV seed at high PD and ST significantly improved yields at low PD. PD affected yields in high, but not low SV. In June, ST resulted in higher yields for low SV planted at low PD. Yields were highest for the high PD compared to medium or low except for low SV, non-treated seed where high and medium PD were higher than low.

**Maturity group V:** Stands were significantly higher in treated than non-treated seed at all three planting dates and in April and June for low quality seed. Stands were higher for high SV than low SV seed. Stands were higher for treated than non-treated seed at all PD and were highest for high followed by medium followed by low PD. Yields were highest when planted in May than in April or June, with high vigor than low vigor seed, and at high and medium PD compared to low.

**Conclusions:** ST improved stands and yields of both high and low SV seed, especially when planted in April or June. Planting densities of at least 200,000 seed/ha is needed for maximum yields.

# Screening Soybean Germplasm and Commercial Varieties for Resistance to Phomopsis Seed Decay: Results from 2012 Trials

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Soybean Phomopsis seed decay (PSD) causes poor seed quality and suppresses yield in most soybean production areas of the United States. In 2009, PSD caused a yield loss of over 12 million bushels in 16 southern states. The disease is primarily caused by *Phomopsis longicolla* along with other *Phomopsis* and *Diaporthe* spp.. Very few soybean cultivars currently available for planting in the US have resistance to PSD. To identify new sources of resistance to PSD and develop high yielding cultivars and breeding lines with PSD- resistance, a multistate and multiyear research project entitled "Screening germplasm and breeding for resistance to Phomopsis seed decay" funded by the United Soybean Board with support from the USDA-ARS was initiated in 2009. A total of 135 selected soybean germplasm lines collected from 28 countries with maturity groups III, IV, and V were field screened by natural infection in 2009 at Arkansas, Mississippi, and Missouri. Seeds were harvested from each plot and tested for percent seed infected by *Phomopsis* spp., germination rate, and visual quality. Based on the results in 2009, 42 lines with most resistant or susceptible reactions were selected and evaluated in 2010, 2011, and 2012 with Phomopsis inoculated and non-inoculated treatments. Preliminary results from 2012 trials showed that seed infection by a variety of soybean fungal pathogens was notably higher in 2012 than in 2010 or 2011. Significant differences in seed infection by *P. longicolla* were observed among soybean lines with some lines having no infection while others had levels as high as 85%. These differences among lines also were reflected in visual seed quality and seed germination. In general, inoculated plots had higher seed infection than the non-inoculated plots. Soybean lines with low seed infection, good visual quality, and high germination rate at all locations and in four years will be selected and used to develop breeding or mapping populations for resistance to PSD. Another study funded by the Mississippi Soybean Promotion Board, evaluated 16 commercial varieties for resistance to PSD with inoculated and non-inoculated treatments and two harvest times at R8 and R8+2 weeks stages (normal vs. delayed harvest) in Mississippi in 2012. Those 16 varieties were selected based on the data from seed assays of 50 commercial varieties in 2011. Several varieties were identified with low disease incidence and good seed quality. An update on other research related PSD and its causal pathogen *P. longicolla* will also be presented and discussed.

# *Adenosylhomocysteinase* (*AHCY*) is essential for virulence of *Cercospora kikuchii* in soybeans

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*Cercospora kikuchii*, the causal agent of cercospora leaf blight (CLB) and purple seed stain (PSS) of soybean, has become a troublesome disease in the southern United States. *Cercospora kikuchii* produces a non-hostspecific phytotoxin known as cercosporin. In our study, light enhanced cercosporin production in complete medium up to 6-fold. We used 2-dimensional gel electrophoresis (2-DGE) to identify differentially expressed proteins in *C. kikuchii* grown under continuous light compared to dark. Six proteins were up- and two proteins were down-regulated in *C. kikuchii* grown under light. One of the up-regulated proteins was identified as adenosylhomocysteinase (*AHCY*). The corresponding full length *AHCY* was cloned from *C. kikuchii* through genome walking. *ahcy* disruption mutants were produced through a hygromycin split marker approach, and the mutants showed drastic reduction in cercosporin production *in vitro* and also reduced virulence on soybean leaves in both detached leaf assay and greenhouse inoculations. To explore the possibility of using *AHCY* in controlling *C. kikuchii* infection of soybean through host gene induced silencing (HIGS), two small portions of *AHCY* gene were inserted into a *Bean Pod Mottle Virus* (BPMV) derived vectors. The silencing was demonstrated by reduction in transcript levels of *AHCY* and reduced *C. kikuchii* biomass in AHCY #6 and AHCY #7 HIGS construct-treated plants compared to empty vector control plants, indicating a possible new approach to control CLB in soybean.

# Fungicide Timing Strategies: Targeting Yield Enhancement in Mississippi Soybean

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Numerous fungicide timing strategies are currently suggested for yield enhancement ("plant health") and to a lesser extent yield loss prevention as a result of foliar diseases (e.g., anthracnose, Cercospora blight, frogeye leaf spot, soybean rust, target spot). Over the past decade research conducted throughout Mississippi has considered the role of timed fungicide applications, mostly containing strobilurin active ingredients, on yield and net returns. More specifically, over the past four seasons, fungicide application trials have considered the response of soybean to several application timings (V5, R3, R5, and sequential applications (V5 fb R5; R3 fb R5; R1 fb R3 fb R5 fb R6)). In most situations, disease was not a limiting factor. In addition, in some instances, insecticide tank mixes were included at specific timings regardless of whether or not insects. In general, the research trials considered 4 fl oz/A of azoxystrobin (as Quadris) at all timings whether applied alone or in tank mix combination with 5.2 fl oz/A of bifenthrin (as Brigade). When compared with the nontreated and averaged over all locations (n=13) the R3 application resulted in the greatest yield response, a 2.8 bu/A positive response and almost a bushel greater than the R5 timing. The sequential application, R3 fb R5, resulted in a response (0.4 bu/A) that was similar to the R3 and R5 applications. However, fungicide application regardless of timing was not significantly different from the nontreated.

During 2012, soybean fungicide trials considered seven different products (Domark, Evito, Headline, Headline AMP, Quadris, Quilt Xcel, and Stratego YLD) applied at vegetative stages (V5), a reproductive growth stage (R5) and at sequential timings (V5 fb R5) in half- and full-rates. Fungicides were applied at V5 in a tank mix that included glufosinate (22 fl oz/A of Liberty) and without an herbicide to serve as the adjuvant. All applications made at R5 included 0.25% (v/v) of a non-ionic surfactant. Disease incidence during the trials was limited and only Cercospora blight and target spot were observed consistently. Harvested yield from fungicide treated plots was not significantly different from the nontreated for the trial conducted without glufosinate. Averaged across all products the V5 timing increased yield by more than 2 bu/A when compared with the nontreated while the R5 applications resulted in a reduced yield when compared to the V5 timing. The sequential timing resulted in a little less than a half bushel increase compared to the V5 timing. In general, fungicide applications that included glufosinate as a tank mix tended to significantly increase yield compared to the nontreated. When the V5 timing included glufosinate as the tank mix component and when average across all products the V5 timing resulted in a 4.5 bu/A increase compared to the nontreated. The R5 timing resulted in a 6 bu/A increase compared to the nontreated while the sequential timing had the greatest yield increase (6.3 bu/A) compared to the nontreated.

# Industry Pest Information Platform for Extension and Education (iPiPE)

Scott Isard, Roger Magarey, Julie Golod and Joe Russo

The Industry Pest Information Platform for Extension and Education (iPiPE) provides an information technology (IT) solution for the collection and management of crop and pest observations. These observations can be viewed independently and will also be input into models. They will be accessible by other analysis tools in support of pest scouting, phytosanitary activities, and production decision making in the field. The iPiPE has integrated smartphone with traditional computer applications to enable the transfer of observations directly from the field and for the delivery of decision-support products to personnel in the field. Inherent in the iPiPE design is its record keeping capabilities and its ability to respect the privacy of growers and organizations, and the professionalism of participants who have access to iPiPE crop and pest data. This paper describes iPiPE pest-data-user categories and rules. iPiPE Data Submission, Data Sharing and Data Viewing rules specify how field observations are managed from the moment they are uploaded to the iPiPE platform to their incorporation into decision support products.