3-2008

# Proceedings of the 35th Annual Meeting, Southern Soybean Disease Workers (March 12-13, 2008, Pensacola, Florida)

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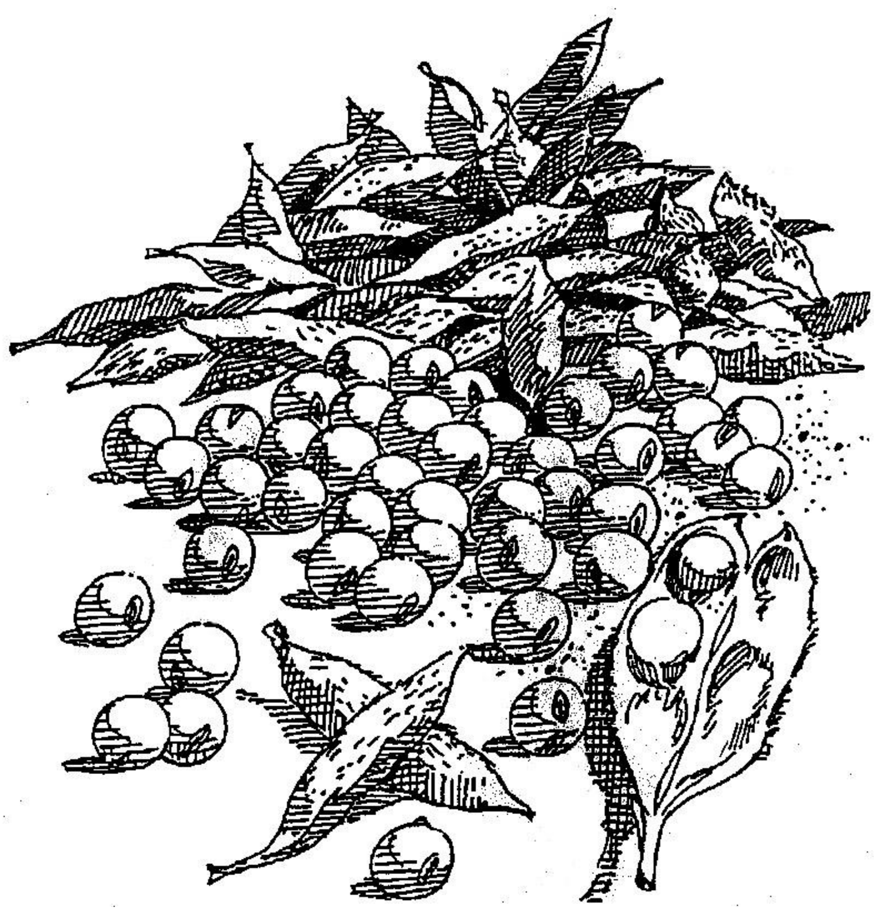
# PROCEEDINGS OF THE SOUTHERN

# SOYBEAN DISEASE WORKERS



## THIRTY-FIFTH ANNUAL MEETING

March 12–13, 2008 | Pensacola, Florida

# SOUTHERN SOYBEAN DISEASE WORKERS
## 35th ANNUAL MEETING

March 12 – 13, 2008
Pensacola, FL

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

## 35th Annual Meeting of the Southern Soybean Disease Workers
## March 12 – 13, 2008
## Pensacola, FL

### Tuesday March 12

| | |
|---|---|
| 11:00 am | **Registration** |
| 1:00 pm | **Welcome and Introductions**<br>Allen Wrather |
| | **Contributed Papers**<br>Moderator – Dr. Clayton Hollier |
| 1:10 pm | **Effects of Row Spacing and Leaf Wetness on the Temporal and Spatial Spread of Soybean Rust within Soybean Canopies**<br>D.F. Narváez, J.J. Marois, D.L.Wright, and S. Isard. |
| 1:30 pm | **Effects of Potassium, Chloride and Minor Element Nutrition on Asian Soybean Rust**<br>R.W. Schneider, E.P. Mumma, C.L. Clark and C.G.Giles |
| 1:50 pm | **The Impact of Selected Fungicide Treatments on Disease Progress of Asian Soybean Rust and Other Diseases of Soybean**<br>G.B. Padgett, M.A. Purvis, A. Hogan, and S. Martin |
| 2:10 pm | **Soybean Sudden Death Syndrome Variety Testing at Southern Illinois University**<br>Craig Herzog, Catherine Schmidt, and Michael Schmidt |
| 2:30 pm | **Soybean Yield Suppression Due to Diseases for the Top Eight Soybean-Producing Countries in 2006**<br>A. Wrather, S. Koenning, R. Balardin, L.H. Carregal, R.Escobar, G.K. Gupta, Z. Ma, W. Morel, L.D. Ploper, and A. Tenuta |
| 2:50 pm | **Impact of Frogeye Leaf Spot on Soybean Yield in the Lower Midwest**<br>L.M. Vick, A.K. Vick, J.P. Bond, and J.A. Wrather |
| 3:10 pm | Break |
| | **Graduate Student Papers**<br>Moderator – Dr. Alemu Mengistu |
| 3:30 pm | **Laboratory Evaluation of Soybean Resistance to Pod Blight Caused by *Cercospora kikuchii***<br>B.C. Wells and Gabe Sciumbato |

3:30 pm **Laboratory Evaluation of Soybean Resistance to Pod Blight Caused by *Cercospora kikuchii***
B.C. Wells and Gabe Sciumbato

3:50 pm **Temporal Dynamics of Root and Foliar Symptoms of Soybean Sudden Death Syndrome at Different Inoculum Densities**
C. Gongora-Canul, F.W. Nutter, Jr., and L.F.S. Leandro

6:00 pm Social Coral Reef room - ground floor of the tower

7:00 pm Dinner

## Wednesday March 13

8:00 am **Registration**

**Discussion Session**
Moderator – Allen Wrather

9:00 am Soybean Rust Sentinal Survey Discussion
Don Hershman

9:20 am SSDW Business Meeting

# SOUTHERN SOYBEAN DISEASE WORKERS
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| SOUTHERN SOYBEAN DISEASE WORKERS<br>2007 TREASURY REPORT |
|---|
| Operational [redacted] Planters First Bank, Hawkinsville, GA |

| Receipt Summary | | |
|---|---|---|
| Interest on Operational Account | $ | 49.38 |
| 2007 Meeting Registration Receipts | $ | 5,380.00 |
| 2007 Soybean Disease Atlas Sales | $ | 235.00 |
| **Total Disbursements** | **$** | **5,664.38** |

| Disbursement Summary | | |
|---|---|---|
| Printing Fees | $ | 0 |
| Postage | $ | 0 |
| 2007 Annual Meeting Costs | $ | 4,665.71 |
| SSDW Association Awards | $ | 1,130.71 |
| Bank Account Fees | $ | 0.00 |
| **Total Disbursements** | **$** | **5,796.42** |

| SSDW Assets – December 31, 2007 | | |
|---|---|---|
| Beginning Balance – 1/01/07 | $ | 3,447.41 |
| Receipts | $ | 5,664.38 |
| Disbursements | $ | 5,796.42 |
| Net Assets – 12/31/07 | $ | 3,315.37 |
| **Balance of Operational Account** | **$** | **3,315.37** |

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# SOUTHERN UNITED STATES SOYBEAN DISEASE LOSS ESTIMATE FOR 2007

Compiled by Stephen 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 (6), 1985 and 1986 (2), 1987 (3), 1988 to 1991 (5), 1992 to 1993 (8), 1994 to 1996 (4) have been published. A summary of the results from 1974 to 1994 for the Southern United States was published (7) in 1995, and soybean losses from disease for the top ten producing countries of 1994 was published in 1997(9). 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 (10, 11). In 2005, a summary of disease losses for the US from 1996-2004 was published electronically (12) and in 2006 a summary from 2003 to 2005 was published in the Journal of Nematology (13).

The loss estimates for 2007 published here were solicited from: Edward Sikora in Alabama, Clifford Coker in Arkansas, Robert Mulrooney in Delaware, James Marois, Jim Marois, and Jim Rich in Florida, Bob Kemerait in Georgia, Don Hershman in Kentucky, 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, Melvin Newman in Tennessee, Tom Isakeit in Texas, and Patrick Phipps in Virginia. 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, questionnaires to Cooperative Extension staff, research plots, grower demonstrations, private crop consultant reports, foliar fungicide trials, and "pure guess". The production figures for each state were taken from the USDA/NASS website in mid January of 2008. 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 2007 was 2,000,000 acres less than in 2006. The 2007 average per acre soybean yield decreased from that reported in 2006. In 2007, 478 million bushels were harvested from over 15 million acres in 16 southern states. The overall average (weighted for acreage) for the 16 reporting states was 32 bushels/acre in 2007 while the overall average reported in 2006 was 36.8 bushels/acre (Table 1). The 2007 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 2007 was 7.22 % or 30.72 million bushels in potential production. In 2005, Tennessee reported the greatest percent loss at 16.01 %, followed by Florida at 12.0 %.

The estimated reduction of soybean yields is specific as to the causal organism or the common name of the disease (Table 3). The total reduction in soybean yield due to diseases in the 16 southern states was 30.72 million bushels in 2007 down from 52.5 million bushels reported in 2007; largely due to lower production as a result of drought and decreased acreage in most states.The highest average estimated percent loss was caused by soybean cyst nematode at 1.15 %. Although Asiatic soybean rust was detected in 9 states in 2007 yield losses were reported only from Florida (2 %), Georgia (1 %), South Carolina (0.10%), Oklahoma (1.5 %), Texas (2 %), Alabama (1 %), Arkansas (0.01), and Louisiana (1 %).

Diseases continued to cause significant loss in soybean production throughout the 16 southern states that participated in this disease loss estimate in 2007. It is essential that Extension and University research continue their efforts to discover methods to control these diseases and to educate soybean producers concerning the best methods to prevent yield loss due to soybean diseases.

Table 1. Soybean production for 16 Southern states in 2007.

| State | Acres harvested | Yield/acre (bu) | Total production (bu) | Potential Production (bu) |
|---|---|---|---|---|
| Alabama | 180,000 | 21 | 3,780,000 | 4,064,516 |
| Arkansas | 2,790,000 | 36 | 100,440,000 | 108,361,204 |
| Delaware | 145,000 | 24 | 3,480,000 | 3,558,646 |
| Florida | 12,000 | 24 | 288,000 | 327,273 |
| Georgia | 275,000 | 30 | 8,250,000 | 899,1826 |
| Kentucky | 1,080,000 | 26 | 28,080,000 | 30,908,090 |
| Louisiana | 590,000 | 42 | 24,780,000 | 27,290,749 |
| Maryland | 380,000 | 27 | 10,260,000 | 10,428,949 |
| Mississippi | 1,420,000 | 40 | 56,800,000 | 59,651,334 |
| Missouri | 4,550,000 | 37 | 168,350,000 | 174,636,929 |
| North Carolina | 1,360,000 | 21 | 28,560,000 | 30,875,676 |
| Oklahoma | 175,000 | 24 | 4,200,000 | 4,635,762 |
| South Carolina | 425,000 | 19 | 8,075,000 | 8,739,177 |
| Tennessee | 970,000 | 18 | 17,460,000 | 20,788,189 |
| Texas | 82,000 | 37 | 3,034,000 | 3,193,684 |
| Virginia | 480,000 | 27 | 12,960,000 | 13,642,105 |
| Total | 14,914,000 | Avg.=28.3Wt.Avg.=32.1 | 478,797,000 | |

Literature Cited


1. Koenning, S.R. 2005. Southern United States soybean disease loss estimate for 2004. Proceedings of the Southern Soybean Disease Workers, Thirty Second Annual Meeting, March 2-3 Scottsdale, AZ. Pp. 1-5.

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

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

4. 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.

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

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

7. 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.

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

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

10. 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.

11. 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.

12. 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

13. 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.

Table 2. Estimated percentage loss of soybean yield due to diseases for 16 southern states during 2007.

| Disease | AL | AR | DE | FL | GA | KY | LA | MD | MS | MO | NC | OK | SC | TN | TX | VA | Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Anthracnose | 0.00 | 0.26 | 0.10 | 0.00 | 2.00 | 0.02 | 0.50 | 0.01 | 0.38 | Tr | 0.05 | 0.20 | 0.10 | 1.00 | 0.00 | 0.40 | 0.26 |
| Bacterial diseases | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.20 | 0.02 |
| Brown leaf spot | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.30 | 0.10 | 0.25 | Tr | Tr | 0.10 | 1.50 | 0.25 | 1.00 | 0.00 | 0.20 | 0.23 |
| Charcoal rot | 3.00 | 3.30 | 0.00 | 1.00 | 1.00 | 5.00 | 0.50 | 0.01 | 2.75 | 1.20 | 0.20 | 1.00 | 0.10 | 6.00 | 0.00 | 0.10 | 1.62 |
| Diaporthe/Phomopsis | 0.50 | 0.01 | 0.10 | 0.00 | 0.00 | 0.80 | 0.50 | 0.00 | 0.10 | 0.00 | 0.20 | 0.00 | 0.05 | 1.00 | 0.00 | 0.10 | 0.21 |
| Downy mildew | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.01 | Tr | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.16 |
| Frogeye | 0.00 | 0.01 | 0.00 | 3.00 | 0.25 | 0.01 | 0.50 | 0.00 | Tr | Tr | 0.20 | 2.00 | 0.15 | 2.00 | 0.00 | 0.00 | 0.51 |
| Fusarium wilt and rot | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | Tr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Other diseases b | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | 0.05 | 0.00 | 2.00 | 0.20 | 0.15 |
| Phytophthora rot | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.50 | 0.05 | Tr | 0.50 | 0.10 | 0.20 | 0.00 | 0.10 | 0.00 | 0.00 | 0.06 |
| Pod & stem blight | 0.00 | 0.20 | 0.00 | 1.00 | 0.00 | 0.10 | 0.50 | 0.20 | 0.18 | 0.00 | 0.10 | 0.20 | 0.10 | 0.10 | 0.00 | 0.00 | 0.17 |
| Purple seed stain | 0.50 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 2.00 | 0.00 | 0.75 | 0.00 | 0.20 | 0.20 | 0.15 | 0.10 | 0.50 | 0.10 | 0.30 |
| Aerial blight | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.10 |
| 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 | 0.00 | 0.02 | 0.01 | 1.00 | 0.00 | 1.00 | 0.10 | 0.00 | 0.18 | 0.30 | 0.10 | 1.00 | 0.10 | 1.00 | 0.00 | 0.50 | 0.34 |
| Southern blight | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 1.00 | 0.00 | 0.00 | 0.20 | 0.00 | 0.15 | 0.00 | 0.00 | 0.10 | 0.09 |
| Soybean cyst nematode | 0.00 | 1.80 | 1.00 | 0.00 | 0.00 | 1.80 | 0.00 | 0.10 | 0.25 | 1.50 | 4.00 | 1.50 | 1.00 | 3.00 | 0.00 | 2.50 | 1.15 |
| Root-knot nematode | 2.00 | 1.50 | 1.00 | 2.00 | 3.00 | 0.00 | 1.00 | 0.00 | Tr | Tr | 1.00 | 0.10 | 2.50 | 0.10 | 0.00 | 1.50 | 0.98 |
| Other nematodes c | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 1.50 | 0.00 | 0.00 | 0.50 | 0.28 |
| Stem Canker | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.01 |
| Sudden death syndrome | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.05 |
| Virus d | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | 0.75 | 0.01 | 0.00 | 0.00 | 0.06 |
| 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 |
| Soybean rust | 1.00 | 0.01 | 0.00 | 2.00 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.10 | 0.00 | 2.00 | 0.00 | 0.54 |
| Total disease % | 7.00 | 7.31 | 2.21 | 12.0 | 8.25 | 9.15 | 9.20 | 1.62 | 4.78 | 3.60 | 7.35 | 9.40 | 7.60 | 16.01 | 5.00 | 5.00 | 7.22 |

a Rounding errors present. TR indicates Trace.
b Other diseases listed were: red crown rot caused by Cylindrocladium parasiticum in NC, GA, SC, and VA.
c Other nematodes listed were: Stubby root, Lesion, Sting and common Lance in VA; Columbia lance in NC, SC, and Georgia.
and Reniform in AL,AR,GA,NC, SC, and TX.
d Viruses were identified as: SMV in AL, AR, GA, MS, NC, OK,SC, and VA; BPMV AR,DE,LA,MS,NC,OK, and VA; TobRSV in AR, NC, and SC; and PMV in NC and VA.

Table 3. Estimated suppression of soybean yield (bushels in millions) as a result of disease for 16 southern states during 2007.

| Disease | AL | AR | DE | FL | GA | KY | LA | MD | MS | MO | NC | OK | SC | TN | TX | VA | Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Anthracnose | 0.00 | 0.28 | 0.00 | 0.00 | 0.18 | 0.01 | 0.14 | 0.00 | 0.22 | 0.00 | 0.02 | 0.01 | 0.01 | 0.21 | 0.00 | 0.05 | 0.07 |
| Bacterial diseases | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.01 |
| Brown leaf spot | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.09 | 0.03 | 0.03 | 0.00 | 0.00 | 0.03 | 0.07 | 0.02 | 0.21 | 0.00 | 0.03 | 0.03 |
| Charcoal rot | 0.12 | 3.58 | 0.00 | 0.02 | 0.09 | 1.55 | 0.14 | 0.00 | 1.64 | 2.10 | 0.06 | 0.05 | 0.01 | 1.25 | 0.00 | 0.01 | 0.66 |
| Diaporthe/Phomopsis | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.25 | 0.14 | 0.00 | 0.06 | 0.00 | 0.06 | 0.00 | 0.00 | 0.21 | 0.00 | 0.01 | 0.05 |
| 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 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 |
| Frogeye | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.14 | 0.00 | 0.00 | 0.00 | 0.06 | 0.09 | 0.01 | 0.42 | 0.00 | 0.00 | 0.05 |
| Fusarium wilt and 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 | 0.00 | 0.00 |
| Other diseases b | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.06 | 0.03 | 0.01 |
| Phytophthora rot | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.01 | 0.00 | 0.87 | 0.03 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.07 |
| Pod & stem blight | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.03 | 0.14 | 0.02 | 0.10 | 0.00 | 0.03 | 0.01 | 0.01 | 0.02 | 0.00 | 0.00 | 0.04 |
| Purple seed stain | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.55 | 0.00 | 0.45 | 0.00 | 0.06 | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 | 0.07 |
| Aerial blight | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 |
| 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 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.31 | 0.03 | 0.00 | 0.10 | 0.52 | 0.03 | 0.05 | 0.01 | 0.21 | 0.00 | 0.07 | 0.08 |
| Southern blight | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.06 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 |
| Soybean cyst nematode | 0.00 | 1.95 | 0.04 | 0.01 | 0.00 | 0.56 | 0.00 | 0.01 | 0.15 | 2.62 | 1.24 | 0.07 | 0.09 | 0.62 | 0.00 | 0.34 | 0.48 |
| Root-knot nematode | 0.08 | 1.63 | 0.04 | 0.00 | 0.27 | 0.00 | 0.27 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.22 | 0.02 | 0.00 | 0.20 | 0.19 |
| Other nematodes c | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.27 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.13 | 0.00 | 0.00 | 0.07 | 0.05 |
| Stem Canker | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| Sudden death syndrome | 0.00 | 0.11 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.06 | 0.17 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.03 |
| Virus d | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.01 |
| 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 | 0.01 | 0.00 |
| Soybean rust | 0.04 | 0.01 | 0.00 | 0.00 | 0.09 | 0.00 | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.01 | 0.00 | 0.06 | 0.00 | 0.03 |
| Total disease % | 0.28 | 7.92 | 0.08 | 0.03 | 0.74 | 2.83 | 2.51 | 0.17 | 2.85 | 6.29 | 2.27 | 0.44 | 0.66 | 3.33 | 0.16 | 0.16 | 30.72 |

**a Rounding errors present.**

# Effects of Row Spacing and Leaf Wetness on the Temporal and Spatial Spread of Soybean Rust within Soybean Canopies

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Soybean rust (SBR), caused by *Phakopsora pachyrhizi,* has the potential to be an economic threat to U.S. soybean producers after its arrival on the continental United States in 2004. The use of fungicides to control SBR may be problematic due to the large acreage needed to be protected, high costs of these fungicides, and cost of application.

Cultural practices such as the use of lowered seed rates, increased row widths, and proper row orientation to the sun have been prescribed as environmental modifications that create a microclimate less conducive to foliar disease development.

Narrow row spacing will affect canopy microclimate variables by causing earlier onset and increased duration of suitable leaf wetness, relative humidity, and optimal temperatures with reduced solar radiation influencing spatial and temporal disease development earlier than wider spaced rows.

The microclimate data gathered in Florida along with the assessment of soybean rust spatial development and rate of spread will help to indicate if studied cultural practices and microclimate factors within the soybean canopies increase soybean rust epidemics.

Our objectives were:
- Determine the effects of row spacing (7, 14, 30 inch rows) on microclimate variables and the architecture of soybean canopies.
- Determine the effect of row spacing on the spatial distribution and rate of spread of an induced soybean rust epidemic in soybean canopies.
- Correlate relationships between microclimate variables and soybean rust spread within canopies at different row spacing.
- Determine the influence of different periods of leaf wetness and respective microenvironments on infection and rust development on soybean in the field.

Growing soybeans in 7.5, 15 or 30 inch rows did not significantly alter the rate of disease spread or disease increase over time. Rate of disease progress does not vary with the row spacings considered.
Our data corroborated previous findings and shows that not only does longer periods of leaf wetness increase disease severity, but also that the rate of spread of the disease to upper leaves is faster.

# Effects of Potassium, Chloride and Minor Element Nutrition on Asian Soybean Rust

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There is an extensive literature base on the effects of plant nutrition on disease. Potassium (potash) has been the subject of numerous investigations, and there are many examples of its ameliorating effects, although in most cases the effects of the accompanying anion, e.g. chloride, have not been documented. This field study was conducted to investigate the effects of potassium and the minor elements boron and manganese on Asian soybean rust (ASR) and other diseases.

Potassium chloride (KCl) was broadcast on the soil surface immediately before planting at 60 and 120 pounds per acre. Other plots received equivalent amounts chloride in the form of calcium chloride ($CaCl_2$). Manganese (Mn) and boron (B) were applied as foliar sprays at R1 at 0.5 and 0.25 pounds/acre, respectively. Sidedress applications of KCl and $CaCl_2$ were made at R1 either as single applications or supplemental applications following the preplant treatments. Several interaction treatments also were included in which KCl, $CaCl_2$ and minor elements were evaluated. In addition, foliar applications of urea-N at 5 and 10 pounds/acre were made at R1. Preplant soil samples were collected for analysis and leaf samples were collected during early reproductive growth in order to assess the effectiveness of our applications.

Results from our quantitative disease severity evaluations clearly showed that disease initiation was delayed and rate of disease development was reduced in the better treatments. Preplant applications of either KCl or $CaCl_2$ at 60 pounds/acre Cl resulted in the least disease. Sidedress applications, either as the sole source or supplementary source, were significantly less effective than the preplant treatments. Minor element applications were variable in their effects and did not show a significant interaction with the main effects. There were significant yield responses, which were related to disease severity and rate of disease increase. There were no differences in disease severity across all treatments at late R6.

Results from this study, which was a repetition of a similar study conducted in 2005, suggest that ASR may be attenuated, but not controlled, with nutritional supplements. Disease pressure was very high in this study, which suggests that under less severe conditions these treatments may have provided sufficient control without having to resort to fungicide applications. Also, it is possible that the chemical rate and number of applications may be reduced in conjunction with this cultural control practice.

# The Impact of Selected Fungicide Treatments on Disease Progress of Asian Soybean Rust and Other Diseases of Soybean.

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Soybean diseases reduced overall production in Louisiana by 3.16 million bushels or 11% during 2006. Prior to 2004, strobilurin and benzamidiazole chemistries were the foundation of fungicide programs in this state. However, the discovery of soybean rust (SBR) in Baton Rouge, LA in November 2004 has heightened concern within the U.S. soybean community because of the devastating potential of this disease. The effectiveness of current fungicide management programs against SBR has not been fully evaluated in Louisiana. To address this concern, tests were conducted in a producer field in Jefferson Davis parish and on the LSU AgCenter Dean Lee Research Station in Rapides parish to evaluate fungicide impact on SBR disease progress, late-season disease progress, and soybean yield. Aerial or ground foliar applications of selected fungicide treatments were applied either once or twice during the reproductive growth stages (R1 to R5). Disease incidence and severity were assessed several times during the growing season using accepted rating scales. When possible, soybean plots were harvested to assess treatment effects on yield and quality.

While triazole chemistries were more efficacious on SBR than strobilurin chemistries, differences were noted among the triazoles. When evaluating the residual activity of fungicide treatments, SBR severity did not appreciably increase in triazole treatments until 41 days after application, compared to 34 days in strobilurin treatments. Strobilurin products were most efficacious against aerial blight, while thiophanate methyl provided the best protection against Cercospora foliar blight. Unfortunately, no single fungicide class provided broad spectrum disease control; therefore, tank mixes of several fungicide classes will be needed to ensure effective management. Yields from fungicide-treated soybean ranged from 4% to 17% more than non-treated soybean. These results can be used to demonstrate that fungicides are effective for managing soybean diseases in Louisiana, but more research will be needed to determine the impact of application number, application timing, and disease initiation on soybean yield and quality.

# Soybean Sudden Death Syndrome Variety Testing at Southern Illinois University

Craig Herzog, Catherine Schmidt, and Michael Schmidt

Researchers at Southern Illinois University Carbondale have been engaged in the testing for variety reaction to soybean sudden death syndrome (SDS) since 1986. Goals of this project are to determine the variability in soybean for resistance to this disease, identify candidate parents for breeding efforts, to develop populations for inheritance studies, and to identify a set of varieties to serve as differentials for use in other studies. Trial entries include public and private cultivars, experimental lines and selected plant introductions. This effort began with the testing of a couple hundred varieties at a single location and has evolved into a multi location effort, consisting of over 1100 varieties having a range in maturity groups (MG) I through V, with each variety tested in at least three locations. Trials consist of three replications arranged as a randomized complete block design. Plots consist of two 10' rows on 30" centers. Varieties are partitioned into trials based on relative maturity with MGII through MGIV trials split into an early and late version. Beginning in 2006, trials are further split into glyphosate resistant and conventional classes. Disease scores are taken as close to growth stage R6 as possible. Many of the trials established in the 1980's and early 1990's were harvested for yield. The selection of sites with a proven history of intense SDS pressure and planting early (one week before frost free date) have been found to be most important to attaining SDS resistance information. Our experience has been that sites with natural infestation of SDS show better results than sites that are inoculated. The interaction between seasonal precipitation and thermal patterns with plant growth stage has a large effect on SDS expression. Trials consisting of three different maturity groups planted at the same location and on the day can exhibit differential intensities of SDS symptoms. We have compiled a data set consisting of those trials where therein the susceptible checks have exhibited a DX of 15 or greater. Of the 465 environments established over the 21 years, 138 met this criterion. Regression analysis on those trials harvested for yield has shown that for every 10 DX unit increase, yield is reduced by 7 percent. To meaningfully compare data across environments exhibiting differential SDS expression a relative DX (RDX) is computed for each variety as a percentage of the susceptible check, RDX = (entry DX/susceptible check DX )* 100. An analysis of RDX data will be presented to support that commercial varieties have been improved for resistance to this disease and that Glyphosate resistant varieties are no longer any more susceptible than conventional varieties. The temporal trend regarding the SDS/SCN interaction will be explored.

## Soybean Yield Suppression Due to Diseases for the Top Eight Soybean-Producing Countries in 2006.

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The objective of this project was to compile estimates of soybean yields suppressed due to diseases in the top eight soybean-producing countries for the 2006 harvested crop. The purpose is to provide this information to help local and world agencies allocate funds for research and to help scientists focus and coordinate research efforts. Methods used by scientists to estimate soybean yield suppression due to diseases in these countries were systematic field surveys, cultivar trials, and questionnaires sent to field workers and extension staff. Asian soybean rust caused more total yield suppression (13.2 million t) in these eight countries than any other disease during 2006. Next in decreasing order of total yield suppression were SCN (7.2 million t), brown spot (4.3 million t), seedling diseases (3.4 million t), anthracnose (2.5 million t), and charcoal rot (2.5 million t). Total estimated soybean yield suppression due to diseases in these countries during 2006 was 59.9 million t. Soybean yield suppression due to rust during 2006 was reported from all of these countries except Canada, but it was only reported from China during 1998. Soybean yield suppression due to SCN during 2006 occurred in Argentina (0.02 million t), Brazil (0.5 million t), Canada (0.09 million t), China (3.2 million t), and the US (3.4 million t). Scientist in Bolivia, India, and Paraguay reported no yield suppression due to SCN during 2006 and 1998. Clearly, SCN and other diseases caused extensive reductions in soybean yield in the top eight soybean-producing countries during 2006. Yield losses in some countries may have been worse if not for the use of disease management strategies and systems. Scientists at the universities developed most of the disease-resistant cultivars and other disease management strategies and systems. To reduce disease losses, research and extension efforts must be expanded to provide more effective preventive and therapeutic strategies and systems.

# Laboratory Evaluation of Soybean Resistance to Pod Blight Caused by *Cercospora kikuchii.*

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*Cercospora kikuchii* attacks the leaves, pods and seeds of soybean plants. Most significant losses associated with *C. kikuchii* infection are with the seed disease known as purple seed stain. Purple seed stain reduces seed quality and grade. Seed infection is a direct result of pod infection. *C. kikuchii* grows on the pod walls and colonizes adjacent seed coats. Inoculating pods from R3 to R6 results in seed infection characterized by purple seed stained coats. However, leaf infection and seed infection are independent events, and inoculating leaves does not produce the purple stained seeds. In fact, a soybean variety may be resistant to the leaf disease but susceptible to pod blight and the subsequent seed disease.

Environmental conditions at the time of inoculation and several days following inoculation have the most impact on the incidence of purple seed stain. Infection is most severe during warm, wet weather. Moisture and temperature serve as a threshold that determines if infection takes place. A temperature range between 60 to 86° F and an 18 to 24 hour period of surface wetness is required for successful pod infection.

In 2002, there was an extended period of warm, rainy weather in the Mississippi Delta when Maturity Group IV soybeans were in the final stages of maturity (R5-6). Mass yield losses near 100% occurred due to a pod blight by *C. kikuchii*. However, infection was variety specific leaving some fields unaffected. A laboratory method in order to determine a soybean variety's resistance to pod blight was developed and incorporated into our state disease screening trials. For each variety, 20 green R6 field grown pods were surface sterilized in 15% sodium hypochlorite for 3 minutes and aseptically placed in moist chambers (Hoffman # Cont 156C). Ten pods were sprayed with a 150,000 spore/ml solution of *C. kikuchii* and ten with sterile water as a check. The moist chambers were incubated (Percival I-35D) at 80°F for 7 days. Pods were rated by the percentage of surface area infected. Resistant (R) soybeans were not infected, moderately resistant (MR) were up to 25% infected, moderately susceptible (MS) were 25% to 75% infected, and susceptible (S) were over 75% infected. Data from three years of evaluations illustrate that later maturing varieties are more resistant to pod infection by *C. kikuchii*. This method will allow growers to select soybean varieties with resistance to pod blight caused by *C. kikuchii*.

# Temporal Dynamics of Root and Foliar Symptoms of Soybean Sudden Death Syndrome at Different Inoculum Densities

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Sudden death syndrome (SDS) caused by *Fusarium virguliform,* is an important disease of soybean. To date, there is limited understanding of the highly variable and unpredictable expression of root and foliar symptoms in both field and controlled environments. Foliar symptoms alone could be a poor indicator of root colonization by the pathogen and the potential losses in plant biomass. The objective of this work was to describe and compare the temporal dynamics of SDS root and foliar symptoms at different inoculum densities.

Soybean seeds cv Ag2403 were planted in a soil:sand (1:1 vol.) plus cornmeal mixture (1.5%) and inoculated at concentrations of 0, 1, $10^1$, $10^2$, and $10^3$ spores/g of dry soil. After inoculation, plants were maintained under growth chamber conditions at 17°C for 7 days followed by 24 °C for 43 days. Foliar and root disease severity were assessed six times (9, 15, 20, 30 40, and 50 days after inoculation) on destructively sampled plants. The monomolecular model was found to best describe temporal dynamics, and therefore, this model was fitted to all disease progress curves.

Root and foliar severity and AUDPC increased with increasing inoculum density (P=0.05), with the effects more evident for foliar than root symptoms. Differences in root rot were much more evident at early sampling times, in contrast to the very similarly high root rot severity levels being observed at the end of the experiment regardless of the level of inoculum density plants were subjected to. Rates of disease progress generally increased with increasing inoculum density for both root and foliar symptoms, except for the highest inoculum density ($10^3$) in which disease severity decreased at the later sampling times. The incubation period for root and foliar symptoms decreased from 20 to 9 and 20 to 15 days, respectively, with increasing inoculum density. Root biomass decreased as inoculum density increased over time (p=0.05), with up to a 70% reduction in root biomass being observed. The onset of foliar symptoms occurred 6 to 11 days after root symptoms appeared, and time for foliar symptoms decreased as inoculum density increased. The most reliable interval to estimate foliar symptoms based on root rot assessments was 15-30 days after inoculation, since root rot severity at these sampling times showed the strongest relationship with final foliar severity ($R^2$ =0.72-0.98) and AUDPC ($R^2$ =0.74-0.98).

This study shows that inoculum density differentially affects the progress of SDS foliar and root symptom expression over time. Roots need to be assessed earlier than foliar symptoms to detect treatment effects, which may explain why previous studies found poor correlations between root rot and foliar symptoms when both are assessed at the end of experiments. Root biomass was shown to be greatly reduced by *F. virguliforme* infection, even in the absence of foliar symptoms. This suggests that the potential for substantial yield losses in asymptomatic plants. The importance of root rot should therefore be further investigated to support both SDS resistance breeding and yield loss estimates.

# Impact of Frogeye Leaf Spot on Soybean Yield in the Lower Midwest

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*Cercospora sojina* Hara, the causal agent of frogeye leaf spot (FLS) is becoming a persistent threat to soybean production in the North Central region. Over the past 10 years, the incidence and severity of the disease has increased. The disease can be managed effectively with the use of resistant varieties; however, very few varieties have durable resistance (*$Rcs_3$* gene) for all known pathotypes. The objectives of this project were to determine the impact of *C. sojina* on soybean yield and to compare the efficacy of fungicides in managing this disease.

To determine the impact of *C. sojina* on soybean yield, a trial was established in a production field in Tamms, IL. Treatments consisted of 3 soybean genotypes with or without a treatment of Headline (6 oz/A) at the R3 growth stage. Two susceptible varieties, Asgrow 4703 and Pioneer 94M70, and a resistant variety, Pioneer P94M50, were used in this trial. Soybean varieties were planted in 4 row plots (6.1 m long on 7.6 cm centers). The 6 treatments were arranged in a randomized complete block design and were replicated 5 times. A *C. sojina* isolate was grown on soybean, lima bean medium for 10 days to produce spores. At the soybean growth stage R1, spores and water were applied to all plots using a $CO_2$ backpack sprayer at a rate of 88 ml per row or ~33,000 spores per plant. Symptoms were expressed after 11 days, and the plants were rated 14 and 21 days after the fungicide was applied. Severity ratings of anthracnose and pod and stem blight were very low, presumably due to the dry conditions following the R4 growth stage. Foliar ratings of FLS were significantly higher in the non-treated control for the two susceptible varieties. Symptoms of FLS were not observed in resistant variety, and soybean yield was similar for the fungicide treated and non-treated plots. For the susceptible varieties, soybean yield was 7-10 bu/A higher, and FLS symptom severity was lower in the fungicide treatment when compared to the non-treated control.

Foliar fungicides trials were conducted in 2005 – 2007 to determine the impact and timing of fungicides in managing FLS. These trials were established in a similar manner as described previously with the exception that natural inoculum was used. Disease severity was moderate to severe. Fungicide applications were applied primarily at the R3 growth stage; however some trials included R5 applications (in addition to R3 or only at R5). Plots were rated for FLS and other foliar diseases. Most fungicides reduced the severity of FLS; however the highest yielding treatments were the stobilurin fungicides.