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Proceedings of the 31st Annual Meeting, Southern Soybean Disease Workers (February 15-16, 2004, St. Louis, Missouri)

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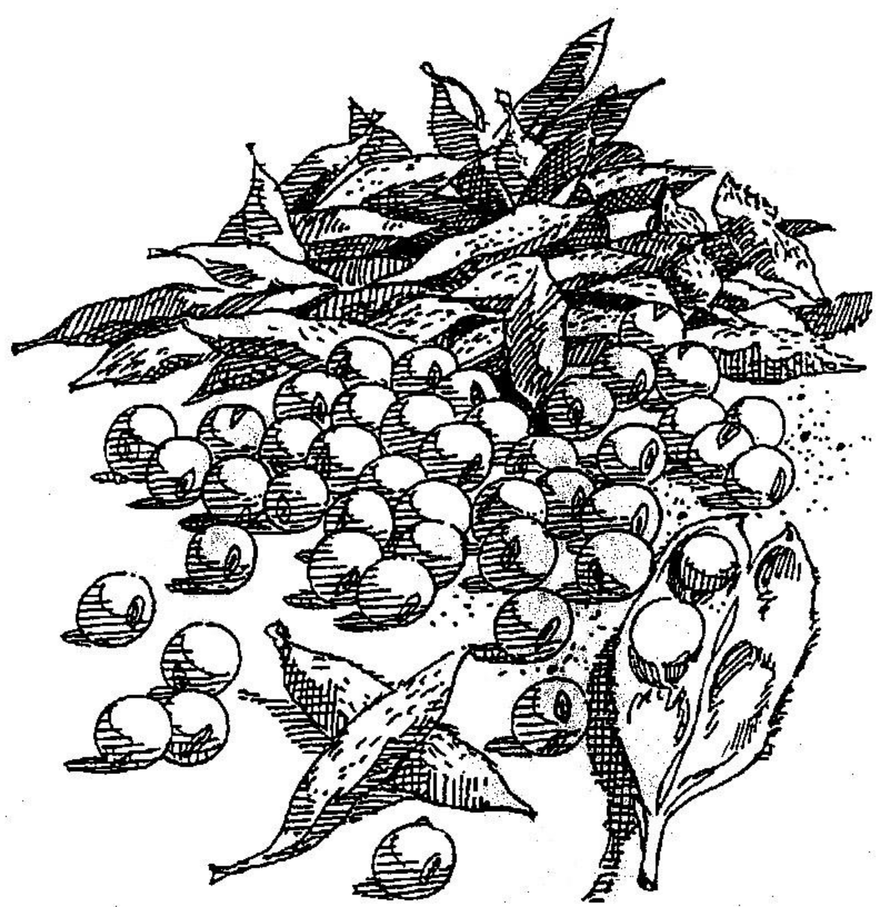
PROCEEDINGS OF THE SOUTHERN SOYBEAN DISEASE WORKERS



THIRTY-FIRST ANNUAL MEETING

February 15–16, 2004 | St. Louis, Missouri

PROCEEDINGS OF THE SOUTHERN SOYBEAN DISEASE WORKERS

31TH ANNUAL MEETING

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

31th Annual Meeting of the Southern Soybean Disease Workers
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Monday, 15 February 2004

Soybean Rust Colloquium

1:00-1:15	**Introductions** David Wright, NCSRP, IA, Soybean Promotion Board
1:15-2:00	**Academic Research** Glen Hartman-U. of Illinois
2:00-2:45	**Commodity Group** Neil Caskey-American Soybean Assoc.
2:45-3:00	***Break***
3:00-3:45	**Regulatory** Robert Spade,USDA-APHIS
3:45-4:30	**Seed Industry** Greg Lamka-Pioneer Seeds
4:30-5:30	**Discussion Panel** David Wright Moderator
5:30-6:00	**Registration**
5:30-5:45	**Shift in Soybean Disease Incidence and severity Following Adaptation of the ESPS (Early Soybean Productions system) In Mississippi.** G.L. Sciumbato and D.H. Poston
5:45-6:00	**Impact of Foliar Fungicides on Soybean Yield and Net Return** B.L. Spinks, D.H. Poston, G.L. Sciumbato, and M.A. Blaine
6:00-6:15	**Inheritance of Resistance to Phomopsis Seed Decay in Soybean PI 80837** E.W. Jackson, P. Fenn, P. chen, P.K. Miller
6:15-6:30	**Inheritance of Resistance to Purple Seed Stain in Soybean PI 80837** E.W. Jackson, P. Fenn, P. chen, P.K. Miller
6:30-6:45	**Population Structure of Cercospora kikuchii as Assessed with Vegatative Compatibility Groups and DNA Fingerprints** Guohong Cai and Raymond W. Schneider

6:45-7:00	**Reniform Nematode Reproduction on Soybean in 2003 Tests** R.T. Robbins, L. Rakes, L.E. Jackson, E.E. Gbur, and D.G. Dombek
7:00-7:30	**Break and SSDW Business Meeting**
7:30-9:30	**Meetings of the North Central Regional Technical Committees** Business Meeting-NCR-137 Business Meeting-NCR-200 Business Meeting-NCR-504

Monday, 16 February 2004

Research Presentations on Regionally Important Diseases

8:00-8:30	**Registration**
8:00-8:10	**Introduction/Greetings** Boyd Padgett
8:10-8:30	**Cercospora Leaf Spot** Ray Schneider
8:30-8:50	**Seedling Disease** John Rupe
8:50-9:10	**Sudden Death Syndrome** Mike Schmidt
9:10-9:30	**Froyeye Leaf Spot** Dan Phillips
9:30-9:50	***Break***
9:50-10:10	**Virus Diseases** John Hill
10:10-10:30	**Sclerotinia Stem Rot** Craig Grau
10:30-10:50	**Brown Stem Rot** Dean Malvick
10:50-11:10	**Phytopthora Root Rot**

Anne Dorrance

11:10-11:20 **Concluding Statements by Boyd Padgett**

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SOUTHERN UNITED STATES SOYBEAN DISEASE LOSS ESTIMATE FOR 2003

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 the 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 on line in 2003 (10,11).

The loss estimates for 2003 published here were solicited from: Edward Sikora in Alabama, Clifford Coker in Arkansas, Robert Mulrooney in Delaware, Dan Phillips in Georgia, Don Hershman in Kentucky, Ken Whitam in Louisiana, Arvydas Grybauskas in Maryland, Gabe Sciumbato in Mississippi, Allen Wrather in Missouri, Steve Koenning in North Carolina, John Mueller in South Carolina, Melvin Newman in Tennessee, Joseph Krausz in Texas, and Patrick Phipps in Virginia. Various methods were used to obtain the disease losses, and most individuals used more than one. Allen Wrather provided the estimate for Oklahoma for 2003. 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 supplied by the state crop reporting services. 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).

In the southern states, the 2003 average soybean yield and acreage increased from that reported in 2002. In 2003, 537.4 million bushels were harvested from 16 million acres in 15 southern states. The overall average for the 15 reporting states was 31.3. The overall average reported in 2002 was 26.7 bushels/acre. The Average yield (weighted by production) in 2003 was 33.5 bushels/acre. The 2003 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 2003 was 10.67 %, a substantial decvrease from the 12.25 % loss for 2002. In 2003, Tennessee reported the greatest percent loss at 27.62 %, followed by Mississippi and Louisiana at 16.0 %.

The estimated reduction of soybean yields is specific as to the causal organism or the common name of the disease (Table 3). The estimated reduction in soybean yield due to diseases during 2002 was greatest in Tennessee with 15.96 million bushels. The total reduction in soybean yield due to diseases in the 15 southern states was 79.69 million bushels in 2003 up from 70.27 million bushels reported in 2003; largely because of 11 % greater production as a result of higher than average yields in most states.

The highest average estimated percent loss was caused soybean cyst nematode 2.06% (14.86 million bushels), followed by frogeye leafspot 1.77 (9.86 million bushels), and root-knot nematode at1.2 % (4.62 million bushels) (Tables 2 & 3).

Diseases continued to cause significant loss in soybean production throughout the 15 southern that participated in this disease loss estimate states in 2003. 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 2003.

State	Acres harvested	Yield/acre (bu)	Total production (bu)
Alabama	155,000	34	5,270,000
Arkansas	2,900,000	37	107,300,000
Delaware	175,000	38	6,650,000
Florida	<10,000	NA	NA
Georgia	180,000	33	5,940,000
Kentucky	1,251,000	43	53,800,000
Louisiana	760,000	34	25,840,000
Maryland	430,000	37	15,910,000
Mississippi	1,410,000	36	50,800,000
Missouri	4,950,000	29	143,600,000
North Carolina	1,400,000	30	42,000,000
Oklahoma	255,000	25	6,375,000
South Carolina	410,00	27	11,070,000
Tennessee	1,100,000	38	41,800,000
Texas	180,000	26	4,680,000
Virginia	480,000	34	16,320,000
Total	16,036,000	Avg. =31.3 /Wt. Avg. 33.5	537,355,000

Literature Cited

1. Koenning, S.R. 2003. Southern United States soybean disease loss estimate for 2002. Proceedings of the Southern Soybean Disease Workers. 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.

Table 2. Estimated percentage loss of soybean yields for 16 southern states during 2003a.

Disease	AL	AR	DE	GA	KY	LA	MD	MS	MO	NC	OK	SC	TN	TX	VA	Avg.
Anthracnose	0.50	0.90	0.50	0.20	0.04	1.00	1.00	1.00	TR	0.40	TR	0.75	4.00	3.00	0.10	1.03
Bacterial diseases	0.00	0.00	0.00	0.00	0.01	TR	0.00	TR	0.00	0.10	TR	0.25	0.00	0.20	TR	0.05
Brown leaf spot	0.00	0.01	TR	0.00	0.25	0.00	0.05	0.50	0.00	0.20	0.00	0.25	3.00	0.20	TR	0.34
Charcoal rot	0.00	2.00	0.00	0.20	0.50	1.00	0.00	1.00	2.50	0.05	1.50	0.05	2.00	3.50	0.10	0.96
Diaporthe/Phomopsis	0.50	0.30	TR	0.30	1.00	0.00	0.00	2.00	0.00	0.20	0.50	0.05	1.00	1.50	0.00	0.53
Downy mildew	0.00	0.00	TR	0.00	0.01	TR	0.00	TR	0.00	0.25	0.00	0.05	0.01	0.10	0.00	0.04
Frogeye	1.50	0.50	0.00	1.00	0.15	0.20	0.00	5.00	TR	0.70	0.00	5.00	8.00	1.00	TR	1.77
Fusarium wilt and rot	0.00	0.00	0.00	0.00	0.02	0.00	0.00	TR	TR	0.00	0.00	0.01	0.00	0.20	0.00	0.02
Other diseases **b**	0.00	0.00	0.00	0.50	0.00	0.00	0.00	TR	0.00	4.50	0.00	0.00	0.00	0.00	0.20	0.37
Phytophthora rot	0.00	0.01	0.00	0.00	0.01	0.20	0.00	TR	1.00	0.30	TR	0.01	0.00	0.10	0.00	0.13
Pod & stem blight	1.00	0.56	TR	0.20	0.30	2.00	TR	2.00	0.00	0.40	0.50	0.05	0.00	1.50	0.20	0.67
Purple seed stain	0.25	0.10	TR	0.15	0.10	6.00	0.05	2.00	0.00	0.10	0.10	0.05	1.00	1.50	0.10	0.82
Aerial blight	0.00	0.45	0.00	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.14
Sclerotinia	0.00	0.00	0.00	0.00	0.00	TR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.01
Seedling diseases	1.00	0.05	0.50	0.10	0.50	1.00	TR	1.50	0.10	0.05	0.50	0.01	2.00	0.50	1.00	0.63
Southern blight	0.25	0.03	0.00	0.10	0.01	TR	0.00	TR	0.00	0.20	TR	0.50	0.00	0.20	0.10	0.12
Soybean cyst nematode	0.25	4.00	3.00	3.00	2.50	0.20	2.00	0.20	1.50	5.00	0.75	2.00	4.50	0.00	2.00	2.06
Root-knot nematode	0.50	2.00	TR	3.50	0.00	3.00	TR	TR	0.00	1.20	0.10	3.00	0.00	0.30	0.80	1.20
Other nematodes **c**	0.25	0.01	0.00	0.25	0.00	0.20	0.00	TR	0.00	0.60	0.00	2.00	0.01	0.00	0.20	0.25
Stem Canker	2.00	0.25	0.00	0.50	0.01	TR	0.00	0.20	0.00	0.00	0.00	0.00	0.10	0.10	0.00	0.23
Sudden death syndrome	0.00	0.13	0.00	0.00	0.01	0.00	TR	0.10	TR	0.00	0.00	0.00	2.00	0.10	0.00	0.18
Virus **d**	1.00	0.02	0.00	0.00	0.01	0.20	0.00	TR	TR	0.20	0.00	1.00	0.00	0.00	TR	0.20
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	TR	0.00
Total disease %	9.00	11.31	4.00	10.00	5.43	16.00	3.10	16.00	5.10	14.45	3.95	15.03	27.62	14.30	4.80	**10.67**

a Rounding errors present. TR indicates trace.

b Other diseases listed were: ozone in NC, red crown rot caused by *Cylindrocladium parasiticum* in NC GA, and VA.

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

d Viruses were identified as: SMV in AR, GA, KY, MS, NC, SC,and VA; BPMV in AR, KY, MS,NC, and VA; Tobacco ringspot in AR; and yellow mosaic in TX.

Table 3. Estimated suppression of soybean yield (bushels in millions) as a result of disease for 16 southern states during 2003.

Disease	AL	AR	DE	GA	KY	LA	MD	MS	MO	NC	OK	SC	TN	TX	VA	Total
Anthracnose	0.03	1.10	0.03	0.01	0.02	0.31	0.16	0.61	0.00	0.20	0.00	0.10	2.31	0.16	0.38	**5.42**
Bacterial diseases	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.05	0.00	0.03	0.00	0.01	0.00	**0.10**
Brown leaf spot	0.00	0.01	0.00	0.00	0.14	0.00	0.01	0.30	0.00	0.10	0.00	0.03	1.73	0.01	0.02	**2.35**
Charcoal rot	0.00	2.44	0.00	0.01	0.28	0.31	0.00	0.61	3.78	0.02	0.10	0.01	1.16	0.19	0.22	**9.13**
Diaporthe/Phomopsis	0.03	0.37	0.00	0.02	0.57	0.00	0.00	1.21	0.00	0.10	0.03	0.01	0.58	0.08	0.05	**3.04**
Downy mildew	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.12	0.00	0.01	0.01	0.01	0.00	**0.15**
Frogeye	0.09	0.61	0.00	0.07	0.09	0.06	0.00	3.03	0.00	0.34	0.00	0.65	4.62	0.05	0.25	**9.86**
Fusarium wilt and rot	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	0.01	0.00	**0.02**
Other diseases	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	2.21	0.00	0.00	0.00	0.00	0.00	**2.24**
Phytophthora rot	0.00	0.01	0.00	0.00	0.01	0.06	0.00	0.00	1.51	0.15	0.00	0.00	0.00	0.01	0.00	**1.74**
Pod & stem blight	0.06	0.68	0.00	0.01	0.17	0.62	0.00	1.21	0.00	0.20	0.03	0.01	0.00	0.08	0.00	**3.07**
Purple seed stain	0.01	0.12	0.00	0.01	0.06	1.85	0.01	1.21	0.00	0.05	0.01	0.01	0.58	0.08	0.05	**4.04**
Aerial blight	0.00	0.55	0.00	0.00	0.00	0.31	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.01	0.00	**1.17**
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	0.01	0.00	**0.01**
Seedling diseases	0.06	0.06	0.03	0.01	0.28	0.31	0.00	0.91	0.15	0.02	0.03	0.00	1.16	0.03	0.03	**3.09**
Southern blight	0.01	0.04	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.10	0.00	0.07	0.00	0.01	0.00	**0.24**
Soybean cyst nematode	0.01	4.87	0.21	0.20	1.42	0.06	0.33	0.12	2.27	2.46	0.05	0.26	2.60	0.00	0.00	**14.86**
Root-knot nematode	0.03	2.44	0.00	0.23	0.00	0.92	0.00	0.00	0.00	0.59	0.01	0.39	0.00	0.02	0.00	**4.62**
Other nematodes	0.01	0.01	0.00	0.02	0.00	0.06	0.00	0.00	0.00	0.29	0.00	0.26	0.01	0.00	0.00	**0.67**
Stem Canker	0.12	0.30	0.00	0.03	0.01	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.06	0.01	0.00	**0.65**
Sudden death syndrome	0.00	0.16	0.00	0.00	0.01	0.00	0.00	0.06	0.00	0.00	0.00	0.00	1.16	0.01	0.01	**1.39**
Virus	0.06	0.02	0.00	0.00	0.01	0.06	0.00	0.00	0.00	0.10	0.00	0.13	0.00	0.00	0.00	**0.37**
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	**0.00**
Total loss	0.53	13.78	0.28	0.66	3.09	4.93	0.51	9.68	7.72	7.09	0.26	1.95	15.96	0.78	12.46	79.69

SHIFTS IN SOYBEAN DISEASE INCIDENCE AND SEVERITY FOLLOWING ADAPTION OF THE ESPS (EARLY SOYBEAN PRODUCTION SYSTEM) IN MISSISSIPPI

G. L. Sciumbato and D.H. Poston. Delta Research and Extension Center, Stoneville, MS 38756

The ESPS has been widely adapted by Mississippi producers. Traditionally soybeans of the maturity groups late V , VI and VI were planted from mid-to late May and harvested in October. Now, soybeans in Maturity groups III, IV, and V are planted from mid April to mid May and harvested in August and September. Weather records have shown that average rainfall is higher during the pod fill period (from mid May to mid June) of the Maturity Group III, IV, V than it is during the pod fill of the Maturity Group VI and VII (Mid July through September). Other advantages of the ESPS system are that fewer irrigations are needed and the soybeans are exposed to disease for a shorter period of time.

We have observed a dramatic increase in seedling disease when the soybeans are planted earlier. Seed treatments were not recommended or used when soybeans were planted in mid to late May. However, seed treatment is recommended and is routinely used by the producer in the ESPS system. The main seedling disease observed is caused by *Pythium* Spp. *Rhizoctonia* and other seed decaying fungi are also occasionally found. Incidence of *Phytophthora* Root Rot has not increased yet.

Late season foliar and stem diseases have increased under the ESPS system. Incidence of aerial web blight (*Rhizoctonia solani*) has increased. In 2003, high incidences of frog eye leaf spot (*Cercospora sojina*) and brown spot (*Septoria glycines*) were observed on certain varieties in the Delta. In the past, most Maturity Group III and IV and some early V group soybeans have managed to mature before stem canker developed. However, when Group IV and V beans are planted early, they are in the field longer. Weather conditions were ideal for stem canker development in 2003 and some early planted Group IV and V varieties which had been rated as Resistant were damaged by stem canker.

Pod diseases have increased on irrigated soybeans or when rainfall during pod fill is normal or above normal. In 2001, the Delta had an extended unusual rainy period when the Group III and IV soybeans were in the later stages of pod fill. There was widespread pod rot on certain varieties which often destroyed the entire crop. The purple leaf stain fungus (*Cercospora kikuchii*) is isolated from the rotted pods. In 2002, there was an extended rainy period during the later stages of pod fill of the Maturity Group V soybeans and *Phomophsis* spp. caused widespread pod rot. Seed quality of the Maturity group III and IV is typically poor. The reason for the poor seed quality is a combination of diseases and high temperatures during pollination and pod fill.

Even though insect pressure is higher, virus diseases (soybean mosaic and bean pod mottle) have been observed to be lower under the ESPS system probably because the beans are maturing when it is very hot and virus symptoms are masked.

IMPACT OF FOLIAR FUNGICIDES ON SOYBEAN YIELD AND NET RETURNS

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Twelve foliar fungicide treatments were evaluated at five locations in the Mississippi Delta in 2003. A randomized complete block experimental design with a split plot treatment structure was used. Main and sub-plot factors were fungicide treatment and application timing, respectively. Fungicide treatments were: 6.2 oz/A Quadris, 0.75 lb/A Topsin M, 1.5 pt/A Bravo Weatherstik, 2 oz/A Dimilin, 6.2 oz/A Quadris + 0.5 lb/A Topsin M, 6.2 oz/A Quadris + 1.0 pt/A Bravo Weatherstik, 6.2 oz/A Quadris + 2 oz/A Dimilin, 1.25 lb/A Solubor + 2 oz/A Dimilin, 3.1 oz/A Quadris + 2 oz/A Dimilin, 3.1 oz/A Quadris + 0.5 lb/A Topsin M, 5 oz/A Tilt, 3.9 oz/A Tilt + 4.1 oz/A Quadris, and a nontreated control. Application timings were R3 and R5. Applications were made with a tractor-mounted compressed-air sprayer calibrated to deliver a spray volume of 15 gpa at 33 psi. Soybean varieties and planting dates were DPL 4748S (April 17), DPL 4748S (May 27), DK5366RR (April 9), P95B96 (April 30), and DK5366RR (May 16) for locations A, B, C, D, and E, respectively. Visual rating for Frogeye leaf spot (FLS), caused by *Cercospora sojina* Hara, were taken at all locations approximately 2 weeks after R5 applications. Soybean yield and net returns above fungicide and application costs were determined. Net returns were calculated using a $5.00/bushel price for soybean.

Averaged across application timings, FLS severity was reduced by 9, 10, 7, 10, and 9 of the 12 treatments evaluated at locations A, B, C, D, and E, respectively. Dimilin and Solubor + Dimilin did not reduce disease severity at any location. Treatments containing 6.2 oz/A Quadris provided the most consistent and efficacious FLS control across locations. R5 applications were most efficacious at location A where MG IV soybean was planted in April. For the same variety planted in late-May at location B, the R3 application was the most efficacious. R3 applications were also the most efficacious for MG V soybean planted in late-April to mid-May at locations D and E. Efficacy did not differ by timing at location C where MG V soybean was planted in early-April. Soybean yield was highest where FLS control was greatest. Fungicides did not improve yield at location A and were not economical. Yield increases from fungicides occurred at locations B and C, but increases did not offset fungicide and application costs. Quadris alone, Quadris mixed with other fungicides, and Topsin M alone improved soybean yield and net returns at location D. Increases in yield and net returns at location D with these treatments ranged from 4 to 11 bushels/A and $21 to $38/A, respectively. Net returns were $24/A higher at location D when applications were made at R3 instead of R5. At location E, the R5 application was made too late (R6) and this greatly reduced treatment efficacy and yield responses. Significant yield increases at location E occurred with 6 oz/A Quadris, 2 oz/A Dimilin, 6 oz/A Quadris + 0.5 lb/A Topsin M, and 6 oz/A Quadris + 2 oz/A Dimilin; however, net returns were not significantly improved with any treatment.

Statistical increases (alpha = 0.10) in yield and net returns associated with foliar fungicides rarely occurred in this study except at location D. However, numerical increases were consistently observed. Taking into account all plots treated with a given treatment in this study, the greatest likelihood of receiving a positive net return occurred with 3.1 oz/A Quadris + 2 oz/A Dimilin where there was a 75 percent chance of a positive economic return.

INHERITANCE OF RESISTANCE TO PHOMOPSIS SEED DECAY IN SOYBEAN PI 80837

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Phomopsis seed decay (PSD), caused by *Phomopsis* spp. reduces the quality and viability of soybean seed. Pod fill and seed maturation under periods of high moisture lead to increased incidence of PSD, a major problem in ESSPS. Control of PSD is problematic, and development of resistant germplasm has not been fully explored. Previous research has identified several genotypes including PI 417479 and PI 80837 with possible resistance to PSD. Inheritance of resistance to PSD was studied in PI 417479 and led to the development of a resistant breeding line MO/PSD-0259 and two resistant lines.

The objectives of this study were to determine inheritance of resistance to PSD in PI 80837 and if its resistance is distinct from resistance in MO/PSD-0259. Crosses were made between PI 80837 and two PSD-susceptible genotypes, 'Agripro 350' and PI 91113. Additional crosses were made between PI 80837 and PSD-resistant MO/PSD-0259. Seed from field plots were assayed from three generations (F_1, F_{1r}, F_2, and $F_{2:3}$) of 'Agripro 350' x PI 80837, one F_2 population of PI 91113 x PI 80837, and two generations (F_2 and $F_{2:3}$) of PI 80837 x MO/PSD-0259. Seed infection in F_1 and F_{1r} plants was not significantly different from the resistant parent for the 'Agripro 350' x PI 80837 cross, suggesting that resistance in PI 80837 was under nuclear control. Chi-square analysis showed that the F_2 population and $F_{2:3}$ lines satisfactorily fit 3:1 (R:S) and 1:2:1 (R:H:S) ratios, respectively for the cross 'Agripro 350' x PI 80837. The F_2 population of PI 91113 x PI 80837 also segregated 3:1 (R:S). The F_2 population satisfactorily fit a 15:1 (R:S) genetic ratio for the cross between PI 80837 and MO/PSD-0259. These results indicate that resistance to PSD in PI 80837 is conditioned by a single dominant gene that is different from resistance in MO/PSD-0259.

INHERITANCE OF RESISTANCE TO PURPLE SEED STAIN IN SOYBEAN PI 80837

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Purple seed stain, caused by *Cercospora kikuchii*, is favored by periods of intermittent moisture combined with warm temperatures during flowering. Purple seed stain can lead to reduced market grade, poor processing qualities, and reduced seed vigor. One recommendation for control suggests planting less susceptible cultivars, thus development of resistant genotypes would be valuable. Inheritance studies on a resistant cultivar (SJ.2, Thailand) indicated that resistance was conferred by a single dominant gene. PI 80837 was reported to have low levels of purple seed stain in numerous field tests. Hereditability studies by Wilcox et al. (1975) indicated that resistance in PI 80837 was under moderately strong genetic control ($h^2 = 0.91, F_2$).
The objective of this study was to determine the inheritance of resistance to purple seed stain in PI 80837. Crosses were made between PI 80837 and three purple seed stain susceptible genotypes, 'Agripro 350', PI 91113, and MO/PSD-0259. Seed from field plots were assayed from three generations (F_1, F_{1r}, F_2, and $F_{2:3}$) of 'Agripro 350' x PI 80837, one F_2 population of PI 91113 x PI 80837, and two generations (F_2 and $F_{2:3}$) of PI 80837 x MO/PSD-0259. F_1 and F_{1r} plants were not significantly different from the resistant parent for the 'Agripro 350' x PI 80837, suggesting that resistance was under nuclear control. Chi-square analysis showed the F_2 populations and $F_{2:3}$ lines satisfactorily fit 3:1 (R:S) and 1:2:1 (R:H:S) ratios, respectively for all crosses. These data suggest that resistance to purple seed stain in PI 80837 is due to a single dominant gene under nuclear control.

POPULATION STRUCTURE OF *Cercospora kikuchii* AS ASSESSED WITH VEGETABLE COMPATIBILITY GROUPS AND DNA FINGERPRINTS

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Cercospora kikuchii causes purple seed stain and Cercospora leaf blight (CLB) in soybean. The former disease has been a recurring grain quality problem for many years, and CLB was considered to be a minor, cosmetic disease until about 1998 in Louisiana. There was a severe drought and unusually high temperatures during that year in the mid-Gulf region of the U.S. Little is known about the population structure of this pathogen. For example, are there genetic lineages within the pathogen population? If so, do soybean cultivars react differently to these lineages? What is the structure of vegetative compatibility groups (VCGs), and are there genetic differences between leaf and seed isolates?

Two approaches were used to address these questions. First, however, a large collection of isolates was amassed with isolations having been made from seeds and leaves of several soybean cultivars at several locations during 2 years in Louisiana. Isolates were identified by tissue source (leaf vs. seed), location, cultivar, and year in order to determine the roles of each of these variables in genetic lineages. In the first approach, nitrogen non-utilizing mutants were generated, and all possible pairings were conducted in order to construct VCGs. VCGs have been very useful in characterizing population structures in asexual fungi, including *Fusarium oxysporum* and *Verticillium* spp. In the second approach, random amplified polymorphic DNA (RAPD) and microsatellite-primed PCR (MP-PCR) were used to generate molecular fingerprints, which were employed to construct detailed lineages of isolates within the natural groups, i.e. leaf vs. seed, cultivar, location and year. In addition, virulence to six soybean cultivars was assessed in an attempt to divide the isolates into additional natural groups.

Only 16 of 56 self-compatible isolates were assigned to six multi-member VCGs, 01-06, with two or three isolates in each VCG. The other 40 isolates were not vegetatively compatible with any isolates other than themselves. All six multi-member VCGs contained isolates from different soybean cultivars, and three included isolates from different locations. Only one VCG included isolates from both leaves and seeds, while two and three multi-member VCGs included isolates only from leaves or seeds, respectively. Based on analysis of molecular variances, isolates from different cultivars or different locations in Louisiana were not significantly different, but the Louisiana population was significantly different from isolates collected outside the state. Leaf and seed populations were significantly different. In the clustering analysis, isolates from Louisiana were grouped into four lineages, clades A-D. Clades A-C were further grouped into a large clade, ABC. Clade B was the most dominant lineage in Louisiana. Multilocus gametic disequilibrium tests did not reject the null hypothesis of random mating in clade B, but it was rejected in clades A and D and the total collection. Some isolates within a VCG were closely related, but isolates within a VCG were not clustered together according to VCG in general. Clade D was significantly more virulent across all cultivars than the other lineages. There is evidence for a covert sexual stage in this fungus.

RENIFORM NEMATODE REPRODUCTION ON SOYBEAN IN 2003 TESTS

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In 2003 greenhouse pot experiments,129 soybean varieties from the Arkansas variety testing program were tested to determine their suitability as hosts for the reniform nematode, *Rotylenchulus reniformis*. The *R. reniformis*-resistant varieties Forrest and Hartwig, the susceptible variety Braxton, and fallow-*R. reniformis*-infested soil served as controls. Total number of eggs and nematodes extracted from both the soil and roots from each pot, reproductive indices (RI = Pf/Pi), RI/RI of Forrest (RF), RI/RI of Hartwig (RH), log ratio [$\log_{10}$ (RF + 1)], log ratio [$\log_{10}$ (RH + 1)], RF calculated from $\log_{10}$ (RF + 1), and RH calculated from $\log_{10}$ (RH + 1) were calculated for each cultivar or breeding line. Varieties with RF's significantly greater than the RF on Forrest (1.00) were considered suitable hosts for *R. reniformis*. In the 2003 Arkansas variety test 122 of 129 lines had significantly more reproduction than Forrest when the log ratio [$\log_{10}$ (RF + 1)] were compared. Seven cultivars had log ratios not significantly higher than Forrest. These cultivars were Croplan Genetics RC4992, DT99-17145, Terral TVX57R301, Progeny 4884RR, Delta Grow 5650RR, FFR 4922RR, and Pioneer Brand 94M70. All lines including Forrest had more reproduction than Hartwig when the log ratio [$\log_{10}$ (RH + 1)] were compared.