3-2010

Proceedings of the 37th Annual Meeting, Southern Soybean Disease Workers (March 10-11, 2010, Pensacola Beach, Florida)

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Proceedings of the Southern Soybean Disease Workers

37th Annual Meeting

March 10-11, 2010 Pensacola Beach, Florida

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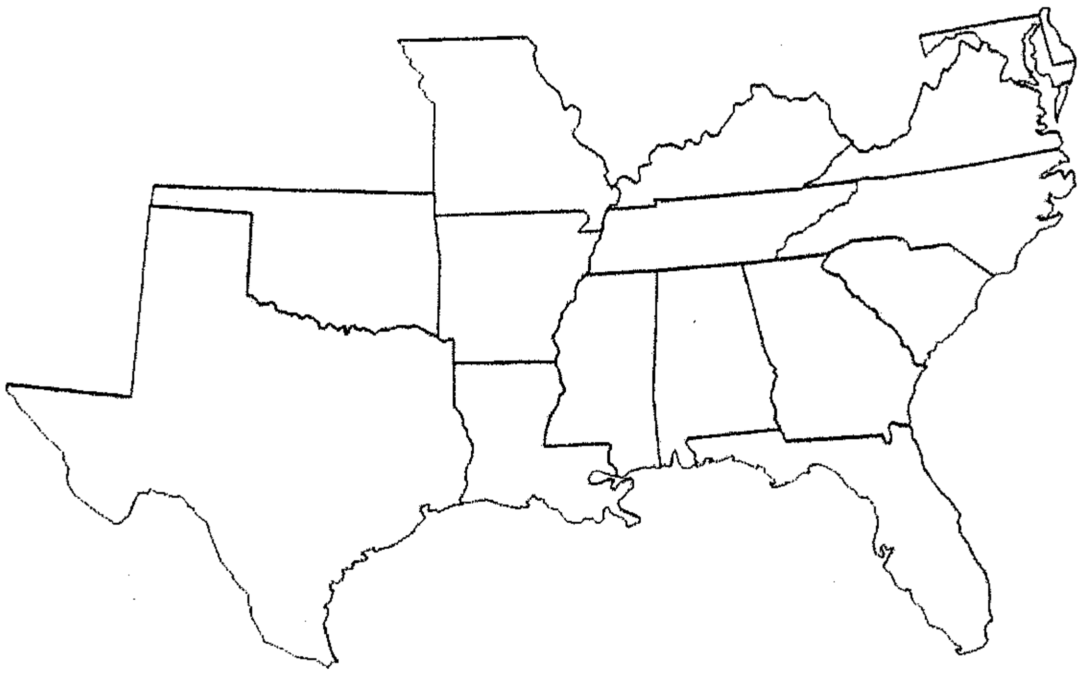
PROCEEDINGS OF THE SOUTHERN SOYBEAN DISEASE WORKERS

37TH ANNUAL MEETING

March 10-11, 2010

Pensacola Beach, Florida



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

37th Annual Meeting of the Southern Soybean Disease Workers
March 10-11, 2010
Pensacola Beach, Florida

<u>Wednesday, 10 March 2010</u>

Soybean Rust Colloquium

1:00-1:15	**Introductions** Jason Bond
1:15-3:00	**Green Bean Symposium** Jason Bond, Moderator
1:15-1:35	**Factors Contributing to Green Plants at Maturity** D. J. Boquet, R.L. Leonard, G.B. Padgett, R. W. Schneider, J. Griffin, J. Davis and R. Vaverde
1:35-2:00	**The Green Stem Disorder Enigma in Illinois** C. Hill and G. Hartman
2:00-2:20	**The Influence of Fungicides, Herbicides, and Their Interactions on Green Bean Syndrome** G.B. Padgett, D. J. Boquet, R. W. Schneider, and M. A. Purvis
2:20-2:40	**Association of Stink Bug Injury with A "Green Plant" Malady in Soybean** J. H. Temple, B. R. Leonard, J. Davis, P. Price, and J. Hardke
2:40-3:00	**Managing Green Stem: Desiccant Application Timing in Indeterminate and Determinate Soybean** J. M. Boudreaux, J. L. Griffin, R. W. Schneider, and G. B. Padgett
3:00-3:20	***Break***
3:20-4:40	**Graduate Student Paper Competition** Boyd Padgett, Moderator
3:20-3:40	**Disinfection of Soybean Seed by Sterilization of *C. kikuchii* and Other Seedborne Fungi with Gaseous Chlorine Compounds** P. Price, D. J. Stephens, R. W. Schneider, and G. B. Padgett
3:40-4:00	**Field Evaluations of *Simplicillium lanosoniveum* as a Biological Control Agent for *Phakopsora pachyrhizi*** N. A. Ward, R. W. Schneider and C. L. Robertson

4:00-4:20	**Effects of Environment and Cultivar on Charcoal Rot Development in Soybeans** M. Doubledee, J. Rupe, C. Rothrock, S. Bajwa, A. Steger and R. Holland
4:20-4:40	**Field Evaluation and Molecular Screening of Soybean Lines for Resistance to Sudden Death Syndrome** D. W. Clark and S. Kantartzi
4:40-5:40	**Break and SSDW Business Meeting**
6:15-7:15	**Social (Poolside)**
7:15	**Dinner (Poolside)**

Thursday, 11 March 2010

8:00-8:30	**Registration**
8:10-11:50	**Southern Soybean Disease Workers Paper Session** Clayton Hollier/Boyd Padgett, Moderator
8:10-8:30	**Effect of a Fungicide and Insecticide Application on Soybean Seed Quality in Mississippi** T.W. Allen, C.H. Koger, A.L. Catchot, J. Gore, D. Cook, R.E. Baird, S. Martin, and C. Daves
8:30-8:50	**USB Funding of Soybean Disease Research** R. Joost
8:50-9:10	**Can Headline Fungicide Reduce Yield Loss in Soybean Caused by Soybean Cyst Nematode?** D. E. Hershman and B. S. Kennedy
9:10-9:30	**Efficacy, Yield and Economics of Ballad Plus Biofungicide for Soybean** S. Atwell, D. Warkentin, and D. Manker
9:30-9:50	***Break***
9:50-10:10	**Management of Soybean Nematodes Through the use of Resistance and Nematicides** M. Emerson, S. Monfort, A. Carroll, J. Fortner, T. Kirkpatrick, and J. Barham

10:10-10:30	**Asian Soybean Rust in Louisiana: Evidence of a Dynamic Pathogen** C.A. Hollier, P.A. Bollich, G. B. Padgett and M. A. Purvis
10:30-10:50	**Alabama Disease Survey** E. Sikora, J. F. Murphy, K. Lawrence, and D. Delaney
10:50-11:10	**Black Root Rot of Soybean: An Emerging Problem in Arkansas, Louisiana and Mississippi** C. Coker, T. Allen, and G.B. Padgett
11:10-11:30	**Soybean Resistance to SCN in North Carolina, a Continuing Story** S. R. Koening
11:30-11:50	**Research Update on Screening Germplasm and Breeding for Reisitance to Phomopsis Seed Decay in Soybean** S. Li, A. Wrather, P. Chen and J. Rupe
12:00-1:15	***Lunch Break (on your own)***
1:20-2:00	**Cliff Coker,** Moderator
1:20-1:40	**Soybean Vein Necrosis Virus: A New Widespread Virus in the Southeast and Midwest** J. Zhou, R. -H. Wen, M. Newman, S. K. Kantartzi, M. R. Hajimorad and I. E. Tzanetakis
1:40-2:00	**Black Root Rot a New Soybean Disease to Arkansas** A. Carroll, S. Monfort, M. Emerson, and J. Fortner
2:00-3:00	**Business Meeting** Treasury Report

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SOUTHERN SOYBEAN DISEASE WORKERS FY 2009 TREASURY REPORT
Operational Account #99724 Planters First Bank, Hawkinsville, GA

Receipt Summary - 2009	
Interest on Operational Account	$ 8.77
2009 Meeting Registration Receipts	$ 2,804.00
2009 Industry Support	$ 2,812.77
2009 Soybean Disease Atlas Sales	$ 1,000.00
Total Receipts	**$ 6,625.54**

Disbursement Summary - 2009	
Printing Fees	$ 95.13
Postage	$ 250.96
2009 Annual Meeting Costs	$ 4,970.48
SSDW Association Awards	$ 1,201.41
Bank Account Fees	$ 0.00
Total Disbursements	**$ 6,517.98**

SSDW Assets – December 31, 2009	
Beginning Balance – 1/01/09	**$ 3,493.46**
Receipts	**$ 6,625.54**
Disbursements	**$ 6,517.98**
Net Assets – 12/31/09	**$ 3,601.02**
Balance of Operational Account	**$ 3,601.02**

[redacted]

Clifford M. Coker [redacted]
12/31/09
SSDW – Treasurer

Table of Contents

Southern United States Soybean Disease Loss Estimate For 2009

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

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) in 2006 a summary from 2003 to 2005 was published in the Journal of Nematology (13), and in 2009 a summary of losses from 1996-2007 was published on line in Plant Health Progress (14).

The loss estimates for 2009 published here were solicited from: Edward Sikora in Alabama, Clifford Coker in Arkansas, Robert Mulrooney in Delaware, Jim Marois 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, and 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 2010. 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 2009 was almost 700,000 acres more than in 2008 (1). The 2009 average per acre soybean yield increased from that reported in 2008. In 2009, 779 million bushels were harvested from over 19 million acres in 16 southern states, a hundred bushels more than the drought affected crop in 2008. The overall average (weighted for acreage) for the 16 reporting states was 40.0 bushels/acre in 2009 while the overall average reported in 2009 was 37.6 bushels/acre (Table 1). The 2008 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 2008 was 9.28 % or 88.28 million bushels in potential production. In 2009, Tennessee reported the greatest percent loss at 29.72 %, followed by Louisiana at 13.4 %.

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 88.28 million bushels in 2009 up from the 50.38 million bushels reported in 2008. A likely reason for the increase was the increase in production combined with greater acreage that was grown without rotation. The highest average estimated percent loss was caused by soybean cyst nematode at 1.38%. Only two states, Oklahoma and Texas, reported a lower percentage of disease loss in 2009 as compared to 2008. Diseases continued to cause significant loss in soybean production throughout the 16 southern states that participated in this disease loss estimate in 2009. 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 2009.

State	Acres harvested	Yield/acre (bu)	Total production (bu)
Alabama	430,000	40	17,200,000
Arkansas	3,270,000	37.5	122,625,000
Delaware	183,000	42	7,686,000
Florida	34,000	38	1,292,000
Georgia	450,000	36	16,200,000
Kentucky	1,420,000	48	68,160,000
Louisiana	940,000	39	36,660,000
Maryland	475,000	42	19,950,000
Mississippi	2,030,000	38	77,140,000
Missouri	5,300,000	43.5	230,550,000
North Carolina	1,770,000	34	60,180,000
Oklahoma	390,000	31	12,090,000
South Carolina	570,000	25	14,250,000
Tennessee	1,530,000	45	68,850,000
Texas	190,000	25	4,750,000
Virginia	570,000	38	21,660,000
Total	19,552,000	Avg.37.6, Wt. Avg. 40.0	779,243,000

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Table 2. Estimated percentage loss of soybean yield due to diseases for 16 southern states during 2009.

Disease	AL	AR	DE	FL	GA	KY	LA	MD	MS	MO	NC	OK	SC	TN	TX	VA	Avg.
Anthracnose	1.00	1.00	tr	0.00	2.00	0.50	5.00	0.00	1.00	0.05	0.03	0.50	0.25	5.00	0.00	0.30	1.04
Bacterial diseases	0.00	0.01	0.00	0.50	0	0.00	0.00	tr	0.10	0.00	0.00	0.20	0.10	0.00	0.00	0.01	0.06
Brown leaf spot	0.00	0.02	tr	0.00	tr	0.40	0.00	0.05	1.00	0.00	0.10	0.50	0.25	3.00	0.00	0.20	0.35
Brown stem rot	0.00	0.00	0.00	0.00	tr	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.01
Charcoal rot	0.10	2.00	0.00	0.50	tr	0.50	0.10	0.00	2.00	0.50	0.10	1.00	0.02	0.10	0.10	0.01	0.44
Diaporthe/Phomopsis	2.50	1.00	0.10	0.50	2.00	0.80	1.00	0.00	2.50	0.25	0.50	1.00	0.50	6.00	0.00	0.10	1.17
Downy mildew	0.00	0.01	0.00	0.50	0.00	0.00	0.00	0.00	tr	0.00	0.00	0.10	0.25	0.00	0.00	0.00	0.05
Frogeye	0.25	0.01	0.00	2.00	tr	0.02	0.10	0.00	0.15	0.10	0.01	0.10	0.20	5.00	0.00	0.00	0.50
Fusarium wilt and rot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	tr	0.00	0.00	0.00	0.00	tr	0.00	0.00	0.01	0.00
Other diseases b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.30	0.20	0.20	0.00	0.50	0.60	0.13
Phytophthora rot	0.00	0.00	0.00	0.00	0.00	0.01	0.10	tr	tr	1.50	0.20	tr	tr	0.10	0.00	0.00	0.13
Pod & stem blight	2.00	1.30	0.00	0.50	5.00	0.10	2.00	0.05	2.00	0.00	0.20	0.50	0.50	0.50	1.00	0.30	1.00
Purple seed stain	2.00	0.03	0.00	0.00	0.50	0.01	2.00	0.05	2.00	0.01	0.20	0.50	0.10	3.00	0.20	0.20	0.68
Soybean cyst nematode	tr	0.50	2.00	1.50	tr	2.00	0.00	0.50	0.10	2.00	4.50	2.00	1.50	3.00	0.00	2.50	1.38
Root-knot nematode	0.00	0.70	1.00	2.00	3.50	0.00	1.00	0.10	tr	0.05	0.75	0.20	2.50	0.00	0.00	1.50	0.83
Other nematodes c	0.00	0.00	0.00	0.00	1.50	0.00	1.00	0.00	0.00	0.00	0.50	tr	3.00	0	0.00	0.50	0.41
Rhizoctonia aerial blight	0.00	0.02	0.00	0.00	0.00	0.00	0.10	0.00	tr	0.00	0.00	0.00	tr	0.00	0.00	0.00	0.01
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	0.01	0.00	1.00	0.30	0.80	0.00	0.00	0.75	0.50	0.20	0.50	0.02	1.00	0.00	0.50	0.35
Southern blight	0.00	0.01	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.20	tr	tr	0.00	0.00	0.10	0.05
Soybean rust	1.00	1.40	0.00	2.00	0.50	0.00	1.00	0.00	0.25	0.00	0.00	0.20	0.10	0.01	0.00	0.00	0.40
Stem Canker	1.00	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.10	0.00	0.00	tr	tr	0.01	0.00	0.01	0.07
Sudden death syndrome	0.00	0.01	tr	0.00	0.00	0.10	0.00	0.00	0.10	0.10	0.00	0.00	0.00	3.00	0.00	0.01	0.21
Virus d	0.22	0.00	0.00	0.00	tr	0.01	0.00	0.00	0.00	0.00	0.20	tr	tr	0.00	0.00	0.10	0.03
Total disease %	10.07	8.05	3.10	11.00	15.80	5.26	13.40	0.76	12.30	5.06	7.99	7.50	9.49	29.72	1.80	7.15	9.28

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, Cercospora blight MS, and Neocomospora stem blight in AR.

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 2009.

Disease	AL	AR	DE	FL	GA	KY	LA	MD	MS	MO	NC	OK	SC	TN	TX	VA	tot/Dis
Anthracnose	0.19	1.33	0.00	0.00	0.38	0.36	2.12	0.00	0.88	0.12	0.02	0.07	0.04	4.90	0.00	0.07	10.48
Bacterial diseases	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.03	0.02	0.00	0.00	0.00	0.15
Brown leaf spot	0.00	0.03	0.00	0.00	0.00	0.29	0.00	0.01	0.88	0.00	0.07	0.07	0.04	2.94	0.00	0.05	4.36
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	0.05	0.05
Charcoal rot	0.02	2.67	0.00	0.01	0.00	0.36	0.04	0.00	1.76	1.21	0.07	0.13	0.00	0.10	0.00	0.00	6.37
Diaporthe/Phomopsis	0.48	1.33	0.01	0.01	0.38	0.58	0.42	0.00	2.20	0.61	0.33	0.13	0.08	5.88	0.00	0.02	12.45
Downy mildew	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.00	0.00	0.07
Frogeye	0.05	0.01	0.00	0.03	0.00	0.01	0.04	0.00	0.13	0.24	0.01	0.01	0.03	4.90	0.00	0.00	5.47
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	0.22	0.00	0.20	0.03	0.03	0.00	0.02	0.14	0.64
Phytophthora rot	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.88	3.64	0.13	0.00	0.00	0.10	0.00	0.00	4.80
Pod & stem blight	0.38	1.73	0.00	0.01	0.96	0.07	0.85	0.01	1.76	0.00	0.13	0.07	0.08	0.49	0.05	0.07	6.66
Purple seed stain	0.38	0.04	0.00	0.00	0.10	0.01	0.85	0.01	1.76	0.02	0.13	0.07	0.02	2.94	0.01	0.05	6.37
Soybean cyst nematode	0.00	0.67	0.16	0.02	0.00	1.44	0.00	0.10	0.09	4.86	2.94	0.26	0.24	2.94	0.00	0.58	14.29
Root-knot nematode	0.00	0.93	0.08	0.03	0.67	0.00	0.42	0.02	0.00	0.12	0.49	0.03	0.39	0.00	0.00	0.35	3.54
Other nematodes c	0.00	0.00	0.00	0.00	0.29	0.00	0.42	0.00	0.00	0.00	0.33	0.00	0.47	0.00	0.00	0.12	1.63
Rhizoctonia aerial blight	0.00	0.03	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
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	0.01	0.00	0.01	0.06	0.58	0.00	0.00	0.66	1.21	0.13	0.07	0.00	0.98	0.00	0.12	3.83
Southern blight	0.00	0.01	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.02	0.26
Soybean rust	0.19	1.87	0.00	0.03	0.10	0.00	0.42	0.00	0.22	0.00	0.00	0.03	0.02	0.01	0.00	0.00	2.88
Stem Canker	0.19	0.04	0.00	0.00	0.00	0.01	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.34
Sudden death syndrome	0.00	0.01	0.00	0.00	0.00	0.07	0.00	0.00	0.09	0.24	0.00	0.00	0.00	2.94	0.00	0.00	3.35
Virus d	0.04	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.02	0.20
Total disease loss	1.92	10.74	0.25	0.16	3.04	3.78	5.67	0.15	11.70	12.29	5.23	0.98	1.49	29.12	0.09	1.67	88.28

a Rounding errors present.

Factors Contributing to Green Soybean Plants at Maturity

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The green plant malady in soybean is an abnormal condition where, after pod maturity, plant stems and leaves remain partly or completely immature. It usually is an insidious problem in that the crop appears normal and the problem is not recognized until too late to salvage the crop. There are many different degrees of greenness with many different causes. It also manifests with various levels of pod set and seed development varying from normal yield to 100% blank pods. The malady can cause yield and seed quality losses of 10 to 100%. The first widespread occurrence of green plants in Louisiana was reported in the 1980's. The causes of the malady were reported to be primarily stinkbug damage but also viruses, microplasms or phytoplasmas. Twenty years later in the 1990s the problem became more extensive and the causes were not always identifiable. The number of factors contributing to green plants has seemingly increased. These additional factors appear to be related to changes in plant genetics and management practices that cause abnormal physiological responses to external signals. Although insects remain the primary cause of the green plant malady, variety genetics increasingly plays a key role in much of the present day green plant malady, as newer plant genetics interact with the environment and management practices. Reduction in occurrence of green plants is attainable through variety selection and management. Remedies include intensive insect control, avoidance of varieties with a history of green plants, avoidance of non-optimal planting date and avoidance of stresses during pod and seed development. Producers should also know the expected maturity date of fields to be able to take early action when fields do not mature on time. Desiccates applied timely can sometimes salvage a crop but late applications of desiccates are much less effective.

The Green Stem Disorder Enigma in Illinois

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Over the last decade or so, soybean farmers in Illinois and throughout the Midwest have increasingly complained about soybean plants with green stems but ripe pods that are difficult to cut and harvest. Scientists in the Midwest call this problem green stem disorder because the cause is unknown. There is no evidence that green stem disorder affects soybean yield directly, but it is a nuisance that can reduce profit margins when it requires increased fuel and time to cut through patches afflicted with the disorder during harvest.

Early work on this problem implicated infection by *Bean Pod Mottle Virus* (BPMV) as the cause of the disorder (3). We conducted field tagging and inoculation experiments to study this and found that BPMV infection and green stem disorder were completely independent of each other (2). In the field tagging experiments, we found that many plants infected with BPMV did not develop green stem disorder, and conversely, many plants that had green stem disorder were not infected with BPMV. From the inoculations, conducted inside field cages to isolate the plants from BPMV beetle vectors, we found that green stem disorder developed without BPMV infection and that BPMV infection did not increase green stem disorder incidence. We also tested Bean leaf beetle, leaf hopper, and stinkbug feeding in the same experiments and found that these bugs had no effect on the incidence of green stem disorder.

While recording disease observations in soybean yield trials conducted across the state, we noticed differences in sensitivity to green stem disorder and we began recording incidence data. We found significant differences in sensitivity among cultivars, with consistent differences in sensitivity among check cultivars, indicating the existence of genetic variability among cultivars for green stem disorder sensitivity (1). We continue to record green stem incidence in the statewide tests and report the results to producers online (http://www.vipsoybeans.org).

We conducted follow-up field experiments with green stem sensitive and insensitive soybean genotypes and fungicide application and found that fungicide application elevated incidence, especially in sensitive genotypes, suggesting that fungal infection could be involved in the disorder. After plating out stem pieces from green and normal stems, we found that *Colletotrichum* spp. was predominant in green stems and *Macrophomina phaseolina* was predominant in normal stems. We are continuing to investigate this apparent association.

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The Influence of Fungicides, Herbicides, and Their Interactions on Green Bean Syndrome

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Green bean syndrome is influenced by several factors including certain fungicides and herbicides. Symptoms associated with this malady include plants with green stems, mature pods, and varying degrees of foliage retention. The syndrome is thought to interfere with harvesting efficiency because of excessive moisture associated with green stems and leaves. To gain a better understanding of how fungicides and herbicides influence green bean syndrome, the amount of green stems and foliage retention was quantified in field trials conducted over the past several years. Tests have been conducted on the Macon Ridge Research Station near Winnsboro, Louisiana; Northeast Research Station near St. Joseph, LA; Ben Hur Research Station near Baton Rouge, Louisiana; and in production fields in northeast Louisiana. Two tests conducted in 2008 and 2009 documented the impact of Headline and Domark fungicides and Roundup herbicide in several soybean varieties. Two fungicide applications, one at R3 (Headline 6.0 fl oz/A) followed by another at R5 (Headline 6.0 fl oz/A plus Domark 5.0 fl oz/A) were applied. Roundup herbicide was applied (32.0 fl oz/A) to soybean during the early reproductive stage. In other studies, percent green stems were quantified in soybean treated with selected fungicides at various rates and timings. Based on results from these studies, percent green stems were higher in soybean treated with strobilurin fungicides compared to non-treated soybean. The effect of Roundup was not as consistent as the fungicide treatment, but a slight increase in green stems was noted in some varieties. While the incidence of green stem was higher in soybean treated with a fungicide, yields were not adversely affected compared to the non-treated.

Association of Stink Bug Injury with A "Green Plant" Malady in Soybean

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In recent years soybean growers have experienced significant problems with plants retaining green leaves, green stems, and/or green pods in fields of mature soybean resulting in delayed harvest and decreased quality of harvested samples. In some cases, this problem has prevented seed harvest and the field has been destroyed. In other situations, seed quality reductions have caused significant losses in seed value or the entire load of soybean has been rejected at the storage elevator.

The condition can be influenced by several biotic and abiotic factors including cultivars, insect pests, fungicides, viruses, and environmental stresses. Historically, stink bug (Pentatomidae) injury to seeds is known to cause these effects. This late-season soybean malady, or "green plant" problem has been characterized by plants with green stems, green pods, and varying degrees of green foliage retention in fields that should normally be demonstrating normal crop maturity.

Previous studies in the Southern U. S. have associated seed feeding by the southern green stink bug, *Nezara viridula* (L.), green stink bug, *Acrosternum hilare* (Say), and brown stink bug, *euschistus servus* (Say) with delayed maturity of soybean plants. Since 2002, another phytophogaus stink bug, the redbanded stink bug, *Piezodorus guildinii* (Westwood), has reached outbreak levels across Louisiana. In recent surveys, the redbanded stink bug comprised 58% of the total stink bug population in Louisiana. This species is indigenous to South America and numerous studies have reported that this pest can also increase the incidence of delayed maturity and "green plant" symptoms. This work also suggests that redbanded stink bugs actually increase the frequency of delayed maturity above that observed for southern green stink bug.

During 2007-2009, field trials in Louisiana have attempted to gain a better understanding of the association of stink bugs, especially the red banded stink bug on the soybean "green plant" malady. The results of a stink bug management trial showed the incidence of green stems, green pods, and leaf retention were reduced by 45, 5, and 50%, respectively, when insecticide sprays were continued through the R7 growth stage compared to that in a non-treated control. In a similar trial, green stems, green pods, and leaf retention were reduced 24, 11, and 28%, respectively, in plots treated through R7 compared to the non-treated control. Artificial infestations of redbanded stink bugs (1.5X threshold) maintained during each of the (R2-R6) growth stages increased the incidence of green stem (12-28%) and green pods (5-22%). Unfortunately in other field studies where stink bugs have been removed as a pest, the "green plant" malady can still be observed in many soybean fields. The insect management studies validate previous research that stink bugs contribute to this problem. However, numerous trials in Louisiana also indicate that more than one factors contribute to theses maladies.

Paraquat and Sodium Chlorate Application Affects Soybean Harvest and Yield

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Research was conducted to evaluate soybean response to harvest aid treatments including paraquat at 0.28 kg ai/ha applied alone and with carfentrazone at 0.014 kg ai/ha and sodium chlorate applied alone at 6.72 kg ai/ha. Indeterminate and determinate soybean cultivars were treated when moisture of seed collected from the top 4 nodes of plants where seed would be most immature averaged 60, 50, 40, 30, and 20% (+ or – 2%). For each soybean cultivar the harvest aid by timing interaction was not significant for any of the parameters measured and data were averaged across harvest aid treatments. Application of harvest aid at 60% average seed moisture reduced yield for the indeterminate cultivar 15.4% compared with the nontreated. At 60% average moisture all seed within the top of the crop canopy had not reached physiological maturity (R6.5) and seed weight was reduced. Yield was not negatively affected when harvest aid was applied at 50% average seed moisture and soybean was harvested around 14 d before the nontreated. Although planting dates for the Maturity Group (MG) IV indeterminate cultivar differed by 26 days in the two years, number of days from planting to harvest aid application at 50% seed moisture was 112 and 116 days.

For MG V and MG VI determinate cultivars, application of harvest aid at 60% average seed moisture reduced yield compared with the nontreated 21.9 and 18%, respectively, and 15.7 and 4%, respectively, when harvest aid was applied at 50% average seed moisture. Soybean yield reduction was not observed when harvest aid was applied at 40% seed moisture and harvest was around 8 days earlier for the MG V cultivar and 10 to 14 days earlier for the MG VI cultivar. For the determinate cultivars planted in May, number of days from planting to application at 40% seed moisture was 123 and 127 (MG V) and 139 d (MG VI). The greater flexibility in harvest aid application timing with the indeterminate cultivar is because the most immature seeds (seeds that have not reached physiological maturity) would be present in the top of the plant. For determinate soybean, the most immature seed would be present in both the top and bottom of the plant. With the increased production of early maturing soybean cultivars in the mid-South and increased incidence of soybean leaf retention and presence of green stems and pods, use of a harvest aid for crop desiccation is expected to become an important component of soybean production systems.

Disinfection of Soybean Seed by Sterilization of *C. kikuchii* and other Seedborne Fungi with Gaseous Chlorine Compounds

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Purple seed stain and Cercospora leaf blight, caused by *Cercospora kikuchii*, are significant diseases of soybean worldwide. The diseases have increased in incidence and severity during the past ten years, particularly in the Mid-Southern United States. It has been documented that the pathogen is spread through seed, indicating a possible value in disinfecting seed. Additionally, this method may have potential as a research tool in epidemiological research of these diseases. A previously-developed method of seed disinfection was modified and tested on soybean. The seed treatment apparatus consisted of an enclosed chamber, and a chemical reaction was initiated by combining commercial bleach (6.0% NaOCl) and 0.6M KH_2PO_4. This reaction produced chlorine gas, hypochlorous acid, hypochlorite ions, and oxygen, depending on the temperature and pH. Normal and purple-stained soybean seed were subjected to various times of exposure (0-16 hours). Subsequently, seed were surface-sterilized and placed on acidified potato dextrose agar (PDA). Preliminary data indicate an optimum treatment time of 8-12 hours, with reductions in seed germination and seedling vigor.

Field Evaluations of *Simplicillium lanosoniveum* as a Biological Control Agent for *Phakopsora pachyrhizi*

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Simplicillium lanosoniveum is an inhabitant of soybean rust sori where it parasitizes urediniospores and affects sorus development. Microscopic observations indicated that the filamentous fungus penetrated and colonized urediniospores within 5 days of inoculation. To further evaluate the impact of this mycoparasitic fungus, we conducted field tests in 2009 near Baton Rouge, LA to evaluate *S. lanosoniveum* as a biological control agent. Treatments included foliar applications of conidia of *S. lanosoniveum* at various plant growth stages and rust severities. Leaf samples were collected weekly from late vegetative stages through senescence and were rated for disease severity and total number of sori. Next, we subjected total leaf genomic DNA, including all associated microorganisms, to qPCR analyses in order to quantify *S. lanosoniveum* and *P. pachyrhizi*. We found that *S. lanosoniveum* colonized and survived on leaf surfaces for 6 weeks after the earliest inoculation. This led to delayed disease development and reduction in numbers of sori. We conclude that *S. lanosoniveum* has mycoparasitic properties that should be exploited for biological control of soybean rust and possibly other rust diseases. This field of investigation incorporates ecological principles into the study of phyllosphere microbiology, which may lead to alternative means of disease control.

Effects of Environment and Cultivar on Charcoal Rot Development in Soybeans

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Charcoal rot of soybean caused by the soilborne fungus *Macrophomina phaseolina* (Tassi) Goid is a disease associated with high soil temperatures and low soil moistures. Above-ground symptoms, which can be difficult to distinguish from drought symptoms, include small leaves, low vigor, early senescence and significant yield loss. No soybean line is highly resistant to *M. phaseolina*, but a few lines may have moderate resistance. Separating the affects of drought from disease is difficult. The objectives of this research were to 1) separate the effects of cultivar and drought on the development of charcoal rot and 2) determine the efficacy of non-destructive techniques to measure disease development during the season. In 2008 and 2009, the soybean cultivars, DT97-4290 and Delta Pine 4546 (moderately resistant), R01-581F-CR (drought tolerant), and LS980358 (susceptible) were grown in microplots in the presence or absence of *M. phaseolina* and irrigated or drought-stressed in a factorial randomized complete block design experiment with five replications. Soil moisture, soil temperature, and rainfall were monitored. Root colonization and plant growth was assessed at growth stages V2/V3 and V4/V5. Stomatal conductance was measured with a porometer. Canopy temperature was measured with an infrared sensor and the temperatures were used to calculate Crop Water Stress Index (CWSI). Yield, root/stem disease severity, plant height stem discoloration and *M. phaseolina* colonization were determined at harvest. When differences between treatments occurred, irrigated plots had higher stomatal conductance than water-stressed plots and plants in infested plots had lower stomatal conductance than those in non-infested plots. Plants in infested, non-irrigated plots had lower stomatal conductance than those in infested irrigated or non-infested irrigated or non-irrigated plots. Irrigated plants had lower CWSI than water-stressed plots. In 2009, plants that were water-stressed had lower yields than those that were irrigated. When looking at the infested plots, the cultivar LS980358 had a higher percentage of plant height stem discoloration than the other three cultivars. In 2008, the cultivar LS980358 had higher root/stem severity ratings than the other three cultivars.

Field Evaluation and Molecular Screening of Soybean Lines for Resistance to Sudden Death Syndrome

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Sudden Death Syndrome (SDS) of soybeans, caused by a strain of the fungus known as *Fusarium virguliforme,* is a common problem throughout Illinois, particularly when cool temperatures and rainy conditions occur throughout the early flowering period. Losses commonly do not exceed 10- 15% of a crop, but cases have occurred where yields were reduced over 70% due to SDS. There is no 100 percent proven agronomic practice for controlling SDS, so the identification of genes associated with resistance are required for the development of varieties that will offer the producer the most economically efficient way to manage the disease. The primary objective of this study was to identify soybean lines from MG 3.7 to 4.9 resistant to *F. virguliforme* by field screening in multiple locations in Southern Illinois. In total, 55 advanced breeding lines along with four checks, one resistant-Ripley and one susceptible-Spencer and two maturity checks CM497, and LS03-4303 were tested and data showed that there were significant differences in disease severity among cultivars, indicating genetic variability for SDS resistance. All the 55 lines subsequently tested for the possible presence of previously reported *QTLs* using 14 microsatellite markers located on LG C1, D1b, D2, I, J, L, and O. An integrated analysis of phenotypic and molecular data may be useful in developing soybean cultivars with broad resistance to SDS and adapted to Southern Illinois area.

The Impact of a Foliar Fungicide and Insecticide on Seed Quality in Mississippi

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Over the past two seasons some of the more prevalent late-season soybean diseases have been pod and seed related, especially in maturity group IV soybean varieties. Particularly in 2009 this occurred due to the widespread and prolonged inclement weather conditions along with overcast skies and moderate temperatures that coincided with important pod development stages immediately prior to physiological maturity. In addition to conducive environmental conditions the continuous wetting and drying of soybean pods across a large geographic area likely contributed to increased Phomopsis seed decay. Preventing further infection once the initial infection has occurred appears difficult and fungicides may or may not play a role in reducing losses due to poor harvested seed quality. Additionally, it is believed that stink bugs may play a role in disease incidence and progression since in some years they tend to be a late-season pest and due to the nature of their feeding mechanism may create a wound court that would allow moisture into the seed pod and increase disease. In response to this growing problem in the Mississippi production area the specific objectives of this project were to determine interactions between fungicide and insecticide applications applied at various timings on yield and seed quality of MG IV soybeans. Coordinated research projects to address this topic were conducted at three locations throughout Mississippi, with trials conducted in Raymond, Starkville, and Stoneville and using the same soybean variety, a 4.7 relative maturity variety with a history of poor weathering performance. In addition, studies with caged stink bugs were conducted under a lateral move irrigation system to determine the impact of weathering in situations with and without the insect and with and without fungicide and insecticide treatments at more advanced reproductive growth stages. Several different application timings (R3, R5, and R3 followed by R5) were conducted with azoxystrobin (Quadris at 4 fl oz/A) and bifenthrin (Brigade at 5.2 fl oz/A) to determine the impact on yield and harvested seed quality. Fungicide and insecticide applications were made and plots were harvested to determine yield. Grain samples were submitted post-harvest to the Farmer's Grain Terminal grading facility to determine the overall quality losses due to excessive moisture, heat damage, mold, and stink bugs. In general, harvested yield was increased over the azoxystrobin treatment and the untreated control when bifenthrin was included in the treatment combination. The overall total damage as well as stink bug damage varied between locations. Raymond was the single location where heavy, season long stink bug pressure occurred. Plots subjected to caged stink bugs received excessive rainfall late in the season and were not able to be assessed nor harvested mechanically. However, these plots were later planted than the other research plots (by almost a month) and were subjected to a greater period of rainfall prior to physiological maturity. The greatest losses on a per acre basis occurred at the Starkville location and were related to excessive mold (fungal) damage while the Raymond location had the greatest elevator deductions due to stink bug damage. Losses in seed quality due to all components as well as the economics of the specific treatments will be discussed.

USB Funding of Soybean Disease Research

Dr. Richard Joost
United Soybean Board/SmithBucklin

The United Soybean Board (USB) directs the efforts of the soybean checkoff. USB is composed of 68 volunteer farmer-leaders who are nominated by their state checkoff organizations, called Qualified State Soybean Boards (QSSBs), and appointed by the U.S. Secretary of Agriculture. The soybean checkoff is supported entirely by soybean farmers with individual contributions of 0.5 percent of the market price per bushel sold each season.

There are five major program areas funded by the USB-directed checkoff program. These include New Uses, Domestic Marketing, International Marketing, Producer Communications, and Production Research. The Production Research program consists of three research areas including yield, composition and research coordination.

The yield research area is approached using three strategies. The first strategy is to protect existing yield potential from losses to biotic and abiotic stresses. The second strategy is to find ways to increase genetic yield potential and the final strategy is to develop superior production practices, predictive models and monitoring systems in order to increase yield.

Most of the soybean disease research funded by USB addresses the first strategy of protecting existing yield potential. For the current 2010 fiscal year the USB Production Committee is investing more than $4 million in 21 soybean disease projects. Eight of these projects deal with efforts to control damage due to soybean cyst nematode (SCN). These efforts include the evaluation of existing cultivars for SCN resistance, the identification of new SCN resistance genes and their incorporation into soybean germplasm, and the development of new technologies such as RNAi to silence genes related to the development of SCN feeding sites.

Six of the disease projects funded at over $1.1 million are related to soybean rust (SBR). This includes efforts to identify new SBR resistance genes and incorporate them into high yielding cultivars, monitoring dissemination patterns of SBR spores and development of innate resistance to combat SBR and other soybean diseases.

In addition to these major efforts research is also being supported to address charcoal rot, soybean viral diseases, *Fusarium* root rot, soybean sudden death, *Phytophthora*, and *Phomopsis* seed decay. These studies address a variety of approaches including the development of screening techniques, identification of genetic resistance, management practices and others.

Can Headline® Fungicide Reduce Yield Loss in Soybean Caused by Soybean Cyst Nematode?

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Soybean Cyst Nematode (SCN) is the most damaging pest of soybean in Kentucky. A limited survey of grower fields conducted in 2007, revealed that most SCN populations in Kentucky are now variants of HG-Type 2 and are able to reproduce on the majority of resistant cultivars grown in the state (i.e., have PI88788 in their pedigree). Evidence is substantial that most resistant cultivars are still producing good yields despite allowing limited SCN reproduction. However, significant yield (3-5 bu/ac) is still being lost in many fields, even where resistant cultivars are planted. A preliminary study conducted in 2008 suggested that applying a strobilurin fungicide at the early pod stage (R3) could limit yield losses caused by SCN. A similar result was found in a study conducted in 2009. In these studies, yields were 4-5 bu/ac higher when Headline (a strobilurin) was applied to a SCN-susceptible cultivar, in the absence of significant fungal disease pressure, and SCN levels were moderate to high. Strobilurin fungicides are reported to impart stress tolerance benefits to treated crops; however it has not been possible to predict when these benefits might be realized following an application. Our hypothesis is that applying a strobilurin fungicide can help SCN-stressed crops compensate for damage, resulting in higher yields compared to where a strobilurin fungicide is not applied. Furthermore, that SCN analysis results could provide an important additional rationale for when to apply (or not apply) a strobilurin fungicide, such as Headline. This is a novel research approach to minimizing yield losses caused by SCN. An expanded study will be carried out in 2010.

Efficacy, Yield, and Economics of Ballad Plus Biofungicide for Soybeans

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Biopesticides have traditionally been deployed in the high value fruit and vegetable markets due to their specificity and cost of production. Further, production issues, reproducibility and stability of formulations have hindered their adoption by conventional growers. Advances in research and development at AgraQuest have resulted in Ballad Plus, a biofungicide that can be stored and handled like conventional pesticides and is now an affordable alternative for crops such as soybeans.

Ballad Plus biofunigicide represents a new opportunity for improved yield and return on investment for soybean growers. Its unique mode of action can help with resistance management in a market that currently utilizes only two classes of fungicides, DMI's and QoI's, both of which have documented examples of resistance. Ballad Plus is based on a patented strain of *Bacillus pumilus*, QST 2808, first isolated at AgraQuest in 2001. Antifungal amino sugars produced by this strain compete for the enzyme that uses glucose to build pathogen cell walls. This leads to control of diseases by disruption of cell metabolism, inhibition of septum formation, inhibition of new cell wall formation, and destruction of cell integrity causing death of pathogen cells. This unique mode of action has been demonstrated to be a strong tool in disease resistance management. In addition, Ballad Plus has been shown to trigger induced systemic resistance in plants, helping them fight off diseases that can rob yield.

Trials conducted from 2006 to 2009 have shown that a single application of Ballad Plus provides an increased yield over untreated acres in greater than 70% of the trials. Further improvements in yield are observed when Ballad Plus is used as a tank mix with strobiliurins, providing an increased yield in 90% of trials. University research with Ballad Plus has also shown promise for control of Asian Soybean Rust. While Ballad Plus was shown to have statistically significant suppression of ASR, it also demonstrated improved efficacy in a tank mix with strobilurins compared to strobilurins alone. In addition, Ballad Plus has demonstrated efficacy on other key diseases such as Frog Eye leaf spot, *Cercospora sojina* and Brown leaf spot, *Septoria glycines*.
In both single applications and tank mixes, Ballad Plus has been shown to provide growers with excellent opportunities for return on investment. With an average 2 bushel increase over untreated acres, Ballad Plus alone can provide 5 to 15 fold return on investment. In tank mixes with strobilurins, the additional yield increase can provide 2 to 12 fold return on investment with the added benefit of resistance management combining protectant and systemic modes of action.
Ballad Plus efficacy, biological nature, spectrum of activity, compatibility and mode of action make it an ideal tank-mix or rotational partner in a disease management program. Ballad Plus has a caution label, with a 4-hour REI and a 0-day PHI. Ballad Plus is safe to beneficial insects and mites, thus fitting well into biologically-based pest management programs.

Management of Soybean Nematodes Through the use of Resistance and Nematicides in Arkansas

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Root-knot nematode is one of the most economically important nematodes in Soybeans in Arkansas. In fields with severe infestations, yield loss up to 50% has been observed. Recent shifts in acreage from cotton to soybeans, little available resistance and limited available nematicides, producers are struggling to manage the impact of this nematode. Field studies were conducted in 2009 to: 1) determine the efficacy of using currently-labeled nematicides for nematode management in soybean, 2) evaluate nematicides labeled in other crops that might have potenetial in soybeans, and 3.) evalaute additive benefit of resistance without and in combination with nematicides.

Field trials were conducted using Armor 55A5 (resistant) and Armor 53Z5 (susceptible) soybean varieties near Black Oak, Arkansas. Treatments consisted of Telone (3 gal/A), Avicta seed treatment (2.78 fl oz/cwt), Aeris seed treatment (3.2 fl oz/cwt), Temik (5 lb/A), Temik (5 lb/A) followed by Temik (5 lb/A) at V3, Vydate C-LV foliar (1 qt/A) at V3, Vydate C-LV in-furrow (1 qt/A), Vydate seed treatment (1.6 fl oz/A) and an untreated check. The trial was planted in a RCB design with four replications of each treatment. Plant stands counts were taken 16 days after planting (DAP) on both resistant and susceptible varieties. Root knot nematode soil samples were taken at 16 DAP and 176 DAP. Root gall ratings were visually accessed using a 0-10 scale where 0 = no galls and 10 = 100% of root system galled (128 DAP). Plots were harvested 20 Oct 09.

The excessive rainfall throughout the growing season negatively impacted root-knot nematode counts; however, significant root galling was observed 2 Sept 09 on the susceptible variety. Telone (3 gal/A), Vydate C-LV in-furrow (1 qt/A), and Vydate C-LV foliar (1 qt/A) were the only treatments that significantly lowered root gall ratings (128 DAP) on Armor 53Z5. Yield differences were not significant for any treatment on the resistant variety Armor 55A5. Telone (3 gal/A), Vydate C-LV in-furrow (1 qt/A), Vydate C-LV foliar (1 qt/A), and Vydate C-LV seed treatment (1.6 fl oz/A) provided a significant yield increase when compared to the untreated check on Armor 53Z5. In general, yield differences were the greatest on the Armor 53Z5 due its susceptibility to root knot nematodes and response to nematicides.

Asian Soybean Rust in Louisiana: Evidence of a Dynamic Pathogen

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Asian soybean rust was discovered in Louisiana in November, 2004. With this discovery the common assumption was that the pathogen, *Phakopsora pachyrhizi,* would develop much the same as it had in other areas of the world where it had been devastating to the local soybean crop. Observations of its development and spread in Louisiana and much of the Gulf of Mexico coastal states, have revealed that the pathogen has been slow to develop. The revised assumption is that re-establishment is required each year due to freezing temperatures destroying known warm-season hosts in the state.

Observations on kudzu (*Pueraria* spp.) during over-wintering periods along coastal Louisiana revealed evidence of survival of *P. pachyrhizi* under environmental conditions previously thought to destroy both the host and pathogen. Although kudzu is very susceptible to freezing temperatures, some plants will survive in protected areas such as, under mats of dead kudzu, next to overhangs or warmed walls of buildings, under road or rail overpasses, behind shrubs or inside abandoned buildings. If infected hosts survive, the pathogen will survive also.

Annual initial observations of infected kudzu were recorded earlier since the initial observation in November, 2004. In 2005, the initial observation regardless of host was in October, in 2006 it was June, May in 2007 and January in 2008 and 2009.
With the mild winters of 2008 and 2009, *P. pachyrhizi* was able to survive the occasional sub-freezing temperatures on kudzu that lead to early, rapid increases of inoculum. A prolonged spring drought followed the initial buildup delaying the epidemic to early June when it was first observed on soybeans.

Overall trends have moved toward survival of inoculum on protected hosts. Not only survival has occurred but new uredinia have formed during winter months producing viable spores at a level of 10% germination.

ALABAMA DISEASE SURVEY

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A statewide soybean disease survey was conducted in 2009. Observations were taken from 40 fields on incidence and severity of various foliar diseases, plant viruses, and plant-parasitic nematodes. Results showed that Cercospora blight was the most common disease observed; found in over 77% of the fields surveyed. Downy mildew, target spot and soybean rust were also observed in about 40% of the fields studied. Disease severity for Cercospora blight ranged from moderate-to-severe in 45% of the fields where it was detected. Disease severity for downy mildew, target spot and soybean rust was in the low-to-trace range in the majority of fields where these diseases were observed.

Stem canker was observed in 22.5% of the fields surveyed with incidence usually between 5-10%. Incidence estimated at 35% was observed in two fields in Escambia County in Southwest, Alabama. Based on our observations it appeared that the disease would cause significant yield loss in these two fields.

Bean pod mottle virus (BPMV) was detected in 65% of the fields surveyed with incidence ranging from 2-54% in affected fields. *Soybean Mosaic Virus* (SMV) was found in 48% of the fields surveyed and incidence ranged from 2-88% in affected fields. *Tomato spotted wilt virus* (TSWV) was detected in five of the 40 fields surveyed and incidence reached 11% in one field. Reniform nematodes were found in 30% of the fields surveyed in 2009. Root lesion nematode (20% of fields), root-knot nematode (15%) and soybean cyst nematode (7.5%) were also detected. Three races of soybean cyst were identified among populations collected from various fields in the 2008 disease survey. These were identified as soybean cyst races 2, 5 and 14. Results from the two-year survey show that soybeans are exposed to multiple pathogens. Incidence and severity of these diseases vary by year depending on prevailing weather conditions. The high incidence of Cercopsora blight and the potential damage from soybean rust strongly suggest that a fungicide application would be economical for foliar disease control in most years. The appearance of stem canker in 2009 exhibits the benefit of using stem canker-resistant varieties and following a crop rotation program. BPMV, SMV and TSWV are all insect-transmitted virus and the relatively high incidence of BPMV and SMV suggest that researchers should take a closer look at their impact on soybean production in Alabama. The same is true for reniform nematodes which were found in approximately 30% of the fields surveyed in both 2008 and 2009.

Black Root Rot of Soybean: An Emerging Problem in Arkansas, Louisiana and Mississippi

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Soybean acreage has increased steadily over the last few years in Arkansas, Louisiana, Mississippi and surrounding states. Cotton acreage has decreased to an all time low and highly productive land which has historically been considered "cotton ground" is now planted to soybeans. Extension plant pathologists have been observing an increase in the occurrence of soybean plants on this acreage exhibiting foliar symptoms very similar as those observed on plants infected with the stem canker pathogen. However, no cankers have been observed on the stems of symptomatic plants. Unlike stem canker or sudden death syndrome, a dry decay of the crown, the lateral root system and tap root allow easy removal of reproductive growth stage plants from the soil. Most of the work on the older, symptomatic plants has been confirmed to field observations on its etiology and attempting to conduct Koch's postulates on the causal agent. Koch's postulates have been completed with the soil inhabitant *Thielaviopsis basicola* confirmed as the pathogen in question. The fungus *T. basicola*, causal agent of Thielaviopsis Root Rot also called Black Root Rot, causes disease on a wide host range of plants, including cotton, soybean, and most legumes. Leaf symptoms of black root rot on older plants begin as interveinal chlorosis followed by necrosis progressing up the entire plant, not just on leaves that are primarily attached on only one side of the main stem as with stem canker. The primary, secondary, and tertiary leaf veins remain green as chlorosis develops uniformly over the trifoliate. The foliar symptoms differ from stem canker in that the colors do not appear dull and the plants do not exhibit symptoms more pronounced on one side of a leaflet and more pronounced on one leaflet of the same trifoliate. The main veins remain green following interveinal tissue death and the leaves eventually wilt and most remain attached to the plant.

The scope of this problem in production fields in unknown at this time. Observations have been documented on numerous cultivars and in numerous fields throughout the soybean production areas of Arkansas, Louisiana, and Mississippi. The observations of black root rot on soybean are most common in production fields with a recent history of cotton production; however, this is not so in every case.

Soybean Resistance to SCN in North Carolina, a Continuing Story

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The soybean cyst nematode (SCN) for example infests at least 60% of the soybean acreage in North Carolina and accounts for yield losses in this state of 4 to 8% on an annual basis. Losses in soybean production to SCN in North Carolina in 2009 were estimated to be worth over 30 million dollars at $10.00 US per bushel. Surveys of populations of SCN in North Carolina by this investigator and co-workers has shown that the majority of SCN populations in North Carolina can be classified as races 2 and 4 which cannot be managed with most current resistant cultivars. Private and public soybean breeders have supplied promising lines for testing in cyst nematode infested fields and these have been evaluated in field plots. Experiments were conducted from 2006 through 2009 with soybean lines and varieties in fields infested with the soybean cyst nematode, *Heterodera glycines*. Plots were twenty five feet long with four rows and 5 foot alleys. In most instances there are six replications. Cysts were counted from three plants per plot 28 days after planting (cyst 28 DAP) and egg counts per 500 cm3 soil at harvest (PF). Soybean cultivars with resistance to races 1 and 3 or 3,9 and 14 generally had high rates of reproduction indicating that resistance from PI 88788 or Peking is no longer valuable in much of North Carolina. Cultivars with resistance derived from Hartwig generally yielded much better than susceptible cultivars or cultivars with defeated resistance genes. Cultivars Fowler, Jake, NC7003CN and Pioneer 95M60 generally yielded more than other cultivars. A number of cultivars from the USDA program and other states show promise as tools to manage this nematode. More cultivars with resistance to *H. glycines* are needed in modern crop production systems.

Research Update on Screening Germplasm and Breeding for Resistance to Phomopsis Seed Decay in Soybean

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Soybean Phomopsis seed decay (PSD), caused by *Phomopsis longicolla,* is the major cause of poor seed quality in the United States, especially in the mid-southern USA. To identify soybean lines resistant to PSD, field screening of 135 selected soybean germplasm lines representing 28 worldwide origins and MG3-5 maturities along with PSD resistant and susceptible checks were performed in Arkansas, Missouri, and Mississippi. Prior to the field screening, thirty seeds of each line were assayed for incidence of *P. longicolla* and germination rate. Each entry was grown in a single 3-m row plot in a randomized complete block design with four replications. Seeds from each plot were collected when the plants were mature. A total of 200 seeds of each line were assayed for the incidence of *P. longicolla* and 400 seeds for germination tests in each location.

Preliminary results showed that incidence of *P. longicolla* was significantly different ($P \leq 0.05$) among soybean lines. Several lines were identified that had low disease incidence, good visual quality, and high germination rate. These lines will be confirmed for resistance in 2010 field trials. In addition, several advanced lines with PSD resistance derived from PI 80837 and PI 360841 were developed. These early-maturing lines with PSD resistance will be evaluated for adaptation and yield in 2010. Moreover, four F2 plant populations were derived from three different PSD resistance sources in attempts to pyramid different genes for PSD resistance from PI 91113, PI 360841, and PI 417479.

Soybean Vein Necrosis Virus: A New Widespread Virus in the Southeast and Midwest

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A new virus was discovered in association with a new disease affecting soybean in the Southeast and Midwest. Symptoms start as chlorotic lesions along the main veins and become necrotic as the season progresses. The disease is widespread in almost all fields surveyed but the intensity of symptoms is not consistent, ranging from chlorotic spots in few leaves to leaf death on a large percentage of the canopy. The new virus, provisionally named Soybean vein necrosis virus (SVNV), is predicted to be transmitted by thrips in a persistent manner given that it belongs to the genus *Tospovirus*.

The genome of SVNV is composed of three negative strand ssRNA molecules of 9, 5 and 2.6 Kb. The ends of the genomic RNAs are complementary and they, presumably, play an important role in RNA circularization during replication. There are five open reading frames identified and they code for the RNA-dependent RNA polymerase, movement protein, glycoproteins, RNA silencing suppressor and nucleoprotein. The nucleoprotein gene was used to determine the genetic diversity of the virus and determine whether the observed symptomatology is cultivar or virus isolate dependent. Fourteen isolates from Arkansas, Illinois, Tennessee and Kentucky were sequenced and pairwise comparisons revealed minimal diversity with nucleotide sequence identities ranging from 98 to 100%. Isolates from different states did not show higher levels of diversity than those within a field, indicating that symptom intensity is probably cultivar dependent. We are currently working on the identification of SVNV vectors and the effect of mixed infection between SVNV and major soybean viruses.

Black Root Rot a New Soybean Disease to Arkansas

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Black Root Rot was initially found in Arkansas on soybeans in 2008. This was the first documented observation on soybean in the southern part of the United States, since it has only been observed as a problem in the northern United States due to cooler weather patterns. The fields confirmed with black root rot on soybean were in Phillips, Desha, and Drew in 2008 and then in 7 other counties (Ashley, Chicot, Jefferson, Lee, Lincoln, Monroe, and Poinsett) in 2009. This disease is caused by the fungal pathogen *Thielaviopsis basicola*. This disease find in Arkansas tends to be linked to fields with a history of monoculture cotton in the delta, which over the past few years have been shifted to soybean production fields. This disease attacks the root of the plant through the fungus colonizing the cortical tissue of seedlings, causing a dark brown or black discoloration of the root and hypocotyl, which results in stunted, slow-developing plants. In server cases, the disease can cause the seedling to die prematurely. The only identification for this disease is under microscope or plated on a carrot based selective media.

Disease Screenings for this disease were very under a control environment to support field observations. The first initial screening was completed in the fall of 2008. Soil was gathered from the initial location in Phillips County, AR for the test. The soil was sterilized to eliminate undesired pathogens. A portion of the soil was artificially inoculated with *T. basicola* at 200 cfu per g of soil. Fifty soybean seeds were then planted in sterilized soil and fifty soybean seeds were planted in the inoculated soil. The growing conditions for the soybeans were 10 hour days at 70^{o} F for 29 consecutive days. On the 30^{th} day, the roots were cut from the plant and washed for 20 minutes under running water. They were then surface sterilized in 10% bleach solution for 1 minute and 30 seconds. The roots were plated on a carrot based selective media. T. basicola colonies were discovered after two weeks incubation at 70^{o}F in a dark location. Chlamydospores (25-65 X 10-12 μm) and endospores (8-30 μm X 3-5 μm) were observed under a compound microscope.

The result of this screenings showed *T. basicola* can cause significant damage to soybeans where 71% of the plants emerged in the sterilized soil compared to 38 % of the inoculated plants. Of the 38% that germinated and emerged in the inoculated soil, 79% were symptomatic and infected with black root rot.