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Proceedings of the 18th Annual Meeting, Southern Soybean Disease Workers (March 20-21, 1991, Lexington, Kentucky): National Perspective on Soybeans

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PROCEEDINGS OF THE

SOUTHERN SOYBEAN DISEASE WORKERS

EIGHTEENTH ANNUAL MEETING

MARCH 20-21, 1991

LEXINGTON, KENTUCKY

"NATIONAL PERSPECTIVE ON SOYBEANS"

Tuesday

March 19

* Soybean Cyst Nematode Symposium
* Social

Wednesday

March 20

* General Session
* Graduate Student Competition
* Awards Banquet

Thursday

March 21

* NCR-137 Committee Meeting
* Contributed Paper Session

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Associate Professor, Louisiana Agricultural Experiment Station
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BUSINESS SESSION

PRESIDENTIAL ADDRESS

Donald E. Hershman
University of Kentucky

For the past five years, the addresses given to you by your Presidents have underscored the numerous accomplishments of the SSDW since its inception in 1973. However, each President also discussed that the time is ripe for the SSDW to consider some significant changes. More recent addresses indicated that change is not just desirable, but may, in fact, be necessary in order for the organization to survive.

The big question has been, and continues to be, the definition of change as it relates to our very survival. In 1988, past President Gerard T. Berggren, Jr. (then Chairman of the ad hoc committee on SSDW reorganization) suggested that perhaps the SSDW has fulfilled its mission and no longer needs to exist. These comments, I believe, were precipitated by greatly reduced attendance at our Annual Meetings. Poor attendance was the result of restricted travel budgets, a fantastic reduction on participation by industry and, quite frankly, lack of interest and enthusiasm by many SSDW members.

While the dismantling of the SSDW was never seriously considered, it did prompt the leadership of the organization to discuss ways to reverse the negative trends. Discussion ranged from the incorporation of an additional crop (e.g. wheat or rice) into the SSDW, the inclusion of other pest-related disciplines relative to soybean production (e.g. entomology), involvement with soybean pathologists outside the southern region, and the promotion and establishment of a regional or national soybean conference, with the SSDW being a part of a larger organization. Of these four directions, the latter two seemed to hold the most promise.

At last year's Annual Meeting, I reported, as Chairman of the ad hoc committee on SSDW reorganization, that the current administrative, scientific and political climate was not ready to support a national or regional conference for soybeans. While this is the current state of things, it is my personal view that an interdisciplinary soybean conference of regional or national scope will eventually generate significant support. This will occur when interdisciplinary and multi-regional research and Extension activities become more common place, and when funds for discipline-specific travel within a crop become even more restrictive.

Having tested the waters and being rebuffed for a regional or national conference, this meeting is the first serious attempt by the SSDW to develop a better working relationship with soybean pathologists outside the southern region. In retrospect, perhaps this approach is the most logical. Consolidation of some sort of working relationship between soybean pathologists would, I suspect, be necessary for us to ultimately be active participants in a national conference.

The success of this meeting will determine the nature and extent of the future relationship between northern and southern soybean disease workers. This relationship will then be either solidified or weakened during next year's meeting with the soybean breeders in St. Louis. Thus, the next two years are extremely important to the life of the SSDW as an organization.

Arguments could be made for and against meshing the SSDW into a more encompassing soybean disease workers group, or retaining the SSDW as is, but meeting with northern pathologists on a regular basis. I also feel confident that some SSDW members will express desire to maintain the status quo. Certainly the membership of the SSDW and attendance at its meetings have stabilized somewhat during the last two years. This has helped to allay fears in many that the organization is destined to self-destruct. However, I believe that we must not and cannot turn back from the present course.

All indications are that resources at all levels will become more restrictive with time. Specifically, travel funds will diminish and funds made available for various research and Extension projects will become more national and/or interdisciplinary in scope. Funding sources such as USDA competitive grants and a national soybean checkoff program will set the stage for future change within each of our respective disciplines. It is my sincere hope and desire that the SSDW membership will continue to be a leader in future developments, and not just a follower. I believe that time will prove this to be the case.

I appreciate the opportunity to have served as your President. As I pass the torch to Dr. J. Allen Wrather, Jr., your next President, I feel it is significant that he resides in one of the few member states of the SSDW that is arguably both north and south. Please give Dr. Wrather your full support in moving the SSDW forward to even greater achievements that those which have distinguished this group since its beginning.

DEVELOPMENTS IN SUSTAINABLE AGRICULTURE

Paul F. O'Connell, Deputy Administrator, USDA-CSRS.

There is a broad recognition that modern agriculture has done a tremendous job of providing high quality and reasonably priced food and fiber for the consumer. However, there are increasing concerns about the long-term sustainability of this system. These concerns include growing resistance to pesticides by insects, weeds, diseases and other pests, loss of genetic diversity, contamination, of groundwater, persistent soil erosion, depletion of irrigation water supplies, aggravated salinity and the loss of fish and wildlife habitat. Research and eduction programs in sustainable agriculture focus on an integrated approach to the science and art of farm management, searching for alternative farming practices that are profitable and correct or alleviate the above mentioned concerns.

Presentation will cover principles of sustainable agriculture, research priorities, and potential benefits.

SOYBEAN DISEASES IN THE MIDWEST

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Many of the 35 soybean pathogens recognized as important economically in the Soybean Disease Compendium (Sinclair and Backman, 1989) occur in the northern states, however, only about 15 pathogens (Table 1) regularly cause soybean diseases that are readily recognized. Disease symptoms, yield losses and management of the major diseases of the Midwest will be discussed.

Table 1. Diseases and causal orgamisms common to Midwest Soybean Production.

Disease	Causal Organism(s)
Foliage	
Brown Spot*	Septoria glycinea Hemmi
Downy Mildew	Peronospora manschurica (Naum.) Syd. ex Gaum.
Cercospora Blight*	Cercospora kikuchii (T.Matsu. & Tomoyasu) Gardner
Bacterial Blight	Pseudomonas syringae pv. glycinea (Coerper) Young
Bud Blight	Tobacco Ringspot Virus
Soybean Mosaic	Soybean Mosiac Virus
Root and Lower Stem	
Phytophthora Rot*	Phytophthora megasperma Drechs. f.sp. glycinea Kuan & Erwin
Rhizoctonia Root Rot	Rhizoctonia solani Kuhn
Brown Stem Rot*	Phialophora gregata (Allington. & Chamerlain) W. Gams
Charcoal Rot	Macrophomina phaseolina (Tassi) Goid.
Sudden Death Syndrome*	Fusarium solani (App. & Wollenw.) Synd. & Hans.
Stem Canker	Diaporthe phaseolorum (Cke. & Ell.) Sacc. var. caulivora Athow&Caldwell
Pod & Stem Blight and Seed Decay*	Diaporthe/Phomopsis spp.
Purple Seed Stain	Cercospora kikuchii
Soybean Cyst Nematode*	Heterodera glycines Ichinohei

*=Diseases with high incidence or of major concern in specific areas.

SOYBEAN DISEASES OF SIGNIFICANCE TO THE SOUTHERN UNITED STATES AND THEIR MANAGEMENT

William F. Moore, Extension Plant Pathologist, Mississippi State University.

Soybean diseases are a limiting factor to soybean production potential in the southern United States, particularly in years when conditions favor their development. The most widespread and commonly occurring diseases are charcoal rot, pod stem blight, anthracnose, cercospora leaf blight, frogeye leaf spot, septoria brown spot, stem canker, and the soybean cyst nematode. Other disease, such as sudden death syndrome, seedling disease, southern stem blight, root-knot nematodes and virus diseases occur in some locations and some states annually, but are generally not as devastating to yield over a widespread multi-state area.

Disease complexes in individual soybean fields are not uncommon. In some Southern States, such as south Alabama, soybean fields have a complex of root-knot and cyst nematodes. Cercospora leaf blight, frogeye leaf spot, and pod stem blight occur in the same soybean fields over a multi-state area and frequently cause severe reductions in yields in years when conditions favor their development.

The soybean cyst nematode now infests much of the acreage planted to soybeans in the southern United States. During the 1970's the soybean cyst nematode resulted in major losses in production, particularly in the Mississippi Delta States. During the 1960's the major race of the soybean cyst nematode of concern to producers was Race 3. The introduction of the Race 3 resistant variety Pickett was thought to have been the answer to the prevention of yield losses from SCN, but within several years of this introduction and widespread planting in Race 3 infested soils other races of the SCN began to emerge and cause yield losses. It was not until the introduction of resistance to other races and the use of rotation that the losses from the SCN began to decline in the southern United States. Additionally, fungal parasites of the SCN also have assisted in preventing increases in SCN populations in many soybean fields.

The lower stem and root rots have contributed the greater percentage losses from diseases in the southern United States. The disease of greatest concern in this group is charcoal rot. During years when drought stress is a factor in production, charcoal rot, a disease for which there is no resistance, results in heavy losses in yield. Yet, it is a disease which receives little research attention.

In years when environmental conditions favor their development, pod and stem blight, anthracnose, cercospora leaf blight, frogeye leaf spot and, in more northern areas of the southern U.S., brown spot, become limiting factors in production. There is no resistance to pod and stem blight and anthracnose. The practice suggested for reducing losses from these late-season diseases is the use of foliar applied fungicides. Most states have released point systems to aid producers in determining if the use of foliar applied fungicides is economical.

The most potentially devastating disease to susceptible varieties in years favoring its development is stem canker. There are currently 30 varieties available in Maturity Groups V through VIIII with a high level of stem canker resistance.

Sudden death syndrome, first described in Arkansas, occurs in most Southern States under conditions favoring its development. Several states are involved in research to determine what factors favor the development of SDS, the relationship between the soybean cyst nematode and the fungus which incites SDS, and which varieties resist SDS.

DISEASE RESISTANCE IN THE DEFENSE OF YIELD - A COMMERCIAL BREEDER'S PERSPECTIVE

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The author proposes to address the subject of commercial plant breeding as a pragmatic approach to the ancient art, and how this translates into every day practice. Yield testing in productive environments, which also manifest pressures from various diseases and pests, will be described as the commercial breeders' means of achieving multiple breeding objectives while remaining focused on the main issue which is the yield productivity. Major consideration will be given to this yield response under disease pressure in relation to the important "disease tolerance" concept. The interaction between the plant breeder and the plant pathologist is an important one, but the relationship is often marred due to the lack of communication in the setting of combined objectives. In this context, it will be stressed that the all important issue of assigning disease ratings to varieties should be done wherever possible in relation to the final yield, in order to avoid over estimates of disease susceptibility ratings. The case for the establishment of standardized disease rating scales will be reemphasized, and furthermore that they be made simple enough to be used by plant breeders and their technicians, many of whom are not graduates, as well as by plant pathologists, fungicide people and the farmer; the final end-user of this information base who is often completely confused by the complexity of it all. Finally, it will be suggested that we try to establish standard sets of uniform check varieties to act as differentials for the more important diseases encountered and also some of the more frequently occurring races and biotypes.

THE EFFECTS OF POTASSIUM FERTILIZATION AND WEED CONTROL ON THE SEVERITY OF ANTHRACNOSE AND POD AND STEM BLIGHT OF SOYBEAN IN LOUISIANA

F.G. Barker, G.T. Berggren, and J.P. Snow, Department of Plant Pathology and Crop Physiology, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, LA 70803.

Yield and disease parameters were determined for the cultivar 'Davis', planted on 76 cm rows, in field experiments conducted from 1987 through 1990. Three rates of potassium (K) (0,50.5, and 101.0 kg/ha) were applied as KCl to a K deficient soil (27-30 mg/kg). Two weed control schemes, season-long weed control and unrestricted weed growth, were subplots. Brachiaria platyphylla, Ipomoea hederacea, and Melochia corchorifolia were predominant weeds. Oat seed infested with Diaporthe phaseolorum var. sojae (Dps) was applied to the test area, whereas Colletotrichum dematium var. truncatum occurred naturally. Extractable soil potassium was significantly increased with increasing rates of fertilizer K. Yield and disease rating were significantly improved over the check with 50.5 kg/ha K, regardless of weed control treatment. Potassium at 101 kg/ha reduced yield in the "no weed" subplots but significantly improved seed quality in both. In 1990, the field experiment was reproduced in the greenhouse with soil collected from the centers of each field plot. A supplemental application of K at 50.5 kg/ha was substituted for the weed control/no weed control subplots. Three plants/pot were inoculated with a spore/mycelial solution of Dps ($9X10^5$ spores/ml) at R3-R4. Disease rating was significantly lowered by 101 kg/ha K. The 50.5 kg/ha rate alone or supplemented with additional K, significantly increased total number of weight of seed and significantly reduced percent blank pods and percent damaged seed. Highest rates of K either did not improve or adversely affected yield and other disease parameters.

INHERITANCE OF SOYBEAN SDS RESPONSE IN SEGREGATING F_5 DERIVED LINES

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Soybean (Glycine max (L.) Merr.) cultivar response to Sudden Death Syndrome (SDS) varies widely, though to date no immune genotypes have been found. Soybean cyst nematode (SCN, Heterodera glycines Ichinohe) resistant lines are generally less susceptible to SDS than SCN susceptible lines. The objective of this study was to determine the relationship of SCN resistance to SDS response in random segregating lines from two different crosses. One hundred F_5 derived lines from 'Essex' (SCN and SDS susc.) x 'Forrest' (SCN race 3 res., mod. res. to SDS) and 89 F_6 derived lines from 'Pyramid' (SCN race 3 & 4 res. and mod. res. to SDS) x 'Douglas' (SCN and SDS susc.) were evaluated in two replications in a field infested with SCN races 3 & 4 and SDS. Disease incidence (DI), disease severity (DS), and reproductive growth stages (R) were scored weekly and DI and DS interpolated to an R6 standardized score. In the cross of Essex x Forrest, the parents differed by 61 in DI (81 vs. 20%), while a 32 percentage point difference in DI was associated with SCN race 3 resistance among the derived lines (60 vs. 28%). Therefore, 53% of the difference in DI between the parents was accounted for by SCN race 3 resistance. Also, 48% of the difference in DS was associated with SCN resistance. Similarly, in the cross of Pyramid x Douglas, SCN race 3 resistance accounted for 55% of the difference in both DI and DS.

SELECTION OF SOYBEAN GENOTYPES WITH SUPERIOR FIELD WEATHERING QUALITIES

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Loss of seed quality due to field weathering is often a problem in much of the southern soybean growing region of the United States. Losses are greatest in years when excessive or prolonged rainfall prohibits prompt harvest of the soybean crop. To select for resistance to field weathering both an artificial weathering procedure and natural field weathering were used to compare eight commercial varieties and 16 plant introductions. Pods picked at R8 and at harvest maturity were weathered at 30C and 95-100 percent relative humidity in a laboratory seed germinator in the artificial weathering procedure. Field weathered pods were picked at R8 and at weekly intervals for the subsequent six weeks. All seeds were tested for germination following weathering treatments. Incidence of <u>Phomopsis</u> infection and hardseededness were also determined. Several plant introductions were found to be superior to the commercial varieties tested in resistance to weathering, as determined by both artificial and natural weathering procedures. Susceptibility to <u>Phomopsis</u> infection and degree of hardseededness were found to influence weathering resistance.

SOUTHERN STEM CANKER EPIDEMICS: THE INFECTION WINDOW AND THE RELATIONSHIP BETWEEN INOCULATION TIMING AND YIELD OF SOYBEAN

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Experiments were conducted during the 1989 and 1990 growing seasons. The objective of the first experiment was to monitor spore release by Diaporthe phaseolorum (Cke & Ell.) var. caulivora Athow and Caldwell (Dpc) in a soybean field with a history of stem canker. Spore releases were monitored weekly using sets of bait plants (soybean planted in plastic pots). A set (25 to 50 plants) was placed in the field for seven days, after which it was retrieved and replaced with a new set. When lesions were evident on the stems of the plant sets, each set was rated for stem canker incidence. Rainfall data and temperature were also recorded. Stem canker incidence was highest in the set exposed during the seventh and fourth weeks of the 1989 and 1990 growing seasons, respectively. Stem canker incidence and rainfall were positively correlated (P=0.28). The objective of the second experiment was to initiate stem canker epidemics at various times during the growing season and determine the effect on soybean yield. Bedford and Wilstar 550 were planted in four row plots arranged in a randomized complete block design. The two center rows were inoculated once using Dpc infested oats at a predetermined growth stage (planting to R3). Disease severity, both foliar and stem ratings, was recorded several times during the experiment. Severity was highest (97%) and yield was reduced most (91%) in plots inoculated between the Vc and V7 growth stages. Yields and severity were negatively correlated (P=0.0007).

COMPARISON OF SOUTHERN AND NORTHERN ISOLATES OF DIAPORTHE PHASEOLORUM VAR. CAULIVORA, THE SOYBEAN STEM CANKER PATHOGEN

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Fourteen isolates of Diaporthe phaseolorum var. caulivora representing six southern states (LA, GA, FL, MS, TN, and AK) and two northern states (OH and IO) were compared for colony morphology, style of perithecia formation, response to different temperatures, phenol peroxidase activity, and virulence to the soybean cultivar 'Bedford'. All northern isolates produced white colonies with dense tufts of mycelia, whereas southern isolates exhibited uniform white, dark brown or light brown mycelia. Observation of perithecia with light and scanning electron microscopes showed singly-borne and caespitose perithecia formed by southern (except FL40) and northern isolates, respectively. Northern isolates were distinguishable from southern isolates by morphological and cultural characteristics. Northern isolates showed strong phenol oxidase activity compared to southern isolates. Northern isolates were highly virulent to 'Bedford', but southern isolates exhibited diverse virulence. Growth of all isolates tested was significantly inhibited at 30 C. To compare genetic diversity between two populations, phenol-soluble polypeptides from selected isolates were analyzed by 2-dimensional electrophoresis. The genetic relationship in addition to the variation in morphological and physiological characteristics between two populations of the soybean stem canker pathogen will be discussed.

SOYBEAN SUDDEN DEATH SYNDROME CULTIVAR RESPONSE

P.T. Gibson, M.L. Shenaut, V.N. Njiti, W. Matthews, M. Schmidt, and O. Myers, Plant and Soil Science, Southern Illinois University, Carbondale, IL 62901.

Several hundred soybean (Glycine max (L.) Merr.) cultivars, experimental lines, and ancestral parents have been field tested with natural infestation between 1987 and 1990 against soybean sudden death syndrome (SDS, primary causal agent--Fusarium solani). Test fields were selected based on prior observation of severe and uniform SDS pressure. Entries ranged from maturity groups 1 to 7, grouped by maturity so that all entries in a trial matured within 10-15 days. Disease incidence (DI, 0 to 100%, plants with visible leaf symptoms) and disease severity (DS, 1=mild chlorosis, 5=severe necrosis, 9=plant death) were rated weekly from when sufficient symptoms were present until senescence. Developmental stage (R-stage) was recorded to 0.1 stage at each scoring, and DI and DS were linearly interpolated to R6 (full pod stage). All entries tested showed some leaf symptoms. Every maturity (MG) contained extremely susceptible genotypes as well as ones with minimal symptoms. The vast majority of genotypes with the least severe SDS symptoms were also resistant to one or more races of soybean cyst nematode (SCN, Heterodera glycines), although several exceptions occurred. 'Ripley', which is SCN susceptible, was among the least susceptible to SDS. Conversely, 'Asgrow 5403', resistant to SCN races 3 & 14, was extremely SDS susceptible, as were the original sources of SCN resistance; 'Peking', PI 88.788, PI 90.763, and PI 437.654. Most genotypes performed consistently across years, although some seemed quite environmentally sensitive, including 'Essex' and 'Centennial'. As an example of the range of responses, the late MG4 cultivar 'CM 497' had an average DI of 91% with a DS of 4.2 while 'TN 4-86' had a DI of 3% and DS of 1.8. Several pedigree associations have been observed, with most derivatives of 'Forrest' and 'Bedford' showing little disease, and derivatives of 'Mitchell' being very susceptible. The responses of Centennial derivatives are environmentally dependent, responding in each test similarly to Centennial itself. In conclusion, field testing for soybean cultivar response to SDS was effective, but multiple environments must be used to ensure representative results.

CHITINOLYTIC FUNGI ASSOCIATED WITH *HETERODERA GLYCINES* IN MISSOURI

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Heterodera glycines, soybean cyst nematode (SCN), is a major pest of soybean in Missouri. Present economical control measures include crop rotation and resistant varieties. Sedentary endoparasitic nematodes such as SCN are thought to be ideal targets for biological control because the eggs are concentrated within or near the female. The major structural component of nematode egg shells is chitin, thus chitinolytic fungi may have potential as biological control agents.

Plots in 3 Missouri soybean fields (located near Baring, Mexico, and Portageville) were sampled. Two locations had 2 soybean varieties with and without aldicarb and 1 location had 1 variety with 4 insecticides/nematicides and 4 herbicides. Soil samples were taken 3 times during the growing season and SCN eggs extracted and counted. Live eggs were assayed for the presence of chitinolytic fungi (100 eggs per plate of acidified water agar). Fungi which grew from these eggs were transferred to minimal medium containing chitin as the sole carbon source. Plates of chitin medium were examined 14 days later for clear zones surrounding the agar plug, evidence of chitin utilization.

Those fungi utilizing chitin were transferred to chitin medium plates and the fungi allowed to grow for 7 days. SCN eggs (100/ml) were added to each plate containing a single chitin utilizing fungus. The plates were at 3 wk for percentage of eggs colonized by the fungus.

Chitinolytic fungi were recovered from 2 locations in at-planting samples and from all 3 locations at mid-season sampling. Chitin utilizing fungi were recovered more frequently from sites with higher number of SCN eggs per 100 cm^3 soil.

SOURCES OF RESISTANCE TO HETERODERA GLYCINES IN SOYBEAN CULTIVARS

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Since the discovery of soybean cyst nematode (SCN) Heterodera glycines Ichinohe as the pest of soybeans (Winstead et al, 1955), plant breeders have been involved in developing resistant cultivars. Although, a large number of SCN resistant PI lines have been reported (Ross and Brim, 1957; Epps and Hartwig, 1972; Anand and Gallo, 1984; and Anand et al, 1988) it was not known how many of these have been used in resistant variety development. A survey was conducted to determine the sources of SCN resistance in the varieties which are currently being grown or the ones in the final stages of testing which are being considered for release. These results are based on the information supplied by both the public and private breeders and may not necessarily be complete.

The first resistant variety developed and released was Pickett which carried resistance from Peking (Brim and Ross, 1966). After the establishment of physiological races in SCN (Golden et al, 1970), Pickett was recognized to be resistant to Races 1 & 3. Bedford was the first Race 4 (now classified as Race 14) resistant cultivar released in US (Hartwig & Epps, 1978) and since it was developed from a cross involving resistance from Peking, it may carry Race 3 resistance from both Peking and PI 88788 or either of them.

A total of 130 SCN resistant soybean cultivars have been developed. Out of which 57 are by the public institutions and remaining (73) by the private companies. Sixty nine cultivars are resistant to Race 3 only, all of which derived resistance which can be traced back to Peking. Amongst the Race 14 resistant cultivars, 24 derived resistance from only PI 88788 or its derivatives and another 31 had both Peking and PI 88788 in the ancestory. There were only two cultivars resistant to Race 5 derived from PI 90763. One germplasm (S88-2036) which is resistant to all known races of SCN have been developed and released. It derived its resistance from PI 437654 and Forrest (Peking), (Anand, 1991).

Although a large number of SCN resistant PI lines are available, the resistance from only a few have been utilized. In most cases, the agronomically superior derived lines or cultivars have been used in breeding program. It is likely that full gene complement for resistance from PI line may not get transferred to the derived lines (Anand & Shumway, 1984). It is therefore necessary to broaden the genetic base for SCN resistance in our cultivars by using additional resistant PI lines.

J77-339 - A SOYBEAN LINE HIGHLY SUSCEPTIBLE AND HIGHLY RESISTANT TO STEM CANKER

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After stem canker was first identified in Tennessee in 1981, research was begun in 1982 to evaluate soybean cultivars and lines for reaction to the disease. Fifteen cultivars and lines were evaluated in 1982 in an effort to locate disease resistance. 'J77-339', observed in 1981 in other areas to be very susceptible to stem canker, was included as a susceptible standard for comparing the other cultivars and lines. J77-339 was extremely susceptible to stem canker in 1982 with death of all plants and no harvestable seed. In 1983-85, 30, 36, and 15 cultivars and lines, respectively, were compared for reaction to stem canker; J77-339 continued to be very susceptible. During 1982-84, J77-339 seed planted were either breeder seed or were seed in which purity of the line had been maintained. In 1984-89 an area on the University of Tennessee West Tennessee Experiment Station at Jackson was used for increasing seed of the line for future research plantings. The area was planted each year with seed harvested from the area the previous year. Stem canker appeared in the seed-increase plot in 1985, and during 1986-87 disease severity was at a high level. Seed produced were from plants which survived the stem canker. During 1988-89, the incidence and severity of stem canker was observed to be low in the seed-increase area and in plots planted with seed from the increase area. In 1989, 'RA 604', which had been observed earlier to be highly susceptible to stem canker, was rated 3.4 on a scale of 0 to 5 (5 = all plants dead) while J77-339 was rated 0.4. Yields were 22.4 and 34.2 bu./A., respectively, for RA 604 and J77-339. In 1990, J77-339 seed that were genetically pure were obtained from the Delta Branch Experiment Station at Stoneville, MS. Seed from Stoneville and seed produced at Jackson were compared in two trials which included RA 604 and 27 other cultivars and lines. In one experiment, RA 604, J77-339 (Stoneville), and J77-339 (Jackson) were rated 3.2, 4.8, and 0.8, respectively, for stem canker, and yields were 33.1, 10.4, and 36.7 bu/acre. In a second experiment, planted late and greatly damaged by dry weather, RA 604, J77-339 (Stoneville), and J77-339 (Jackson) were rated 3.6, 4.4, and 0.7, respectively; yields were 15.8, 8.8, and 15.9 bu.

It appears that a line highly resistant to stem canker has been naturally selected from the original highly-susceptible line. The selected line like its predecessor has white flowers and tawny pubescence with very poor agronomic characters such as shattering, tall growth and lodging, and low-yield potential.

COMPARISON OF INOCULATION METHODS FOR THE EVALUATION OF SOYBEAN RESISTANCE TO STEM CANKER

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Several methods are currently being used by scientists to determine soybean resistance to stem canker. When stem canker first became a problem in the Southern United States, extension or research personnel evaluated variety trials which were infected by chance with the stem canker organism or they planted a variety trial in an area with a history of high stem canker prevalence. Often the disease did not develop uniformly or was not severe enough to provide reliable ratings. Another method which has been used in inoculating the plants with stem canker infested toothpicks. This can be done by inoculating the plants two to three weeks after planting by inserting an infested toothpick into the stem one to two inches above the soil line. Susceptible lines will either die or become severely infected with the fungus. The disadvantage of this method is that it is very labor intensive, slow, and the degree of resistance to stem canker cannot be measured. A variety responds as either resistant or susceptible. Soybean plants can also be inoculated forty to fifty days after planting by inserting an infested toothpick in the top of the soybean plant. This method is less labor intensive and by measuring lesion length, the degree of resistance of a particular soybean variety can be determined. The disadvantages of this method are that it is labor intensive, the effect of stem canker on soybean yields cannot be determined, and by inoculating late in the season, there may not be enough time for the disease to develop before the early season soybeans mature. We have tried to conduct trials in the greenhouse or growth chamber using toothpicks with mixed results. At certain times of the year these tests have been successful but consistency in results had not been obtained. Soybean varieties can be inoculated in the field with spore or mycelial suspensions. We have had mixed results with mycelial inoculations. Inoculation with spore suspensions have worked but it is difficult to produce spores in sufficient quantities for inoculation. Plots can be inoculated with plant debris collected from stem canker infested fields, but it is hard to store the inoculum over the winter and control of the biotype is lost. Another method employs the use of infested grain sorghum as inoculum. The fungus is grown on sterile white grain sorghum. When the fungus has overgrown the sorghum, it is spread out to dry and stored in paper bags for later use. We have found that placing the seed on the soil surface next to the soybean plant is much more effective than applying the inoculum in-furrow at planting. Plants are normally inoculated when they are two to four inches high at the rate of two grams of inoculum per row ft. Plants are normally inoculated again two weeks after the initial inoculation. Moisture is needed to initiate spore formation and splashing rain is needed to disperse the spores. Sprinkler irrigation is useful, but infection occurs as long as there is a minimal amount of rain after inoculation. The disadvantages of using infested grain sorghum are the difficulties encountered in inoculum production and a less precise measurement of varietal resistance. A significant advantage of this method is that it permits a measurement of the effect of stem canker on yield.

EVALUATION OF CULTIVARS FOR STEM CANKER RESISTANCE IN AN INOCULATED NURSERY

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Twenty soybean cultivars including 17 cultivars for which the reaction to stem canker was not previously known were rated in an inoculated nursery at Baton Rouge. Cultivars entries were replicated four times in two-row plots 6.0 meters in length. Plots either received rain or were irrigated before inoculation. One row of each plot was inoculated at the V3 growth stage and again at the V7 growth stage with 5.5 million ascospores per ml. Total volume applied to the plants was 330 ml per 30 meters of row. Small lesions could be seen on stems of inoculated plants within a week after the second inoculation. Foliar symptoms were apparent within six weeks. Yield of cultivars with high stem canker ratings were reduced compared to noninoculated controls. In most cases yields of cultivars with low stem canker ratings were unaffected compared with noninoculated controls.

SAPROPHYTIC ABILITY OF THE SOYBEAN STEM CANKER PATHOGEN AND FORMATION OF PERITHECIA ON HOST AND NON-HOST PLANTS

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The saprophytic ability of Diaporthe phaseolorum var. caulivora and formation of perithecia were investigated. Two soybean cultivars (Glycine max, 'Bedford' and 'Bay'); five non-host species, wheat (Triticum aestirum), wild poinsettia (Euphorbia heterophylla), joint vetch (Aeschynomene virginica), cocklebur (Xanthium strumarium), and hemp sesbania (Sesbania exaltata); toothpicks; and capillary glass tubes were tested as substrates. Perithecia developed on all plant materials including toothpicks. There was little difference in the number of perithecia formed among the four isolates (OPE3, MS82-5, FL40, and OH1483) and eight plant material combinations. However, development of perithecia was delayed on wheat and toothpicks compared to other plant materials tested and produced fewer perithecia. Certain strains produced perithecia on the PDA plate itself, but others did not. Plant materials including toothpicks enhanced and/or stimulated perithecia formation. When two isolates (OPE3 and GA563) were paired on a PDA plate, perithecia were observed in the area where the two isolates met. This indicates that fertile isolates of the homothallic soybean stem canker pathogen exist and perithecia formation may be a strain-specific phenomenon.

SOYBEAN YIELD LOSSES DUE TO LEAF BLIGHTS IN INDIANA

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Both _Septoria glycines_ and _Cercospora kikuchii_ are endemic soybean pathogens capable of causing severe leaf blight and yield reduction. In 1989 and 1990, each leaf blight diease was characterized on soybean cultivars Miami, Century 84, Hobbit, and Williams 82. The soybean cultivars differing in growth habit and/or maturity were either inoculated with _S. glycines_ or _C. kikuchii_ at the R2 growth stage, protected with fungicides, or left untreated. Yield reductions in 1989 and 1990 due to each leaf blight in inoculated treatments were similar for all the soybean cvs with the exception of Century 84. Compared to fungicide protected plots, _S. glycines_ inoculaton caused 27, 21, 18, and 10% yield reduction in 1989 and 2, 17, 22, and 7% yield reduction in 1990 on Century 84, Miami, Hobbit, and Williams 82, whereas 19, 22, 27, and 14% reduction in 1989 and 4, 24, 27, and 11% in 1990 were attributed to _C. kikuchii_ inoculation, respectively. Yield reductions were explained mainly by reduction in seed weight either at the bottom or top of the stem canopy depending of the pathogen and on the growth habit of the clutivar. The number of pods and seeds per pod were not affected. Brown spot and Cercospora leaf blight due to natural infections in 1989 did not affect yield in the indeterminate cultivars, but yield was reduced 13% by Cercospora infections in the determinate cv. Hobbit. In 1990, brown spot did not affect yield, but late season leaf blight due to _C. kikuchii_ was more pronounced in the untreated plants and yield reductions occurred in Hobbit (15%), Miami (15%), and Williams 82 (10%). Increases in the lenght of the reproductive period and seed size were associated with the foliar fungicide treatment in these cultivars in 1990, but only with Hobbit in 1989. Incidence of purple seed stain was increased by the _C. kikuchii_ inoculations in all cultivars but was not associated with leaf blight severity among the four cultivars tested. Purple stained seeds occurred primarily in the top section of the stems on Hobbit whereas the most susceptible indeterminate cvs., Century 84 and Miami, had purple stained seeds throughout their stem profile.

Although, severe Cercospora leaf blight has been reported primarily from the southern states, severe blight with yield reductions similar to those caused by _S. glycines_ were observed in these inoculation tests; and, the yield reduction due to _C. kikuchii_ in the determinate and indeterminate cvs. in 1990 without inoculation indicate the destructive disease potential of these pathogens of soybeans in the midwestern states.

INCIDENCE OF SCN IN ONTARIO AND THE EFFECT OF PLANTING DATE ON YIELD LOSS

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Since the discovery of SCN in 1987, it has now been identified in five counties in Ontario. At present, incidence and damage has been restricted to sandy loam or loam soils. A resistant cultivar yielded 64% more than susceptible cultivars at a site with a high number of SCN. Race 3 was identified in five of five sites sampled for races. In 1989, populations of J2 larvae in fallow soil increased after soil temperatures exceeded 15-20C and reached a maximum during mid July. In an experiment to determine the effect of planting date on yield loss caused by SCN, planting on May 10, May 30 and June 30 resulted in yields of a full season cultivar that were 86, 94 and 63% respectively of check plots treated with temik. Yields of a short season cultivar planted on the same dates were 77, 64 and 57% respectively of the check plots. Early planting, while activity of SCN was minimal, permitted a longer vegetative growth stage before primary and secondary infection by SCN occurred. Early planting of full season cultivars may reduce the damage caused by SCN in northern production areas.

INFLUENCE OF 7 ROTATION OPTIONS ON *HETERODERA GLYCINES* EGG DENSITIES AND YIELD OF LINFORD AND WILLIAMS 82 SOYBEAN CULTIVARS

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Replicated field trials were conducted at 2 locations in north Missouri to study the effects of 7 crop rotation options (fallow, susceptible soybean, corn, sorghum, canola, red clover, and oats) on *Heterodera glycines* (HG) eggs densities in 1989 and 1990. A HG resistant (Linford) and HG susceptible (Williams 82) soybean cultivar was planted in 1990 after the preceding year's rotation options and seed yield collected. The change in HG egg densities (Pf/Pi) under each option, measured over the 6 month growing season (May - October), was 0.43 (sorghum), 0.47 (corn), 0.56 (red clover), 0.65 (fallow), 0.85 (oats) and 0.93 (canola). HG egg densities in plots planted to Williams 82 increased 1.33 and 2.41 in 1989 and 1990, respectively, at the Baring location, (1989 Pi=57,489 eggs/250 cm^3; 1990 Pi=28,362 eggs/250 cm^3) and 3.87 and 40.3 fold in 1989 and 1990, respectively, at the Centralia location (1989 Pi=3,702 eggs/250 cm^3; 1990 Pi=780 eggs/250 cm^3). Seed yield of Linford averaged 18% and 62% higher at Centralia and Baring, respectively, compared to Williams 82. Compared to soybean following soybean, yields of both cultivars were significantly higher after corn and sorghum at the Baring location. At the Centralia location, yields of Williams 82 were higher after red clover and canola, whereas, Linford yields were significantly greater following all rotation options except corn and fallow.

Five HG resistant (Lewis 388, NK31-33, Linford, MFA3038, Asgrow 3415) and 2 HG susceptible (Stine 3790, Resnik) soybean cultivars in maturity group 3 were grown in a replicated field site with a nondetectable preplant level of *H. glycines*. Stine 3790 yielded significantly higher than all other cultivars. Yields of the HG resistant cultivars ranged from 4.2 to 8.3 bushels/acre less than Stine 3790. Yields of Resnik were not significantly higher than the HG resistant cultivars except for Asgrow 3415.

SOYBEAN-PEANUT ROTATIONS FOR THE MANAGEMENT OF MELOIDOGYNE ARENARIA

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The value of 'Kirby' soybean (*Glycine max*) for the management of *Meloidogyne arenaria* in 'Florunner' peanut (*Arachis hypogaea*) was studied for six years in a field experiment at the Wiregrass substation, near Headland, Alabama. The experiment was established in a field that had been in peanut with winter fallow for the past 10 years. Plots were eight-row-wide and 10 M long and there were eight replications (plots) representing each treatment in a randomized complete block design. End-of-season juvenile populations of the nematode were generally low (<50/100 cm^3 soil) in plots with soybean and high (>150/100cm^3 soil) in those with monoculture peanut (P). In 1990 juvenile populations in plots with peanut following one (S-P) or two years (S-S-P) of soybean were of the same size as those in P plots; however, peanut yields in S-P and S-S-P plots were respectively 89% and 83%, higher than the yields from P plots. At plant application of aldicarb 15G (3.3 kg a.i./ha in a 20-cm-wide band) to monoculture peanut [P(+)] resulted in an average yield increase of 21% over the six years of the study and in a 31% increase in 1990. Use of the nematicide in peanut in the S-P rotation resulted in an average yield increase of 13.8% throughout the study compared to S-P without nematicide; the corresponding yield increase for 1990 was 14.6% Peanut yields in the S-S-P rotation with aldicarb were higher by 29.5% in 1987 and 26.2% in 1990 than the yields for this rotation without nematicide. Kirby soybean can be used as a rotation crop to increase peanut yields but it has no effect on *M. arenaria* juvenile populations in peanut following soybean.

TROPICAL CORN-SOYBEAN ROTATION IN A FIELD INFESTED WITH ROOT-KNOT AND CYST NEMATODES

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The value of Pioneer 304C tropical corn (Zea mays) as a rotational crop to increase soybean (Glycine max) yields and for the management of Heterodera glycines and Meloidogyne arenaria was studied for two years in a field experiment in southwest Alabama. The field had been in soybean with ryegrass (Lolium sp.) for the preceding eight years. In 1989 the field was divided into two 30 x 91 M rectangular sections one of which was planted with corn and the other with Kirby soybean. In 1990 each section was divided into eight 30 x 6M blocks separated by alleys of equal size. Each block was then divided into 14 plots each 1.5 (two rows) x 6M with four border rows on each side of the block. Soybean cultivars Braxton, Brim, Bryan, Kirby, Leflore, Stonewall and Thomas were planted in each block to have for every cultivar one plot with no nematicide application and another with an at-plant application of aldicarb (2.2 kgs.a.i./ha in 20-cm-wide band) all arranged in a randomized complete block design. The average yield of the cultivars following corn was 69% higher than the average yield for the monoculture system; however, cultivars differed in their response to the rotation. Yields of Bryan, Kirby and Leflore increased the least (11-34%) in response to the rotation and those of the other cultivars were improved by 125% or more. Application of aldicarb resulted in an average 34% yield increase which ranged from 11% for Bryan soybean to 105% for Stonewall. Soil samples for nematode analysis were collected from each plot one month before harvest. Aldicarb had little effect on juvenile populations of H. glycines or M. arenaria in soil. M. arenaria juvenile populations were higher in rotation plots than in those with monoculture while the reverse was true for H. glycines. The highest numbers of M. arenaria juveniles were associated with cultivars Leflore and Thomas and the lowest numbers of cyst nematode juveniles were with Leflore. Juvenile populations of H. glycines were highest in plots with Braxton.

LONG-TERM EFFECTS OF BAHIAGRASS-SOYBEAN ROTATION ON SOYBEAN YIELDS IN A FIELD INFESTED WITH MELOIDOGYNE ARENARIA AND HETERODERA GLYCINES

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The value of Pensacola bahiagrass (*Paspalum notatum*) as a rotation crop for the management of nematode problems in soybean (*Glycine max*) was studied in a field infested with *Meloidogyne arenaria* and *Heterodera glycines*. In 1986 the field was divided into four rectangular 30x91 M sections two of which were planted with bahiagrass and the other two with Kirby soybean. This arrangement was maintained in 1987 and in 1988 each section was divided into eight 30x6M blocks separated by alleys of equal size. Each block was divided into 1.5(two rows)x6M plots with four border rows on each side of the blocks. Soybean cultivars Braxton, Kirby, Leflore, Ransom, and Stonewall were planted in the plots so as to have in each block for each cultivar a plot treated at planting with nematicide (aldicarb) and another untreated. Border rows were planted with Kirby soybean and treatments were arranged in a randomized complete block design. Soybean cultivars were planted again in 1989 and in 1990 following the same arrangement. Bahiagrass was not a host for *M. arenaria* nor for *H. glycines*. Soybean cultivars following bahiagrass in 1988 yielded an average 114% more than the cultivars under monoculture. The superiority in yield of the bahiagrass-soybean rotation over monoculture was maintained for all cultivars through 1989 and 1990; however, there were marked declines in yield with each successive year. Average soybean yields in 1989 and 1990 in the rotation system were respectively 42% and 20% of the average 1988 yield. Aldicarb application to rotation plots increased yields of all cultivars but one (Ransom) in 1988 but had no effect on any cultivar in the other years. Nematicide application to monoculture plots resulted in increased yields for most cultivars in 1988 and 1990 but was ineffective in 1989. For all cropping systems the lowest end-of-season populations of *H. glycines* juveniles in soil were in plots with Leflore and the highest numbers in those with Braxton or Kirby. End-of-season *M. arenaria* juvenile populations in soil were generally highest in plots with Leflore in monoculture and in rotation plots.

SORGHUM-SOYBEAN ROTATION FOR THE MANAGEMENT OF ROOT-KNOT AND CYST NEMATODES IN SOUTH ALABAMA

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The effect of Pioneer 8222 sorghum (Sorghum bicolor) in rotation with soybean (Glycine max) cultivars on soybean yield and on root-knot (Meloidogyne arenaria) and cyst (Heterodera glycines) nematodes was studied for two years in a field at the Gottler farm near Elberta in southwest Alabama. The field was infested with the two nematodes and had been in soybean for the preceding 8 years. In 1989 the field was divided into two rectangular sections each 30 x 91 M and one section was planted with sorghum and the other with Kirby soybean. In 1990 each section was divided to have eight blocks 30 x 6 M separated by seven alleys of equal dimensions. The blocks were divided into plots each 1.5 M (2 rows) wide to have 14 plots per block with four border rows on each side of the block. Seven soybean cultivars (Braxton, Brim, Bryan, Kirby, Leflore, Stonewall, Thomas) were planted in the plots and there were for each cultivar in every block a plot treated at-plant with aldicarb (2.2 kg a.i./ha in a 20-cm-wide band) and an untreated plot all arranged in a randomized complete block design. Border rows were planted with the Kirby cultivar. Aldicarb application resulted in an overall 44.3% increase in soybean yield; the magnitude of the increase depended on the cultivar and the production system. Thus, while yield response to the nematicide in monoculture plots averaged 62% increase, the increase for the sorghum-soybean rotation averaged 34.7%. Yield increments in response to aldicarb application ranged from 16.0% for cultivar Bryan to 92.3% for Brim soybean. Soybean following sorghum resulted in an average 81.4% increase in yield over the monoculture system. The degree of response to the rotation depend on the cultivar and it varied from 21.3% yield increase for Bryan soybean to over 150% for cultivars Brim, Braxton, Stonewall, and Thomas. Soil samples for nematode analysis were collected from every plot four weeks before harvest. Juvenile populations H. glycines and M. arenaria in soil were higher in plots with the rotation than in those with monoculture. The highest populations of M. arenaria juveniles were associated with Leflore, Thomas and Stonewall. Aldicarb application had little effect on juvenile populations of the nematodes. The highest juvenile populations of the cyst nematodes were in plots with Braxton and the lowest in those with Leflore.

RIVAL SOYBEAN SEED TREATMENT - A REVIEW OF FIELD PEFORMANCE

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Soybean seeds can be attached by many seed and soil pathogens. In order for a seed treatment to be consistently beneficial, it must have a wide spectrum of activity. Rival, a mixture of Captan, PCNB and TBZ provides protection from Rhizoctonia, pod and stem blight and Pythium. Addition of Apron to Rival will also reduce infection by early season Phytophthora.

Rival has been evaluated in small plot trials in major soybean growing areas for the last four years and has provided constant disease control when conditions favored disease development. Commercial use of Rival in 1990 under very stressful growing conditions resulted in excellent stands and satisfied growers.

UNIFIED SOYBEAN DISEASE RATINGS

Glenn R. Bowers, Jr. Chairman, Disease Resistance Committee
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A universal procedure for determining a plant's response to a given disease and the amount of damage suffered from this disease is required to facilitate understanding and communication among researchers and extension specialists interested in a host-pathogen complex. To this end the Disease Resistance Committee of SSDW has begun developing unified rating scales and methods of evaluation for several key soybean diseases. The following paper discusses a system for stem canker. We do not anticipate everyone adopting these systems. However, it is our hope that the systems proposed here will at least provide a means to interpolate between other rating systems.

STEM CANKER DISEASE RATING

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A universally understood rating procedure that also produces reliable results requires a common scale, a set of common check cultivars, a minimum plot size, and the proper time(s) to rate. Effectively rating for severity of stem canker requires a numerical scale that is easy to use and understand, is related to yield reduction, and can readily be used to label a cultivar as resistant or susceptible. The stem canker sub-committee of the Disease Resistant Committee proposes that the scale listed in Table 1 meets these criteria and should be considered when rating stem canker. This is a modified version of the pretransformed arc sine scale proposed by Backman et al. (Plant Dis. 69:641-647). This new scale has been expanded to a 0-9 range from the 0-5 range of Backman et al. and eliminates the use of a decimal place for ease of data entry. It still allows for rating to one decimal place to allow for small changes in disease severity at either extreme of the scale. The gradation in the scale reflect the eyes ability to better discern changes in disease severity at either extreme as compared to changes in the middle range. The system of Backman et al. had a strong correlation (r^2=0.94) between stem canker rating and yield loss. We expect that this proposed scale would have a similar relationship.

Table 1. Rating scale for stem canker in soybean.

Score	Description	Reaction
0	No disease	R
1	Two or three plant dead or dying	MR
2	10% of plants dead or dying	MS
3	20% of plants dead or dying	S
4	35% of plants dead or dying	S
5	50% of plants dead or dying	S
6	65% of plants dead or dying	S
7	85% of plants dead or dying	S
8	95% of plants dead or dying	SS
9	All plants dead	SS

If required, intermediate levels can be scored by extending the scale to one decimal point. This may be the case for the low (0-2) and high (7-9) ends of the scale.

Plot size is also important. A reliable assessment may not be made if the plot size is too small. This is particularly true when ratings fall at either extreme of the scale when it is easy to miss a few diseased or healthy plants. The proposed scale reflects the number of plants from 40' of row.

Including a common set of resistant and susceptible check cultivars in each test allows one to compare relative disease severity between tests. Table 2 lists the proposed check cultivars for Maturity Groups V-VIII.

Table 2. Stem canker resistant and susceptible check cultivars.

Maturity Group	Resistant	Susceptible
V	Bay, Hutcheson	Forrest, Asgrow 5539
VI	Tracy M	RA 606
VII	Braxton	Bragg
VIII	Dowling, Coker 6738	Hutton, Kirby, Coker 338

The point in plant development when disease ratings are conducted can be critical. It is recommended that stem canker ratings be done at late R5 to early R6. A good test requires that at least 50% of plants of the susceptible check cultivars be dead or dying when the rating is done. If fewer disease symptoms are evident the ability to resolve between reaction classes is lost.

SOUTHERN UNITED STATES SOYBEAN DISEASE LOSS ESTIMATE FOR 1990

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In 1990, soybean yield losses due to diseases was lower than normal. The crop loss estimate from all pathogens in 1990 was 10.37 percent. This resulted in a 50,790,000 bushel loss worth 304,740,000 dollars.

Soybeans and soybean products continue to be a very important southern agricultural commodity. In 1990, 472,211,000 bushels were harvested from 18,429,000 acres. Average yields of each southern state in 1990 were as follows:

Alabama 17 bushels/acre;	Arkansas 25 bushels/acre;
Delaware 34 bushels/acre;	Florida 25 bushels/acre;
Georgia 13 bushels/acre;	Kentucky 31 bushels/acre;
Louisiana 24 bushels/acre;	Maryland 36 bushels/acre;
Mississippi 21 bushels/acre;	Missouri 30 bushels/acre;
North Carolina 24 bushels/acre;	Oklahoma 20 bushels/acre;
South Carolina 18 bushels/acre;	Tennessee 26 bushels/acre;
Texas 28 bushels/acre;	Virginia 31 bushels/acre.

MATERIALS AND METHODS

The purpose of the SSDW Disease Loss Estimate Committee is to compile and record soybean disease loss estimates from southern states as the official disease loss statement on the production year. The disease loss estimates (Table 1) are annually solicited from Cooperative Extension Service and Experiment Station personnel in each southern state. The disease loss estimates reported here were derived from IPM field monitoring programs, research plots, field observations, diagnostic clinic records and grower demonstrations.

The bushel loss estimates for each state, disease, and totals are listed in Table 2. Dollar losses are based on what yields would have been had there been no disease present and are calculated on a cost of $6.00 per bushel times the estimated loss.

RESULTS AND DISCUSSION

The losses to some soybean diseases were down in 1990 because of the below normal rainfall in parts of the soybean growing areas. Nematodes are estimated to have reduced yields by

18.71 million bushels worth $112,26 million dollars. Soil diseases are estimated to have reduced yields by 16.55 million bushels worth $99.30 million dollars. Foliage, pod, and stem diseases are estimated to have reduced yields by 15.53 million bushels worth $93.18 million dollars. At the established average annual price received by southern soybean growers of $6.00 a bushel, the 50.79 million bushel loss due to diseases cost growers an estimated $304.74 million dollars.

Total average percent soybean disease loss in the southern states in 1990 is estimated at 10.37. Florida reported the highest disease loss at 30.5 percent. States reporting disease losses of 10 percent or over were Alabama (10.0), Arkansas (10.0), Florida (30.5), Louisiana (11.0), North Carolina (16.67), South Carolina (16.66), and Tennessee (10.06).

Soybean diseases continue to cause significant reductions of possible income to producers (Tables 2 and 3). Therefore, there continues to be a need for expanded research efforts to provide more effective and economical disease control practices.

Table 1. Estimated percent loss of soybean yields in 1990 to disease.

PERCENT LOSS PER STATE

	AL	AR	DE	FL	GA	KY	LA	MD	MS	MO	NC	OK	SC	TN	TX	VA	AVG.*
Diseases																	
Seedling diseases	.2	3.0	TR**	5.0	--	.2	.5	--	.67	1.0	.06	.4	.2	2.0	.1	.2	.85
Root & Stem rots	.4	1.0	TR	10.0	--	.1	.5	--	.33	1.0	.16	.3	1.5	1.0	.9	.3	1.09
Diaporthe-pod & stem blight	.3	1.0	.5	TR	--	1.5	.5	TR	1.37	--	.1	1.0	1.0	.01	1.0	.4	.54
Charcoal rot	.5	1.0	--	1.0	--	.2	2.0	--	3.17	2.0	.5	2.3	.05	2.5	.1	--	.96
Sudden death syndrome	--	TR**	--	--	--	.1	TR	--	TR	TR	--	--	--	.01	--	--	.007
Stem canker	.2	TR	--	TR	--	TR	.5	--	.77	--	--	--	.01	.2	.01	--	.11
Anthracnose	1.0	1.0	.5	1.0	--	.5	1.0	TR	.90	--	--	2.0	1.5	.5	4.0	.1	.88
Downy mildew	.5	TR	TR	TR	--	.1	TR	--	TR	--	--	TR	.1	.1	--	--	.05
Cercospora-purple seed stain and blight	.2	TR	TR	TR	--	.2	.5	--	.90	--	.1	1.0	.5	.01	.3	.1	.24
Brown leaf spot	.5	2.0	--	TR	--	1.0	TR	TR	.17	--	--	TR	.2	1.0	.1	.1	.32
Foliar diseases others	.5	--	--	--	--	--	.5	--	.70	--	.1	1.0	.5	.01	.3	--	.23
Bacterial diseases	.1	TR	--	--	--	TR	TR	--	TR	--	--	TR	.1	.01	--	TR	.01
Virus diseases	.1	TR	TR	TR	--	.1	TR	--	TR	1.0	.6	TR	.5	.01	.01	.2	.16
Soybean Cyst nematodes	3.0	1.0	3.0	1.5	.5	2.5	2.5	5.0	.20	4.0	6.0	.7	5.0	2.5	.01	4.0	2.59
Root-knot nematodes and ecto-parasitiac types	1.5	--	1.0	12.0	1.5	TR	2.5	1.0	.13	--	2.05	.5	5.5	.1	.1	1.0	1.81
Other diseases	1.0	--	--	--	--	--	TR	--	TR	--	7.0***	--	--	.1****	.2	.5*****	.55
Total Percent loss*	10.0	10.0	5.0	30.5	2.0	6.5	11.0	6.0	9.31	9.0	16.67	9.2	16.66	10.06	7.13	6.9	10.37

* Rounding errors present.

** TR = Trace

*** 7% Yield loss due to ozone.

**** Pre-harvest seed deterioration.

***** .5% Yield loss due to Red Crown Rot (Cylindrocladium).

Table 2. Estimated reduction of soybean yields in 1990 to disease.

BUSHEL LOSS X 10^6 FOR STATE*

	AL	AR	DE	FL	GA	KY	LA	MD	MS	MO	NC	OK	SC	TN	TX	VA	Total	Dollar Loss X 10^6**
Diseases																		
Seedling diseases	.02	2.64	TR	.12	--	.08	.23	--	.29	1.34	.02	.02	.03	.72	.007	.04	5.56	33.36
Root & Stem rots	.03	.88	TR	.24	--	.04	.23	--	.14	1.34	.06	.02	.25	.36	.06	.05	3.70	22.20
Diaporthe-pod & stem blight	.03	.88	.04	TR	--	.6	.23	TR	.6	--	.04	.05	.17	.004	.07	.07	2.78	16.68
Charcoal rot	.04	.88	--	.02	--	.08	.94	--	1.39	2.68	.19	.12	.01	.89	.007	--	7.25	43.50
Sudden death syndrome	--	TR	--	--	--	.04	TR	--	TR	TR	--	--	--	.004	--	--	.04	.24
Stem canker	.02	TR	--	TR	--	TR	.23	--	.34	--	--	--	.002	.07	.001	--	.66	3.96
Anthracnose	.08	.88	.04	.02	--	.2	.47	TR	.39	--	--	.1	.25	.18	.28	.02	2.91	17.46
Downy mildew	.04	TR	TR	TR	--	.04	TR	--	TR	--	--	TR	.02	.04	--	--	.14	.84
Cercospora-purple seed stain and blight	.02	TR	TR	TR	--	.08	.23	--	.39	--	.04	.05	.08	.004	.02	.02	.93	5.58
Brown leaf spot	.04	1.76	--	TR	--	.4	TR	TR	.07	--	--	TR	.03	.36	.007	.02	2.69	16.14
Foliar diseases others	.04	--	--	--	--	--	.23	--	.31	--	.04	.05	.08	.004	.02	--	.77	4.62
Bacterial diseases	.01	TR	--	--	--	TR	TR	--	TR	--	--	TR	.02	.004	--	TR	.03	.18
Virus diseases	.01	TR	TR	TR	--	.04	TR	--	TR	1.34	.23	TR	.08	.004	.001	.04	1.75	10.50
Soybean Cyst nematodes	.25	.88	.21	.04	.04	1.0	1.17	.94	.09	5.36	2.27	.04	.83	.89	.001	.72	14.73	88.38
Root-knot nematodes and ecto-parasitic types	.13	--	.07	.29	.13	TR	1.17	.19	.06	--	.77	.03	.91	.04	.007	.18	3.98	23.88
Other diseases	.08	--	--	--	--	--	TR	--	TR	--	2.65	--	--	.04	.01	.09	2.87	17.22
Total disease loss***	.84	8.80	.36	.75	.17	2.60	5.16	1.13	4.07	12.07	6.30	.46	2.76	3.60	.49	1.23	50.79	
Dollar loss X 10^6**	5.04	52.80	2.16	4.50	1.02	15.60	30.96	6.78	24.42	72.42	37.80	2.76	16.56	21.60	2.94	7.38		304.74

* The bushel loss is based on the percent loss of what yield would have been had no disease occurred.

** Dollar loss = estimated loss x 6.00/bushel.

*** Rounding errors present.

Table 3. Southern states soybean disease loss estimate in bushels-dollars - 1990.

DISEASE	BUSHEL LOSS x 10^6*	DOLLAR LOSS x 10^6**
Soil		
Seedling	5.56	33.36
Root and lower stem rots	3.70	22.20
Charcoal rot	7.25	43.50
Sudden death syndrome	.04	.24
SUBTOTAL	16.55	99.30
Nematodes		
Cyst nematodes	14.73	88.38
Root-knot and other nematodes	3.98	23.88
SUBTOTAL	18.71	112.26
Foliage		
Diaporthe Pod and stem blight	2.78	16.68
Stem canker	.66	3.96
Anthracnose	2.91	17.46
Downy mildew	.14	.84
Cercospora	.93	5.58
Brown leaf spot	2.69	16.14
Bacterial diseases	.03	.18
Other foliar fungi	.77	4.62
Virus	1.75	10.50
Others	2.87	17.22
SUBTOTAL	15.53	93.18
TOTAL	50.79***	304.74***

* The bushel losses are computed from percent loss estimates from each of the States x what total production would have been had no disease occurred.

** The dollar loss is derived by multiplying bushels by $6.00/bushel.

*** Rounding errors present.

Table 4. Estimated percent loss of soybean yields (1974-1982).

YEAR	1974	1975	1976	1977	1978	1979	1980	1981	1982
Seedling Disease	2.52	1.30	1.83	1.47	1.29	1.66	2.21	1.76	1.10
Root and Lower Root Rots	2.99	2.69	2.61	2.95	3.16	2.50	3.75	3.55	3.75
Charcoal Rot									
Diaporthe - Pod and Stem Blight	3.40	3.32	2.27	2.79	1.98	1.68	1.70	1.60	1.91
Stem Canker									
Anthracnose	3.30	3.68	3.29	2.46	3.23	2.60	3.15	3.08	2.96
Sudden Death Syndrome									
Downy Mildew		.81	.60	.47	.36	.21	.16	.21	.18
Cercospora - Purple Seed Stain	1.90	1.82	1.14	.94	1.81	1.20	.87	1.01	.96
Brown Leaf Spot		1.33	1.03	.86	.90	.90	.97	1.40	.89
Bacterial Diseases	1.13	.67	.62	.45	.26	.16	.06	.14	.07
Foliar Fungal Diseases	2.70	.64	1.03	.70	1.34	1.15	.56	.64	.31
Cyst Nematode	5.20	3.76	4.85	3.66	3.52	3.70	3.38	2.86	2.29
Root Knot and Other Nematodes	5.20	3.75	3.61	3.07	1.63	2.79	3.35	2.73	2.11
Virus	1.60	.80	1.56	.94	.65	.43	.33	.56	.48
Other	3.40	.73	1.06	.46	.29	.25	.73	.73	.75
Total Loss	33.34	25.3	25.5	21.22	20.42	19.23	21.22	20.28	17.76
Total Acres (Millions)	22.67	25.22	23.6	27.75	30.76	34.05	33.44	31.26	33.58

compiled by W.F. Moore, Mississippi State University.

Table 4. Estimated percent loss of soybean yields (1983-1990), (continued).

YEAR	1983	1984	1985	1986	1987	1988	1989	1990	Avg.
Seedling Diseases	1.12	.96	.86	.75	1.08	1.03	1.09	.85	1.35
Root and Lower Root Rots	4.66	4.04	1.92	1.97	2.82	1.82	1.74	1.09	2.82
Charcoal Rot						.98	.52	.96	.82
Diaporthe - Pod and Stem Blight	1.71	2.0	2.62	2.48	1.33	1.16	1.13	.54	1.98
Stem Canker	1.44	.11	.03	.88	.63	.12	2.02	.11	.67
Anthracnose	1.70	1.12	1.35	1.22	.91	1.04	1.33	.88	2.19
Sudden Death Syndrome						.15	.02	.007	.06
Downy Mildew	.06	.07	.05	.02	.01	.02	.07	.05	.21
Cercospora - Purple Seed Stain	.76	.51	1.09	.92	.38	.47	.41	.24	.97
Brown Leaf Spot	.60	.47	.50	.36	.31	.21	.32	.32	.71
Bacterial Diseases	.03	.07	.02	.02	.04	.04	.05	.01	.23
Foliar Fungal Diseases	.41	.32	.17	.24	.50	.73	1.57	.23	.78
Cyst Nematode	2.65	2.48	5.77	2.51	2.61	2.68	2.70	2.59	3.36
Root Knot and Other Nematodes	2.81	2.35	2.25	1.72	1.91	1.41	2.12	1.81	2.62
Virus	.21	.14	.17	.16	.16	.22	.09	.16	.51
Other	.44	.21	.29	.49	.07	.07	.64	.55	.66
Total Loss	18.60	14.85	17.9	13.74	12.78	12.16	15.81	10.40	19.94
Total Acres (Millions)	27.94	28.41	25.29	22.28	19.93	19.94	20.83	19.14	

compiled by W.F. Moore, Mississippi State University.

SSDW TREASURERS REPORT
12/31/1989 TO 12/31/1990

OPERATIONAL ACCOUNT 25-[redacted]
1ST NATIONAL BANK OF OPELIKA

BALANCE ON 12/31/1989	$4929.12

RECEIPTS FROM 12/31/1989 TO 12/31/1990

INTEREST ON OPERATIONAL ACCOUNT 25-[redacted]	$ 355.67
HOSPITALITY SUITE CONTRIBUTIONS	$ 340.00
PUBLICATION REVENUES	$1098.30
1990 MEETING RECEIPTS	$4260.00
CLOSE OUT AND DEPOSIT OF SCHOLARSHIP CD 5/1/90	$2958.79
TOTAL RECEIPTS AS OF 12/31/1990	$9012.76

DISBURSEMENTS FROM 12/31/1989 TO 12/31/1990

SSDW PRINTING COSTS	$ 761.73
POSTAGE AND MAIL ROOM FEES	$ 396.46
GRADUATE STUDENT EXPENSES	$ 868.26
SSDW RELATED SECRETARIAL FEES	$ 276.50
TOTAL MEETING EXPENSES	$3166.22
AWARDS	$ 834.11
CPA FEES	$ 325.00
TOTAL DISBURSEMENTS AS OF 12/31/1990	$6628.28

ASSETS OF SSDW AS OF 12/31/1990

TOTAL 1990 REVENUES	$9012.76
BALANCE OF OPERATIONAL ACCOUNT ON 12/31/1989	$4929.12
TOTAL DISBURSEMENTS FOR 1990	- $6628.28
NET ASSETS OF SSDW ON 12/31/1990	$7313.60
BANK BALANCE AS OF 12/31/1990	$7313.60

NOTE SCHOLARSHIP ACCOUNT AS CD WAS CLOSED OUT ON 5/01/1990 AS APPROVED BY STEERING COMMITTEE. THE CLOSE OUT BALANCE OF $2958.79 WAS REDEPOSITED INTO OPERATIONAL ACCOUNT AND IS SHOWN AS PART OF 1990 REVENUES.

[redacted]

--12/31/1990

GLENN G. HAMMES TREASURER SSDW

SOUTHERN SOYBEAN DISEASE WORKERS

1990-1991 COMMITTEE CHAIRMEN

Audit:	Robert P. Mulrooney University of Delaware
Awards:	Joseph A. Fox Mississippi State University
Disease Loss Estimates:	G.L. Sciumbato Mississippi State University
Disease Resistance:	Glenn R. Bowers, Jr. Texas A & M University
Educational Resources:	Patrick D. Colyer Louisiana Agricultural Experiment Station
Foliar Disease:	John C. Rupe University of Arkansas
Graduate Student Awards:	Terry L. Niblack University of Missouri
Hospitality:	Charles T. Graham Gustafson, Inc.
Local Arrangements:	Donald E. Hershman University of Kentucky
Nematology:	John D. Mueller Clemson University
Nominations:	William S. Gazaway Auburn University
Program:	Patrick D. Colyer Louisiana Agricultural Experiment Station
Public Relations:	Mark C. Hirrel Consultant, Little Rock, AR
Scholarship:	Melvin A. Newman University of Tennessee
Seed Pathology and Seedling Disease:	G.L. Sciumbato Mississippi State University

Site Selection:	Edwin F. Koldenhoven Griffin Corp.
Steering:	Donald E. Hershman University of Kentucky
Ad Hoc Reorganization:	Donald E. Hershman University of Kentucky

SOUTHERN SOYBEAN DISEASE WORKERS

1990 AWARD RECIPIENTS

Past President Award	William S. Gazaway Auburn University
Distinguished Service Award	
Junior Award	John P. Damicone Mississippi State University
Senior Award	Johnnie P. Snow Louisiana State University
Special Appreciation Award	Patrick D. Colyer Louisiana Agricultural Experiment Station
Graduate Student Presentation	
1st Place	M.S. Zimmerman (H. Minor, Advisor) University of Missouri
2nd Place	W.H. Lee (J.P. Snow and G.T. Berggren, Advisors) Louisiana State University