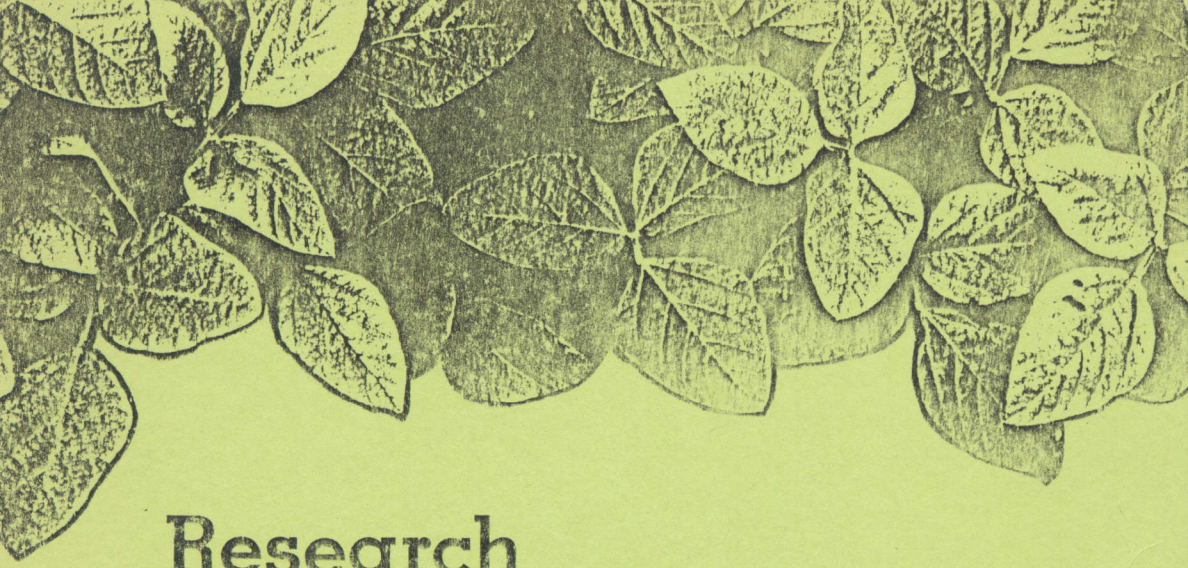

Research Supported by Alabama Soybean Producers

A Summary of 1982 Results

Alabama Agricultural Experiment Station
Auburn University
Gale A. Buchanan, Director
Auburn, Alabama

Auburn University

Auburn University, Alabama 36849

Alabama Agricultural Experiment Station

Office of the Dean and Director
107 Comer Hall

Telephone (205) 826-4840
ACTS: 923-4840

September 7, 1983

TO: Alabama Soybean Check-Off Contributors

Attached are brief summary reports on 1982 research provided by project leaders involved in soybean research supported by the Alabama Soybean Producers. The findings reported in these summaries illustrate the value of these supported projects to the overall soybean research program of the Alabama Agricultural Experiment Station.

We appreciate very much the support of our research programs provided by the Alabama Soybean Producers. We feel that the results of our research efforts are important and enable our soybean industry to be more competitive. We are firmly convinced that there are still many problems that remain unsolved at this time. We pledge to you our continued efforts in solving those problems that will enable soybean producers to be as competitive as they possibly can in the years ahead.

Sincerely yours,

Gale A Buchanan

Gale A. Buchanan
Dean and Director, AAES

SOYBEAN BREEDING AND GENETICS RESEARCH

D. B. Weaver, Department of Agronomy and Soils

The first full year of the soybean breeding and genetics program at Auburn was completed in 1982. From the F_5 seed obtained from the University of Georgia and planted in 1981, 2600 F_6 lines were planted in the field at Tallassee in 6-foot rows and evaluated for agronomic characteristics except for yield. Most were maturity group VI or VII. About 200 lines were selected for further evaluation based on uniformity, lodging resistance, and visual appearance. F_1 hybrid seed from crosses made in 1981 were advanced to the F_2 in Belize, Central America, during the winter of 1982. F_2 plants were planted at Tallassee during the summer of 1982 and single seed were harvested for further advancement during the 1983 winter in Belize. Crosses were made in the field between parents having desirable characteristics and F_1 seed were sent to Belize for generation advance. Cross-pollination conditions were excellent during 1982 and high numbers of F_1 seed were obtained.

Seven commercial and public cultivars were evaluated for resistance to root-knot nematode (*Meloidogyne incognita*) in an infested field during 1982. All cultivars were planted with and without Soilbrom 90 (a nematicide) in a 2 x 7 factorial experiment. The major purpose was to evaluate the interaction between cultivars and nematicide treatment. No definite conclusion can be drawn until the experiment can be repeated at least one more year, but it appeared that public cultivars had higher levels of nematode resistance than commercial cultivars. In the same field, 32 S_1 families from a population that had been random-mated for six generations were evaluated for root-knot nematode resistance. Fifteen families were selected as resistant and these will be random-mated in 1983 as part of an ongoing recurrent selection scheme aimed at improving overall levels of nematode resistance. With the help of the winter nursery, it should be possible to have a selection cycle every 2 years.

Indeterminate and determinate cultivars (Duocrop and Braxton and Foster, respectively) were evaluated for their response to 100% defoliation at three growth stages in a double-crop situation. Plants were planted after wheat on June 21 and defoliated at the R4, R5, and R6 growth stages. Based on one year's data, it appears that critical stages for yield loss from defoliation are not the same as those previously described for full season soybeans. The indeterminate growth habit proved to be no advantage in recovering from the defoliation treatment as it has been in experiments on full season soybeans. Duocrop was significantly lower-yielding than the best determinate cultivar, Braxton, in the untreated plots, indicating that the indeterminate growth habit is not an advantage in late planted soybeans.

Thirty cultivars were tested for reaction to stem canker in a stem canker infested area near Marion Junction. They were visually rated for disease severity and compared for two planting dates. There was a good correlation between final seed yield and visual rating. Tracy M and Braxton showed good resistance, and Hutton and Wilstar 790 were most susceptible. Mean yield of the second planting date was higher, but the increase in yield was due to better performance of the susceptible cultivars. Later planting had no effect on the resistant cultivars.

Fifty cultivars, experimental lines, and obsolete cultivars were screened in replicated plots in 1982 for genetic differences in physiological characteristics related to midday plant water status. The purpose is to find rapidly measurable characteristics which can be used to screen segregating populations for yield potential. Significant differences were observed within maturity groups on several days for stomatal aperture, stomatal resistance, leaf temperature, leaf photosynthetic rate, and seed yield. Some of these characteristics were correlated at certain growth stages, and correlations with seed yield were high on days of high temperature and light intensity.

SOYBEAN WEED CONTROL

R. Harold Walker, Department of Agronomy and Soils

Experiments were conducted at eight different experiment stations in Alabama. Number of experiments at each location were: Black Belt 5; E. V. Smith 3; Gulf Coast 4; Plant Breeding Unit 1; Prattville Field 3; Sand Mountain 3; Tennessee Valley 11; Wiregrass 10. The general areas of research were: (1) herbicide evaluation; (2) weed control systems and economics; (3) pest management pesticide interactions; 4) weed competition.

Herbicide Evaluation. Approximately 14 new compounds were evaluated for weed control potential in soybeans. Of these, only a few looked promising. Dupont's A5969 at rates of 15 to 140 grams per acre provided excellent control of common cocklebur, sicklepod, bristly starbur, and prickly sida. These weeds were controlled when A5969 was applied preplant incorporated, preemergence, and postemergence over-the-top. Soybean tolerance was good to excellent. This new family of herbicides appears to offer excellent broad spectrum weed control at extremely low rates. However, some concern exists about potential carry-over to corn, sorghum, and cotton. Research with this family of herbicides will be expanded during 1983.

The postemergence applied grass control herbicides, Poast and Fusilade, continue to provide good to excellent control of annual grasses and johnsongrass. Other compounds showing equal or better grass control during 1982 were Dow's XRM-4570 and American Hoerst's HOE-00581. Mixing Poast with Basagran or Blazer again reduced the activity of Poast on crabgrass. Combining Fusilade and Basagran was not as antagonistic as combining Fusilade with Blazer.

One additional compound showing good weed control was American Hoerst's HOE-00661, a paraquat-like herbicide. It provided knock-down weed control as good as paraquat on most

species and better for smartweed and lambsquarters control.

Weed Control Systems and Economics. Weed control systems research involves sicklepod, sicklepod plus morningglories, cocklebur, and johnsongrass. In addition to collecting weed control and soybean yield data, we are further evaluating each system by calculating net returns to land and management (NRLM). This additional evaluation, in general, shows we cannot afford or do not need 90% or better weed control to produce high NRLM. I am convinced this type information will help simplify our weed control decisions. I am presently summarizing the sicklepod and cocklebur data and will have it finished by spring 1984.

Pest Management/Pesticide Interactions. Research was conducted during 1981 and 1982 to evaluate potential pesticide interactions with preplant (Treflan, Lencor, Vernam) and postemergence (Blazer, Blazer plus 2,4-DB) applied herbicides and insecticide/nematicide (Temik, Nemacur) applied in all possible combinations. For both years, no pesticide interactions were detected.

Research was conducted to evaluate what effects toxaphene applied for sicklepod control had on soybean insects and yield. Treatments receiving toxaphene produced yields just as good as treatments receiving no toxaphene. However, where toxaphene was applied corn earworm and three cornered alfalfa hopper populations increased. This increase in harmful insects was not found to affect soybean yield. We were able to document again that beneficial insects were more numerous in plots that had some sicklepod when compared to those kept weed-free all season.

Weed Competition. Weed competition is presently being studied with sicklepod and cocklebur, the purpose of which is to determine the relative competitiveness of weeds as affected by soybean row spacing. Learning the relative competitiveness of weeds under different

production systems should provide information that could be used to predict yield losses when a mixed population of weeds exists in a soybean field. The overall objective is to develop better ways of deciding when or when not to implement weed control.

Other competitive work is being done with bristly starbur. This weed is very competitive with soybeans. It is nearly as competitive as cocklebur. The bristly starbur research will be completed during 1983.

SOYBEAN DISEASE RESEARCH

P. A. Backman, Department of Botany, Plant Pathology, and Microbiology

Research on soybean diseases addressed two major problem areas during the 1982 season: (1) developing information on disease control assuming $6-7 per bushel soybeans, and (2) developing control strategies for the emerging stem canker problem before it spreads to the rest of the state.

Improved Economies in Soybean Disease Control Programs. Scheduling of soybean fungicide applications has been evaluated since 1977. Sprays applied on an as-needed basis were compared for profitability to the standard two-spray system. The average number of sprays was reduced to 1.3 per year, with $3 more soybeans produced per dollar invested in fungicides. The standard program only returned $1.17 per dollar invested. These data have convinced duPont to market Benlate in the Southeast based on an as-needed application schedule.

Continuing studies indicate that the addition of petroleum oil-surfactant blends to soybean fungicides

improves disease control in dry years, however, they do not have the same effect in a wet year. Similar disease control effects exhibited by the insecticide Lannate were not present in the very wet summer of 1982.

Variability of the fungicide Bravo in controlling soybean diseases has been a point of continuing mystery. Results from this year indicate that the soybean variety may affect the performance of this fungicide. This information is supported by results from potato tests conducted in the Northeast. The ability to get reproducible results from Bravo would give farmers an alternative to the resistance-prone benzimidazoles.

Stem Canker. This disease continues to spread out of the Black Belt and into adjacent areas and nearby states. Resistant varieties and tolerant varieties have been identified, as have those varieties that are highly susceptible. The following points have been developed that should aid farmers in developing a control strategy:

1. Plant the most resistant variety suitable for your location, nematode analysis, and scheduling requirements.
2. Plant susceptible varieties last, so they will avoid some of the disease.
3. Plant clean seed from clean areas, and if there is any question have the seed treated.
4. Cultivation makes little difference in disease severity.
5. Benlate applied in the month before bloom and during pod elongation can greatly reduce disease.
6. In dry years, add some penetrator or similar adjuvant to your spray tank.
7. Disease is more severe during drought or nematode stress.
8. It is better to have more sprays or a low rate of fungicide than less applications of a full rate.

SOYBEAN NEMATOLOGY RESEARCH

R. Rodriguez-Kabana, Department of Botany, Plant Pathology, and Microbiology

Research in 1982 was directed to acquire data to establish the relation between yield losses and nematode numbers. Results indicated that the relation between yield losses and nematode numbers is affected by the cultivar and that there may also be a seasonal effect. It was possible to establish equations to describe the relation between yields and root-knot nematode (*Meloidogyne incognita*) numbers for cultivars: Ransom (susceptible), Bragg (intermediate tolerance), and Foster (tolerant). Generally, the linear equations for resistant cultivars have slope values smaller than those for susceptible varieties; however, the yields corresponding to the no-nematode (clean field) situation indicated that many varieties are superior in yield potential to the tolerant varieties.

These results represent a first step in the development of accurate recommendations for management of nematode problems in producers' fields. Once the relation between yield losses and nematode numbers is established, then we can put dollar values to it and come out with recommendations that will be more accurate than those we have today.

Other research involved determination of the efficacy of combination systemic + fumigant nematicides. Results indicated no economic advantage from the use of combination treatments. The fumigant nematicide (ethylene dibromide) was much more economical alone and no yield advantage was gained by including Nemacur, Furadan, Temik, or Vydate with it.

Other soybean research was directed to isolating fungi parasitic of nematodes. A number of fungal species capable

of destroying eggs of soybean cyst and root-knot nematodes were isolated from soybean fields. Some of these species offer good potential for development as biological control agents. However, this will take some time before we can move with it in the field.

Cooperative work with Dr. David Weaver revealed that there were no commercially available cultivars among those tested that could be grown economically in a field severely infested with the root-knot nematode (*M. incognita*) without the use of an efficacious nematicide.

There was a total of 2,990 field plots dedicated to soybean research on nematode control in 1982.

Future Plans. We plan to continue work on determination of yield loss equations and to expand work on population dynamics of root-knot and cyst nematodes as influenced by cultivar and season. This is absolutely necessary to acquire a body of knowledge for extension personnel to be able to make accurate nematode control recommendations. It is visualized that this work will require several years.

We plan to continue cooperative work with Dr. David Weaver on development of nematode-resistant varieties.

We also will continue nematicide screening work and experiments on ways and methods of applying these materials in the most efficacious manner.

Work on biological control and the effect of rotations will continue. We are planning development of new rotation systems with innovative crops. This work will be done in cooperation with Drs. Harold Walker and Joe Touchton.

MANAGEMENT OF SOYBEAN INSECT PESTS

T. P. Mack, Department of Zoology-Entomology

The effects of three cornered alfalfa hoppers on soybean plant growth were investigated this past summer in an experiment conducted at the Auburn University Rhizotron. Plants were infested with 16 three cornered alfalfa hoppers per row-foot in one side of a caged bin, with control plants on the other side of each bin. Four bins (replicates) were run. All plants were kept relatively insect free until the R1 stage, when the bins were infested. Soybean root growth measurements were made twice weekly. No significant differences (P=.05) occurred in soybean root growth between infested and control plants. However, three cornered alfalfa hopper feeding significantly reduced stem, pods, and seed dry weight. There was a 48% yield loss in infested plants compared to uninfested plants. This work will be continued in 1983 with an early season infestation being examined.

Toxaphene applications in soybeans for sicklepod control affected the population dynamics of a number of insects. It increased podworm density with both broadcast and band applications kept weed free all season. However, there were no differences in podworm populations between toxaphene sprayed or nonsprayed plots kept weed free for only 2 or 6 weeks. This appears to be due to increased numbers of natural enemies in plots kept weed free for 2 or 6 weeks and receiving toxaphene compared to plots kept weed free all season and reciving no toxaphene. Thus, the occurrence of some sicklepod apparently increased the abundance of natural enemies. Three cornered alfalfa hopper populations also increased in the toxaphene sprayed plots. The increases in abundance of these two important soybean insect pests were due, we believe, to decreases in the natural enemy populations from the toxaphene applications. *Geocoris punctipes* immatures and Striped Lynx spiders, which are common natural enemies, greatly

decreased in abundance in the toxaphene sprayed plots. However, insect fluxes were not found to affect soybean yield. A second year's data will be collected to verify our first year's results.

Temperature and age of the adult female definitely affected the oviposition rate of soybean loopers. Approximately twice as many eggs were laid at 26°C than at the coolest temperature tested (17°C). Further, adult female soybean loopers laid eggs at their fastest rate at 26°C. The longevity of adult female soybean loopers decreased linearly as temperature increased. The daily oviposition rate was found to be significantly related to temperature and adult age in a regression model. With this model it is now possible to estimate the number of eggs laid by a female soybean looper given her age and the temperature. This can then be related to the number of adult female loopers present in a field to determine when an outbreak of loopers is likely to occur and its approximate size.

Sixty soybean strains, cultivars, and varieties were monitored weekly in a replicated test designed to determine if any of the plants were resistant to any of the commonly occurring soybean insect pests. A number of the strains showed some resistance to soybean loopers and three cornered alfalfa hoppers, as measured by number of loopers per row-foot. This work will be continued in 1983.

Four insecticide efficacy tests were conducted this past year. These looked at both systemic and foliar applications of a number of different compounds, and their efficacy against podworms, soybean loopers, bean leaf beetle, and three cornered alfalfa hoppers. Compounds tested include a number of experimental synthetic pyrethroids, a fungicide (screening for insecticidal activity), and an insect growth regulator. A number of the unregistered compounds showed great promise for controlling soybean loopers, and all of the new compounds controlled podworms and three cornered alfalfa hoppers.

Information contained herein is available to all persons regardless of race, color, sex, or national origin.