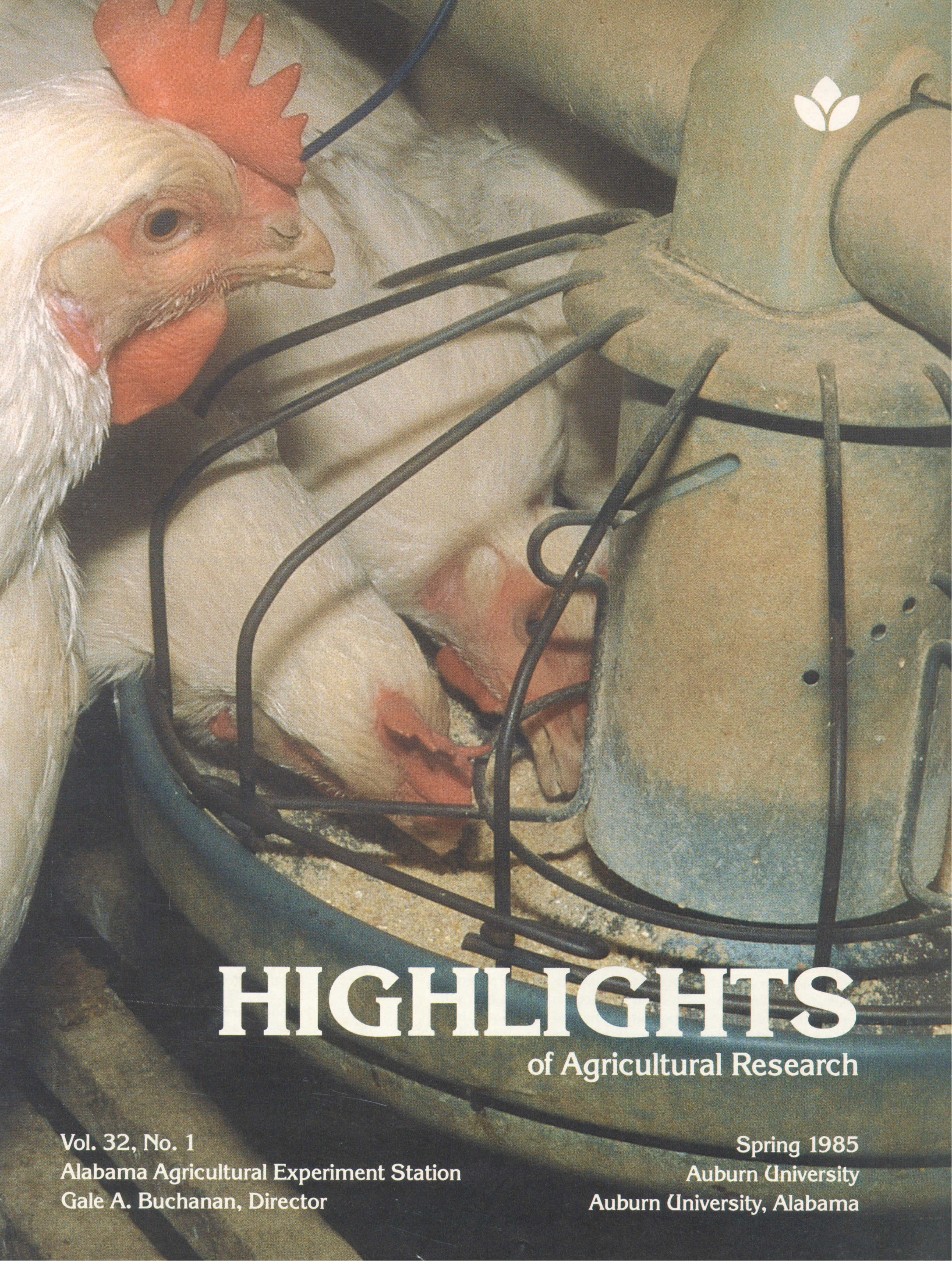


HIGHLIGHTS
of Agricultural Research

Vol. 32, No. 1
Spring 1985
Alabama Agricultural Experiment Station
Auburn University
Gale A. Buchanan, Director
Auburn University, Alabama

DIRECTOR'S COMMENTS

FEW WOULD ARGUE that American agriculture is facing serious problems. Farmers from almost every corner of the nation are in great financial difficulty. The root causes of these problems are complex, and they vary to a great extent with commodity, size of farm, and geographical region of the country. At the head of the list, however, are low prices of commodities which have been brought about by oversupply and softening of export markets as the dollar has grown stronger. These price and marketing problems, along with increased costs of production and serious droughts that were widespread in 1980 and 1981 and regional in 1983, have brought agriculture to its knees in a way we have not seen since the 1930's.

Facts uncovered in a recent survey conducted by our Department of Agricultural Economics and Rural Sociology provide stark reality of the seriousness of the problem and the weakness of the agricultural economy in this State. Farmers surveyed reported that their debt-to-asset ratio grew from a manageable 15-17% in the late 1970's to more than 28% in December 1984. The past year alone had an increase of nearly 50% in average debt-to-asset ratios, which points up the tenuous financial solvency of Alabama farmers as a group. Even more alarming is that over 38% of the farmers who responded to the survey indicated they would likely leave farming in the next 5 years. While many of these are leaving farming for retirement and health reasons, financial difficulties are a leading reason for this trend.

GALE A. BUCHANAN

Solving the problems in agriculture offers a unique challenge to the many institutions, organizations, and individuals associated with agriculture. There will be much discussion during the coming months as a new farm bill is written. Every citizen should be concerned about the farm bill, not just farmers and related industries. The agricultural system that has provided so abundantly for Americans throughout this nation's history deserves the concern and support of all citizens.

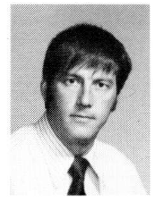
While government farm programs are crucially important to farmers at this time, scientific technology offers the greatest hope for long-term improvement and final solution to agricultural problems. We must look to research to (1) improve efficiency of production of crops currently grown in Alabama, (2) improve quality of farm products, (3) identify new and profitable farm enterprises, (4) open up new marketing opportunities, and (5) protect our soil and water resources.

Work of the Alabama Agricultural Experiment Station is directed towards these basic objectives, and we are making progress. For example, a multi-departmental project has shown that efficiency—and profitability—of peanut production can be improved by more carefully managing production inputs. Limited-tillage production methods are being perfected that reduce production costs and cut down on soil erosion, two important goals.

Although we must continue to carry out long-range research to provide the basis for successful agriculture in the future, we pledge to continue practical studies that will improve efficiency. Such research will help soften the effects and shorten the duration of the serious times currently faced by Alabama agriculture.

may we introduce. . .

Dr. Joe Touchton, associate professor of agronomy and soils. Born in Valdosta, Georgia, Dr. Touchton came to Auburn in 1980 from the University of Georgia, where he was an assistant professor of soil fertility and crop management. He holds a B.S. in agronomy and a M.S. in soil fertility from the University of Georgia and a Ph.D. in soil fertility from the University of Illinois.



Specializing in soil fertility as it relates to minimum-tillage and no-tillage cropping systems, Dr. Touchton is conducting research to determine fertilizer requirements for various crops and crop combinations in limited-tillage systems. His report in this issue of Highlights indicates effective starter fertilizer placement varies among crops.

Dr. Touchton received the 1983 Director's Research Award from the Alabama Agricultural Experiment Station and the 1984 Outstanding Teacher Award from the Department of Agronomy and Soils. He was chairman of the committee that originated the Southeastern No-tillage Systems Conference.

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Information contained herein is available to all without regard to race, color, sex, or national origin.

ON THE COVER. Grain sorghum may be superior to corn in broiler breeder rations, as noted in the story on page 14.

Alabama Farmers Support Voluntary Agriculture Programs, Oppose Mandatory Programs

L.E. WILSON and J.L. ADRIAN
Agricultural Economics and Rural Sociology Research
J.L. JOHNSON, Cooperative Extension Service

THE AGRICULTURE and Food Act of 1981 expires this year. If it is not replaced, commodity price and income support programs could revert to permanent legislation, some dating back to the 1930's. This is not likely to happen, and current legislation will probably be extended with revisions. The nature of these revisions will be critically important to Alabama farmers, so their ideas should be considered.

Since enactment of the 1981 legislation, agriculture has changed dramatically. There have been two bumper crops, followed by the worst drought in 50 years. Export demand has declined, leading to a massive acreage reduction program. Farm program costs increased from about $4 billion in 1979 to over $20 billion in 1983. A payment-in-kind (PIK) program was instituted to help maintain financial stability. Despite these efforts, the Farmers Home Administration (FmHA) emerged as a primary lender of operating credit, which was a sign of economic difficulties.

In retrospect, it is clear that policy makers were off-target when formulating the 1981 Act. Therefore, a better job is needed in developing the 1985 farm bill so it can adequately serve as the basic agricultural legislation for the rest of this decade.

In anticipation of legislation, position reports have been prepared by various interest groups and conferences have been held around the country. Since agricultural programs affect farmers directly, individual farmers should have input into the policy formulation process.

Alabama farmers were afforded the opportunity to express their opinions through an Alabama Agricultural Experiment Station questionnaire mailed in early 1984 to a random sample of 1,479 Alabama farmers. This was one of 17 similar surveys conducted in 1984 by agricultural economists in a cross-section of states. In Alabama, 284 farmers completed and returned the survey questionnaires. Although only a 19% response, this number may be representative of the State's active farmers.

Five major policy issues were explored in the survey: price support programs, loan rates, and target prices; foreign trade; disaster protection for farmers; farm program expenditures and the Federal budget; and farm financing. For each issue, a series of questions and alternative responses were presented to the farmer. In addition to the overall responses, data were subgrouped with respect to size of farming operation, dependency on nonfarm income, and the most important source of farm income.

Alabama farmers supported voluntary agricultural programs, with few supporting mandatory programs. Farmers with larger operations and those more dependent on farm income favored target prices and deficiency payments. Crop farmers were in favor of keeping target prices and deficiency payments at current or higher levels, while livestock farmers wanted lower grain support prices. Farmers also desired continuation of the farmer-owned grain reserve, with a limit placed on payments. They also preferred loan rates being set in relation to market prices, and using the PIK program when large stocks reappear. Respondents strongly supported the requirement that farmers must follow recommended soil conservation practices to qualify for price and income support programs.

Among the proposals to increase agricultural export sales, Alabama farmers' top choices were strengthening the General Agreement on Tariffs and Trade and promoting bilateral trade agreements. The majority also saw benefits from expanding exports through use of farmer-financed market development.

There was considerably less support for the other alternatives: a two-price plan, increased funding for food aid to hungry nations, and formation of an export cartel. Few farmers favored lowering support prices to achieve increased exports.

Farmers generally preferred a continuation of Federal Crop Insurance programs with costs shared by farmers and the government. However, opinions were divided about program mechanics. Many farmers did not respond to the crop insurance questions, implying that the crop insurance program was not well understood.

The great majority of farmers were concerned about Federal budget deficits and the resulting impact on interest rates. Decreasing or eliminating food stamps, maintaining a limit on direct farmer payments, and use of a low "safety net" price program were viewed as ways of reducing agricultural program funding. Farmers with small operations most commonly favored giving price and income support to the small and medium-size farmers. Those farmers who relied primarily on off-farm income for their livelihood also favored targeting program benefits to the smaller farms. These opinions were evenly divided among crop and livestock producers.

About half of the farmers favored continuation of the FmHA policy of foreclosing only after all repayment efforts have failed. Less than one-fourth desired a moratorium on farm foreclosures.

The views expressed by Alabama farmers were similar to those stated by approximately 8,000 farmers in the 17-state study. Producers in 12 of 17 states more frequently preferred voluntary programs. Mandatory programs were more popular in the wheat-producing Great Plains States. Sentiment for eliminating set-aside, price support, and government storage programs was expressed by a sizeable minority of respondents.

The majority of those surveyed favored continuation of target prices and deficiency payments, as well as continuation of the farmer-owned reserve. Future use of PIK programs was favored in 11 states, including Alabama. The majority of respondents expressed the sentiment to (1) change future farm programs to give the most benefits to smaller farmers, and (2) to require farmers to follow approved soil conservation policies to qualify for price supports. Concern over the consequences of large Federal deficits was widespread. A majority of farmers in every state favored balancing the budget by cutting all government programs, including farm price supports.

Variety Selection and Cultural Practices Help Control Soybean Stem Canker

D.B. WEAVER and B.H. COSPER, Agronomy and Soils Research
P.A. BACKMAN, Botany, Plant Pathology, and Microbiology Research

STEM CANKER disease of soybeans was first identified in Alabama in 1977. Its severity since that time has varied, being most destructive in 1981 and again in 1983, when the disease continued its spread, infesting 36 Alabama counties. Research at the Alabama Agricultural Experiment Station was begun in 1981 to identify methods of reducing losses caused by stem canker.

Selection of the proper variety is perhaps the most effective method for stem canker control. As early as 1981 it was noticed that some varieties showed severe disease symptoms and yield losses up to 80%, while other varieties, sometimes in the same field, showed no symptoms and produced good yields.

Tests were initiated in 1982 at the Black Belt Substation comparing varieties in several infested fields for stem canker resistance, see table. Based on a series of greenhouse and field experiments, Bay, Tracy M, Braxton, and Dowling remained essentially free of disease symptoms. All other varieties grown in Alabama showed a range of disease expression, from moderately resistant to highly susceptible. Some of Alabama's most popular varieties (Hutton, Bragg, and Coker 237) are considered to be most susceptible. There was good general correlation between disease symptoms and yield loss, although some varieties, such as Ransom, developed disease symptoms but had higher yield than Tracy M. Auburn research and observations in farmers' fields around the State have shown, however, that all but the most resistant varieties can suffer complete yield loss under severe stress and a high level of disease.

RELATIVE STEM CANKER RESISTANCE OF SELECTED SOYBEAN CULTIVARS

Resistant
Bay (V)[1]; Tracy M (VI); Braxton VII; Dowling (VIII)
Moderately Resistant
Terra Vig 505, Deltapine 105, Deltapine 345, Wilstar 550, Shiloh (V); Centennial, Davis, RA 680, Coker 156 (VI); Wright, Ransom, Coker 317, GaSoy 17 (VII); Coker 368, Coker 488, Cobb (VIII)
Moderately Susceptible
Bedford, Forrest, Essex, A5474 (V); Jeff, Lee 74, S69-96, Deltapine 506 (VI); Gregg, Gordon (VII); Foster, Kirby (VIII)
Susceptible
AP 55, A5939 (V), RA 502, RA 604, Brysoy 9, Bradley (VI); Coker 237, Bragg, McNair 770, Wilstar 790, RA 701 (VII); Coker 338, Hutton, RA 801 (VIII)

[1]Numbers in parentheses refer to maturity groups of preceding cultivars.

Even though stem canker is an important production problem, other production practices and environmental conditions are important when selecting a variety. For example, the most stem canker resistant varieties have no resistance to soybean cyst nematode, and only Braxton has root-knot nematode resistance. Tracy-M, although being nearly immune to stem canker, has not yielded as well as some of the more susceptible varieties, indicating its poor overall adaptability. A major objective of plant breeders is the development of soybean varieties that combine stem canker resistance with good nematode resistance and other desirable agronomic characteristics.

A study of the life cycle of the organism that causes stem canker suggests that certain cultural practices can help reduce disease losses. (See story on page 5.) Because the organism overwinters on crop debris, any practices that involve planting soybeans where debris from the previous year's soybean crop is still present in the field may encourage stem canker. Whether the disease was evident the year before is sometimes not important; it may have been present at a level too low to be noticed. Therefore, it is unwise to no-till beans using a susceptible or moderately susceptible variety, especially in a field that had beans the previous year. Deep tillage, to bury crop debris, is the recommended practice in this situation. Rotation with nonhost crops, such as corn or grain sorghum, can also help reduce soybean crop debris and control disease loss, not only for stem canker, but for other diseases as well.

Soybean variety with resistance to stem canker is shown on left and an infected, nonresistant variety on the right.

Research into the effect of planting date on stem canker severity has been conducted with mixed results. In 1982, beans planted June 15 yielded 19% more than those planted May 15 for a group of moderately resistant varieties, and 28% more for a group of moderately susceptible varieties. In 1983, delayed planting caused a slight yield decrease for moderately resistant varieties, showed no effect on moderately susceptible varieties, and increased yield of only the most susceptible varieties. Disease levels were moderate both years. While delayed planting can be effective as a control measure in many cases, a number of other factors may affect planting date response. Delayed planting alone is not capable of assuring a good yield every year.

Any of the control practices noted can affect the severity of stem canker infestation. Varietal selection is the most important control method currently available. If it is necessary to plant one of the more susceptible varieties because of problems with other pests or seed availability, rotation and deep tillage can help reduce disease loss. Any of these practices can interact with other pests, moisture availability, length of growing season, and other environmental factors. Good judgement must be used in planning an overall stem canker control strategy.

SOYBEAN STEM CANKER: INFECTION, DISEASE DEVELOPMENT, AND CONTROL

P.A. BACKMAN, M.A. CRAWFORD, and E. SMITH, Botany, Plant Pathology, and Microbiology Research, D.B. WEAVER, Agronomy and Soils Research

Soybean plant infected by soybean stem canker fungus.

STEM CANKER disease of soybeans is one of the most destructive pest problems facing Alabama growers. Other diseases caused by this group of fungi are pod and stem blight and seed and seedling blights. Alabama Agricultural Experiment Station tests at the Black Belt Substation and Plant Breeding Unit have uncovered some facts about the causal organism, *Diaporthe phaseolorum* var. caulivora, to help farmers combat this disease.

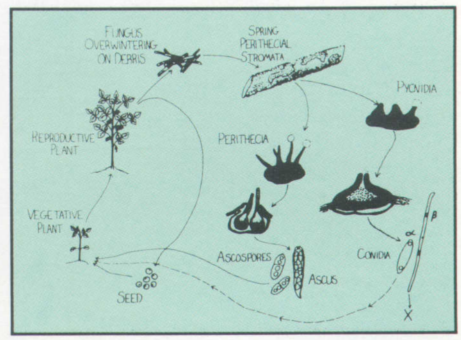
The life cycle of the stem canker fungus (illustrated in the drawing) is just beginning to be understood. The fungus is apparently introduced into fields by way of contaminated seed produced in infected plants. The level of fungus in the seed may be so low that it is virtually undetectable, even using sophisticated laboratory techniques; however, this low level of disease can infest fields.

Typically, spores of the fungus are produced in late April through June in plant debris from the previous soybean crop. These spores germinate and infect the plant through the leaves. As the fungus grows, it moves into the stem where it remains virtually undetectable for several weeks. It is during this period of leaf infection and symptomless residence in the stem that fungicides can be best used to obtain control. In tests at the Black Belt Substation best results were achieved when fungicides were applied between V2 and V6 (two-leaf and six-leaf stages of development). Later sprays made during the bloom to pod-fill periods are helpful, but require more fungicide and are less effective. Benlate® used at rates of between 4 and 8 oz. per acre applied over the row (banded) was quite effective in reducing stem canker and increasing yields by as much as 60% on varieties with intermediate susceptibility in the Auburn tests.

As the soybean begins to bloom and produce pods, it begins to add stress to itself because of the increased requirements of supporting the seed crop. This along with other stresses, such as drought, nematodes, and fertility imbalances, triggers the stem canker fungus to produce the symptoms that are typical of stem canker. However, in 1984, frequent rainfall throughout much of Alabama during July and August kept stress low and disease developed only on the most susceptible cultivars.

Disease symptoms begin as small, brick-red to red-black, shallow cankers, usually beginning near a lower leaf node. As the infection develops, the canker becomes sunken and darkened and eventually girdles the stem. When girdling occurs it prevents further development of pods and seeds, and causes leaf symptoms. Leaves begin to show symptoms when cankers are of intermediate size; these include a yellowing followed by necrosis (browning) between the veins. Eventually the whole plant dies, with the dried leaves being retained on the stem. Yields may be reduced by more than 80% in susceptible cultivars, however seed infestations have not been found to exceed 5%.

After the death of the plant, the fungus continues to develop in the debris. About February, spore producing structures (perithecia) begin to form that exude spores in the late spring and early summer. These spores are in a sticky gelatinous matrix that is dispersed to nearby plants by splashing rain. During thunderstorms, wind-driven rain can move the spores several hundred yards. Infections occur when the spores land on moist soybean leaves.



Life cycle of the stem canker fungus may hold the key to future control of the disease.

Based on research between 1980 and 1984 several control procedures have been developed that will allow Alabama farmers to manage stem canker disease of soybeans:

1. Plant the most resistant cultivar available that is adapted for your location. (See article on page 4 in this issue.)

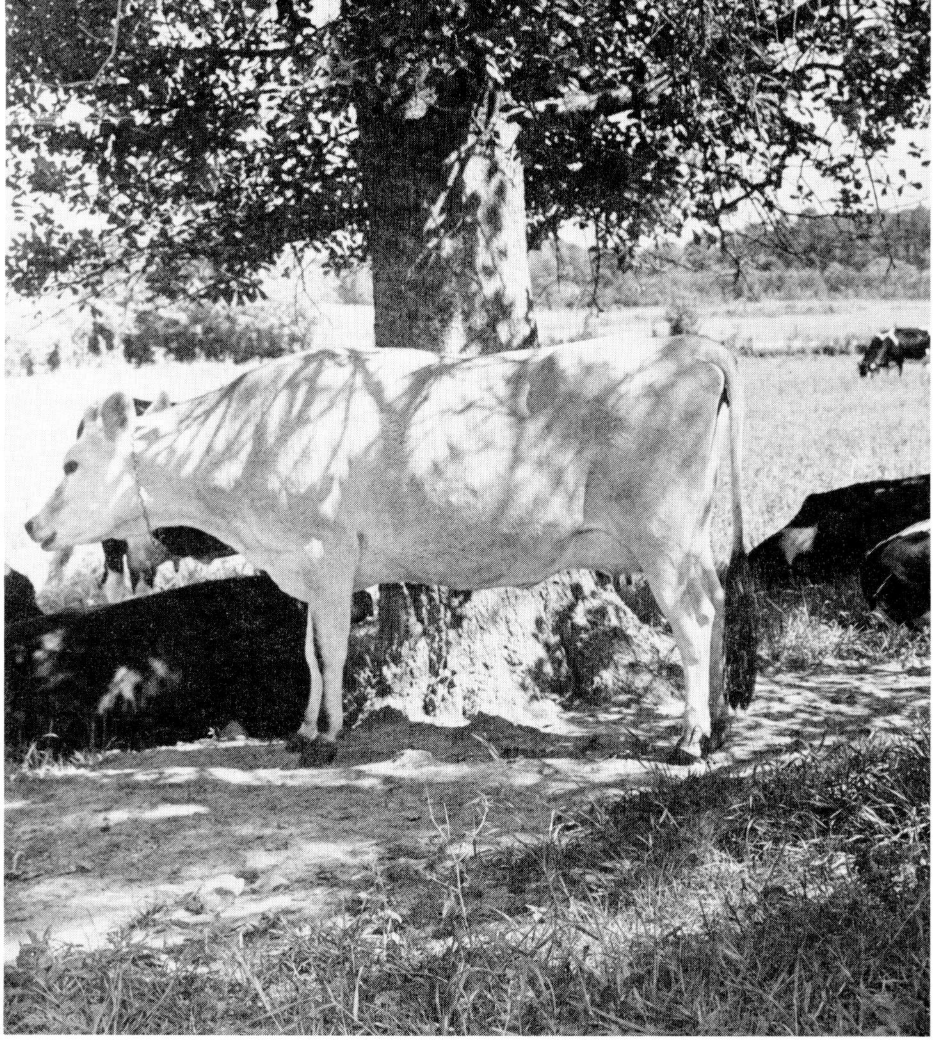
2. Employ good rotation and cultivation practices to reduce the inoculum originating from crop debris.

3. Plant clean seed or fungicide treated seed (if the origin is unknown), particularly if your soybean fields have never had stem canker.

4. Plant high risk fields late. Late maturing varieties planted after June 15 in Alabama often escape the spores released during May and June, with little disease development.

Many of these recommendations were adopted by farmers in Alabama's Black Belt for the 1983 season. Damage in this region was greatly reduced, while the disease continued to spread to other areas of the State that had not adopted these practices, resulting in an estimated $17 million loss.

Fungicide applications are still experimental, but do show promise for control of stem canker in cultivars of intermediate susceptibility. Further research is required to evaluate treatment timings and rates of application. Research is also continuing on the relationships between time of infection, environmental stress, and cultivar selection to better predict disease severity.



Metabolic Effects of Feeding Whole Cottonseed to Dairy Cows

K.A. CUMMINS and G.E. HAWKINS, Animal and Dairy Sciences Research

ALTHOUGH numerous studies have been conducted on feeding of whole cottonseed to dairy cows, there remains a lack of information on certain biochemical effects of feeding it to lactating dairy cows. A recent study by the Alabama Agricultural Experiment Station showed no significant short-term effects from feeding whole cottonseed to dairy cows, but hinted at some adverse long-term problems.

Whole cottonseed as a feed for dairy cows is high in protein, energy, and fat. It is also abundant in Alabama, and compared to other feeds, it is economical. But it has some definite biochemical problems. Whole cottonseed contains two physiologically active compounds, gossypol and cyclopropene fatty acids, about which little is known.

Gossypol, a yellow plant pigment, in cottonseed meal is toxic to young dairy calves and injected gossypol is toxic to castrated sheep. Gossypol has been shown to cause breakage of red blood cells and a resulting anemia. Significant concentrations of it have been found in blood and liver tissue of mature dairy cows consuming cottonseed meal.

Cyclopropene fatty acids are a component of cottonseed oil. Milk fat from cows fed whole cottonseed, cottonseed oil, or mechanically extracted cottonseed meal contain reduced amounts of short-chain fatty acids. This reduced mammary fat synthesis is possibly due to the effects of cyclopropene fatty acids, which are known to inhibit fat synthesis in laboratory tests. For these reasons a study was carried out to evaluate the effects of whole gin-run cottonseed in a balanced high-energy diet fed to dairy cows for the duration of a lactation.

Thirty-two Holstein cows were assigned to either a control diet based on corn, corn silage, and soybean meal or a diet containing 18.5% whole cottonseed in the dry matter. Both diets contained 18% crude protein and were balanced for all required nutrients, see table.

Dry matter intake was reduced in cows fed whole cottonseed. However, the daily mature equivalent milk production per cow was not affected by the diet fed. The milk production findings are similar to those reported by other researchers for cows fed whole cottonseed. Feeding the whole cottonseed diet did not affect length of lactation.

Percentages of total solids, protein, and fat in milk produced were not affected by diet. These findings differ from reports by other universities in which milk fat percentage was increased and protein percentage decreased in milk from cows fed diets containing whole cottonseed. Diet had no effect on overall blood hemoglobin concentration throughout lactation. Feeding whole cottonseed did not appear to cause anemia, though by the end of lactation cows fed whole cottonseed did show somewhat higher fragility of red blood cells.

Gossypol was detected in blood and liver of the cows fed whole cottonseed. Cyclopropene fatty acids were detected in milk and fat tissue from cows fed whole cottonseed. Milk fat and body fat contained a higher proportion of long-chain and unsaturated fatty acids in cows fed whole cottonseed, indicating an inhibition of fat synthesis by the cows.

The effects of long-term inclusion of whole cottonseed in dairy cow diets are not known. While few effects were seen over one lactation, gossypol and/or cyclopropene fatty acids may accumulate in body tissues if regularly fed to dairy cows, and their physiological and toxic effects may become more pronounced. Auburn University's current recommendation is to feed dairy cows 4-6 lb. of whole cottonseed per day. Feeding whole cottonseed makes it easier to include adequate energy and fiber in dairy cow diets, but will probably not increase milk or milk fat production, and may decrease milk protein. Whole cottonseed should be included in dairy cow diets only when it is economically advantageous. Presently, whole cottonseed is worth approximately $140 per ton as a dairy cow feed.

EFFECTS OF FEEDING WHOLE COTTONSEED TO DAIRY COWS

Measurement	Control diet	Whole cottonseed
Dry matter intake, lb./day	41.6	39.4
Milk, lb./day	60.5	60.5
Milk fat, %	3.72	3.71
Milk protein, %	3.3	3.2
Blood hemoglobin, mg %	9.9	10.5
Plasma gossypol, mg/ml	.0	1.2
Liver gossypol, p.p.m.	.0	36.4
Milk cyclopropene fatty acids, p.p.m.	6.6	59.6
Adipose cyclopropene fatty acids, p.p.m.	60.5	148.5

Starter Fertilizer Placement with In-row Subsoilers

J.T. TOUCHTON and D.H. RICKERL, Agronomy and Soils Research

WHEN in-row subsoilers are used in no-tillage systems, the most logical placement for starter fertilizers is directly behind the subsoil shanks. Most fertilizers, if placed too close to the seed, can injure or kill germinating seeds or small plants. Dropping the fertilizer directly behind the in-row subsoil shank can result in fertilizer seed contact and injury.

During the past few years, most of the research conducted with starter fertilizers in no-tillage systems dealt primarily with dry fertilizers. These fertilizers were dropped directly behind the subsoil shank with an applicator tube mounted above the soil surface. Although relatively high rates of dry fertilizers were dropped behind the subsoil shanks, toxicities were not found, and yield responses in some tests were impressive.

Unlike dry fertilizers, which will filter down the subsoil channels, liquid (solution and suspension) fertilizers tend to stop at the first point of soil contact. If the fertilizers stop near the point of seed placement, toxicities are likely to occur. In some of the first studies with liquid fertilizers, the applicators were rigged similar to dry applicators and the fertilizers were allowed to free fall from a point several inches above the soil surface. In some studies, no problems were encountered, but in others, toxicities occurred. To avoid potential toxicity problems with fluid fertilizers, tubes were mounted behind the subsoil shank, see sketch, and the fertilizer was released 6 to 10 in. below the soil surface. Although favorable yield responses were obtained with the deep-placed fertilizer, there was much concern that the young plant roots were not reaching the fertilizer early enough for maximum benefits.

In 1984, studies were conducted by the Alabama Agricultural Experiment Station at the Wiregrass Substation to compare starter fertilizer placement methods for corn, peanuts, and cotton grown in conservation tillage systems. Starter fertilizer treatments were: (1) no starter, (2) 22 lb. per acre N (30% N solution), and (3) 22 lb. per acre of N and P_2O_5 (made by mixing 30% N solution and 10-34-0 ammonium polyphosphate solution). Fertilizer placement treatments were: (1) deep placement directly behind the subsoil shank, as shown in the sketch, (2) 2 x 2 placement (2 in. beside and below the seed) with in-row subsoiling; and (3) 2 x 2 placement without in-row subsoiling.

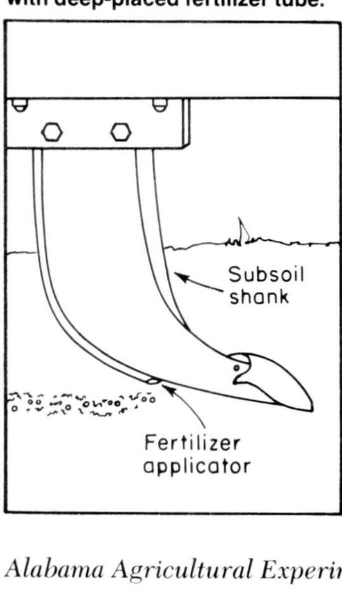
For each crop, higher yields were obtained with than without in-row subsoiling, see table. The 2 x 2 placed starter with subsoiling was more effective than deep placement for corn and peanuts, but the deep placement was more effective for cotton. Higher corn yields were obtained with the N-P starter treatment than with N alone, but peanut and cotton yields were as high with N alone as they were with the N-P combination.

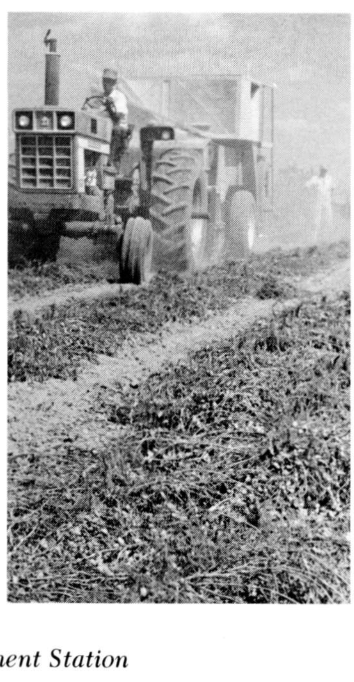
Firm conclusions cannot be drawn from 1 year of data, but it appears that effective starter fertilizer placement may vary among crops. Also, judging from data collected from this and other studies conducted during the past few years, N, not P, is generally the most important ingredient in starter fertilizers. Yield responses to P are frequent enough to justify including P in the starter, but the N rate probably should be as high if not higher than the P rate.

CORN, PEANUT, AND SEED COTTON YIELDS AS AFFECTED BY STARTER FERTILIZERS, FERTILIZER PLACEMENT, AND IN-ROW SUBSOILING

Starter fertilizer	In-row subsoil	Fertilizer placement	Yield per acre		
			Corn	Peanuts	Seed cotton
			Bu.	*Lb.*	*Lb.*
None	Yes	--	109	3,180	4,380
	No	--	40	2,350	4,030
N	Yes	deep	114	3,290	4,530
	Yes	2 x 2	128	3,630	4,280
	No	2 x 2	51	2,570	4,110
N-P	Yes	deep	124	3,160	4,510
	Yes	2 x 2	141	3,760	4,490
	No	2 x 2	57	2,600	4,230

Diagram of in-row subsoil shank with deep-placed fertilizer tube.





SEED TREATMENT WITH BAYLETON REDUCES FUSIFORM RUST IN FOREST NURSERIES

W.D. KELLEY, Botany, Plant Pathology, and Microbiology Research

FOREST NURSERIES rely on Bayleton® (triadimefon) for controlling fusiform rust on young pine seedlings. It was first shown to effectively control the disease on slash and loblolly seedlings in 1979. Since then it has been thoroughly tested and registered for use in forest nurseries in the Southeast.

The standard nursery treatment includes three foliar sprays, each at a dosage rate of 4 oz. active ingredient per acre (8 oz. Bayleton 50 WP). Timing of the sprays is at equal intervals beginning about 3 weeks after sowing and ending around June 7-15.

In addition to foliar spraying, a seed soak treatment is used to protect young seedlings for about 14 days after emergence. This method calls for soaking pine seeds for 24 hours in a solution containing 1 oz. of Bayleton 50 WP in 5 gal. of water.

Using the Bayleton seed treatment provides uniform protection for about 30 days after sowing; thus, the nurseryman can delay the first foliar spray until emergence is essentially complete. If the seed treatment is not used, adequate protection with foliar sprays can be accomplished only by increasing the frequency of application during the seedling emergence period (7 to 21 days after sowing for loblolly pine and 5 to 14 days for slash pine).

Bayleton, applied as a foliar spray, has kickback activity (i.e., systemic activity against established infection) of 7+ days and provides protection against future infections for about 21 days. However, this applies only to seedlings that are emerged at the time of application. Seedlings that emerge after the first foliar spray are not protected until the second spray is applied, and if the time period between the two sprays exceeds the kickback capability of Bayleton, rust infections can occur. The seedling emergence period for loblolly pine is sufficiently long to require at least two foliar sprays in lieu of seed treatment to provide protection from rust, whereas one foliar spray is sufficient for slash pine.

A simpler seed treatment method has proved its value in Alabama Agricultural Experiment Station research done to refine treatment rates and procedures. These studies have been done at several nurseries.

The new seed treatment method eliminates the 24-hour seed soak method, and requires only 10 minutes of mixing in a tumbler apparatus. The seed treatment consists of 1 oz. of Bayleton 50 WP per 25 lb. of wetted pine seed, along with latex sticker (if desired) and a bird repellent.

RESULTS OF RUST CONTROL PROGRAMS AT TWO FOREST NURSERIES

Seed treatment	Sowing date	Dates of Bayleton foliar sprays			Pct. rust
		1st	2nd	3rd	
Union Camp nursery					
Bayleton 50 WP	April 18	May 7	May 23	June 23	0.3
Nontreated	April 18	May 7	May 23	June 23	14.1
McMillan-Bloedel nursery					
Bayleton 50WP	April 23	May 7	May 15	May 30	.3
Nontreated	April 23	May 7	May 15	May 30	2.0

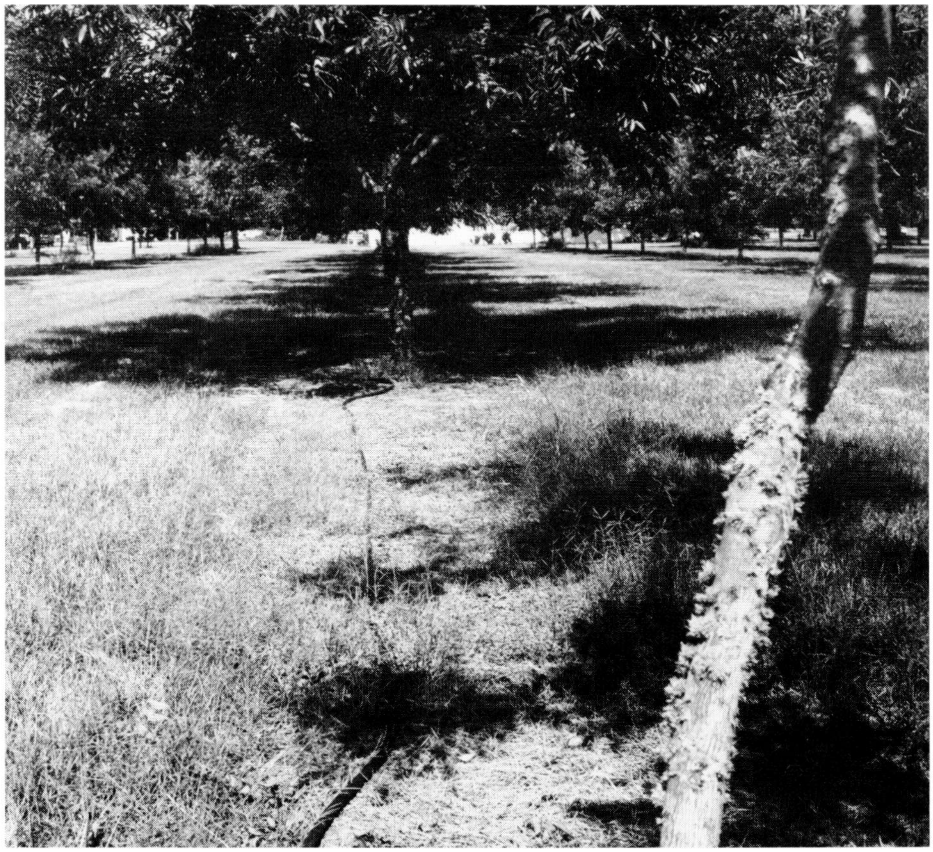
Value of this seed treatment as part of a rust control program was established in tests at the Union Camp nursery, near Union Springs, Alabama, and at the McMillan-Bloedel nursery, near Camden, Alabama. One seed lot at each nursery was halved, with one half getting the seed treatment and the other half receiving only the bird repellent and latex sticker.

Bayleton-treated and nontreated seed were sown in April on adjacent beds at each nursery. The foliar spray schedule was the same for beds with both treated and nontreated seed.

Seedlings in six treated and six nontreated beds at each nursery were examined for fusiform rust galls in early November. Counts were made at five sampling points, 30 ft. apart, in each bed. At each sampling point, 100 seedlings each in drill rows two and seven were examined individually and the numbers of galled seedlings were recorded. Data averages are given in the table.

At least one rust infection period occurred at each nursery during the seedling emergence period in 1984. Rust was controlled in plots sown with Bayleton-treated seed, but an acceptable level of control was not obtained in plots planted to nontreated seed even though foliar sprays were applied. These data provide a strong case in favor of treating pine seed with Bayleton.

A 24(c) registration is in effect for Alabama, permitting use of the simplified method of treating pine seed with Bayleton 50 WP. Thus, the easier system is a viable option. Data used to obtain the 24(c) registration in Alabama are available to other states wishing to petition for a similar registration.



PROPER SCHEDULING MAKES DRIP IRRIGATION EFFECTIVE IN PECAN ORCHARDS

H.J. AMLING and J. SNELL, Horticulture Research
N.R. McDANIEL and E. CARDEN, Gulf Coast Substation

DRIP IRRIGATION is rapidly gaining popularity among pecan producers. Many drip systems are being installed in Alabama and across the pecan belt as growers seek to minimize drought losses and assure dependable quality nuts.

Drip irrigation works on the principle of preventing moisture stress rather than correcting stress, as is often the case with sprinkler irrigation. Thus, an entirely different concept of irrigation scheduling is required. This need is being addressed in Alabama Agricultural Experiment Station research using a "pressure bomb" to measure water stress of trees.

Only 10 to 25% of the root system of a pecan tree is needed to supply the tree's water needs if that root fraction is in soil with moisture near field capacity. Point sources of water that emanate from drip emitters create localized areas under the tree canopy that can meet this requirement.

Pecan root growth is enhanced deep into the B soil horizon in this localized area under an emitter. As learned in the study, however, once soil was depleted of moisture at a depth of 18 in. in this localized area, it took 7-10 hours to regenerate the moisture to near field capacity. This was with a 1-gal.-per-hour emitter used in Red Bay and Norfolk soils.

These results emphasize that frequent releases of water from an emitter are required to maintain moisture levels in soil under the emitters. This becomes more evident as rainfall amounts and frequencies decrease.

In the Experiment Station tests, a pressure bomb was used to measure plant water stress to determine when irrigation was required. What the pressure bomb actually measures is the amount of pressure required to force water out of a leaf via its petiole. This equals pulling force of the leaf to draw in water. This force increases as available soil moisture decreases. Such data measurements are referred to as plant water potential. The research objective was to correlate pecan leaf water potential measurements with production-reducing drought stress.

Early in these investigations it became clear that water potential between trees grown under different soil moisture regimes did not differ appreciably during the day. It was at night that water potential differences developed. Trees subjected to higher available soil water irrigation regimes recovered from drought stress earlier in the night and to a greater degree than trees receiving less or no water from irrigation. It was also found that trees maintained under a specific irrigation regime exhibited the same water potential diurnal patterns from one 24-hour cycle to the next 24-hour period.

Pre-dawn water potential values were collected during the later stages of an extended drought which occurred during the nut sizing period. This related water potential differences to specific reductions in nut volume as given in the table. These data also showed that drip irrigation at the appropriate water rate could, if properly scheduled, equal sprinkler irrigation in nut size achieved.

Use of the pressure bomb to measure water potential can provide the basis for effective scheduling of drip irrigation.

EFFECT OF IRRIGATION ON LEAF WATER POTENTIAL AND NUT SIZE AND QUALITY DURING DROUGHT STRESS PERIOD WHEN NUTS WERE SIZING

Irrigation treatment	Leaf water potential at 5:30 a.m.	Nuts per lb.	Nut volume	Kernel weight
	(-) bars	*No.*	*cc*	*Grams*
Sprinkler with tensiometer over-ride at 30 centibars	2.4[1]	49	14.6[2]	4.7
8 gal. drip per day	3.5	49	13.2	4.9
4 gal. drip per day	5.9	51	12.7	4.6
1 gal. drip per day	7.6	57	11.8	4.1
No irrigation	8.6	70	9.5	3.4

[1]The lower the number, the less stress the tree is under.
[2]The higher the number, the better the nut quality.

Relative tax burden of Alabama's farmers

H.W. KINNUCAN and G.D. HANSON
Agricultural Economics and Rural Sociology Research

THE RECORD Federal budget deficits of recent years and the apparent inability of Congress to bring government spending under control will probably mean higher taxes for most Americans in the years ahead. That taxes have a profound effect on American agriculture has been documented in a recent U.S. Department of Agriculture study showing that tax policy increased land prices, encouraged the formation of larger farms, provided incentives for farm incorporation, altered farm management practices, and increased the use of farmland as a tax shelter for farmers and nonfarmers alike.

Economists are concerned about taxation because it can distort incentives to produce and invest, thereby leading to resource misallocation and slower economic growth. For example, the tax provision that permits the expensing of certain capital items, such as orchard development costs, can encourage overexpansion in affected industries. The consequent lower prices can result in inadequate returns to resources employed in the industry.

Another concern shared by politicians, voters, and economists alike is one of equity and the distributional impacts of tax policy. A general consensus in favor of a progressive tax structure appears to exist in the United States. This means that the level of taxation should be based on an individual's ability to pay, i.e., persons with higher income should pay proportionally more in taxes than those with lower incomes. Moreover, a tax system is considered "fair" if individuals earning approximately the same income pay the same amount in taxes.

Research being conducted at the Alabama Agricultural Experiment Station is attempting to shed light on the fairness of farm taxation and how it affects incentives to produce and invest. The following conclusions are based on a representative sample of 1979 income tax returns that reported farm income.

State differences in tax equity appear marked, even within a particular region. Considering Alabama and the four states contiguous to it, the percentage of adjusted gross income paid by farmers for taxes in 1979 varied from 15.4% in Tennessee to 26.0% in Florida, table 1. Taxes included in this measure are Federal income taxes, state and local taxes, self-employment (Social Security) taxes, real estate taxes, and sales and property taxes.

Under a progressive tax system one would expect states with higher average incomes to pay higher taxes. However, the data contradict this notion; farmers in Alabama, Georgia, and Florida had similar incomes in 1979 but average tax rates differed by 43%, with Alabama farmers carrying a much lower tax burden than either Georgia or Florida producers. An interesting aspect of the data is that while farmers in each state on average showed a net loss from farming, income from nonfarm activities was sufficient to offset these losses and provide an acceptable standard of living to the average farm household, table 1. Tennessee had the highest adjusted gross income among Southeastern States in 1979, but it also had the lowest average tax rate (15.4%). The apparent weak correlation between income levels and relative tax burdens calls into question the equity of our current tax system, at least as it relates to the farm sector.

In addition to taxes levied at the Federal level, farmers are also subject to a variety of state and local taxes. Policies regarding these taxes can differ widely among states and these differences help explain the widely varying effective tax rates noted. For example, Alabama farmers have low real estate taxes relative to neighboring states and this has kept their overall tax burden down, table 2. However, part of the tax relief experienced by Alabama farmers because of low real estate taxes is offset by relatively high state and local taxes (averaging 9.4% of their tax bill in 1979). Sales and property taxes represent about 5% of all taxes paid by Alabama farmers. This is high relative to neighboring states, especially Georgia and Florida, table 2.

Agriculture is often referred to as a tax-favored industry because farmers can use special tax provisions such as cash base accounting, expensing of selected capital costs, and conversion of ordinary income into capital gains to lower tax rates. Despite this characterization, data from the study suggest that farmers are paying a significant portion of their income toward taxes. Alabama farmers, with 18.2% of their average 1979 income diverted to taxes, appear to have a somewhat lower tax burden than farmers in neighboring states (when income levels are held constant). Because low taxes and a healthy economy generally go hand in hand, Alabama farmers and other citizens will want to ensure that tax dollars are spent wisely and efficiently by paying close attention to new legislative initiatives to raise taxes.

TABLE 1. AVERAGE INCOME EARNED AND TAXES PAID BY FARMERS IN SELECTED SOUTHEASTERN STATES, FY 1979

State	Income		Taxes paid	
	Net Farm	Adjusted gross	Amount[1]	Proportion of adjusted gross income
	Dol.	*Dol.*	*Dol.*	*Pct.*
Alabama	-2,489	23,619	4,305	18.2
Tennessee	- 148	38,856	5,989	15.4
Mississippi	- 634	13,623	2,651	19.5
Georgia	-7,066	24,396	5,705	23.4
Florida	- 494	24,939	6,477	26.0

Source: Internal Revenue Service Data Files.
[1]Taxes include those listed in table 2.

TABLE 2. DISTRIBUTION OF FARM TAX BURDEN IN SELECTED SOUTHEASTERN STATES, FY 1979

State	Federal income tax	State & local tax	Self-employment tax	Real estate	Sales & property tax	Total tax bill
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Alabama	76.0	9.4	8.1	1.3	5.2	100
Tennessee	83.1	1.0	8.8	3.1	4.0	100
Mississippi	79.0	6.6	5.7	2.2	6.5	100
Georgia	75.7	11.0	7.0	3.4	2.9	100
Florida	87.9	.4	4.3	5.0	2.4	100

Source: Internal Revenue Service Data Files.

Seepage and Evaporation Losses from Farm Ponds

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FARM PONDS are used for watering livestock, irrigation, fish rearing, and recreation. Because ponds are important in Alabama, research on the hydrology of farm ponds and their watersheds was conducted at the Alabama Agricultural Experiment Station. The first task was to estimate water losses resulting from evaporation and seepage.

Evaporation was determined by lining a 1/10-acre, triangle-shaped pond with an impermeable liner and constructing a barrier around the pond to divert runoff. Evaporation rates for the pond, located on the Fisheries Research Unit, at Auburn, are given in the table. Year to year variation is not great, and evaporation would differ by 10% or less over the State. The data represent normal pond evaporation in Alabama.

Total pond evaporation at Auburn (42.2 in.) is somewhat less than the normal annual rainfall (54.4 in). However, evaporation was in excess of precipitation for the period May through October, figure 1. The annual precipitation excess averages only 11.0 in. Thus, rain falling directly into a pond barely replaces evaporation and fails to compensate for evaporation during most warm months.

WATER LOSSES FROM PONDS BY EVAPORATION AND SEEPAGE

Month	Evaporation	Seepage[1,2]
	In.	*In.*
January	0.70	- 1.24
February	1.90	- .56
March	2.70	+ .93
April	4.16	+2.40
May	5.05	- 1.86
June	4.48	- 1.86
July	6.05	- 4.96
August	5.38	- 5.58
September	5.04	- 6.30
October	3.00	- 4.96
November	2.06	- 2.40
December	1.72	- .93
Total	42.24	-27.32

[1]Seepage values are averages of 20 ponds.

[2]- indicates seepage out; + indicates seepage in.

Seepage for ponds was determined during periods without rainfall when water was neither flowing into or out of ponds. The change in water depth during this time represented seepage plus evaporation. Seepage was determined by subtracting evaporation, as estimated for the lined pond, from the depth change. Average seepage rates for 20 ponds in the Alabama Piedmont are provided in the table. Water seeped from ponds during all months except March and April when water seeped in; seepage was greatest during summer and fall. Seepage varies greatly among ponds. It occurs primarily through or under the dam, but pond bottoms may also seep. Seepage is less for ponds with properly constructed dams and/or ponds in areas with tight, clay soils. Average summer seepage rates (July through September) for ponds in the Piedmont ranged from -3.98 to -10.05 in. per month. Preliminary studies indicate that seepage losses for ponds in the Black Belt Prairie region are only about one-third of ponds in the Piedmont.

Seepage plus evaporation for ponds on the Piedmont averaged 69.6 in. per year—more than the annual rainfall. Seepage and evaporation will approximately equal annual rainfall even for ponds constructed on tight soils.

Changes in water depth for a pond in the Piedmont are illustrated in figure 2. The pond was full or overflowing from January through May. The water level then steadily declined in response to less rainfall and greater seepage and evaporation to the lowest level in early November. December rains quickly refilled the pond.

Although timing of events may differ by a few weeks among years, figure 1 presents the typical pattern for water-level changes in ponds that receive no inflow from springs, wells, or streams. The importance of having a watershed large enough to quickly fill the pond during winter is obvious. Ponds must also have enough storage capacity to maintain adequate depths and volumes of water during summer and fall. Selection of a site with relatively impervious soils, replacement of sandy areas in bottom with clay, and proper dam construction reduce seepage. Evaporation cannot be reduced, but removal of vegetation around edges will decrease water loss to transpiration by plants.

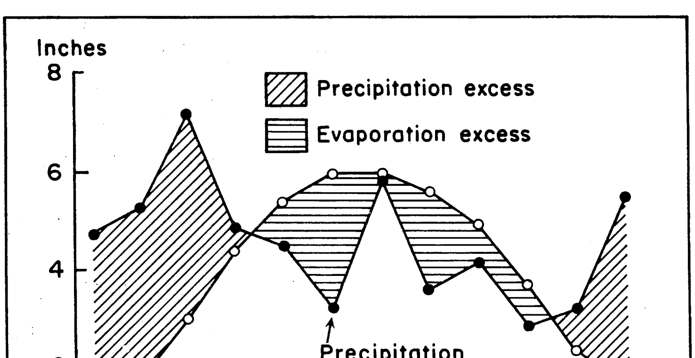
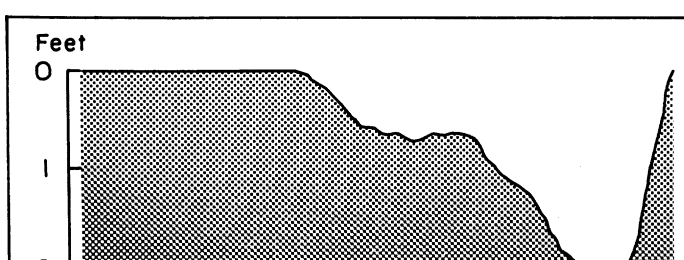


FIG. 1 (left). Farm pond evaporation May-October in central Alabama.

FIG. 2 (below). Changes in water depth in farm pond in central Alabama.



An Economic-Engineering Model to Select Optimal Location, Size, and Number of Center Pivot Irrigation Systems

G.C. JOHNSON and E.W. ROCHESTER, Agricultural Engineering Research
L.U. HATCH and W.E. HARDY, JR., Agricultural Economics and Rural Sociology Research

THE SELECTION of the optimal center pivot irrigation system design poses special problems in the Southeastern United States, because many fields are of irregular size and shape. A large center pivot system is less expensive per unit area than a smaller system, but a design utilizing several smaller systems may cover more area in a particular field. A method for determining the most economical combination of different sizes of center pivot systems has been developed by agricultural engineers and economists in the Alabama Agricultural Experiment Station. This method utilizes an optimizing technique called mixed integer linear programming.

The first step is to determine the sizes of center pivots to be evaluated. An economic budget, consisting of annual fixed and operating costs, is estimated for each size pivot. These costs will vary from field to field, depending upon such factors as available water supplies, soil types, topography, and interest rates. The average yield increase resulting from irrigation can be obtained by referring to controlled irrigation experiments for the region in which the field is located. Alternatively, historical records can be examined and the yield for years with adequate and timely rainfall can be compared to the average yearly yield.

The next step is to enter coordinates of the field boundaries into the computer. This is done by laying a map of the field over a digitizing tablet and encoding the points of inflection along the field boundaries (see Highlights Vol. 31, No. 1, p. 10). The field and surrounding area are then approximated by a rectangular grid of points. By utilizing the coordinates of the boundaries, each point is classified as being either inside or outside of the field. The gross profit associated with irrigating the area represented by one grid point is obtained by multiplying the yield increase by the market price for the crop.

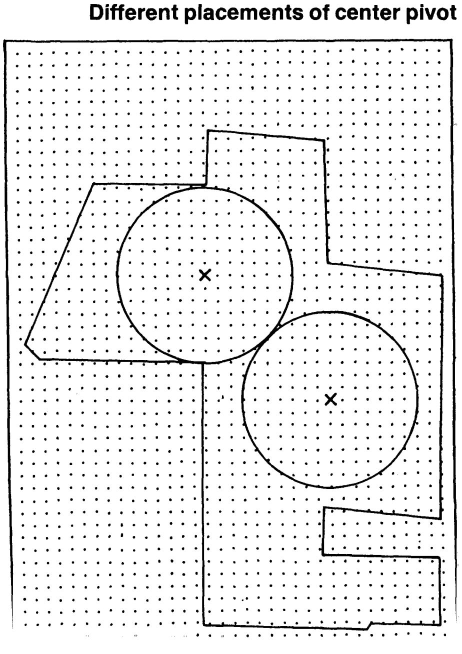
The computer program analyzes all of the possible locations for each size center pivot. The possible locations are constrained by requiring that no points outside the field boundaries can be irrigated. In some cases the center pivots may overlap each other, and a point may receive two or more applications. To account for this, the program limits the yield increase to that of one irrigation, but the cost for each application remains constant. The objective function is an equation which calculates the profit for the operation by determining the gross profit from irrigation minus the cost of the irrigation systems. The linear program maximizes the profit for the field by iteratively analyzing combinations of different irrigation systems until the optimal solution is found.

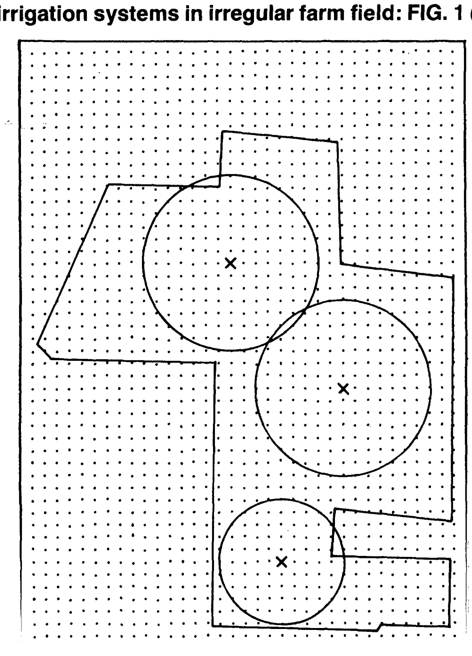
As an example, peanuts are considered for irrigation. Three center pivot sizes were chosen: a 188-acre pivot, a 138-acre pivot, and a 96-acre pivot. As the price of peanuts is varied, the location, number, and size of pivots change. At a market price of 21¢ per lb., irrigation is not economically feasible because the returns for the additional peanuts produced under irrigation will not pay for the cost of the irrigation system. As the market price increases to 23¢ per lb., two 188-acre pivots are chosen, see figure 1. The value of yield increase for a 96-acre pivot does not exceed its cost until the market price is 26¢ per lb., see figure 2. An additional pivot cannot be positioned on the field without overlap. The market price for peanuts must reach 29¢ per lb. before a second 96-acre pivot is chosen, see figure 3. The 138-acre pivot costs less per unit area than the 96-acre pivot, but was not chosen because it could not be positioned without considerable overlap. Other parameters, such as the cost of the center pivot systems, the yield increase due to irrigation, or the cost of fuel, can be varied to illustrate their impact on the optimal solution.

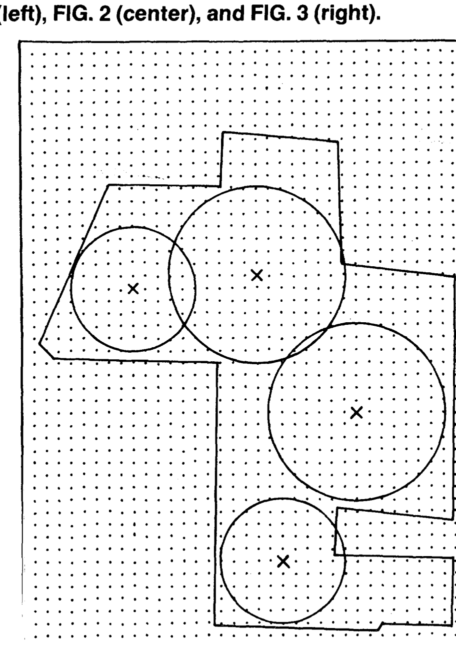
This example illustrates that economic feasibility of center pivot irrigation is dependent upon several parameters that may vary for different fields and crops. The peanut example was chosen simply to illustrate the functioning of the model. By inserting the specific parameters associated with a particular field and crop, the model can derive optimal location, size, and number of center pivots under the selected circumstances. In addition, selected parameters can be varied to obtain the range of that parameter for which the solution remains unchanged.

Presently the model requires access to a mainframe computer and peripheral devices such as a digitizing tablet for encoding the field boundaries from maps or aerial photographs. These requirements restrict the potential distribution to extension agricultural engineers, dealers, and consultants. Additional modifications and feasibility studies are planned for the model before it is available for public use.

Different placements of center pivot irrigation systems in irregular farm field: FIG. 1 (left), FIG. 2 (center), and FIG. 3 (right).







Perceptions of Passive Solar Housing

C. BUGG and J.O. BEAMISH, Home Economics Research

PASSIVE SOLAR housing has the potential to reduce the residential energy consumption of traditional fossil fuels. This housing type uses construction materials and methods, design concepts, landscaping, and site orientation to retain the sun's heat in winter and to reduce solar heating in summer.

Houses with sunspaces and greenhouses utilize passive solar technology. Other types of passive solar systems use masonry walls or water tanks to store solar heat. All of these systems require adequate southern exposure to assure solar gain and should have shading devices, such as trees, eaves, and overhangs, to reduce solar heating in summer months.

Passive solar systems are mechanically simple, require little or no maintenance, and promote lower utility bills. Despite these advantages, this energy saving alternative has not been widely adopted. Housing intermediaries, such as builders, bankers, and housing officials, have often been skeptical of the investment potential of these systems. These intermediaries believe consumers have negative attitudes about passive solar housing. By identifying consumers' true perceptions of passive solar housing, adoption strategies can be developed and targeted to overcome potential consumers' and housing intermediaries' hesitation to accept passive solar housing.

A recent regional survey, "Perceptions of Alternative Housing," sought to identify consumers' awareness and perceptions of several housing alternatives including passive solar. Households were interviewed in seven Southern States: Alabama, Arkansas, Florida, Georgia, North Carolina, Oklahoma, and Virginia. Four counties in each state were selected by a stratification process based on median annual income and number of nonfarm households. Households in each county were randomly selected from 1980 property tax rolls with a total sample size for the region of 1,804.

An Alabama Agricultural Experiment Station study examined demographic characteristics of survey respondents who were aware of passive solar housing and would consider this housing alternative, as well as those who were aware of passive solar housing but would not consider it. Respondents' perceptions of passive solar housing were also analyzed.

Fifty-four percent of the survey respondents indicated they would consider living in a passive solar home, and therefore were classified as adopters. The 27% who definitely or probably would not consider such housing were classified as nonadopters. Nineteen percent of the respondents were undecided about whether they would adopt passive solar housing.

Data showed that 70% of adopters had heard about passive solar housing, but only 19% had seen this house type. Only 3% of the adopters had actually lived in passive solar housing. Twenty-six percent of the adopters had not known about passive solar housing.

Of the nonadopters, 58% had heard about passive solar housing, but only 11% had seen this house type. Only one nonadopter had lived in this type of housing. Forty percent of the nonadopters had not known about solar passive housing.

Those who had some awareness of this housing alternative were classified as knowledgeable adopters and nonadopters. Forty percent of those surveyed were classified as knowledgeable adopters and 16% were classified as knowledgeable nonadopters.

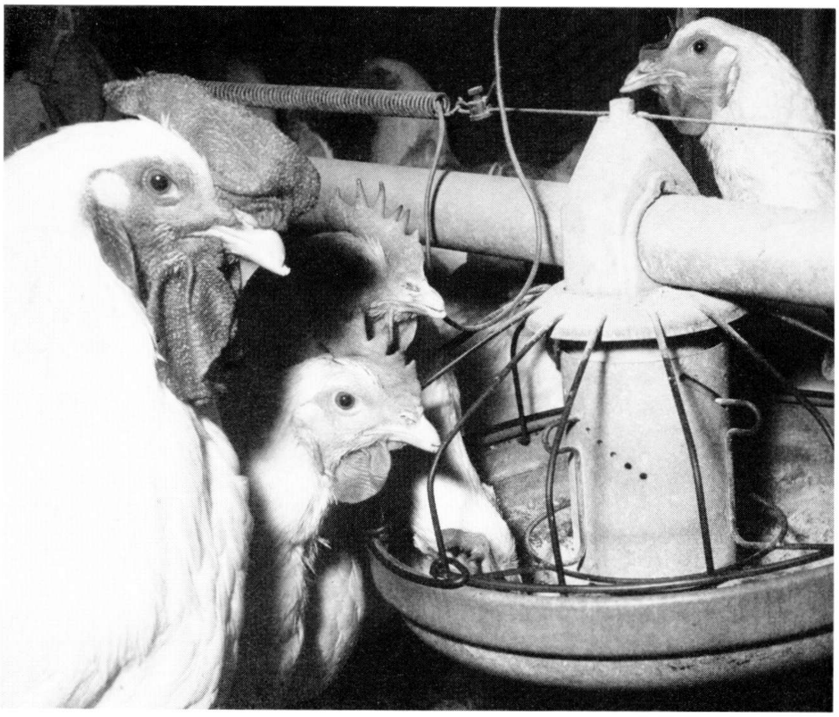
The average age of the knowledgeable adopters was 46. They were primarily white, in the middle stages of the family life cycle, in professional or technical occupations, and had an average take-home income of $20,570 in 1980. The knowledgeable nonadopters were most often older (average age 56), white, retired, and in a later stage of the family life cycle. They had an average income of $14,706.

Knowledgeable adopters indicated several characteristics as positive features of solar housing. Most frequently mentioned were energy efficiency, design/appearance, comfort/convenience, and use of the natural environment. Knowledgeable nonadopters also reported energy efficiency as a positive feature of passive solar housing, but a high proportion of responses indicated that they were not sure or did not know what features they liked.

When asked what they disliked about passive solar housing, knowledgeable adopters' most frequent responses were nothing, uncertain/don't know, and design/appearance. Knowledgeable nonadopters also frequently reported uncertain/don't know and design/appearance. In addition, they reported the cost of passive solar housing as a negative feature.

Passive solar housing is an energy-saving alternative that may be acceptable to many consumers in the Southern region. The findings indicate that many people are at least aware of this alternative and have some understanding of its benefits. Even people who would not adopt the alternative perceived it as energy efficient. However, many of the nonadopters who were aware of passive solar housing responded they did not know what they would like or dislike about it. This seems to indicate a need for further dissemination of relevant information to increase knowledge about this type of housing. Negative perceptions of design/appearance and cost factors suggest that the development of passive solar designs that are attractive and economical adaptations of traditional housing styles could improve acceptability. Better understanding of passive solar housing and the development of varied design techniques could increase the acceptability of this housing alternative among nonadopters and improve its marketability among housing intermediaries.

Southern exposure on this Elkmont, Alabama, home permits solar gain in winter months. Reflective shades and overhangs prevent overheating of storage tanks and interior spaces during warmer periods.



Grain sorghum proves high quality alternative broiler breeder ration

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C.D. SUTTON, Cooperative Extension Service

DEPENDING upon geographic location and market price, sorghum and wheat are used instead of corn in poultry feed. Such utilization has been mostly limited to broilers, pullets, and commercial layers, with almost none included in broiler breeder rations. However, recent poultry research at the Alabama Agricultural Experiment Station indicates that these alternative grains are well suited for broiler breeder rations.

Because of the feeding pattern of broiler breeders, incorporation of alternate grains into their rations would appear to be both practical and beneficial. During the growing period, as well as throughout the production cycle, breeder-type birds are restricted to approximately 70-75% of full feed. Therefore, palatability problems that sometimes occur with alternate grains in full-fed birds would probably not be as prevalent with the restricted broiler breeder.

Three experiments were designed to determine the feasibility of using grain sorghum as the sole source of grain in a broiler breeder ration. Two of the experiments were done with standard-size broiler breeders, while the third study utilized the dwarf broiler breeder. Reproduction parameters measured in the experiments included age at sexual maturity, egg production, fertility, hatchability, shell quality, and body weight. One of the experiments has been completed (terminated when birds were 52 weeks of age), while preliminary data are available on the other two studies.

In experiments 1 and 2, 750 Arbor Acre hens were placed in cages at 19 weeks of age. When the birds were 22 weeks of age, half the population was placed on a breeder ration with corn as the sole grain source, while the other half was placed on a ration containing sorghum as the grain source. The two rations were formulated to be isocaloric, and to contain similar levels of essential amino acids. The birds were artificially inseminated weekly to evaluate fertility and hatchability. Egg production was recorded daily and summarized over 2-week periods. Shell quality, body weight, and egg weight were measured every 4 weeks.

In Experiment 3, 372 dwarf broiler breeder females were used. As in the previous two studies, half the population was fed a ration containing corn as the only grain source, while the other half was fed a diet containing sorghum as the source of grain. Unfortunately, age at sexual maturity could not be established in this experiment due to lack of individual hen observation. However, all other parameters measured in experiments 1 and 2 are also being recorded in this study.

In Experiment 1, birds fed grain sorghum rations had higher levels of production after 24 weeks of age than those fed corn rations. In addition, the average age at sexual maturity (age at first egg) was earlier for the sorghum-fed birds (224 days) than for the corn-fed birds (230 days). Body weights of birds at 30 weeks of age were heavier for the sorghum than for corn-fed birds; this difference remained throughout the experiment. Fertility, hatchability, egg size, and shell quality were not affected by grain source.

The difference in percent hen-day production between rations followed the same pattern in Experiment 2 as in Experiment 1, but differences were less. Nevertheless, production of the sorghum-fed birds was equal to or greater than that of the corn-fed birds for 12 of the 14 weeks when production was measured. At 36 weeks of age, body weight of the sorghum-fed birds was slightly heavier than that of the corn-fed birds. As in Experiment 1, there have been no differences yet in fertility, hatchability, egg weight, or shell quality.

Results from Experiment 3 with the dwarf birds are similar to the previous two experiments, with birds consuming sorghum rations showing higher levels of production than those consuming corn rations. Although age of sexual maturity was not observed in this study, it is reasonable to assume birds fed sorghum rations matured earlier than those consuming corn-based rations because the rate of egg production has been higher for that group since the onset of peak production.

Corn has traditionally been the standard grain used in poultry rations, while alternate sources have been considered inferior for maintaining optimum performance at least cost. The objective of these studies was to determine reproductive performance when sorghum was substituted for corn in broiler breeder rations. Results to date from these three experiments, however, indicate that sorghum is not only equivalent, but is superior to corn in broiler breeder rations for maintaining egg production and age of sexual maturity. In addition, grain sorghum rations did not affect fertility, hatchability, egg size, or shell quality.

Currently, no explanation can be offered for the better production responses obtained with grain sorghum versus corn rations based on the known nutritional value of the diets. Chemical analysis of the two rations showed that the protein content of the corn diet was 15.7% and that of the sorghum diet was 16.5%. Although the sorghum ration was 0.8% higher in protein than the corn ration, previous Experiment Station studies have shown that this small difference in protein would not affect either egg production or age at sexual maturity. There were few differences in amino acid profiles between the two rations. Thus, nutritional content alone does not explain the unexpected positive results obtained from feeding grain sorghum versus corn rations to broiler breeders.

Nitrogen Fixation in Soybeans Reduces Production Inputs

D.L. THURLOW and A.E. HILTBOLD, Agronomy and Soils Research

LEGUMES HAVE ACCESS to a source of nitrogen that is not available to other plants—the atmosphere. That's why soybeans and other legume crops make high yields of protein without requiring N fertilization.

The ability of *Rhizobium* bacteria in the root nodules of legumes to take gaseous nitrogen from the atmosphere and fix it into forms usable by plants is well known. What has not been well defined, however, is just how much usable nitrogen is fixed in soybeans. That's the reason for an Alabama Agricultural Experiment Station study that measured amount of nitrogen fixation by soybeans and determined its dollar value.

Results of this experiment show that 150-200 lb. of N per acre are fixed in soybean roots. This amount from the atmosphere would be equal to double that amount from commercial sources, representing a value in the $75 to $100 per acre range.

These findings are averages of 8 years of research at 11 locations across Alabama. Yield of beans and nitrogen content of plant material were compared among Lee (a nodulating variety), N-N Lee (a non-nodulating bean), and a group of maximum yielding varieties. The amount of fixed N was determined as the difference in total N contents of N-N Lee and Lee, or other fixing varieties, at maturity.

Bean yields of Lee and the other N-fixing varieties were two to three times greater than those of N-N Lee. Crop N contents showed even greater differences due to fixation. Atmospheric N fixation in Lee amounted to 154 lb. per acre, while the maximum yielding varieties fixed 191 lb. per acre.

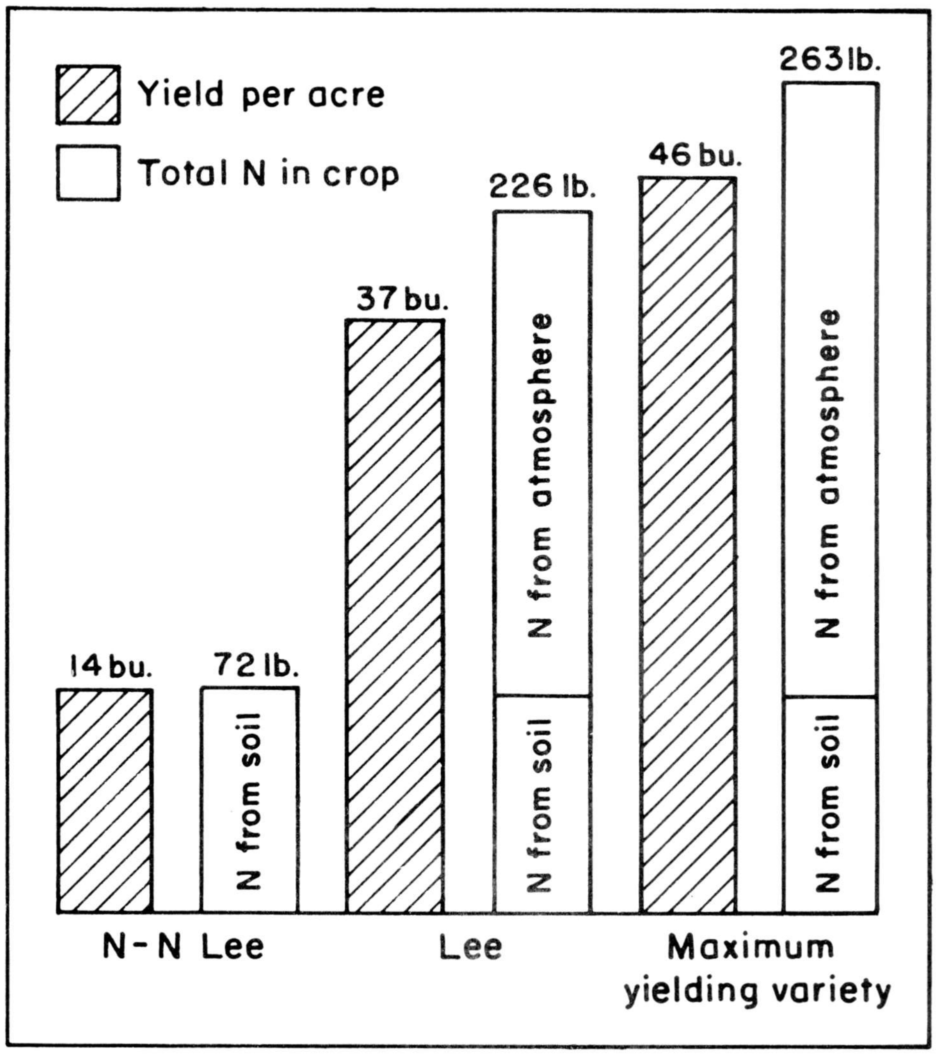
From 70 to 73% of the N in N-fixing soybeans was derived from the atmosphere. If the crop were grown without benefit of N fixation, high rates of N would have to be applied to obtain equivalent N uptake and yield. At current fertilizer cost, N fixation is worth $75 to $100 per acre.

Another benefit of N fixation is the residual N left in the field in leaves, stems, and pods after soybean harvest. Residues of Lee soybeans contain about 60 lb. of N per acre, of which 42 lb. came from the atmosphere. This N becomes available to following crops such as wheat.

The capacity of soybeans to fix large amounts of atmospheric N is particularly important to growers in the Southeast. Soils in this region characteristically supply little N from organic matter, crop residues, or carryover fertilizer. Soils of the Midwest, on the other hand, supply more N from these reserves. Thus, Midwest soybeans fix correspondingly less atmospheric N than soybeans grown in the South. Midwestern soybeans obtain about 40% of their N from the atmosphere, as compared with an estimated 70% or more in Alabama.

This ability of N fixation to provide adequate N for high yields in the Southeast has helped make soybeans a profitable crop in the region.

Value of nitrogen fixation by soybeans is illustrated by differences in yield and total N in crop between nodulating and non-nodulating varieties.



Root Systems Vary Among Corn Hybrids

R.L. IRWIN and W.C. JOHNSON
Agronomy and Soils Research
C.B. ELKINS, Coop. USDA

THERE HAS BEEN a revolution in corn production in the last two decades. Before 1960, open pollinated varieties were planted in wide rows at low populations, with complete mechanical cultivation and moderate fertilization used. Today, efficient corn hybrids are planted thickly, with minimum tillage, chemical weed control, and high fertilization practices followed. These changes have been made possible by new technologies resulting from research in plant breeding, agronomy, engineering, and chemical weed control.

Farmers today have a vast array of distinctly different corn hybrids from which they may choose those best suited for the management system used. Traditionally, corn hybrids have been developed by selecting those that produce the most harvested grain of acceptable quality. Little attention has been given to specific morphological characteristics and almost none to those relating to the roots. This is rather surprising since grain yields ultimately depend on the plant's ability to obtain adequate nutrients and water from the soil.

A hybrid developed using one specific cultural system would be best adapted to that system and might not perform as well as other hybrids when grown using a different system. Differences among the roots of hybrids could influence their cultural adaptation. Wide variations in roots were discovered in an Alabama Agricultural Experiment Station study done to survey corn root systems for variation in several characteristics that could be important in developing management systems.

Eleven hybrids were chosen from the Alabama Agricultural Experiment Station's preliminary corn hybrid test at the Plant Breeding Unit, Tallassee. The soil is Cahaba fine sandy loam. Roots of each hybrid were excavated and carefully washed when the grain was in the milk stage of maturity. The washed root systems were taken to the laboratory and the following data taken on each plant: number of nodal roots, nodal root diameter, nodal root angle to the stalk, and number of branch roots.

EDITORS NOTE: R. Lamar Irwin is a recent B.S graduate from Foley, Alabama. This report contains data he obtained during his senior year in a special research project directed by the junior authors.

Acute type roots of the two varieties at top contrast with the more horizontal type of the bottom two varieties.

Two distinct phenotypes were obvious as soon as the soil was washed away. The hybrids had either horizontally growing nodal roots or nodal roots with an acute angle to the stalk. These two types of root systems are illustrated by the photographs. Zimmerman Z28Y and Sunbelt 1827 are examples of the acute type roots, whereas Coker EX 2454 and Sunbelt 1880 illustrate the more horizontal type.

This limited survey revealed large morphological differences. However, it is not known how these measured differences will influence or determine a hybrid's suitability for a particular system of culture, such as "no-till." Experiments are underway to explore the role of root morphology in the adaptation of hybrids to different systems of culture.

CHARACTERISTICS OF ROOTS ARISING FROM THE THIRD HIGHEST ROOT BEARING NODE

Brand/hybrid	Number of roots	Root diameter	Root angle	Secondary roots/2 cm
	No.	*mm*	*Deg.*	*No.*
Sunbelt 1827	24	4.0	40	5
Sunbelt 1880	14	6.7	--	11
Zimmerman Z28Y	15	7.1	51	20
Zimmerman Z27Y	12	7.3	56	36
Rag 5X	19	6.5	54	21
Stauffer 57759	19	6.8	70	28
Coker Ex 2454	5	7.5	62	22
Jacques 7900	11	7.2	84	16
Ring Around 1502 M	11	7.2	85	43
FFR 744C	16	8.6	61	0
Pioneer 3147	10	6.3	68	24

AUrora: A high quality "Jumbo" cantaloupe

J.D. NORTON, R.D. COSPER, D.A. SMITH, and K.S. RYMAL, Horticulture Research

AURORA, a new cantaloupe variety developed and released by the Alabama Agricultural Experiment Station, helps meet the needs of cantaloupe growers by combining multiple disease resistance with large, good quality fruit. It is adapted for growing throughout the Southeast, where mildew and blight are serious disease problems.

Diseases like downy mildew, powdery mildew, and gummy stem blight have seriously limited cantaloupe production in the humid Southeast because most varieties are susceptible. Although varieties resistant to downy mildew and powdery mildew have been available since the late 1930's, these older varieties are not dependable enough for today's melon growers. Thus, the new AUrora variety, the first large fruited "Jumbo" type with resistance to gummy stem blight, may fill an important need in the region.

Development of AUrora is the result of intensified efforts to breed cantaloupes suited for growing in the South. Southland, Gulfcoast, and Chilton were earlier Auburn releases, and other varieties have been released in Florida, Georgia, and South Carolina, as well as by the USDA Agricultural Research Service.

Backcrossing and inbreeding were used to obtain resistance to gummy stem blight, downy mildew, and powdery mildew. After crossing Southland with PI 140471, Experiment Station researchers used backcrossing and disease screening to select disease resistant plants that produced high quality fruit.

Resistance to gummy stem blight came from PI 140471 and resistance to downy mildew and powdery mildew came from Southland.

The fruit of AUrora mature in 70-75 days. They are mostly round to round-oblong, slightly ribbed, and well covered with a medium net. The flesh is thick, deep orange (24A[1]), and has excellent flavor and aroma. Taste tests indicated that the edible quality (color, texture, taste) was higher for AUrora than for Planters Jumbo and Edisto 47. Ascorbic acid was also higher than in Planters Jumbo and Mainstream, table 2. The seed cavity is small. Fruit size varies with different fertility and moisture levels, production areas, and growing seasons. The average size is 4.1 lb. with a diameter of 6 in. and length of 7 in.

Size for the commercial pack is 18. Since this is too large for the standard 45, 36, 27, and 24 pack, the "Jumbo" melons are suited for local markets, home gardens, and other outlets for high quality cantaloupes.

AUrora fruit are firm enough for harvesting and handling in commercial markets. Flesh is firm at full slip, but softens to excellent dessert quality 3 to 4 days after harvest.

[1]Colour Chart, The Royal Horticulture Society, London.

The new variety was grown as AC-68-52 in trials at Auburn, E. V. Smith Research Center, and other Experiment Station units in Alabama, in the Southern Cooperative Cantaloupe Variety Trials in other Southern States, and in demonstration plantings by commercial growers and home gardeners. Although resistant to prevalent diseases, such disease control measures as crop rotation, seed treatment, and spraying may be necessary.

AUrora compares favorably with established "Jumbo" type varieties in disease resistance, yielding ability, shipping quality, and edible quality as indicated by taste tests and soluble solids, tables 1 and 2.

TABLE 1. DISEASE INDEX RATINGS FOR DOWNY MILDEW, POWDERY MILDEW, AND GUMMY STEM BLIGHT

Variety	Disease index[1]			
	Downy mildew	Gummy stem blight	Powdery mildew	Average
AUrora	1.0	2.0	1.0	1.4
Chilton	1.0	1.5	1.0	1.2
Edisto 47	1.5	5.0	1.5	2.7
Gulfcoast	1.0	1.5	1.0	1.2
Mainstream	1.5	4.0	1.5	2.3
Planters Jumbo	1.5	4.0	1.5	2.3

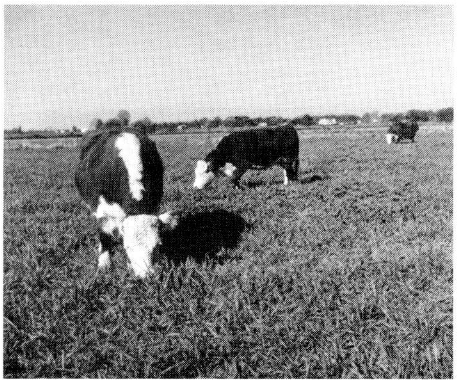
[1]Disease index: 0 = no injury, up to 5 = all plants severely damaged.

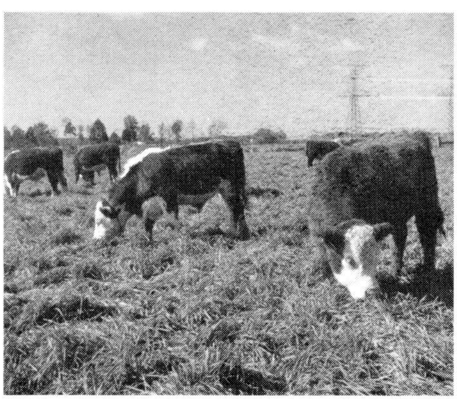
TABLE 2. AVERAGE YIELD, FRUIT WEIGHT, SOLUBLE SOLIDS, ASCORBIC ACID, TASTE TEST, AND RIND FIRMNESS OF CANTALOUPE VARIETIES, E. V. SMITH RESEARCH CENTER, 1977-83

Variety	Yield per acre	Fruit weight	Soluble solids[1]	Ascorbic acid[2]	Taste test[3]	Rind firmness[4]
	Lb.	*Lb.*	*Pct.*			*Lb./sq. in.*
AUrora	34,246	4.19	11.90	65.0	7.97	47.47
Chilton	28,570	2.96	12.91	61.3	8.23	72.16
Edisto 47	23,561	4.37	11.85	80.0	7.41	40.08
Gulfcoast	29,387	3.09	12.14	52.5	8.07	68.41
Mainstream	23,152	3.18	10.56	50.0	8.00	52.87
Planters Jumbo	19,665	3.62	10.63	56.0	7.67	40.86

[1]Total soluble solids determined with a Bausch and Lomb refractometer, 0-25% scale.
[2]Ascorbic acid content in milligrams per 100 grams of fruit.
[3]Taste test ratings are the average scores on fresh, chilled fruit: 9 or 10 = highly acceptable, 7 or 8 = acceptable, 5 or 6 = barely acceptable, below 5 = unacceptable.
[4]Puncture test performed with Instron 1122 Instrument, 1 cm Magnus Taylor Probe.

Feeding Cattle to Slaughter Weights Can Reduce Producers' Risks





K.A. ADEROGBA, G.M. SULLIVAN, and N.R. MARTIN, Agricultural Economics and Rural Sociology Research
R.R. HARRIS
Animal and Dairy Sciences Research

CARRYING CALVES to slaughter weights can be an economical alternative to selling calves at weaning. A vertically integrated operation, in which more than one step of the production cycle is completed on the farm, can increase earnings to producers and reduce risks associated with the production and marketing of calves.

An Alabama Agricultural Experiment Station study examined production and market strategies for winter forage-grain beef production systems in southwest Alabama. Forage availability, animal weights, and market prices were analyzed in a computer simulation model to select the optimum number and sex of cattle to be raised on a representative farm to gain the greatest net return based on costs and prices during 1961-83.

For the study, a representative farm size of 325 acres was assumed for the area with no competing crop activities for the available land. The pasture used was a rye-ryegrass-clover mixture that was established in September according to Auburn University's recommended practices. The fertilization rate was 100-60-60 lb. of N, P, and K per acre with split applications of N at planting in September and later in February before spring growth.

The type of cattle available for grazing were steers and heifers of British breeds for three starting weight categories: 350 lb. (light), 450 lb. (medium), and 550 lb. (heavy). Cattle were purchased in October, preconditioned, and placed on pasture in November. Cattle required minimal supplement while on grazing. Stocking density of the pasture was inversely related to the three weight classes of cattle.

The feed ration was 67% corn, 10% each of cottonseed meal, cane molasses, and bermudagrass hay, and 3% minerals. All feeds were assumed purchased at market prices, and cattle were fed on the farm without any specialized feeding facilities. Two marketing alternatives were analyzed: (1) selling directly off pasture in March, April, or May, and (2) selling after grain feeding for 30, 60, 90, or 120 days after grazing.

Research data on forage and grain finishing trials at the Lower Coastal Plain Substation at Camden were used in the analysis. Figures for forage production of rye-ryegrass-clover and weight gain from forage and grain were available for 10 years from the Substation. A 14-year study of steers slaughtered directly from pasture without supplemental feeding resulted in 41% Choice carcasses, 53% Good, and the remainder Standard.

Analysis of market prices during 1961-83 showed that the optimum feeding system for all weight classes of steers and light weight heifers was 30 days of grain feeding following continuous grazing from November through May. Medium and heavy weight heifers were most profitable when sold directly off pasture in May when grazing was finished. Feeding longer than 30 days was not profitable in any case.

All steer weight classes had higher net returns and lower associated risk than did heifers. The risk variability coefficients for steers were 71, 84, and 95 cents, which means that each dollar of net returns has less than one dollar of absolute risk, see table. The higher risk coefficients for heifers reflect lower net returns and greater price variability from year to year for this class.

When all classes and weight categories were considered together, light weight steers generated the highest net return with 454 steers grazed until May, then grain fed for 30 days, and sold at an average weight of 802 lb. The net return was $42,023 to land, labor, and management with risk of $29,818 in absolute deviation in the return. Approximately 136 tons of feed were required for the 30 days while cattle were on feed.

The results indicate that an integrated forage and grain feeding system for stocker cattle can be profitable in Alabama. Limited grain feeding of cattle is possible after a winter grazing program with on-farm feeding. The selection of light weight stocker steers generated greater net returns for the operation with lower risks than did other classes of cattle.

An increased supply of grain-fed cattle in Alabama will require some adjustments in the marketing system for these types of cattle. Improved coordination among producers, meat packers, and processors will be necessary to determine preferred carcass size, yield, and grades for cattle. The results show that vertical integration of cattle on forage and grain is economically sound for producers with the potential for reducing marketing and production risks.

NET RETURNS AND RISK FOR VERTICALLY INTEGRATED CATTLE PRODUCTION SYSTEMS OF FORAGE AND GRAIN FEEDING FOR A 325-ACRE PASTURE

Stocker category by starting weights	Grazing period	Feedlot period	Number produced	Stocking density/acre	Maximum net returns	Maximum risk	Risk variability
	Mo.	*Days*	*Head*	*Head*	*Dol.*	*Dol.*	*Dol.*
Steers							
Light (350)	Nov.-May	30	454	1.39	42,023	29,818	0.71
Medium (450)	Nov.-May	30	396	1.22	32,303	27,095	.84
Heavy (550)	Nov.-May	30	362	1.11	27,732	26,455	.95
Heifers							
Light (350)	Nov.-May	30	461	1.42	23,687	27,055	1.14
Medium (450)	Nov.-May	--	398	1.22	9,307	26,233	2.81
Heavy (550)	Nov.-May	--	365	1.12	14,348	24,693	1.72

Multiple Herbicide Applications, Herbicide Plus Cultivation Control Bristly Starbur in Peanuts and Soybeans

L. WELLS and R.H. WALKER, Agronomy and Soils Research

BRISTLY STARBUR may not be a well known weed in much of the State, but it is getting the attention of peanut and soybean growers in south Alabama. As noted in Alabama Agricultural Experiment Station tests, this broadleaf annual can cause significant yield losses. In addition to competing for water, nutrients, and space, it can increase disease problems and interfere with crop harvest.

Apparently bristly starbur is increasing in prevalence and distribution, probably because of widespread use of herbicides such as Treflan®, Balan®, and Lasso®. These herbicides have little effect on large-seeded broadleaf weeds, resulting in the weed spectrum shifting from mostly grasses to predominantly broadleaves.

Fortunately, there are methods available that control this pest. Multiple applications of herbicides or combinations of herbicides and cultivations gave good control of bristly starbur and resulted in high crop yields in Experiment Station tests.

Several systems of control for bristly starbur in peanuts were evaluated in 1983 tests at the Wiregrass Substation, Headland. Evaluated were herbicides commonly used at cracking time or as postemergence over-the-top applications, alone or with one or two cultivations, and in various combinations. Data were collected in peanuts grown on an area heavily infested with the weed.

Findings were that cultivation or cracking time herbicides alone provided poor season-long control. The end result was low yields. Herbicides plus cultivations or multiple applications of Premerge 3® generally provided acceptable control, and yields were similar to the weed-free check. Use of Amiben® plus Premerge 3 caused moderate injury to peanuts, and this was reflected in a trend toward lower yields.

An experiment at the same location in 1981 evaluated systems for controlling bristly starbur in soybeans. The test included preemergence herbicides alone, preemergence plus postemergence herbicides applied over-the-top, and one, two, or three cultivations alone.

All of the systems gave acceptable control, except Dyanap® applied preemergence at 3 lb. per acre or Benazolin® postemergence over-the-top at 0.25 lb. per acre. However, yields were lower when only postemergence-applied herbicides were used, as compared to cultivations, preemergence treatments alone, or preemergence plus postemergence treatments.

Using only herbicides applied postemergence over-the-top resulted in lower yields because of weed competition before the herbicides were applied (5 weeks after planting). Therefore, early season control is imperative, and can be achieved by using an effective preemergence herbicide, such as Lexone®, or by early cultivation.

Results with several effective treatments, given in the tables, indicate that bristly starbur can be controlled in both soybeans and peanuts. However, control was more readily achieved in soybeans than in peanuts. Using the prescribed rates of Premerge 3 in peanuts and Lexone in soybeans resulted in acceptable control and high crop yields. Both herbicides are labelled for the crops specified, and current economic conditions do not prohibit their use.

TABLE 1. BRISTLY STARBUR CONTROL AND PEANUT YIELDS WITH DIFFERENT CONTROL SYSTEMS

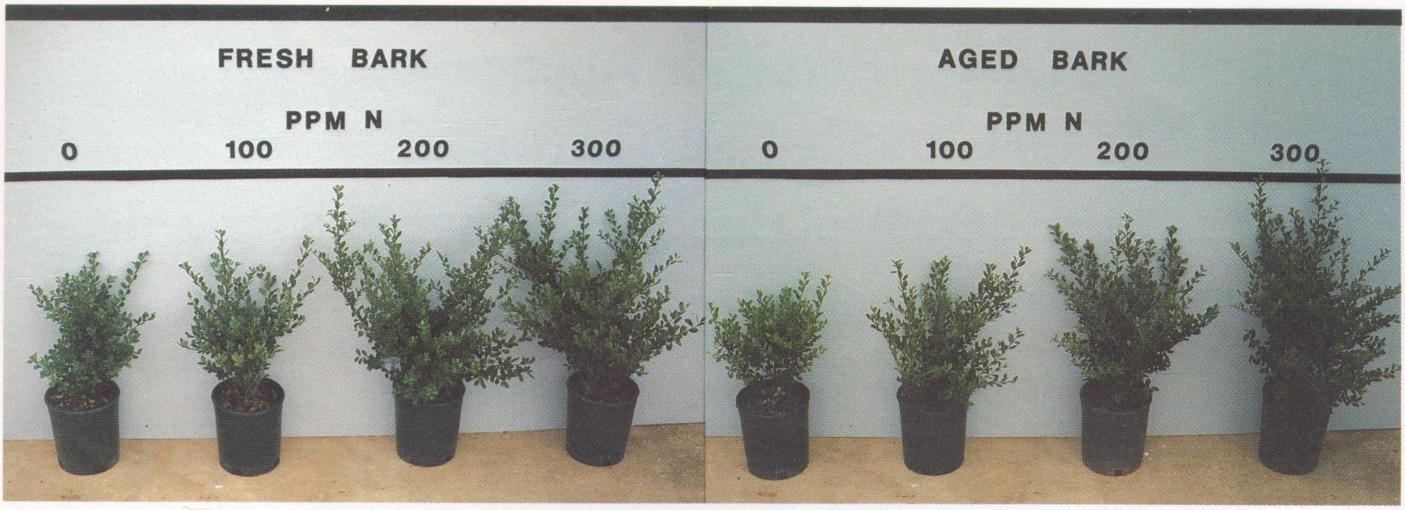
Treatment[1]	Bristly starbur control				Peanut yield/ acre
	June 2	June 14	July 18	Aug. 10	
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Lb.*
2 cultivations	0	78	62	49	1,827
Lasso + Premerge 3 (AC)—3.0 + 1.5 lb.	96	51	32	9	1,249
Lasso + Premerge 3 (AC)—3.0 + 1.5 lb. + 1 cult.	98	90	74	61	2,461
Premerge 3 (AC)—1.5 lb. + 1 cult.	96	89	75	71	2,605
Premerge 3 (AC) + Premerge 3 (POT)—0.75 + 0.75 lb.	97	58	94	97	2,407
Premerge 3 (AC) + Premerge 3 (POT)—0.75 + 0.75 lb. + 2 cult.	98	92	94	98	2,723
Premerge 3 (AC) + 2,4-DB (POT)—1.5 + 2.0 lb. + 2 cult.	97	90	86	88	2,859
Weed-free check	99	99	99	99	2,967
Weedy check (no control)	0	0	0	0	850

[1]AC is over-the-top application 19-21 days after planting; POT designates postemergence over-the-top applications, first one 45-48 days after planting and a second, if applicable, 88-91 days after planting.

TABLE 2. BRISTLY STARBUR CONTROL AND SOYBEAN YIELDS WITH DIFFERENT CONTROL SYSTEMS

Treatment[1]	Soybean injury		Bristly starbur control		Soybean yield/ acre
	June 23	Aug. 2	June 23	Aug. 29	
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Bu.*
1 cultivation	11	1	0	90	47
Lexone (PRE)—0.38 lb.	16	1	99	96	48
Lorox® (PRE)—1.5 lb.	19	3	85	84	43
Lexone (PRE) + Dyanap (POT V10)—0.38 + 2.25 lb.	25	12	99	99	51
Dyanap (POT V10 + V16)—1.5 lb.	3	24	0	97	30
Basagran® (POT V10 + V16)—0.50 lb.	6	3	0	96	37
Blazer® (POT V10 + V16)—0.38 lb.	13	10	0	71	35
Weed-free check	5	0	100	98	50
Weedy check (no control)	4	5	0	0	34

[1]PRE is application to soil surface immediately after planting; POT designates over-the-top application; V10 and V16 denotes 10- and 16-node stages, respectively.



PLANT GROWTH SIMILAR IN FRESH AND AGED PINE BARK

G.S. COBB, Ornamental Horticulture Substation, G.J. KEEVER, Horticulture Research

PINE BARK is commonly used as a growth medium or medium component in the production of container-grown woody ornamentals. Growers have reported that the use of fresh, instead of aged, pine bark results in reduced plant growth. However, Alabama Agricultural Experiment Station research indicates that fresh bark does not require additional N to make it comparable in quality to aged bark.

Since fresh bark typically has a higher carbon to nitrogen (N) ratio than aged bark, there is an increased demand for N by microorganisms actively decomposing such bark. Because of this increased demand for N in fresh pine bark, it was believed that additional N might be necessary for crop growth similar to that in aged bark. Thus, effects of supplemental N on the growth of selected woody ornamentals growing in both bark types were evaluated in the Experiment Station study.

Milled pine bark was obtained and stored in an unprotected outdoor location. One year later a new supply was obtained from the same source. Prior to use, both barks were amended with 10 lb. of dolomitic limestone, 2 lb. superphosphate, 2 lb. gypsum, 1.5 lb. Micromax, and 10 lb. Osmocote 17-7-12 per cubic yard. Uniform *Euonymus japonica* Microphylla, *Ilex crenata* Compacta, and *Rhododendron* hybrid Hino-crimson liners were potted in 1-gal. plastic containers in August 1981. Euonymus and holly were grown in full sun, Hino-crimson azalea was grown in 47% shade, and all plants were irrigated as needed by overhead impulse sprinklers. Treatments included fresh or aged pine bark with weekly applications of 0, 100, 200, or 300 p.p.m. N from ammonium nitrate. After 3 months, foliar color, shoot growth, and foliar and medium analysis were evaluated.

Compacta holly grown in fresh and aged pine bark with supplemental nitrogen show comparable growth.

Color ratings at 0 or 100 p.p.m. supplemental N and growth indexes at all N levels were generally higher for plants grown in fresh bark than for those grown in aged bark. Foliar rating and growth indexes increased with increasing rates of N regardless of bark age. Plant dry weight increased with increasing N, and growth generally was not different between bark types. With both fresh and aged bark, foliar N increased, while foliar potassium (K), phosphorus (P), calcium (Ca), magnesium (Mg), iron (Fe), manganese (Mn), and zinc (Zn) decreased with increasing levels of N fertilization. Growth-medium analysis revealed higher levels of Mg in aged bark than in fresh, while nitrate-N, P, K, Ca, soluble salts, and pH did not differ between bark types or among levels of supplemental N fertilization.

Plant growth and appearance were as good in fresh as in aged bark, even without supplemental N. This indicates that fresh bark did not require additional N compared to aged bark, and that bark of both ages responded similarly to incorporated Osmocote. Foliar color improved with supplemental N up to 200 p.p.m. and growth increased as N increased. This indicates the benefits of supplemental N fertilization when Osmocote 17-7-12 is incorporated at 10 lb. per cubic yard in a pine bark growth medium.

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