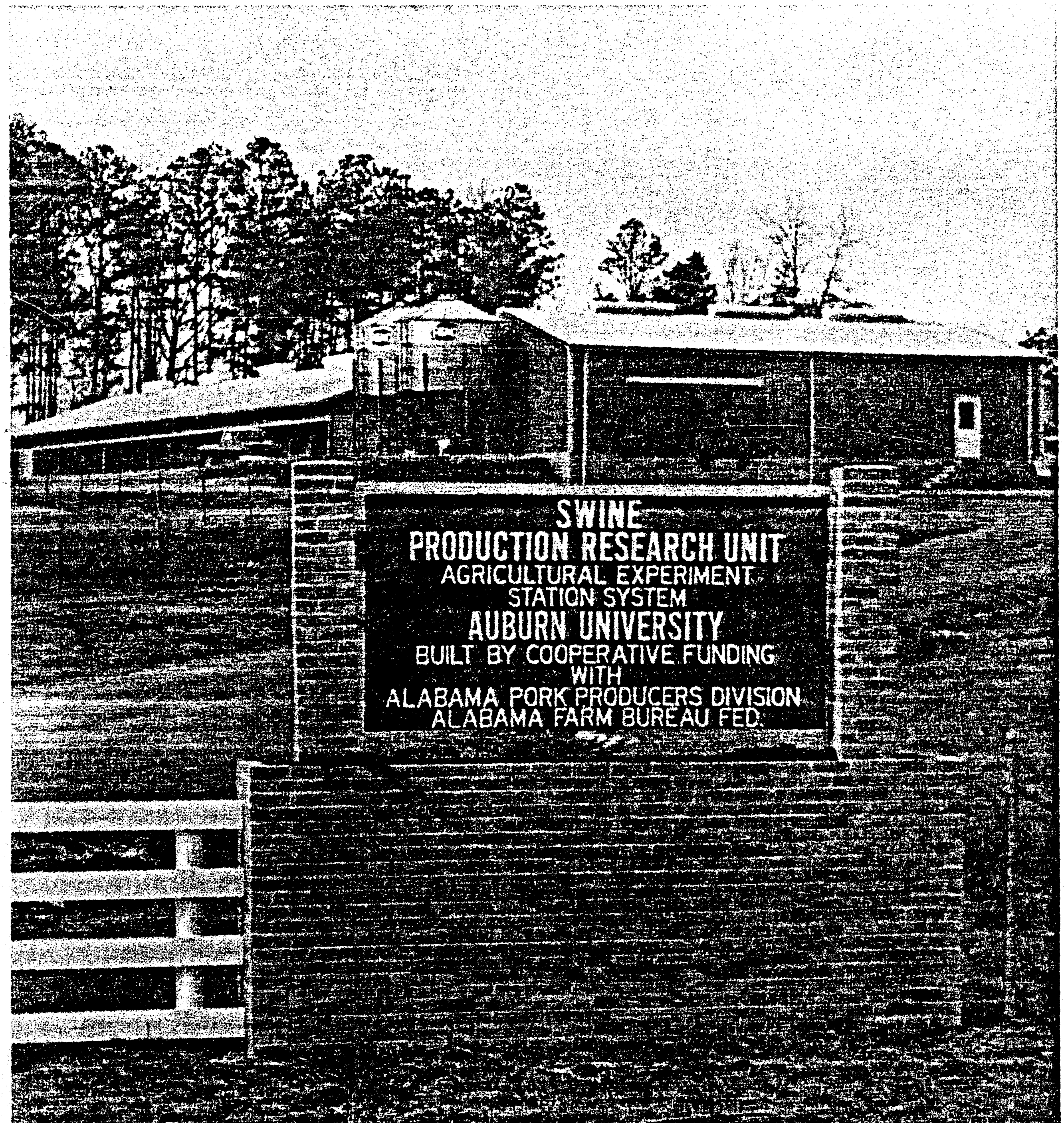
highlights

of agricultural research



Volume 25, No. 1

Spring 1978

Agricultural Experiment Station
R. Dennis Rouse, Director

Auburn University
Auburn, Alabama

Director's Comments

BECAUSE OF THE SERIOUSNESS of the farm situation, I thought it appropriate to ask one of our senior agricultural economists, Dr. Morris White, to prepare the Director's Comments for this issue.

The current unfavorable farm situation that has spawned farmer demonstrations and threats of strikes developed because of the very nature of agricultural production and the effects of government farm programs and world market conditions.

R. Dennis Rouse

Agricultural production consists of a series of continuous biological processes that cannot be turned on or off in a short time span. The elapsed time between making a decision to produce and the date the product is ready for market can be long enough that supply and demand often change during the period. The seasonal nature of agricultural production also creates problems—in both production and marketing. The high ratio of overhead costs to direct costs forces farmers to produce at full capacity even though they are virtually powerless to increase domestic or foreign markets. Since the farmer's price for his products is determined by factors other than time, effort, and expense of production, he is required to make large production investments with no assurance of getting back his investment or of being paid for his risk and labor.

Government attempts to solve the "farm problem" began in 1933 with passage of the Agricultural Adjustment Act, a measure designed to reduce supplies of wheat, corn, cotton, rice, peanuts, and tobacco. Under this "Parity Program," farm prices were supported by the Government at a level that would give these commodities buying power equal to what the same crops had in 1910-14. Eligibility required that farmers accept acreage allotments. The basic provisions of this program continued through the early 1960's, spanning the period when research technology became available to allow tremendous yield increases. Farmers took advantage of this technology to boost production since they were eligible for support prices on all allotted acres. Thus, the program that was begun to reduce supplies of farm products instead resulted in increasing quantities in Government storage. At the same time, world markets were lost because support prices were higher than the world market.

In response to public pressure to reduce the tremendous cost of storing commodities accumulated by the Government, the Food and Agricultural Act was passed in 1965. Under this legislation, farmers would sell commodities on the open market and receive income support through direct payments. By 1972 this had greatly reduced the volume in storage.

The 1972 Russian purchase of a large quantity of grain, along with two poor crop years worldwide, increased the world market. Two devaluations of the dollar boosted foreign demand for U. S. food and feed grains, and the government encouraged sales to help overcome deficits in U. S. balance of payments brought on by high imports of high priced oil. Farmers responded to Government encouragement and high prices to produce at full capacity. Then commodity prices dropped in 1977, and U. S. farmers were caught in a cost-price squeeze.

If farmers are encouraged to produce at capacity when the export need is great for agricultural products, it is reasonable to provide income assistance when the export market slackens and the combined domestic and export market is not sufficient to keep prices high enough to make farming profitable. The nation needs a system whereby farm operators can earn enough for a standard of living equal to what is available from employment in other industries. Unless this is done, numbers of farmers will continue to decrease and the time will come when, relatively, per capita income going to agricultural producers will increase. Then consumers will pay a higher proportion of their disposable incomes for food.

Will adequate assistance come soon enough to cause current farm operators to continue? If not, will the alternatives be as palatable as doing what is required to maintain the family farm system of agriculture?

may we introduce . . .

Lavern Brown, head of the Department of Research Operations. The former superintendent of the Lower Coastal Plain Substation in Camden, has been head of the Department since it was formed in 1974.

Brown, a native of Montpelier, Mississippi, graduated from Mississippi State College in 1947 and served as superintendent of the Northeast Mississippi branch of the Mississippi Agricultural Experiment Station until 1949, when he came to Camden as superintendent of the substation.

While in Camden, Brown's research efforts focused on livestock production. He co-authored several publications on the management of beef brood-cow herds and was an early advocate of the use of more forage in the production of slaughter animals.

Brown is instrumental in the development of facilities at the E. V. Smith Center at Shorter. He is responsible for the development of new physical facilities and the renovation and improvement of existing field facilities for the Agricultural Experiment Station on the main campus and the substations, and he has recently been given responsibility for the teaching farm on campus.

Brown is a member of Alpha Zeta, Beta Beta Beta, Blue Key, and Phi Eta Sigma professional and honorary societies.

HIGHLIGHTS of Agricultural Research

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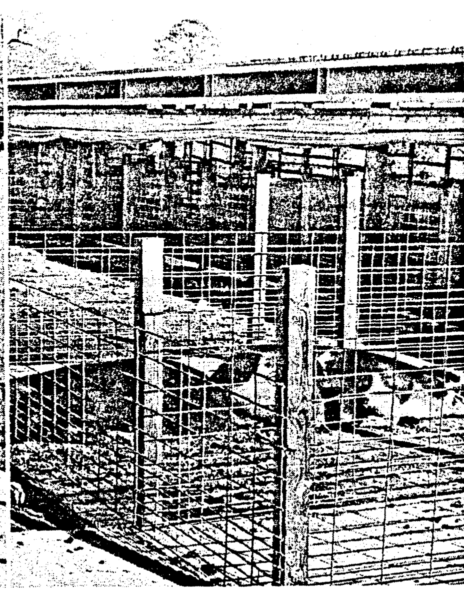
ON THE COVER. All phases of the life cycle of swine can be studied in Auburn's new and modern swine research facility.


New Facility Boosts Auburn Swine Research

T. J. PRINCE, Department of Animal and Dairy Sciences

ALABAMA'S SWINE PRODUCTION potential came a step nearer to fulfillment when a new and modern swine research facility was put into operation last year by the Auburn University Agricultural Experiment Station. The new facility, located at Auburn, is a total production system which incorporates the latest design in buildings and equipment, serves as a model facility for producers, and allows intensive research in a production type unit.

Research at the new facility will encompass all phases of the life cycle of the pig. Facilities for the breeding herd include both high investment total confinement facilities and low-cost open lots. The breeding herd is divided between the two types of housing to allow comparisons of cost of production and reproductive efficiency of sows. These long-range comparisons will aid producers in selecting sow facilities that will give greatest productivity at the lowest production cost.

Equipment has been included in the gestation unit to facilitate controlled feeding of individual sows for nutrition experiments. Research is planned to determine minimum energy and protein requirements for various phases of the gestation period. Such information could be used to reduce costs for the sow herd while maintaining reproductive efficiency.

The farrowing-nursery complex is designed to take advantage of Alabama's favorable climate for reducing building and maintenance costs. A solar heating system has been included in the 14-crate facility to study the feasibility of using the sun's energy for supplemental heat. Solar energy is used to heat water which is circulated through the floors in the baby pig areas. A separate system is available for cooling the floor under the sows to maintain lower temperatures for the sow while providing a warmer environment for the pig.

Experiments are being conducted to determine the feasibility of the solar energy system in comparison with conventional energy sources. Efforts will be made to determine optimum floor temperatures and air temperatures for pigs during the first weeks after birth. Similar studies will be done in the nursery unit for pigs 3 to 8 weeks old when temperature is less critical.

Nutrition and management practices in the farrowing house and nursery will also receive research attention. Methods of feeding and managing pigs soon after birth will be investigated to identify methods of increasing pig growth and survivability in early life.

Growing and finishing pigs are housed in a total confinement, slatted floor barn. The 36-pen facility, with a capacity of 12 pigs per pen, provides the opportunity for nutrition research using a large number of animals in a commercial-type facility. This unit should prove to be an excellent facility for nutrition experiments and the testing of new products and feed additives. Results from these studies will be incorporated into recommendations to producers.

Waste disposal at the research unit is handled by an automatic flushing system and a two-stage lagoon. The flush tanks operate on a preset schedule to automatically flush wastes from under the slatted floors to the first-stage lagoon. Waste water is pumped from the second-stage lagoon back to the flush tanks to be reused for flushing the buildings. This is an exceptional labor-free system for removing wastes from large production facilities.

An environmental physiology laboratory has been added to complement the nutrition and production research facilities. The physiology laboratory is equipped with two controlled environment chambers, a surgery room, and experimental laboratories. The environmental chambers will provide model systems to study physiological and nutritional responses to adverse environmental conditions during breeding, gestation, farrowing, and growth in the nursery. Temperature and humidity can be controlled independently in each animal room. Thus, gilts and boars can be stressed by high temperature and humidity during breeding while baby pigs can be exposed to cold damp conditions such as those found in the farrowing house or nursery during the winter.

An $80,000 donation from the Alabama Pork Producers, a division of the Alabama Farm Bureau Federation, helped finance construction of the new research facility, an addition that should prove valuable to the State's swine industry.

STATUS REPORT ON TALL FESCUE

R. L. HAALAND, Dept. of Agronomy and Soils

Tall fescue is a good pasture for brood cows and calves.

TALL FESCUE has been around a long time, having been brought to the United States from Europe in the early 1800's. However, it did not gain prominence in the Southeast until the 1950's when seed of the widely adapted Kentucky-31 variety became available. Today fescue is grown on much of the permanent pasture land in the northern half of Alabama, as well as being used as a turf and soil conserving crop.

Virtually all of the fescue grown in the Southeast is Kentucky-31. This variety was found in 1931 (hence its name) growing on the William Suiter Farm in Kentucky by an observant University of Kentucky agronomist, Dr. E. N. Fergus. Fescue was growing on the farm when Mr. Suiter bought it in 1887. It is thought that the seed came from a Virginia seedsman sometime earlier.

Kentucky-31 Variety Selected

Through natural selection, the fescue became adapted to Kentucky and actually developed into an ecotype. Dr. Fergus collected seed from the fescue grown on the Suiter farm and evaluated it at the University of Kentucky. Its outstanding performance led to a variety increase and release in 1945.

Fescue acreage expanded into Alabama in the early 1950's when seed supplies of Kentucky-31 became available. Because of the variety's wide adaptability, acreage continued to expand through the 1960's. Badly eroded land taken out of row crop production was often planted to fescue, providing both land stabilization and productive pastures.

Although Kentucky-31 is widely adapted and provides adequate pasture for brood cows and calves, it has several weak points:

1. Grazing season is often concentrated in spring and fall with little forage production in winter.
2. It is generally not adequate as the sole source of feed for growing steers and heifers.
3. Kentucky-31 forms a dense sod that is too competitive for legumes.
4. Susceptibility to nematodes causes unsatisfactory performance on sandy soils.
5. Susceptibility to rust results in reduced production and lowered forage quality when rust infects Kentucky-31.

Better Varieties Sought

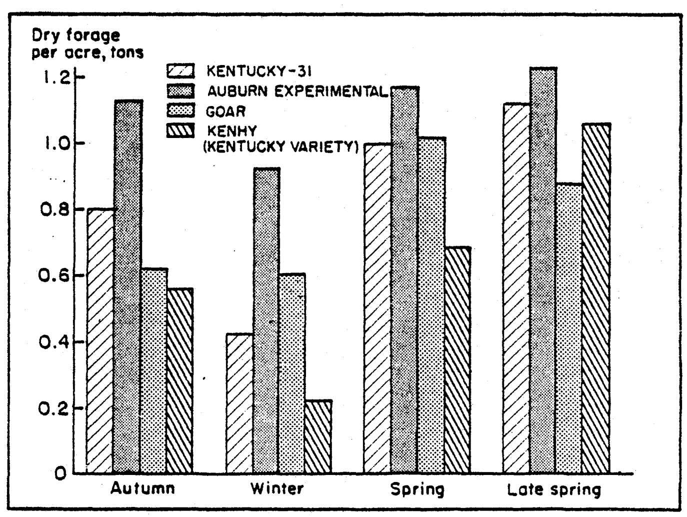
Varieties more winter productive than Kentucky-31 are being sought in Auburn University Agricultural Experiment Station research. Goar, a variety obtained from the Soil Conservation Service in California, proved to be more winter productive than Kentucky-31, but it is highly susceptible to rust. Many introductions from the Mediterranean region were evaluated and found to be winter productive. In 1968, a fescue breeding program was initiated at Auburn to screen Mediterranean types for winter productivity and develop new varieties superior to Kentucky-31.

The Auburn breeding program has resulted in several new experimental lines that produce two to three times as much winter forage as Kentucky-31, as illustrated by the graph. This program continues to apply selection pressure for nematode and disease resistance, high forage and seed yield, and compatibility with legumes.

Today there are more than a million acres of Kentucky-31 tall fescue in Alabama. As with other pasture crops, the acreage of fescue will fluctuate with the price of cash crops. If crop prices increase enough, some pastures will be plowed up and put into row crops.

Winter productive tall fescue varieties will probably make their commercial debut in the early 1980's. As seed become available, these improved varieties will be planted instead of Kentucky-31. Being more compatible with legumes, the new varieties can be grown with legumes to give more productive and higher quality pastures.

The new fescue varieties should make a valuable contribution to the forage economy of the South within the next decade.



A new Auburn tall fescue provides more winter forage than is made by Kentucky-31, the standard variety.

FOREST TENT CATERPILLAR IN THE MOBILE-TENSAW RIVER BASIN

JAMES D. HARPER, Dept. of Zoology-Entomology

EACH SPRING, beginning about mid-March and continuing through May, the forest tent caterpillar *Malacosoma disstria* (Hübner) defoliates as much as 100,000 acres of water tupelo in Alabama. This activity occurs in the southwestern area of the State in the cypress-tupelo swamps of the Mobile-Tensaw River basin and extends northward to the lower portions of the Alabama and Tombigbee Rivers. The region is characterized by meandering and intertwining river systems which are bounded by natural levees, fig. 1. The land between these levees is at or below the surrounding river level and is covered with water much of the year. These "ponds" provide ideal habitat for cypress and water tupelo forests. Tupelo in turn provides a preferred food source for the forest tent caterpillar. It is not known how long the tent caterpillar has been in the swamp, but scattered records suggest that it has been present for at least 50 years and probably much longer.

The natural levees support forests of oak, ash, sycamore, and other trees which are not heavily attacked by the tent caterpillar. Thus most people who use the area for fishing and other recreational purposes never see the vast amount of defoliation which occurs just a few hundred feet inland from the river banks. Inside the ponds, what would normally be a lush, dense-canopied forest in late May has more the appearance of a winter scene. Heavy populations of tent caterpillars can strip both canopy and understory of their foliage within 3-4 weeks following hatching, fig. 1.

The forest tent caterpillar, in the adult stage, is a small brown moth with a wingspread of approximately 1-1½ in. Adults emerge from cocoons in mid- to late-May. After mating, the females deposit their eggs in bands around small twigs of the host trees, usually near the top of the forest canopy. Larvae develop within the eggs in late summer but do not hatch until the following March. Hatching is always closely synchronized with bud-break in the host trees. Larvae feed initially on swollen leaf buds, on tender, expanding leaves, or on flowers, fig. 2. As they mature, they consume any host foliage available to them. Contrary to their common name, forest tent caterpillars do not form tents. They feed openly in masses, retreating in mass to branch crotches and tree trunks between feeding periods, fig. 3. Larval development is completed in 6-7 weeks.

The population of tent caterpillar in the Mobile-Tensaw Basin has been under intermittent study by U. S. Forest Service and Auburn University Agricultural Experiment Station scientists since the late 1950's. Specific studies have dealt with chemical and biological control methods, caterpillar biology and ecology, impact of feeding on the host trees, and annual extent of defoliation.

Since 1963, the annual acreage defoliated by this pest has varied from 14,000 to nearly 100,000 acres. Many areas have been completely defoliated each spring for up to five consecutive years and a few for 10 years or more. Repeated defoliation does not kill tupelo, but U. S. Forest Service studies have demonstrated that a marked growth decrease occurs. Defoliated trees refoliate in mid- to late-May.

Several materials, notably the microbial *Bacillus thuringiensis* and the chemical trichlorfon have been demonstrated to effectively control forest tent caterpillar in these populations. On the basis of small and large scale field tests, both appear to be safe for use in this relatively sensitive environment. Currently, however, the cost of control with either material is about equal to the value of annual growth loss on a per acre basis. Therefore, it would be uneconomical to make aerial insecticide applications.

Other factors such as naturally occurring predators, parasites, and disease agents are currently being investigated in this population. Many such agents have been found in the population. Future research efforts will be directed toward enhancing activity of these agents and in introducing new biological control agents which may be able to establish themselves. Once established, introduced agents often regulate host populations naturally and require no further inputs of time and money.

FIG. 1. Gray areas between the rivers are water tupelo forests completely defoliated by forest tent caterpillar. Dark strips lining the rivers are non-host tree species which the caterpillar does not prefer. FIG. 2. Feeding damage by young larvae on expanding water tupelo leaves. Larvae massed on the leaves are approximately seven days old. FIG. 3. Mature forest tent caterpillar larvae resting on a branch of their host tree in late April.

INTERPLANTING CORN and SOYBEANS

COOPER KING, DON THURLOW, GALE BUCHANAN and DAVID TEEM*,
Dept. of Agronomy and Soils
LAVERNE BROWN** and JOE LITTLE, Lower Coastal Plain Substation
JOHN EASON and MARVIN RUF, Sand Mountain Substation.

MEASUREMENTS OF CORN grain yield from outside border rows of an irrigated, 20-in. row experiment at Auburn University Agricultural Experiment Station showed that present-day hybrids have the potential of yielding over 350 bu. of grain per acre.

Tests were begun in 1973 at the Lower Coastal Plain Substation and in 1974 at the Sand Mountain Substation to determine if the "border effect" might be shown when corn and soybeans are grown together. Peak requirements for light and moisture are during the months of June and July for corn, and August and September for soybeans. It was thought that planting alternate strips of corn and soybeans would be advantageous for corn, but it was not known to what extent. The effects of such practices on soybeans had not been determined. Three row patterns of interplanting corn and soybeans versus solid corn and solid soybeans were used to make evaluations.

The planting pattern treatments were as follows: (All plots consisted of 16 narrow rows, 20 or 30 in. apart.)

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**Now Head, Department of Research Operations.

(1) Solid planted corn—middle 4 rows of a 16-row plot were harvested.

(2) Solid planted soybeans—middle 4 rows of 16-row plot were harvested.

(3) Four rows of soybeans alternated with 2 rows of corn—rows 5 and 6 and 11 and 12 were harvested for corn yield. Rows 7, 8, 9, and 10 were harvested for soybean yield.

(4) Four rows of soybeans alternated with 4 rows of corn—row 5, 6, 7, and 8 were harvested for corn yield. Rows 9, 10, 11, and 12 were harvested for soybean yield.

(5) Four rows of corn alternated with an area equivalent to 4 rows skipped—rows 5, 6, 7, and 8 were harvested for corn yield.

The experimental design was a randomized complete block with four replications. Narrow rows were used for both crops at both locations (20-in. rows for all tests except 30-in. rows at Lower Coastal Plain Substation in 1975 and 1976). Corn was planted at the rate of 36,000 seeds per acre and soybeans were seeded at the rate of 60 lb. per acre. Application of P, K, Zn, and lime was adequate for both crops as recommended by soil test with the corn receiving 200 to 300 lb. nitrogen per acre. No N was applied to the soybeans. Recommended herbicides were used to control weeds in both crops and no cultivations were made. The test at the Lower Coastal Plain Substation was irrigated each year while the test at the Sand Mountain Substation received only natural rainfall.

On a planted acre basis, dramatic increases in corn yields were made by all three interplanting patterns at both locations each year; however, in each case a moderate reduction in soybean yield was obtained. At Camden, the two corn:four soybean pattern produced 75% more than the solid planted corn and the four corn:four soybean pattern produced 53% more than the solid corn. At Crossville, the two corn:four soybean pattern produced 63% more than did the solid planted corn and the four corn:four soybean pattern produced 34% more than the solid corn. At neither location did the four corn:four skip row show any real advantage over the two planting patterns in which soybeans were interplanted with corn. At both locations, both the two corn:four soybean and the four corn:four soybean patterns resulted in a 25% to 30% decrease in soybean yield. However, assuming the value of a bushel of soybeans to be about three times that of a bushel of corn, then the 10 to 14 bu. per acre reduced soybean yield just about equals the value of the increased corn yield.

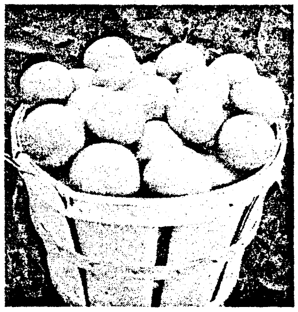
In summary, the increase in corn yield per planted acre was rather dramatic (similar to that for skip row cotton). However, the overall economic value of the system needs further evaluation because of the reduced soybean yields.

YIELD OF CORN AND SOYBEANS AS AFFECTED BY INTERPLANTING PATTERNS, LOWER COASTAL PLAIN AND SAND MOUNTAIN SUBSTATION, 1973-1976

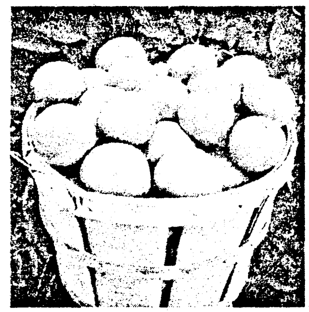
Treat no.	Treatment description	Yield of grain, Camden (irrigated)											
		1973		1974		1975[1]		1976[1]		Mean		Relative yield	
		Corn	Soybeans	Corn	Soybeans	Corn	Soybeans	Corn	Soybeans	Corn	Soybeans	Corn	Soybeans
		Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Pct.*	*Pct.*
1	Solid planted corn	140.0	—	114.5	—	66.7	—	87.5	—	102.2	—	100	—
2	Solid planted soybeans	—	17.7	—	[2]	—	52.5	—	45.0	—	38.4	—	100
3	2 rows of corn: 4 rows of soybeans	253.3	17.6	222.6	[2]	84.4	34.4	153.7	27.3	178.5	26.4	175	69
4	4 rows of corn: 4 rows of soybeans	214.8	13.0	180.8	[2]	90.8	38.0	140.5	13.6	156.7	27.5	153	72
5	4 rows of corn: 4 rows of skipped area	171.3	—	189.7	—	89.4	—	148.2	—	149.7	—	146	—

Treat no.	Treatment description	Yield of grain, Crossville (unirrigated)									
		1974		1975		1976[3]		Mean		Relative yield	
		Corn	Soybeans	Corn	Soybeans	Corn	Soybeans	Corn	Soybeans	Corn	Soybeans
		Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Pct.*	*Pct.*
1	Solid planted corn	97.1	—	170.7	—	47.8	—	105.2	—	100	—
2	Solid planted soybeans	—	34.5	—	43.1	—	63.2	—	46.9	—	100
3	2 rows of corn: 4 rows of soybeans	189.8	16.0	212.5	39.6	113.0	46.7	171.8	34.1	163	73
4	4 rows of corn: 4 rows of soybeans	142.0	16.6	195.4	38.1	84.3	47.7	140.6	34.1	134	73
5	4 rows of corn: 4 rows of skipped area	175.1	—	215.9	—	91.7	—	160.9	—	153	—

[1]Yields of corn were reduced by early lodging of corn.
[2]Yields of soybeans were not valid because of excessive nudsedge competition.
[3]Yields of corn were reduced apparently by poor seed set.



Subsoil Acidity STOPS Tomato Roots REDUCES Yield



B. D. DOSS, USDA, ARS
C. E. EVANS, Dept. of Agronomy and Soils
JACK TURNER, Dept. of Horticulture

SUBSOIL ACIDITY is a common problem in the Southeast, and one that is being intensified by use of high rates of acid-forming fertilizers without a balanced liming program.

Low subsoil pH reduces root and shoot growth of many plants, and thus results in a restricted root system. A shallow root system prevents plants from making effective use of subsoil-stored water during periods between rains. Even during years of normal or good rainfall, there are usually periods between rains when water in the surface soil is insufficient to prevent drought stress.

How subsoil acidity reduces plant growth and cuts yield of tomatoes was shown by cooperative USDA, ARS-Auburn University Agricultural Experiment Station research in 1975-76. Tropic and Walter tomato varieties were test varieties for the experiment on Lucedale fine sandy loam soil. These varieties were used because of their different growth characteristics: Tropic is an indeterminate plant and Walter is semideterminate.

The surface soil (0 to 6-in. depth) of the test field was uniformly limed to about pH 6.0. Subsoil (6 to 12-in. depth) pH treatments ranged from 4.4 to 6.2.

Rainfall was favorable during the test years: 126% of normal in 1975 and normal in 1976.

Both plant growth rate and plant height at beginning of harvest were greater on plots having higher subsoil pH than on low pH subsoil plots. Final plant heights ranged from 24 to 46 in. for Tropic and 18 to 31 in. for Walter. Marketable tomato yields of both varieties increased as subsoil pH increased, with maximum yields occurring at pH 5.4 to 5.9, as shown below:

Subsoil pH	*Per acre yield, lb.*	
	Tropic	*Walter*
4.4 to 4.5	25,140	19,190
4.6 to 4.9	30,420	24,650
5.0 to 5.3	30,030	29,280
5.4 to 5.9	45,660	34,130
6.0 to 6.2	38,290	31,460

Yields for Tropic ranged from about 25,000 lb. per acre at the lowest pH to about 46,000 at pH 5.4 to 5.9. With Walter, the range was from 19,000 to 34,000 lb. Tropic outyielded Walter by an average of about 6,200 lb. per acre.

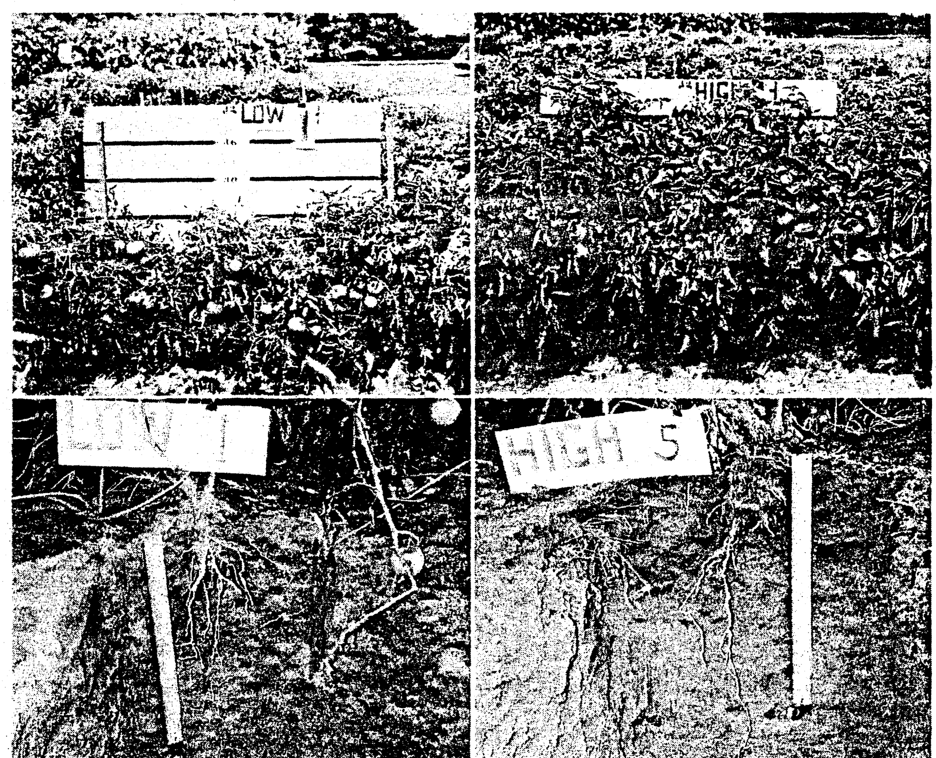
Subsoil pH did not affect fruit size distribution for Walter, but Tropic had a higher percentage of large size fruit at pH levels above 5.0 than at pH below 5.0. Cull tomato yields were not affected by subsoil pH.

Tomato roots failed to penetrate subsoil that had a pH of 4.6 or less. Roots stopped at about 6 in. where the limed surface soil met the acid subsoil. With subsoil pH of 6.0, however, numerous roots grew below the 6-in. depth, along with a taproot that extended below 24 in. The amount of soil water extracted from various soil depths paralleled observed root growth, with more water being removed from the less acid subsoils.

Considerable disease was present at the end of the season in both years, with low subsoil pH plots having a higher percentage of diseased plants. Disease decreased the number of harvests on some plots, especially during 1976 when more than 50% of plants were dead on some plots by the last harvest date.

The reduced yield of marketable fruit from low subsoil pH probably resulted from a combination of a shallow root system, which was unable to furnish adequate water during the critical water-use period, and more diseased plants, which shortened the harvest season.

The problem of subsoil acidity can be prevented or alleviated by a good liming program.



Low subsoil pH caused smaller plants and less root growth of tomatoes (left) as compared with rooting depth and plant growth on soils with 6.0 subsoil pH.

'77—A Summer to Forget

Cause and Control of the Fall Armyworm

MAX H. BASS, Dept. of Zoology-Entomology

DURING THE SUMMER of 1977 the fall armyworm came early and stayed late in Alabama and became the number one insect problem in the State. The fall armyworm has been recorded as an annual pest in Alabama for more than 100 years. Auburn University Agricultural Experiment Station records indicate severe outbreaks several times, especially in 1912 and 1930, but there is no indication of any previous year when damage was as severe as was recorded in 1977.

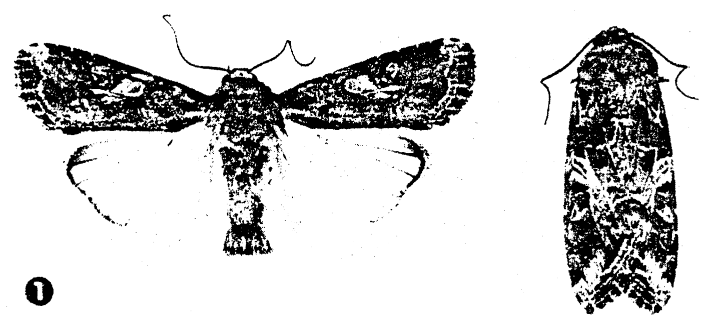
As the name would indicate, the fall armyworm usually occurs in late summer or fall—but not in 1977. Frank McQueen, extension survey entomologist, reported in his "Weekly Insect Survey Report", dated April 4, that the fall armyworm (mistakenly identified at that time as the true armyworm, since the fall armyworm was very unlikely to occur so early in the year) was occurring on grasses and young corn in Geneva, Covington, and Coffee counties. Two weeks later, (April 15) the identification had been clarified and the fall armyworm was again reported in south Alabama counties. Infestations were light at that time and there was not cause for alarm, but the occurrence that early, especially following the severe winter of 1976-77, was certainly an oddity.

Infestations of fall armyworm continued to be noted progressively further north in the State until, by June, light infestations were occurring in North Alabama and serious problems were developing in Central and South Alabama. Almost no crop escaped some damage. The fall armyworm attacked peanuts, soybeans, cotton, grain sorghum, corn, sudan-sudex grasses, johnsongrass, Coastal bermuda, various pasture grasses, and commercial hybrid grasses on golf courses, lawns, cemeteries, and football fields. Various other crops were attacked to a lesser extent. Infestations peaked in late July or early August and *slowly* diminished. An occasional population of damaging proportions could still be found in late October.

McQueen has been a professional observer of the insect problems faced by Alabama for the past 42 years. Perhaps a quote from his report of September 27, would be a worthy epitaph for 'the summer of the fall armyworm.' "There seems to be no end to the amount of damage done directly and indirectly to Alabama Agriculture and agribusiness by . . . the fall armyworm. This insect was a major pest of corn, soybeans, peanuts, grain sorghum, and cotton; of lawns, pasture grasses, and hay crops; of golf and other recreational turf areas. This insect first lowered the yields of the corn crop and then allowed entry of aflatoxin fungus, further reducing the crop's dollar value. Damaged corn shucks allowed entry of stored grain pests before harvest. Cattle herds, already in poor flesh as a result of the dry summer and insect-damaged pastures, are heading for winter with hay barns empty. Light calves are being produced for the market. Brood cows have been reduced (since the feed supply will not accommodate larger herds) and years will be required to rebuild these herds. Also, the fall armyworm caused a tremendous increase in the use of insecticides, with accompanying increased costs to growers and increased amounts of these toxic materials being placed into our soils and air . . . and the first killing frost is still 35-45 days away."

Fall Armyworm Biology

The adult fall armyworm is an ash-gray moth with a wing span of about 1½ in. Forewings are mottled and have white or light gray spots near the tips. Hindwings are white with a narrow, smokey-



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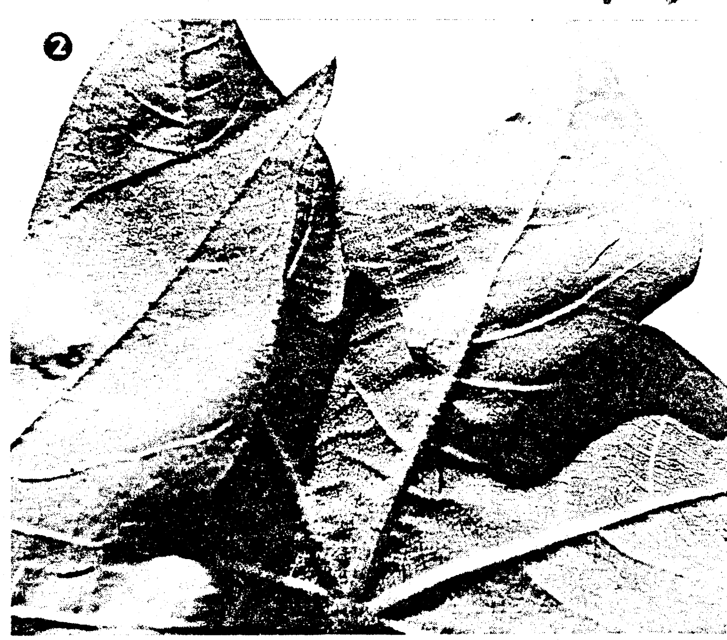

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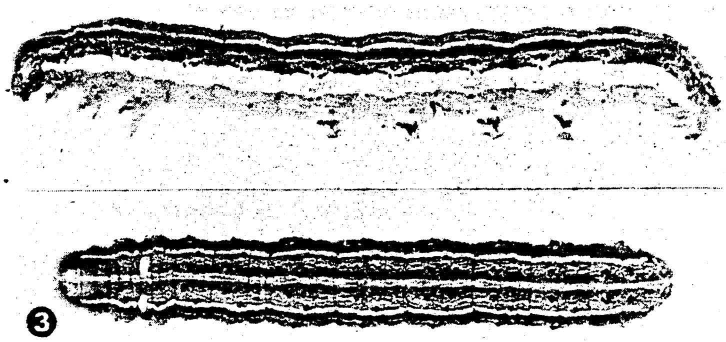
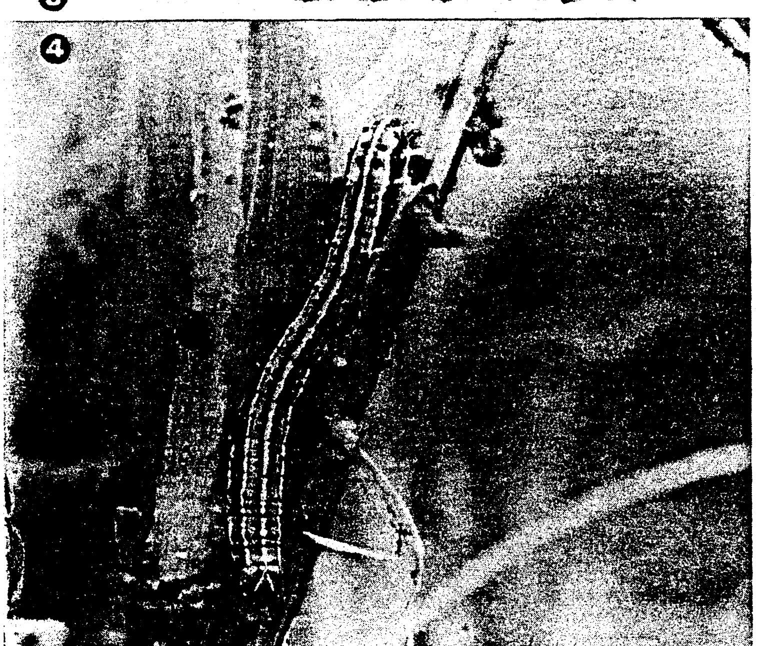
FIG. 1. Adult fall armyworm moth. FIG. 2. Fall armyworm egg of fall armyworm. This is the most destructive stage. FIG. 4. (Figures 2 and 4 courtesy of Ronald Smith and John French, Ala

brown edge (fig. 1). The moths are seldom observed during daylight hours. They become active about dusk and feed on flower nectar. Adults live for 2 to 3 weeks. Females lay their eggs (fig. 2) in masses of 50 to several hundred on foliage at night. The eggs are light gray and masses are covered with grayish fuzz from the moth's body. Eggs hatch in 2-4 days.

The destructive stage is the larval form (fig. 3). Larvae are white when first hatched and have black heads. Their bodies darken and noticeable stripes appear as they become older. When fully grown the larvae are about 1½ in. long and vary in color from light green to almost black with several stripes along the body. The head is dark and shiny in the fully grown worm and is marked with a light colored inverted Y (fig. 4). Development from egg to mature larva requires 2-3 weeks. The larvae then burrow into the soil for an inch or two, construct cells, and pupate. Shortly after pupation the pupae are reddish-brown, but gradually darken and become almost black. Most fall armyworms in a given population are about the same age and usually pupate at about the same time. Because of this, a severe population may seem to suddenly disappear. During summer pupation lasts from 10-14 days, after which, moths emerge. This insect overwinters in the pupal state.

There is a question as to whether the fall armyworm overwinters in Alabama, because the insect is highly susceptible to cold temperatures. From this year's experience, it would appear that the insect either overwinters in southern Alabama or makes its way (the moths are carried by air currents) into the State very quickly in some years.





nasses on underside of cotton leaves. FIG. 3. Top and side view
Fall armyworm on corn—note inverted Y on the worm's head.
ama Cooperative Extension Service.)

Why This Year?

Why was Alabama plagued by such severe fall armyworm populations during 1977? Perhaps there are several reasons:

(1) The cold winter. The winter was *uniformly* cold from November to March. Alabama's winters are usually characterized by intermittent freezes and warm spells. Insects emerge during warm spells and are caught by the next freeze. During the winter of 1976-77 there were few extended warm periods and many lepidopterous insects (like the fall armyworm) were kept safely in hibernation. Thus we started the summer with an unusually high number of surviving fall armyworms as far north as the cold permitted.

(2) The cold winter—again. Many of the fall armyworm's natural enemies are wasps and beetles which do not hibernate in the soil, but hibernate under trash or in natural cracks and crevices in and around fields and remain relatively exposed to the elements. Auburn research indicated extremely low populations of beneficial insects until late in the growing season.

(3) The dry summer. Virus diseases that affect the fall armyworm are frequently started from soil-borne viral particles which are splashed up on foliage (or on the worms themselves) by rain; hence, no rain equals no diseases.

Control

During the summer of 1977 several experiments were conducted to determine control measures for the fall armyworm. Several insecticides which had given good control of this insect in previous years were found to be ineffective; at least when applied to populations on peanuts, soybeans, and cotton. In tests on peanuts, materials and rates per acre which consistently gave 80% or better control in several tests were: methomyl (Lannate® or Nudrin®), 0.5 lb. (active ingredient), monocrotophos (Azodrin®), 0.5 lb; chlorpyrifos (Lorsban®), 0.75 lb; Bolstar®, 0.75 lb; acephate (Orthene®), 1.0 lb; and methomyl bait (NuBait®), 0.25 lb.

Trichlorfon (Dylox® or Proxol®) and carbaryl (Sevin®) failed to afford acceptable control of fall armyworm populations *on peanuts.* Personal communications with entomologists in other states indicated similar results when these materials were used against fall armyworms on peanuts. However, some research in other states and observations by Extension personnel of farmer applications in Alabama have indicated that carbaryl at 2 lb. per acre and trichlorfon at 1 lb. per acre have given effective fall armyworm control when applied to populations *on grasses.* The diet of insects is known to affect their susceptibility to certain insecticides, which could be a factor in this case.

The new synthetic pyrethroids (Ambush®, Pounce®, Pydrin®) were tested against this insect and failed to give acceptable control.

Summary

In the summer of 1977 the fall armyworm was the most serious insect pest in Alabama. It attacked many crops, some of which had never been damaged by this insect before. Farmers need to be able to separate these larvae from other similar caterpillars in order to initiate control programs early and to select appropriate control chemicals. The destructive larval stage can be identified by the light colored inverted Y on the head. The fall armyworm's extreme abundance this year can probably be traced to the unusually cold previous winter and to the unusually dry summer. Research indicated that good chemical control could be obtained with Lannate®, Nudrin®, Azodrin®, Lorsban®, Bolstar®, Orthene®, or NuBait® at previously stated rates.

Using Nuclear Science to Improve Centipedegrass

W. J. JOHNSTON, RAY DICKENS, and RON HAALAND
Department of Agronomy and Soils

CENTIPEDEGRASS is a low-growing, sod-forming grass used for lawn and general purpose turf throughout much of the lower South. Even so, the grass as it presently exists is less than ideal for these purposes. All centipedegrass looks essentially the same. This lack of morphological variability has limited selection of turfgrass varieties. Use of centipedegrass has also been limited by its lack of winter hardiness, and slow rate of establishment.

Genetic mutation using gamma radiation from a nuclear source offers a possible technique for rapidly improving turfgrass. Centipedegrass is well suited to mutation breeding because problems of seed production can be overcome by vegetative propagation. In Alabama, vegetative propagation is presently the most common method of establishing centipedegrass.

Work is currently under way at Auburn University's Agricultural Experiment Station to evaluate the use of gamma radiation to induce morphological variations, increase cold tolerance, and improve establishment rate in centipedegrass.

Centipedegrass seed were exposed to 0, 10, 20, 30, 40, and 50 kilorads of gamma radiation from a cobalt source at the Auburn University Leach Nuclear Science Center. The seed were planted in fumigated soil, and seedlings were grown in flats in a greenhouse. After 4 months, 95 irradiated plants and 11 controls were evaluated for differences in leaf blade width, blade length, and internode length.

The range in all three criteria was greater for the irradiated plants than for plants produced by the untreated controls, table 1. Other changes noted in treated plants include wrinkled leaves, variegated leaf color, dwarfness, and a more prostrate growth habit. Therefore several changes in the morphology of centipedegrass have been induced by nuclear radiation.

TABLE 1. MORPHOLOGICAL VARIATIONS IN IRRADIATED CENTIPEDEGRASS

	Irradiated plants		Controls	
	Max.	Min.	Max.	Min.
Blade width (mm)	6.8	3.7	6.1	4.1
Blade length (cm)	6.3	1.8	4.7	2.5
Internode length (cm)	4.0	0.6	4.1	2.0

Thirteen irradiated selections and two non-irradiated selections, 'Oklawn' (cold tolerant) and 'FC-2' (not cold tolerant), were cold hardened, exposed to subfreezing temperatures, and returned to the greenhouse where plant survival was determined 3 weeks later. Three irradiated selections were consistently superior or equal to Oklawn at each exposure temperature, see figure. These three selections offer the potential for developing a more cold-tolerant cultivar of centipedegrass and are being evaluated under field conditions this winter.

None of the irradiated selections showed a superior rate of cover when compared to non-irradiated controls in greenhouse studies. Dwarfs or plants with a reduced growth rate were quite common among the irradiated selections. This is a common effect of irradiation of plant seed.

Real possibilities exist for using mutation breeding techniques to improve morphological characteristics and cold tolerance in this species. It would appear that the rate of cover of centipedegrass established from sprigs can not be improved through irradiation breeding. However, the development of numerous dwarfs does present the possibility of making selections for the development of a very low-growing, dense type of centipedegrass. Improvements in these aspects should increase the suitability of centipedegrass for turf use throughout the South.

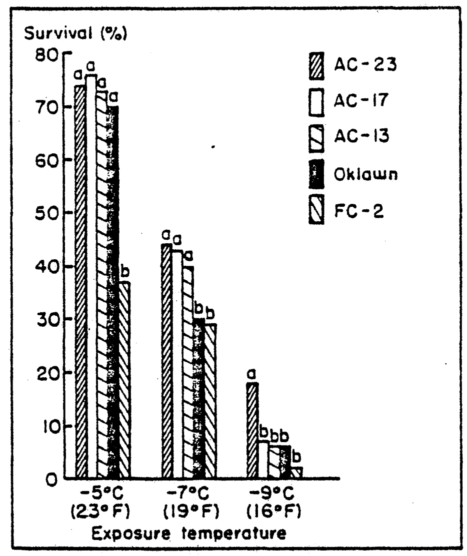


FIG. 2. Effect of temperature on survival of centipedegrass selections.

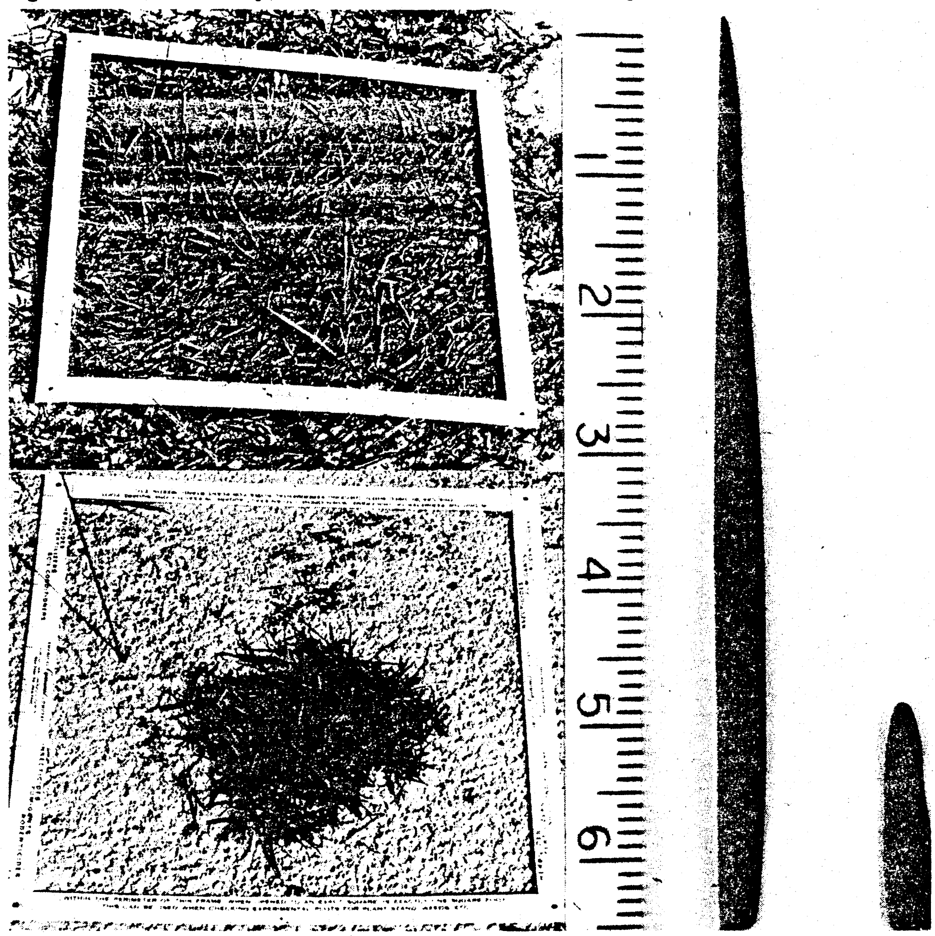


FIG. 1. Leaf length (right) varied greatly among irradiated selections of centipedegrass. A common effect (left) noted from radiation treatment was reduced growth rates as illustrated by plant at bottom.

SIGN of INSECT BORER DAMAGE in SOUTHERN PINE LUMBER DOES it ALWAYS MEAN the HOME IS INFESTED?

L. L. HYCHE, Department of Zoology-Entomology

LUMBER FROM SOUTHERN PINE is one of our most highly favored materials for construction of buildings, especially homes. It is also highly favored by some insects.

Termites and certain species of "powder-post" beetles and wood borers are common attackers of lumber in homes and other wood structures. It is common knowledge that these insects can cause serious and costly damage; consequently, most homeowners are alert and have conducted periodic inspections of evidence of infestations. Wood-infesting insects work quietly and secretively most of the time and may often go undiscovered until evidence of damage gives away their presence. Thus, signs of damage, such as tunnels and exit-entrance holes, are often valuable aids in detecting infestations of some species. Also, because type of damage is often characteristic to a species or insect group, it may aid in identifying the insect involved. However, to automatically assume that visible signs of damage definitely establish the presence of an active infestation is hazardous and may lead to the application of expensive control measures which are needless—*needless because the existence of such signs does not always mean that the wood is currently under attack.*

FIG. 1. Section of southern pine 2×4 with typical ambrosia beetle, "pinhole borer", and round-headed wood borer damage sign.

A Case in Point

Figure 1 represents a typical and common case. In this section of 2 x 4 southern pine framing taken from a residence, holes and tunnels made by insects are obvious. Discovery of damage of this extent could cause alarm. However, in this case it would be unwarranted for: (1) this damage does not indicate presence of an active infestation; (2) the board and other like boards in the house are not in danger of reinfestation by the species originally responsible; and (3) no control measures are necessary. Why not? The answer is found in recognizing the damage type and understanding the habits of the insects causing it.

The Insects, Their Habits and Damage

The small, dark, circular pencil-lead-size holes and tunnels, figure 1, are typical signs of activity by ambrosia beetle, figure 2, and certain "pinhole borer" adults. The oblong cavities, figure 1, are typical of the larvae of one of several species of common round-headed or long-horned wood borers, figure 3. In each case the wood was infested and damage done *before* the board was in place—in fact, most likely before it was even sawed. The habits of these species explain this.

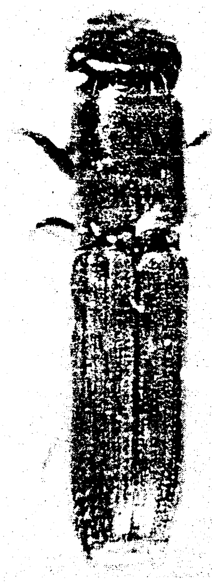


FIG. 2. Adult ambrosia beetle (photo by J. V. Edelson).

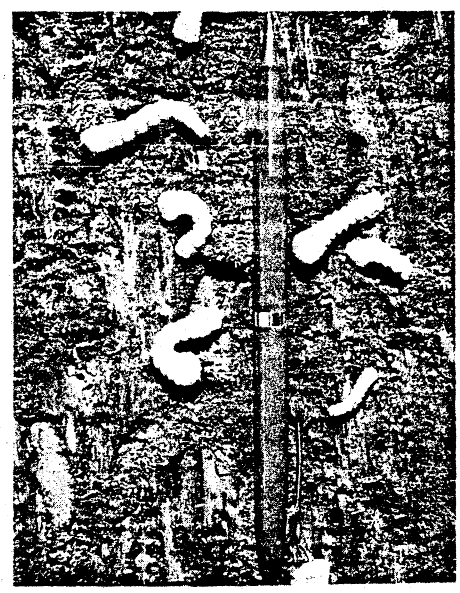


FIG. 3. Larvae (Sawyers) of a common species of long-horned wood borer.

Ambrosia beetles and "pinhole borers" involved attack only freshly cut green pine logs, green lumber, or still green trees dying from bark beetle attack, disease, fire, or other causes. They do not attack, nor can they survive in, dry seasoned wood. The adults tunnel in both sapwood and heartwood, and signs of their attack remain conspicuous in the lumber. Habits of the long-horned wood borers are somewhat similar to those of ambrosia beetles in that these particular species also infest only green logs or freshly killed green trees. Adults deposit eggs in the inner bark and larvae develop primarily in this region. Prior to pupation the larvae tunnel into the wood and construct pupal cells. Processing of the timber to lumber then exposes these tunnels and cells to view. These borers, unlike a few species, do not reinfest the same wood after emergence.

A Word of Caution

The foregoing indicates that discovery of insect damage sign does not necessarily mean an active infestation is present; however, with certain species such sign may be a true indicator. Thus, detection should be followed by thorough investigation before the decision to treat or not to treat is made.

PERFORMANCE of COMMERCIAL SOYBEAN INOCULANTS in ALABAMA

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Department of Agronomy and Soils

SOYBEANS without effective root nodulation are as nitrogen deficient as cotton or corn without fertilizer N. Root nodule bacteria *(Rhizobium japonicum)* provide the potential for high yields of soybeans by supplying nitrogen from the air. With expanding soybean production in the South, many fields are planted with soybeans for the first time. Effective inoculation of the seed with *Rhizobium* is essential in fields where soybeans have not been grown recently. To meet this need, the legume inoculant industry markets cultures of *Rhizobium* dispersed in peat, clay, or oil. Some of the products include the trace element molybdenum and a fungicide to provide seedling plants with protection from disease.

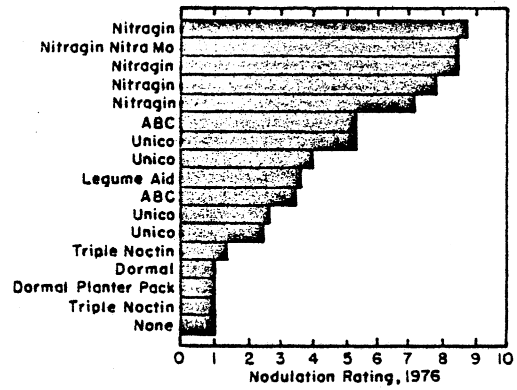
Field experiments were conducted at the E. V. Smith Research Center with more than 45 products purchased at seed stores in Alabama. Soils were essentially free of soybean *Rhizobium* so that nodulation was dependent upon the product applied. Each inoculant was applied at planting according to manufacturer's instructions. Plants were dug at early bloom stage each year to determine nodulation of soybean roots. In 1976, a rating scale from 0 to 10 was used to measure taproot nodulation with 0 being no nodulation and 10 abundant nodulation. In 1977, root nodules were counted. Results are shown in graphs.

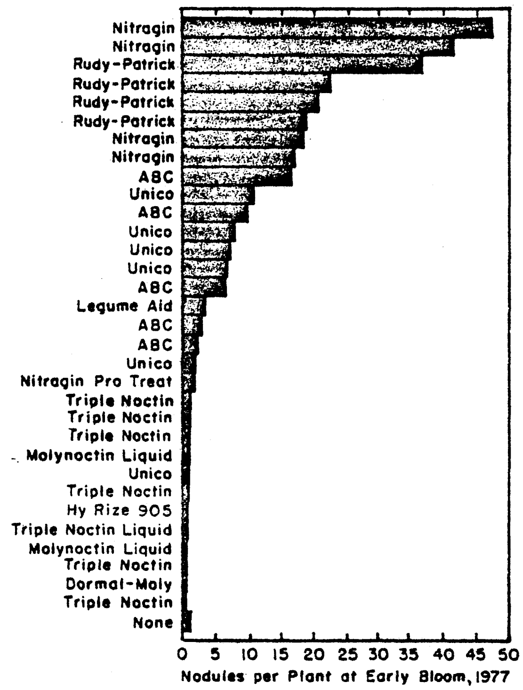
Nitragin inoculants were superior to other peat-base products tested in 1976. Dormal (dried bacteria with clay base) and Triple Noctin (dried bacteria with molybdenum and fungicide) produced no nodulation. Among 32 products tested in 1977, Nitragin and Rudy-Patrick inoculants produced more nodules than did other products. With hot, dry soil conditions that occurred after planting in 1977, many of the Unico, ABC, and Legume Aid treatments were little if any better than untreated controls. Dormal and the various Noctin products were consistently without effect.

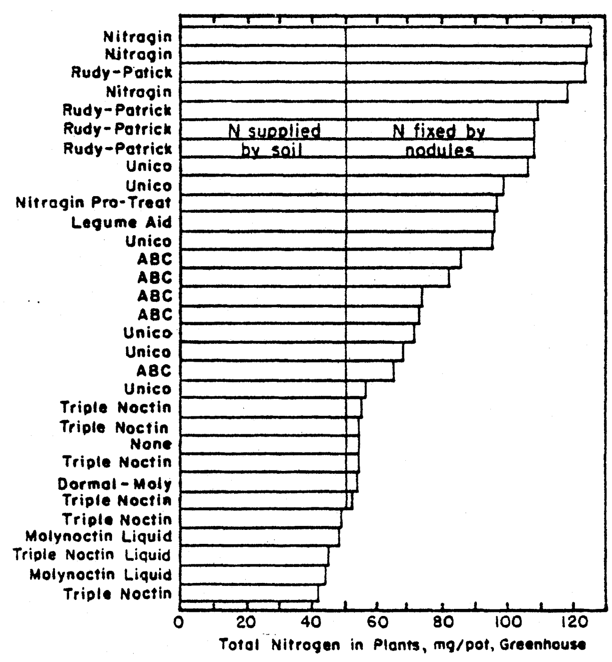
The 1977 inoculants were also compared in a greenhouse experiment where nitrogen content of soybean plants was determined after 6 weeks of growth to provide a measure of N fixation resulting from the treatments. The graph shows the order of N fixing ability to be essentially the same as that for nodulation in the field. Several peat-base inoculants performed better in the greenhouse than in the field. Bacterial plate counts of these inoculants showed low nodulation compared to others producing abundant nodulation. With drought stress in the field these marginal products fail.

In four instances, samples of the same lot of inoculant were obtained from different stores in Alabama. No evidence was found that different storage conditions were related to inoculant performance.

The peat-base products of Nitragin and Rudy-Patrick have provided adequate nodulation and N fixation in soybeans. Addition of molybdate and captan fungicide to the peat-base culture at planting (Nitragin Pro Treat) markedly reduced nodulation. Incompatability of molybdate or fungicide additives with *Rhizobium* in the various Noctins may account for their poor performance as inoculants. Liming acid soils to favorable pH for soybeans generally eliminates the need for added molybdenum. In fields without the soybean *Rhizobium*, however, the essential key to success is a good inoculant.







FOREST TREES can grow well utilizing lesser amounts of essential soil mineral elements than agricultural crops. As would be expected, therefore, trees also respond less consistently and less positively to fertilization. Forestry research has defined only a limited number of situations in which economic responses to fertilization are assured.

Demand for timber has grown steadily in recent years, resulting in more intensive management practices. Intervals between harvests have shortened and the proportion of tree crop harvests has increased. Evidence is accumulating that without fertilization the greater drain of mineral nutrients under intensive management may cause reduced yields within a few rotations. Whether to stimulate increased yield or to prevent reduction in yield, forest fertilization seems certain to become increasingly common.

As with agricultural crops, the nutrient element most often deficient for good tree growth is nitrogen. Simple studies of growth response of forest stands to nitrogen fertilization, however, have not clearly defined the conditions which must exist before a response can be expected. Effective fertilization of trees, which are long-lived, relatively slow-growing, and deep-rooted, presents more involved problems than annual crops. The fertilizer may be applied at the wrong time of the year or at the wrong stage of the tree's life. Other vegetation may compete strongly with the trees for uptake of fertilizer. When an element appears to be limiting for good growth, some other essential factor may be even more limiting.

Forest scientists are currently investigating various fundamental aspects of the role of mineral nutrients, including nitrogen, in tree growth. One important area of study is the dynamics of mineral elements in forest ecosystems. With long-lived crops, such as trees, minerals cycle continuously and repeatedly between trees and soil, and a reserve storehouse of minerals accumulates in the litter on the forest floor. Forest scientists need more data on the quantities and rates of transfer, respectively, within and among the different parts of natural forest ecosystems. More knowledge is also needed about the fate of applied fertilizers. What proportion of the fertilizer is absorbed by forest stands, and how long and where is it retained within the ecosystem? Answers to these questions should lead to more efficient fertilization practices and less pollution of drainage waters from fertilized areas.

In 1971 a study of nitrogen cycling in loblolly pine plantations was begun by forestry researchers from Auburn University's Agricultural Experiment Station at the Lower Coastal Plain Substation in Camden. Several unthinned, 13-year-old plantations were sampled to determine the amounts and distribution of nitrogen contained within the vegetation and the soil. In March of 1972 ammonium nitrate was applied to portions of each plantation at rates of 100, 200, and 400 lb. per acre. In August of 1972, a series of three biennial samplings was initiated to monitor stand growth and changes in nitrogen content and distribution.

NITROGEN CONCENTRATION OF EACH PART OF STAND FOR EACH FERTILIZER RATE, AUGUST 1972

Part of stand	Unfertilized	Rate of fertilization: 100 lb. per acre	200 lb. per acre	400 lb. per acre
		Percent		
Trees				
Foliage	1.18	1.27	1.37	1.41
Branches	0.15	0.20	0.21	0.22
Bole wood	0.08	0.08	0.08	0.09
Bole bark	0.21	0.23	0.28	0.30
Roots	0.21	0.25	0.41	0.30
Understory vegetation	0.83	0.97	1.35	1.36
Litter	0.65	0.69	0.72	0.75
Soil	0.03	0.03	0.03	0.03

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Dept. of Forestry and Lower Coastal Plain Substation

ESTIMATED AMOUNTS OF FERTILIZER NITROGEN PER ACRE CONTAINED IN EACH PART OF STAND, AUGUST 1972

Part of stand	Rate of fertilization: 100 lb./acre		200 lb./acre		400 lb./acre	
	Lb.	*Pct.*	*Lb.*	*Pct.*	*Lb.*	*Pct.*
Trees						
Aerial parts	53.5	54	55.3	28	69.6	17
Roots	3.3	3	31.8	16	12.2	3
Understory vegetation	1.3		2.0		1.8	
Litter	−0.4		5.9		8.3	
Total stand	57.7	58	95.0	47	92.0	23

All parts of the stands showed evidence of some increase in nitrogen concentration in the first samples following fertilization, and concentrations increased with higher levels of fertilization. Greatest increases, as would be expected, were in the foliage, bark, and roots of the trees, and in the understory vegetation. No increases in growth due to fertilization were detected in the trees or other vegetation after one growing season, nor had any been expected after such a short interval. Therefore, by applying the nitrogen concentrations, which were determined the year before fertilization, to the weights of the various parts of the vegetation after fertilization, it was possible to obtain estimates of fertilizer nitrogen recovery.

Quantity taken up by the aerial portion of the trees increased as the rate of fertilization increased from 100 to 400 lb. of nitrogen per acre, but percentage recovery decreased. At the lowest rate recovery was more than 50%, comparing favorably with average recovery by fast-growing crops such as cotton and corn, but it fell to less than 20% at the highest rate. Understory vegetation was light, as is typical of young, well stocked pine plantations, and it recovered less nitrogen at the higher rates than was held by the litter.

The importance of stand stocking was indicated by the relatively low nitrogen content of the trees above ground on plots which received the 200 lb. per acre rate. A pine beetle epidemic caused an average drop of 10% in stocking during 1972. By contrast, there was an increase of 5% for the other treatments which escaped heavy pine beetle attacks. The high nitrogen content of tree roots in this treatment suggests that nitrogen was absorbed soon after application but not transferred well to the tops of dying trees.

Later samplings will reveal how well these plantations are able to retain or conserve the applied nitrogen, where it is held and whether it produces any growth response. Such information should help to define the picture of nitrogen cycling in pine plantations and thereby to improve fertilization practices.

PEANUT WEEDS *Zapped* BY RONSTAR

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PAUL A. BACKMAN and R. RODRIGUEZ-KABANA, Dept. of Botany and Microbiology

RONSTAR® is a new weapon in the chemical arsenal of peanut weed killers. This herbicide provided effective control of several peanut weeds in 8 years of testing at Auburn University Agricultural Experiment Station. Pending approval of an experimental use permit by the Environmental Protection Agency, Ronstar[1] (common name, oxadiazon) will be available on a limited basis for control of weeds in peanuts in 1978.

Experiments at the Wiregrass Substation, Headland, measured both herbicidal performance and peanut response to Ronstar. Because it controlled certain broadleaf weeds in 1970-72 tests, subsequent experiments concentrated on Ronstar's ability to control Florida beggarweed.

Ronstar was applied preemergence in 15-17 gal. of water per acre with a compressed air, tractor-mounted plot sprayer. Florunner peanuts were planted in 3-ft. rows in all experiments at a seeding rate sufficient to give 3 to 4 plants per row-ft. Experiments specifically designed to measure effectiveness against Florida beggarweed and sicklepod received a pretreatment of benefin (Balan®).

Disease and insect control and other cultural practices were at a level for maximum production. Weed and peanut plant counts and the early-season ratings were made approximately 4 weeks after planting. A second control rating was made 3 to 6 weeks later.

Control of crabgrass, goosegrass, and crowfootgrass was commercially acceptable in all years with all rates of application at the time of the first control evaluation, table 1. Later in the season (second rating time), however, control was commercially acceptable in only 2 of the 3 years from the 3-lb. per acre rate of Ronstar and in only 1 of 3 years at the 1.5-lb. rate. Control of broadleaf weeds (morningglories, sicklepod, and Florida beggarweed) was similar to control of annual grasses in most of the experiments.

In 1974 and 1975 experiments, Ronstar was found to have substantial activity against Florida beggarweed, one of the most troublesome weeds in peanuts, table 2. Late season ratings showed that 1.5 lb. per acre gave commercially acceptable control of beggarweed in 1975. With the 3.0-lb. rate in 1974, control was 74% or better.

Ronstar often caused substantial phytotoxicity to peanuts, expressed primarily as early-season stunting, table 3. Such phytotoxicity was relatively short lived. Ratings made later in the season usually indicated complete recovery. Complete recovery is further supported by the lack of a yield reduction following treatment with Ronstar at rates as high as 4.5 lb. per acre, table 4. Although appearance of the peanut plant indicated complete recovery, treatment with Ronstar generally reduced plant canopy size.

Extensive studies on non-target effects of Ronstar have revealed that this herbicide reduces losses to the stem rot fungus (white mold). This observed reduction in disease apparently more than compensates for any phytotoxicity to peanuts.

TABLE 1. WEED CONTROL FROM RONSTAR, WIREGRASS SUBSTATION

Herbicide rate, lb./acre	Grass control						Broadleaf control					
	First ratings			Second ratings			First ratings			Second ratings		
	1970	1971	1972	1970	1971	1972	1970	1971	1972	1970	1971	1972
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
1.5	86	97	84	89	22	8	74	86	84	80	23	19
3.0	100	99	94	99	85	44	99	91	93	99	66	46
4.5	98	99	99	95	78	77	98	95	100	100	68	78
0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 2. CONTROL OF FLORIDA BEGGARWEED WITH RONSTAR, WIREGRASS SUBSTATION

Herbicide rate, lb./acre	Control at two rating times			
	First ratings		Second ratings	
	1974	1975	1974	1975
	Pct.	*Pct.*	*Pct.*	*Pct.*
1.5	94	90	41	80
3.0	99	100	74	99
4.5	100	100	99	99
0	0	0	0	0

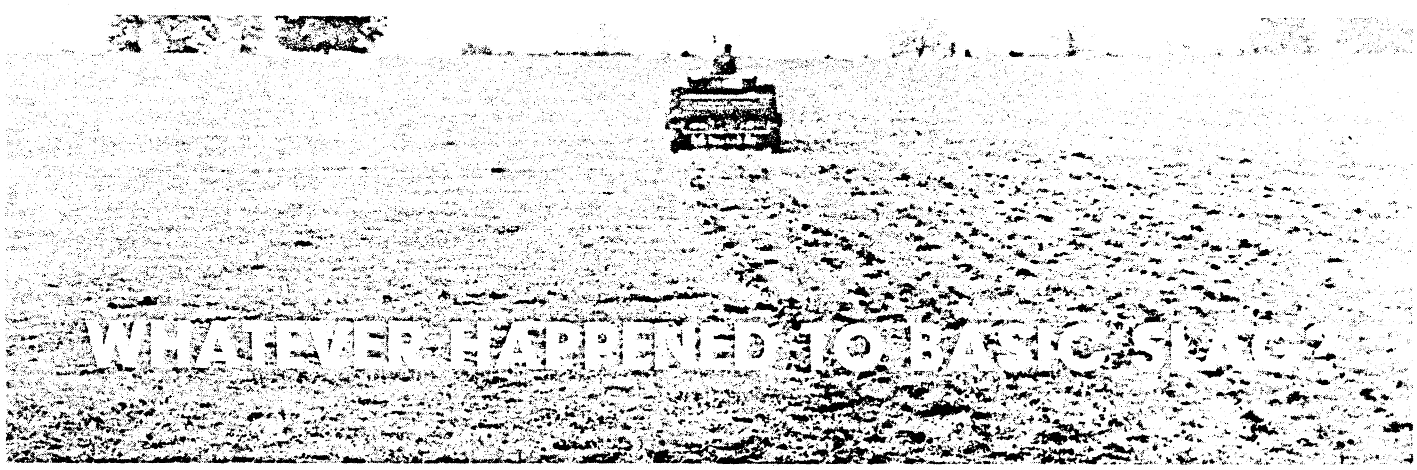
TABLE 3. CROP INJURY FROM USE OF RONSTAR FOR PEANUT WEED CONTROL, WIREGRASS SUBSTATION

Herbicide rate, lb./acre	Crop injury observed at each rating time									
	First ratings					Second ratings				
	1970	1971	1972	1974	1975	1970	1971	1972	1974	1975
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
1.5	3	10	11	14	3	0	0	0	0	4
3.0	14	16	13	39	32	0	3	0	0	13
4.5	23	32	5	45	43	0	10	0	4	16
0	0	0	0	0	0	0	0	0	0	0

TABLE 4. PEANUT YIELD WITH USE OF RONSTAR FOR PEANUT WEED CONTROL, WIREGRASS SUBSTATION

Herbicide rate, lb./acre	Per acre yield, unshelled peanuts				
	1970	1971	1972	1974	1975
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
1.5	2,382	3,256	2,087	3,773	4,112
3.0	2,364	3,149	2,622	3,773	3,987
4.5	1,900	3,131	2,319	3,532	4,326
0	2,578	3,068	2,498	3,550	4,469

[1]A product of Rhodia, Inc.



WHATEVER HAPPENED TO BASIC SLAG?

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ALABAMA FARMERS were quick to recognize the value of basic slag soon after it was first ground and bagged at the Ensley plant of U. S. Steel Corp. in Birmingham in 1915. This steelmaking byproduct had a high content of phosphorus and lime, both of which were deficient in Alabama soils, which made it an excellent soil amendment for use in the State.

Basic slag soon became a major fertilizer and liming material in Alabama and the Southeast, and it also was used extensively in Europe. By the time World War II began, basic slag ranked second only to superphosphate in the worldwide use of phosphorus fertilizer. But recent-year steelmaking changes have altered the composition of basic slag, and it is no longer a major fertilizer and liming material in Alabama.

Phosphorus Recovered in Slag

Because phosphorus makes steel brittle, it must be removed from the ore in the steelmaking process. This is done by adding limestone to the molten ore so that the lime combines with the phosphorus and floats to the top. It is then separated, cooled, ground, and bagged. This material is called basic slag.

Iron ore contains other impurities that must also be removed during steelmaking. These impurities also are removed by lime. Thus, the composition of basic slag depends on the kinds and amounts of impurities in the iron ore. Since the value of the slag is primarily from its phosphorus content, steel made from low-phosphorus iron ore will produce a basic slag of little value as a soil amendment.

Slag Composition Changes

There has been a significant change in recent years in the steelmaking process, in the sources of iron ore, and in the chemical impurities contained in the ore. This has led to a corresponding change in the composition of basic slag marketed for agricultural use in Alabama.

Basic slag has been studied at the Auburn University Agricultural Experiment Station since the 1920's. The phosphorus present in basic slag was found to be as available as that from superphosphate on Alabama's acid soils. Experiments in those early years were done with basic slag that contained about 10% available phosphorus, about half of what superphosphate contained in those days.

Old vs. New Slag

In a recent Auburn study with present-day basic slag, major differences were found between the "old" basic slag and the "new" basic slag. The most important differences were in phosphorus contents and liming values. A comparison of these properties is given in table 1 for samples of basic slag produced by U. S. Steel Corp. in Birmingham in 1957 and 1975. The available phosphorus content in 1975 was found to be only about one-tenth of that in 1957 basic slag. The liming value was about two-thirds as much in 1975. Whereas practically all of the phosphorus in the 1957 sample was available, only about two-thirds in the 1975 sample was available.

In many experiments between 1930 and 1960, the old basic slag was equal to superphosphate as a direct fertilizer application to crops. As a residual phosphorus fertilizer, slag was equal to or greater than superphosphate. The liming value of basic slag was generally rated as about three-fourths that of agricultural limestone.

TABLE 1. COMPARISON OF OLD AND NEW FORMS OF BASIC SLAG

Property	Comparison	
	1957 slag	1975 slag
	Pct.	*Pct.*
Available phosphorus (P_2O_5)	10.1	1.3
Total phosphorus (P_2O_5)	10.9	2.1
Lime equivalent ($CaCO_3$)	78.0	55.0
Passing 100-mesh screen	80.0	80.0

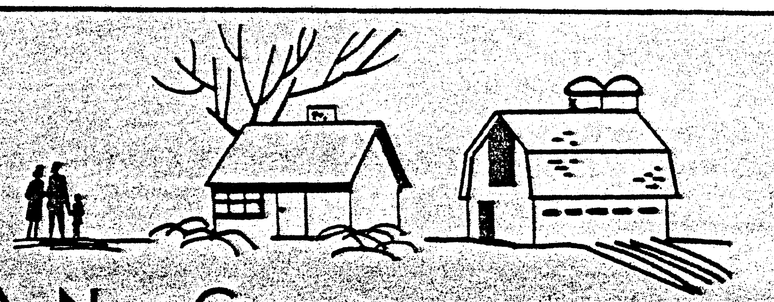
Value of the new basic slag relative to the old is demonstrated by comparing how many pounds of each are required to supply 60 lb. of available phosphorus (P_2O_5), table 2. Whereas 600 lb. of the 1957 basic slag equaled 130 lb. of concentrated superphosphate (300 pounds of ordinary superphosphate), it took more than 2 tons of the new material for the same amount of P_2O_5.

TABLE 2. COMPARISON OF AVAILABLE PHOSPHORUS CONTENT OF DIFFERENT MATERIALS

Material	Available P_2O_5 content	Amount to furnish 60 lb. P_2O_5
	Pct.	*Lb.*
Ordinary superphosphate	20.0	300
Concentrated superphosphate	48.0	130
Old basic slag	10.1	600
New basic slag	1.3	4,600

In a similar comparison of liming value ($CaCO_3$ equivalent), the new basic slag had a lime equivalent of 55%. This compares with 78% for the old basic slag and 90% for calcitic lime. Thus, it requires 3,300 lb. of the new basic slag or 2,300 lb. of the old slag to equal 2,000 lb. of calcitic lime.

The test results emphasize that the new basic slag differs from the old in its lower liming potential and in its much lower content of available phosphorus. Extremely high rates of present-day basic slag are required to supply adequate phosphorus or lime on deficient soils.



A New Game – Estate Planning

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THE FASTEST MOVING, most serious game around these days is planning estate distribution.

A recent survey of farmers in the more prominent agricultural counties in Alabama revealed some alarming information. Most farmers do not understand the needs for estate planning. There was limited realization of the tax liability or asset distribution problems in improper planning. Fewer than 40% of the farmers had drafted wills. Of those individuals with wills, nearly 25% had wills over 10 years old. The number of old wills is not bad nor does it indicate poor planning. Rather, it means that many farmers could be facing unforeseen problems if no periodic updating has been done.

An effective will can accomplish many of the estate planner's objectives. However, failure to draft a will may result in serious complications in estate settlement. Where an individual dies intestate (without a will), his right to dispose of property as he pleases is forfeited and the property is distributed according to State "Laws of Descent and Distribution." This method of distribution is inflexible and oblivious to any particular objectives the decedent may have had. Thus, family hardships may result.

Other estate planning tools include gifts, trusts, insurance, and the method of ownership. Use of these tools as complements to a will and to themselves greatly increases the assurance of desirable estate settlement.

The need for proper estate planning by farmers increased in the last decade as the value of farm estates rose dramatically. Most of the increases resulted from land value changes. Higher real estate values have resulted in estate tax levies far in excess of levels anticipated because of the low cost basis in farms and ignorance of the real value of farm land. Increased capital investments also contributed to a pressing need for planning.

These pressures have resulted in new laws. The most recent Federal tax legislation, passed in 1976, provided for significant changes in the tax levies on personal estates. The personal exemption level of $60,000 was replaced by a unified estate tax credit system which makes the effective tax exemption reach nearly $176,000 in 1981.

An indication of the need for planning even though tax laws were changed is found in the table—farmer net worth is growing.

Net worth averages for a survey are often misleading. In this case more than 65% of the estates were valued less than $300,000 net. However, over 20% were valued in excess of $500,000. In fact, the net worth for farms ranged up to $2,380,400. These statistics indicate significant planning needs regardless of the 1976 Tax Reform Act.

Assets and liabilities	*Average value*	*Percent of net worth*[1]
Land value (total)	$ 236,850	69.0
Residence	22,700	10.9
Insurance	45,430	19.3
Stocks, bond savings	11,230	4.0
Supplies and inventory	2,020	0.6
Machinery and equipment	29,470	9.2
Other personal property	9,960	3.5
Livestock	39,520	8.2
Total assets	359,070	
Liabilities	-22,910	11.0
Net worth	$ 336,270	

[1]Percentages will not add to 100 since values represent only farms reporting each item.

A general lack of knowledge concerning estate planning among respondent farmers was evident from the survey. More than 88% of the respondents had not studied any estate planning publications at the time of interview, and 95% had never attended training sessions of any sort on the subject.

In most instances a lack of knowledge on a subject means one should seek competent assistance from others. The logical source for such assistance is an attorney trained in the particular area of estate planning. Fewer than 40% of respondents had consulted attorneys, and not all of these had used their services.

Attorneys who were named by respondents were asked to determine the extent of estate planning in the study areas. Respondent attorneys averaged 23 years in practice and had drafted an average of 18 wills per year for clients. Few of these were farmer clients. Approximately one-third of the lawyers encouraged clients to develop a comprehensive estate plan. Most of these lawyers had special training in estate planning or tax management. These data suggest that farmers should use caution in selecting consultants for estate-planning. As there exists in other professions, there are specialists trained for estate planning. Likewise, attorneys need to acquire more skills in this area in order to properly advise clients.

Thus, problems in estate planning and estate distribution for a majority of Alabama farmers are a logical expectation. New tax laws may have a tendency to lull farmers and estate consultants into a false sense of security. This is especially true since 95% of the surveyed farmers mentioned tax avoidance as a major estate planning objective. Taxes are an important factor, but proper estate administration and distribution may be more important, especially if a decedent has specific desires, or heirs have specific needs. Overconcern with tax liability among respondent farmers and limited concern for other planning objectives were implied from the survey. Each farm family needs to discuss the needs and goals of the family in the event of death. A carefully developed estate plan, when carried out, will eliminate much of the cost, confusion, and frustration common in the event of an unexpected death.

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