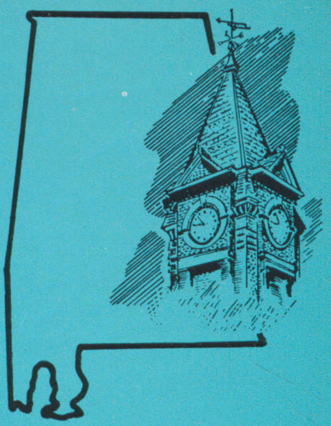
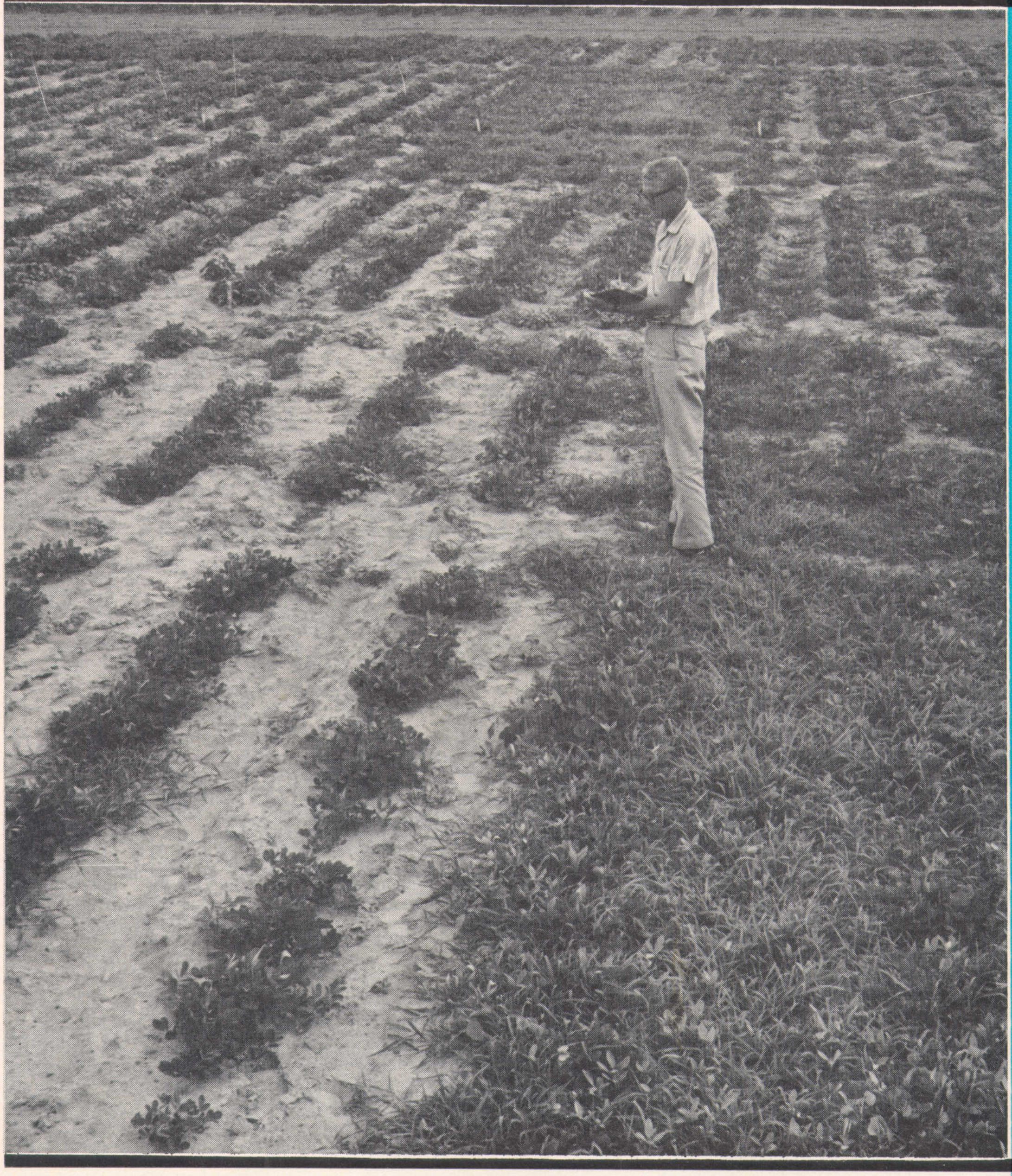
VOLUME 13, NUMBER 4 WINTER 1966

HIGHLIGHTS

OF AGRICULTURAL RESEARCH





HERBICIDES . . .
show promise for weed control in peanut fields, details on page 4

AGRICULTURAL EXPERIMENT STATION
AUBURN UNIVERSITY

HIGHLIGHTS of Agricultural Research

A Quarterly Report of Research Serving All of Alabama

VOLUME 13, NO. 4 WINTER 1966

In this issue . . .

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AGRICULTURAL EXPERIMENT STATION of AUBURN UNIVERSITY

Auburn, Alabama

New and Timely PUBLICATIONS

Listed here are timely and new publications reporting research by the Agricultural Experiment Station.

Bul. 362. Response of Planted Loblolly Pine Following Various Conversion Methods.

Bul. 363. Forage Systems Compared for High Producing Cows.

Bul. 367. Marketing Outdoor Recreational Services.

Bul. 371. Size Adjustments of Alabama Grade A Milk Producers.

Bul. 372. Tolerance of Cottonwood to Certain Herbicides.

Cir. 152. Spacing and Rates of Nitrogen for Corn.

Leaf. 65. Warrior — A Bruchid-Resistant Vetch.

Leaf. 70. Serala—A New Sericea.

Leaf. 71. Yuchi—New Arrowleaf Clover.

Leaf. 72. Performance of Peach Varieties for Commercial Production in Central Alabama.

Prog. Rept. 84. Rainfall Distribution in Alabama.

Prog. Rept. 85. Early Thinnings from Pine Plantations.

Free copies may be obtained from your County Extension Chairman or by writing the Auburn University Agricultural Experiment Station, Auburn, Alabama.

Growth of ball clover from Mobile, left, and Dallas County on January 17 at Plant Breeding Unit, Tallassee, illustrates winter production differences between strains of the reseeding clover.

Nature Changes Ball Clover on Alabama Farms

C. S. HOVELAND and W. C. JOHNSON, JR.
Dept. of Agronomy and Soils

NATURE MAY PROVE to be a valuable ally in the effort to develop better adapted strains of ball clover.

Recent Auburn research suggests that ball clover is changing to produce new strains on Alabama farms. This rapid natural selection of types best suited to specific climate and soil conditions may be a reason for the adaptability of this annual reseeding clover.

Ball clover was introduced from Turkey as P.I. 206769 in 1953. The original introduction was planted by the Soil Conservation Service near Selma, and all subsequent plantings came from this field. Since considerable variation now exists in the clover, it was suspected that local strains, or ecotypes, may have developed in older reseeding pastures.

To investigate this theory, ball clover seed was collected from eight fields in central and southern Alabama for test plantings. All eight collection fields were initially planted with seed from the Selma field, and all had reseeded 5 to 9 years. The seed were planted in a yield trial at the Plant Breeding Unit near Tallassee in central Alabama. Observational tests were planted at the Gulf Coast Substation, Fairhope, and Tennessee Valley Substation, Belle Mina (southern and northern Alabama, respectively). A spaced plant nursery was established at the Plant Breeding Unit to determine amount of variation within each seed source.

Late autumn growth of plants from the various seed sources differed greatly. As shown by data in the table, seed collected from the two southern locations produced largest plants by December 6. Similar results were observed in tests at the Gulf Coast and Tennessee Valley substations.

Best winter production was obtained with plantings of seed collected near Mobile. However, it had somewhat greater freeze damage. The Flomaton strain, also from southern Alabama, made less winter growth than the Mobile strain. Seed collected at Flomaton were from a poorly drained site that is excessively wet until late spring. This condition favors a plant type that makes most of its growth in spring.

Early winter forage production was similar among plantings from seed collected at the six central Alabama locations. Spring forage production of all entries was satisfactory, although strains from poorly drained pastures were somewhat less productive.

Flowering dates of the clover entries were similar, except the Mobile strain was about a week earlier.

Spaced plants were studied from each of the eight seed sources. Individual plants within each seed source differed markedly in winter production, growth habit, and blooming date. A wide range in plant size was found in each seed source. However, seed collected from the southern locations, Mobile and Flomaton, produced a higher proportion of plants having high winter production.

PERFORMANCE OF BALL CLOVER STRAINS, PLANT BREEDING UNIT, TALLASSEE, WINTER 1965-66

Origin of ecotype	Years of natural reseeding	Plant height, Dec. 6	Dry forage/acre	
			Jan. 17	Total
	No.	*In.*	*Lb.*	*Lb.*
Southern Alabama				
Mobile	5	2.6	896	3,964
Flomaton	6	1.8	400	4,185
Central Alabama				
Prattville	5	.8	242	3,787
Dallas County, No. 1	8	.9	167	3,481
Carrollton	6	.6	111	3,805
Dallas County, No. 3	5	.4	45	3,386
Dallas County, No. 2	9	.4	20	3,537
Autaugaville	5	.4	0	3,462

Several facts are obvious from results obtained.

(1) There is a great deal of genetic variability in commercial ball clover.

(2) Environmental pressures at a particular location caused natural selection of plant types better suited to conditions in the area. Ball clover seed harvested from southern Alabama fields that have reseeded for several years will produce plants with less cold hardiness, more winter forage production, and an earlier blooming date than will strains from more northern reseeding pastures.

(3) Because of the large amount of variation within each strain, it is doubtful if locally adapted strains will retain their particular characteristics after several generations of reseeding in a different environment. Most likely they will again change in response to the new environment. This could prevent development of varieties that are genetically stable under reseeding conditions.

(4) The large amount of variation within ball clover probably explains why this clover is adapted to widely different environmental conditions.

These weed control research plots illustrate results possible from use of herbicides. Plot at left was treated with 2 lb. Vernam and one at right with 1.5 lb. Balan, both applied preemergence and incorporated ahead of planting. Check plots were completely covered with weeds.

Weeds in Peanuts Controlled by Herbicides

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Dept. of Agronomy and Soils

MECHANIZATION has essentially eliminated hand labor in peanut fields, except for weed control. If herbicides can be used to replace hand weeding, labor for peanut production can be further reduced by about one-third. Several herbicides have been evaluated in recent years with some showing considerable promise.

Preemergence Treatments

Vernolate (Vernam) has been evaluated for weed control in peanuts since 1960 in tests at the Wiregrass Substation, Headland. Control has been satisfactory when the material was applied at rates of 2.5 to 3 lb. active material per acre and incorporated into the soil before planting. It has effectively controlled such grasses as crabgrass and goosegrass, and the broadleaf weeds carpet weed and Florida pusley; however, it is completely ineffective against such pests as Texas millet and Florida beggarweed.

Although no reductions in yield have been noted in Alabama, Vernam occasionally causes some injury to peanuts. This is characterized by overall stunting of peanut plants and "leaf seal" of individual leaflets. Injury is temporary and usually not evident after 4 or 5 weeks. Incorporation of Vernam by disking is satisfactory, but the most effective method of application and incorporation is not known. An added bonus of Vernam is that it is fairly effective in reducing stands of nutsedge.

Benefin (Balan), a relatively new peanut herbicide, was first evaluated in Alabama in 1965. Like Vernam, it requires incorporation for consistent weed control.

The spectrum of weeds controlled by Balan parallels closely that of Treflan. Unlike Vernam, Balan is effective in controlling Texas millet but has no activity against nutsedge. Consequently, the combination of Balan-Vernam offers promise for those areas in which nutsedge and Texas millet are the predominant weed species. Balan's major weakness is its lack of activity against many broadleaf weeds, such as morning glory, cocklebur, sicklepod (coffee weed), and beggarweed.

Several herbicides evaluated for the first time in 1966 did an excellent job of controlling grasses or broadleaf weeds, or both, in peanuts. For example, Daxtron applied preemergence at rates as low as 0.5 lb. per acre was effective against both grasses and broadleaf weeds. This control appeared to last throughout the 1966 season.

Cracking Time Treatments

Contact herbicides, such as DNBP, are most effective when applied as weeds are emerging or shortly thereafter. If weeds are small, DNBP alone gives satisfactory control. To obtain control for a longer period, a herbicide with some residual activity (Sesone, Falone, and Diphenamid are examples) should be included with DNBP. This is especially necessary during a wet spring when weed seeds germinate throughout the growing season. In contrast, a single application of DNBP will often produce satisfactory weed control during an extremely dry spring. An important point to remember is that DNBP will burn plant foliage, particularly when weather is hot and dry; however, in no cases have peanut stands or yields been affected.

Daxtron, an experimental herbicide, is not only active as a preemergence herbicide, but it is also effective when applied postemergence to weeds. Application with as little as 0.25 lb. active material per acre gave commercial weed control in 1965 and 1966. The inclusion of DNBP with Daxtron has not given an appreciable increase in weed control. Daxtron applied at 1 lb. or more per acre after peanuts are up has caused some injury.

HERBICIDAL CONTROL OF ANNUAL GRASSES AND BROADLEAF WEEDS IN PEANUTS

Herbicide used, lb. per acre	Grass control		Broadleaf control[1]	
	1965	1966	1965	1966
	Pct.	*Pct.*	*Pct.*	*Pct.*
Preplant incorporated				
Vernam, 1	73	77	97	12
Vernam, 2	98	90	97	0
Vernam, 3	99	99	100	0
Balan, ½	96	63	99	63
Balan, 1	99	98	98	73
Balan, 1½	98	99	99	93
Balan, 3	99	99	99	93
Postplant preemerge				
Daxtron, ½	----	99	----	93
Daxtron, 1	----	99	----	99
Cracking time				
Daxtron, ¼	81	94	98	99
Daxtron, ½	94	99	99	100
DNBP, 1½ + Daxtron, ¼	89	97	99	99
DNBP, 1½ + Daxtron, ½	91	100	100	99
DNBP, 3 + Diphenamid, 4	49	97	91	97
DNBP, 1½ + Sesone, 3	51	84	99	97
DNBP, 1½ + Falone, 3	17	84	100	99
DNBP, 4½	91	87	100	97

[1] Predominant broadleaf weeds were carpet weed and Florida pusley in 1965 and Florida beggarweed, morning glory, and Florida pusley in 1966.

This group of bulls is the right age for profitable slaughter.

YOUNG Fat BEEF BULLS are PROFITABLE for SLAUGHTER

W. B. ANTHONY, *Department of Animal Science*
J. G. STARLING, *Wiregrass Substation*

YOUNG BULL BEEF, not usually exceeding 16 months of age, is flavorful and tender, and contains less fat than steer beef. Furthermore, young bulls grow faster and use feed more efficiently than steers.

These are facts but marketing channels usually discriminate against young slaughter bulls.

An experiment conducted recently at the Wiregrass Substation of the Auburn University Agricultural Experiment Station, showed superiority of growth rate of young bulls over that of steers. Not only did intact bulls gain more rapidly, they also used feed more efficiently and produced carcasses with more lean meat and less fat than steers in the same test. Some of the data are shown in Tables 1 and 2.

Pens of young bulls and steers were full fed a standard fattening mixture that contained in per cent, ground ear corn, 68.5; cane molasses, 10; ground Coastal hay, 20; salt, 1; defluorinated phosphate, 0.5; and vitamin A, 1000 I.U. per pound.

The bulls gained on the average 0.29 lb. per day (10%) more than steers and on 42 lb. less feed per cwt. of gain. These cattle were sold on the basis of carcass weight and grade. The test called for cattle to be marketed and graded together without regard that some were bulls. This situation was not obtained as a result of management of the carcasses at the packing plant. Bull carcasses were segregated from steer carcasses when placed in the cooler.

Test cattle were sold under contract with the Federal Meat Grading Service for carcass evaluation. Carcasses of all experimental animals were graded; however, bull carcasses had already been identified as carcasses of bulls by cooler placement. The carcass data, Table 2, show that bull carcasses had less outside fat and less marbling than steer carcasses. A major difference was in ribeye area. The intact bull carcasses had 13% more lean meat in the ribeye than steer carcasses.

The objective of this research was to find a way to use the superior growth rate and carcass merit of young bulls. Success in retarding development of secondary sex characteristics in young bulls without loss of superior growth potential has been partially accomplished by use of estrogen. Results on one treated group of bulls are shown in Tables 1 and 2. The estrogen-treated bulls out performed the control steers. The treated animals also had only slight development of secondary sex characteristics, except that the presence of testicles was obvious. These animals were already approaching sexual maturity when placed on the experiment.

In other tests bull calves were treated at birth with estrogen. The treatment resulted in almost complete retardation of sexual characteristics. These estrogen castrates also outgained steer calves. In another test fully developed bulls were treated with estrogen with only limited success. These mature bulls were sexually quiescent for several weeks, but returned to normal before they had finished the feeding period. These experimental results suggest that only bull calves can be successfully castrated with estrogen.

TABLE 1. PERFORMANCE DATA FOR TREATED AND UNTREATED BULLS AND STEERS

Item	Bulls untreated	Bulls treated	Control steers
No. animals	6	6	12
Days on feed	173	173	173
Total gain, lb.	516	501	465
Av. daily gain, lb.	2.98	2.90	2.69
Feed/cwt. gain, lb.	919	930	961
Yield grade	2.15	2.73	2.97

TABLE 2. CARCASS DATA FOR TREATED AND UNTREATED BULLS AND STEERS[1]

Item	Untreated bulls	Treated bulls	Control steers
Carcass wt., lb.	582	568	551
Dressing %	57.8	55.5	56.0
Fat thickness, 12th rib, in.	0.1	0.2	0.2
Ribeye area, sq. in.	11.2	10.0	9.9
Kidney, pelvic, heart fat, %	2.2	2.3	2.6
Marbling score,[2]	2.5	2.6	4.8
USDA grade[3]	11.5	11.2	11.2

[1] On color evaluation bulls had a tendency to have darker color of lean than the steers; treated animals had a color of lean intermediate between controls and intact bulls.

[2] Moderate, 7; modest, 6; small, 5; slight, 4; trace, 3.

[3] Choice, 13; Good, 10.

Converting HARDWOOD THICKETS to PINE FORESTS

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W. J. WATSON, *Lower Coastal Plain Substation*

How to convert a hardwood thicket into a pine forest was the question in mind when a research project was started at the Lower Coastal Plain Substation of the Auburn University Agricultural Experiment Station in 1959.

The location for the study was a dry ridge with an adjoining south-facing slope, a fair to good pine site but a poor hardwood site. Most of the soil, of the Cuthbert series, consisted of 9 to 24 in. of fine sandy loam over a subsoil of compacted sandy clay. The existing forest consisted of densely growing hardwoods less than 4 in. in diameter with scattered larger trees. The species were mainly upland oaks and hickories.

Planting and direct-seeding of pines was done in December, 1959. The treatments consisted of: (1) bulldozing late in the previous spring, windrowing and burning the debris, and following late in the previous summer by poisoning any sprouting stumps and by disking; (2) burning with strip headfires in the previous August, and, in the spring subsequent to the planting and seeding of pines, injecting with herbicide all hardwoods to a minimum diameter of about 1 in. at the ground line; (3) cutting all trees late in the previous spring, and following with broadcast burning in the previous August; (4) injecting with herbicide all hardwoods, as in treatment 2, in the subsequent spring; and (5) no treatment (check). The herbicide was an oil solution of 2,4,5-T having a concentration of 40 lb. acid equivalent per 100 gal.

The loblolly seed were collected in 1958 from trees at the Lower Coastal Plain Substation; the slash seed were collected from nearby Monroe County the same year. Seedlings were grown at the Auburn Nursery and hand-planted on the plots. Seed used for direct-seeding were placed in cold storage for 1 year, then half the seed of each species stratified for 30 days in wet moss. Stratified and unstratified seed were then mixed and treated with bird and rodent repellents. Seed spots were prepared by raking aside any litter and breaking any soil crust present. The seed were dropped and pressed in with the sole of the shoe. Laboratory germination percentages at the time of the seeding were 67 for the loblolly and 72 for the slash pine.

The table shows that after 5 years loblolly was superior to slash pine in survival and height for every treatment. However, the table does not include the results from one bulldozed plot which, unlike all the other plots, was on a deep Lakeland sand. On this plot, planted slash pine survived 63.6% as compared with 33.5% for loblolly; seeded slash had a survival of 4.8% as compared with 4.3% for seeded loblolly.

For converting hardwood thickets on sandy loam ridges and slopes to planted loblolly pine, acceptable treatments, in order of preference, are bulldozing, cutting and burning, and burning and poisoning. For planting slash pine, bulldozing, and cutting and burning are the acceptable treatments. It is thought, however, that the burning and poisoning treatment would have given results with both pines equal to those for cutting and burning if the burning had been done after leaf fall instead of in August. For deep sands, only slash pine should be planted, with bulldozing the preferred treatment.

Direct-seeding survival could have been improved 50 to 100% through (1) planting stratified seed in early February, and (2) planting the seed ¼ in. deep in a well firmed seedbed.

Survival and Average Heights After 5 Years for Planted and Direct-Seeded Pines[1] for Various Site Preparation Treatments

Treatment	Planted		Direct-seeded	
	Survival	Height	Survival	Height
	Pct.	*Ft.*	*Pct.*	*Ft.*
1. Bulldozing	85.8	11.0	6.2	7.4
	58.5	10.0	4.3	6.0
2. Burning and poisoning	56.0	8.5	2.6	5.0
	33.5	6.7	0.9	4.8
3. Cutting and burning	72.4	9.5	7.1	5.2
	59.4	8.3	4.5	4.8
4. Poisoning	34.9	7.3	3.6	5.8
	19.0	6.0	1.0	5.4
5. Check	29.8	5.4	0.9	2.3
	17.0	4.4	0.0	----

[1] The top figure of each pair is for loblolly pine; the bottom figure is for slash pine.

(L) Hardwood thicket condition on pine site; (C) planted pines in third growing season among hardwood regrowth after burning plus herbicide injection treatment; (R) the planted pines overtop the hardwood regrowth after four growing seasons.

FACTORS *Affecting* *Nozzle Orifice Wear*

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Dept. of Agricultural Engineering

SUCCESSFUL use of herbicides, insecticides, and fungicides on the farm depends to a large extent on application of correct dosages of the proper chemicals.

The list of chemicals used to control weeds, insects, and diseases in field crops grows each year. These chemicals are becoming more selective in their control, and more care is required in their application. Applying too much chemical can result in crop injury, excessive residues, and costly wastes; but applying too little will not do the job.

With introduction of ultra low volume sprays in which quantity per acre is measured in ounces instead of gallons, the application of the correct dosage is becoming even more important.

The nozzle is one of the key parts in a sprayer system because it controls the application rate. Any wear of the nozzle orifice (opening) will cause a change in application rate. A study was conducted by Auburn University Agricultural Experiment Station to provide information on nozzle orifice wear, and consisted of the following laboratory tests:

(1) A comparison of abrasiveness of the herbicide diuron [3-(3, dichlorophenyl)-1, 1 dimethylurea] formulated as a wettable powder (DW) with diuron formulated as a liquid suspension (DL).

(2) A comparison of wear resistance of brass, stainless steel, and aluminum nozzle tips.

(3) A determination of the effects of orifice size and pressure on orifice wear.

Comparison of Abrasiveness

A mixture of 1 lb. (active) diuron wettable powder (DW) in 25 gal. water was recirculated at 40 p.s.i. (lb. per sq. in.) through 6 brass fan nozzle tips, FS 7-80°. The tips had a rated discharge capacity of 0.336 g.p.m. (gal. per minute) at 40 p.s.i. The nozzle tips were calibrated at beginning of the test and recalibrated after the first, third, and sixth hour and every 6 hours thereafter. The diuron mixture was drained from the tank each 3 hours of recirculating and a new mixture added. This was necessary to prevent the particles from wearing smooth because of continuous recirculation.

The entire procedure was repeated with 1 lb. (active) diuron liquid suspension (DL).

The comparative abrasiveness of diuron (DW) and diuron (DL) to brass nozzle tips is graphically shown in Figure 1.

Wear Resistance of Different Metal Tips

Diuron (DW) in water was recirculated at 40 p.s.i. through 9 fan nozzle tips, FS 7-80°, 3 each of brass, stainless steel, and aluminum.

The progressive wear of the nozzle tips is shown in Figure 2. The degree of nozzle wear is shown as increase in flow over initial flow.

Orifice Size and Pressure

Tests were conducted to determine the effects of orifice size and pressure on orifice wear.

The diuron (DW) mixture was recirculated at 40 p.s.i. and at 20 p.s.i. through FS 11-80° (1.012 g.p.m.) and through FS 7-80° (0.336 g.p.m.) brass nozzle tips.

Results of these wear tests are illustrated in Figures 3 and 4.

Summary

Diuron wettable powder (DW) was more abrasive to brass nozzle tips than diuron liquid suspension (DL).

Stainless steel nozzle tips were more resistant to wear than brass or aluminum nozzle tips. Most wear occurred during the first few hours of all nozzle tips.

Orifice wear increases with either increase in pressure or decrease in orifice size. This emphasizes the importance of using low pressures and large orifices when possible.

All tests point up the importance of frequent recalibration when applying agricultural chemicals to field crops. This is especially true during the first few hours of operation when using brass or aluminum nozzles to apply wettable powders.

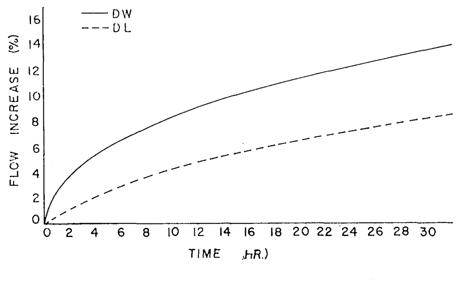

FIG. 1. Comparative abrasiveness of diuron (DW) and diuron (DL) to FS 7-80° brass nozzle tips.

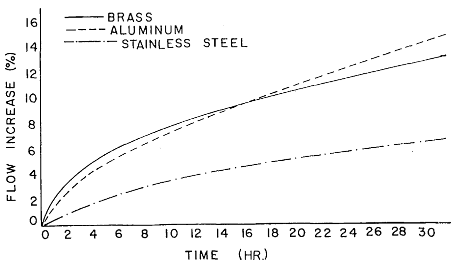

FIG. 2. Progressive wear of FS 7-80° brass, stainless steel, aluminum nozzles when 1 lb. of active diuron (DW) in 25 gal. water is sprayed through the nozzles at 40 p.s.i.

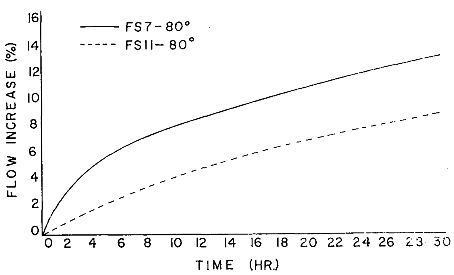

FIG. 3. Progressive wear of FS 7-80° and FS 11-80° brass nozzles when 1 lb. of active diuron (DW) in 25 gal. water is sprayed through the nozzles at 40 p.s.i.

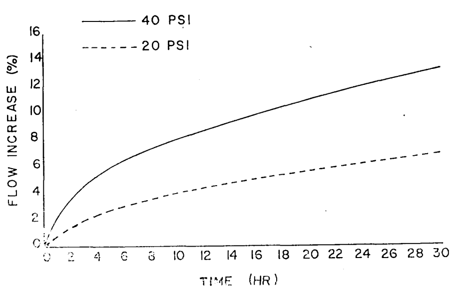

FIG. 4. Progressive wear of FS 7-80° brass nozzles when 1 lb. of active diuron (DW) in 25 gal. water is sprayed through the nozzles at 40 and 20 p.s.i.

COTTON'S Ups and Downs

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THE BIG CROP COTTON has had its ups and downs. Throughout most of Alabama's agricultural history, cotton has been the leading source of farm income. It is still a major source of income although 1966 cash receipts from cotton will be lower than those of recent years.

What are some of the trends and variations in acreage, yield, production, price, and cash receipts for cotton?

In 1866 Alabama farmers harvested 977,000 acres of cotton. Acreage increased steadily until 1911-15 when the boll weevil made inroads into Alabama's cotton. (See chart.) From 1920 to 1930 acreage increased again; however, since the 1930's acreage has steadily declined. A major reason has been government acreage control programs.

In 1966, about 575,000 acres of cotton were harvested. This is the second smallest acreage in 100 years. The smallest acreage harvested was 530,000 acres in 1958.

Until about 1930, yield of lint cotton did not improve much over an average of 150 lb. per acre. With reduced acreages in the 1930's and early 40's, farmers could plant a larger portion of the crop on their best land. Improvement in acre yield resulted from planting better varieties and applying research findings on fertilization, spacing, and insect control.

The State average yield barrier of 300 lb. of lint per acre was broken first in 1944, the 400-lb. barrier in 1955, and the 500-lb. barrier in 1963. The 1964 average yield of 512 lb. per acre was the highest on record. The lowest average per acre yield was 93 lb. in 1923 followed closely by the low of 95 lb. in 1916.

Yield per acre varies among years, among fields on the same farm, among farms, states, and counties. Variation in lint yield per acre by counties was studied by 5-year periods since 1941.

Average county yields have increased since 1941 in all counties. However, yields in northern Alabama are somewhat higher than those in southern Alabama. For the 5 years, 1941-45, all counties except 15 located south of Jefferson had an average deviation in yield of 20% or more from the 5-year average. The pattern of yield variation changed for the period 1961-65. Most northern and southwestern Alabama counties had an average deviation in yield of 20% or more from the 5-year average.

In 1890, Alabama first produced more than a million bales of cotton. Total production increased until 1914. From that year to 1935, there were several periods of ups and downs. More than a million bales were produced in 1948 and in 1955, the last year of such a bumper crop.

Although reduced acreages since the 1930's were associated with higher yields, the increases in yields were not sufficient to prevent a downward trend in total production.

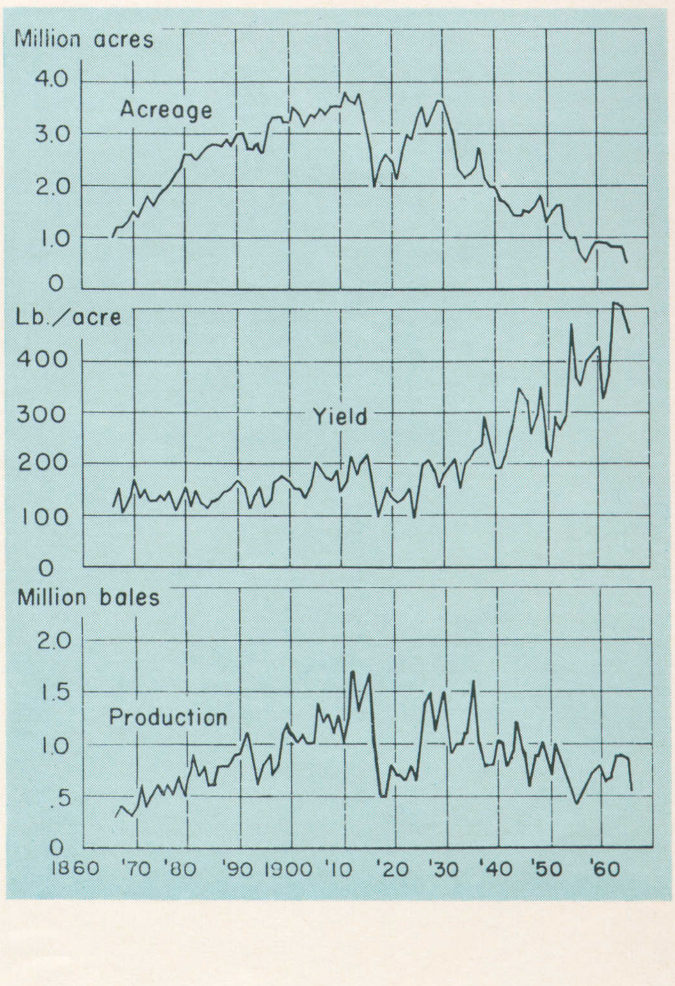
In 1966 with its 550,000 bale crop, production will be the lowest since 1958 if the September estimates hold true. In no year of Alabama's cotton production history of 1918 to 1956 was the total crop below 500,000 bales. As early as 1870 Alabama farmers produced more than 550,000 bales.

Prices received by farmers for cotton lint have also fluctuated. In the late 1800's, Alabama farmers received an average price of about 8¢ per lb. for lint cotton. Average annual prices increased from this level to almost 35¢ per lb. in 1919. By 1931, average price dropped to slightly under 6¢, the lowest for any year of record. Since 1946 annual average prices received by producers have been between 29¢ and 40¢ per lb.

Value of the cotton crop results from production times price. The record dollar value of any Alabama cotton crop, excluding seed, was in 1948 when 1.2 million bales were produced and the price per lb. averaged 30.8¢. Value of the lint was more than $184 million. The lowest value crop was $21.7 million in 1894. In only 2 years (1957 and 1958) since 1943 was the crop value below $100 million. There will be a substantial decrease in value of the 1966 crop as compared with those of the 1963, 1964, and 1965 crops.

Cotton has been and continues to be a major contributor to Alabama farm income. During the 5-year period 1925-29, cotton and cottonseed accounted for 73% of total cash farm receipts. For 1960-64, cotton and cottonseed made up 24% of cash farm receipts. Although its relative importance has declined, cotton is still the major source of cash receipts from field crops.

Throughout the past 100 years, Alabama cotton has had its ups and downs. To some, cotton's future in Alabama appears uncertain. **For producers who achieve efficiency in production and produce the quality cotton demanded by mills, the future will hold more "ups" than "downs."**



NITROGEN + IRRIGATION

formula for consistently high corn yields

C. E. SCARSBROOK, *Dept. of Agronomy and Soils*

IRRIGATION MAKES POSSIBLE top yields of corn year after year. High yields can be made nearly every year if irrigation is used along with adequate fertilization, proper spacing, good seed, and other good management practices.

Many experiments have shown that return from fertilizer is much greater when supplemental water is supplied to eliminate drought limitations. Typical results are illustrated by the graphs, which summarize findings at three experimental locations.

A 5-year irrigation experiment at the Tennessee Valley Substation revealed typical response to nitrogen and water for corn (see graph). There was little effect from irrigation when no nitrogen was applied, but yield was increased 24 bu. per acre when 120 lb. of nitrogen was added.

Corn was irrigated between the tasseling and early dent stages when plants had the most critical need for water. About two irrigations of 2 in. each, put on by sprinkler, were required each year. Increased yield of at least 16 bu. per acre is required to pay the cost of two irrigations, according to an estimate reported in Mississippi Agricultural Experiment Station Bulletin 559.

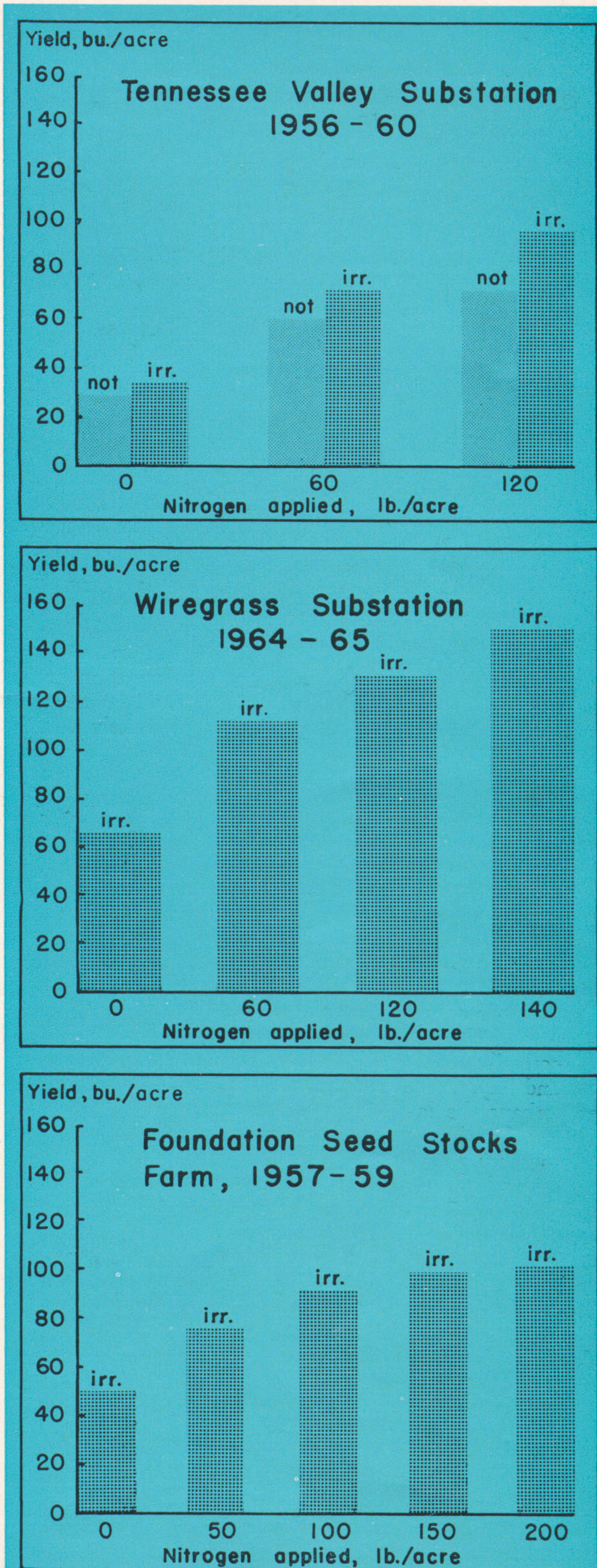
Average yields as high as 149 bu. per acre were made with irrigated Florida 200 variety corn during a 2-year period at the Wiregrass Substation (see graph). Yields went up with each increase in rate of nitrogen.

Yields reported are from 9-in. spacing in 3-ft. rows (19,400 plants per acre). There was a progressive loss in yield as drill spacing was increased when 60 lb. or more nitrogen was added. For example, with the 240-lb. nitrogen rate, yields from 9-, 12-, 15-, and 18-in. spacings were 149, 137, 128, and 115 bu., respectively.

Lodging was not serious regardless of nitrogen rate or spacing during the 2 years of the experiment. Close spacing resulted in smaller ears and fewer ears per stalk. Ear size and number per stalk increased as nitrogen rate went up. Ear size ranged from ¼ to ½ lb., and number of ears per stalk from a low of 9/10 to a high of 1-9/10. Where corn is mechanically picked, ear size is not particularly important unless ears are extremely small.

Corn responded to 150 lb. of nitrogen in a 3-year study at the Foundation Seed Stocks Farm, Thorsby (see graph). Lodging in 1 year amounted to 30 to 40%, but it was less than 10% in the other 2 years. Lodging was not related to amount of nitrogen applied.

Based on test results with irrigated corn, 160 lb. per acre is the recommended nitrogen rate for all areas except Sand Mountain; 180 lb. is suggested for that region. Following soil test recommendations for phosphate, potash, and lime application has proved best. Drill spacing of about 9 in. in 36- to 40-in. rows is suggested.



How nitrogen and irrigation work together for consistently high corn yields is illustrated by these research results.

FEEDLOT Steer FATTENING in Gulf Coast Area

R. R. HARRIS, *Dept. of Animal Science*
H. F. YATES and J. E. BARRETT, JR.
Gulf Coast Substation

COOL-SEASON ANNUAL GRAZING followed by a drylot fattening period is an excellent system for the production of slaughter beef in the Gulf Coast area of Alabama.

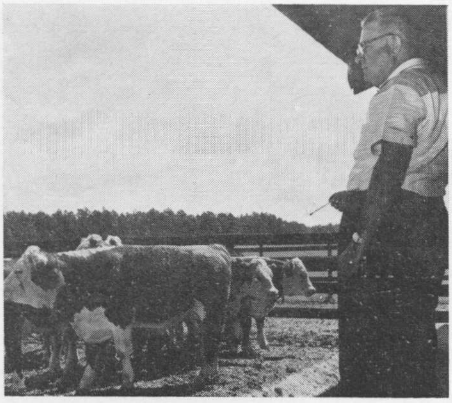
Stocker calves grazing crops such as oats-clover, rye-ryegrass-clover or rye-clover, usually gain at least 1.50 lb. daily for the period October-May. When removed from grazing these cattle are ideally suited for finishing on blended, fattening mixtures in a drylot.

Research using variations of this system has been in progress at the Gulf Coast Substation of Auburn University Agricultural Experiment Station since the late 1950's. In all cases, calves used in these tests had grazed cool-season annual pastures before being subjected to treatments described. Results from several of the more recent feedlot fattening studies are presented.

During earlier work with feedlot fattening there appeared to be a "ceiling" of about 2 lb. of daily gain. Cattle were being fed in a pine grove, and air movement seemed to be limited. The feedlot area was located in a natural land depression or "drain." Since these cattle were normally in the feedlot during May, June, and July, the observation was made that perhaps the lack of air movement contributed to the mediocre performance.

In the spring of 1962, a new feedlot facility was built at another location on the Substation. This pole-type barn was built on a knoll in a large cleared area and air drainage seemed excellent. There was no natural shade in the lots, but good artificial shade was provided.

At the end of oat grazing, May 3, 1962, cattle were divided into four groups with three groups fed at the new facility and one group fed at the original location. All cattle were full-fed a blended, high-roughage fattening mixture consisting of ear corn, 69%; Coastal hay, 20%; soybean meal, 10%; mineral, 1%. During the ensuing 94-day test, the average daily gains (ADG) of the three groups fed at the new location were 2.35, 2.29, and 2.16 lb., whereas those fed at the original site gained only 1.90 lb. Cattle fed at the new location consumed less total feed, 2,082 lb. vs. 2,257 lb.; ate less feed daily, 22.1 lb. vs. 24 lb.; and required less feed per cwt. of gain, 942 lb. vs. 1,261 lb. The increased feed efficiency of cattle at the new facility resulted in a cheaper feed cost per cwt. of gain, $18.53 vs. $24.77.



This group of stocker calves at the Gulf Coast Substation has been on cool-season grazing and are here in the feedlot for the fattening period.

These results, coupled with observations from previous tests, confirmed the theory that air drainage or movement is definitely a factor in feedlot fattening of cattle, especially in areas of high humidity such as the Gulf Coast.

"Marbling" is the term used to denote interspersal of fat in the lean; there is a fairly high relationship of marbling with carcass grade and flavor of meat. Even though cattle fattened in the research studies at the Gulf Coast Substation graded Good-Choice, the carcasses were generally not well marbled. To improve marbling, choline was added to the basal fattening mixture. This water-soluble, "B" vitamin is a nutrient that aids in transport of fat and thus could conceivably improve marbling of the carcass. Results of the 3-year study are given in the table. The basal feed mixture, as described, and the experimental mixture were identical except the addition of choline supplement, (6 g./25 lb. of feed).

No major differences were observed between cattle fed the two rations. Neither the ADG, 2.75 vs. 2.68 lb., nor the feed per unit of gain, 8.44 vs. 8.80 lb., was improved by addition of choline. The choline-fed cattle did have slightly higher marbling scores (4.9 vs. 4.4), but there was not a significant effect.

Some nutritionists advocate feeding large (20,000-30,000 I.U. daily) doses of vitamin A as a protection against heat stress in feedlot cattle. Cattle used in the Gulf Coast feedlot studies routinely come off excellent pastures, and, therefore, would not be expected to be deficient in vitamin A or carotene (precursor of vitamin A). Nevertheless, if large doses of "A" do help cattle combat heat stress, then the addition of this vitamin might prove to be beneficial.

In 1962, one group of 10 steers was fed the basal mixture and a comparable group received the same mixture with 30,000 I.U. of vitamin A given per animal daily.

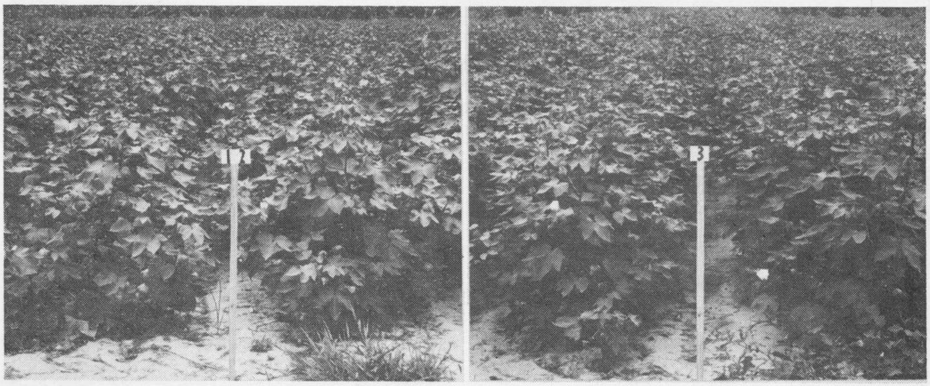
In this 94-day test, there were no major differences in animal performance or carcass data. Cattle fed the basal mixture gained slightly faster, 2.35 vs. 2.29 lb.; consumed less feed per cwt, of gain, 942 vs. 985 lb.; and had a slightly lower feed cost per cwt. of gain, $18.53 vs. $19.50 than comparable cattle fed the vitamin A supplement.

PERFORMANCE OF CATTLE FED HIGH-ROUGHAGE FATTENING MIXTURE WITH CHOLINE—FAIRHOPE, 1963-65

Item	Basal	Basal + Choline[1]
Number of animals	27	27
Length of test, days	68	68
Initial weight, lb.	777	794
Final weight, lb.	964	976
ADG—feedlot, lb.	2.75	2.68
Fattening feed/steer, lb.	1,578	1,601
Fattening feed/cwt. gain, lb.	844	880
Feed cost of gain $/cwt.	17.16	17.87
Carcass grades: (No.)		
Good	20	19
Choice	7	8
Yield, %	58.20	58.23
Backfat thickness, in.	.42	.36
Ribeye area, sq. in.	9.94	10.51
Numerical grade[2]	10.8	11.1
Yield grade[3]	2.8	2.2
Marbling score[4]	4.4	4.9

[1] Choline added at rate so that average daily consumption during 3-year test was 5.53 grams.
[2] Good = 10; High Good = 11.
[3] Range 1-5; lowest most desirable.
[4] Slight = 4; Small = 5.

Cotton in a 3-year rotation outyielded cotton continuous by 745 lb. seed cotton per acre. (L) Cotton in rotation (+N) yielded 2,834 lb. (R) Cotton continuous (+N) yielded 2,089 lb. Location: Sand Mountain Substation; year, 1965.



ROTATIONS *increase yields of* COTTON, CORN *and* OATS*

D. G. STURKIE
Dept. of Agronomy and Soils

CROP ROTATIONS are of value! On what basis – increased yields, maintenance of organic matter, and less disease?

Numerous rotation studies have been reported, but few have had uniform treatment of nitrogen (N), phosphorus (P_2O_5), and potassium (K_2O). Many included legumes. Thus the effect of rotation itself could not be measured without the confusing effect of variation in nitrogen because of legumes or variation in phosphorus and potassium.

Results of experiments reported here were conducted at three locations in Alabama for a 36-year period. The soils and test locations were: Decatur clay, Tennessee Valley Substation, Belle Mina; Hartsell fine sandy loam, Sand Mountain Substation, Crossville; and Norfolk sandy loam, Wiregrass Substation, Headland – outlying units of Auburn University Agricultural Experiment Station System. All plots had the same rate of N, P_2O_5, and K_2O. The rate was sufficient to maintain a level of phosphorus and potassium favorable to the crop planted. Nitrogen was applied at the following per-acre rates: 36 lb. (1930-1944), 48 lb. (1945-1959), and 72 lb. (1960-1965). The pH of the soil was kept at about 6 to 6.5 by addition of lime as needed.

The experimental plots were designed so that each crop in a rotation was grown each year. In all cases stalks were left on the plots; only the grain and seed cotton were removed. No legumes were grown in the rotations. In studies involving legumes, still larger yield increases were obtained.

EFFECTS OF ROTATION ON YIELDS OF COTTON AND CORN

Cropping system	Substation	Six-year periods 1930-1935 (1)	1936-1941 (2)	1942-1947 (3)	1948-1953 (4)	1954-1959 (5)	1960-1965 (6)	Av.
		Yields of seed cotton per acre, pounds						
Continuous cotton	Wiregrass	1232	1415	922	1059	1767	2418	1469
	Tenn. Valley	1154	1214	1183	1146	1155	1759	1268
	Sand Mountain	1394	1528	1588	1348	1836	1946	1607
	Average	1260	1386	1231	1184	1586	2041	1448
Two-year rotation, cotton-corn	Wiregrass	1341	1503	1254	1361	1722	2395	1596
	Tenn. Valley	1240	1481	1421	1270	1360	2004	1463
	Sand Mountain	1395	1533	1641	1396	1874	2174	1669
	Average	1325	1506	1439	1342	1652	2191	1576
Three-year rotation, cotton-oats-corn	Wiregrass	1489	1690	1479	1605	1893	2619	1796
	Tenn. Valley	1370	1595	1522	1347	1447	2174	1576
	Sand Mountain	1363	1707	1824	1584	1986	2433	1816
	Average	1407	1664	1608	1512	1775	2409	1729
		Yields of corn per acre, bushels						
Continuous corn	Wiregrass	29.9	30.1	37.8	27.5	48.7	60.2	38.4
	Tenn. Valley	29.9	36.1	23.0	35.6	30.4	45.3	33.4
	Sand Mountain	41.3	38.9	39.6	49.9	63.2	74.7	51.3
	Average	33.7	35.0	33.5	37.7	47.4	60.0	41.0
Two-year rotation, cotton-corn	Wiregrass	23.9	31.6	31.3	29.3	48.2	58.9	37.2
	Tenn. Valley	34.0	42.1	31.0	40.6	39.4	57.2	40.7
	Sand Mountain	39.2	37.1	40.8	49.3	62.2	81.4	51.7
	Average	32.4	36.9	34.4	39.7	49.9	65.8	43.2
Three-year rotation, cotton-oats-corn	Wiregrass	34.3	31.8	36.8	25.0	55.7	75.6	43.2
	Tenn. Valley	39.4	45.3	31.8	46.7	41.4	68.1	45.4
	Sand Mountain	44.5	43.9	52.0	67.3	73.4	93.4	62.4
	Average	39.4	40.3	40.2	46.3	56.8	79.0	50.3

Yields of cotton and corn under cropping systems of continuous culture, 2-year rotations, and 3-year rotations are given in the table. In practically all instances, average yields of cotton and corn were increased by rotation. The average increases from the 2-year rotation were 2.2 bu. of corn and 128 lb. of seed cotton, while those from the 3-year rotation were 9.3 bu. of corn and 281 lb. of seed cotton. Results from the last 6 years of the experiment show increases of 5.8 bu. of corn and 150 lb. of seed cotton from the 2-year rotation, and increases of 19.2 bu. of corn and 368 lb. of seed cotton from the 3-year rotation.

Yields of oats were increased by rotations to a much greater extent than were those of cotton and corn. Although liberally fertilized, the oats in continuous culture failed completely by the end of 12 years. Oats in a 3-year rotation grew well throughout the 36-year experiment. Apparently oats cannot be grown continuously on the same area successfully because of various soil-borne diseases.

Rotation is desirable for high yields of cotton and corn and is a must for oats.

* Tests reported here were conducted under supervision of the late Fred Stewart and John Boseck, Tennessee Valley Substation; R. C. Christopher and S. E. Gissendanner, Sand Mountain Substation; and the late J. P. Wilson and C. A. Brogden, Wiregrass Substation. Their assistance is gratefully acknowledged.

Paternal Half-Sisters Vary Widely in Production Among State Dairy Herds

NATRAJAN SRINIVAS and GEORGE E. HAWKINS
Department of Dairy Science

ALABAMA cows on DHIA test in 1965 produced 9,366 lb. of milk and 367 lb. of butterfat. This is 2,761 lb. less milk and 95 lb. less fat than the national average. Since bulls available for artificial breeding of Alabama dairy cows are among the top sires used nationally, production by artificially bred Alabama cows should come close to that of all U.S. cows.

To shed light on this low production problem, an Auburn University Agricultural Experiment Station study was done to (1) compare production of cows in Alabama DHIA herds sired by the same bull, and (2) compare production of these Alabama cows with their paternal half-sisters in all U.S. DHIA herds.

Study information came from machine processed Alabama DHIA records on cows sired by bulls in artificial insemination studs. All records of complete lactations – 250 to 305 days – were used for comparing paternal half-sister production. The final analysis was restricted to data on sires having three or more daughters in each of three or more herds with milking records completed between October 1, 1961, and May 31, 1964. All production records were converted to 2x, ME, FCM basis (twice-daily milkings, mature equivalent, 4% fat corrected milk).

Wide Variations Found

Records of half-sisters sired by Holstein and Jersey bulls and producing in different herds showed wide variation in FCM levels. These differences were related to production levels of all their herdmates of the same breed.

One sire had 160 daughters in 41 Alabama DHIA herds, and their average FCM production on different farms ranged from 9,369 to 16,220 lb. This whopping 6,851 lb. difference was the greatest variation noted. Lowest variation among half-sister production was 592 lb. of milk, but the average amounted to 3,100 lb. difference between highest and lowest.

Reasons for the large production differences between daughters of a given sire cannot be precisely determined. Since dam and sire contribute equally to the offspring's milk producing ability, it is obvious that differences in dams of the half-sisters caused some variability.

Feeding Level Implicated

Differences in feeding among farms were identified as causing some of the production variations. Relationships between the cows' intake of estimated net energy (ENE) and their production showed that 64 to 76% of the difference was nutritional. The lowest level of production was found on farms having a low level of feeding and highest production was recorded where feeding was at a high level. There is no assurance that additional feed intake would have increased milk production on farms feeding low levels of energy. However, higher production would not be possible without corresponding increases in energy consumption.

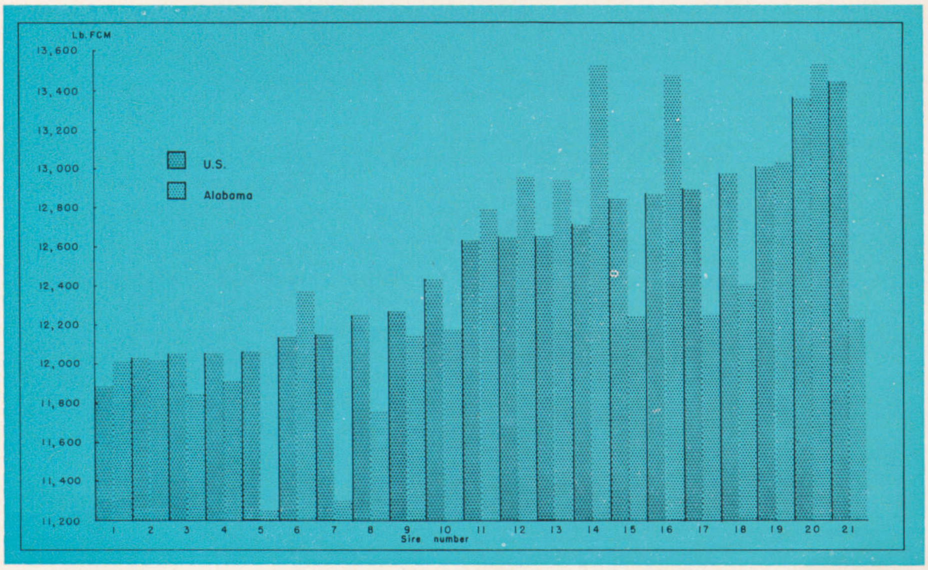
Production by paternal half-sisters varied about the same among herds in the same county as it did throughout the State. Therefore, variation in climate within the State was not a major factor in determining ENE intake or FCM production. Although level of feed intake appeared to be the principal limitation, differences in herd management also could have contributed to production variations among the half-sisters.

Alabama vs. National Records

Records of all Alabama DHIA daughters of all artificial insemination Holstein sires completed during the study period showed an average of 11,535 lb. of milk (2x, ME, 305-day). This is 829 lb. less than the national Holstein average.

The relative FCM production that may be expected of Alabama and U.S. paternal half-sisters by proven Holstein sires is illustrated in the graph. Adjusted milk records of Alabama daughters by nine of the sires were greater than for all U.S. daughters of these bulls. For the other 12 sires, however, Alabama daughters made poorer production records than other U. S. daughters.

Analysis of data from the 21 sires shows good potential for Alabama daughters of these bulls. According to this analysis, for each 100 lb. FCM increase by all U.S. daughters, a 95 lb. increase can be expected for the Alabama half-sisters. Such facts emphasize the importance of selecting sires whose future daughters have the highest predicted superiority over their herdmates for both milk and fat production.



Records of Alabama and U.S. daughters of 21 Holstein sires are compared here. All records are FCM, on basis of mature equivalent, twice-daily milking, and 305-day lactations.

Potatoes in plot No. 7 at left were grown from application of 2/3 ammonium sulphate plus 1/3 sodium nitrate. Potatoes in right of this plot were from ammonium sulphate without nitrate nitrogen or lime. Potatoes in left of plot No. 5 were grown with ammonium sulphate with 1,000 lb. of limestone. Potatoes at right of plot were with ammonium nitrate.

EFFECTS of NITROGEN Source and LIME on POTATO YIELDS

W. A. JOHNSON and L. M. WARE, *Department of Horticulture*

THE SOURCE OF NITROGEN used under certain soil conditions can affect potato production.

A 4-year study of the effect of nitrogen sources on Irish potato production was made on a Chesterfield sandy loam soil at the Auburn University Agricultural Experiment Station. The study included the effects of different sources and combinations of sources of nitrogen with different rates of sulfur and lime on soil acidity, yields of potatoes, and the appearance of physiological leaf-roll.

Fertilizer used consisted of 2,400 lb. per acre per year of an 8-8-8, one-half applied at planting time and one-half one month after planting. Sources of nitrogen used were ammonium sulphate, ammonium nitrate, sodium nitrate, and combinations of the two acid-forming sources with the base-forming source. Sulfur and lime were applied to obtain a wide range of soil acidity for plots receiving the ammonium source of nitrogen. Sulfur was applied at the beginning of the experiment at the rates of 1,500, 1,000, 500, and 0 lb. per acre. In one treatment receiving ammonium sulphate, an annual application of 1,000 lb. per acre of limestone was added.

When the sources of nitrogen were used independently, the average yields of potatoes, both the No. 1 grade and totals for the 4 years were highest from use of ammonium nitrate, intermediate from use of sodium nitrate, and lowest from use of ammonium sulphate. Yields from treatments receiving ammonium sulphate were materially decreased when a high rate of sulfur was added at the beginning of the test. An application of 1,000 lb. of limestone annually increased the yields of potatoes when the source of nitrogen was ammonium sulphate. In treatments receiving ammonium nitrate yields were decreased from the highest rate of sulfur. Greatest yields of potatoes were produced from use of ⅔ ammonium sulphate plus ⅓ sodium nitrate and ⅔ ammonium nitrate plus ⅓ sodium nitrate. When the two acid-forming sources of nitrogen were used separately the ammonium nitrate produced the greatest yield but when ⅓ of the nitrogen in each treatment was from sodium nitrate, ammonium sulphate was as good as the ammonium nitrate source.

In 1959 sulfur and lime were applied February 24 and nitrogen February 28 and April 1. Soil pH readings made May 18 closely reflected treatments. The lowest readings were from plots receiving sulfur with acid-forming sources of nitrogen. These ranged from pH 3.78 to 4.22. Without sulfur the pH was 4.54 from ammonium sulphate and 4.90 from ammonium nitrate. Application of 1,000 lb. per acre of limestone in treatments receiving ammonium sulphate resulted in a pH of 4.83. Plots receiving sodium nitrate had a pH of 5.78. By the end of the fourth year the ammonium sulphate and ammonium nitrate plots receiving different rates of sulfur and the one rate of limestone had increased slightly in pH readings, whereas, in other plots there was a slight pH decrease.

Physiological leaf-roll was apparent in plots receiving all nitrogen from ammonium sulphate. Leaf-roll was absent in ammonium nitrate plots with equivalent pH readings, with exception of a slight incident of leaf-roll in 1960 in ammonium nitrate plots receiving 1,500 lb. of sulfur. Leaf-roll became more severe and plant size smaller on ammonium sulphate plots as soil acidity was increased by the application of sulfur. The leaf-roll was accompanied by a purplish red color. Plants with severe leaf-roll were usually dead before harvest.

EFFECTS OF SOURCES AND COMBINATION OF SOURCES OF NITROGEN AND SOIL ACIDITY ON YIELDS, QUALITY AND LEAF-ROLL OF POTATOES

Treatments 1				Yields per acre 4-year av. 1959-62		Specific gravity (1.0 omitted)		Soil pH		Leaf-roll[3] rating 1960-62
Sources and ratios of N			Sulfur or lime[2]							
$(NH_4)_2SO_4$	NH_4NO_3	$NaNO_3$		Total	No. 1's	1959	1960	1959 May 18	1962 April 11	
3/3		0		213	166	613	565	4.54	4.56	7.7
2/3		1/3		350	303	657	650	4.83	4.68	10.0
1/3		2/3		297	248	674	673	5.16	4.93	10.0
0		3/3		288	238	657	658	5.78	5.41	10.0
	3/3	0		312	267	670	662	4.90	4.75	10.0
	2/3	1/3		346	299	666	673	5.19	4.94	10.0
	1/3	2/3		322	273	660	681	5.35	5.04	10.0
3/3			3S	139	90	617	535	3.78	4.48	5.8
3/3			2S	176	128	604	550	3.91	4.45	7.1
3/3			S	214	176	605	527	4.22	4.41	7.6
3/3			L	290	249	651	595	4.83	5.23	9.3
	3/3		3S	247	188	626	573	3.78	4.56	9.9
	3/3		2S	284	240	643	622	4.05	4.59	10.0
	3/3		S	304	267	654	645	4.39	4.70	10.0
L.S.D. at the .05 level				53	55	039	081			
L.S.D. at the .01 level				71	74	052	179			

[1] Fertilizer applied consisted of 2,400 lb. of 8-8-8 per acre with 1,200 lb. applied before planting and 1,200 lb. to side 1 month after planting.

[2] S represents 500, 2S 1,000, and 3S 1,500 lb. of sulfur applied at the beginning of the test in 1959 to lower the soil pH. L represents limestone applied each year at the rate of 1,000 lb. per acre.

[3] Ratings for leaf-roll: 10 = no leaf-roll and 0 = severe leaf-roll.

A New APPROACH To POULTRY LITTER PROBLEMS

J. R. HOWES, *Department of Poultry Science*

WASTE DISPOSAL for humans and animals is becoming an increasing problem.

Traditional methods of utilizing used poultry litter and manure from cage operations are not so widely employed as in the past. The reasons are high labor costs and more economic means of obtaining plant nutrients from artificial fertilizers. Use of machinery has also greatly enhanced the handling of poultry manure; however, frequently manure is available when it is not wanted and storage involves odor and fly problems in addition to expensive handling. Good poultry manure should not, if possible, be wasted since it represents a valuable form of plant nutrients and organic matter for soil improvement.

Litter Material Shortage

The poultry farmer is also faced with difficulties and expenses in obtaining readily available dry litter materials. In northern Alabama some farmers are now trucking shavings more than 100 miles which is expensive. Shavings are also being used more in the manufacture of wood products and supplies are diminishing as a result.

Urbanization also brings complaints about flies and odors where neighbors are near established poultry farms, especially if cage operations are involved.

Composting Poultry Litter in the House

Although composting is an old practice, the continuous composting of chicken manure inside the poultry house while birds are present represents a new approach. A commercial concern in Georgia has developed a technique and a microbiological inoculum for this purpose. The inoculum, "Litterlife"[1], when properly applied and managed will compost poultry litter and continue to break down fecal material as it appears. In so doing the supstrate for odors and fly breeding is continuously removed.

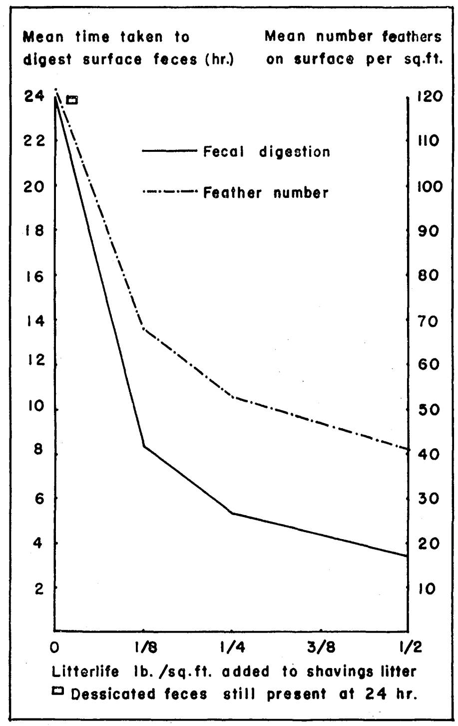
Studies Conducted

During 1965 several studies at Auburn University Agricultural Experiment Station showed that composted poultry litter eliminated fly and odor problems and that this treated litter could be safely reused several times, thereby reducing costs for new shavings. The disposal problem was reduced since the composted material could be safely used in urban gardens as an odorless organic fertilizer. Composted litter proved to have a much wider range of moisture, compared with shavings litter, without becoming either too dry and dusty or wet and conducive to the development of pathogens and parasites.

Aerobic Fermentation

Unlike anaerobic digestion that yields strong odors, the "Litterlife" system is aerobic and once stabilized gives no odors. The inoculum contains 46 species of bacteria plus basal ingredients to start microbial activity when air, water, cellulose and fecal material are provided in the correct ratio.

Poultry maintain an aerobic environment by scratching in the litter. The selected microorganisms were chosen to break down urea, uric acid, and other nitrogenous products in the excrement. In so doing the waste materials are converted into amino acids and moisture, nitrogen, and other simple volatile odorless compounds.



This chart shows the relationship of Litterlife inoculum level to time taken to digest feces and number of surface feathers. Data are for 8-week broilers, one bird per sq. ft.

Research Results

In several studies broilers raised on composted litter invariably produced slightly higher weight gains and better feed efficiency as compared with control birds on untreated used litter or fresh shavings. This result may be a development of B vitamins and antibiotics in the treated litter. Replacement pullets on restricted diets to delay maturity if raised on composted litter consequently require more restriction.

The temperature of 140-160° F. is reached during the initial composting. If the material is turned to include surface material during this process, most pathogens are apparently destroyed. Further studies to investigate the carryover of specific disease agents are planned.

The current recommended application rate for "Litterlife" is ½ lb. per sq. ft. of litter. This is being further investigated, although it is certainly better than ⅛ or ¼ lb. rate as studied at present, see figure.

The composting of cage manure is being investigated. The chief problem is maintaining aerobic conditions that may be possible by occasional mechanical agitation of the manure under the cages.

Composted litter appears to have less chances of developing parasites at higher humidities than traditional litter materials. Houses containing composted litter therefore, may be more safely humidified to reduce atmospheric dust.

Composted litter may be made with shavings, corn cobs, rice hulls, peanut shells and any other source of cellulose currently used as litter material. The possible use of soil as a source of cellulose is being investigated since this is readily available to all poultry farmers.

[1] The inoculum "Litterlife" was used in research studies at Auburn. This use does not imply endorsement by the Agricultural Experiment Station, Auburn University.

Farm and Nonfarm Economic Trends Closely Related

MORRIS WHITE, *Department of Agricultural Economics and Rural Sociology*

NO LONGER is it enough for a farm operator to be up-to-date on farm prices and economic trends alone. Instead, he needs latest information on general economic changes that are occurring, since today's commercialized agriculture is closely related to all parts of the nation's economy.

Changes occurring in agriculture are affected directly by fluctuations in prices received for farm products, as well as by kinds and volumes of products produced for sale. On the other hand, changes in nonagricultural prices are becoming increasingly important as agriculture becomes more commercialized and jobs related to agriculture become more numerous.

Trends Within Agriculture

Number of farms and farm population decreased rapidly during the 1956-65 decade, with farm population dropping from 11.1% to 6.4% of the nation's total, Table 1. Despite the drop in farm population while total population was growing, agricultural output increased faster than population during 1956-65, Table 2. And production growth was greater in the Southeast than in other regions.

A change that created farm problems was the increase in production expenses at a faster rate than farm output growth. Production expenses for Alabama farmers increased 46% between 1956 and 1965.

Although changes in prices received by farmers have varied among commodities, the average for all commodities was at the same level in 1965 as in 1956. Gross farm income rose during the decade, but this was brought about by an increase in farm output. In contrast, there was not a substantial increase in net farm income except in 1965.

Changes Outside Agriculture

Many changes in the nonagricultural segment of the economy are of importance to agriculture. While growing at a slower rate than in the previous decade, the nation's population increased about 14% between 1956 and 1965. Increasing per capita income during the decade meant that the growing population was spending much more money. Consumer disposable income (income after taxes) has risen continuously, and is now more than 50% higher than 10 years ago.

Consumer prices have not risen in proportion to consumer incomes, and averaged only 17% higher in 1965 than in 1956. Output of consumer goods and services have been adequate, so consumers have been able to satisfy their wants at prices low in relation to income.

Increases in consumer incomes have not resulted in a large increase in purchases of food or other agricultural products. Instead, buying changes have been in quality and form of goods. Off-farm jobs have been created to provide services for which consumers were willing to spend the increased income. (Making food "table-ready" is an example of such services.) Many of those jobs are performed by persons who, otherwise, would likely be back on the farm.

Other Changes Expected

Careful analysis of economic factors indicates that additional changes can be expected, and they could come rapidly. A combination of an abundance of resources in agriculture and the revolution in agricultural mechanics, chemicals, biology, and management have contributed to record production without a rise in prices of farm products.

Because farm product prices have not gone up in relation to other prices, the agricultural segment of the economy has not received its share of increased income. Although the farm population made up 6.4% of the total in 1965, it received only 3.5% of the national income. Per capita disposable income for the farm population averaged only 55% of that for the nonfarm segment during the 1956-65 decade. This helps explain why human resources have been moving out of agriculture at a rapid rate.

It has been estimated that 3.5% of the population could produce enough agricultural commodities for the nation. This could be true, but those who make up the 3.5% will demand a relatively higher return than those currently in agriculture are receiving. To adequately pay the 3.5%, the other 96.5% of the population can expect to pay relatively higher prices for agricultural products.

TABLE 1. TRENDS IN FARM AND NONFARM POPULATION AND INCOME, UNITED STATES, 1956-65

Year	Population			Income		
	Farm	Nonfarm	Farm as percentage of nonfarm	Farm	Nonfarm	Farm as percentage of nonfarm
	Thousands	*Thousands*	*Per cent*	*Millions*	*Millions*	*Per cent*
1956	168,221	18,712	11.1	$14,530	$336,269	4.1
1957	171,274	17,656	10.3	14,563	351,533	4.0
1958	174,141	17,128	9.8	16,941	350,821	4.6
1959	177,073	16,592	9.4	15,070	384,955	3.8
1960	179,912	15,620	8.7	15,733	396,539	3.8
1961	182,961	14,790	8.1	16,765	408,215	3.9
1962	185,846	14,300	7.7	17,163	438,042	3.8
1963	188,580	13,354	7.1	17,238	462,069	3.6
1964	191,269	12,943	6.8	16,252	498,163	3.2
1965	193,703	12,352	6.4	19,519	536,455	3.5

Source: *Farm Income Situation,* USDA Economic Research Service, July 1966.

TABLE 2. INDEX NUMBERS OF FACTORS RELATED TO ALABAMA AGRICULTURE, 1956-65

Year	Index numbers (1957-59 = 100)					
	Farm output		Production expenses of Ala. farmers	Prices received by Ala. farmers	Alabama net farm income	Consumer prices
	United States	Southeast				
1956	97	107	92	97	106	95
1957	95	95	93	97	83	98
1958	102	99	100	103	113	101
1959	103	106	107	100	103	101
1960	106	108	110	97	102	103
1961	107	118	111	97	96	104
1962	108	110	119	99	99	105
1963	112	120	125	100	113	107
1964	112	124	129	97	114	108
1965	115	128	138	97	129	112

STONEFLIES *are important sources* of FISH FOOD

HUGH B. CUNNINGHAM
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TASTY MORSELS to many Alabama fish species are the stoneflies!

Supposedly they are rare in Alabama, that is, if you go by infrequent reports in scientific journals. Yet they are common and represent one of the more important sources of fish food.

Stoneflies spend most of their life (growing stage) in the water. They live in a large variety of situations ranging from cold, spring-fed streams to warmer waters of large rivers and standing ponds and lakes. Different species exhibit different preferences concerning the kinds of water in which they live just as do fish. Therefore, stoneflies are a food supply source for a large variety of fishes.

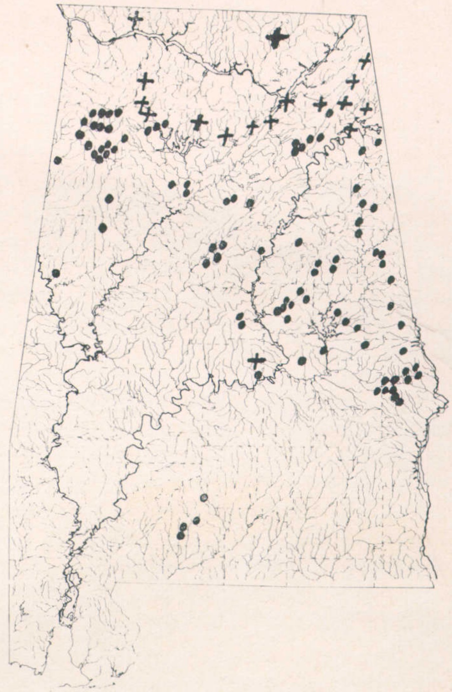
Often intricate interrelationships that exist between many kinds of plants and animals are overlooked in our everyday evaluation of living things. Since stoneflies never bother people, it is easy to unthinkingly arrive at the conclusion that stoneflies are not important. This group is chiefly plant feeders. Thus they aid in converting the high carbohydrate-low protein plant materials into high protein food utilized by many intermediate species. Finally much of these conversion products end up producing more and larger fish that provide sport for a great many people, and more important they supply a large amount of high-protein food for consumption by the world's human population. This points out only one of the aforementioned interrelationships of which nature has many to offer.

As with most insects including stoneflies, the adult or reproducing stage (winged insect) is present in the spring or summer. However, a few groups of stoneflies comprising more than 50 species have adults present only during the cold season of the year, from late November through March.

During the years in which insects have been collected and studied intensively in the United States, the winter forms of stoneflies have been taken at about 16 different localities, mostly in the northern one-fourth of Alabama (see map). Scientists with whom the author is collaborating have been interested in and have worked with this group of insects for several years. It is expected that important contributions will be made to science, particularly in respect to where different species occur, where they come from, how they developed, and the effect that the ice age or glaciers had upon present distribution.

Stoneflies were collected last winter to establish how far south their ranges extend. A Soil Conservation Service biologist cooperated in last winter's collection.

The accompanying map shows where the insects have been found. The crosses (+) are the locations where these stoneflies had been collected prior to last winter. The dots represent locations where one up to several different species and from one to more than 100 specimens were taken. These collections demonstrate that Alabama not only has more



kinds but they range over a much greater area of the state than was thought heretofore.

Editor's Note. Winter stoneflies are dark brown to black, slender insects ranging from ¼ to 1 in. in length. *Highlights* readers who would like to take part in this study may easily collect stoneflies from railings on cement bridges where they commonly occur. Put your collections in a small bottle of rubbing alcohol and please label where collections were made. Mail to:

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