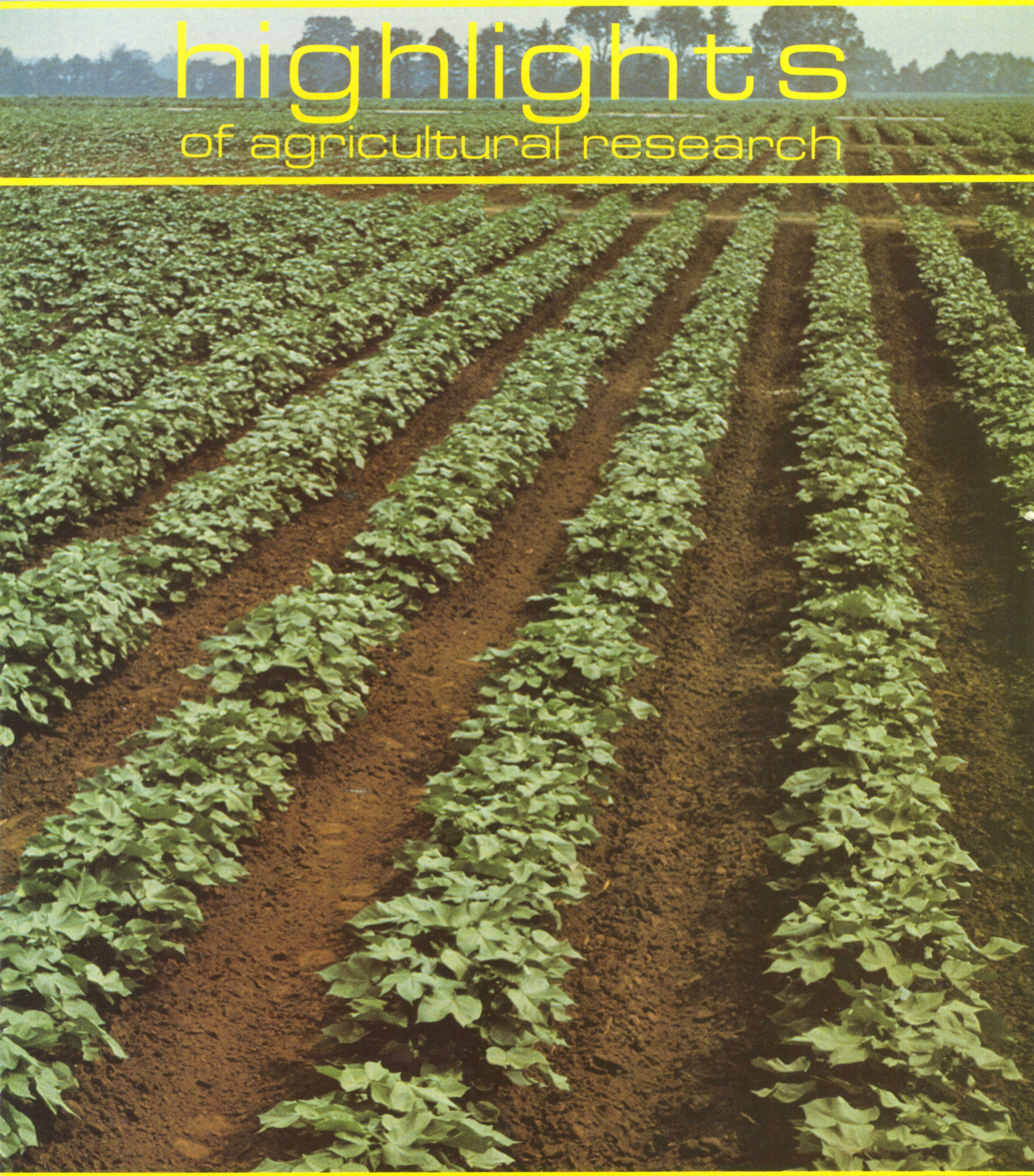
highlights of agricultural research



Vol. 26 No. 2 Summer 1979

AGRICULTURAL EXPERIMENT STATION
R. DENNIS ROUSE, DIRECTOR

AUBURN UNIVERSITY
AUBURN, ALABAMA

DIRECTOR'S COMMENTS

THE ALABAMA AGRICULTURAL EXPERIMENT STATION is the single organization legally charged with development of innovative, new information for Alabama agriculture and forestry. This program, the foundation of Alabama's largest industry, has been effective in the past and every indication is that if given support to offset the ravages of inflation and meet new responsibilities, it will continue to provide information necessary for continued growth and development of production and industrial agriculture and forestry.

R. DENNIS ROUSE

Funding this research program is an investment that returns dividends to all people, not just producers.

Economic studies of the benefits from Agricultural Experiment Station research and dissemination of information by the Cooperative Extension Service have been conducted over the years by several different organizations. These have all shown that returns on this investment are great – a 36% average annual rate of return according to a recent analysis.

Last year, in view of the tight budget situation in most states and at the Federal level, the State Agricultural Experiment Station Directors across the Nation assigned a group of distinguished quantitative agricultural economists to make an analysis of the effects of a decrease in level of public fundings of agricultural research.

They chose to study the effect of a 10% reduction in programs. This happens to be approximately the current rate of inflation and, therefore, would be the reduction in program resulting from a failure to increase appropriations the amount necessary to offset inflation for just 1 year. In the first example, the funding reduction was temporary and was later restored in amounts necessary to restore the benefits lost from under-funding. In this situation, each $1.00 saved by under-funding required $2.30 in additional tax dollars to compensate later.

In a second example, the funding reduction was not restored. In this example, each $1.00 saved by under-funding cost the consumer an additional $6.14 in increased cost of agricultural products.

Thus, either way, failure to adequately support agricultural research and extension now will be a cost to be borne by the consumers for years either in increased taxes or increased food cost.

In the second example involving a family of four, the cost per person for each $1.00 saved, by not increasing funding to offset inflation for 1 year would be $22.44 at the $5,000 annual salary level, $5.68 at the $10,000 annual salary level, $4.02 at the $15,000 annual salary level, and $3.77 at the $20,000 annual salary level. Thus, agricultural scientists are our best inflation fighters. Cost of food will rise more rapidly if agricultural research and extension are underfunded. Investments in agricultural research and extension save tax dollars and decrease the cost of food. There is no doubt about it – these two agricultural programs are a good investment!

Auburn University is not just one of 14 publicly supported institutions of higher learning in Alabama. It is unique! It has been assigned the responsibility through the Alabama Agricultural Experiment Station and the Alabama Cooperative Extension Service for a publicly supported program of research and the dissemination of research results so as to serve all the people. Agriculture is unique because it is responsible for an essential commodity – food. Auburn University is unique among higher education in Alabama because it has the responsibility for providing information necessary to keep Alabama agriculture and forestry competitive – and healthy.

may we introduce . . .

Dr. Michael James Gaylor, assistant professor, Department of Zoology-Entomology, School of Agriculture and Agricultural Experiment Station. Dr. Gaylor's area of specialization is cotton insects.

A native of Verbena, Ala., he came to Auburn from Texas A&M University Research and Extension Center at Dallas. He received both B.S. and M.S. degrees from Auburn University and the Ph.D. from Texas A&M University. His undergraduate major was in zoology and graduate major in entomology with specialization in pest management and a minor in game management.

Gaylor has authored or co-authored more than a dozen technical articles in his field. He is a member of Sigma Xi, Phi Kappa Phi, Gamma Sigma Delta, Alpha Zeta, and Phi Eta Sigma.

HIGHLIGHTS of Agricultural Research

SUMMER 1979 VOL. 26, NO. 2

A quarterly report of research published by the Agricultural Experiment Station of Auburn University, Auburn, Alabama.

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

ON THE COVER. Cotton experimental plots at the Tennessee Valley Substation, Belle Mina.

FACTORS DELAYING MATURITY and LIMITING COTTON YIELDS in ALABAMA

MICHAEL J. GAYLOR,
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GALE A. BUCHANAN,
Department of Agronomy & Soils
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Tennessee Valley Substation
FLOYD R. GILLILAND,
Formerly, Dept. of Zoology-Entomology
RICHARD L. DAVIS,
Formerly, Alabama Cooperative Extension Service

W. B. Webster, superintendent, examines experimental cotton plots at the Tennessee Valley Substation for plant bugs.

In recent years Alabama farmers have become increasingly concerned with production practices that may delay maturity and thus limit yields or in other ways may lower profits. Delayed harvest increases the probability of frost damage, increases the probability that fall rains will make harvest difficult, and increases the cost of insect control. In addition, when crop residue destruction is delayed, insect problems usually are increased the following year.

In 1976, a 3-year experiment was initiated at the Tennessee Valley Substation of the Agricultural Experiment Station to determine some of the production practices that may limit yields or delay maturity. Production practices included in the study were: (1) date of planting, (2) nitrogen rates, (3) control of plant bugs, and (4) herbicides. The experiment was conducted on a Decatur clay loam.

Two dates of planting were included in the study. In the "early" planting, cotton was planted as soon as possible after fear of frost was past (April 6, 1976 and 1978, and April 8, 1977). The "late" planting was about 3 weeks later (April 29, 1976, May 3, 1977, and May 17, 1978). In only 1 of the 3 years of the study did early planting increase yields. In 1977 the early planting increased yields by about 150 lb. of seed cotton per acre. Surprisingly, in neither of the 2 years in which earliness was measured did planting date have a significant impact.

In 1976, dimethoate (Cygon®) was applied at 0.2 lb. a.i. per acre to all plots on June 10 for control of a thrips infestation. Additional applications were made to two-thirds of the plots for plant bug control on July 6, and one-half of these plots was treated again on July 23. In 1977 insecticide treatments for plant bugs were started on June 13 and on July 1, leaving one-third of the plots untreated. In 1978, a single application was made on July 19. Despite differences in numbers of plant bugs of up to 12,000 per acre in treated plots compared with untreated plots in 1976 and 15,000 per acre in 1977, no significant differences in yield or maturity were obtained. These results indicate that the economic injury level for plant bugs is above 15,000 per acre. More studies are needed to precisely define the economic injury level of plant bugs.

Under some conditions excessive nitrogen may cause excessive vegetative growth and delayed fruiting. In the present study nitrogen was applied at 60, 90, and 120 lb. per acre. No differences in maturity were found at first harvest, however, in 1976 and 1978 the cotton was harvested twice. In 1976, about 120 lb. less seed cotton per acre was harvested in the plots receiving 60 lb. of N when compared to the plots with higher rates. In contrast, in 1977 the highest rate of N decreased yields by about the same amount. No differences in total yield were obtained in any N treatment in 1978.

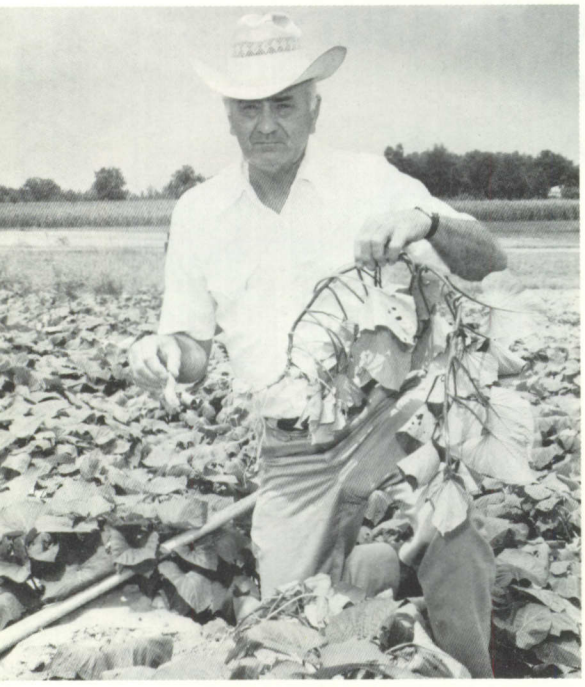
In this series of experiments the production practice with greatest impact on yield and earliness was the herbicide program. The herbicide treatment consisted of trifluralin (Treflan®), 0.75 lb. per acre, applied as a preplant incorporated treatment, fluometuron (Cotoran®), 2.0 lb. per acre, as a preemergence treatment, fluometuron + MSMA, 1.5 + 1.0 lb. per acre, applied as a directed, postemergence treatment, and fluometuron, 1.0 lb. per acre, applied as a post directed treatment at layby. This program was compared to plots which received no herbicides. Weeds were controlled in all plots by hand-weeding to ensure that weeds would not mask results of the experiment. In both years in which cotton was harvested twice the herbicide treatment delayed maturity significantly, see table. Also, during both of these years the herbicide treatment greatly reduced total yields. Almost all of this reduction occurred early in the season and was reflected at first harvest. In 1976 the cotton did not recover from this early damage. In 1978 significantly more cotton was harvested at the second picking from the herbicide treatment than from the no herbicide treatment. This recovery was not enough, however, to compensate for the early damage.

Under grower conditions differences between herbicide-treated and untreated plots might not be as great as in this experiment. Competition from weeds would be expected to decrease yields in the untreated plots below yields obtained in this study. Results of this study do suggest that herbicides may decrease yields and delay maturity of cotton. Additional studies are needed to develop weed control programs which have less adverse effects.

Effects of Herbicides on Cotton Yields and Earliness

Treatment	Yield	1976 average	1977 average	1978 average	
		Percent of yield in 1st picking	Yield	Yield	Percent of yield in 1st picking
	Lb.	*Pct.*	*Lb.*	*Lb.*	*Pct.*
Herbicides	1,454 a	53 a	1,634 a	1,176 a	42 a
No herbicides	1,772 a	63 b	1,650 a	1,707 b	70 b

Averages within columns followed by the same letter are not significantly different at the 5% level of probability according to an AOV.



A QUALITY COMPARISON of SEED PIECE and SLIP PRODUCED SWEETPOTATOES

DURWARD A. SMITH and JACK L. TURNER, Department of Horticulture

A NEW LABOR SAVING METHOD of planting sweetpotatoes involves the planting of seed pieces as is done with Irish potatoes. This method saves considerable labor when compared with the old method of growing slips in hotbeds then transplanting to the field. However, yields to date from the seed piece studies have been lower than yields from the same transplanted selections. These lower yields have been the result of a reduction in stand due partially to seed piece rot.

This study by the Department of Horticulture, Agricultural Experiment Station, was initiated to determine if differences in quality can be detected in roots resulting from the two different propagation methods. Six varieties of sweetpotatoes tested for seed piece propagation suitability in the 1978 Sweetpotato Cooperative Trials were selected for this test. All roots were harvested on the same date and cured at 85°F and 95% relative humidity for 8 days. Number 1 potatoes were selected and tested for flavor, texture, color, soluble solids, and total solids, with objective tests used whenever possible.

A baking test was conducted with the sweetpotatoes being baked for 90 minutes at 325°F in a rotary tray, forced-air oven. This special oven ensured a uniform cooking rate. The baked sweetpotatoes were evaluated for flavor by a panel of five trained judges using a triangle test. In this triangle test the judges were presented with three samples from the same variety, two samples being alike and one different (either seed piece or slip produced). The judges were then asked to identify the odd sample. As reported in table 1, no significant differences in flavor between seed piece and slip produced sweetpotatoes were detected in any of the varieties tested.

Objective measurements were made for color using the Hunter Color Difference Meter, for texture using an Instron Universal Testing Machine equipped with a Kramer shear-cell, for soluble solids using a refractometer, and for total solids by AOAC methods. A summary of these data is presented in table 2.

Color difference for total light reflectance, redness, and yellowness between the two cultural practices was examined and found to be insignificant.

The texture test shear cell is designed to stimulate the shearing action that occurs in the chewing of food. In this device knives are forced through a slotted plate, thus shearing and extruding a slice of sweetpotato. The machine records the amount of force necessary to bite through the slice. None of the varieties tested showed a significant difference in texture between seed piece and slip propagated roots.

Seed pieces of sweetpotato, above; C. C. Carlton, Superintendent, Chilton Area Horticulture Substation, at left, examines seed piece that produced the vine he is holding.

Soluble solids, which are primarily sugars, are very important in sweetpotato flavor. No significant difference was found in either soluble solids or total solids between sweetpotatoes grown by planting seed pieces and those produced from transplanting.

These data indicate that seed piece grown sweetpotatoes are equal in baking quality to roots grown from transplanted slips.

TABLE 1. SENSORY EVALUATION OF SEED PIECE VS. SLIP GROWN SWEETPOTATOES BAKED AT 325° FOR 90 MINUTES, USING TRAINED JUDGES AND TRIANGLE TESTS

Variety	Number of trials	Number of correct responses	Number of correct responses required for significant difference at 5% level
NC-320	15	8	10
NC-317	15	4	10
Carver	15	6	10
VPI-51	15	8	10
Centennial	15	9	10
MD-304	15	8	10

TABLE 2. MEAN VALUES OF COLOR, TEXTURE, SOLUBLE SOLIDS AND TOTAL SOLIDS OF SWEETPOTATOES BAKED AT 325°F FOR 90 MINUTES

Variety	Color values			Texture in Kg	Soluble solids	Total solids
	L°	*a°*	*b°*	*Slice 5×4×½ cm*	*Pct.*	*Pct.*
NC-320 seed piece	49.2	21.7	27.1	2.58	33.4	54.2
NC-320 slip	47.7	23.4	27.6	2.27	34.4	54.6
NC-317 seed piece	50.6	20.8	27.4	2.98	26.1	49.3
NC-317 slip	52.3	20.8	26.0	2.86	26.5	49.3
Carver seed piece	45.8	25.1	26.4	1.60	32.2	53.6
Carver slip	48.8	24.7	28.3	1.58	31.2	53.2
VPI-51 seed piece	46.6	23.7	25.5	1.94	33.3	55.1
VPI-51 slip	45.3	24.1	24.3	2.39	35.8	56.0
Centennial seed piece	50.9	21.1	30.5	1.59	32.1	51.4
Centennial slip	48.3	23.9	28.4	1.45	29.2	50.9
Md-304 seed piece	44.2	21.9	25.2	2.34	31.3	52.3
Md-304 slip	45.3	22.4	24.6	2.41	30.3	51.9

°L = light reflectance, a = redness, b = yellowness.

HOWARD A. CLONTS, Dept. of Agricultural Economics and Rural Sociology

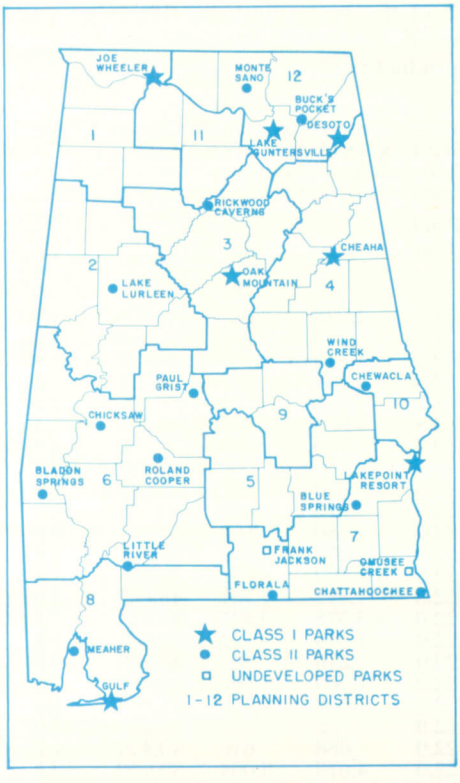
DECISION TIME FOR STATE PARKS

ALABAMIANS CAN SATISFY almost any recreational desire in one of their state parks. But the future looks questionable. State parks are certain to go down hill unless adequate operation and maintenance funds become available.

The Alabama parks system was begun in the late 1920's, but received little attention until 1967 when a bond issue made $43 million available for development. Today state parks lands cover 49,474 acres, of which 47,259 acres are in 22 developed parks.

Since 1967, a total of $70 million in State and Federal funds has been spent in park development. Most of the funds were used for intensive development in Joe Wheeler, Lake Guntersville, DeSoto, Cheaha, Oak Mountain, Lakepoint, and Gulf parks. Three others, Lake Lurleen, Roland Cooper, and Wind Creek, also received significant development. Much of the development has been of the resort type, but significant improvements in camping, hiking, picnicking, fishing, and swimming also were included.

A major problem now looms for the parks. Large scale capital development eventually requires large scale operation and maintenance expenditures. In recent years, increasing fund shortages have resulted in reduced maintenance and curtailed services in the parks. Some parks needing development have remained undeveloped.



Location of Alabama State parks is shown by planning districts.

ACREAGE IN ALABAMA STATE PARKS, BY TYPE OF PARK

Park and type	Acres
Resort parks	
Gulf	6,160
Joe Wheeler—resort	2,480
Lake Guntersville	5,835
Lakepoint	1,220
Natural parks—water based	
Chattahoochee	596
Florala	35
Joe Wheeler—Wheeler Dam	420
Lake Lurleen	1,625
Little River	960
Meaher	1,327
Oak Mountain	9,940
Paul Grist	1,080
Roland Cooper	200
Wind Creek	1,354
Natural parks—landforms	
Buck's Pocket	2,000
Cheaha	2,719
Chewacla	696
Chickasaw	580
DeSoto	4,990
Monte Sano	2,140
Bladon Springs	357
Blue Springs	103
Rickwood Caverns	380
Undeveloped parks	
Frank Jackson	2,050
Omusee Creek	165
Other lands	62
TOTAL	49,474

Growing use of Alabama state parks points up needs for the future. In 1978 an estimated 6,424,110 people visited the parks. This will jump to around 16 million visitors in the year 2000, based on a moderate rate of increased public use.

Public concern about quality of parks' recreational opportunities in the future was obvious in a survey of over 1,000 park users. Most expressed concern unless money and personnel shortages are overcome in the near future.

Concerning sources of funds, a third said both entrance fees and activity fees in parks could be raised. Nearly half, however, said tax money should provide needed funds for operation and maintenance. Nearly all respondents considered current fee levels in state parks as reasonable. They expect to pay for use, but only up to a point. In essence, park users said park construction is a public expense, park operation is a shared public and individual user expense, and park maintenance is primarily a public expense.

Based on an accepted planning standard of 15 acres per 1,000 residents in Alabama, an additional 21,377 acres of land in developed parks will be needed by 1980. Nearly 26,000 acres will be needed by the year 2000. This means that, unless additional acquisitions are made, there will likely be only 11.0 acres per 1,000 residents by 2000. These figures are based on developed parks, not just lands owned by the Parks Division of the Department of Conservation and Natural Resources. A developed park does not mean one with every acre changed in some fashion. Rather, it means enough improvements have been made to make the park lands accessible for a pleasant visitor experience.

For state parks to truly serve recreational needs of Alabamians, a number of changes in individual parks will be required. Some present parks do not have the potential to become satisfactory parks. These should be phased out and replaced with more suitable areas. Parks such as Little River, Blue Springs, and Rickwood need significant changes. Other areas need less development but more maintenance.

All in all, Alabama state parks have great potential for service. The turning point is now. If energy shortages persist, nearby recreational opportunities will be in high demand. State parks can fill a portion of those needs. The big question concerns funding for additional capital development to complete the full park system renovation, assure ample operation and maintenance over the years, and finance a land acquisition program to reserve needed lands for future use.

Trapping Channel Catfish from Upland Ponds

R. O. SMITHERMAN, M. C. MOHEAD, W. G. MUSTIN, and R. K. GOODMAN
Department of Fisheries and Allied Aquacultures

Fish from corral seine being weighed during loading operation.

CATFISH HAVE TRADITIONALLY been harvested from Alabama ponds by draining during the late autumn or early winter. This practice is necessary since these ponds must be refilled from runoff water during late winter and early spring.

Because most fish farmers must harvest in a relatively short time span, capacity of processing plants is exceeded, and price is driven down by the temporary oversupply of fish. Some farmers choose to carry their fish over into the second year, a most inefficient procedure during which fish become larger than optimum size for processing, thus reducing their market value. Growers must then resort to fish-out, or sport-fishing to sell their product.

Ongoing research in fish harvesting at Auburn University Agricultural Experiment Station is evaluating alternative methods for capturing catfish without draining ponds. Three techniques for partial harvest using entrapment nets associated with feeding have been tested in ponds stocked at 3,000 fish per acre. The gear included lift nets, drop nets, and corral seines.

Evaluations of each gear type were made for efficiency of capture and effects of the trapping activity on production of catfish. Significant quantities of fish were taken with each of the trapping devices.

The lift net consisted of a 14×20 ft. rectangular net with ¾ in. bar mesh. Maximum catch, after baiting the trap area in a 2.2-acre pond with floating catfish feed, was 1,100 fish of harvestable size. However, due to small trap area and trapping activity, feed was under utilized, resulting in poor feed conversion, variable sizes of fish, and reduced production.

The drop net was a 100-ft. length of 10-ft. deep nylon seine, bar mesh 1 in., suspended above the water surface on metal stakes in a 1.3-acre pond, forming a semicircular feeding area of 5,000 sq. ft. The suspended seine allowed fish to swim freely into the feeding area, and fish were captured when the seine dropped after remote release of suspension devices. The initial catch of 1,327 fish was the largest, and subsequent catches were less reduced than those of the lift net. Feeding behavior, food conversion, growth, and size variability were less affected by trapping activity than with the lift net.

The corral seine was a 120-ft. length of 10-ft. deep nylon seine with 1-in. bar mesh positioned in a 3.5-acre pond. It was positioned parallel to the shore forming an open-ended corral 30 ft. wide. Feed was applied with a trailer mounted, motor-operated blower with which fish were trained to follow the feeding path into the corral. Entrapment was completed by drawing the ends of the seine to the shore. Fish were successfully trained within 5 days to follow the feeding path through the corral in large numbers. The first entrapment yielded 1,635 fish. As temperature declined in autumn 1977, catch declined.

Further testing of the corral seine was done during August 1978 to March 1979 in five ponds ranging from 1.3 to 22.0 acres. The corral seine used was 200 ft. × 6 ft. × 1¼ in. mesh. In ponds 1.3 to 3.5 acres, only 100 ft. of the seine was stretched parallel to the shore, the remainder folded at the ends of the corral. In the 22-acre pond, the entire seine was extended for a larger feeding area.

The results of the trapping efforts are summarized in the table. From the smaller ponds, individual trap catches averaged 849 lb. (16.8% of total population), but ranged from 280 to 2,525 lb. per haul. In the smallest pond, the first catch was 68% of the whole population, and 2 weeks later the second catch was 28% of the remainder.

Ten trapping efforts were made in the 22-acre pond from August 31 to December 6, 1978. The initial catch was 7,213 fish weighing 6,853 lb., which represented 12% of the total population. Two separate sites, on the east and west sides of the pond, were used for subsequent trappings to minimize trap avoidance. The catches declined as temperature decreased, ranging from 3,600 to 730 lb. during September 6 through December 6. Trapping was reinitiated January 8, 1979, with a catch of 36 lb. The catch increased to 610 lb. on February 24, and 5,094 lb. on March 28, as feeding vigor increased.

Trapping with the corral seine has indicated the potential for removing significant quantities of channel catfish from upland ponds with steeply sloping or obstructed bottoms which cannot be conventionally seined, or ponds which cannot be drained and quickly refilled. It also allows for marketing catfish throughout much of the year. Further, this is a means for more efficient use of the pond water and nutrients for maximizing aquatic productivity.

HARVEST OF CHANNEL CATFISH FROM UPLAND PONDS WITH A CORRAL SEINE IN AN AREA BAITED WITH FLOATING CATFISH FEED

Date	Pond no.	Pond area	Catch		Pond population	Population captured
			No.	Wt.		
				Lb.	*No.*	*Pct.*
11/15/78	S-4	1.3	1,928	2,525	3,666	68.9
11/29/78	S-4	1.3	359	323	1,144	28.2
10/6/78	S-12	2.2	1,375	1,650	6,072	22.6
10/6/78	S-11	2.8	458	550	7,618	7.2
10/17/78	S-11	2.8	275	330	7,160	3.8
11/1/78	S-11	2.8	233	280	6,885	3.4
10/17/78	S-9	3.5	425	540	9,660	4.4
11/1/78	S-9	3.5	465	590	9,235	5.0
12/6/78	S-9	3.5	670	852	8,645	7.8
8/31/78	S-1[E]	22.0	7,213	6,853	60,720	11.9
9/6/78	S-1[E]	22.0	1,180	1,500	53,507	2.2
9/6/78	S-1[W]	22.0	2,832	3,600	52,327	5.4
9/28/78	S-1[W]	22.0	800	791	49,495	1.6
10/4/78	S-1[E]	22.0	1,471	1,751	48,695	3.0
10/11/78	S-1[W]	22.0	3,578	3,225	47,224	7.6
10/25/78	S-1[W]	22.0	1,043	1,122	43,646	2.4
11/1/78	S-1[E]	22.0	216	354	42,603	0.5
11/29/78	S-1[W]	22.0	1,303	1,590	42,387	3.1
12/6/78	S-1[E]	22.0	598	730	41,084	1.5
1/8/79	S-1[E]	22.0	32	36	40,486	0.07
2/24/79	S-1[E]	22.0	488	610	40,459	1.2
3/28/79	S-1[E]	22.0	4,075	5,094	39,966	10.2

[E] — Eastern trap site of the pond.
[W] — Western trap site of the pond.

Potential New Mycotoxins in Cotton and Cottonseed

U. L. DIENER, R. E. WAGENER, G. MORGAN-JONES and N. D. DAVIS
Department of Botany and Microbiology

COTTONSEED MEAL is a potentially important source of protein in human diets. Annual production of cottonseed meal in the U.S. could yield about 625,000 tons of high-quality, edible flour containing 65% protein by the Liquid-Cyclone-Process. However, the presence of mycotoxins in cottonseed meal precludes its use for human food.

Aflatoxin was first discovered in cottonseed meal in 1960, when it caused liver cancer in hatchery trout. Although aflatoxins in excess of 30 parts per billion (ppb) occurred in 7% of 1,293 samples of cottonseed meals from the 1965-66 crop, inactivation of aflatoxins in cottonseed and peanut meals has been accomplished by ammoniation on a commercial-scale. Only *Aspergillus flavus* and *A. parasilticus* of the *A. flavus* group of species produce aflatoxins. Cottonseed is invaded before harvest by other fungi, which potentially may be mycotoxin producers. Some of the other fungi were isolated from Alabama cotton in 1973 and 1974, while others were obtained from investigators in Georgia, Mississippi, and Louisiana. Pure cultures of each fungus were grown in flasks on sterilized, nutrient-amended shredded wheat. After 14-21 days incubation at 25°C, the moldy substrates were extracted, filtered, evaporated under an airstream, and prepared for brine shrimp, chicken embryo, and rat bioassays. Data were taken on mortality of brine shrimp, chick embryos, and rats. In addition, the mean average weight gain or loss relative to a control group was calculated for each group of rats. Rats were autopsied at death or after 14 days and pathological changes were noted.

Of 47 fungal isolates tested, the toxicity of 28 isolates to brine shrimp, chick embryos, and rats is shown in the table. Forty percent of the isolates were moderately or highly toxic to chick embryos. Of the 33 isolates tested on rats, seven killed at least one of six rats in their group. Rats fed extracts from eight of the 33 isolates showed reduced weight gain of 10% or more in comparison to the control group. Pathological examination of treated rats revealed that extracts of seven isolates caused hemorrhaging, while extracts of three isolates caused kidney abnormalities. Extracts of *F. oxysporum* (973) caused the shedding of hair by one group of rats, the first observance of this symptom.

Other than aflatoxin no other mycotoxins have been reported in cottonseed. Notable in this study has been the high toxigenicity of several species of *Alternaria, Fusarium,* and *Penicillium.* All three genera contain species that cause well-known mycotoxicoses in man and animals. These findings and the toxicity of other fungi in these bioassays justify continuing research to isolate the toxic compounds, identify their structure, and to determine whether they are known toxic metabolites or new mycotoxins. Ultimately, fungal production of the toxic metabolites on cottonseed and surveys of commercial cottonseed meals for any mycotoxins, known or new, should be carried out to determine the hazard to human health of cottonseed meal and processed protein obtained from meal.

These data showed that some of the fungi (other than the *A. flavus* group) associated with cotton bolls and seed produce substances toxic to brine shrimp, chick embryos, and/or rats in the laboratory, but it was not demonstrated in this research that any of these unknown fungal metabolites are produced naturally in cottonseed, meal, or other cottonseed products.

TOXICITY OF FUNGI ISOLATED FROM COTTONSEED AND BOLLS

AUA culture number	Fungus	Source	Brine shrimp mortality[1]	Chicken embryo deaths total eggs	Mortality	Pct. wt. loss	Pathol. changes[2]
	Uninoculated checks		0	0/50	0	---	
582	A. alternata	GA	1	10/10	0	−13	
584	A. alternata	MS	2	10/10	5/6	---	
843	A. tenuissima	AL	0	19/20	3/6	---	Hemor.
560	A. tenuissima	LA	0	10/10	0	---	Kidney, Hemor.
823	Aspergillus foetidus	AL	0	6/20	0	−15	Kidney, Hemor.
839	A. versicolor	AL	0	14/20	0	+ 9	
561	Botryodiplodia theobromae	LA	2	5/10	0	---	Kidney
586	B. theobromae	MS	2	4/10	0	−25	Hemor.
837	B. theobromae	AL	0	5/10	0	−10	
585	Cladosporium herbarum	MS	1	9/10			
937	Colletotrichum gossypii	AL	2	2/10	0	−13	Hemor.
890	Epicoccum pupurascens	AL	1	7/10			
825	Fusarium equiseti	AL	0	10/10	0	---	Hemor.
972	F. heterosporum	AL	0	1/10	0	+10	
845	F. lateritium	AL	0	8/10	0	---	
587	F. moniliforme	MS	2	8/10	0	+10	
893	F. moniliforme	AL	0	6/10	0	+10	
973	F. oxysporum	AL	0	9/10	2/6	−16	Shed Hair
564	Fusarium roseum	MS	1	5/20	0	−13	
575	F. roseum	LA	0	1/10	1/6	---	
590	Helminthosporium sp.	MS	1	5/10	0	---	
854	Mucor racemosus	AL	0	4/10	0	−10	
591	Myrothecium roridum	MS	1	6/10	1/6	---	
1002	Nigrospora sphaerica	AL	0	0/10	1/6	---	
1036	N. sphaerica	AL	0	0/10	0	− 8	
822	P. notatum	AL	1	15/20			
846	P. steckii	AL	2	9/10	1/6	+ 9	
905	Pestalotiopsis sp.	AL	0	2/20	0	---	Hemor.

[1] 2, 60 to 100% mortality of shrimp; 1, 20 to 59% mortality; and 0, 0-19% mortality (approximately 50 brine shrimp/ml).
[2] Pathological abnormalities observed: Hemor. = hemorrhages.

RIGHTS
in the use of water in Alabama[1]

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WATER is one of Alabama's most abundant and most valuable natural resources. The availability of usable water has always been paramount to the success of any agricultural and many other enterprises. Today's increased technology has made more water available and in the process has sparked many complex legal controversies.

The right of a farmer-landowner to use water for agricultural purposes varies substantially with the source of water in question. There are three different sources from which water may be obtained: a watercourse, percolating water, and surface water.

Rights in the Use of Watercourse Water

A watercourse is defined as any water flowing generally in a well-defined channel on or below the surface of the earth. In Alabama, the right of farm landowners to use water in a watercourse is based on the principle of the "Riparian Rights Doctrine." The basic premise of this doctrine is that the right to the use of water in its natural state is appurtenant to the ownership of land through which it flows.

Riparian owners (owners of land containing a watercourse) have an undisputed property right to the use of channeled water flowing through or under their land. It is an exclusive right, and only riparian owners have a right to use water in a watercourse (or riparian water). However, it is a conditioned right, and riparian owners are limited by law in where and how they may use riparian water.

Alabama law allows that riparian water may be used only for enrichment or development of riparian land; riparian land being defined as all contiguous land contained in the same natural watershed as the riparian water source. Hence, a riparian landowner can use riparian water anywhere on his farm, so long as the farm is contained on a contiguous tract of land and does not extend beyond the natural watershed of the riparian source of water.

The general rule on use of riparian water may be referred to as the "natural-flow-subject-to-reasonable-use" doctrine. In other words, the right of every riparian owner is to enjoy the natural flow of watercourses which traverse his land, unimpaired in quality, and undiminished in quantity, except to the extent necessarily resulting from a "reasonable" use of such watercourses by other riparian owners. "Reasonable use" is determined by the size of the watercourse and the general usage of the water in the locality.

In "Elmore vs. Ingalls," the court declared that each riparian owner is entitled to make a reasonable use of riparian water for domestic, agricultural, or manufacturing purposes. This case establishes that a riparian owner has the right to use riparian water for almost any conceivable farm purpose. Furthermore, it indicates that water may be used to the extent that the flow of water to others is reduced, so long as an adequate volume remains for other riparian owners to use.

Though a farmer can not assert ownership to the water itself, there is nothing in Alabama law to prevent an agricultural landowner from utilizing any riparian water (either on or beneath the ground) found on his property. Irrigating crops or watering livestock is certainly a "reasonable use," provided the watercourse is of adequate size to accommodate the farmer's needs, without drastically reducing the flow of water leaving the farm. Even if the farmer requires more than his reasonable share of riparian water, it is possible to negotiate the right to additional water.

Rights in the Use of Percolating Water

Percolating water is water beneath the earth which is not confined to a well-defined channel. Percolating water seeps into the ground from the earth's surface. The right of a landowner in Alabama to use percolating water is largely based on the 1936 case of "Sloss-Sheffield Steel & Iron Co. vs. Wilkes." The court held in this decision that the "landowner has a right to reasonable and beneficial use of waters upon land or its percolations for agriculture, manufacturing, irrigation, or development of land for mining, although underground waters of neighboring properties may be thus interfered with or diverted."

It must be remembered that this case applies only to percolating water (or underground water not in a well-defined channel) and that the "Riparian Rights Doctrine" governs the use of channeled underground water. With today's technology, the distinction between the two types of underground water is readily discernible.

"Sloss-Sheffield" is notable in that it adds a different view to the "reasonable use" concept. This case allows that percolating water may be used by a landowner to the extent that underground water of neighboring properties is interfered with or diverted. The only restriction placed on the water user is that he may not "waste" the water to the injury of others.

A farmer-landowner is thus allowed greater freedom to use percolating water than he is riparian water. So long as the farmer is utilizing the percolating water found under his farm for a reasonable and beneficial agricultural purpose, there is almost no legal limit on the quantity he is entitled to use.

Rights in the Use of Surface Water

Surface water is that water which is on the earth's surface, but does not flow in a well-defined channel or basis. The general rule in Alabama is that a landowner may use all surface water as he pleases, even if such use deprives a lower-elevation landowner of the water's benefits. Thus, Alabama law clearly discriminates against lower property owners, making their right to the use of surface water subordinate to that of higher-elevation landowners.

However, in Alabama with it's abundant rainfall, the problem usually doesn't come in surface water usage, but rather it comes generally in discharging the surface water. In rural (unincorporated) acres, the upper landowner has the right to discharge the surface waters which naturally flow upon or through his land, onto or over the property of a lower landowner. Furthermore, the lower landowner can not interrupt or obstruct this flow. Only within the municipal limits of an incorporated city, may an Alabama property owner legally prevent surface water from flowing onto his land.

Thus a farmer-landowner is entitled to use all surface water he can catch or contain on his property, for any lawful purpose he desires. However, he is prevented by law from damming or blocking surface water off his land, and his only legal resource is to divert unwanted water onto the property of any lower landowners.

[1] Many of the facts of this article were derived from Bulletin 89, *Water Laws of Alabama*, Geological Survey of Alabama 1974.

SECTIONED AND FORMED STEAKS FROM FORAGE-FED BEEF

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acceptability of restructured steaks indicates potential market for young bulls finished on forage

RESTRUCTURED FRESH MEAT cuts may be an idea whose time has come. These sectioned and formed cuts seem to fill the growing demand for convenience foods at retail and by the fast food industry. In addition, there is a chance for a savings to the consumer since more economically produced meat can be used.

Use of beef from forage-fed bulls in restructured products has been an active interest in meats research at the Auburn University Agricultural Experiment Station. Such animals produce lean beef more efficiently than steers, but the bull carcasses grade lower than steers. Auburn findings indicate that this beef can be used to produce a restructured product with desired sensory and physical properties.

Restructured steaks for evaluating were made from carcasses of two 14-month-old Charolais x Angus bulls that were slaughtered at the Auburn Meats Laboratory. The carcasses were chilled 48 hours at 36°F, and the chucks and rounds were removed, boned, and defatted. The boneless chucks were frozen overnight at −30°F, tempered for 36 hours at 26°F, and sliced wafer thin on an automatic slicer. The boneless rounds were tenderized three times using a reciprocating blade tenderizer with a belt setting of 1 in. per advance. This tenderization assured maximum cell disruption. The rounds were then cut into 2- to 3-in. cubes and the excess gristle and connective tissue were trimmed off.

Steps in forming the steaks were as follows: (1) 25 lb. each of the wafer sliced chunks and tenderized beef cubes were blended in a Hobart horizontal mixer for 15 minutes and formed into logs; (2) the logs were frozen at −30° for 48 hours and tempered at 26°F for 36 hours; (3) the logs were pressed using a 3-in. diameter cylindrical die in a hydraulic press, and thin sliced into ⅝-in.-thick steaks. These steaks served as the control in comparison with other restructured steaks that received a salt treatment in efforts to improve quality.

Steaks for the salt added treatment were prepared in exactly the same way except that 0.75% salt and 16 oz. of water were added to the meat at the beginning of the mixing cycle. All steaks were placed in styrofoam trays, PVC overwrapped, and frozen for subsequent evaluation by a sensory panel and with an Instron, an instrument that measures toughness.

Color was evaluated on two steaks from each treatment by a 6-member trained sensory panel. Steaks were prepared for the panels and for Instron evaluation by griddle broiling to an internal temperature of 160°F on a commercial electric griddle. Cooking loss was determined by weighing steaks before and after cooking.

The sensory properties, tenderness, juiciness, flavor, and amount of connective tissue, were evaluated by the panel using a rating scale. Instron compression values (measured in kilograms of force) give evidence of the amount of force required to push a metal plate through a cooked meat sample, while the Instron tension scores reflect the force required to pull a 1.4 × 5-centimeter strip of cooked steak into two pieces.

RATINGS OF RESTRUCTURED STEAKS BY SENSORY PANEL AND INSTRON

Quality measure	Results by treatment	
	Control	Salt added
Sensory panel[1]		
Tenderness	5.3	5.5
Juiciness	4.4	5.0
Connective tissue	5.4	5.9
Flavor	5.2	6.2
Color	4.0	4.7
Instron values		
Compression[2]	838	755
Tension[3]	.024	.057
Cooking loss, pct.	33.4	31.8

[1] Rated on scale of 1-8, where 1 = extremely undesirable and 8 = extremely desirable.
[2] Kilograms of force required to push a metal plate through a cooked meat sample.
[3] Kilograms of force to pull a 1.4 × 5-centimeter strip of cooked meat into two pieces.

As shown in the table, the sensory panel noticed no significant difference in tenderness or amount of connective tissue between steaks containing salt and the control steaks. The average values for juiciness were slightly higher for the steaks containing salt than the control steaks, and cooking loss was significantly lower for salt treated steaks. Adding salt caused improvement in flavor, according to the sensory panel. Panelists were permitted to use salt on the cooked sample during testing if desired, so the flavor difference noted was related to flavor alteration of the meat mix during processing and cooking.

Previous research also found that flavor was enhanced by incorporation of salt into the meat mix. The same research also showed that steaks containing salt develop off flavors during freezer storage. Color of steaks containing salt was significantly more desirable than the color of control steaks. This agrees with results of previous studies with restructured beef steaks.

Physical properties of the cooked restructured steaks containing salt were superior to the controls as evaluated by the Instron. Compression scores were significantly lower and the tension scores were significantly higher for the salt treatment. This indicates that the meat particles bound together better with salt addition, but still retained more desirable compression scores, which is indicative of desired tenderness.

The reported findings established that an acceptable restructured steak product can be manufactured from young bull beef. Based on this study, the addition of 0.75% salt provides improved sensory and physical properties.

Irrigation and In-row Chiseling Boost Tomato Yields

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WATER GENERALLY HEADS THE LIST of factors that limit crop production in Alabama. Even in years of high rainfall, poor distribution during critical periods and poor water use because of soil compaction may result in reduced yields or crop failure. Thus, use of supplemental water and breaking up of soil hardpans could be expected to reduce crop losses from rainfall shortage.

A combination of irrigation and in-row chiseling gave a positive yield response in 1976-78 tomato production research at the E. V. Smith Research Center. The project evaluated furrow, sprinkle, and trickle irrigation methods with and without in-row chiseling for staked Tropic tomatoes grown on an Orangeburg sandy loam soil.

On furrow and sprinkle irrigated plots, water was added 6-7 days after rains of 1 in. or more, and at 6- to 7-day intervals thereafter until a wetting rain occurred. Irrigation on trickle plots was applied 4-5 days after rain and then every 2 days until another rain came. Trickle irrigation water was applied through a single line of twin-wall plastic tubing placed on the soil surface next to the plants. Chiseling was done directly beneath the row to a depth of 12-14 in. immediately before plants were set in mid-April.

All plots were adequately fertilized according to soil test recommendations. Plants were staked and tied with twine when approximately 18 in. high and thereafter whenever the plants grew another 6 in. taller. Weekly spraying with insecticide and fungicide provided effective pest control. Weeds were controlled by herbicide.

Irrigation requirements were relatively high during 1977 and 1978 as a result of low rainfall. Rainfall during the period from planting to last harvest was approximately 21 in. in 1976, but only 11 in. in 1977 and again in 1978. Lowest amount of irrigation water applied per season was in 1976 – 3.3 in. from 6 trickle irrigations and 9.0 in. from 6 irrigations by the sprinkle method. Most water applied in a year was 9.6 in. from 35 irrigations by the trickle method and 20.0 in. from 13 sprinkle irrigations in 1977. Amount of water applied was approximately the same for the furrow and sprinkle methods – more than twice as much as with trickle irrigation.

MARKETABLE TOMATO YIELDS WITH THREE IRRIGATION METHODS, WITH AND WITHOUT IN-ROW CHISELING

Irrigation and tillage method	Per acre production			
	1976	1977	1978	Average
	Lb.	*Lb.*	*Lb.*	*Lb.*
No irrigation				
Not chiseled	43,840	17,180	34,610	31,880
Chiseled	45,670	24,710	30,380	33,590
Furrow irrigation				
Not chiseled	42,280	42,160	45,350	43,260
Chiseled	50,120	40,370	47,400	45,960
Sprinkle irrigation				
Not chiseled	43,500	41,930	43,470	42,970
Chiseled	52,020	41,610	45,500	46,380
Trickle irrigation				
Not chiseled	45,830	40,370	40,390	42,160
Chiseled	48,960	44,940	48,210	47,370
Average, all treatments				
Not chiseled	43,860	35,410	40,930	40,070
Chiseled	49,190	37,910	42,870	43,320

Both the rate of plant growth in early season and plant height at first harvest were increased by irrigation and in-row chiseling. Height of plants at the beginning of harvest ranged from an average of 25 in. for the nonirrigated, unchiseled treatments to 48 in. for the irrigated and chiseled treatment. The greatest effect from irrigation or chiseling was in 1977 when average plant height was increased an average of 16 in. by irrigation and another 4 in. by chiseling.

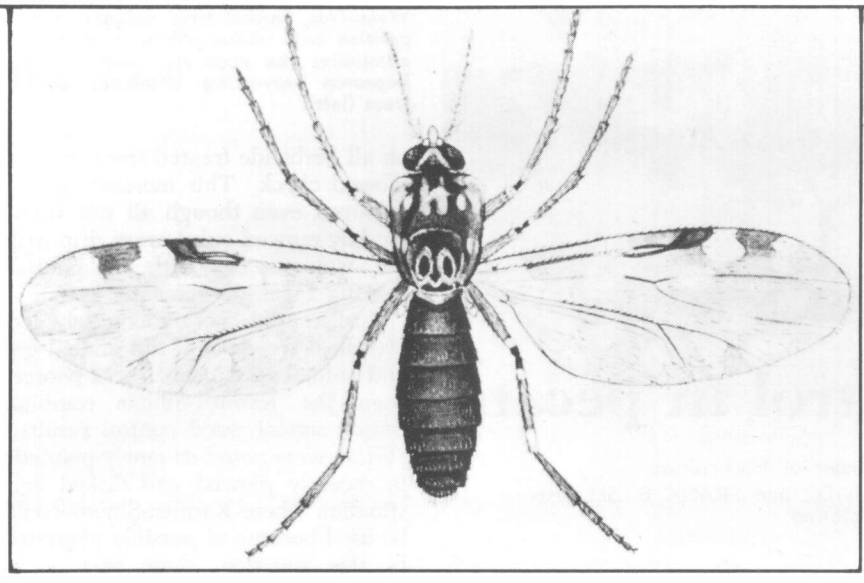
Three-year average marketable tomato yields ranged from 32,000 to 47,000 lb. per acre, see table. Yields were increased by irrigation during 1977 and 1978, but not in 1976, a year of high rainfall during the growing season.

Response to irrigation was greatest in 1977 when rainfall was lowest during the peak fruiting period. There was little difference between average yields of the three irrigation methods, but the trickle method used less than half the irrigation water that was applied to the furrow or sprinkle irrigated treatments. An average for 1977 and 1978 showed that irrigation increased yields by 16,750 lb. per acre above nonirrigated yields.

In-row chiseling increased yields for all treatments in 1976. In 1977, chiseling did not increase production on the sprinkle and furrow treatments. The next year chiseling upped yields on irrigated plots but not on nonirrigated plots. The greatest effect from chiseling was on nonirrigated plots in 1977 when yields were increased 7,530 lb. per acre, 44% above unchiseled plots.

The percentage of large fruit was increased by both irrigation and chiseling. The amount of cull fruit was not affected by chiseling, but tended to be decreased by irrigation. A count of diseased plants at the end of each harvest season showed that a higher percentage of plants were diseased on sprinkle irrigated plots than on either furrow or trickle irrigated plots.

Effect of sprinkler irrigation on tomato growth is illustrated by this comparison of irrigated plants (right) and those not irrigated (left).



BITING MIDGES:
Pest of Man, Livestock, and Wildlife

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FIG. 1. Adult biting midge showing conspicuous wing markings, which aid in identification.

Bites which are often mistakenly attributed to mosquitoes or black flies are actually caused by minute blood-sucking flies which, like mosquitoes, must feed on blood in order to develop their eggs. They are members of the family Ceratopogonidae and are thus called ceratopogonids or biting midges. Because of their extremely small size (.04 to .08 in.) which makes them nearly invisible to the casual observer, they are often referred to as "no-see-ums." Another common name is punkies, a corruption of an Algonquin Indian word for ash or ash-like, referring to their grayish, fleck-like appearance and the associated burning sensation produced as they feed.

Biting midges are especially a problem in coastal areas where they breed in salt marshes and along beaches, accounting for another common name, sand flies. Further inland they cause severe discomfort to campers, sportsmen, and other outdoor enthusiasts. In addition to biting man, these flies readily attack wildlife, cattle, and other domestic livestock, causing an undertermined amount of economic losses.

Not all ceratopodogonids feed on man and large mammals. Those that do typically belong to the genera *Culicoides* and *Leptoconops*. Other biting midges feed on birds, snakes, frogs, and even many groups of insects. The feeding habits of most members of this large, diverse family are still unknown.

These flies breed in a wide range of aquatic and semi-aquatic habitats including the edges of ponds and streams, low-lying woodlands, seepage areas, and the organically-rich soils of swamps and bogs. Rot holes in trees in which water and organic debris accumulate provide ideal sites for development of several of the woodland species that readily attack man.

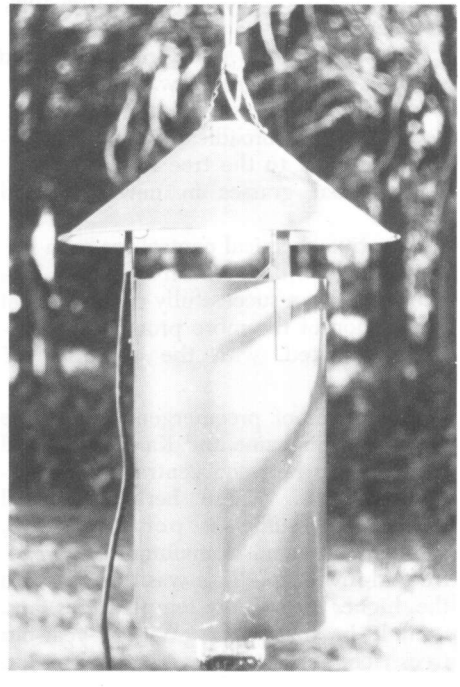
Although biting midges do not appear to play a significant role in the transmission of human disease agents in the United States, they are vectors of two important viral diseases of domestic and wild animals: bluetongue of sheep and cattle, particularly in the Western States, and epizootic hemorrhagic disease of deer in the Southeast. The latter has caused high mortalities in white-tailed deer populations as the result of outbreaks in Alabama, Georgia, North Carolina, and Tennessee over the past several decades.

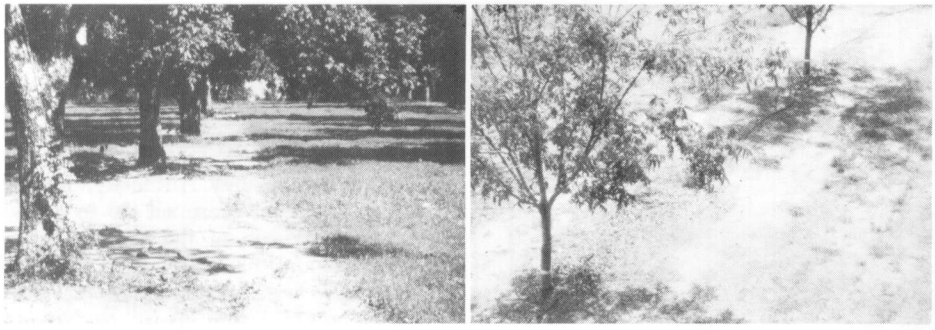
A state-wide survey of the biting midges in Alabama was initiated in 1976 to determine what species are found here, their seasonal occurrence, relative abundance, and breeding habits. Prior to this time only 16 genera and 59 species had been reported in the State. With the cooperation of personnel of the Agricultural Experiment Station, five State Parks, the Wheeler National Wildlife Refuge, and the Tennessee Valley Authority, regular trapping locations were set up to collect these flies in each of the major physiographic regions of the State. Standard New Jersey light traps, figure 2, were operated nightly from April to November. In addition, extensive collections of substrate samples from potential breeding sites have been made from which adults have been reared in the laboratory.

A total of 142 species in 24 genera is now known to occur in Alabama, including 42 species of the man-biting genus *Culicoides*. A number of previously undescribed species in at least four different genera has also been collected. *Culicoides variipennis* and *C. occidentalis sonorensis*, known vectors of bluetongue, have been found to be common near livestock facilities in several parts of the State.

In an effort to learn more about *C. o. sonorensis* and its potential role in the transmission of bluetongue virus in Alabama, a detailed field study of the biology of this species was begun earlier this year at the Black Belt Substation in Dallas County. This type of study, together with an on-going survey, will provide much needed information on this economically-important, yet poorly known, group of biting flies in the Southeast.

FIG. 2. Standard New Jersey light trap used in ceratopogonid survey.





Weed-free, in-row strip reduces weed competition with young pecan trees (right) and eliminates the need for cross mowing and improves harvesting efficiency of bearing trees (left).

in-row weed control in pecans

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Gulf Coast Substation

A COMBINATION of herbicides and mowing is one of the widest used weed control management practices for orchard floors in the eastern portion of the U.S. pecan belt. Herbicides are used to maintain a 7- to 8-ft.-wide weed-free strip in the tree row. Remainder of the orchard floor is mowed.

In young trees, the weed-free row strip is primarily needed to reduce weed competition. In bearing orchards it eliminates the need for cross mowing. A harvesting advantage is that nuts from the weed-free strip can be blown to one side, which improves efficiency of the sweeping operation.

Pecan weed control research by the Auburn University Agricultural Experiment Station, conducted since 1962, has defined weed problems in the tree row, as follows:

1. Annual grass and broadleaf weed complexes in the tree row.
2. Perennial grasses in the row.
3. Perennial broadleaf weeds immediately adjacent to the tree itself.
4. Annual grasses in newly planted trees.

Effective chemical control for each has been found in the Auburn research. The data have been successfully used for label registration of the more promising chemicals evaluated, with the exception of 2,4,5-T.

Persistence of preemergence herbicide activity of Simazine and Karmex differed considerably between central and southern Alabama. These herbicides used alone had insufficient persistence in southern Alabama to maintain the weed-free, in-row strip. This was attributed to the higher prevailing temperatures and rainfall in that area. With 4-year-old trees, long-term trials were then set up to evaluate a Karmex-Sinbar combination and Surflan. These treatments were considered at the time to be more persistent in preemergence activity, but they were not registered for such use.

Earlier work had found that continued use of preemergence herbicides alone without applications of postemergence materials increased perennial weed pressure from bermudagrass, dewberry, and blackberry. Consequently, Roundup was included, used alone and in conjunction with the preemergence herbicides.

No visual tree damage occurred with any of these herbicides, even though the lower 1 ft. of tree trunk was sprayed. *In separate studies it was found that Roundup could not be allowed to contact even one compound leaf without substantial phytotoxicity the following spring.* Applying Roundup with Simazine, Karmex, or Sinbar as a tank mix also resulted in nearly complete inactivation of the Roundup. This did not occur when tank mixed with Surflan.

Herbicide treatment did not affect tree size or number of nuts per tree. However, size of nuts was substantially larger on all herbicide treated trees than on the mowed check. This increase in nut size occurred even though all test trees (including mowed only) were drip irrigated (8 hours per day with one emitter delivering 1 gal. of water per hour).

Surflan did not adequately control broadleaf weeds as it did annual grasses, and annual grass control was poorer than from the Karmex-Sinbar combination. Better annual weed control results from Surflan were noted on newly planted trees in recently plowed and disked fields, a situation where Karmex-Sinbar could not be used because of possible phytotoxicity. In this situation, there was no visual toxicity from Surflan.

The preemergence herbicides evaluated do not prevent the pegging down of perennial grass stolons that grow into the treated strip. The greater the vigor of these grasses the more intense is this problem.

Perennial grasses in the tree row, particularly bermudagrass, are readily controlled by Roundup and Dalapon. Shading does not improve Roundup effectiveness as it does with Dalapon. Hence, Roundup is far more effective in young orchards than is Dalapon. In contrast to Dalapon, Roundup is not effective against bermudagrass in the spring. Its use for this purpose is restricted to mid and late summer. However, Roundup will also control perennial broadleaf weeds, such as honeysuckle and poison ivy, even if applied in the spring. Control of brambles can be achieved with Roundup applied at high rates in late summer. Best control of brambles and other perennial broadleaf weeds adjacent to the tree base was obtained using low-volatile esters of 2,4,5-T in water applied as a spot treatment. *This use for 2,4,5-T is not registered.*

EFFECT OF SELECTED HERBICIDES ON GROWTH, YIELDS, AND NUT QUALITY OF 7-YEAR-OLD CAPE FEAR TREES[1]

Treatment	Yield and nut data					
	Nuts per lb.	Nut volume	Percent shellout	Yield per tree	Yield per acre	Nuts per tree
	No.	*cc*	*Pct.*	*Lb.*	*Lb.*	*No.*
Mowed check	66	9.8	58	17.3	718	1,142
Roundup, 4 lb./acre	51	12.6	56	21.6	896	1,102
Roundup, 8 lb./acre	55	11.9	58	28.6	1,187	1,573
Roundup, 2 lb./acre, plus Surflan, 2.25 lb.	57	11.8	59	21.9	909	1,248
Roundup, 2 lb./acre, plus Karmex-Sinbar, 3.2 & 0.8 lb.	54	12.3	58	21.6	896	1,164

[1] Trees drip irrigated with one emitter per tree, 8 hours per day; trees spaced 30 × 35 ft., 41.5 trees per acre.

OFF-FLAVOR in Pond-raised Catfish

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Most catfish farmers would probably agree that pond related off-flavor, namely a musty or muddy flavor, is the number one problem in the industry today. Before a pond of fish can be harvested, the farmer must present a sample of the fish to the processor who cautiously tests the fish by smell and taste for off-flavor. If even slight off-flavor is detected, the fish cannot be harvested and the farmer must wait until the flavor improves.

Off-flavor is not a permanent thing; it disappears soon after the source in the pond is gone. This may take only a week or several months may be required; consequently, off-flavor creates considerable inconvenience in maintaining pond harvest schedules.

Studies on causes and controls for pond related off-flavor in catfish conducted at the Auburn University Agricultural Experiment Station have allowed for some of the following conclusions.

Geosmin is the major compound responsible for the musty flavor in pond raised catfish. Geosmin, or chemically related compounds, also causes musty odor or flavor in public water supplies, various foods, and decaying organic matter in the soil.

Geosmin is produced by some species of blue-green algae and by some actinomycetes. A heavily fed fish pond is a good growth medium for both of these organisms, the algae using inorganic nutrients and the actinomycetes growing on decomposing organic matter. Odor-producing species of both organisms have been identified from ponds with musty flavored catfish.

Musty flavor in catfish occurs more frequently in heavier soils, such as in the Black Belt and the Mississippi flood plain, than in sandier, more acid soils. Off-flavor is reported most often in late summer (perhaps because more fish are harvested then), frequently in cool weather (spring and fall), and occasionally in the winter. A survey in 1975, covering Alabama and Mississippi, indicated that approximately two out of 10 catfish ponds could be expected to have off-flavor fish at any single time during the summer and fall months.

The geosmin-like compounds can be absorbed by the fish through the gills directly from the water; thus, ingestion of geosmin-containing materials is not necessary for the fish to obtain the flavor although they absorb it quicker through the digestive tract. Geosmin is stored in the fat tissue of fish.

When a musty-flavored fish is placed in a geosmin-free environment, this compound disappears from the flesh relatively quickly. Tests showed that no sensorily detectable off-flavor was present when musty-flavored fish were held in clean water for 7 to 10 days at 75°F or for 10 to 15 days at 62°F, depending upon initial flavor intensity. However, along with disappearance of off-flavor there will be a weight loss of 5 to 12% if the fish are not fed.

Controlling off-flavor is difficult because enriched catfish ponds are favorable media for growth of geosmin-producing organisms. Selective destruction of the organisms which cause off-flavor, while sparing those which enhance pond water quality, is difficult.

General recommendations for the control of off-flavor in catfish ponds are not available. Transfer of fish to clean water or rapid exchange of the pond water is effective, but most farmers cannot do this adequately or economically. Judicious use of algacides has shown varying success, but this is hazardous because of the possibility of overkill of algae and subsequent oxygen depletion.

Producers and processors have been educated on the etiology of off-flavor development in catfish and the significance of this problem on marketability of the fish. Research is in progress at this time on pond control measures and objective tests for measuring off-flavor in fish.

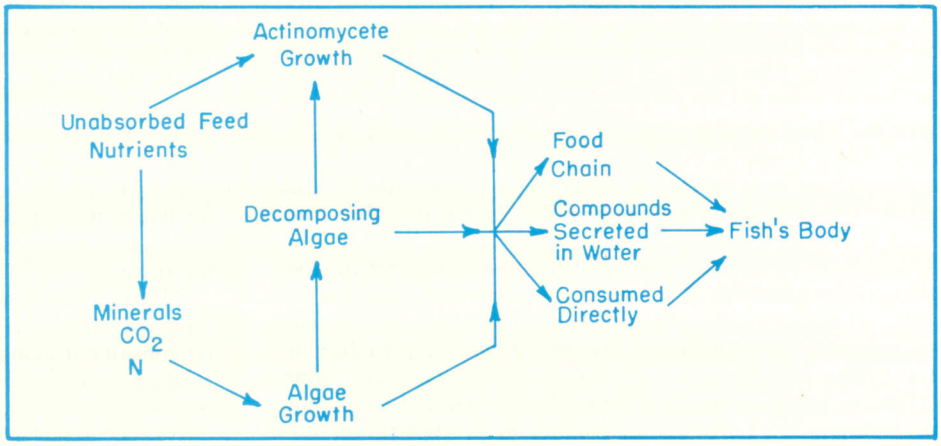
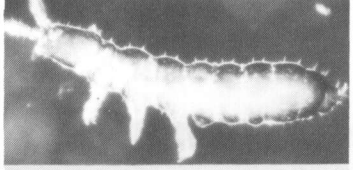


Illustration of the influence of continuous infusion of fish feed into the pond on growth of geosmin-synthesizing organisms and subsequent absorption of the off-flavor compound by fish.



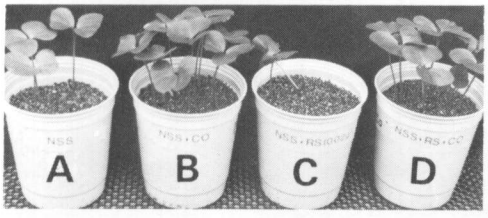


FIG. 1. Onychiurus encarpatus (top) and proisotoma minuta (bottom), soil dwelling Collembola (springtails) from Alabama cotton fields.

FIG. 2. Control of cotton seedling disease by Collembola added to Rhizoctonia-infested field soil. A) Natural, Rhizoctonia-infested field soil only; B) natural field soil + Collembola added; C) supplementary Rhizoctonia inoculum added to field soil; D) supplementary Rhizoctonia + Collembola added.

Suppression of Rhizoctonia Disease in Cotton by Mycophagous Insects

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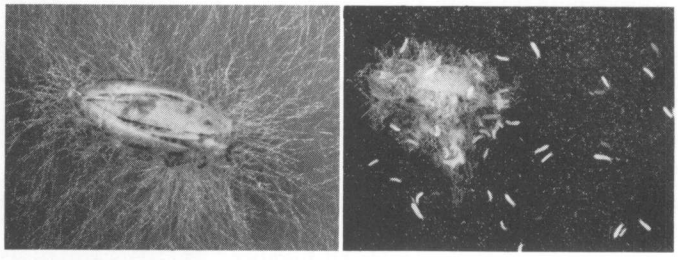

FIG. 3. Destructive feeding of Collembola on oat-grain culture (right) of the fungus Rhizoctonia solani, a cotton root-disease pathogen, culture without insects (left).

SUPPRESSION OF some root-disease fungi by antagonistic components of the soil microflora (fungi, bacteria, etc.) is well documented, but the potential role of soil insects in plant-disease control has been virtually ignored.

Beginning with the graduate studies of Elizabeth A. Wiggins in 1976 at the Auburn University Agricultural Experiment Station, several facts about microarthropods of the Order Collembola (springtails) have been established. Two genera, *Proisotoma* and *Onychiurus*, of these minute insects (1-2 mm long) are prevalent inhabitants in sandy soils common to many Alabama cotton fields. Like the microflora, they are consistently more abundant in the root zone (rhizosphere) than in root-free soil, and their numbers are increased under supplementary inorganic fertilization. The insects also have a tendency to migrate toward plant roots during periods when soil is drying. It was further shown that they can transport fungal spores including spores of the cotton-wilt pathogen, *Fusarium oxysporum* f. sp. *vasinfectum*, on their bristled bodies resulting in colonization of roots with these microorganisms. Thus, it appeared that the insects might be a threat to cotton crops by serving as vectors of disease agents.

Subsequently, it was learned that two species of these Collembola (*Proisotoma minuta*, figure 1, and *Onychiurus encarpatus*) are mycophagous (fungus feeders) and feed destructively upon the cotton root-rot pathogen, *Rhizoctonia solani*, as well as on *Fusarium* and many other soil fungi. Therefore, it is believed that these insects may play a dual role in cotton fields: (1) They may transport abundantly sporulating fungi, both pathogens and non-pathogens, to the root zone, thus influencing ecological phenomena around the roots and affecting plant health and growth; or (2) they may serve as natural biological control agents by destructively feeding upon pathogens and reducing the inoculum density required for root infection. The second part of this hypothesis was tested in further laboratory and greenhouse experiments using mixed populations of the two Collembola species against *Rhizoctonia solani*. This pathogen does not produce spores and, therefore, is not transported by the insects.

First, the destructive capacity of the insects against *Rhizoctonia* was determined in laboratory feeding tests. When the mixed species were introduced into dishes where *Rhizoctonia* was growing from inoculated oat grains on agar, 75-100 insects consumed approximately 90% of the fungal mycelium within 1-2 hours, figure 3. Where *Rhizoctonia* and a common soil saprophyte (*Trichoderma harzianum* or *Aspergillus terreus*) were cultured in the same dish, the insects showed a distinct feeding preference for the pathogen.

A series of repeated experiments was then conducted to determine the capability of the Collembola to reduce the inoculum density of *Rhizoctonia* in a natural field soil and thus protect cotton seedlings from damping-off disease. Fertile sandy loam, containing a natural microflora and known to be infested with *Rhizoctonia solani*, was collected from a local cotton field and mixed for uniformity, then subjected to desired treatments and dispensed in 5.4 cu. in. (about 1/5 pt.) quantities into qt. plastic greenhouse pots. Replicated treatments were as follows: NSS = non-sterilized (natural) soil, nothing added; NSS + CO = natural soil plus laboratory reared Collembola (mixed species) added at 1,000 or 2,000 insects for 2.2 lb. soil; NSS + RS = natural soil supplemented with *Rhizoctonia solani* on chopped oats at the rate of 0.22 g[1] per 2.2 lb. of soil; and NSS + RS + CO = soil with both *Rhizoctonia* inoculum and Collembola added. Ten untreated cottonseed (Stoneville 213) were then planted in each of eight pots per treatment. Percentage seedling emergence was recorded and, 12 days later, all roots and ungerminated seed were recovered from the soil and washed. Root disease severity was rated on a scale of 0 (healthy) to 5 (dead). Ungerminated seed and rotted hypocotyls were categorized as pre-emergence damping-off and rated 5. The presence of *Rhizoctonia* in diseased roots was verified by culturing from washed root segments.

The results are illustrated in figure 2, using pots representative of each treatment. The mycophagous action of Collembola contributed to a significant reduction in both pre- and post-emergence damping-off disease, consequently favoring plant growth and a more fully developed root system. Where 2,000 insects were added per pot, the average numerical disease ratings for treatments represented in figure 2 were: NSS = 2.25, NSS + CO = 0.90, NSS + RS = 4.10, and NSS + RS + CO = 2.20. The addition of supplementary *Rhizoctonia* inoculum to soil already naturally infested with the pathogen represents an extremely high level of inoculum available for infection; therefore, the disease reduction by insect activity in treatment NSS + RS + CO is particularly impressive.

This investigation strongly suggests that microinsects associated with the root surface or rhizosphere of crop plants must be considered along with the microflora in ecological research relating to biological control of soil-borne pathogens.

[1] One gram equals .035 oz.

BUILDING BOARDS

From Cotton Gin Residue, Bark, and Wood Fiber

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COTTON GIN WASTES (from spindle-picked cotton) consist of various portions of stems, leaves, burs, cotton fibers, sand, and soil. Collection and disposal of these waste materials has been the concern of cotton gin managers for many years. Until recently, most southeastern cotton gins burned their wastes in a teepee or open type burner. Other gins have trash hoppers to collect their waste and haul it to a dump. In other cases, gin trash has been composted and then applied to fields. In specific areas, limited amounts of trash have been fed to cattle. Presently, pollution control regulations prohibit some of the above disposal methods.

Cotton gin waste, in most cases, contains an appreciable amount of bundled short cotton fibers. The existence of the cotton fibers could qualify the gin wastes for use as part of the raw material (furnish) for fabrication of non-structural building panels. With the addition of wood particles or fibers and a thermosetting resin, cotton gin wastes could provide the major portion of the needed material to produce insulation building panels for housing.

This work was undertaken to investigate process and other variables for fabricating panels containing large amounts of cotton gin residues, and to compare the properties of these panels with the properties of commercial insulating building boards.

PROPERTIES OF EXPERIMENTAL BOARDS[1] AND OF COMMERCIAL INSULATION BUILDING BOARD

Property	Lower density board	Higher density board	Commercial insulation board
Actual density (pcf)	21.5 (1.2)[2]	27.0 (1.5)	20.6 (0.2)
Plate shear Modulus (10^3psi)	31.2 (1.8)	42.5 (2.2)	12.8 (0.7)
Modulus of elasticity (10^3psi)	93.9 (16.1)	125.4 (15.7)	32.9 (4.5)
Modulus of rupture (psi)	394 (89)	627 (96)	257 (23)
Internal bond (psi)	3.6 (0.9)	6.3 (1.6)	4.0 (0.4)
Nail holding face (lb.)	9.4 (2.3)	16.7 (4.7)	8.4 (1.2)
Thermal conductivity K (BTU-in./hr.-ft.^{2}-F)	0.401 (0.014)	0.449 (0.022)	0.353 (0.007)

[1] Experimental boards contained 60% cotton gin residue, 20% southern pine bark, 20% hardwood fibers, with paper surfaces.
[2] Number in parentheses indicates standard deviation.

Experimental Work

The work involved fabrication and evaluation of building boards from various mixtures of the following components by dry weight: 60% cotton gin residues, 20% southern yellow pine bark, and 20% sweetgum fibers. Bark was included to improve thermal insulation of the board. Boards in this experiment were surfaced on both sides with Kraft paper (0.006 in. thick, ⅓ oz. per sq. ft. weight).

Cotton gin wastes were collected from Alabama gins, dried to 6.5% moisture and crushed with a hammer-mill-type animal feed grinder. Wood particles of southern yellow pine were obtained from a particleboard plant and hardwood fibers[1] (sweetgum) from a fiberboard plant.

The components were dry mixed for 3 minutes in a motorized drum mixer and then blended with urea-formaldehyde concentrate resin (Allied Chemical Fiberbond) at an 8% rate. Board mats (24 in. × 24 in.) were hand formed. Paper surfacing was accomplished in one operation while pressing the board. The inside surface of the Kraft paper was thin coated with urea-formaldehyde concentrate resin. Boards were hot-pressed for 5 minutes at 400 psi (pounds per square inch) and 300°F. Mechanical stops were used to control board thickness of ½ in. and board densities of 22 and 27 lb. per cu. ft. There were eight boards in each density group.

After fabrication all boards were conditioned at 65% R.H. and 72°F. Each board was initially trimmed to 16 in. square and tested non-destructively in plate shear according to ASTM D 3044-76.[2] Afterwards, each board was cut into five flexure specimens 3 in. wide (15 specimens for each mixture) and tested for flexure stiffness and strength. From the tested flexure specimens of each board, six internal bond specimens and three specimens for nail holding were cut and tested.

Experimental results are listed in the table. These boards, as they have been described in the experimental procedure, are reinforced with paper on both surfaces and thus form a sandwich construction. The paper-skin reinforcement has significantly improved all strength properties except internal bond strength. The flexure and plate shear properties of both low and high densities (22 and 27 p.c.f.) paper-surfaced boards are two to four times larger than corresponding properties of the commercial insulation board. The internal bond (I.B.) strength of the low density board is slightly weaker while the I.B. of the higher density board is stronger than that of the commercial insulation board. The nail withdrawal resistance of both density boards is higher than that of the commercial board. The thermal conductivity factors (K) of the low and high density boards are, respectively, 14% and 27% higher than that of the commercial board. However, the insulating values of these two density boards are twice as good as that of ½-in. softwood plywood sheathing ($K = 0.8$).

Results indicate that it is possible to fabricate commercially acceptable building boards that contain large amounts of cotton gin residue (60%), southern pine bark (20%), and hardwood fibers (20%). These boards are reinforced with Kraft paper on both surfaces, and are two to four times stronger and stiffer than the commercial insulation boards. They have good thermal insulation values and are light and easy to handle without breaking.

[1] Sweetgum fibers had been processed in a Bauer 418 pressurized refiner with plate clearance of 0.050 in., stem pressure of 100 psi, and dwell time of 5 minutes.

[2] American Society for Testing and Materials. 1977. Annual Book of ASTM Standards, Part 22. Philadelphia, Pa.

THE ECONOMY OF ALABAMA'S COASTAL COUNTIES

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COASTAL REGIONS in the United States are receiving more and more attention from administrators, planners, and citizens because of the variety of activities which take place on or near the coast and because of the need to preserve the many unique environmental characteristics of coastal areas.

Researchers in the Department of Agricultural Economics and Rural Sociology (funded by the NOAA Office of Sea Grant, Department of Commerce) have undertaken a study of the interactions between economic and environmental concerns in the two-county coastal region of Alabama. The study is divided into two major phases: development of a quantitative model describing the structure of the regional economy, and development of an environmental model describing the relationships between resource use and the production of goods and services in Mobile and Baldwin counties.

The basis of the economic model is a technique known as "input-output analysis." Input-output analysis is fundamentally an accounting system designed to show the flow of goods and services between producers, and from producers to final consumers. The input into the productive process, as well as the output from it, are described in a tabular format and from this framework further mathematical manipulations and economic interpretations can be made.

The first step in constructing an input-output model is to decide on the general groups, or "sectors," into which the various businesses of the economy can be meaningfully combined. In this study, a total of 33 sectors were chosen to represent all activities and industries in the region. The name and composition of each sector is similar to that found in the U.S. national input-output model (for which there are 85 sectors) except that industries important to the region, such as commercial fishing and ornamental horticulture, are given special attention in being accorded their own sectors, while relatively insignificant industries such as leather products and armature rewinding shops were combined into "miscellaneous" categories. The year 1972 was used as the base year because that was the latest date for which reliable output and employment statistics could be obtained for the majority of sectors. Manufacturing sectors hold a prominent place since Mobile County is quite highly industrialized. Conversely, while the natural resource sectors such as seafood, agriculture, and mining are not as significant in the magnitude of their output as the manufacturing or service sectors, they provide substantial employment in Baldwin County.

In a classic input-output study, a sample of establishments from each sector would be interviewed to determine their sales to and purchases from all other sectors. However, because the expense involved in collecting these "primary" data was considered prohibitive, this study assumes that the pattern of sales and purchases is similar to that of the national economy, and the pattern of flows in the national input-output model is used, with some adjustments for regional differences.

When all the information on purchases, sales, and total output is collected and organized the result is a table in which each sector has one row which represents its sales, and one column which represents its purchases. Sales of products are distributed not only to other industries but also to households and exports from the region. Thus, the amount of money made on the sale of output by each sector is exactly accounted for in the amount of money spent by that sector.

While the magnitudes of the flows of goods and services have changed since 1972, it is assumed that the percentage of purchases by a sector from each other sector relative to that sector's total output has remained much the same over the years. From this "production recipe" it is possible to analyze the effects that changes in sectoral output will have today, and with some mathematical manipulation a table can be constructed that traces the "chain reactions" which would be experienced by the entire economy as a result of a change in final sales by any sector. For example, this chain reaction is set in motion when one sector increases its exports. In order to increase production to meet its new export demand it must purchase more inputs. The sectors which provide those increased inputs must increase their own inputs too, and the impulse generated may eventually affect directly or indirectly all of the sectors in the entire economy. This chain reaction is known as the "multiplier effect" and a change in sales to final demand by one sector may be multiplied several times over in its total effect. Using data on employee compensation and employment, which are an integral part of the production process, it is also possible to translate the effects of changes in final sales into household income and employment effects. Thus the economic model of the region provides:

(1) a description of the actual flows of goods and services for 1972; (2) a "production recipe" based on the proportionality of various inputs to total output; (3) a table which quantifies the magnitude of direct and indirect effects on each sector involved in an economic chain reaction; and (4) income and employment multipliers which are used to translate the output effects into income and employment effects.

The second phase of the research is a study of how the environment interacts with the economy of the region. This comprises two aspects: production of air, water, and land pollution, and utilization of natural resources such as water, land, and energy. The approach used in this phase is to extend the economic model to encompass other factors in the productive process which may not be as obvious as raw materials or labor, but which are nevertheless indispensable to each sector in the production of its output. All industries need space and energy to function; many industries locate in coastal areas because of large process and cooling water requirements; most industries require the capacity to discharge wastes into the environment. Just as there are economic multiplier effects due to changes in production, so must there also be environmental multiplier effects. This research will quantify the effect on emissions of total suspended solids, or sulfur dioxide, or solid waste, or the consumption of fossil fuels or water in the region when any sector experiences a change in sales to final demand.

The final economic-environmental model should provide a powerful tool in aiding regional planners in simulating the outcome of different development strategies. By having the complex interactions in the coastal community organized into a format which can quantify the interrelationships, Alabama can plan ahead for growth and change in its coastal counties which will both enhance the economic structure and protect the unique environment of the coastal region.

CREEP FEEDING EFFECTS *Carry Over To* FEEDLOT PERFORMANCE

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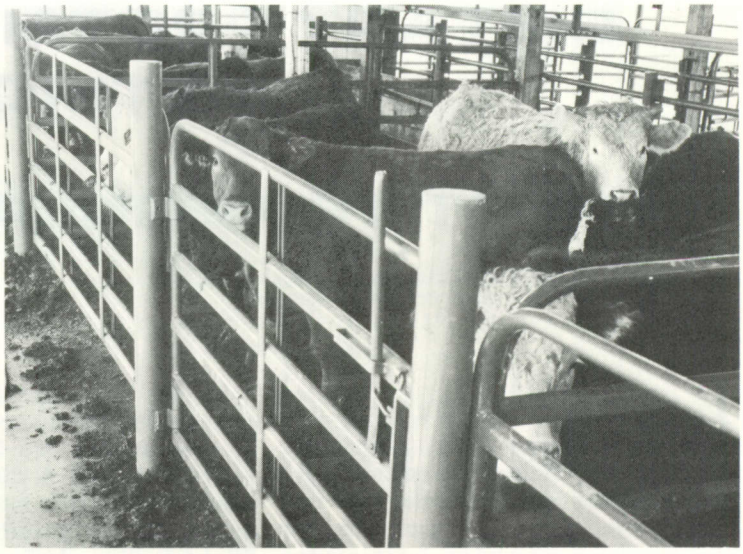

RESULTS OF CREEP feeding nursing beef calves show up in heavier weight at weaning. But feedlot performance also is affected by creep feeding, according to findings of a 5-year Auburn University Agricultural Experiment Station project at the Black Belt Substation. Such things as days to finish, feedlot gain, and carcass weight and quality showed effects of creep feeding. Breed differences also were identified, with crossbred animals gaining faster but requiring more days to reach finish than straightbreds.

Three equal groups of nursing Hereford, Charolais x Hereford, and Simmental x Hereford calves were used to evaluate these creep treatments: (1) control – no creep feed, (2) high protein group – fed a high protein, low energy creep ration, and (3) low protein group – fed whole shelled corn (a high energy feed) to weaning. Creep fed steers averaged 62-70 lb. heavier and heifers about 70 lb. heavier at weaning than the control calves, as reported in the Spring 1978 issue of *Highlights*.

At weaning, the steer calves were put into feedlot for finishing. They were full fed a blended ration consisting of 68.6% ground shelled corn, 15% ground johnsongrass hay, 10% cane molasses, 3.8% cottonseed meal (41%), 0.9% urea, 0.8% salt, 0.45% minerals, and 0.45% dicalcium phosphate, plus vitamin A until finished for slaughter. Breed combinations were the same for the feedlot groups as for the creep feeding phase.

The calves that were creep fed corn (low protein group) required fewer days feeding to reach approximately the same carcass grade, table 1. The control calves had the highest average daily gains, with small (non-significant) differences between the high and low protein groups.

Feed efficiency and carcass grades were similar for all groups. Dressing percentage was highest for the high protein group. Carcass weights per day of age were higher for the calves that had been creep fed. Yield grade favored the control group.

Hereford steers required fewer days of feeding to reach slaughter finish, table 2. Age at slaughter was 14.9 months for Hereford, 15.3 months for Charolais x Hereford, and 15.6 months for Simmental x Hereford steers.

Both groups of crossbred steers had higher average daily gains, higher carcass weights per day of age, and better yield grades than the straight Herefords. The Simmental x Hereford steers had higher carcass grades, but they were slightly older than the other two breed groups. Dressing percentage was higher for the Charolais x Hereford than for the other breeds.

Results showed that steer calves that had been creep fed required slightly fewer days to attain the same carcass grades when finished in feedlot. Although calves not creep fed made higher daily gains in feedlot, the differences were not statistically significant. Carcass weight per day of age was highest for the fed groups, but yield grade was best for the control steers.

Hereford steers were in the feedlot fewer days, but the crossbred steers gained faster, had higher carcass weight per day of age, and better yield grades. Performance of the crossbreed groups was similar, except that the Simmental x Hereford produced slightly better carcass grades and Charolais x Herefords rated best in dressing percentage.

TABLE 1. FEEDLOT PERFORMANCE OF CALVES FOLLOWING CREEP FEEDING, AVERAGE OF ALL BREEDS

Feeding treatment	Days fed	Average daily gain	Feed per lb. gain	Carcass grade	Dressing percent	Carcass wt./day of age	Yield grade
	No.	*Lb.*	*Lb.*		*Pct.*	*Lb.*	
Control	194	2.60	8.70	11.9	63.5	1.42	2.9
High protein	192	2.51	8.91	11.8	64.4	1.51	3.2
Low protein	186	2.48	8.82	11.6	64.2	1.48	3.3

TABLE 2. FEEDLOT PERFORMANCE OF DIFFERENT BREEDS FOLLOWING CREEP FEEDING TEST, AVERAGE OF ALL CREEP TREATMENTS

Breed of calves	Days fed	Average daily gain	Carcass grade	Dressing percent	Carcass wt./day of age	Yield grade
	No.	*Lb.*		*Pct.*	*Lb.*	
Hereford	185	2.41	11.6	63.7	1.40	3.5
Charolais x Hereford	193	2.61	11.5	64.9	1.53	2.9
Simmental x Hereford	196	2.61	12.0	63.8	1.51	2.9

DIETARY PROTEIN and METHIONINE in APPETITE REGULATION

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LIQUID PROTEIN and high protein diets have received much attention today in regard to their ability to promote weight loss. Consumption of a normal diet containing fats, sugars, and protein causes the stimulation of certain brain regions which act to suppress appetite. However, depressed appetite after eating high levels of dietary protein or imbalanced amounts of amino acids (building blocks which combine to form protein) occurs through control of different brain regions.

High protein and imbalanced amino acid diets lead to elevated blood levels of amino acids which cannot be used to build body proteins and consequently may serve as a signal to reduce food intake. Food intake may also be depressed since the animal is unable to utilize the excess nitrogen from degraded amino acids. Furthermore, it has been shown that high levels of ammonia have produced several changes in sugar utilization. Therefore, ammonia poisoning may be an important factor governing depressed food intake after animals have eaten a high protein diet.

The purpose of these experiments by the Department of Home Economics Research, Agricultural Experiment Station, was to investigate the immediate relationship between blood ammonia-nitrogen, blood sugar, and liver glycogen (a storage form of sugar in the body) following overnight consumption of high dietary protein or excess methionine (an amino acid known to depress appetite when fed in high amounts) in rats.

In the first experiment, 50 male Sprague-Dawley rats, average weight 224 g, were divided into 5 groups and allowed ad libitum 5, 20, 40, 60, or 80% casein diets. These met the nutrient requirements for growth except for the 5% casein diet, which was low in protein. After overnight consumption of the diets, all animals were sacrificed; blood and livers were collected for subsequent analysis. Consumption of the 80% casein diet resulted in depressed feed intake and body weight change relative to the 20% casein control. Blood ammonia-nitrogen was elevated above the control level by the 60 and 80% casein diets. Blood sugar increased with dietary protein content to a maximum of 293 mg/dl at the 80% casein level. A concurrent drop in liver glycogen was observed with the minimum being 6 mg/g at the 80% casein level.

The increase in ammonia-nitrogen after eating the high protein diet was expected, since more amino acids were absorbed than could be used to build body proteins and had to be broken down yielding ammonia-nitrogen. The source of elevated blood sugar observed in rats given the high protein diets is not clear. Since the 80% casein diet contained no carbohydrate at all and because liver glycogen stores were severely depleted, the most obvious explanation is increased sugar production from the highly available amino acids and liver glycogen breakdown. However, other factors, such as decreased release and activity of insulin, could produce the excess blood sugar observed after eating high amounts of dietary protein.

In the second experiment 18 male Sprague-Dawley rats, weighing approximately 300 g, were placed into 3 groups and offered a nutritionally adequate, 10% casein diet supplemented with 0.3, 1.5, or 3.0% methionine. As in the previous experiment, all animals were sacrificed following overnight consumption of the experimental diets; blood and liver samples were collected for analysis. The 3.0% methionine treatment resulted in depressed feed intake, loss of body weight, elevated blood ammonia-nitrogen, and depressed blood sugar and liver glycogen concentrations relative to the 3.0% methionine control.

The loss of body weight cannot be explained on depressed food intake alone, but appears to be related to some specific toxic effect of the excess methionine. Theoretically, the excess nitrogen from the methionine itself may be a source of the observed elevated blood ammonia-nitrogen. In addition, the loss of body weight on the 3.0% methionine treatment suggests that body protein breakdown occurred to provide energy and may also be a source of blood ammonia-nitrogen. The drop in blood sugar and liver glycogen may be explained on the basis of depressed food intake which necessitated glycogen breakdown to maintain blood sugar at normal levels. However, the actual mechanisms by which excess methionine depresses appetite is unknown.

The results of these studies suggest that ammonia-nitrogen, which was significantlv elevated by the high protein and 3.0% methionine treatments, may be a major factor in the basic control mechanism that responds to protein quantity and quality.

EXPERIMENT 1. OVERNIGHT EFFECT OF DIETARY PROTEIN LEVEL ON FEED INTAKE, BODY WEIGHT CHANGE, AND VARIOUS METABOLIC PARAMETERS IN RATS[1]

Treatment	Intake		Body wt. change	Plasma		Liver glycogen
	Feed	Protein		Ammonia	Glucose	
	g	*g*	*Pct.*	*μg/dl*	*mg/dl*	*mg/g*
5% casein	23	1.0	3.3	237	222	67
20% casein	19	3.4	3.3	193	212	51
40% casein	14	5.0	1.8	232	246	32
60% casein	12	6.5	2.6	344	264	15
80% casein	10	7.2	1.5	359	293	6

[1] Values are means obtained 18-24 hours after male Sprague-Dawley rats (av. initial wt. 224 g) were offered experimental diets.

EXPERIMENT 2. OVERNIGHT EFFECT OF DIETARY METHIONINE LEVEL ON FEED INTAKE, BODY WEIGHT CHANGE, AND VARIOUS METABOLIC PARAMETERS IN RATS[1]

Treatment	Intake		Body wt. change	Plasma		Liver glycogen
	Feed	Methionine		Ammonia	Glucose	
	g	*g*	*Pct.*	*μg/dl*	*mg/dl*	*mg/g*
0.3% DL-methionine	24	0.15	2.1	207	205	46
1.5% DL-methionine	16	0.29	−0.9	208	170	37
3.0% DL-methionine	12	0.41	−3.6	294	163	24

[1] Values are means obtained 18-24 hours after Sprague-Dawley rats (av. initial wt. 300 g) were offered experimental diets.

STUDENT COMMITMENT TO AGRICULTURE

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To many people agriculture means farming. But agriculture is much more than just farming. There is a wide variety of occupations and employment opportunities within agriculture. Like any economic industry, personnel must be recruited to fill these occupations and to perform the essential activities and duties involved.

With time a youth may be attracted to a specific occupational goal. As decisions are made leading to the attainment of this goal, choices are made and attitudes formed relative to such things as educational courses, parttime and summer work, and organizational memberships. The accumulation of choices creates a sense of commitment to the occupation.

Information for this study of students' commitment to agriculture in the broad sense of agribusiness or the agriculture industry, was provided by students enrolled in Colleges of Agriculture at State Land Grant Universities throughout the South. The sample consisted of 4,567 students responding to a mailed questionnaire during the spring of 1977. Among these were 3,551 attending universities commonly referred to as 1862 institutions which originally served white youth and 1,016 students attending 1890 institutions established for black youth. Throughout this article the designations "1862" and "1890" are used to indicate these two types of institutions training students for occupations in contemporary agricultural occupations. The descriptive information presented here focuses on a number of indicators of public and private commitment to agriculture as an occupational goal.

Public Commitment. Five indicators of behavioral commitment to agricultural occupations are considered, see table. A major commitment was made by each of these college students when choosing to enroll in an agriculture major. But other commitments could have preceded this action. One was in taking elective high school agriculture courses. Of the "1862" students only 23% had taken agriculture courses, compared to 47% of "1890" students. More of the "1890" students reported these courses had influenced them to choose a major in agriculture.

Another act of commitment is to become a member of agriculture related student groups. Two such groups available in many high schools are 4-H and FFA. Students attending "1890" universities were more likely to have participated in these groups than were "1862" students. However, only 19% of "1862" and 30 to 34% of "1890" students had made this type commitment.

Experience working on a farm or in agriculture-related work is considered yet another example of commitment to agriculture. The proportions of "1862" and "1890" students having agriculture work experiences were similar. About 75% had some such experience but only about 40% had multiple agricultural work experiences.

Finally, attention was given to whether adults holding occupations in agriculture other than a parent were viewed as influential in the decision to enroll in a College of Agriculture curriculum. The majority of "1862" students indicated that no such persons served this role; and when some significant adult in agriculture was identified, this influence usually came from a single individual. The most often mentioned person was the agricultural education teacher. Students at "1890" schools were more likely to attribute influence on their college educational choice to such a significant person in agriculture.

Private Commitment. Four indicators of a favorable image of agriculture as an occupation are considered. The vast majority of agriculture students held positive orientations toward the career opportunities in agriculture, with 61% of "1890" and 40% of "1862" students indicating very favorable attitudes. Similarly strong commitment was indicated by rejection of the statement that "agriculture is a declining industry." Eighty percent of the students disagreed with this contention, with the majority indicating strong disagreement.

The negatively expressed idea that agricultural occupations do not require high levels of education was broadly rejected. The majority of both "1862" and "1890" agriculture students (74% and 62%, respectively) disagreed with the statement. Although agriculture is a traditional male occupation, 74% of "1862" and 62% of "1890" students reacted negatively to the contention that "agricultural occupations are unsuited to women."

Indicators of Public and Private Commitment to Occupations in Agriculture Among Agriculture Majors Attending Southern Land-Grant Universities

Indicator	Type universities	
	1862	1890
	Pct.	*Pct.*
Public		
Took an agriculture course in high school	23	47
Participated in high school 4-H program	19	30
Participated in high school FFA program	19	34
Worked on a farm or in agriculture related job	73	78
Influential contact with adult in an agriculture related job	39	59
Private		
There are good career opportunities in agriculture (agree)	87	94
Agriculture is a declining industry (disagree)	85	79
Most work in agriculture can be done by people with little education (disagree)	74	62
Most agricultural occupations are unsuited to women (disagree)	57	63

Conclusions

This study reveals two things about the commitment to agricultural occupations of college students in agricultural majors at "1862" and "1890" universities in the South. First, "1862" students had not made a heavy public commitment to an agricultural occupation prior to entering college. Only farm or agriculture related work experience was a widespread commitment characteristic. From a traditional perspective, students attending "1890" universities were more likely than "1862" students to have made public choices reflecting their commitment to agriculture. Today agriculture students do not have the kinds of training and experiences that were common a decade ago. Second, in spite of a lack of public commitment, private commitment in the form of favorable attitudes toward agriculture as an occupation is exceptionally strong. It would appear that the majority of these students, male and female — black and white, are interested in and committed to agricultural occupations. The questions is: will college trained people find rewarding and meaningful career opportunities in agriculture as it is traditionally structured?

FORCE MOLT CAGED LAYERS IN 6 WEEKS

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Department of Poultry Science

MOST PROGRAMS for force molting caged layers take 8 weeks to complete. But a recently developed program cut this time to 6 weeks in Auburn University Agricultural Experiment Station tests, and without reducing post-molt performance. The reduced time results in savings of 10¢ to 14¢ per hen because of lowered feed costs.

As a premolt treatment, lights should be continuous for 7 to 10 days before beginning the forced molt. Different procedures are followed in "blackout" houses than for hens in conventional layer houses. Also, procedures for a conventional house vary according to time of year, as noted in the table.

Ten days of feed withdrawal in moderate weather should cause the body weight of hens to decrease to about 2.8 lb. (normal 20- to 22-week body weight for the breed). Depending on temperature at time of the forced molt, more or fewer than 10 days of feed withdrawal will be necessary to achieve an average flock body weight of 2.8 lb. Daily weighing of the same 50-bird sample is necessary to assure optimum weight loss.

The pullet grower ration used, starting at day 11, should contain 16% protein, 0.6-0.7% total sulfur amino acids, 1,250 Kcal metabolizable energy, 1.1% calcium, and 0.5% available phosphorus. This diet is formulated to achieve rapid feather growth and return to egg production.

Normal layer diets are inadequate for both egg production and feather growth. Therefore, during the first weeks of egg production after a molt the layer ration should contain additional nutrients to accomplish both of these functions. A layer ration to 50% production should contain 17% to 18% protein, 0.7% total sulfur amino acids, 1,300 Kcal metabolizable energy, 3.5% calcium, and 0.5% available phosphorus. When feather growth is completed, normal nutritional guidelines for layers can be followed.

Light control is critical. Research results suggest that the light control portion of the outlined program helps to stop egg production quickly and uniformly, decreases mortality, and helps to get birds back in production quickly. Birds must not be exposed to increasing daylength during day 1 to day 17. Stable or decreasing daylength is absolutely necessary during this period to ensure an adequate rest period for the flock.

As with the management of any flock, care should be taken to avoid the effects of severe weather, disease, or other problems.

OUTLINE OF FORCED MOLT PROCEDURES

Day	Environmental "blackout house"	Conventional house	
		Increasing daylength June 22-December 22	Decreasing daylength December 23-June 21
1	Remove feed 6 a.m. 6 hours light	Remove feed 6 a.m. Cut lights off	Remove feed 6 a.m. Reduce light to natural daylength expected at day 17 (consult Weather Service for sunrise and sunset of day 17) and add ½ hour to morning and evening
3	Remove water 6 a.m.	Remove water 6 a.m.	Remove water 6 a.m.
4	Return water 1 p.m.	Return water 1 p.m.	Return water 1 p.m.
11	Feed pullet grower 6 a.m., 5 lb. per 100 birds	Feed pullet grower 6 a.m., 5 lb. per 100 birds	Feed pullet grower 6 a.m., 5 lb. per 100 birds
12	Feed pullet grower, 10 lb. per 100 birds	Feed pullet grower, 10 lb. per 100 birds	Feed pullet grower, 10 lb. per 100 birds
13	Begin feeding pullet grower free choice	Begin feeding pullet grower free choice	Begin feeding pullet grower free choice
17	8 hours light	Natural daylength plus 1 hour in fall In summer, natural daylength plus 50 minutes	
24	10 hours light		Do not change if in spring In winter, natural daylength plus 1 hour
28	13 hours light	Increase light 30 minutes, 13½ hours minimum	Increase light at least 30 minutes above natural daylength, 13½ hours minimum
	Return layer ration at 5-10% rate of lay. This will be about day 28		
35	Resume normal lighting program, with 14-15 hours daylength		

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