HIGHLIGHTS

of agricultural research

VOL. 20, NO. 2/SUMMER 1973

Agricultural Experiment Station
AUBURN UNIVERSITY

DIRECTOR'S COMMENTS

THE RESEARCH PROGRAM of the State Agricultural Experiment Stations, including the Alabama Station, was planned to accumulate and advance knowledge in the broad area of agriculture and forestry.

R. DENNIS ROUSE

Few people can be expected to appreciate the contributions that State Agricultural Experiment Stations have made to our modern world. Those directly associated with agriculture are aware of many activities but even those closest associated are usually amazed at the scope of the influence of the agricultural research program on their everyday lives. Those not directly involved in production agriculture usually do not know such a research system exists.

The Agricultural Experiment Station is unique in that for a major part of its program there is no other organization or system that can be expected to provide the benefit of research in the areas of concern to these stations. The Hatch Act that provides Federal funds for the State Agricultural Experiment Station states: "It is also the intent of Congress to assure agriculture a position in research equal to that of industry." The Experiment Station System has provided far more than those statesmen who originated State and Federal support could have imagined. These men were optimistic that one day half the Nation's population could produce food and fiber for all the population. How could the wildest dreamer envision that in 1972 only 5% would produce this food and fiber and in addition $9.4 billion in agricultural products for sale to other countries. This was achieved through mechanization, development of modern pest control methods, and many other technological advances. Much credit goes to the associated free enterprise system and to the productivity of the millions of people released from farm and forest labor into industrial research, production, and distribution. However, there can be no argument that the stimulation of Agricultural Experiment Stations to both farmers and industry deserves a major share of the credit.

The benefits of agricultural research have not been confined to farm production. Few people would associate the 50% increase in life expectancy over the past 50 years with contributions of the Agricultural Experiment Stations. Yet it is not likely that this increase would have been nearly so great without contributions of agricultural research. The findings of agricultural scientists have been directly applicable to human health through discovery of such things as essential mineral elements, vitamins, amino acids, vaccines, and antibiotics. Thus, research planned to improve productivity of farm animals has resulted in further knowledge of human nutrition, food sanitation, and treatment of diseases. This Station currently has research in many areas that will increase knowledge of human health. Agricultural research has also contributed to the quality of the environment through soil and water conservation, eutrophication studies, and reforestation. Thus, there are many ways in which every citizen of the State benefits from research of its Agricultural Experiment Station. Monies spent in agricultural research represent a public investment – an investment that has returned an estimated 700 to 1,300%.

may we introduce . . .

R. T. Lovell, associate professor of fisheries and allied aquacultures, is involved in both research and graduate level teaching at Auburn University. As indicated by his story on page 3, Lovell's research concerns fish nutrition and technology under intensive fish culture for food production. Among his studies have been projects on basic nutritional requirements of catfish, particularly with vitamin C and phosphorus, and investigations of environmental related off-flavors in intensively cultured fish. He has numerous publications reporting results of his research.

A native of Lockesburg, Arkansas, Lovell received the B.S. and M.S. degrees from Oklahoma State University and the Ph.D. from Louisiana State University. He was then on the LSU faculty as assistant and associate professor in food science and technology for 6 years before coming to Auburn in 1969.

In addition to membership in several professional societies, Lovell has been honored with membership in Alpha Zeta, Phi Kappa Phi, and Gamma Sigma Delta, and he is a fellow of American Institute of Chemists.

HIGHLIGHTS of Agricultural Research

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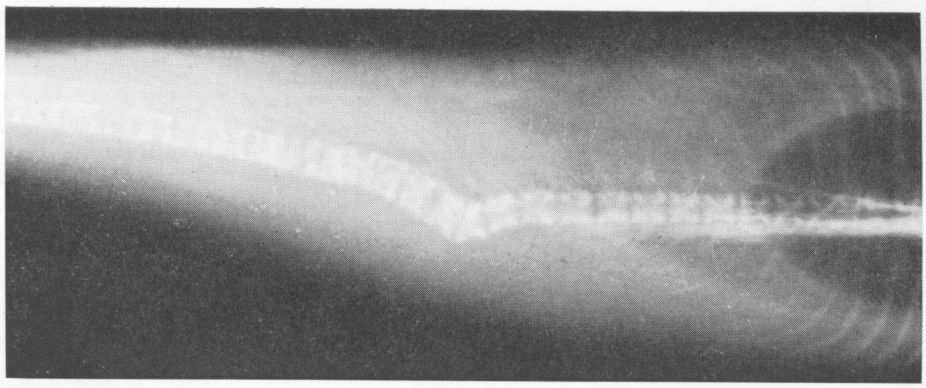
ON THE COVER. Unlike cotton and corn, soybeans has had an increase in Alabama acreage in recent years, see story, page 9.



Curved spine of catfish shown in this radiograph is typical of the crooked back problem of fish deficient in vitamin C. Half-developed vertebrae shown were common in the vitamin deficient fish.

Catfish Need Vitamin C

R. T. LOVELL, *Dept. of Fisheries and Allied Aquacultures*

OVER FIFTY YEARS AGO ascorbic acid was recognized as the nutrient responsible for preventing scurvy in man and was given the title of vitamin C. All animals have a metabolic need for vitamin C, but it had been thought that only man, monkey, and guinea pig needed this vitamin in the diet. New research evidence now points to a need for vitamin C by catfish, disputing results of early research that indicated none was needed.

Since commercial catfish production has gained in prominence, many fish have been brought to the Cooperative Fish Disease Laboratory at Auburn showing disease symptoms but with no signs of infestation with pathogenic organisms. Affected fish all came from some type of modified culture environment where natural aquatic food was limited, and they had been intensively fed commercial type rations that were not supplemented with vitamin C.

The diseased fish usually showed either broken or crooked backs (lateral or vertical curvature of spine), white bands around the body just behind the dorsal fin, irregular surface swimming, tetany when handled, and poor growth and mortality, or a combination of these. Vitamin C deficiency was suspected as being responsible because none of these symptoms have been observed in Auburn research where catfish are grown in artificial cultures with diets supplemented with vitamin C. Neither have the symptoms appeared in catfish with access to significant amounts of pond organisms that are rich in ascorbic acid.

A study at Auburn University Agricultural Experiment Station measured response of channel catfish to vitamin C when grown from stocking to harvest size in a culture system with limited natural aquatic food and intensive feeding. Half of the 1,600 test fish got the following nutritionally adequate feed containing vitamin C:

Ingredient	*Per cent*
Corn	32.7
Herring meal	21.7
Peanut meal	20.3
Dehulled soybean meal	20.3
Dried corn fermentation solubles	6.7
Dicalcium phosphate	1.0
Vitamin mixture	.5
Vitamin C	.88

The other half of the fish got the same feed without the vitamin C.

The 1,600 fingerlings were stocked in four cages (39 x 39 x 39 in.) suspended in a 2.9-acre pond. Feed was allotted once daily, 6 days per week, at a rate beginning at 4% of fish weight and decreasing to 1.5% near end of the trial. Feed allotments were adjusted biweekly based on monthly samplings.

Approximately 25% of the fish from each cage were weighed monthly and inspected for signs of vitamin C deficiency. All fish were counted, weighed, and examined for gross signs of vitamin C deficiency at the end of the feeding period. Radiographs were made of sample fish from all treatments to study bone structure.

Based on growth response, survival, and incidence of deformed fish, the diet used was nutritionally adequate when supplemented with vitamin C. The fingerlings gained over 1 lb. in 180 days, with a favorable feed conversion ratio of 1.29 lb. feed per pound of weight gain. Without supplemental vitamin C, average gain was approximately 2/3 lb. with a feed conversion of 1.88.

Mortality was only 2% among fish fed the complete diet, but 22% for fish on the ration deficient in vitamin C. During the last 73 days of the feeding period, 8 to 12 dead fish per week were removed from cages of vitamin C deficient fish. Cause of deaths was attributed primarily to the bacterium *Aeromonas liquefaciens*.

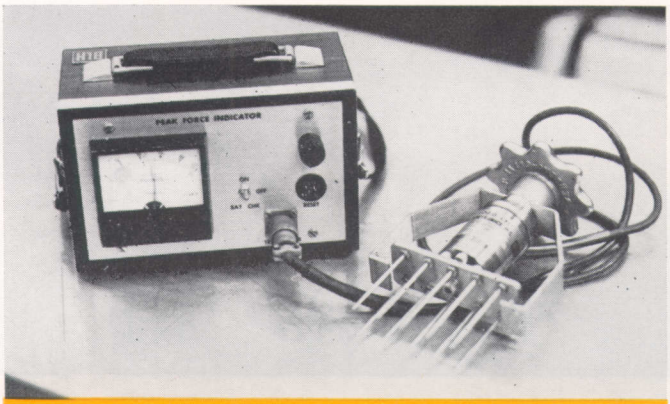
Deformities were identified in 45% of the fish that got no vitamin C in the diet, as compared with only 4% with vitamin adequate feed. Most common deformity was a lateral curvature of the spinal column, usually about midlength of the fish. There was usually external swelling near the damaged area, often with a vertical white band 1/4 to 3/4 in. wide on the back.

Many fish also showed vertically curved spines, most commonly characterized by a large hump near and usually immediately behind the dorsal fin. Severely deformed fish had broken backs. Enlarged, spongy, or half-developed vertebrae were frequent. Hemorrhagic areas were common along the spinal column, particularly at point of injury. Many normal appearing fish had ruptured capillaries near the backbone.

Differences in fish weight and appearance between the two diets were not manifested until after the first 12 weeks of the feeding period, or until the fish weighed 1/5 to 1/3 lb. All fish fed actively until about the last 30 days of the test when the vitamin C deficient fish accepted feed more slowly.

The Auburn feeding trial is the first demonstration that rapidly growing channel catfish need ascorbic acid in feed to prevent extensive deformation of the spinal column, poor growth, and increased sensitivity to infection by bacteria. However, the "crooked back syndrome" may be caused by other factors, independently or through interaction with vitamin C deficiency. Deficiencies of tryptophan and vitamin E and exposure to high levels of various pesticides have caused similar abnormalities of fish.

Most commercial catfish feeds do not contain supplemental vitamin C, since there has been no previous indication of such need in the diet. Major feed ingredients like grains, oilseed meals, and animal byproducts contain only insignificant amounts of ascorbic acid, so commercial fish feed is generally lacking in this nutrient. Although fish probably get enough ascorbic acid from natural pond foods under low to moderate pond stocking density, the shift to intensive culture means that vitamin C is a necessary supplement for feeds.



The Tenderometer Rates Beef Carcass Quality

D. L. HUFFMAN and D. N. MARPLE
Dept. of Animal and Dairy Sciences

PRESENT BEEF QUALITY GRADES purport to group cattle or their carcasses into homogenous grades that reflect eating quality of meat. These quality grades are based largely upon marbling in the rib eye. Marbling is a difficult trait for the producer to evaluate, yet quality grade is a major determinant of price paid for fed cattle. Tenderness is the most important single quality trait in beef; however, the correlation between quality grade (or marbling) and tenderness of beef is relatively low.

The tenderometer is a new device designed to estimate tenderness in the chilled beef carcass. The tenderometer is non-destructive and carcasses can be measured rapidly and easily in the beef cooler. Thus, if proven satisfactory, this instrument could provide valuable grading information for the meat industry. Since tenderness is heritable, these data could be used by producers in selection programs with other important production traits.

The tenderometer consists of 10 pointed probes connected to a force transducer. When the probes are pressed into the exposed rib eye surface of the carcass, the resistance to penetration is registered electrically on a meter calibrated in pounds of force. Presumably, tough meat will offer more resistance to penetration than tender meat.

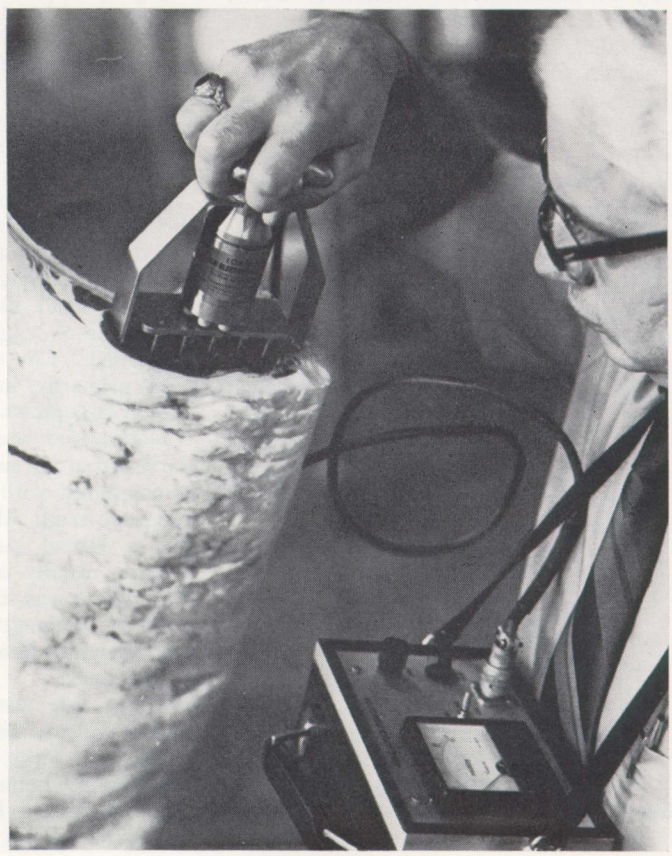
To evaluate the tenderometer, 193 cattle were slaughtered at the Auburn University meat laboratory and chilled at 36°F for 24 hours. Tenderometer readings and USDA quality grade data were recorded and two steaks were removed from the rib region for tenderness evaluation by a trained taste panel and the Warner-Bratzler shear device.

Data were analyzed by the technique of quadrant analysis. This involves plotting individual observations for each method of beef quality evaluation studied (USDA quality grade, marbling, and tenderometer) against a standard method of tenderness evaluation (taste panel and Warner-Bratzler shear). Assumptions were made as to level of acceptable tenderness with each method used. If the observations for the method being studied fell in the acceptable quadrant of the graph for both the method being studied and the standard method of tenderness evaluation, it was termed a correct judgment. It was also termed a correct judgment if it fell in the quadrant where it would have been unacceptable by both the method being studied and the standard method.

It was assumed that carcasses in the Choice and Prime grades were acceptable in tenderness while those in the Good and Standard grades were not acceptable. Quadrant analysis revealed that USDA quality grade correctly predicted tenderness 59% of the time when compared with tenderness measured by the taste panel. When USDA quality grade was compared with Warner-Bratzler shear scores, there were 55% correct judgments. According to this study, the USDA quality grade makes a correct judgement of tenderness approximately 60% of the time.

Marbling score was a slightly more accurate prediction of tenderness (64% for taste panel and 60% for Warner-Bratzler shear) than USDA quality grade. It is difficult to reconcile this fact since marbling is only one of seven factors used in determining of quality grade. However, the tenderometer provided 79% and 76% correct judgments with respect to taste panel evaluations and Warner-Bratzler shear scores. Therefore, the tenderometer appears to do a better job of placing cattle into uniform tenderness groups than either marbling score or USDA quality grade.

At this time it would be a mistake to advocate replacing current USDA quality grades with the tenderometer since USDA quality grades also identify carcasses with desired color of the lean, firmness of lean, texture of lean, and texture of marbling. However, incorporation of the tenderometer reading into the present USDA quality grade standards could reduce tenderness variation within the USDA quality grades.



Height and denseness of this stand of cogongrass illustrate the growth habits that make this plant such a tough pest.

soil sterilants and cogongrass—good but not perfect control*

RAY DICKENS and GALE A. BUCHANAN
Department of Agronomy and Soils

COGONGRASS IS A TOUGH PEST, but control with herbicides appears possible. Soil sterilants gave good results against the perennial in Auburn University Agricultural Experiment Station research.

Research on cogongrass (*Imperata cylindrica*) was begun in 1970 after the grass had spread rapidly in Mobile, Baldwin, and other southern Alabama counties. The weed was introduced into Mobile County in the 1930's or 1940's, and since then has proved itself to be a serious pest. It has no economic value for forage or other uses, and once established it will crowd out desirable species from pastures. Along roads or streets, its tall growth (3-5 ft.) reduces visibility and may be a traffic hazard.

Auburn control research was done during 1970-71 on infested median areas of Interstate-10 west of Mobile. Currently available soil sterilants were tested against the pest grass, with applications made in spring at suggested rates for perennial grasses and at one-half and twice the suggested rates. Those tried were bromacil (Hyvar-X), karbutilate (Tandex), prometone (Pramitol-25E), and prometone-BC (Pramitol-5PS).

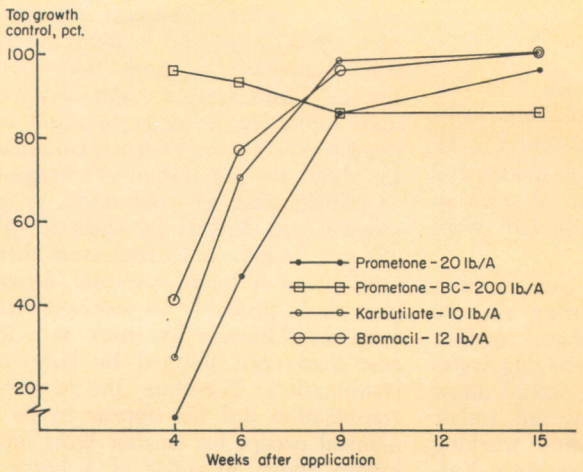


Fig. 1. Control of above-ground portions of cogongrass with soil sterilants during 1970.

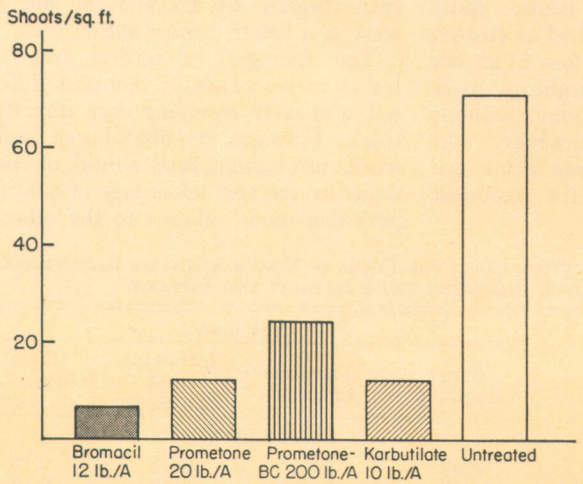


Fig. 2. Effects of soil sterilants on shoot density of cogongrass the spring following treatments.

Ratings were made at intervals after application to measure the degree of control of the above ground portion of the plants. Emerging cogongrass shoots were counted in the spring to evaluate control of the rhizomes (underground portions).

Rates of herbicides that control other perennial grasses generally were effective against cogongrass, Figure 1. Lower rates provided less than uniform control, and higher than normal rates were no better than the recommended amounts. All treatments at some time gave essentially complete top kill of the grass.

Prometone-BC gave the most rapid kill, but recovery was soon evident. This is a pelleted mixture of 5% prometone, 40% inorganic borate, and 50% inorganic chlorate. The chlorate material provides rapid kill but soon becomes ineffective because of leaching and chemical breakdown. The higher rate of prometone-BC gave results equal to control from the other materials.

Neither initial top kill nor rhizome kill showed large differences among the single ingredient herbicides, as shown by Figure 1 and Figure 2. The prometone-BC mixture gave much poorer rhizome control at lower rates, but the high rate gave results against rhizomes equal to those from the single-ingredient herbicides.

Although single applications of the currently available soil sterilants controlled cogongrass, this control was not eradication. Total eradication in most cases will require higher rates than suggested for other perennials or repeated applications.

Soil sterilants should be considered for use as spot treatments on limited areas only. Treated areas will remain free of most vegetation for longer than a year, and soil erosion could be a problem if large areas are treated.

* The research on cogongrass control was done under contract with Alabama Highway Department in cooperation with U.S. Department of Transportation, Federal Highway Administration. Opinions, findings, and conclusions in this article are those of the authors and not necessarily those of the Highway Department or Highway Administration.

Corn barged into the Guntersville area was found to have the lowest transportation cost for that area. (Photo courtesy Tennessee Valley Authority.

Efficient Transportation of Corn in Alabama

G. R. GARDNER
Department of Agricultural Economics and Rural Sociology

ALABAMA FARMERS and agribusiness firms spend an estimated $12 million annually for transportation charges alone on corn that must be imported from Midwestern States.

This annual transportation bill occurs because Alabama is a corn deficit area, annually utilizing far more corn than local farmers produce. In 1970, Auburn researchers estimated that the net corn deficit was 63 million bu. The deficit is increasing, as Alabama corn production declines and utilization of corn by the growing poultry and livestock industries increases.

Auburn economists are studying the corn transportation situation to determine if farmers and agribusinesses can reduce the cost of shipping corn into Alabama by using alternative transportation modes. As part of a regional grain marketing research project, a mathematical model of Alabama's grain handling firms and grain transportation facilities was constructed.

During the 1970 study period, about 80% of all corn imported by Alabama was produced in Indiana and Illinois. Thus, research focused on the transportation of corn from the Midwest via the following modes: (a) direct truck; (b) rail; (c) barge; (d) rail-truck combination; (e) barge-truck combination. Price and quality of corn were assumed to be independent of transportation modes and costs. Actual transportation charges in effect during the study period were used in the model.

Results of the research indicate that cost efficiencies in transporting corn to Alabama might be possible in a number of areas. Additional rail receiving capability throughout the State would allow more corn to be received by rail, rather than by the more expensive trucking method. Some of the smallest corn handling firms, especially those able to receive corn only by truck, may be forced out of business in the near future. Most of these firms were established as custom grinding and mixing operations in an era when Alabama farmers produced most of the corn they used. Today, without rail or barge receiving capability and large storage capacity, these firms are not set up to compete in the imported grain distribution market.

TABLE 1. TYPICAL RATES FOR DIRECT TRUCKING OF CORN FROM MIDWESTERN POINTS TO SELECTED AREAS IN ALABAMA

To	From		
	Mt. Vernon, Ind.	Evansville, Ind.	Belleville, Ill.
	Dollars per bushel		
Guntersville area	0.17	0.17	0.17
Montgomery area	0.21	0.21	0.21
Dothan area	0.24	0.24	0.24

Corn barged into the Guntersville area was found to have the lowest transportation cost for that area. However, most corn handling firms in the area cannot receive grain directly by barge and must have it transhipped by truck to their location from the barge terminals located along the Tennessee River.

The intrastate trucking of corn was found to be considerably more expensive per bushel-mile than interstate truck shipments arriving directly from the Midwest. In addition, the cost of unloading corn from barges and loading out trucks was estimated at more than 4¢ per bushel. Firms located within about a 30-mile radius of a barge terminal could receive corn by barge-truck combination for about 15¢ per bushel (7¢ barge cost, 4¢ transfer cost, 4¢ truck cost), or could receive corn directly by truck for about 17¢ per bushel. If located more than 30 miles from a barge terminal, however, corn could probably be received directly from the Midwest by truck at a lower cost than corn shipped by barge-truck combination. Therefore, the barge-truck combination did not appear to be economical except for smaller firms located within about 30 miles of a barge terminal, tables 1 and 2. Beyond that range, the same businesses could have acquired corn directly by truck from the Midwest at a lower transportation cost.

The managers of several firms were found to be aware of this cost differential, and were receiving corn directly by truck. Changes in either barge, rail, or truck corn hauling rates would, of course, influence the cost advantage of one transportation mode relative to the other.

TABLE 2. TYPICAL TRANSPORTATION COSTS FOR FIRMS IN NORTH ALABAMA RECEIVING CORN BY BARGE-TRUCK SHIPMENT FROM ILLINOIS AND INDIANA

Location of firm	Cost items			
	Barge shipment	Transfer to truck	Intrastate truck shipment	Total transportation cost
	Dollars per bushel			
0-30 miles from Guntersville	0.07	0.04	0.04	0.15
31-70 miles from Guntersville	0.07	0.04	0.06	0.17
71-100 miles from Guntersville	0.07	0.04	0.09	0.20
101-125 miles from Guntersville	0.07	0.04	0.11	0.22

MARINAS in ALABAMA

G. R. GARDNER
Dept. Agricultural Economics and Rural Sociology

Tourism is one of Alabama's most important industries, out-ranked only by manufacturing and agriculture. The State's vast and relatively unspoiled water and land resources annually attract millions of visitors, both Alabamians and out-of-state tourists. The most popular outdoor recreation activities in Alabama are all water based: swimming, fishing, boating, and water skiing.

Auburn researchers engaged in outdoor recreational planning are currently studying marina businesses that provide facilities and services for boaters. Objectives of the research project include determining: (1) the locations of marinas throughout the State; (2) services and facilities available to the boating public; (3) the amount of employment and income generated by marinas; (4) business problems peculiar to the industry; (5) locational and seasonal factors which influence the success of marina businesses; and (6) land, capital, and labor requirements necessary for establishing a marina business.

More than 150,000 pleasure boats were registered in the State in 1973. New boat registrations have nearly doubled in the past 10 years, increasing at an average rate of over 9.5% each year. Thus, about one of every six Alabama families owns a boat, and new boat registrations are increasing much more rapidly than is the State's population.

Auburn's current study of marinas is restricted to privately owned businesses with the following facilities: (1) launching ramp; (2) marine gas and oil; (3) dockside fuel pump; and (4) either wet or covered dry storage areas for boats. There are about 75 such firms in Alabama, and the managers of virtually all were interviewed for the study. Fishing camps, campgrounds, and government operated facilities are not within the scope of the research project.

Statewide, at least 450 water access areas with boat launching ramps are open to the public. Some 350 marinas, fishing camps, and resorts rent boats. There are about 125 businesses that sell new boats, some of which are located on the water and operate jointly as marinas. Most water access facilities in the State are privately owned and operated, although four large marinas are operated by municipal and county governments, see table.

Total capital investment in Alabama marinas, fishing camps, and boat launching ramps is estimated to exceed $27 million. Average capital investment in marinas is about $212,000; the median capital investment is about $155,000. Value of the land alone usually accounts for 50% to 75% of the capital investment. The average marina occupies just over 7 acres.

The marina businesses analyzed had an average gross income of over $100,000 in 1972. More than 80% of the marina owners report that their businesses have experienced increasing sales during the past 5 years. Only 12% report decreasing business activity.

Ownership of Water Access Facilities Open to Public in Alabama*

Ownership	Facilities
	No.
Private	320
State	58**
Federal	37
Municipal	7
County	6
Other	22
Total	450

* Includes marinas, fishing camps, and public launching ramps.

** Many ramps constructed by the State are located adjacent to privately owned marinas and are not counted in this category.

As Alabama becomes increasingly urbanized, more and more families are living in apartments and townhouses without garages or space available for boat storage. Thus, the demand for boat storage facilities is increasing even more rapidly than new boat registrations. Not all marinas provide both wet (i.e. boats stored in the water) and dry storage facilities. Those with such facilities can store an average of about 62 boats in the water and 62 boats in covered dry storage areas. Dry storage consists of sheds where the boat and trailer are stored or stack storage where the boats are stored in warehouse-type facilities. The stack storage represents a higher investment for the operator than shed storage.

Virtually all marina owners interviewed report 90% or higher occupancy rates for their dry storage facilities. More than two-thirds of the owners are planning to construct additional wet or dry storage facilities in the near future.

Rental charges for boat storage facilities vary considerably, depending upon location and other factors. Boat owners pay an average of about $15 per month for mooring their boat at a marina dock and about $13 per month for covered dry storage of their boats.

Preliminary analysis indicates that about 1,000 full-time and seasonal workers are employed by the 75 marinas under study. This total does not include employees of restaurants, boat repair shops, and other associated enterprises often operated by marina owners.

The U.S. boating industry sold more boats last year than any previous year as Americans spent more money for recreation and leisure. Alabama marina owners indicate that they expect increased demand for their facilities and services this summer, and their optimism appears to be justifiable.

Azides for Controlling White Mold and Beggarweed in Peanuts

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

AZIDES are well-known inhibitors of basic biological processes such as respiration, thus they show a broad range of biological activity. Although their effectiveness against nematodes, fungi, bacteria, and weeds under laboratory and greenhouse conditions is well known, few field studies have been conducted. Because of the extremely toxic nature of these compounds, most field studies have been based on pre-emergence applications. Work at the Wiregrass Substation during the 1971 and 1972 seasons was designed to explore the possibility of adding potassium or sodium azide post-emergence to peanuts to control white mold, weeds, and other factors that may affect disease development and yields.

Test Procedure

During the 1971 season potassium azide was applied at rates of 5, 7.5, 10, 15, 20, and 30 lb. of active material per acre. The granulated material was broadcast over the plots at early blooming stage of peanuts, 60 days after planting. Weed populations were determined a month after application, and the number of plants killed by white mold was determined periodically during the season.

Test Results

Observations 1 week after application showed stunting or chlorosis of peanut plants treated with the two highest rates; some "burning" of the leaves was observed with the 15 lb./acre rate. In all cases, plants recovered from the treatment so that 1 month after application no differences were apparent. Numbers of beggarweed decreased drastically at rates of 7.5 lb./acre or higher, Figure 1.

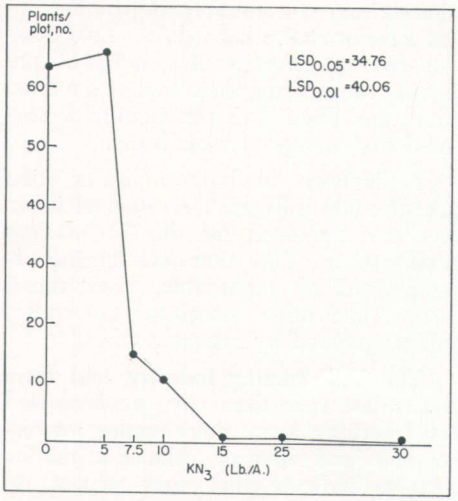


Fig. 1. Effect of potassium azide (KN_3) applications on number of beggarweeds in 1971 peanut test.

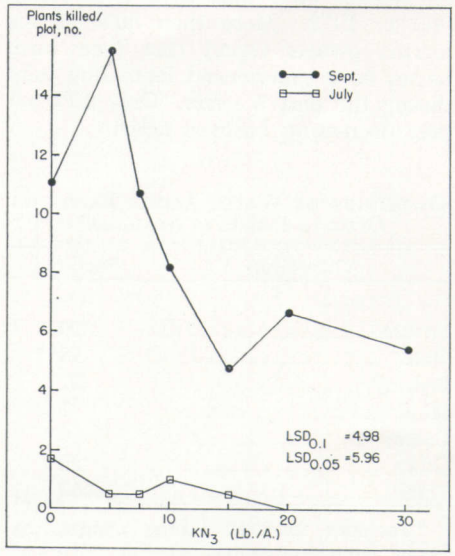


Fig. 2. Suppression of white mold damage to peanuts after postemergence applications of potassium azide.

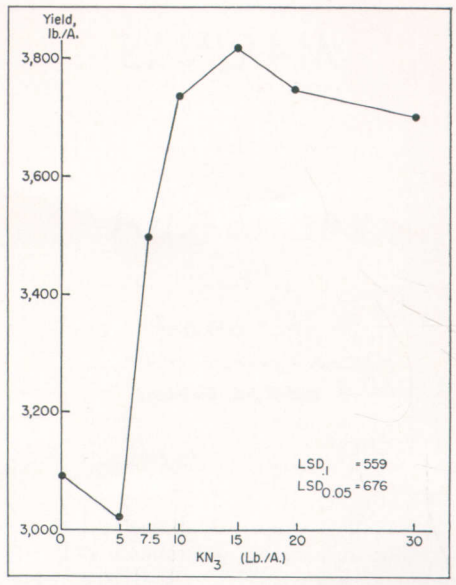


Fig. 3. Peanut yields in relation to post-emergence applications of potassium azide.

Numbers of peanut plants killed by white mold generally decreased with increasing rates of potassium azide (7.5-30 lb./acre), Figure 2. Significantly higher yields of peanuts were achieved with rates of 15 lb./acre and above, Figure 3.

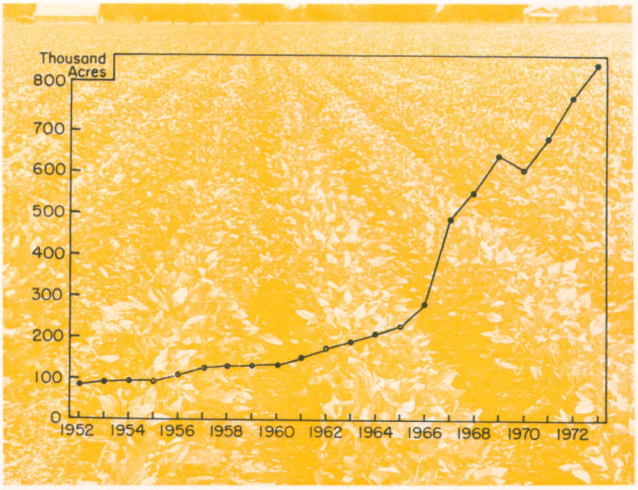
Results of studies conducted during the 1972 season generally duplicated those obtained in 1971 for weed and white mold control. For weed control, application of potassium and sodium azides when beggarweeds were in the very early stages of growth resulted in much more striking results than in 1971, as is shown in the following:

Material	*Rate (lb./A.)*	*Weeds/ 100 ft.*
Control	0	645.0
Sodium azide	8	6.2
Sodium azide	12	0.2
Potassium azide	10	2.2
Potassium azide	15	1.0

Studies in 1972 on time of application also revealed considerable damage to peanut pegs when azide was applied after pegging. Thus, application of these materials will have to be limited to the first 60 days after planting.

Conclusions

In summary, the studies indicate that the experimental granular formulation of azides applied at the early blooming stage of peanuts was tolerated by peanut plants at fairly high levels without reducing yields, reduced extent of damage and loss of peanut plants caused by white mold, provided control of Florida beggarweed, and resulted in significant increases in peanut yields.



There has been a phenomenal increase in soybean acreage in Alabama since the 1950's.

TRENDS in CROP PRODUCTION in ALABAMA

J. H. YEAGER

Department of Agricultural Economics and Rural Sociology

TWENTY YEARS AGO about 60% of the cash receipts from farm sales by Alabama farmers was from crops. In 1972, crops accounted for 35% of cash farm receipts. From 1968 to 1970, crops were less than 30% of the total. This does not mean that crops are no longer important in Alabama.

Total land in farms in Alabama has decreased rather substantially since 1950. The 1969 Census of Agriculture indicated a total of 13.7 million acres in farms out of a total area of 32.5 million acres. Thus, less than half of the State (42%) is in farm land that is the source of production for food and fiber. In 1950, there were 20.9 million acres in farms or 64% of the total land area.

Harvested Cropland

The cropland harvested acreage in Alabama has decreased more proportionally since 1950 than total land in farms. In 1969, only 2.7 million acres were classified as cropland harvested compared with 5.7 million acres in 1950, a decline of more than 50% in a period of 20 years. Acreage in permanent pasture increased during this period while the acreage in woodland on farms decreased, according to the Census of Agriculture.

Although the overall acreage of harvested cropland in Alabama declined since 1950, on larger size farms there was an increase. The farms with 200 or more acres of harvested cropland increased in number from 1950 to 1969. Also, an increase in harvested cropland acreage on farms operated by part owners occurred between 1950 and 1969 while the harvested cropland acreage of full owners declined.

The Statistical Reporting Service of USDA reports the total harvested acreage (excluding duplications) of principal crops. The 1972 figure for Alabama was 2,852,000 acres, which was below the 1971 but above the 1970 figures. Comparing these data for acreages of harvested crops, an 11% decline took place for Alabama while the total U.S. figure decreased only 1% from 1962 to 1972.

Cotton

Total Alabama acreage and production of certain crops have declined while for others there has been an increase in the past 10 to 20 years. Cotton, the major cash crop, declined more than 60% in acreage since 1952. The maximum cotton acreage harvested in Alabama was in 1911 when 3,833,000 acres, or almost seven times the 1972 acreage, was harvested. The acreage has declined almost continuously since 1953 under control programs.

Average yields of cotton have increased since the early 1950's. Records indicate the highest overall average yield occurred in 1971 with 551 lb. of lint per acre while the lowest was in 1923 with 93 lb. of lint per acre. In 1972, it is estimated that cash receipts from cotton, including associated government payments, were more than $128 million.

Corn for Grain

The acreage of corn harvested, like that of cotton in Alabama, has declined for many years with the trend being rather consistently downward since the late 1930's and early 1940's. In 1972, a total of 545,000 acres of corn for grain was harvested, or only 22% of the acreage in 1950.

Progress has been made in improvement of average yield per acre. In both 1971 and 1972 the average yield for the State was 45 bu. per acre. According to the records, these were the highest average yields ever attained although the State average yield for 1967 was 44 bu. per acre.

Corn yields have been rather variable. For this reason and others, farmers who need grain for livestock and poultry production have made the decision to purchase rather than produce. Alabama's deficit in grain production continues to increase each year.

Soybeans

Unlike cotton and corn, the acreage and production of soybeans have made phenomenal increases in the past several years. Although soybean acreage has increased almost consistently since the earliest of records, a major jump occurred from 1966 to 1967 when the Alabama acreage increased 73%. A 13% increase was made from 1971 to 1972. Almost ¾ million acres were planted in 1972 and the indicated acreage for 1973 as of March 16 was for 860,000 acres.

Since the 1950's there has been little evidence of an upward trend in average yield per acre of soybeans. Highest average yields were in 1967 with 27 and in 1971 with 26 bu. per acre. The 1972 yield was reported as 20 bu. per acre. With little or no trend upward in average yields, total production has increased in proportion to the increase in acreage.

Peanuts

Acreage of peanuts harvested has not changed greatly since the mid-1950's. Some increase occurred in 1971 and 1972. Yield per acre increased remarkably in the past few years. The highest reported average yield per acre was 2,070 lb. in 1971. Since 1969, average State yield has been above 1,600 lb. per acre each year. As a result of improvement in yields, total production has increased.

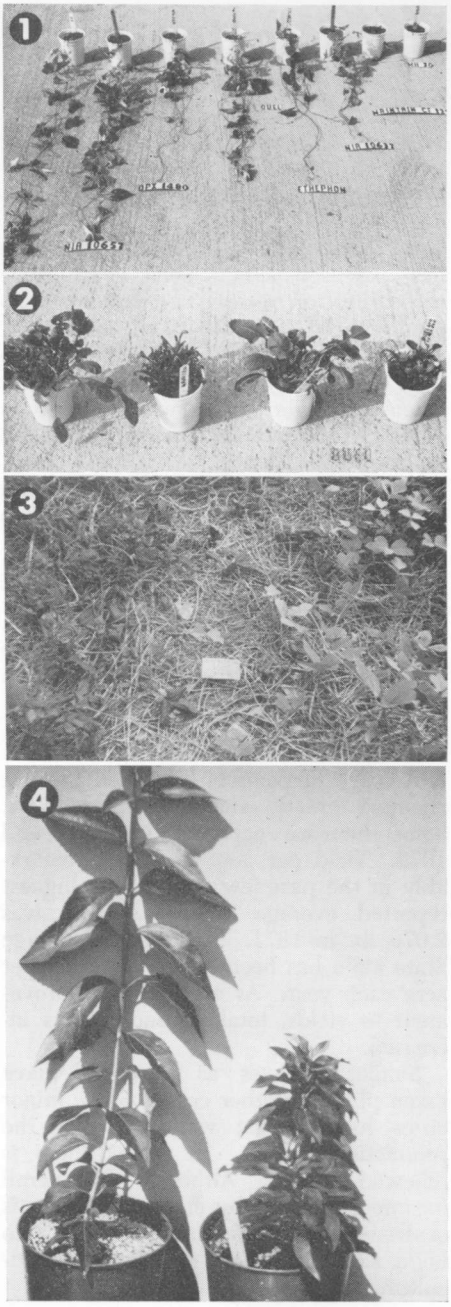
Similar changes as described have taken place for other crops. Some minor crops have almost vanished from the production picture. In others there is renewed interest. Although the overall income generated by crop production is of lesser magnitude, crops continue to be a significant part of Alabama agriculture.

GREEN CONTROL ON THE WAY — To Control Weeds, Regulate Ornamental Growth

KENNETH C. SANDERSON, *Department of Horticulture*

THE FUTURE may see no more scorched earth, herbicide brown-out, mowing, cutting, or pruning! Science is on the brink of offering an alternative – GREEN CONTROL.

The green control method will rely on new and better chemicals. These materials will be able to control a wide range of plant growth, and do it easier, faster, cheaper, ecologically safer, and aesthetically better than conventional control methods.



The new type chemicals will retard and disrupt the growth of weeds instead of killing them. This will leave a limited amount of cover to prevent erosion, and the green cover doesn't present a fire hazard like dead weeds. In addition to controlling weeds in areas inaccessible to mowers or pruning equipment, these chemicals may also control the size and shape of desirable landscape plants with little or no injurious effects.

Potential chemicals for green control have been evaluated in greenhouse and field studies by Auburn University Agricultural Experiment Station. The materials tested were inhibitors, retardants, and an ethylene compound.

Growth inhibitors affect physiological or biochemical processes. They permanently alter leaf, stem, root, or flower growth and often persist throughout the life of the plant. Inhibitors tested included maleic hydrazide (MH-30), morphactins (Maintain CF 125 and Bayer 102613), Niagara 10637, Niagara 10656, and DuPont DPX 1840.

Action of growth retardants is to retard cell division and elongation in shoot tissues. It's primary use is to temporarily regulate plant height without distorting the plant. Tried were ancymidol (Quel, A-Rest®), CBBP (Phosfon®), chloromequat (Cycocel®), and SADH (B-Nine®).

The ethylene compound tested is called ethephon (CEPA). It has a wide range of effects, including death of terminal buds and disruption of shoot growth.

Morningglory, radish, and silktree seedlings about 1½ in. tall were sprayed with each of the following:

500 p.p.m. Maintain CF 125
500 p.p.m. Maintain CF 125 plus 31,619 p.p.m. MH-30
31,619 p.p.m. MH-30
500 p.p.m. Niagara 10637
500 p.p.m. Niagara 10656
400 p.p.m. ancymidol
400 p.p.m. ancymidol plus 1,000 p.p.m. CEPA
5,000 p.p.m. DPX 1840

1. Morningglory treatments, left to right: untreated check, NIA 10657, DPX 1480, ancymidol, ancymidol + ethepon, NIA 10637, and Maintain CF 125 + MH-30. 2. Radish treatments, from left: check, Maintain CF 125, ancymidol, and ancymidol + ethepon. 3. Kudzu treated with Maintain CF 125 + MH-30, shown 6 weeks after treatment. 4. Forsythia untreated (left) and ancymidol treated (right).

Silktree was damaged by all sprays except Niagara 10656 and DPX 1840. Ancymidol, Maintain CF 125, Maintain CF 125 plus MH-30, and ancymidol plus CEPA damaged radish and morningglory. Appearance of plants 8 weeks after treatment illustrates treatment effects, photos 1 and 2.

In April 1971 and May 1972, kudzu was sprayed with the following:

1,000 p.p.m. Maintain CF 125
1,000 p.p.m. Maintain CF 125 plus 3,077 p.p.m. MH-30
3,077 p.p.m. MH-30
2,000 p.p.m. CEPA
6,000 p.p.m. Niagara 10637
9,000 p.p.m. Niagara 10637
4,800 p.p.m. DPX 1840
9,600 p.p.m. DPX 1840

Maintain CF 125 alone or in combination with MH-30 or CEPA controlled growth for 6 to 8 weeks, photo 3.

Drenches and sprays were evaluated on forsythia, a fast growing, flowering shrub, photo 4. Sprays of Niagara 10637 and Bayer 102613 severely distorted new growth. Ancymidol, CEPA, Bayer 102613, and Niagara 10637 sprays and ancymidol drenches delayed flowering. Most effective in controlling growth were 23 p.p.m. ancymidol drench and 6,000 p.p.m. Niagara 10637 sprays, as shown here by forsythia plant heights 5 weeks and 11 months after treating:

Treatment	*Plant height after treating, in.*	
	5 weeks	*11 months*
Drench		
23 p.p.m. ancymidol	8	24
2,400 p.p.m. CBBP	17	28
11,806 p.p.m. chlormequat	20	33
Spray		
125 p.p.m. ancymidol	14	35
50 p.p.m. Bayer 102613	10	35
1,000 p.p.m. CEPA	14	32
6,000 p.p.m. Niagara 10637	6	13
2,500 p.p.m. SADH	15	37
Check	18	29

Health Resources in Rural Areas

WILLIAM E. HARDY, JR.
Dept. of Agricultural Economics and Rural Sociology

THE AVAILABILITY of adequate health services is an important factor directly affecting the quality of life for the entire population, whether rural or urban. If people who need health care are denied access to such services simply because the services do not exist in their particular geographic area, we cannot expect that area to develop or the quality of life enjoyed by its residents to improve.

A national shortage of medical manpower and associated medical facilities is often cited as the major cause of the insufficient supply and inadequate delivery of health care services to rural areas. On a national basis, the doctor-population ratio is approximately 1 doctor for every 675 persons. From a facilities viewpoint, the national average is 205 persons per available hospital bed.

These apparent shortages are intensified in many areas of the country because of the wide disparity in the distribution of these resources as compared to the population. Distribution problems are particularly prominent with regard to manpower. For example, the state of New York has 1 doctor for every 518 persons, while Arkansas and Mississippi have doctor-population ratios of 1 to 1,340 and 1 to 1,448, respectively.

Alabama meets the national average with regard to the number of hospital beds available (205 people per bed), but falls far short of the national figure for available physicians. Alabama's 3.5 million people were served in 1972 by 2,776 physicians. This gives approximately 1,240 people per physician, or almost double the national average of 675 persons per doctor.

Figure 1 and Figure 2 illustrate that there is also great variation of medical resources within the State. Figure 1 gives, by counties, the number of individuals per hospital bed. The figures do not account for the fact that many individuals could cross county borders and use the facilities of a neighboring county or state. Figure 2 shows, by counties, how physicians are distributed throughout the state with respect to the population.

As indicated, Alabama is fairly well off with regard to the availability of hospital beds. Nineteen counties are better than the state and national average. Only 10 counties have more than twice the state average number of persons per available hospital bed and these are somewhat evenly distributed over the state. The only area of the state that seems to have a concentrated lack of hospital beds includes St. Clair, Shelby, Chilton, Coosa, and Elmore counties.

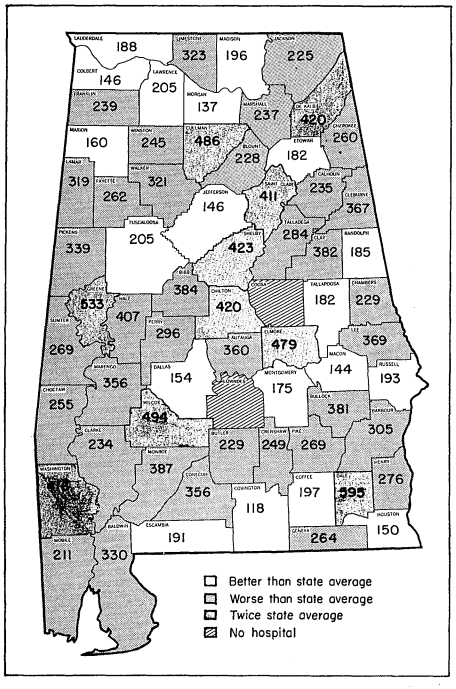


Fig. 1. Number of persons per hospital bed by counties, 1972.

Examination of the data illustrated in Figure 2 reveals that only 10 counties have a physician-population ratio which is better than the state average (1 to 1,240). Each of these 10 counties contains a city with population of at least 30,000 people. From the darker side of the picture, however, 41 counties have more than twice as many people per doctor as the state average. These counties are rural counties and their high population-doctor ratios indicate a general need for more medical personnel in the rural areas of Alabama.

It is obvious from Figure 2 that doctors are concentrated in metropolitan areas. Unless present trends are reversed, many rural areas will be totally without medical personnel in the near future. Already, one county has no doctor. It appears that the rural family doctor is truly a thing of the past.

Several regions of the U.S. have realized the severe shortage of medical manpower in rural areas and have initiated efforts toward solving the problem. Since it appears that very few new physicians will be moving into rural areas, these efforts are directed toward use of physician's assistants and other paramedical personnel. Virginia, New York, North Carolina, and New Mexico are beginning to utilize the services of specially trained nurse practitioners. Washington, North Dakota, South Dakota, Minnesota, Utah, and Maine have limited programs based upon the skills of former military corpsmen.

Such programs utilizing allied health care personnel in medically needy areas appear to be realistic and entirely possible for the future. The ultimate success of these programs would depend on their acceptance by both the public and medical professionals. People must be willing to recognize that in many cases, a highly trained physician is not necessary for good medical care.

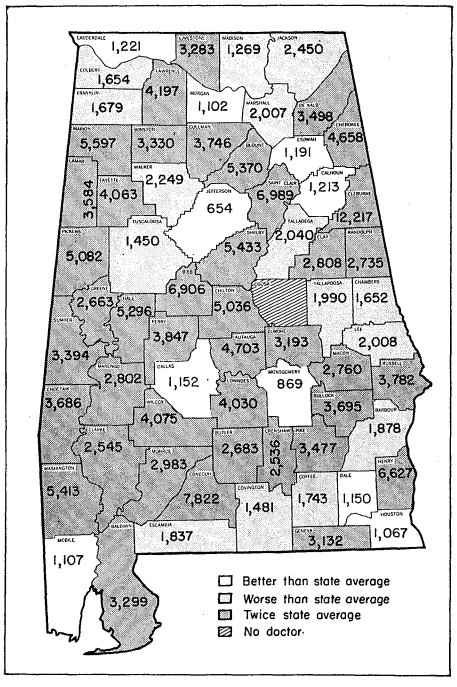


Fig. 2. Number of persons per physician by counties, 1972.

MICHAEL A. DAVIS and S. C. BELL
Dept. of Agricultural Economics and Rural Sociology

Wide Variations in Costs and Returns of Grade A Milk Production

CONSTANTLY INCREASING COST of production represents a nagging problem facing Alabama dairymen as they strive for a reasonable return. Costs vary widely among dairymen, however, so the individual producer has some control over expenses.

Variation in both costs and returns showed up in a recent study of 57 Alabama Grade A dairymen. The investigation, under contract with the Alabama Dairy Commission, was done to determine costs and returns involved in milk production in the State. Dairymen interviewed were selected at random from all producers licensed by the Commission. Information was gained on 1971 operations for all types and sizes of dairies.

Herd size of the 57 dairies averaged 132 cows, with average milk production per cow of 9,046 lb. per year. Average total production per farm amounted to 1.2 million lb. of milk annually.

Total cost of producing milk on the 57 farms averaged $7.82 per cwt. sold, but the variation was from $5.38 to $11.13. Feed cost of $3.51 per cwt. was the major cost item, accounting for 45% of total cost. Included in this figure were costs of hay, grains, and silage crops, as well as purchased feed. Also counted in total feed cost was expense of feed for replacement heifers, calves, bulls, and dry cows.

Operating costs of 68¢ per cwt. of milk sold was the largest item in non-feed variable costs. This included veterinary expense, supplies, breeding fees, utilities, and equipment operating expenses. Labor cost of $1.50 per cwt. was equally divided between hired and family labor and accounted for almost 20% of total expense.

Gross return per cwt. of milk sold by the 57 dairy farms averaged $7.88. This was higher than average price of Grade A milk because sale of cull cows, bulls, heifers, and calves was included. These sales were included because cost of feed for replacement heifers and calves was counted as an expense. Changes in inventory and other receipts, which included miscellaneous sales, were also added to gross receipts.

Average net return to land, labor, and management was $1.56 per cwt. of milk sold. Operator and family labor was charged at $1.75 per hour and hired labor at the cost reported by the farmer. When labor costs were subtracted, average net return to land and management was 6¢ per cwt. of milk sold.

The 57 milk producers were divided into three 19-herd groups according to cost of milk production: low, middle, and high cost groups. Those with the lowest costs were assumed to be the most efficient.

Average production per cow and number of cows per herd showed a decreasing trend from the low cost group to the high cost group. These two factors seemed to be the most important ones influencing cost of production. Average herd size and production per cow for the three producer groups were as follows:

Producer group	*Av. number of cows*	*Av. production per cow, lb.*
Low cost	167	9,900
Middle cost	140	9,550
High cost	89	7,690

Fixed costs showed the largest decrease from high to low cost group. Increasing herd size and increasing milk production per cow contributed to this reduced per unit cost by allowing fixed costs to be spread over more volume of milk. All factors of cost per cwt. of milk sold were lower for the low cost than the high cost group of producers.

Even though the high cost group had higher gross receipts, their costs of production more than offset the increased income. Thus, their net return to land, labor, and management was lower, $0.76 per cwt., as compared with $1.55 and $2.39 for the middle and low cost groups. The high cost group showed a −$1.17 return to land and management, the only group with a negative figure.

Gross receipts were highest for the high cost group, $8.20 per cwt. of milk produced. The middle group was second at $7.85 and the low cost producers received gross of $7.60 per cwt. Higher blend price of Grade A milk was the major factor contributing to higher gross receipts for the high cost group.

COSTS AND RETURNS PER HUNDREDWEIGHT OF MILK SOLD, BY PRODUCER COST GROUPS, 57 ALABAMA DAIRIES, 1971

Item	Average per cwt., by producer group		
	Low cost	Middle cost	High cost
	Dollars	*Dollars*	*Dollars*
Gross receipts			
Milk sales	7.14	7.22	7.41
Livestock sales	.55	.61	.82
Inventory change	−.09	−.02	−.06
Other receipts	0	.04	.03
TOTAL	7.60	7.85	8.20
Costs			
Feed	3.20	3.57	3.76
Non-feed variable	.95	1.30	1.68
Total fixed	1.05	1.44	2.01
TOTAL	5.20	6.31	7.45
Returns			
To land, labor, and management	2.39	1.55	.76
Labor cost	1.18	1.40	1.93
To land and management[1]	1.21	.14	−1.17

[1] No charge for land. Average land used for dairy was 321 acres.

WOOD PULPING WASTE SHOWS POTENTIAL AS CATTLE FEED RESOURCE

W. B. ANTHONY and J. P. CUNNINGHAM, JR.
Dept. of Animal and Dairy Sciences

LIVESTOCK MUST COMPETE with man for many food products. When the supply of a food item such as cereal grains is in short supply, man has priority for the item over animals. The result of such a shortage shows up in reduced supplies of feed for meat and milk producing animals.

Because of potential feed shortages, research continues to seek new sources of feed for cattle. Prime interest at Auburn University Agricultural Experiment Station is given to untapped resources.

Cellulose Has Potential

Cellulose, the most abundant organic material in the world, is one such product being studied. Although a poor animal feed, potentially it could be processed and made useful for cattle feed.

The carbohydrate in wood is made up of both cellulose and hemicellulose. Cellulose is the important constituent in wood as far as the wood pulp industry is concerned. Hemicellulose (pentose sugars) is an undesirable component that is removed prior to the pulping of cellulose for paper. The pre-hydrolizate liquor containing the hemicellulose can be recovered and used as an animal feed.

Current research at Auburn is concerned with one kind of pre-hydrolizate liquor as an animal feed. This product was obtained from a pulping plant, concentrated into molasses, and evaluated chemically and nutritionally as feed for cattle.

Steer Feeding Trial

Three groups of 12 yearling steers were used in a steer finishing trial. They were fed a ration of 73% ground corn, 10% ground alfalfa hay, 10% molasses, 6% cottonseed meal, 1% minerals, and vitamin A to supply 1,000 I.U. per lb. The molasses was either cane molasses, or the concentrated pre-hydrolized liquor (CPL), or a 50:50 mixture of each.

PERFORMANCE OF YEARLING STEERS FED MOLASSES-CONTAINING FEEDS

Item	Kind of molasses		
	Cane	CPL	Half CPL-half cane
Initial live weight, lb.	590	590	592
Final live weight, lb.	944	957	935
Gain, lb.	354	367	343
Daily gain, lb.	2.55	2.64	2.47
Feed per lb. gain, lb.	8.57	8.47	8.61
Number of animals	*12*	*12*	*12*
Days on test	*139*	*139*	*139*

One pen of cattle was full fed each mixture 139 days. All steers were then marketed for slaughter and carcass data obtained. Animal performance was similar among the groups. Differences shown in the table were too small to be attributed to ration differences. Therefore, it was concluded that the CPL had about the same nutritive value as cane molasses.

The same ration formulations were used in another study to determine how well livestock accepted the pulp waste. Six yearling heifers were used, with each group of two animals fed one of the feed mixtures during a preliminary and a 10-day test period.

No Differences in Intake

There were no differences in intake among the three molasses-containing rations. Thus, the CPL material was as palatable as regular cane molasses.

Voluntary intakes by heifers of cane molasses, CPL, and the 50:50 mixture of cane and CPL molasses were measured. The animals received a dried feed mixture calculated to supply maintenance, with the molasses kept before them at all times. Each 10-day trial was preceded by a 6- or 7-day adjustment period.

The intake of CPL was about 60% of consumption of either of the other two molasses, indicating a preference for cane molasses. Average daily consumption during the three trials was 9.5 lb. of cane molasses per heifer as compared with 6.1 lb. for the CPL. Consumption of the half CPL-half cane molasses averaged 10 lb. daily, indicating that the mixture was just as acceptable to cattle as cane molasses.

Surprise from Intake Test

A surprise finding in the liquid molasses intake test was that animals fed CPL gained weight, whereas those fed cane molasses lost weight. These results suggest that the CPL may have influenced rumen microbial activity to enhance utilization of feed by the animals. This suprising finding will be investigated.

There are other untapped feed resources for cattle, and research will be continued to identify such products and evaluate them for feeding cattle.

COMPARATIVE RESISTANCE of COMMERCIAL STRAINS of BROILERS to MAREK'S DISEASE

ROBERT N. BREWER and L. W. JOHNSON
Department of Poultry Science

MAREK'S DISEASE is a condition of young, growing chickens characterized by lymphocytic tumors of the nerves, skin, muscles, and visceral organs.

Although this disease was described in the late 1800's, the full effect of its devastation has been seen in broilers, mainly during the last 10 years. During this time Alabama broiler producers have suffered heavy losses due to Marek's morbidity and mortality as well as condemnation at the processing plant. Congested growing conditions, coupled with genetically susceptible breeder stock have contributed to the rapid spread of the disease.

Reduction of economic losses from Marek's disease has been attempted by: (1) security management of breeders and broilers, (2) development of genetically resistant strains of chickens by population selection or blood typing, and (3) vaccination of breeder replacements and broiler chickens at 1 day of age with turkey herpes virus vaccines or whole turkey blood. Although alteration of management practices has not been successful as a control measure, selection of resistant lines of birds and vaccination have helped to bring the disease under control.

Broiler producers have observed great variation in Marek's disease susceptibility among certain lines of broiler breeders and in broiler chicks from crosses of these lines. The research reported here was designed to determine the variation present in 6 of the more widely used broiler breeder lines and to use this information as a foundation for further identification of resistant and susceptible alleles, through blood typing and challenge.

Procedure

Approximately 200 chicks were hatched from each of 6 lines of primary broiler breeders as well as the Auburn Leghorn line (DAX). All birds were wing banded for identification and randomized into 4 large floor pens. These pens had been used in other experiments for over 1 year without new litter being added. The average incidence of Marek's disease by 9 weeks of age in birds grown in these pens had been about 20%.

Management of test birds was similar to that used in commercial broiler operations. All birds were given infectious bronchitis-Newcastle disease vaccine in water at 10 days of age and were fed a commercial broiler ration throughout. All birds that died during the 9 weeks were autopsied and the cause of death determined. Survivors were sacrificed and checked for Marek's disease lesions at 9 weeks of age.

Results

A summary of the findings are reported in the table. Although a few birds dying during the trial had lesions of Marek's disease, most of the positive birds were detected at 9 weeks of age.

Line G (Auburn Leghorns) had a total of 12.5% Marek's disease by 9 weeks of age. This was about as expected for the amount of exposure encountered, and was similar to the levels of the disease seen in many broilers in recent years. The most resistant birds (9.6%) were those in Line C. These birds had lesions in the spleen, liver, skin, gonads, and kidneys. All other lines suffered much more from Marek's disease (19.2-24.9%), and had a wider distribution of lesions. In addition to the organs listed, heart, lungs, proventriculus, and nerves were involved in most of these lines. Of the 5 lines most severely affected, only line E had neural lesions.

This range of responses indicates that these lines have considerable genetic variability affecting Marek's disease. Future work will include an analysis of specific blood types and their relative effects on Marek's disease. When these alleles are clearly defined, progress in selecting resistant stock can be speeded up.

At present, vaccination of all broilers, replacement stock and commercial layers is helping to significantly lower the incidence of Marek's disease. It is believed that the development of genetically resistant parental lines combined with the vaccination program may well provide long range control of Marek's disease.

INCIDENCE OF MAREK'S DISEASE LESIONS IN SIX COMMERCIAL BROILER BREEDER LINES AND AUBURN LEGHORN CONTROLS[1]

Line	Total birds	Marek's disease			Organ having tumors[2]								
		Neg.	Pos.	Pos.	1	2	3	4	5	6	7	8	9
		No.	*No.*	*Pct.*									
A	193	150	43	22.3	+	+	+	+	+		+		
B	193	156	37	19.2	+	+	+	+	+	+			
C	198	179	19	9.6	+	+	+	+	+				
D	191	154	37	19.4	+	+	+	+	+			+	
E	193	145	48	24.9	+	+	+	+	+		+		+
F	182	141	41	22.5	+	+	+	+	+	+		+	
G[3]	184	161	23	12.5	+	+	+	+	+	+			
Total	1334	1086	248	18.6	7	7	7	7	7	3	2	2	1

[1] Total mortality including survivors at 9 weeks of age.

[2] 1 = liver, 2 = spleen, 3 = kidney, 4 = gonad, 5 = skin, 6 = proventriculus, 7 = heart, 8 = lungs, 9 = nerves.

[3] Auburn Leghorn controls.

FIVE DECADES of CHANGE: ALABAMA POPULATION — 1920-1970

J. E. DUNKELBERGER and C. L. VANLANDINGHAM
Department of Agricultural Economics and Rural Sociology

MOST ALABAMIANS are aware there are more people living in the State today than ever before. Changes can be seen in both the trends in geographic distribution of people and in the composition of population regarding their social characteristics.

Number

From 1920 to 1970 the population of Alabama increased by about 1.1 million to its present level of almost 3.5 million persons (3,444,165). Considerable variation in rate of increase existed in each decade. Economic and social conditions within the State and Nation directly affected both the rate of natural increase (surplus of births over deaths) and the rate of net migration (difference between the number of persons moving into and leaving the State).

The largest increase of the 50-year period occurred in the decade of the 1920's. Nearly 300,000 persons were added to the State in this decade primarily because of a dramatic slowing of migration as a direct consequence of reduced economic opportunities in nonfarm employment. The decade of the 1960's showed the smallest increase ever recorded for Alabama except for the Civil War decade of 100 years earlier. The rate of gain during this decade was only 5.4%. This was considerably below the 13.3% recorded for the United States.

Distribution

Alabama has changed from an almost totally rural to an urban state during the past five decades. There were only 39 places with as many as 2,500 residents in 1920. Seventy-eight per cent of all Alabamians lived on farms, in the open country or in hamlets, villages, or towns. By 1970 the number of persons residing in rural areas had declined by 406,633 persons, while the number of urban places had increased to 123 and the number of urban residents by more than 1.5 million. The proportion of rural residents in the State has declined from 78.3% in 1920 to 41.6% in 1970.

Wide variation existed in the rural-urban distribution of people within the 67 counties in 1970, see figure. Four counties — Jefferson, Mobile, Montgomery, and Madison — had more than 75% of their people residing in urban places. Fourteen more counties were over half urban in residence. On the other hand, 11 counties were totally rural and an additional 13 counties had fewer than ¼ of their people residing in urban places.

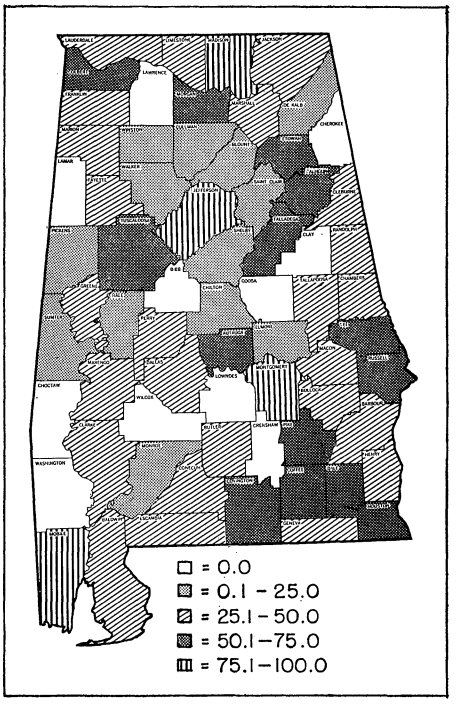
As Alabamians have gravitated to the cities and as the population has increased in number, there has been a marked increase in the density of population. Density increased from 46 to 68 persons per square mile during the past five decades.

Composition

Alabama has experienced considerable change in a number of characteristics important to the future development of the State. Each of these trends can be expected to continue through the current decade.

Age. A gradual aging of the population has occurred over the past 50 years — from a median of 25 years in 1920 to 28 years in 1970. Whereas 46% of the State's residents were less than 18 years of age 50 years ago, now only 36% are. Most of the change is accounted for by the increased number of persons 65 years of age and older — an increase from 4% to almost 10%.

Education. The number of years of schooling completed by Alabamians increased slowly from 1920 to 1950. However, dramatic change occurred during the last two decades. Median education increased by almost 3 years — from 8 to 11 years. This change has not been equally experienced in rural and urban areas. Median education among urban people is almost 12 years (11.9) compared to a rural level of some 2 years less.



Per cent of population classified as urban in each Alabama county in 1970.

Race. The proportion of blacks has declined from a high of 38.4% in 1920 to 26.4% in 1970. Fifty years ago black citizens were proportionately represented in both rural and urban populations of the State, although not proportionately distributed in all geographic areas. Today a higher proportion of blacks live in urban places. Less than 20% of farm residents and 24% of all rural residents are black.

Labor Force. The proportion of Alabamians 14 years of age and older who are either employed or seeking employment is less today than 50 years ago. Fifty-eight per cent of all adults were in the labor force in 1920 compared to between 51 and 52% for each decade since 1940. This stability reflects the counter balancing of two trends. Males now account for only 63% of all workers, rather than the 76% accounted for in 1920. Simultaneously the proportion of women has increased from 24% to 37%.

It is apparent from this overview of the Alabama population that dynamic changes have occurred in the past 50 years which will have a long term impact on the State. Knowledge of these changes and trends is essential for planning to meet the needs of Alabamians in the decade of the 1970's.

Nozzle Arrangement for Cotton Insect Control

W. T. DUMAS
Dept. of Agricultural Engineering

F. R. GILLILAND
Dept. Zoology-Entomology

INSECT CONTROL represents one of the major costs of cotton production in Alabama and much of the cotton belt. Pesticide applications for cotton insect control can be made by aircraft or ground-operated equipment with equal effectiveness if applied properly and at the right time.

One problem encountered in the application of insecticides in the form of liquid sprays with ground-operated sprayers is that of selecting the number of nozzles per row and the arrangement of the nozzles relative to the cotton plants or row. Field studies were conducted cooperatively by the departments of Agricultural Engineering and Zoology-Entomology of the Alabama Agricultural Experiment Station from 1967 through 1969 to evaluate the relative effectiveness of three arrangements of nozzles for the control of cotton insects.

The tests were conducted at the Agricultural Engineering Research Unit and consisted of four treatments replicated four times in a randomized complete block design. The treatments included three nozzle arrangements and an untreated check. The plots were 12 rows wide, 75 ft. long, and were solidly planted in 40-in. rows. All data were collected from the center four rows of the plots.

The number and arrangements of nozzles tested were as follows:

1. One nozzle per row with the nozzle mounted on the spray boom and positioned directly above the row.

2. Two nozzles per row with the nozzles mounted on the spray boom and spaced at 20-in. intervals over row centers and middles.

3. Three nozzles per row with one nozzle mounted on the spray boom positioned directly above the row and one nozzle on a drop on each side of the row spraying laterally into the row.

A 12-row high-clearance sprayer calibrated to deliver 5 gallons per acre at 75 p.s.i. pressure was used to apply all spray material. Although the number of nozzles per row varied, the rate of application for each plot receiving spray was held constant by the use of progressively smaller nozzle tips for the multi-nozzle arrangements. The timing of applications, based on insect counts, was made according to recommendations of the Cooperative Extension Service, with the total number of applications varying from 12 to 14 per year.

YIELD AND INSECT INFESTATION WITH THREE NOZZLE ARRANGEMENTS

Treatment	Boll weevil punc. sq.	Bollworm damage	Bollworms/ 100 term.	Yield seed cotton
	Pct.	*Pct.*	*No.*	*Lb./A.*
1 noz./row	18.5	4.1	3.6	1,923
2 noz./row	16.3	3.0	3.2	2,096
3 noz./row	16.4	3.5	3.4	2,086
Check	60.1	17.3	14.5	1,112

Boll weevil and bollworm populations were sampled within 24 hours prior to each insecticide application. Sampling was achieved with standard techniques. Yield data were collected by mechanically harvesting the center four rows of each plot.

Only slight differences in boll weevil control were evident among the nozzle arrangements. All nozzle arrangements were equally effective in controlling the boll weevil and all treated plots had significantly fewer boll weevil punctured squares than the untreated check.

Seasonal bollworm infestations as measured by the percentage of injured bolls and squares and by the number of live bollworms per 100 terminals indicated that the three arrangements of nozzles produced equally effective bollworm control. All treated plots had significantly lower bollworm infestations than the untreated check.

Yield data show all nozzle arrangement treatments yielded almost twice as much seed cotton per acre as the untreated check with little differences existing among the yields from the treated plots.

In each of the 3 years of testing, all nozzle arrangements tested have resulted in equally good insect control and cotton yields.

AGRICULTURAL EXPERIMENT STATION
AUBURN UNIVERSITY
AUBURN, ALABAMA 36830

R. Dennis Rouse, Director

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