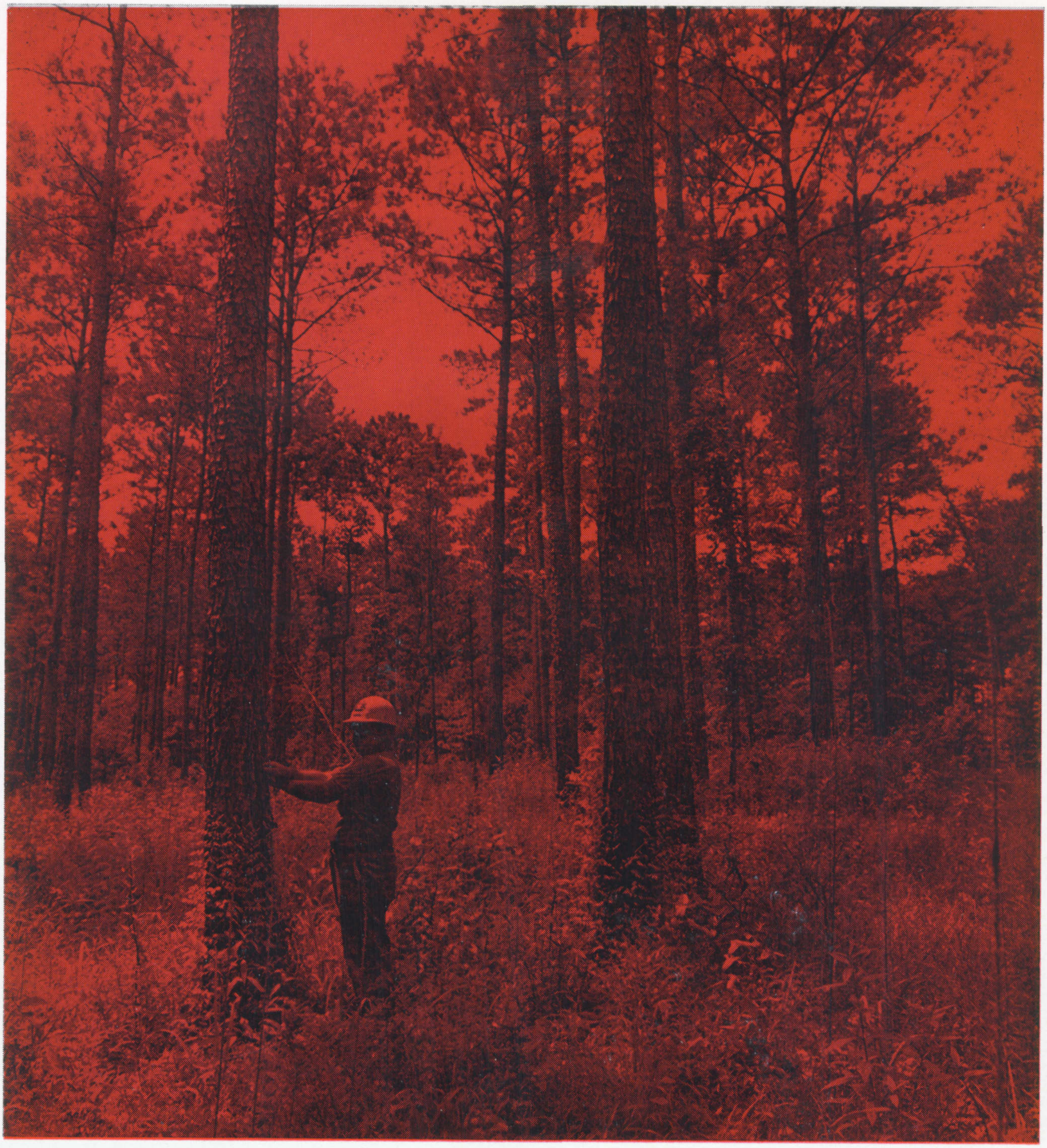
highlights
of agricultural research



Volume 22, No. 3

Fall 1975

Agricultural Experiment Station
R. Dennis Rouse, Director

Auburn University
Auburn, Alabama

DIRECTOR'S COMMENTS

IN TWO PREVIOUS ISSUES of this publication comments have been presented in recognition of the Centennial Year of this Nation's system of Agricultural Experiment Stations. The 100th Anniversary of this historic development, which has contributed so much to the greatness of this Nation through agriculture, merits attention of every person associated with agriculture. Of even greater importance, however, is the need for the 95% who are non-farmers to recognize the vital contribution of agriculture to every facet of our Nation's development. It is also important that these non-farmers in this urban Nation clearly understand that the agricultural industry is vital to the welfare of this Nation.

R. DENNIS ROUSE

What are the important components of American agriculture and how do they interact to account for this outstanding record of agricultural productivity that is unequaled anywhere on earth or in the history of man? Soil, topography, water, and climate are important components, but obviously these are not sufficient. The tenacious desire and honesty of the American farmer for personal independence and his willingness to labor and invest his and his family's total lives have to be vital components, but farmers in other cultures and nations provide living evidence that other components are necessary. We could mention others, but the competitive spirit that prevails among American farmers cannot be overlooked. They will try almost anything in an effort to produce higher yields of plants and animals. Others may have this spirit of competition but the American farmer has one component to assist him that does not exist in any other nation or culture – *a public supported system of agricultural research and education* planned and dedicated to assisting production agriculture.

This system provides the American farmer a network of scientists in every state working on a continuing basis toward solutions to his production and marketing problems; thus, he can exercise competition and try all manner of innovations, but always with a reliable point of reference – what do "his scientists" at "his agricultural experiment station" find in their research. This is the American farmers' *magic potion.*

This year, the Alabama Agricultural Experiment Station and the Farm-City Committee of Alabama are joining in a special Agricultural Appreciation Day, Thursday, November 13, at the Auburn University Memorial Coliseum in an endeavor to bring about this better understanding. Plans are to encourage 2,500 farmers and non-farmers to devote a few hours – 10:00 a.m. to 3:00 p.m. – on that day visiting about agriculture and agribusiness – past, present, and future. In the morning, there will be tours and educational exhibits of agricultural research and development. At noon, there will be a barbecue of Alabama meat products – pork, beef, chicken, and fish – along with appropriate entertainment. The afternoon program begins with an address by Governor George C. Wallace and ends with the Alabama premiere showing of the Agricultural Experiment Station Centennial movie, a 30-minute film highlighting contributions of research to the development and accomplishments of the American farmer and his agribusiness associates.

This program is being developed in order that farmers and non-farmers have a better understanding and appreciation of all the components of American agriculture and their interaction.

When your local Farm-City Committee member contacts you, let me encourage you to accept his invitation to be a part of this 1975 Agricultural Appreciation Day celebration. Come and bring someone who needs to be informed.

may we introduce . . .

Dr. Dale L. Huffman, author of the report on quality of forage-finished beef on page 3, is a professor in the Department of Animal and Dairy Sciences, School of Agriculture and Agricultural Experiment Station. He teaches both graduate and undergraduate meat science courses and conducts research on various aspects of meat science.

Huffman joined the Auburn faculty in 1963 after working as a research meat scientist at the Swift and Company Research and Development Center.

A native of Churchville, Virginia, Huffman was awarded the Ph.D. in animal science (food science minor) by University of Florida in 1962. He holds the B.S. from Cornell University and M.S. from Florida, both with animal science majors.

Numerous scientific and popular publications by Dr. Huffman have disseminated results of his Auburn research, which, in recent years, has emphasized storage of fresh meat in various gas atmospheres and the relation of shelf life in a centralized cutting system. Along with his Auburn research, Huffman worked one year with Swift and Company under an industrial fellowship and has served as consultant to several meat industries and southern universities. He has served on several regional and national professional committees.

HIGHLIGHTS of Agricultural Research

FALL 1975 VOL. 22, NO. 3

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

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ON THE COVER. The results of an intensively managed pine stand is illustrated in this picture. **See story on page 15.**

Cattle Finished on Winter Pasture Rate High in Carcass Quality

D. L. HUFFMAN, *Dept. of Animal and Dairy Sciences*
WALLACE GRIFFEY, *Piedmont Substation*

ANYONE WHO SAYS pasture-finished beef must be of poor quality is simply misinformed. Meat from cattle finished on high quality winter grazing can be equal to that from comparable cattle getting a 90-day feedlot finishing period after grazing. For this result, however, grazing animals must receive adequate nutrients for maintenance, growth, and fattening.

High quality of forage-finished beef was established in a recently completed study at Auburn University Agricultural Experiment Station. Such factors as tenderness, juiciness, and flavor as determined by a sensory panel were considered along with mechanical ratings of tenderness and chemical analysis of moisture and fat content. These findings, coupled with traditional measures of dressing percentage, quality and yield grades, marbling score, backfat thickness, ribeye area, and color of fat, provide a meaningful measure of pasture-fed beef quality.

Comparisons were made between carcasses of two groups of crossbred cattle finished at the Piedmont Substation, Camp Hill. The forage group was finished to market weight on rye-ryegrass-Yuchi arrowleaf clover pastures. The feedlot-finished animals were grown out on the same pastures and then given a 90-day period of feedlot finishing on a conventional high-energy finishing ration.

All cattle were slaughtered at about 1,050 lb. Age of cattle at finishing was about the same for both groups, although rate of gain averaged slightly higher for those finished on grain than for those slaughtered directly off pasture. The cattle were graded by a Federal grader at slaughter. Carcass evaluations were made for organoleptic characteristics.

There was a difference in dressing percentage between the two groups of cattle; however, there were no differences in USDA quality grade, marbling score, USDA yield grade, backfat thickness, or ribeye area. There was a more pronounced yellowish cast to external fat of carcasses from pasture-finished cattle, as indicated by higher scores recorded for external fat color.

Two rib steaks from each carcass were evaluated for tenderness, juiciness, and flavor by a trained, six-member sensory panel using a 1 to 9 hedonic scale (1 = least desirable , 9 = most desirable). The panel rated steaks from grain-fed cattle slightly lower for tenderness and juiciness than those from forage-fed cattle.

Perhaps the most controversial carcass trait related to feeding regime is flavor of meat. In the study, the average steak flavor scores by the sensory panel were identical between the two groups of cattle. Thus, forage-finished beef tasted just as good as grain-fed beef.

Tenderness was evaluated with the Armour tenderometer on uncooked ribeye muscle and with the Warner-Bratzler shear instrument on cooked ribeye samples. The Warner-Bratzler instrument showed forage-finished beef to be slightly more tender since the average score was lower for cattle finished on forage than those finished on grain. However, these differences were not statistically significant. The lower score indicates less resistance to shear force. Armour tenderometer scores were nearly the same (16.3 and 15.8 lb.) for the two groups.

Even though sensory panel tenderness differences were slight, this taste-test evaluation confirms the Warner-Bratzler shear evaluations. Both tests indicated that steaks from cattle finished on pasture were slightly more tender than from those finished on a high-energy ration.

Chemical evaluation of the ribeye muscle indicated that cattle finished on pasture had slightly more moisture in the tissue than those fed out on grain. Percent fat in the ribeye muscle was higher for the grain-fed cattle. This fat difference was not reflected as a difference in marbling of the ribeye muscle, however, since average marbling scores were identical for the two groups.

Results of this study indicate that beef from cattle finished on top quality winter grazing is just as acceptable as that from comparable cattle fed out on a traditional fattening ration for 90 days.

COMPARISON OF CARCASS TRAITS OF CATTLE FINISHED ON FORAGE AND ON HIGH-ENERGY RATIONS

Performance measure	Result, by ration	
	Forage	High-energy
Number of animals	23	10
Weight at beginning of experiment, lb.	639	633
Live weight at finish, lb.	1,051	1,052
Carcass weight, lb.	603	632
Dressing percentage	57.0	60.0
USDA quality grade	11.0(Good+)	11.2(Good+)
Marbling score[1]	4.3	4.3
USDA yield grade	2.7	2.5
Backfat thickness, in.	.40	.35
Ribeye area, sq. in.	11.7	11.9
Color of fat[2]	2.0	1.3
Sensory panel scores[3]		
Tenderness	6.6	6.2
Juiciness	7.0	6.4
Flavor	7.6	7.6
Mechanical evaluation[4]		
Armour tenderometer, lb. of force	16.3	15.8
Warner-Bratzler shear, lb. of force	16.6	19.5
Moisture, pct.	73.1	72.2
Fat, pct.	3.3	4.2

[1] Scale of 1-10: 1 is devoid of marbling, 10 has abundant marbling.
[2] Scale of 1-3: 1 is white, 3 is yellow.
[3] Scale of 1-9: 1 is least desirable, 9 is most desirable.
[4] Higher score is tougher.

FOUNDING AND DEVELOPMENT of the AUBURN EXPERIMENT STATION

ROY ROBERSON, *Department of Research Information*

WHAT TO PLANT, how, when, and where are questions that have confronted farmers since the inception of farming, but today's farmers have a storehouse of research information to refer to in answering these questions. However, before the founding of the Agricultural Experiment Station System, farmers had only one way of answering such problems: trial and error.

Though the Agricultural Experiment Station at Auburn was founded in 1883, it's roots go back to the passage of the Morrill Act in 1862. At the end of the Civil War, Alabama accepted a land-grant offer from the Federal Government and the Alabama Agricultural and Mechanical College was established at Auburn to replace the East Alabama Male College, which had been struggling to exist there since 1856.

The first board of trustees for the college sought to establish a system of experimental farms in the State. A college farm of 16 acres was under cultivation by 1874, and arrangements had been made to experiment with cotton and corn in the Tennessee Valley near Courtland. Other outlying experiments were added 3 years later in Wilcox County.

By the early 1880's there was a clamoring for agricultural research, but no funding was available. In 1883, a 226-acre experimental farm was established in Auburn. The farm was financed by a special fertilizer tax, which had been approved by Alabama farmers. Further impetus for research came in 1887, when the Federal Hatch Act was passed. Research funds were almost tripled in Alabama with the beginning of federal-state cooperation in a nationwide research program on behalf of farmers.

Though results of experiments by scientists at Auburn weren't widely distributed throughout the State, farmers began to utilize some of these research findings that filtered down to them. In 1886, farmers in the Black Belt or prairie canebrake played an instrumental part in founding the Canebrake Experiment Station, whose scientists published some of the first research publications in Alabama.

Cooperative fertilizer experiments with farmers in different soil-type regions of the State were started in 1888. The Local Experiment Law, passed by the State Legislature in 1911, expanded field research experiments, which were conducted throughout the State in cooperation with farmers.

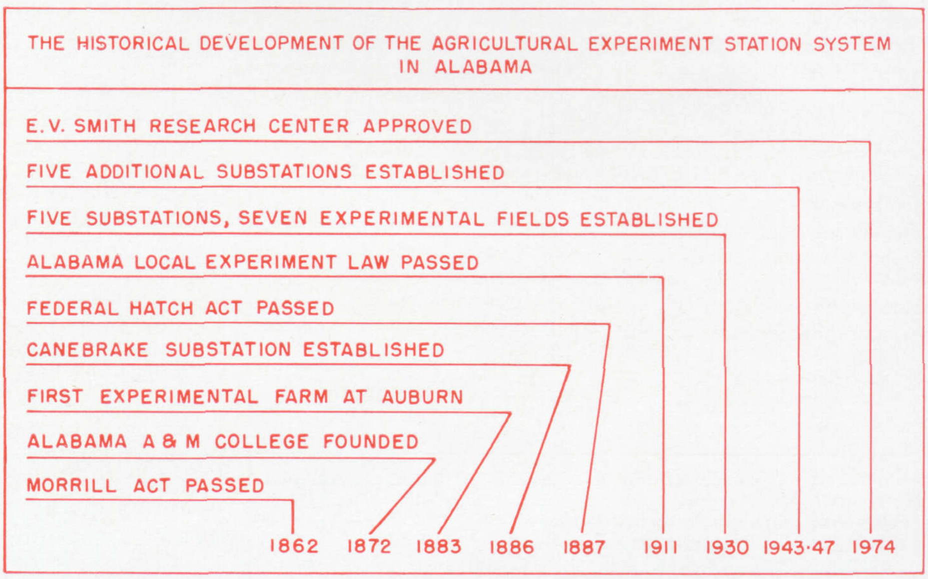
In 1927, the Alabama Legislature provided for the establishment of a substation in each of the five major soil regions of the State and for experimental fields in the less extensive soil-type regions. By 1930 the Gulf Coast Substation at Fairhope in Baldwin County, Black Belt Substation at Marion Junction in Dallas County, Sand Mountain Substation at Crossville in DeKalb County, Wiregrass Substation at Headland in Henry County, and the Tennessee Valley Substation at Belle Mina in Limestone County were established. Experimental fields were started at Alexandria, Prattville, Tuskegee, Monroeville, Brewton, Aliceville, and LaFayette (the first and latter two were discontinued).

The legislatures of 1943 and 1947 provided for the establishment of the Upper Coastal Plain Substation at Winfield in Fayette and Marion counties, North Alabama Horticulture Substation at Cullman in Cullman County, Piedmont Substation at Camp Hill in Tallapoosa County, Chilton Area Horticulture Substation at Clanton in Chilton County, and the Lower Coastal Plain Substation at Camden in Wilcox County. The Ornamental Horticulture Field Station at Spring Hill in Mobile County was officially established in 1951, though it was an outgrowth of the Spring Hill laboratory, which started in 1928.

A seed stocks farm at Thorsby and a plant breeding unit at Tallassee are also parts of the system. In 1974, the Alabama Legislature approved funding for the renovation of Main Station facilities at Auburn and for the relocation of some Main Station facilities at the E. V. Smith Research Center to be located on a plot of 3,200 acres of recently purchased land near Milstead in Macon County.

Agricultural research recommendations from early Experiment Station findings were slow to be accepted by farmers in Alabama, but in recent years an agricultural revolution has been in progress and has required the knowledge and research findings of trained scientists. From the Experiment Station System have come better varieties of plants and seeds; more effective and economical methods for producing food, feed, and fiber; more effective insect, disease, and weed control; improved feeding, breeding, and polycultural techniques for more economical production of beef, pork, poultry, and fish products; greater efficiency in machinery for the utilization of fossil fuels and human labor; and better management techniques for wildlife, forestry, and recreation – to mention just a few.

Today's Agricultural Experiment Station in Alabama, which is one of 50 in the United States, consists of a Main Station at Auburn, and soon to be established, the E. V. Smith Research Center, plus 21 outlying units.



Calcitic or Dolomitic Lime? Soil Test Tells Which is Best

FRED ADAMS, *Department of Agronomy and Soils*

ALABAMA'S MAJOR soil fertility problem today is low pH. Over half of all soil samples tested by Auburn University's Soil Testing Laboratory during the past year came from fields that needed lime. The need is especially acute for many farmers growing corn, cotton, peanuts, and soybeans.

Over 2.5 million acres in Alabama were planted to corn, cotton, peanuts, and soybeans in 1975, and about 1.4 million of those acres needed lime. Meeting the lime needs of these four cash crops alone would have required more than 2 million tons, Table 1, yet only 1.4 million tons of lime were used in the State. Much of this was used on pastures, so it is obvious that many fields that needed lime did not get it.

The present need for so much lime did not develop overnight. It has been building steadily with continued use of high rates of nitrogen fertilizers. Practically all nitrogen-containing fertilizers now used are highly effective in making soils more acid.

The overriding purpose of liming is to neutralize toxic levels of acidity by raising soil pH. Other benefits are minor in comparison. Much has been written about how liming improves plant-nutrient availability, but this relationship has little value in present-day farming except for the calcium and magnesium contained in lime.

Calcium is a major component of **all** liming materials. Magnesium is a major component of **some** liming materials. Lime containing magnesium is "dolomitic," that containing little or no magnesium is "calcitic." The two kinds are equally effective in raising soil pH. Since dolomitic lime contains both calcium and magnesium, it is preferred on soils that are **deficient in magnesium.**

Not all soils are deficient in magnesium, of course. This fact is well documented by results of Auburn University Agricultural Experiment Station field experiments done during the past 45 years to identify magnesium-deficient soils. Results from six of these experiments, summarized in Table 2, show soybeans and corn are less likely than cotton to suffer from magnesium deficiency.

Of the five experiments with cotton, three were on soils deficient in magnesium. This showed up in the slight yield advantage from using dolomitic lime (seed cotton yield increases of 110 to 170 lb. per acre). One of five soils was magnesium-deficient for soybeans, but none was deficient for corn.

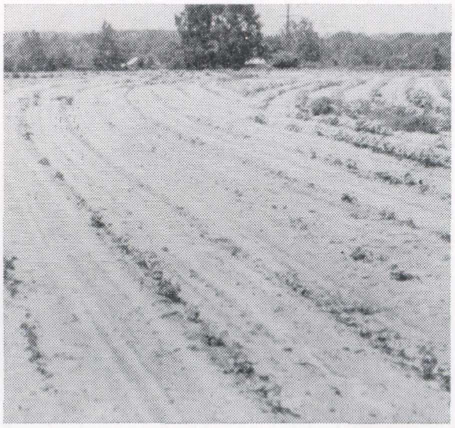
Data in Table 2, along with results of many other experiments, established that magnesium deficiency is most likely to occur on sandy soils of the Coastal Plains and Sand Mountain areas. Cotton yields were often affected by magnesium deficiency on these soils; soybean yields were sometimes affected, but corn and peanut yields showed no serious effects in any experiment. According to Auburn Soil Testing Laboratory records, only 17% of all soil samples received last year were "low" in magnesium, although the percentage was slightly higher for corn and peanuts, Table 1.

The only way to know if a soil is "low" in magnesium and needs dolomitic lime is by a reliable soil test. Auburn's Laboratory has been testing all soil samples for available magnesium since 1963. If the soil needs lime and tests "low" in available magnesium for **cotton**, the Laboratory recommends dolomitic lime for **all** crops. This recommendation is based on the belief that a soil should not be allowed to remain "low" in magnesium.

About one-third of the lime recommendations from Auburn's Soil Testing Laboratory last year called for dolomitic lime. For all others, calcitic and dolomitic limes would have been equally good.

TABLE 1. ESTIMATED LIME NEEDS OF MAJOR ROW CROPS IN ALABAMA, 1975

Crop	Estimated acreage	Percent needing lime	Percent needing dolomite	Average lime rate per acre	Total lime need
	Acres	*Pct.*	*Pct.*	*Tons*	*Tons*
Corn	700,000	63	31	1½	660,000
Cotton	355,000	48	17	2	355,000
Peanuts	204,000	55	23	1	112,000
Soybeans	1,300,000	53	16	1½	1,033,000
TOTAL	2,559,000				2,160,000



Effect of soil acidity on crops is apparent in this July 18 photo made in a cotton field where the soil pH was 4.8.

TABLE 2. COMPARISON OF CROP YIELDS FROM CALCITIC AND DOLOMITIC LIMESTONES AT DIFFERENT LOCATIONS

Kind of limestone	Per acre yield: Seed cotton	Corn	Soybeans
	Lb.	*Bu.*	*Bu.*
Benndale sl[1] (pH 5.2), Brewton			
None	1,350	53	18.8
Calcitic	1,770	68	31.4
Dolomitic	1,830	68	33.4
Increase for Mg[2]	140	NS[3]	2.0
Hartsells sl (pH 4.4), Crossville			
None	1,210	----	17.0
Calcitic	2,270	----	31.5
Dolomitic	2,440	----	33.2
Increase for Mg	170	----	NS
Lucedale sl (pH 5.1), Monroeville			
None	1,240	54	24.0
Calcitic	1,720	63	29.8
Dolomitic	1,830	62	30.2
Increase for Mg	110	NS	NS
Lucedale scl (pH 5.1), Prattville			
None	1,930	73	26.7
Calcitic	2,010	84	27.2
Dolomitic	2,030	82	26.5
Increase for Mg	NS	NS	NS
Malbis sl (pH 4.7), Fairhope			
None	-------	49	29.2
Calcitic	-------	73	44.9
Dolomitic	-------	74	45.6
Increase for Mg		NS	NS
Decatur cl (pH 4.8), Belle Mina			
None	1,250	----	------
Calcitic	2,550	----	------
Dolomitic	2,560	----	------
Increase for Mg	NS		

[1] sl = sandy loam; scl = sandy clay loam; cl = clay loam.

[2] Mg = magnesium in dolomitic lime.

[3] NS = calcitic and dolomitic limes were equal.

Coal Surface Mine Reclamation In Alabama

E. S. LYLE, JR., *Department of Forestry*
E. M. EVANS, *Department of Agronomy and Soils*

THE RECLAMATION of lands that have been surface mined is one of the most controversial issues in Alabama today. Most of this controversy seems to center around the question of whether vegetation can be established on mined areas.

In the opinion of the authors, vegetation can be established on practically all mined areas in the State. Surface mines usually revegetate naturally over a period of years, but often the vegetation has no economic value. It is definitely better to artificially establish some desired vegetation soon after the mining operation is completed.

In some cases large amounts of lime will be required to counteract soil acidity. However, in other cases the soil material is already at a pH level favorable for most plants.

There are other problems that should be considered along with soil acidity. Many mined areas have excessively steep slopes. These slopes are hard to lime, fertilize, plant, and harvest. Steep slopes also allow rain water to move at such a rapid rate that it does not penetrate the soil. Of course, such rapid movement will cause excessive soil erosion.

The third problem is the presence of large amounts of stone in the soil surface. This stoniness prevents the use of mechanical equipment, such as plows and mowing machines.

In spite of the above problems these mined areas can be used for the production of forest products, pastureage, and wildlife. In the past 2 years, research at Auburn University Agricultural Experiment Station has shown that loblolly pine, Virginia pine, slash pine, sycamore, and hybrid poplars will survive and grow well on surface mines, Figure 1. Sweetgum, southern red oak, northern red oak, and yellow-poplar did well on some areas but poorly on others, while cottonwood and black walnut showed poor survival or growth on all areas. In general, hardwoods responded to liming and fertilization but the pines did not.

Pasture plants that appear to be promising are: common bermuda, Pensacola bahia, crimson clover, sericea, and redtop grass, Figure 2. All of these plants required some liming and fertilization. Many of the mined areas would be too stony to machine harvest grasses or legumes but would be satisfactory as grazing areas.

Any grasses and legumes that are used for cattle would also be of value fcr wildlife food and cover. However, some plants were grown exclusively for wildlife. Plants that did well in this category were: bicolor lespedeza, autumn olive, sawtooth oak, and Arnot locust, Figure 3.

FIG. 1. Two-year-old sycamore that was not limed or fertilized.

FIG. 2. Two-year-old common bermuda that was limed and fertilized the first year only.

If possible, the surface mine owner should begin his reclamation effort by carefully planning the regrading job. This is probably the most crucial operation in reclamation procedure. The area should be regraded in such a way that the speed of rainfall runoff is minimized without creating pools and wet spots. Soil water runoff guarantees maximum water percolation into the soil profile with minimum soil erosion.

All of the tree species in this research program were planted as 1-year-old seedlings. However, other work in Alabama indicates that the cheapest method of establishing pine stands would be direct seeding. This is also probably true for some of the hardwoods, but little research has been done on this problem.

Successful establishment of grasses and legumes on surface mines requires the same cultural treatments as on any soil. The acidity must be adjusted to suit the plants to be seeded and the proper amounts of nitrogen, phosphorous, and potassium must be applied. The amount of lime and fertilizer to be used can be determined by sending soil samples to the Soil Testing Laboratory at Auburn University. All lime and fertilizer should be disked or plowed to a depth of 8 to 12 in. A firm, but not compact, seedbed is needed for germination and easy root penetration. It is also advantageous to cover the seed with a thin layer of loose soil or some organic mulching material. Many surface mines have soils that crust easily; therefore, seed should be barely covered by the soil material. Seeding rates for grasses and legumes should be about 50% greater than for ordinary farm pastures. This is particularly true if you do not perform all of the cultural operations.

Present research results show that surface mines can be revegetated. The next step for Alabama is to see that they are revegetated for the future benefit of the State and Nation.

FIG. 3. Autumn olive flowering the second year after planting.

Soybeans command a unique demand on the world market.

The Unique DEMAND SITUATION For SOYBEANS

J. L. STALLINGS and W. J. TALLY III
Department of Agricultural Economics and Rural Sociology

ALABAMA FARMERS may wonder what causes prices of soybeans to be high one year and down the next. While most people realize that something called "demand" is responsible for this, they may not realize the complexity of this demand in the case of soybeans.

Soybeans and their end products are used in a wide range of food, feed, and manufactured items. Though many such uses exist, soybean useage may be delineated into three main areas: soybeans as whole bean products, soybean meal products, and soybean oil products. The last two commodities have been, by far, the most responsible for the phenomenal growth of commercial demand for soybeans. Whole bean products are relatively unimportant.

Demand for soybean oil and meal is determined by dissimilar market forces, making demand analysis for the two types of products complicated. The oil is used mainly for margarine, vegetable shortening, salad oils, and some industrial products. Its demand is determined mainly outside of agriculture. Meal is used for feeding livestock, particularly poultry, and its demand, therefore, is derived from the demand for livestock. The overall demand for soybeans has expanded primarily as a result of increased demand both domestic and foreign for these two end products.

Soybean oil and meal compete with many substitute products, including cottonseed oil, lard, edible tallow, cottonseed meal, tankage, low value by-products, and fish meal. These products, unlike soybeans, are not particularly responsive to oil or meal prices, as most are secondary products of some primary product. An exception is fish meal from the anchovy catch off Peru. Soybeans then, are generally the residual supplier, and derive a magnified effect from the rise or fall in consumption of products produced from soybeans and substitute products.

The increase in worldwide demand for soybean oil and meal since World War II has resulted mostly from economic progress of developed and developing areas of the world. As people within those countries adapted to their new-found affluence, diets changed. A substantial part of this change involved a shift from a primarily cereal-based intake to a diet which included more meat. Gains in consumption of poultry and poultry products made up a large portion of this meat consumption increase.

The last few years have seen striking advances in the technology for conversion of grains and protein feeds to meat. This, in turn, boosted the demand for soybean meal. Soybean meal consumption has expanded from about 5.5 million tons in 1953 to about 12.6 million tons in 1974; and, U.S. soybean meal exports have grown from 272,000 tons in 1952 to 5.6 million tons in 1974.

Paralleling the expansion in soybean meal useage has been a steady growth in useage of soybean oil. Total fat for human consumption in the United States has risen from 45.5 lb. per capita in 1954 to about 53 lb. per capita in 1974. This increase was due primarily to a rise in the consumption of convenience foods prepared outside the home. During this period of rising fat consumption, the components of that consumption changed. Hard fat use declined as price relationships and dietary considerations favored utilization of soft and liquid vegetable fats. During this same period, fats and oils for industrial products remained about the same. The per capita consumption was 22.2 lb. in 1954 and 24.9 lb. in 1974 for an overall fats and oils use (human consumption and industrial use) of 67.7 lb. in 1954 and 77.5 lb. in 1974.

These changes had a direct effect on the soybean industry, since soybeans are the major oilseed crop in the world. Soybean oil currently accounts for about 60% of the total U.S. food fats and oil output. As a result, per capita consumption of soybean oil increased from 15.9 lb. per year in 1954 to its present level of 33.6 lb. per year. Currently, soybean oil has emerged as the leading vegetable oil in the U.S. food fat economy. In 1960, soybean oil accounted for 36% of domestic food fat consumption, while in 1973 it comprised 57% of a 35% larger market.

In all, domestic soybean use increased from 250 million bu. in 1953 to 1.1 billion bu. in 1973. Whole soybean exports increased from 40 million bu. in 1953 to 479 million bu. in 1973. The latter figure accounted for approximately 38% of the total U.S. crop and had a value of $2.1 billion. Another factor in the phenomenal expansion of the soybean industry is that the overall economic and political framework for world trade was more favorable during the last 25 years than at any other period in the world's history. This world trade factor probably holds the key to the soybean industry's future success, and political and economic considerations are currently causing much uncertainty in the soybean industry.

Seeding and Nitrogen Rates Provide Cost Savings with Winter Annual Pastures

C. S. HOVELAND and R. F. McCORMICK, JR.
Department of Agronomy and Soils

THERE'S GOOD NEWS for Alabama cattlemen who rely on rye-ryegrass-Yuchi arrowleaf clover grazing. New research has found a way to cut production costs without sacrificing any of the desirable features of this winter pasture mixture.

Reduced seeding rate of ryegrass and clover and use of low rates of nitrogen are the cost cutting measures coming out of the Auburn University Agricultural Experiment Station study. This permits cutting back on the high establishment cost of this long season, dependable, high quality pasture that puts fast growth on grazing cattle.

Results of a 3-year experiment on Cahaba fine sandy loam at the Plant Breeding Unit, Tallassee, show that lower ryegrass and clover seeding rates than generally used have no effect on forage production. Also, with a good stand of arrowleaf clover, nitrogen rate can be substantially reduced from current use rates.

Wrens Abruzzi rye was seeded on summer-fallowed land in 12-in. rows at 40 lb. per acre during late September each year. Gulf ryegrass at 10 or 20 lb. and Yuchi arrowleaf clover at 5 or 10 lb. per acre were broadcast and rolled into soil already seeded to rye. Nitrogen was applied at rates of 200, 100, and 50 lb. per acre, half in autumn and the remainder in mid-winter. Forage was harvested monthly from November until May or June.

Encouraging Results

Total yields were similar, over 3 tons dry forage per acre, regardless of seeding rates or nitrogen rate, see table. Seasonal distribution of forage was not affected by seeding rate of ryegrass or arrowleaf clover.

Effect of nitrogen rate varied between seasons. There was no effect on February to mid-April production, but lowering N rate caused a slight reduction in November-January production – approximately 10% when N was reduced from 200 to 100 lb. per acre and another 10% when lowered to 50 lb. Thus, going from 50 lb. to 100 lb. N furnished about 270 lb. of dry forage and adding another 100 lb. (total of 200 lb. N per acre) boosted production another 240 lb. during November-January. On the other hand, the higher rates of N generally resulted in lower forage yields from mid-April through May. This was a result of clover growth being reduced by using more than 50 lb. N per acre.

Although additional N fertilizer beyond 50 lb. per acre increased forage yields during the first part of the grazing season, the additional yield did not pay for the N. Assuming dry forage is worth $100 per ton ($0.05 per lb.) and N fertilizer costs $0.30 per lb., there was a loss of $1.50 when the N rate was increased from 50 to 100 lb.

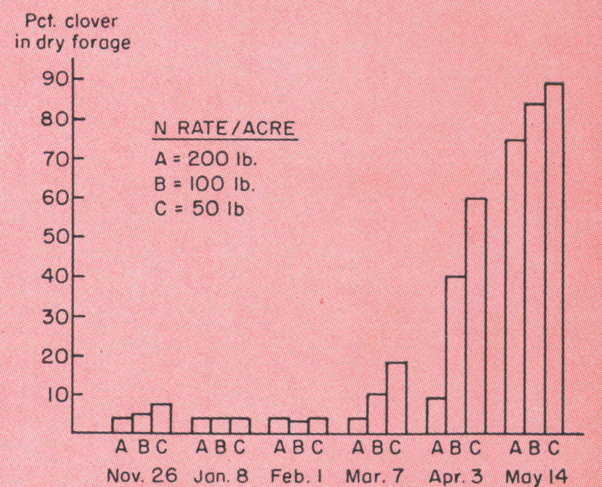
N Affects Clover Stand

Botanical composition of the forage was not appreciably affected by seeding rates, but higher rate of N decreased the percentage of clover during March, April, and May, see graph. Clover provided little forage from November to January in the clipped plots. Under intense grazing, however, clover has been observed to provide a higher percentage of autumn forage than was noted in this experiment. Rye furnished most of the forage in November, but during December and January ryegrass made up 30-50% of the total. Rye provided no forage during April and May.

Results reported show that pasture production can be satisfactory from seeding rates of 10 lb. ryegrass and 5 lb. arrowleaf clover with 40 lb. per acre rye, and fertilized with 50 lb. N. Successful results with these lower seeding and nitrogen rates depend on good seedbed preparation and use of adequate mineral fertilizers and lime. The most important factor in success of this program is good Yuchi arrowleaf clover establishment and root nodulation. Planting scarified clover seed that are well inoculated should result in vigorous legume plants that will provide free nitrogen for the pasture.

EFFECT OF SEEDING RATE AND NITROGEN FERTILIZER ON FORAGE YIELDS, 3-YEAR AVERAGE

Seeding rate and N rate, lb./acre	Seasonal yield of dry forage per acre			
	Nov.-Jan.	Feb.-mid-Apr.	Mid-Apr.-May	Total
	Lb.	*Lb.*	*Lb.*	*Lb.*
20 ryegrass-10 clover				
200 N	2,090	2,390	2,400	6,880
100 N	1,890	2,180	2,900	6,970
50 N	1,570	2,170	2,720	6,460
20 ryegrass-5 clover				
200 N	2,190	2,290	2,070	6,450
100 N	1,820	2,230	2,330	6,380
50 N	1,500	2,110	2,750	6,360
10 ryegrass-10 clover				
200 N	2,040	2,360	2,560	6,960
100 N	1,810	2,350	2,650	6,810
50 N	1,590	2,110	2,950	6,650
10 ryegrass-5 clover				
200 N	2,000	2,300	2,180	6,480
100 N	1,850	2,410	2,490	6,750
50 N	1,620	2,390	2,820	6,830



Proportion of clover in forage getting different rates of N. Seeding rate was 40 lb. rye, 10 lb. ryegrass, and 5 lb. Yuchi arrowleaf clover seed per acre.

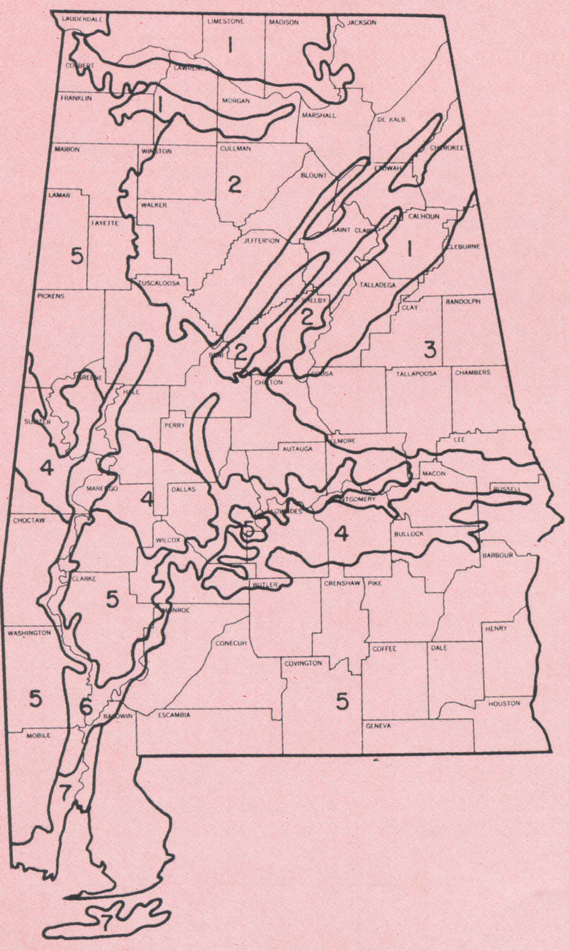
NEW ALABAMA SOIL MAP RECENTLY COMPLETED

B. F. HAJEK, *Department of Agronomy and Soils*

A REVISED SOIL MAP of Alabama that presents up-to-date information has been published. It incorporates latest information from a recently completed general study of the State's soils by Auburn University Agricultural Experiment Station and USDA Soil Conservation Service.

The revision was needed because of (1) development of a new soil taxonomy system that differs from the 1938 system used as the basis for the previous map issued in 1953; and (2) increased knowledge of soil characteristics that significantly affect use and management of soils, which resulted in many soils being renamed and new series established.

The new soil map is included as a part of Agronomy and Soils Departmental Series No. 24, which will be released by the Agricultural Experiment Station in late 1975. The map and report are intended for educational purposes and broad general planning, such as for rural and community development, recreational areas, watersheds, and wildlife management. Detailed soil maps and reports of individual counties, which are in large scale, should be consulted for specific purposes like farm planning, land appraisal, land acquisition, and housing development.



Soil map of Alabama showing soil provinces.

Soil bodies delineated on the map are generally large areas representing a group of soils that are common to whole communities. Each enclosed delineation represents an area containing one or more major soil series (used to name the delineation) and one or more minor soil series that are not indicated by the name of the area. The soils usually have a distinctive pattern and form a characteristic landscape. Thus, the delineations are called soil associations.

The 55 soil associations shown as units on the map and described in the report are grouped into the following 7 soil provinces:

1. **Soils of the Limestone Valleys and Uplands.** This province is the most intensively cultivated area in the State. Most of these soils were formed in material weathered from limestone. Topography is gently rolling to steep. The steeper slopes are generally wooded.

2. **Soils of the Appalachian Plateau.** This soil province is the most mountainous in Alabama. The landscape is folded valleys and ridges, with both conifers and hardwoods on the slopes and narrow ridges.

3. **Soils of the Piedmont Plateau.** Soils of this province make up an area of Alabama that was once extensively cultivated but which is now mostly in woodland. Topography is generally rolling to hilly, becoming mountainous toward the north. These soils formed in the oldest surface rock in Alabama.

4. **Soils of the Prairies.** This is the area that is widely known as the "Black Belt" of Alabama. The name comes from the "blackish" surface soil colors of many of the soils. The topography of these associations is generally rolling, with some steep slopes and many nearly level areas. Large areas of these soils have neutral and calcareous subsoils and some soils have calcareous surface layers. Clayey soils with high shrink-swell properties are common.

5. **Soils of the Coastal Plains.** The largest soil province in the State, this area is part of the Coastal Plain belt that extends unbroken from Virginia to Texas. Alabama's Coastal Plains are generally rolling to hilly woodlands that are dominated by pine forest. However, there are large areas of open land used for cultivated crops and pasture. Deep soils with sandy surface layers are common. Soils with clayey subsoils are common on side slopes in dissected areas.

6. **Soils of the Major Flood Plains and Terraces.** This soil province represents only the Flood Plain and Stream Terrace areas that are wide enough to be shown at the scale used in the "General Soil Map."

7. **Soils of the Coastal Marshes.** This province is made up of the nearly level and level bottomlands and flats along the Mobile River, Mobile Bay, and Gulf of Mexico.

The important soil series in each soil association are described in the report. Each is described in terms of its depth, drainage class, landscape position, and slope range. This is followed by a brief generalized description of a soil profile that best represents the series. Bedrock that underlies the representative soil profile is listed if it is no more than 40 inches from the surface. Additional information about individual soil series and interpretations for some selected uses of soils also are given in the report.

The RURAL ALABAMA FEMALE HEAD And Her HOUSEHOLD

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Department of Agricultural Economics and Rural Sociology

RECENTLY, concern has been expressed over the situation of female household heads, especially those who have dependent children.

These in particular are most likely to be in need of and receive some form of public welfare. For example, according to the 1970 Census, families with male heads in Alabama had a median income of $7,828 compared with $3,303 for those with female heads. Thus, a look into the situation of the female heads and their households in the open-country areas of Alabama may shed some light on problems and potentials for development.

Data are from Southern Regional Project S-79 entitled "Rural Development and the Quality of Life in the Rural South," which involved eight Southern States and Puerto Rico. Only the Alabama portion of the sample, located in open-country areas of Clarke, Monroe, Fayette, and Tallapoosa counties, was utilized. Selected individual and household characteristics are shown for the total and the female household heads.

Of 420 households in the sample, 75 (18%) were headed by a female, which was about equal to the 17% in the 1970 total rural Alabama population. The typical female household head was an aged widow who was retired and either partially or totally disabled. The table shows 67% of the female heads were widowed, 65% were 60 years of age or older, and 72% were retired and either partially or totally disabled. The respective percentages for the total sample were 15, 36, and 39. In addition, 33% of the female heads were black compared with 17% of the total and 36% had 10 or more years of schooling as compared with 47% of the total sample. Since age is highly related to such variables as marital status, educational attainment, and ability to work, it is a crucial variable in assessing potential for improvement in a person's status. Thus, from a development standpoint, potential for improvement is quite limited for these female heads as a whole; however, their situation is not as bleak as it first appeared.

Of the 75 female heads, only 19 (25%) were in the labor force (working or looking for work) compared with 272 (65%) of the total. The percentage distribution for occupations showed that the largest proportion (37%) of the female heads were employed as domestics; however, they compared rather favorably in the manager, proprietor, professional, and technical category (16% of females; 17% of total), sales and clerical (16% vs. 7%), and operatives (16% vs. 22%).

Household characteristics showed some positive signs as far as socio-economic status was concerned. Even though the annual household income of female heads was quite low (63% below $2,000 compared with 23% of total), income for many households was for one person only. Fifty-five percent of the female heads, compared to only 14% of the total, lived alone; thus, for many households, income per capita was not so deficient. On the other hand, 27% of the female headed households contained 3 or more persons and limited income placed them in a disadvantaged condition. These were the ones most likely to receive welfare assistance. Forty-four percent of the female heads reported their major source of income as social security or pension – not surprising in view of their age. Only 27% reported salary or wages as the most important source, while 19% reported welfare as the major source. Thus, transfer payments were an important part of the economic well being of these female heads and for most, increasing these was the most likely means of economic betterment. Some on welfare income could possibly become more economically independent through a job or a better paying job.

A subjective item to determine the respondents evaluation of his or her household's current socio-economic status was utilized. This was accomplished by asking the respondent to place himself or herself on a rung of a 10-rung ladder (rung 1 being lowest and rung 10 highest). The results indicated that female heads tended to rate their households lower, although the differences were not great. Twenty-four percent of the female heads placed their households on rungs 1-4, compared with 13% of the total. Conversely, 38% of the female heads rated their households at the upper levels (rungs 7-10), compared with 49% of the total. The average score for female heads was 5.7 and for the total it was 6.5; generally, female household heads were relatively positive in their assessment of household well being.

These female heads of households in many respects were rather disadvantaged. To a large extent, this was highly correlated with being aged. Thus, for most of these female heads, little directed change is possible. On the other hand, those able to work should be aided in getting more economically rewarding positions.

PERCENTAGE DISTRIBUTION OF SELECTED INDIVIDUAL AND HOUSEHOLD CHARACTERISTICS FOR THE TOTAL AND THE FEMALE HOUSEHOLD HEAD, OPEN COUNTRY AREAS, FOUR ALABAMA COUNTIES

Characteristics	Household heads	
	Female	Total
INDIVIDUAL	*Pct.*	*Pct.*
Marital status		
Married	0	75
Never married	15	5
Separated or divorced	18	5
Widowed	67	15
Age		
Under 39 yr.	12	30
40-59 yr.	23	34
60 + yr.	65	36
Ability to work		
Fully able	28	61
Partial or total disability	25	14
Retired	47	25
Race		
White	67	83
Black	33	17
Education		
0-6 yr.	36	27
7-9 yr.	28	26
10 + yr.	36	47
Occupation of heads in labor force		
Agriculture	0	6
Manager, proprietor, professional, technical	16	17
Sales and clerical	16	7
Crafts or foreman	0	28
Operatives	16	22
Service	0	2
Domestic	37	2
Labor	5	15
Unemployed	10	1
HOUSEHOLD		
Annual household income		
$0-$1,999	63	23
$2,000-$4,999	24	25
$5,000-$7,999	11	24
$8,000 and over	2	28
Most important source of income		
Salary or wages	27	62
Profit or fees	3	6
Social security or pension	44	26
Welfare	19	4
Other	7	2
Size of household		
1 person	55	14
2 persons	18	33
3 or more persons	27	53
Self placement on ladder		
1-4 rungs	24	13
5-6 rungs	38	38
7-10 rungs	38	49

* Except for the occupation of heads in the labor force, percentages are based on 75 female heads and 420 total. The bases for occupational distribution are 19 for female and 272 for total.

EARTHY, MUSTY ODORS IN DRINKING WATER

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CITIES AND TOWNS throughout the country are periodically plagued with objectionable odors in their drinking water.

The problem is not restricted to the United States but has been reported in Egypt, Russia, Israel, England, The Netherlands, and others. These odors, which in severe cases render the water unpalatable, are most often described as earthy, musty, wood-like, potato-bin, camphoric, leathery, fishy, and others. This problem is of increasing concern to municipal water boards and water treatment managers. However, this problem is not restricted to those concerned with providing suitable drinking water but is also extended to the freshwater fish industry. Fish living in water having the objectionable odor may absorb and accumulate in their tissues the chemical agent(s) responsible for the odor. The odor persists even after cooking and gives the fish an undesirable taste.

Since the first report 75 years ago, numerous articles have been published attributing "earthy" or "musty" odors in water to actinomycetes (filamentous type of bacteria) growing in the reservoir water or bottom mud. Aquatic actinomycetes of the genus *Streptomyces* can produce the same objectionable earthy-musty odors characteristic of contaminated water when cultured in the laboratory, Figure 1. Aquatic actinomycetes such as *S. odorifer* and *S. griseus*, as well as a few members of the genera *Nocardia* and *Micromonospora*, are known to produce the earthy-musty odors. Certain species of the blue-green algae *Anabaena, Aphanizomenon, Oscillatoria, Symploca,* and *Microcystis* can also produce earthy-musty odors when grown in the laboratory.

Considerable progress in the chemistry of odorous metabolites of actinomycetes has been made in the past 8 years. The most important contribution was made by Dr. Nancy Gerber at Rutgers University, who chemically characterized the structure of the major earthy-smelling substance produced by actinomycetes and named it geosmin, Figure 2. Geosmin is a clear neutral oil that has an extremely low odor-threshold concentration (0.2 p.p.m.) and characteristic earthy odor at high dilutions. Geosmin has been confirmed as the earthy-smelling substance produced by numerous actinomycetes and blue-green algae noted above.

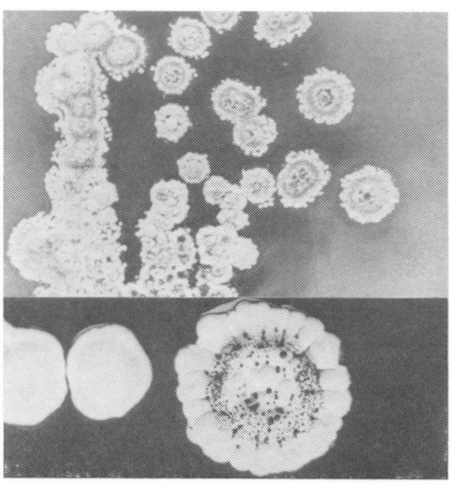

FIG. 1. Culture of an aquatic actinomycete which produces geosmin.

In addition to geosmin, a camphor-menthol smelling substance is produced by a few *Streptomyces* species and has been identified as 2-methyl-isoborneol. This substance has been isolated from only one natural body of water (in The Netherlands) and is not considered to be a serious problem as a drinking water contaminant. Other odorous compounds have been identified.

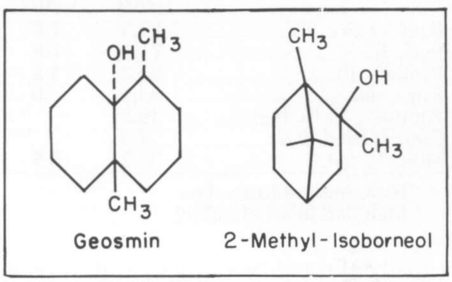

FIG. 2. Chemical structures of two major odorous compounds isolated from water.

The city of Auburn has experienced odors described as earthy in its water supply for over a decade. These odor episodes usually appear in early to late spring and persist for 2-4 weeks. In the spring of 1974, however, the earthy odor appeared in late January and persisted for 4-5 months. Investigations by the authors have confirmed geosmin as the principal odor-causing substance in the Auburn drinking water. While contribution to the earthy odor by blue-green algae cannot be ruled out at this time, it appears that actinomycetes are the principal biological agents responsible for the production of geosmin during the odor episodes. Although the earthy odor occurs only at certain times of the year, actinomycetes can be isolated from the local reservoir and its tributaries throughout the year and induced to produce both geosmin and 2-methyl-isoborneol when grown on an appropriate medium in the laboratory. Research is being conducted by the authors to determine what factors (chemical and environmental) trigger the production of geosmin at specific times of the year.

The principal problem for water-plant managers is elimination of the earthy odor from the raw water prior to distribution for drinking. Two approaches include: (1) removing geosmin at the water treatment plant, and (2) controlling geosmin production at the source. Several chemical treatments have been applied with varying degrees of success. These include chlorination, permanganate oxidation, alum coagulation, and adsorption to granular carbon. At this time, there seems to be no universally acceptable method of removing geosmin from water on a scale large enough to satisfy the needs of water treatment plants.

Another approach to eliminating earthy odors from water is by controlling the causative organisms, i.e. preventing algal blooms or actinomycete sporulation. Certain chemicals have been used to control algal blooms with some success. A biological control method was suggested when it was shown that the geosmin odor can be eliminated from water by the common soil bacterium *Bacillus cereus.* Large quantities (10^5-10^6/ml) of this bacterium added to a lake (Lake Hefner, Oklahoma) reduced the odor to an acceptable level. Our laboratory is presently searching for additional bacterial strains which may be more efficient in the degradation of geosmin and also investigating the potential of a microbial-free enzyme system for removal of odorous compounds from water.

COMPONENTS of MARKETING MARGIN For SELECTED FARM FOODS

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Department of Agricultural Economics and Rural Sociology

THE CONSUMER'S DOLLAR spent for food pays for all services involved in producing, processing, and distributing.

Large increases in costs in most phases of marketing – including labor, packaging, and transportation – have been major factors in widening marketing margins and rising retail prices. A 1973 study was made by commodity specialists and researchers in the National Economic Analysis Division of the Economic Research Service of cost and profit components of margins from the farm through the retail market. Although substantial increases in marketing margins have taken place since 1973, proportions spent for various components of the margins have not changed greatly.

Charges for different marketing operations varied widely among commodities, see table. Assembly and procurement comprised a relatively small proportion of the retail price – 2% or less for all commodities included except milk, which was 4%. Differences among various commodities in the amount of processing required are reflected in the charges. Almost half the retail price for frozen french fried potatoes was for processing, and only 4% for beef. Intercity transportation charges reflected differences in perishability, bulkiness, and shipping distances. Costs for transporting a 10-lb. bag of potatoes were comparatively greater than that for meat, which is dense in volume and has higher value per unit.

In recent years an increasing number of jobs, previously performed by various types of wholesalers, have been taken over by processors and/or retailers. Growth in volume handled by retail stores, and improved communication and transportation systems have been important factors in elimination of some wholesalers. Processors can prepare and ship desired quantities to a retailing firm's district warehouse where individual retail store volumes of various products are assembled.

Retailing continues to be the most expensive marketing operation for a majority of products. The situation with some products, however, is that consumer demands for more processing and improved packaging have resulted in charges for these services exceeding the charge for retailing. French fried potatoes and milk are examples of such products. Important factors contributing to wide retailing margins are wages and salaries, risks of price changes, costs necessary to maintain product quality, and physical product deterioration.

Allocation of charges among margin components is sometimes difficult and requires detailed accounting procedures. It is possible to determine components for which the cost is greatest and to show relationships of component costs among food products. Labor is, by far, the most costly component for all products studied except french fried potatoes. Changes in salaries and wages have a greater effect on the marketing margin for some products than for others. Similarly, marketing margins of all products will not be equally affected by changes in packaging and transportation costs. The proportion of margins going for some components (e.g. business taxes, interest) is relatively uniform among food products. Wide proportional changes in costs of some components result in minor changes in total marketing margin.

Unusually large increases have occurred in operating expenses of food marketing firms since August 1973, see figure. Although price increases are slowing for some components, further increases for labor, transportation, and possibly energy will keep pressure on marketing margins.

Increases in hourly earnings of food processing, wholesaling, and retailing employees the past year have been greater than in any year for which comparable data are available. The pace of wage increases, attributed to workers' reaction to inflation and efforts to regain lost purchasing power, can be expected to be reflected in wider marketing margins. Costs of food containers and packaging materials are substantially higher than in 1974, but prices have stabilized and did decline in both April and May of 1975. Fuel and electric rate increases also leveled off, but recent developments in the energy situation could result in another round of increases in the near future. Recent trends indicate that the transportation system shouldn't be under as much strain in 1975 as during 1972-1974. However, rates are expected to rise and transportation will continue to be a major marketing cost.

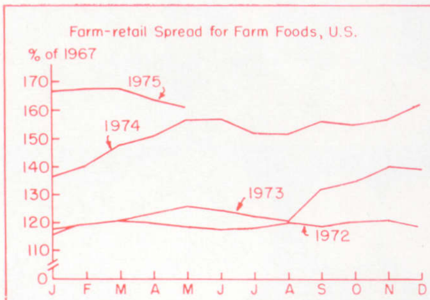
Another factor contributing to the marketing margin is the decline in output per man-hour in food manufacturing firms. Productivity data showed that in 1973 output of food manufacturing firms declined three times more than total hours worked, thereby pushing unit labor cost higher.

An examination of marketing operations and the various components of marketing margins reveals why farm producers of some commodities receive a greater proportion of the retail price than do producers of other commodities. It does not indicate the relative profits earned by producers of various farm food products.

DISTRIBUTION OF RETAIL PRICE ACCORDING TO FARM VALUE AND MARKETING OPERATION, 7 FARM FOOD PRODUCTS, U.S., 1973

Food item/unit	Farm value	Marketing operations					Retail price
		Assembly and procurement	Processing	Intercity transport	Wholesaling	Retailing	
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Beef, choice, lb.	89.9	1.5	5.8	1.1	8.9	28.3	135.5
Pork, lb.	71.5	1.8	12.9	1.1	2.4	20.1	109.8
Broilers, lb.	35.3	1.2	6.7	1.1	2.9	12.4	59.6
Eggs, doz.	54.4	.9	8.1	1.2	2.8	10.7	78.1
Potatoes, 10 lb. bag	49.8	[1]	22.1	12.6	3.9	34.1	122.5
French fried, 9 oz.	4.3	[1]	8.5	1.0	1.0	2.4	17.2
Milk, ½ gal.	33.2	2.5	11.6	[2]	13.0	5.1	65.4

[1] Included in farm value.
[2] Included in wholesaling.



The spread is the gross margin received by marketing firms for assembling, processing, transporting and distributing a market basket of food.

NUTRITIONAL STATUS of Nine-Year-Old GIRLS in ALABAMA

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NUTRITIONISTS and related health specialists have long recognized the need to develop programs which will deal adequately with problems of malnutrition in the United States.

The Auburn University Agricultural Experiment Station is conducting research to try to identify potentials for modification of food choices. Objectives are correlating food choices with nutritional health of preadolescent girls and assessing the impact of economic level and ethnic background on the nutritional health of these girls.

Nutritional information is being collected on 100 preadolescent girls (50 whites and 50 blacks) from Alabama for a 3-year longitudinal study. Half of the subjects are from low-income families ($1,200 per capita per year or less) and half from families of higher income ($2,000 per capita per year or more). A 24-hour dietary recall is taken each year from each participant and intake of major nutrients, vitamins, and minerals is calculated from food composition tables. Once-a-year blood and urine samples are collected and assayed for several nutrients.

Anemia was a common problem, particularly in black girls, Table 1. Although serum levels of iron were low in approximately one-fourth of the girls in each income and racial group, the level of unsaturated iron binding capacity (UIBC), a better indicator of long-term iron status, was more frequently abnormal in black girls. This suggests that iron deficiency was probably responsible for the anemia. Further support of iron deficiency as the cause for the anemia is the normal serum levels of folic acid, Table 1. Lack of folic acid, one of the B vitamin group, is the second largest cause (after iron deficiency) of anemia in North American women. Despite normal serum values, dietary intake of this vitamin averaged less than one-third of the recommended amount, suggesting that the criteria for folate intake probably needs further investigation.

The nutritional status for other water-soluble vitamins varied widely. Values for erythrocyte glutamic-pyruvic transaminase pyridoxal stimulation index (EGPT Index), a measure of the vitamin B_6 status, were abnormal for most girls, Table 1. This suggests either that deficiency of this vitamin is common or that criteria established for adults do not apply to this age. Urinary excretions of thiamine (vitamin B_1) and riboflavin (vitamin B_2), measurements which have been more thoroughly evaluated in children, were normal for all girls. Urinary ascorbic acid (vitamin C) excretion, again a relatively uncommon measurement in children, seemed high for all groups. Only for this last vitamin did one group, the white moderate income, appear to have better nutritional status than the other three. Mean dietary intakes of all three vitamins were adequate.

Mean serum retinol (vitamin A) levels were in the range usually found for North American children. The means were quite similar for all groups, although girls in the black moderate income group had a slightly higher incidence of low values. This indicates that vitamin A deficiency may be a problem for these girls.

Total serum protein mean values, Table 2, were similar for all groups. However, serum albumin was significantly lower in black girls, although income did not seem to contribute to these differences. The variation in alubmin could not be related to dietary protein as indicated from the preceding day's intake, as the black moderate income group consumed more protein than the other groups and all groups consumed nearly twice the recommended intake for protein.

Serum cholesterol levels appeared to be higher in black girls, while triglyceride levels were lower, Table 2. Only one girl had a cholesterol level that would be considered abnormally elevated.

Anthropometric measurements showed that a greater number of black girls had smaller skinfolds and weighed less, Table 3. However, a large number of overweight girls was also found in this group. Girls from the black low income group showed the highest number of small skinfolds and weight for height ratios, possibly indicating that they consistently had the poorest nutritional intake.

In summary, deficiencies of several nutrients may be present in preadolescent girls. Although income does not seem to be responsible for these differences, racial differences in nutrient status were shown.

TABLE 2. MEAN VALUES FOR SERUM TOTAL PROTEIN, ALBUMIN AND LIPIDS

Race and income	Total protein g/100 ml	Albumin g/100 ml	Cholesterol mg/100 ml	Triglycerides mg/100 ml
White moderate	7.3	5.0	142	75
White low	7.3	4.8	135	74
Black moderate	7.2	4.4	154	66
Black low	7.1	4.4	157	65

TABLE 3. NUMBER OF PARTICIPANTS WITH ABNORMAL ANTHROPOMETRIC VALUES

Race and income	Skinfold		Weight for height, pct. normal	
	<7.0 mm	>17	<85%	>115%
White moderate	4	3	0	2
White low	2	1	2	1
Black moderate	6	4	4	4
Black low	12	0	5	5

TABLE 1. NUMBER OF PARTICIPANTS WITH ABNORMAL BLOOD LEVELS OF NUTRIENTS

Race and income	Hemoglobin g/100 ml	Iron μg/100 ml	UIBC μg/100 ml	EGPT index	Folacin ng/ml	Retinol μg/100 ml
White moderate	0	6	0	6	2	1
White low	3	4	3	9	0	2
Black moderate	6	5	4	8	1	4
Black low	8	6	6	8	0	2

Vetch for Green Manure— Time to Reconsider?

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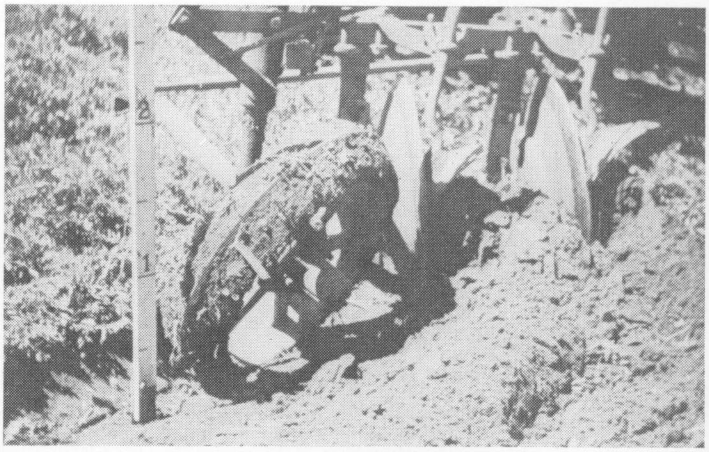

BEFORE WORLD WAR II, winter legumes were widely grown in Alabama to furnish nitrogen for cotton and corn. Then synthetic N became available in adequate amounts and at low cost, and farmers shifted to commercial nitrogen. Now there is renewed interest in legume green manure crops since inflation and the energy crisis combined to push fertilizer N prices to high levels.

Fortunately, research on value of turning under legumes had been continued by Auburn University Agricultural Experiment Station so up-to-date information is available. Results of these tests at the Brewton and Monroeville experiment fields show that legume nitrogen is just as good as 90-120 lb. of commercial N for both cotton and corn. Thus, the choice between sources can be made solely on the basis of cost and convenience.

Three Cropping Comparisons

Vetch plots have had winter legumes with applications of 90 and 120 lb. N from ammonium nitrate for continuous corn, continuous cotton, and for a 2-year rotation of corn and cotton. Data in the table are from the last 11 crop years, excluding years when drought or some other factor limited yields to less than 40 bu. corn or 1,500 lb. seed cotton.

Vetch plots have had winter legumes continuously since 1931. Plots receiving 120 lb. N had no legumes for this period but have received fertilizer N since 1948. Uniform applications of phosphorus and potassium were broadcast each year in the spring when vetch was turned; pH has been maintained at optimum levels. Vetch was planted as early as corn and cotton stalks could be cut. It got no fertilizer.

CORN. Vetch turned for green manure is a satisfactory source of N for corn. As shown in the table, yields from vetch were about the same as from 90 N and averaged only 3 bu. less than from 120 lb. N at both locations. Vetch supplied adequate N for corn in most years. Even though vetch growth was not good every year, residue from previous vetch crops supported good yields. Under farm conditions, however, it is a good idea to apply some N when the winter legume fails. This will assure an adequate supply of N.

COTTON. Yields of continuous cotton preceded by vetch were slightly higher than from 90 or 120 lb. of N at both locations. Even in 1974 at Brewton when no vetch was produced, residual N from previous vetch crops produced over 2 bales per acre. In that year, N in addition to vetch residue increased cotton yield 440 lb. In most years, however, additional N did not increase yield of cotton.

ROTATION. Rotating corn with cotton did not increase corn yields at either location. Cotton production was not increased by rotation at Brewton, but at Monroeville, where yields were lower, there was an average increase of about 200 lb. seed cotton when rotated with corn. Yields of corn and cotton grown with legume N were about the same when crops were rotated as when each was grown continuously.

Choice Available

Findings for 11 years at the two locations establish that vetch turned for green manure is equivalent to 90 to 120 lb. of fertilizer N for both corn and cotton. There was no distinct advantage to either crop from a 2-year rotation, since yields were just as good from continuous cropping. The choice between using legumes or fertilizer N can be made by comparing costs and convenience. Use of legumes may again become desirable if N costs remain at present levels or increase and if legume seed are available at reasonable prices.

COMPARISON OF LEGUME NITROGEN AND COMMERCIAL NITROGEN FOR COTTON AND CORN, TWO LOCATIONS, 1964-74

Treatment	Corn yield per acre					Seed cotton yield per acre				
	Brewton		Monroeville			Brewton		Monroeville		
	1971[1]	10-yr. av.	1968[1]	10-yr. av.	Av.	1974[1]	10-yr. av.	1970[1]	10-yr. av.	Av.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Continuous cropping										
120 lb. N	**119**	**88**	81	61	**77**	3,440	2,210	1,810	1,720	1,980
90 lb. N	111	81	79	61	73	**3,630**	2,310	**2,110**	1,740	2,040
Vetch + 60 lb. N	**118**	**86**	**88**	**67**	**78**	3,400	2,260	1,990	**1,820**	2,050
Vetch only	107	80	82	**65**	74	2,960[2]	**2,370**	2,050	**1,830**	**2,110**
Cotton-corn rotation										
120 lb. N both crops	**111**	76	83	66	72	3,450	2,060	2,240	1,840	1,960
90 lb. N both crops	**110**	**89**	79	61	**78**	3,640	**2,350**	2,260	1,940	**2,160**
90 lb. N cotton/vetch-corn	100	81	79	62	73	3,610	2,320	1,790	1,790	2,070
Vetch-cotton/vetch-corn	96	77	81	64	72	2,870[2]	2,170	2,510	**2,010**	2,090

[1] Best year at each location; best yields in bold type.
[2] Vetch was total failure at both locations in 1974.

POTENTIALS FOR INTENSIVELY MANAGED FOREST LANDS

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IT IS VIRTUALLY certain that many pine stands in the Lower Coastal Plains province of Alabama will respond favorably to management. In 1967, a test of this premise was begun at the Lower Coastal Plain Substation near Camden. The forest had been cut to an 8-in. stump diameter in 1951, removing practically all of the merchantable timber and subsequently offering protection from wildfire. The developing forest of mixed loblolly pine (*Pinus taeda*) and shortleaf pine (*P. echinata*) started in 1951 with little or no merchantable volume. The costs of management were satisfied completely with income from cuts made under the management program.

Test Preparation

Intensive management was begun in 1967 and 1968 on two tracts of land at the Lower Coastal Plain Substation. The tracts were designated Managed Forest Units (MFU-1 and -2), and each was mapped and inventoried by stands that were sufficiently uniform to be distinguishable from the forest on adjoining areas. Prescription treatments established on individual stands included selective harvesting, thinning, complete harvest, prescribed fire, and clearcutting in strips for the purpose of regeneration by natural and direct seeding.

Results

In one stand designated for growing sawtimber as the main crop, all trees less than 9.6 in. d.b.h. (diameter breast high) were cut. All trees 9.6 in. d.b.h. or larger were cut in one stand designated for growing cordwood as the major crop. The table shows the sawtimber and cordwood volumes inventoried on MFU-1 and MFU-2 before the first intensive management cuts in 1967 and 1968, respectively, and the amounts 5 years after the initial managed cut. Average volumes on both tracts were 5,052 bd. ft. plus 5.2 cords per acre before cutting and 5,191 bd. ft. plus 6.7 cords 5 years later. These figures represent a substantial increase in value of the two tracts, and their improved condition ensures that future increases should be more rapid.

Conclusions

The costs for intensive management over the 5-year period were $158.23 for MFU-1 and only $43.96 for MFU-2. Income from the harvest was $1.451.75 for MFU-1 and $2,206.50 for MFU-2. Net cash income of $3,456 in addition to volume increase of 21,133 bd. ft. plus 226.3 cords during the initial 5 years of managing a 151.7-acre, recently cut-over forest evidence the practicality of management in forests like the two tracts near Camden.

TIMBER VOLUMES PRESENT ON 2 MANAGED FOREST UNITS BEFORE THE FIRST CUT AND 5 YEARS LATER[1]

Tract	Area	Initial volume		Volume 5 years after harvest	
	Acres	*Bd. ft.*[2]	*Cords*	*Bd. ft.*[2]	*Cords*
MFU-1	85.5	446,284	518.6	518,825	291.2
MFU-2	66.2	320,095	267.3	268,687	721.0

[1] Nearly all of the volume was pine, but the small amount of hardwood that was present is included.

[2] International ¼-inch rule.

American Woodcock in Alabama

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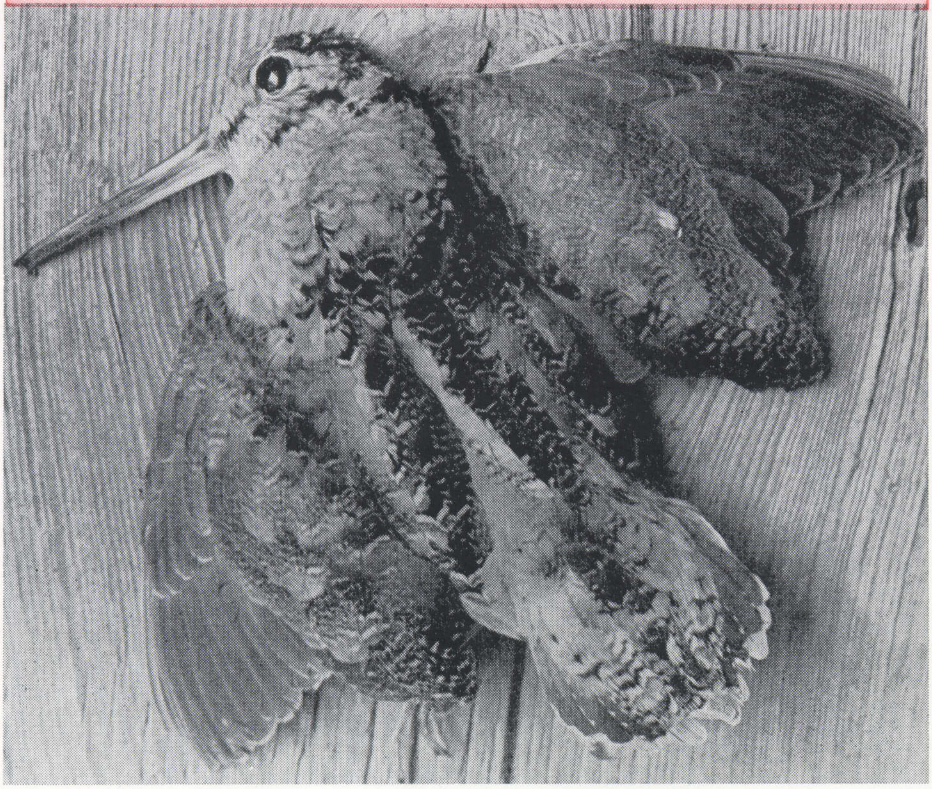
Department of Zoology-Entomology



ONE OF THE most prized game birds of the northern and northeastern United States goes virtually unhunted in Alabama and those of us who hunt these secretive birds of our brushy bottomlands are at a loss to explain why.

The American woodcock is a medium sized bird offering excellent recreational opportunities to Alabama sportsmen who enjoy shooting over hunting dogs. This odd looking bird is present in most sections of Alabama from October to March in good numbers. Along the heavily vegetated drainages of east-central Alabama it is not uncommon to flush 15 to 20 of these tricky flyers in a couple hours time.

Woodcock nest in Alabama but such incidences are reported to be quite low. Wildlife researchers at the Auburn University Agricultural Experiment Station have begun to investigate the nesting activities of woodcock in Alabama and the findings have been surprising.

During the fall and winter of 1973-74, considerable effort was directed toward the study of courtship behavior and subsequent nesting and brood rearing activities of the woodcock in and around Lee County, Alabama. Courtship display began as early as December 14, 1973, and continued through the first of March, 1974. Nest construction and egg laying at the primary study area began as early as the first week of February. By April 1, 1974, more than 15 active nests or brood groups were found and studied on a study area smaller than 200 acres. Backdating hatching dates showed that 9 of the 15 clutches were completed between February 4 and 12. All nests observed contained 4 eggs each.

During the same time period in 1974 and 1975, three nests and 13 broods were located in Lee, Macon, and Choctaw counties. Game management officials at the Wheeler National Wildlife Refuge in the Tennessee Valley reported two nests and one woodcock brood during the last week of February, 1975.

Further investigations are in progress and the implication of the findings are important to the conservation and wise use of this renewable natural resource. At present, it appears that the woodcock is being hunted in Alabama during the first month of their nesting season. Several nests have been reported by local hunters who had killed or attempted to kill brooding females before they were aware the birds were nesting.

Several nests and broods were located in areas subject to application of prescribed burning programs for enhancement of bobwhite quail habitat. Nests and young broods would very likely be harmed by these burning programs which are geared to the reproductive cycle of quail and other common ground nesting birds of Alabama. It is also possible that traditional burning schedules designed to benefit quail, deer, and turkey will need to be altered where landowners are interested in the welfare of woodcock and further research should determine if changes are needed in the woodcock hunting season dates.

While wildlife researchers at Auburn are busy studying the biology of woodcock in Alabama, wingshooters in the State are reminded that the woodcock is a fine sporting bird, excellent table fare, and apparently quite abundant during late fall and winter.

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