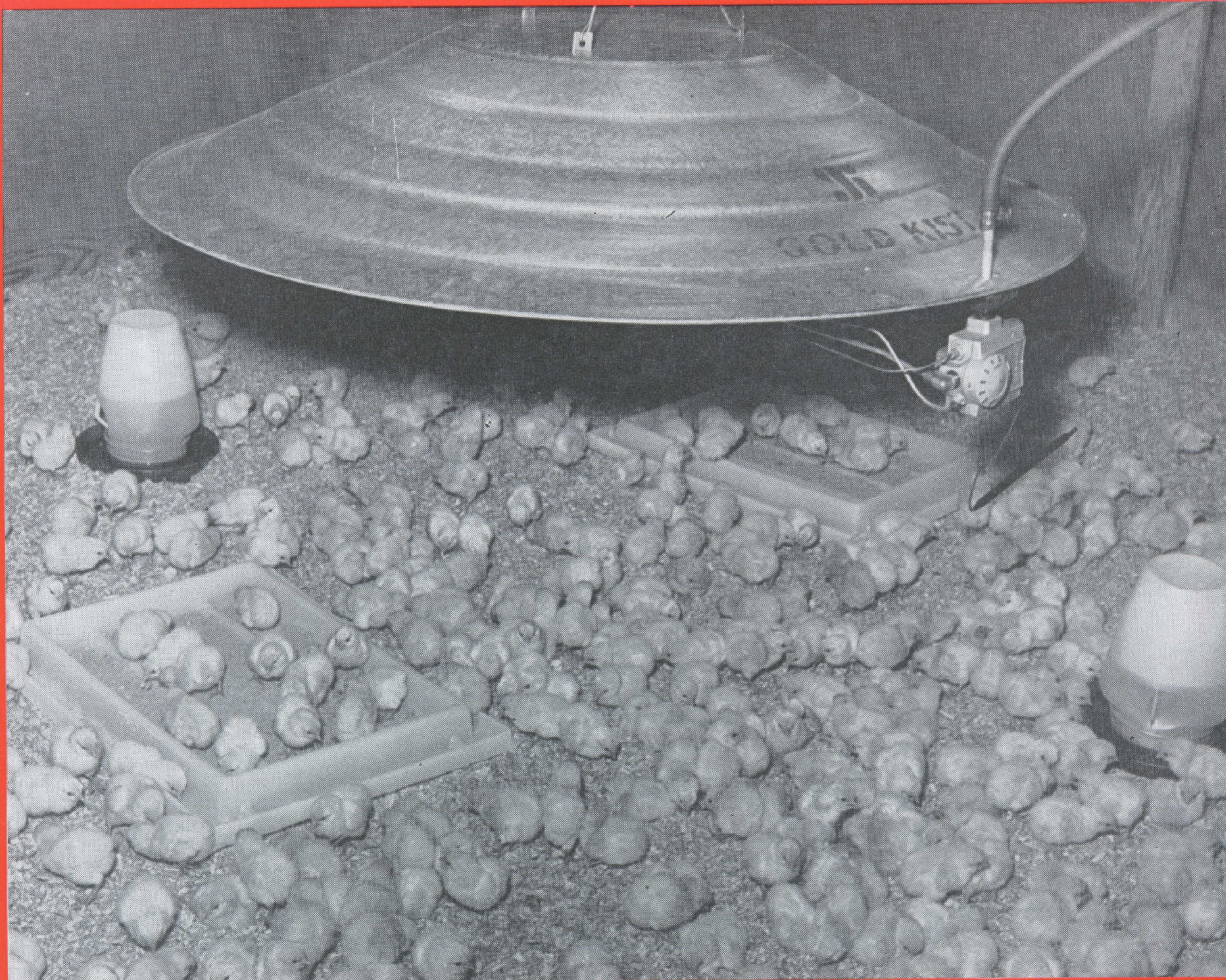

VOL. 21, NO. 3/FALL 1974

HIGHLIGHTS

of agricultural research

AGRICULTURAL EXPERIMENT STATION/AUBURN UNIVERSITY
R. Dennis Rouse, Director
Auburn, Alabama

DIRECTOR'S COMMENTS

SOIL, WATER, AND AIR are our most basic natural resources. The association of these components has made possible habitation of this planet by plants and animals, including man. How much can our basic resources be altered and yet maintain a healthy planet – for man?

R. DENNIS ROUSE

With the world population increasing at a rate of 70 million a year, or the equivalent of adding the population of the United States to the world every 3 years, surely we are on a collision course with depletion of our natural resources. Many decisions of National, State, and local policy must be made to ensure continued productivity.

If the population of the United States were to increase for the next 25 years at the same rate as the past 25 years, there would be need for doubling available goods and services. Can we imagine this occurring with anywhere near the standard of living that exists today? Can we continue to take productive agricultural land for highways, building sites, and many non-agricultural productive uses? We must find some way to keep good agricultural land available for food and fiber production and use good land management to meet current and future demands.

Most farmers, and most rural people, realize the value of good conservation practices. These people know that good fertile soils are not developed in a short time. We owe much to those who for years have talked and practiced conservation management of soil and water. Even so, their efforts have been insufficient and must be reinforced by better land use planning and implementation.

A basic concept of soil conservation is to use land for what it is best suited and in which use it will continue to be productive. To apply this practice requires an understanding of soil capability. Capability in land use planning requires a systematic classification of soils on which soil capability and interpretation for land-use can be based.

This nation began an effort many years ago through the Soil Conservation Service, U.S. Department of Agriculture, to complete soil surveys of all land. However, this agency requires collaboration within states from State Departments of Agriculture and Land Grant Universities. A soil survey is a service but also requires research support by State Agricultural Experiment Stations. The State Department of Agriculture and Industries, like the Soil Conservation Service, is recognized as the state service agency for agriculture in providing soil surveys of Alabama.

A county soil survey not only provides valuable information for conservation and use of proper crop, pasture, and forest land, but invaluable information for city planners, land developers, highway and sanitation engineers, and others concerned with the use of land.

In Alabama an effort to achieve a modern soil survey of every county began over 30 years ago. The process is tedious and has not received needed support to complete the job. A modern soil survey report has been published for 18 counties. Field work has been completed in nine counties and soil survey reports are in process of being completed. Ten other counties have active field survey work in progress. At the present level of support it will take another 20 years to complete survey reports in all 67 counties. With rapid industrial development, increasing need for production of food and fiber, and interest in land use legislation, I believe Alabamians should support an all-out effort to complete the soil survey of every county in Alabama within 10 years. This would require twice the total current financial support.

may we introduce . . .

Dr. Robert N. Brewer, senior author of the article on page 3, is associate professor of poultry science. His major research emphasis is on preventing and controlling disease of poultry, but he also carries out studies concerned with other phases of management. In the story on page 3, Brewer and associates report on experiments aimed at reducing energy requirements for broiler production, a critical need.

A native of Franklin County, Alabama, Brewer joined the Auburn faculty in 1967 upon completion of doctoral studies at University of Georgia. He received his B.S. in 1955 and M.S. in 1960 from Auburn University, and the Ph.D. was awarded by University of Georgia in 1968. His principal fields of specialization were poultry parasitology and pathology.

Brewer served as assistant county agent for the Alabama Cooperative Extension Service for 3 years and was poultry specialist for the Pillsbury Company for 4 years. He holds membership in Gamma Sigma Delta, Sigma Xi, and Kappa Delta Pi honoraries, and is a member of the Poultry Science Association.

HIGHLIGHTS of Agricultural Research

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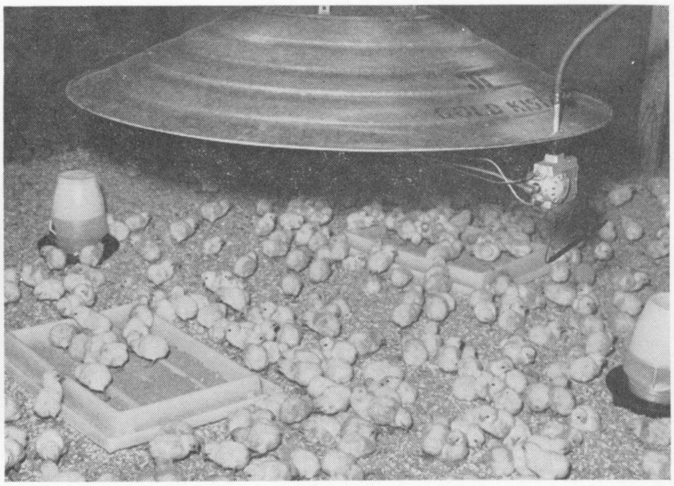
ON THE COVER. Reduced energy requirement for broiler production is possible, based on research reported on page 3.

Energy Savings in the Poultry House

R. N. BREWER, *Dept. of Poultry Science*
J. L. KOON and C. A. FLOOD, *Dept. of Agricultural Engineering*



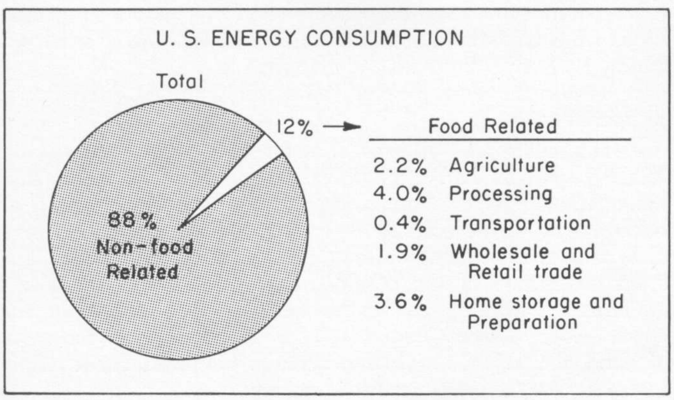
WHILE NATIONAL ENERGY CONSUMPTION continues its upward spiral, amount used in food production remains low in proportion to other sectors of the economy. Agriculture and related industries use only about 12% of the Nation's total energy, as shown by the graph. Actual agricultural production accounts for only 2.2%. Processing, transportation, and home use take the other 9.8%. These figures indicate real efficiency, in comparison with 20% required to heat and cool homes, and 25% for running automobiles and other transportation.

But energy is still an important and costly input to agriculture. Poultry producers are dependent on such fuels as electricity, liquid petroleum (LP) gas, and coal. Last winter's shortages and projected shortages of fuels were a source of alarm for members of Alabama's poultry industry, as were rapidly increasing fuel prices. These concerns created a strong interest in methods of conserving fuel to not only reduce expenses but to assure an uninterrupted supply.

Meeting the Challenge

A combination of basic research and field testing was used by Auburn University Agricultural Experiment Station in attacking the fuel economy problem. The aim was to cut energy use, but without depressing production efficiency. Production practices involving changes in housing, brooding equipment, and management were identified as having potential for savings in fuel requirements.

Housing. House construction and environmental control were reevaluated in efforts to get greatest efficiency of brooding and heating. Insulating roofs with high quality material having insulating value of at least 8 RU (resistive units) reduced heat loss from the building by approximately 25%. The full value of such insulation was realized only when air exchange and heat management were carefully controlled.



Brooding equipment. Preliminary work at Auburn has shown that improper management of LP gas brooders – the major type used in Alabama – can result in as much as 50% loss in heating efficiency. Thus, opportunities for savings are great. Clinics and training sessions were offered to teach correct care and maintenance of gas brooders for peak operating efficiency. Data is presently being collected on heat output and radiation efficiency of gas brooders in an attempt to improve performance of present systems.

Management practices. Keeping the risk of chronic respiratory disease and Mareks disease to a minimum permits use of certain management practices that help conserve fuel. One of these, a return to semi-cold room brooding, is accomplished by enclosing two or three brooders within a brooder guard to restrict movement of the chicks and keep them close to the heat. This method saves fuel by reducing the area to be heated. In a 3-week comparison of partial-house and whole-house brooding, one integrated firm in northern Alabama saved approximately 15% on fuel by using partial-house brooding. And this was in mild weather. Area to be heated was restricted by partitioning off about one-third of the broiler house with polyethylene film. Such a system requires more rigid management and some form of mechanical air exchange for protection of the chicks.

What Lies Ahead?

Best management of housing and equipment will be needed in the future so Alabama poultrymen can further reduce fuel use. Also needed are new techniques for utilization of present types of fuel, such as improved brooder design, construction, maintenance, and operation.

Alternative sources of cheap energy must be integrated with improved house design to minimize dependence on traditional fuels. Many people consider the sun to be the most promising permanent source of energy. Solar heating of buildings has been tried and proved, indicating that the sun might become the energy source that can assure an uninterrupted supply of poultry and eggs for the future. Plans are underway at Auburn to study the feasibility of using solar energy to heat poultry houses.

A conventional management system for beef cows was compared with two confined systems for a 5-year period at the Lower Coastal Plain Substation. At left is a group in confinement and at right is a group under conventional management.

CONFINED FEEDING of BEEF BROOD COWS

R. R. HARRIS and W. B. ANTHONY, *Dept. of Animal and Dairy Sciences*

V. L. BROWN, *Lower Coastal Plain Substation*

C. C. KING, *Dept. of Agronomy and Soils*

S. C. BELL, *Dept. of Agricultural Economics and Rural Sociology*

THE HIGHEST YIELDING forage crops are not usually efficiently utilized when grazed by beef cattle. Thus, some system other than grazing should be used for maximum benefits.

Confined feeding systems permit the rationing of nutrients to cows based on their requirements, and require less land than conventional systems. High crop yields and efficient cattle management can probably be combined more effectively in confined feeding programs than in conventional production systems.

Procedures

A conventional management system for beef cows was compared with two confined systems in each of 5 years at the Lower Coastal Plain Substation, Camden, Alabama.[1] Fifteen cows were assigned to each system. Hereford and Angus-Hereford crossbred cows were bred to performance-tested Hereford bulls. Cows in the conventional system were fed grass hay plus 2 lb. of cottonseed meal from November 1 to early spring. During the remainder of the year they grazed Coastal bermudagrass at the rate of 1 cow-calf unit per acre.

Cows and calves in the confined groups were restricted to 3-acre wasteland areas in which they were either fed intermediate type (NK-300) sorghum silage or Coastal bermudagrass hay as their major feedstuff. Protein supplement was fed in amounts calculated to satisfy the protein needs of these confined cows. Calves in the two confined groups were given a blended creep mixture but those in the conventional group were not creep-fed.

All crops used in the study received lime and mineral fertilizer according to soil test recommendations for maximum production. The 15 acres of Coastal bermudagrass assigned to the conventional system were divided into three pastures of about equal size and grazed rotationally. Surplus forage was removed as hay. These Coastal swards, which were utilized both for grazing and hay, received 200 lb. of N annually. Another area of Coastal which produced hay that was fed to one of the confined groups got 400 lb. of N per acre. All N was applied in split applications.

Results

Coastal managed for both grazing and hay produced an average of 1.7 tons of hay per acre annually during the 5-year study, in addition to providing grazing for 1 cow-calf unit. Coastal managed solely for hay yielded an average of 7.5 tons per acre and sorghum silage production averaged 17.2 tons (35% DM) per acre during the 5-year experiment.

One acre of established Coastal fertilized with 200 lb. of N provided grazing and hay for 1 cow-calf unit annually using conventional management. One acre of land devoted to production of an intermediate type sorghum silage or Coastal for hay supported 1.34 and 1.74 cow-calf units, respectively. A cow unit confined to a wasteland area the year around required 12.8 tons of sorghum silage or 4.3 tons of Coastal hay annually when these feedstuffs were the major source of energy.

Confined cows fed sorghum silage and protein supplement weaned calves weighing 551 lb., compared with 511 lb. for calves from dams fed Coastal hay in confinement. Calves from conventionally-managed cows weighed 453 lb. at weaning. Calves from confined-fed cows consumed 1,422 lb. of blended creep feed per head, whereas those from the conventional system were not creep-fed. As indicated by slaughter grades, calves from cows in confinement were fatter at weaning than those from cows in the conventional system (low Choice vs. average Good). Percentages of calves weaned were 92, 88, and 84 for the conventional, silage-fed, and hay-fed cows, respectively.

The costs and returns showed that both confinement feeding systems had a negative return to land, labor, and management. When comparing the total cost per pound of beef produced, the confinement systems were more expensive than the conventional system ($.30, $.34 vs. $.26). The main advantage of the confinement systems was the lower amount of land required to furnish sufficient forage for the cows (0.58, 0.75 vs. 0.94 acres/cow-calf unit.) As the price of land increases, the lower acreage required for confinement feeding becomes more important.

[1] For detailed reports of this study see Agricultural Experiment Station Bulletins 411 and 428.

Nematodes Cut Fescue Yield on Sandy Soils

C. S. HOVELAND, C. D. BERRY*, and R. F. McCORMICK, JR., *Department of Agronomy and Soils*
R. RODRIGUEZ-KABANA, *Department of Botany and Microbiology*

EVIDENCE THAT NEMATODES are now attacking tall fescue is bad news for Alabama farmers who rely on this productive pasture grass. And there are a lot of cattlemen to be alarmed over this news, since Alabama has about a million acres of fescue.

Damage from nematodes showed up as reduced yields on light textured soils. Treating with soil sterilants or nematicides increased forage production on infested soils, but the treatment was not economical. Thus, the search goes on for a method of dealing with this new problem.

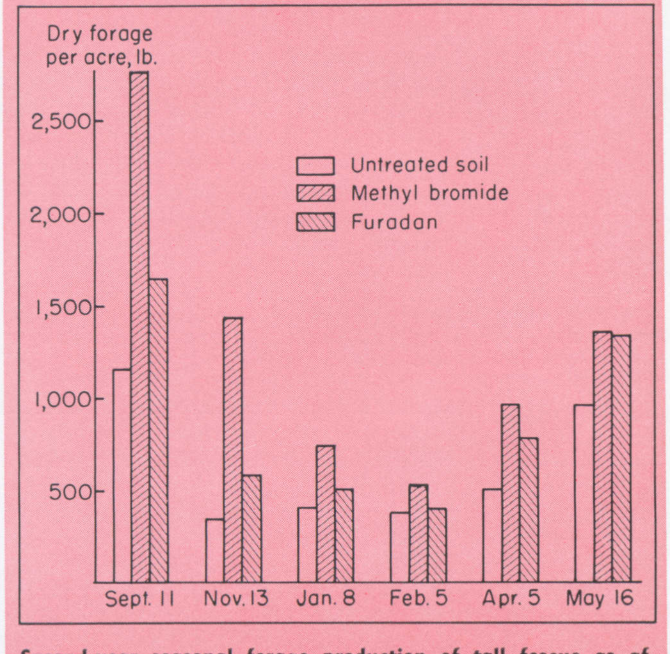
Nematode Effect Studied

Effect of nematodes was studied at the Plant Breeding Unit, Tallassee. Kentucky 31 fescue was planted September 1972 on Augusta fine sandy loam soil that had received three treatments for comparison: (1) treated with methyl bromide, (2) treated with Furadan nematicide, and (3) left untreated.

The grass got 200 lb. of nitrogen annually, split into four applications. Forage was harvested at 4- to 8-week intervals over a 2-year period. Nematode populations in the soil were measured at three dates.

Plots treated with methyl bromide made highest yield the establishment year. Even more significant, autumn production the second year was nearly three times that on untreated soil, as shown by the graph. Autumn production is important because this growth is vital for winter grazing.

Differences among treatments were less in winter when cold reduced all growth and in spring when soil moisture was abundant. Furadan was less effective than methyl bromide, but still resulted in substantial increases in forage yield over untreated soil.



Second-year seasonal forage production of tall fescue as affected by soil treatment the establishment year.

Culprits Identified

Soil nematodes are probably responsible for most of the yield losses on untreated soil, and stubby root and stunt species were identified as the culprits. Soil populations of these were still greatly reduced 19 months after treatment with Furadan (April 1974), as shown below:

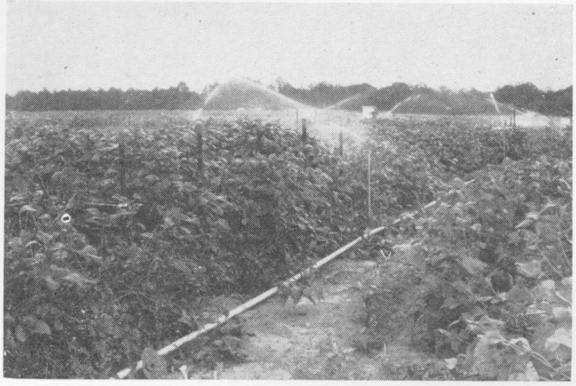
Treatment/acre	*Nematodes/450 ml. soil*	
	Stubby root	*Stunt*
Untreated	160	35
Furadan 10G, 5 lb.	50	8

Lance nematodes were also present, but populations remained relatively unaffected by the treatment.

Nematodes destroyed much of the tall fescue root system on untreated soil. Dry weights of roots per 5-in. core dug in December 1973 were 5.6, 1.7, and 1.2 g., respectively, for methyl bromide, Furadan, and untreated plots. Plants with reduced root systems were unable to use water and nutrients at depths beyond 3 to 4 in. Thus, nematode attacks made fescue more susceptible to fall drought, resulting in some stand reductions.

Although these results show that nematodes can sharply reduce forage yield, treating tall fescue with methyl bromide or a nematicide is not economical at present. The best bet is to restrict new plantings to loam or clay soils where nematodes are less prevalent. If nematode-resistant fescue plants can be found, it may be possible to breed resistant varieties that are adapted to sandy soils.

* Now Manager, Sorghum Research, Cargill, Inc., Lubbock, Texas.



Little soybean acreage in Alabama is irrigated. Here is one irrigation system in use.

WHAT ABOUT IRRIGATION for SOYBEANS?

HOWARD T. ROGERS and D. L. THURLOW
Department of Agronomy and Soils
B. D. DOSS, *Coop. ARS, USDA*

A SMALL ACREAGE of soybeans is irrigated in the Southeast. However, this crop has been grown under irrigation in some regions of the U.S. for many years using water from wells. Developments could change the prospect for irrigation of soybeans in the Southeast, a region of plentiful water resources.

In the past, a soybean/corn price ratio of about 3 to 1 has favored planting corn in the Midwest Corn Belt. During 1965-73, the price ratio averaged about 2.5 to 1. A large expansion of soybean acreage took place in the Southeast during this period. Higher prices for beans extended plantings to drouthy, upland soils not well adapted to the crop.

Several experiments were conducted in recent years to measure response of soybeans to irrigation on upland soils.

Irrigated soybeans, as a double crop after small grain, at Auburn, produced 44 to 50 bu. per acre in 5 of 6 years (1967-72) with a 6-year average increase of 34% for small amounts of supplemental irrigation, Table 1. Largest increase for irrigation in this experiment on Dothan sandy loam was 20 bu., or 80%, in 1970. An average increase of 10 bu. was obtained from the application of less than 3 in. of water. Soybeans were double-cropped after wheat for grain and rotated with cotton.

Another experiment at Auburn was designed to compare the irrigation response of seven soybean varieties of widely varying maturities planted at three different dates. A top yield of 62 bu. per acre was produced under irrigation in 1973, first year of the experiment. This was an extremely dry year at Auburn with less than 1 in. of rain between August 17 and September 27.

Levels of Irrigation and Critical Period

Three levels of irrigation were compared for Bragg and Hampton beans in 24- and 36-inch rows at three plant populations on Lucedale sandy loam at Thorsby, Table 2. Severe lodging in the furrow-irrigated beans reduced the potential for high yields regardless of row width or plant population. In spite of lodging, however, irrigation increased yields 10 to 18 bu. per acre 2 of 3 years (1968-70). A moderate level of irrigation produced as many beans as a high level in 1968 and 1970.

In another 3-year experiment on this soil, field plot covers were used to control rainfall, and water stress was imposed on plants at various stages of growth to determine the critical period for irrigating soybeans for maximum yields. The pod-fill stage, from about August 15 to September 20 for Bragg soybeans at Thorsby, was the critical time for adequate water. Withholding water for 10 days during late pod-fill to keep field capacity of the soil below 10%, with adequate water the rest of the season, reduced average bean yields about 11 bu.

Conclusions

When soybeans are double-cropped with small grain, soil moisture frequently limits the acreage that can be planted to soybeans. Irrigation would assure a stand of beans in a double-cropping system. Whether this would be practical on a given farm would depend on such factors as field layout and water source. Most years, the same irrigation system could be used for cotton and soybeans on upland soils in central Alabama, with priority given to cotton. From the standpoint of timing and crop needs, dual use of irrigation equipment on corn and soybeans also would appear practical, especially for medium- to late-maturing soybeans.

TABLE 1. RESPONSE OF BRAGG SOYBEANS TO SPRINKLER IRRIGATION WHEN PLANTED AS A DOUBLE CROP AFTER WHEAT ON DOTHAN SANDY LOAM, AUBURN, 1967-72

Year	Rainfall 8/20-9/23[1]	Water applied	Yield per acre		Increase from irrigation
			Not irrigated	Irrigated	
	In.	*In.*	*Bu.*	*Bu.*	*Pct.*
1967	10.5	2.0	49	50	2
1968	1.7	3.0	30	44	47
1969	8.0	2.3	41	45	10
1970	3.1	3.0	25	45	80
1971	4.4	1.5	26	32	23
1972	3.7	4.5	32	46	42
Six-year average		2.7	34	44	30

[1] Twenty-six year average rainfall for this period is 3.9 in.

TABLE 2. AVERAGE RESPONSE TO FURROW IRRIGATION OF BRAGG AND HAMPTON SOYBEANS PLANTED AT TWO ROW WIDTHS AND THREE PLANT POPULATIONS, LUCEDALE SANDY LOAM, THORSBY, ALABAMA, 1968-70[1]

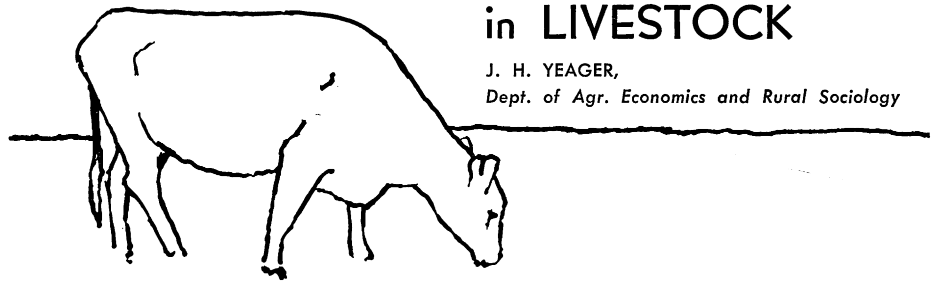
Year	Rainfall 8/11-9/20[2]	Yield per acre		
		No irrigation	Moderate level of irrigation[3]	High level of irrigation[3]
	In	*Bu.*	*Bu.*	*Bu.*
1968	5.2	25.6	35.2	35.2
1969	4.5	30.6	45.1	49.2
1970	6.2	36.6	39.5	40.6

[1] Data reported for 1969 are for Bragg variety only because of poor stands of Hampton. Row widths were 24 and 36 in. Populations were 44,000, 87,000, and 131,000 plants per acre.

[2] Average rainfall for this period and location is 5.6 in.

[3] Soil moisture was maintained above 30 and 70% of field capacity for "moderate" and "high" levels, respectively.

We've COME a LONG WAY in LIVESTOCK



J. H. YEAGER,
Dept. of Agr. Economics and Rural Sociology

A DRAMATIC CHANGE in Alabama agriculture in the past 50 years has been the development of the livestock industry.

Alabama has made rapid strides in number of livestock on farms, production, marketing, and in cash receipts.

Increases in number of head of livestock on farms and production have not been without economic significance. Farm income has increased as a result of increased production and marketings. Farm labor has been utilized more fully throughout the year. Land that might not have been utilized to its best advantage has been developed in forage and other crops sold through livestock.

Development of Alabama's livestock industry has meant greater capital investments and increased credit needs, as well as providing opportunities for many agribusinesses in the State. Businesses that supply feeds, medical and veterinary supplies, and fencing materials, and those that provide for livestock marketing, meat processing, handling, and distribution have resulted from livestock advances.

Cattle

On January 1, 1974, Alabama had 2,240,000 head of all cattle on farms, according to the Cooperative Crop and Livestock Reporting Service, Montgomery, Alabama, Table 1. Cattle numbers have more than doubled since the late 1940's. Although the years shown in the table exhibit a continuous increase, there have been years in which cattle numbers declined, the last being 1969. The last major decline was in 1956.

Almost half (48%) of the total cattle on Alabama farms January 1, 1974, were beef cows and heifers that had calved. This compared with about 34% for the U.S. Only 5% of Alabama's total cattle were milk cows, compared to 9% for the U.S. Second largest category of Alabama cattle was calves less than 500 lb. in weight, which comprised 25% of the total number. Heifers, steers, and bulls of 500 lb. and over accounted for the remaining 22% of all cattle.

Milk cows on Alabama farms have declined continuously, dropping from 440,000 head in 1954 to 110,000 in 1974. The greatest number of milk cows on farm was 471,000 in 1945. A 50% decline has occurred since 1964. In spite of the decline, cash receipts from sale of milk and cream have increased continuously since 1962. A major part of this increase resulted from increased milk production per cow.

Production and marketings of Alabama cattle and calves have increased substantially over the years with total weight marketed in 1973, excluding inter-farm sales, being almost four times the amount in 1940. Cash receipts in 1973 were almost 33 times the dollar amount for 1940. Alabama farmers received an average price of $52.50 per cwt. for calves and $41.60 per cwt. for cattle in 1973, a record year of sales.

A gross measure of beef production per head is obtained by dividing total production by number of head on farms. Pounds of beef produced by this measure have increased from slightly less than 200 lb. per head in 1950 to more than 300 lb. per head in 1973.

Swine

Number of hogs and pigs on farms has not shown the strong trend increase as cattle, Table 2. In fact, declines have occurred each year since 1970. Since 1867, the number of hogs and pigs on farms has fluctuated between a low of 706,000 head in 1965 and a high of 1,640,000 in 1898.

Production of hogs in Alabama has increased since 1965, with the exception of declines in 1972 and 1973. The all-time high in marketings of hogs was in 1971 when 329,175,000 lb. were sold. A significant change has been the difference in annual production and marketings of hogs, largely accounted for by hogs slaughtered on farms. In 1931, the number of hogs slaughtered on farms was almost 10 times the number sold. In 1973, only 44,000 hogs were slaughtered on farms compared with 1,288,000 head marketed.

Cash receipts from the sale of hogs have increased since 1963 with the exception of 3 years. Average price per cwt. of $37.10 in 1973 was an all-time high from hogs. The lowest annual average price received by farmers was $3.25 per cwt. in 1933.

TABLE 2. HOG NUMBERS, PRODUCTION, MARKETINGS, PRICES RECEIVED, AND CASH RECEIPTS, ALABAMA, SELECTED YEARS

Year	No. hogs and pigs on farms	Production	Marketings	Price received	Cash receipts
	Thous.	*Thous. lb.*	*Thous. lb.*	*Dol./cwt.*	*Thous. dol.*
1930	845	126,795	16,120	7.90	2,782
1940	1,267	184,495	79,740	5.00	5,170
1950	1,225	303,821	194,431	17.50	37,608
1960	1,144	278,583	253,753	15.00	38,224
1970	1,110	332,081	294,854	22.20	65,458
1973	960	287,069	272,539	37.10	101,112

TABLE 1. CATTLE NUMBERS, MARKETINGS, PRICES RECEIVED, AND CASH RECEIPTS, ALABAMA, SELECTED YEARS

Year	No. head on farms		Cattle and calves				Milk and cream cash receipts
	All cattle	Milk cows	Marketings	Price received: Cattle	Price received: Calves	Cash receipts	
	Thous.	*Thous.*	*Thous. lb.*	*Dol./cwt.*	*Dol./cwt.*	*Thous. dol.*	*Thous. dol.*
1930	830	379	61,425	5.50	6.20	3,656	8,798
1940	1,024	397	140,400	5.10	7.10	7,605	7,942
1950	1,239	395	172,200	20.20	22.60	37,019	25,705
1960	1,656	270	467,320	17.50	20.30	85,274	38,123
1970	1,953	131	549,090	26.10	33.40	156,187	52,544
1973	2,112	115	551,473	41.60	52.50	248,636	67,032
1974	2,240	110	------	----	----	------	------

The Leaf Surface and Resistance to Fungal Disease

JOHN D. WEETE
Department of Botany and Microbiology

PLANT SCIENTISTS are becoming increasingly aware that the physical and chemical nature of plant-leaf surfaces may afford natural protection against fungal diseases. It is well known that leaf surfaces are covered with an amorphous, noncellular layer called the cuticle which is composed of a substance, cutin. Impregnated in and coated on the cuticular surface is an epicuticular wax. This wax varies from a smooth coating to wax projections, depending on the species of plant, organ of the plant, age of plant part, and environmental conditions.

The epicuticular wax, as the name implies, is composed of a complex mixture of mostly water-insoluble substances (lipids) made up principally of hydrocarbons, waxy esters (long-chain fatty acids plus fatty alcohols), and long chain ketones. These lipids are usually accompanied by a variety of compounds, some water-soluble and in low relative proportions. Components of the wax are produced by the underlying epidermal layer of cells and are extruded through the cuticle onto the leaf surface by a mechanism that has not been clearly established.

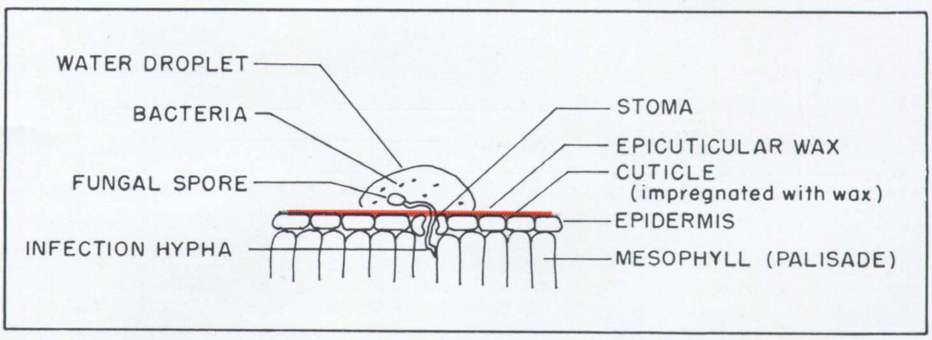
One of the most important functions of epicuticular wax is the control of water-balance within the plant. The hydrophobic (water-repellent) layer of waxy substances provides resistance to the loss of water by evaporation from the leaf surface. When plants are grown under conditions unfavorable (low light intensity, high humidity, etc.) for wax formation and deposition, or if the wax is artifically removed, the cuticle alone offers considerably less resistance to water loss. Other functions of epicuticular wax include protection of underlying tissue against mechanical damage and reducing radiation injury by filtering out ultraviolet light.

The chemical and physical nature of epicuticular wax is particularly significant from the standpoint of natural disease resistance. This wax provides the outermost barrier that invading leaf pathogens must encounter prior to infection. Invasion of a leaf by parasitic fungi usually requires at least short periods of high atmospheric moisture levels. Water remaining on a leaf surface after a rainfall or condensing there from the atmosphere, forms droplets due to the water-repellent nature of the epicuticular wax. These water droplets contain fungal spores, pollen, and bacteria originally present on the leaf surface or trapped from the atmosphere. Most of the microorganisms on the leaf surface are saprophytic (non-pathogenic), and some may be pathogens. The water droplets also contain inorganic and organic substances released from the leaf and from microbes present. The inorganic and some of the organic substances such as organic acids, vitamins, sugars, and growth hormones provide a natural nutrient medium for the germination of fungal spores and for growth of bacteria in the water droplets. Competition for the available nutrients occurs between the fungi and bacteria and, in the case of pathogenic fungi, this competition may significantly influence infection and the incidence of foliar damage. When conditions are favorable the infection process may proceed as illustrated in the Figure. Spores germinate in water droplets, producing infection hyphae that grow toward the stomata (microscopic pores) in the leaf surface where they enter the plant and initiate the disease syndrome.

Not all substances from the epicuticular wax are stimulatory to microbial activity; some plants contain fungitoxic substances that diffuse into the water droplets and inhibit spore germination or development of certain fungi. The leaf surface wax of certain varieties of apple, beet, *Gingko biloba*, broad bean, and others are known to contain substances toxic to some fungi. Although very few of these inhibitory substances have been identified, they are generally believed to be associated with the water-soluble constituents of the wax, rather than the water-insoluble lipids. Plants that produce such diffusable substances possess at least partial immunity or natural resistance to infection by certain potentially pathogenic fungi.

Physical factors such as wettability and leaf surface roughness, which affect the contact areas of the water droplets, may also influence the degree of infection by fungi.

While some plants seem to have resistant factors associated with their epicuticular wax, it is apparent that many of our important crop plants do not possess sufficient natural immunity, and enormous economic losses from disease result annually. In order to fully explore the potential of the leaf surface wax to prevent or reduce fungal infection, research emphasis is needed in the following areas: (1) screening species and varieties of plants related to disease susceptible economic crops for fungi toxic substances in leaf surface waxes, (2) identify leaf-surface inhibitors and study their formation, (3) determine the mechanisms and factors that affect the translocation of these substances from the leaf cells to the epicuticular wax, (4) determine the genetic factors related to the production of antifungal substances and, (5) establish breeding programs to select for natural resistance related to the epicuticular wax. Several of these areas, particularly the identification of leaf surface waxes and fungitoxic substances, are presently under laboratory investigation by the author.



Shown here is the process of infection of a leaf by a pathogenic fungus.

Economics of Large Round-Bale Systems vs. Conventional Bale System

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W. B. ANTHONY, *Department of Animal and Dairy Sciences*
L. A. SMITH, *Black Belt Substation*

TESTS WERE CONDUCTED during 1972-73 at the Black Belt Substation comparing conventional bale and large-round bale systems of harvesting and feeding hay.

Results from time and motion studies made by the Agricultural Engineering Department determined physical performance. Cost information on equipment was obtained from manufacturers and machinery dealers. Feeding trials and analysis were done by the Department of Animal and Dairy Sciences and the Black Belt Substation. Budgets were prepared by the Department of Agricultural Economics and Rural Sociology for the following three harvest and feeding systems:

System I – New Holland 277 baler producing conventional bales; New Holland 1047 Stackcruiser for hauling conventional bales to storage; pickup truck used for feeding once a day; no panels.

System II – Vermeer 605 baler producing large-round bales; front end loader and pickup truck for hauling round bales to storage; front end loader and pickup truck for feeding free choice; no panels.

System III – Same as System II but using panels around bales to help control hay waste.

Total costs per ton harvested and fed were computed for assumed average amounts of hay harvested per year ranging from 250 tons to 2,000 tons, Table 1. These costs were based on budgets for the Black Belt Substation, which harvests approximately 500 tons of hay per year and modified for various assumed tons per year. The total hay cost included all costs of machinery, labor, and other costs in producing, harvesting, storing, and feeding. It *did not* consider losses from feeding or by spoilage. These data show that total hay cost per ton harvested and fed was cheaper for System II, the large-round bale system without panels, than for the other two systems. The conventional bale system had the highest cost per ton in this test. However, cost data from Table 1 do not include hay utilization – only the costs involved in getting hay to the animal.

The total feed costs per hundredweight gain are presented in Table 2. These data include hay costs and other feed costs, such as corn and cottonseed meal, and *do* consider losses from feeding and by spoilage.

Data in Table 2 indicate a distinct advantage in total costs per hundredweight gain for System III, the large-round bale system with panels. System I, the conventional bale system, was second in cost and System II, the round bale system without panels, had the highest cost. The relative costs per hundredweight of gain occur in the same order as efficiency of feeding. Excessive hay wastage in System II resulted in poorer utilization and the highest cost per hundredweight gain in spite of the fact that it was the lowest cost system in terms of only costs of harvesting and feeding.

TABLE 1. ESTIMATED HARVESTING AND FEEDING COSTS PER TON HARVESTED FOR THREE SYSTEMS OF HANDLING HAY, BLACK BELT SUBSTATION, 1972-73

Item	Cost per unit when average tons harvested/yr. are			
	250	500	1,000	2,000
System I. NH 277 baler; NH 1047 Stackcruiser to storage; pickup for feeding on sod				
NH 1469 Haybine	$ 4.12	$ 2.56	$ 1.79	$ 1.40
Massey Ferguson rake	1.94	1.45	1.21	1.09
NH 277 baler	3.86	2.68	2.08	1.79
NH 1047 Stackcruiser	7.15	4.15	2.64	1.89
Fencing	.04	.04	.04	.04
Tarps and tie-downs	.73	.73	.73	.73
Pickup truck	.73	.73	.73	.73
Hauling and feeding labor	2.34	2.34	2.34	2.34
Total harvesting & feeding costs	$20.91	$14.68	$11.56	$10.01
Growing costs	9.00	9.00	9.00	9.00
Total hay costs	$29.91	$23.68	$20.56	$19.01
System II. 605 Vermeer baler; front end loader; pickup for feeding; no panels				
NH 1469 Haybine	$ 4.12	$ 2.56	$ 1.79	$ 1.40
Massey Ferguson rake	1.94	1.45	1.21	1.09
Vermeer 605 baler	4.18	2.84	2.16	1.83
Tractor w/front end loader	1.77	1.77	1.77	1.77
Pickup truck	.58	.58	.58	.58
Hauling and feeding labor	1.97	1.97	1.97	1.97
Total harvesting & feeding costs	$14.56	$11.17	$ 9.48	$ 8.64
Growing costs	9.00	9.00	9.00	9.00
Total hay costs	$23.56	$20.17	$18.48	$17.64
System III. 605 Vermeer baler, front end loader to storage, pickup for feeding, panels				
NH 1469 Haybine	$ 4.12	$ 2.56	$ 1.79	$ 1.40
Massey Ferguson rake	1.94	1.45	1.21	1.09
Vermeer 605 baler	4.18	2.84	2.16	1.83
Tractor w/front end loader	2.40	2.40	2.40	2.40
Pickup truck	.70	.70	.70	.70
Panels	.42	.42	.42	.42
Hauling and feeding	2.77	2.77	2.77	2.77
Total harvesting & feeding costs	$16.53	$13.14	$11.45	$10.61
Growing costs	9.00	9.00	9.00	9.00
Total hay costs	$25.53	$22.14	$20.45	$19.61

TABLE 2. TOTAL FEED COST PER HUNDREDWEIGHT GAIN FOR THREE SYSTEMS OF HANDLING HAY, BLACK BELT SUBSTATION, 1972-73

Item	Cost per unit when average tons harvested/yr. are			
	250	500	1,000	2,000
System I. NH 277 baler, 1047 Stackcruiser, pickup for feeding on sod				
Hay cost per cwt. gain	$16.14	$12.78	$11.09	$10.26
Other feed cost per cwt. gain	14.09	14.09	14.09	14.09
Total feed cost per cwt. gain	$30.23	$26.87	$25.18	$24.35
System II. 605 Vermeer baler, front end loader, pickup for feeding, no panels				
Hay cost per cwt. gain	$20.70	$17.72	$16.24	$15.50
Other feed cost per cwt. gain	11.56	11.56	11.56	11.56
Total feed cost per cwt. gain	$32.26	$29.28	$27.80	$27.36
System III. Vermeer 605 baler, front end loader, pickup for feeding, panels				
Hay cost per cwt. gain	$12.93	$11.21	$10.36	$ 9.93
Other feed cost per cwt. gain	10.37	10.37	10.37	10.37
Total feed cost per cwt. gain	$23.30	$21.58	$20.73	$20.30

Effects of Sodium Azide On White Mold Sclerotia

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SOIL-APPLIED pesticides may affect propagule germination, growth, and reproductive processes of plant parasitic fungi. Understanding such effects is essential for formulating and developing disease control measures.

A previous publication (Highlights Vol. 20, No. 2, Summer 1973) described the value of azides for controlling white mold (Southern blight) in peanuts. The causal fungus, *Sclerotium rolfsii*, may build up inoculum and survive over winter (or longer) in two ways: by production of numerous, tiny, seed-like propagules (sclerotia) which resist adverse soil conditions and germinate in summer to infect host plants, or by colonizing organic debris as a saprophyte until conditions are favorable for continued growth and infection of plants.

In support of field research studies, laboratory tests were initiated in the Department of Botany and Microbiology to determine precise effects of various sodium azide (NaN_3) levels on general soil fungal populations, germination of sclerotia, and subsequent production of new sclerotia.

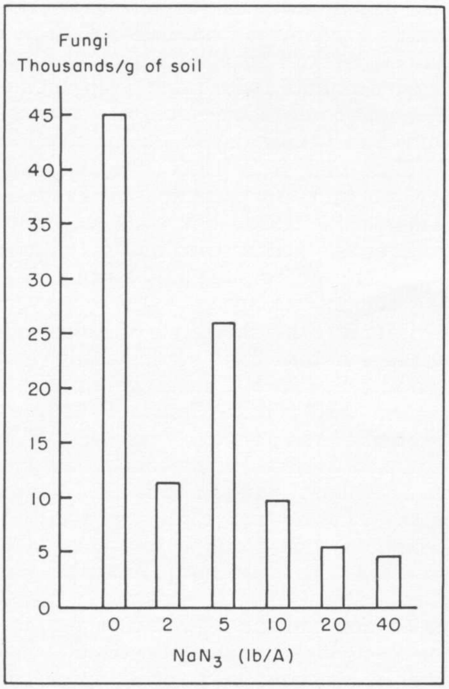

FIG. 1. Effects of sodium azide on populations of soil fungi 3 days after treatment.

Soil used in these tests was a sandy loam collected from a field annually cropped to peanuts at the Wiregrass Substation. Natural sclerotia of *Sclerotium rolfsii* were collected from soil around diseased plants in the same area and stored dry in glass vials. In one test where uncontaminated laboratory sclerotia were used, these were produced by culturing the pathogen in flasks of sterilized peanut field soil.

First, a test was designed simply to provide an indication of the effect of azide on the general population of soil fungi. Azide was applied to flasks of field soil at levels equivalent to 0, 2, 5, 10, 20, and 40 lb. active material per acre. After incubation periods of 0, 3, and 5 days, fungal populations were assessed by a standard soil dilution-plate count technique. In a second test, both field-collected and laboratory-grown sclerotia were placed on the surface of azide-treated field soil (0-40 lb./A. equiv.) in petri dishes and percentage germination recorded at intervals during incubation. Finally, the effect of azide on production of new sclerotia was determined in flasks of sterilized soil, which had been recontaminated with various minute quantities of non-sterilized soil, then inoculated with *Sclerotium rolfsii*. This was included to indicate the influence of the general microbial population on azide effectiveness. The sclerotia when mature (about 30 days), were screened from the soil and counted.

The severe inhibitory effect of NaN_3 on soil fungi in general is evident in Fig. 1. All levels of azide tested had greatly reduced fungal populations 3 days after treatment.

The appearance of germinating sclerotia on soil and the inhibitory effect of a relatively low level of azide treatment are shown in Fig. 2. The effect of azide concentrations equivalent to 1-40 lb./A. was similar for both field-collected and laboratory cultured sclerotia. Germination percentage decreased sharply with increased azide level (Table), and no germination occurred in treatments above 5 lb./A. Time also is an important factor. Note that in all cases sclerotial germination increased between 2 and 7 days after placing on the soil. Thus, azide levels below 5 lb./A. tend to delay rather than prevent germination, suggesting a fungistatic rather than fungicidal effect.

While testing sclerotial germination, it was observed that numbers of new sclerotia produced on the soil plates also varied with azide treatments. Further study revealed that very low levels of azide (0.5-2 lb./A.) inhibit sclerotial formation, and this effect is magnified by the population density of the natural soil microflora. Azide was extremely effective in natural soil and became less effective as the soil microbial population was progressively reduced.

Sodium azide has a broad spectrum inhibitory effect on soil fungi, and specifically inhibits germination and production of white mold sclerotia at low treatment levels. This suggests a potential influence on inoculum density and survival of the pathogen in crops where azides have been used successfully to reduce white mold disease. The influence of other soil microorganisms on the effectiveness of azides deserves further experimental consideration.

TABLE. PERCENTAGE GERMINATION OF FIELD COLLECTED SCLEROTIA AND LABORATORY GROWN SCLEROTIA OF WHITE MOLD FUNGUS 2 AND 7 DAYS AFTER PLACING ON AZIDE-TREATED NATURAL SOIL

NaN_3 conc. (equiv. lb./A.)	Field sclerotia		Laboratory sclerotia	
	2 days	7 days	2 days	7 days
0	95	97	100	100
1	84	91	84	98
2	61	86	5	87
5	0	3	0	15
10	0	0	0	0

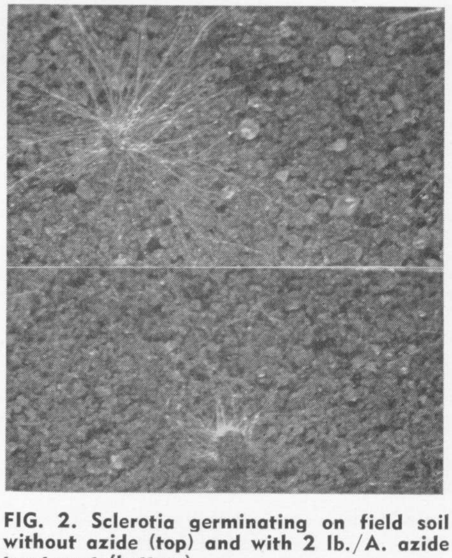

FIG. 2. Sclerotia germinating on field soil without azide (top) and with 2 lb./A. azide treatment (bottom).

Irrigate but Don't Cut for Hay – Route to Top Interstate Seed Yields

HOMER C. ADAMSON[1] and E. D. DONNELLY, *Dept. of Agronomy and Soils*

DEMAND FOR SEED of Interstate sericea lespedeza is running far ahead of supply. This variety, developed at Auburn University Agricultural Experiment Station, is adapted for use on highway rights-of-way where it provides an attractive cover. Its popularity has created a good seed market, but supply has not met demand.

Interstate is a good seed producer, but correct cultural practices are necessary for top production. Auburn research results show that it should be planted broadcast, *not* cut for hay, and irrigated unless rainfall is well distributed throughout the growing season.

Effects of irrigation and hay cutting on seed yields of this summer legume were learned on 5-year-old stands on Lucedale fine sandy loam soil at the Foundation Seed Stocks Farm, Thorsby. Replicated plots in broadcast and 27-in. rows were used for each irrigation and cutting treatment. Seed were combined in October each year (1971 and 1972) from 20 x 150-ft. plots of these treatments: (1) no hay cutting, irrigated; (2) hay cut once when 12-15 in. tall, irrigated; (3) no hay cutting, not irrigated; and (4) hay cut once when 12-15 in. tall, not irrigated.

Irrigation was done to maintain a 50% available moisture level during August and September. At field capacity, average available water per foot of soil was 1.2 in. Water loss under sericea is about 0.2 in. per day on this soil type. Thus, when brought to field capacity by rainfall or irrigation, moisture is sufficient for about 6 days. At that time, supplemental irrigation would be added if there had been no rain during the 6 days.

Rainfall was well distributed in 1971. As a result, there was no yield increase from irrigation on either broadcast or wide-row sericea. It was a different story in 1972, however, when summer rainfall was limited, Figure 1. Irrigation in August and September gave a 74% seed increase in uncut broadcast sericea – going from 431 lb. to 748 lb. per acre. Drought like that of 1972 can be expected in 5 of 10 years in central Alabama,[2] so such increases would not be rare occurrences.

Broadcast sericea generally made higher yields than wide-row sericea, Figure 2, probably because of less weed competition. Even without irrigation, uncut broadcast stands averaged 645 lb. of cleaned seed per acre (860 lb. in 1971 and 431 lb. in 1972).

Cutting hay in May reduced seed yields a whopping 55% on broadcast sericea in 1972. All uncut treatments in Figure 2 averaged 750 lb. of combine-harvested seed, as compared with 340 lb. for all cutting treatments. The hay cutting produced about 3,000 lb. of hay per acre. The hay would be worth about $45 per acre, but $250 worth of seed were sacrificed to get it.

A lot of seed are lost in combine harvesting, according to comparisons of hand and combine harvesting. Hand harvesting of nonirrigated, uncut, broadcast sericea yielded 620 lb. of hulled cleaned seed. The combine harvested only 431 lb. per acre. Thus, only 69% of seed produced were harvested.

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[2] WARD, HENRY S., C. H. M. VAN BAVEL, J. T. COPE, JR., L. M. WARE AND HERMAN BOWER. 1959. Agricultural Drought in Alabama. Auburn Univ. (Ala.) Agr. Exp. Sta. Bull. 316.

FIG. 1. Rainfall and irrigation, July-seed harvest, 1972.

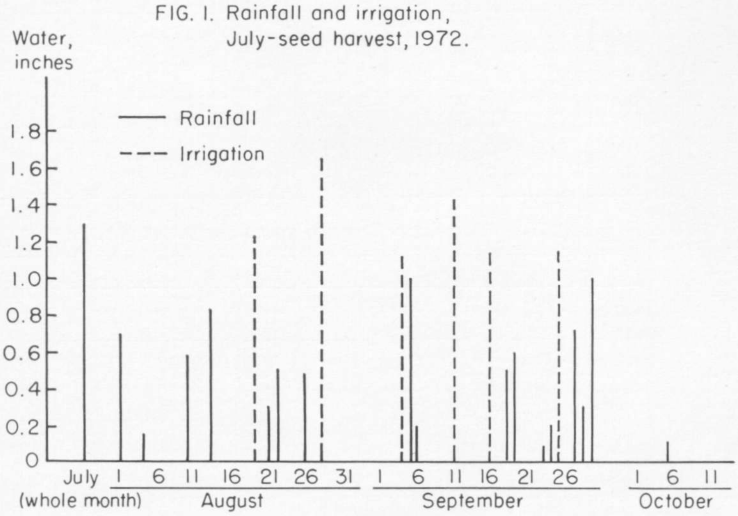
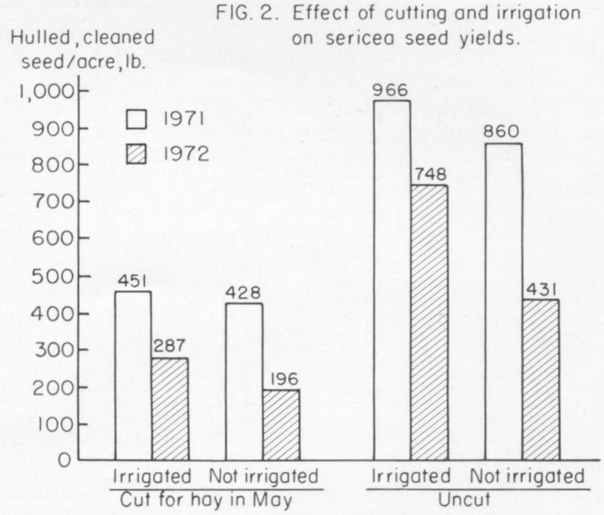
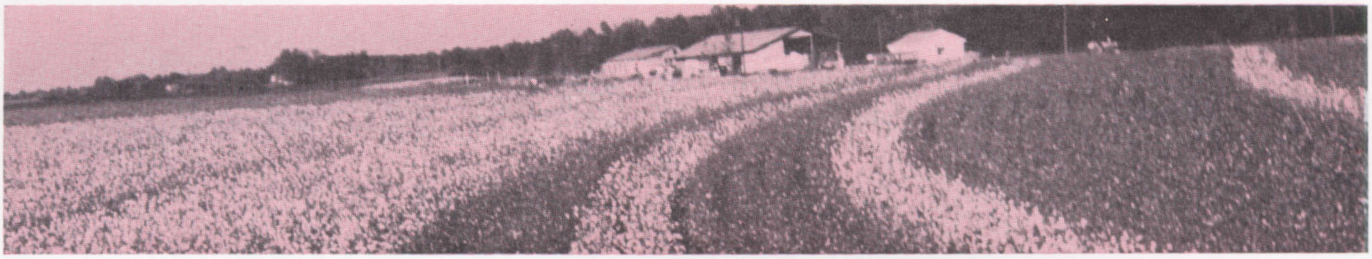


FIG. 2. Effect of cutting and irrigation on sericea seed yields.





Residual Effects of Primary Tillage

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Department of Agricultural Engineering
L. A. SMITH, *USDA, ARS*

IS DEEP, primary tillage necessary each year to produce good yields of cotton?

Research has shown that cotton roots will grow into a loosened zone of soil if it is not recompacted by traffic. To determine if root zone tillage is necessary each year, tests comparing deep tillage with shallow tillage with three levels of tractor traffic are being conducted at the Agricultural Engineering Research Unit in cooperation with the National Tillage Machinery Laboratory on a Norfolk sandy loam soil.

Testing Procedure

The tests consist of six treatments shown in Table 1. All plots were planted in 40-in. rows in a 2 and 1 skip row pattern with all rows located in the same positions each year. In treatments 1 and 2, (controlled traffic) all operations, from residue management through harvest, were conducted with a tractor that had both front and rear wheel spacings of 120 in. center to center. By using 120-in. wheel spacings and by planting 40-in. rows in a 2 and 1 skip row pattern, a minimum distance of 24 in. was maintained between the edge of the tractor tire and the row, including a 6-in. allowance for wobble by the tractor operator. Also, the four-wheeled tractor eliminated all inter-row traffic. In treatments 3 and 4, (tractor traffic) all operations were conducted with a tricycle tractor that had a rear wheel spacing of 80 in. center to center. This resulted in a minimum distance of 4 in. from the edge of the rear tractor tire to the row and also resulted in traffic in all interrows. Treatments 5 and 6 (tractor & sprayer traffic) were the same as treatments 3 and 4 except that the plots received additional late season traffic from a tricycle high clearance sprayer having a rear wheel spacing of 80 in.

All plots in the test site received a uniform, deep tillage treatment in 1970. Beginning in 1971, a Howard Rotovator was used to prepare the shallow tilled plots, treatments 2, 4, and 6. The Rotovator consisted of 48 knives covering a width of 80 in. and a depth of 2 to 3 in. The deep tilled plots, treatments 1, 3, and 5, were prepared with a Ford chisel plow followed by the Howard Rotovator. The chisel plow consisted of 10 chisels covering a width of 80 in. and a depth of 16-18 in. All plots, deep and shallow tilled, were then bedded with disk bedders and planted with a two-row planter.

Yield data were obtained by mechanically harvesting 100 row-ft. of each plot (Table 2).

The controlled traffic plots that were deep tilled in 1970 and shallow tilled in 1971, 1972, and 1973 (treatment 2) essentially yielded as much as the controlled traffic plots that were deep tilled in 1970 and again in 1971, 1972, and 1973 (treatment 1). This indicates that deep tillage may not be necessary each year when preparing a rootbed for cotton, if traffic is controlled to reduce recompaction in the root zone.

The average yield from the controlled traffic plots (treatments 1 and 2) was 560 lb. of seed cotton per acre more than the tractor traffic plots (treatments 3 and 4) and 766 lb. per acre more than the tractor plus sprayer traffic plots (treatments 5 and 6). Some physical damage to the plants by the late season sprayer traffic was observed. This damage would account for some of the yield reductions in tractor plus sprayer traffic plots.

Test Results

In 1973 tractor traffic reduced yields 31.0% in the shallow tilled plots as compared to 24.5% in 1972 and 12.3% in 1971. This indicates that after deep tillage more than 1 year of traffic may be required to recompact the soil and that compaction can be cumulative.

TABLE 1. RESIDUAL TILLAGE TREATMENTS

Treatment number	1970 tillage	1970 traffic	1971-72-73 tillage	1971-72-73 traffic
1	Deep	Controlled	Deep	Controlled
2	Deep	Controlled	Shallow	Controlled
3	Deep	Tractor	Deep	Tractor
4	Deep	Tractor	Shallow	Tractor
5	Deep	Tractor & sprayer	Deep	Tractor & sprayer
6	Deep	Tractor & sprayer	Shallow	Tractor & sprayer

TABLE 2. YIELD OF SEED COTTON FROM RESIDUAL TILLAGE STUDY

Treatment			Pounds seed cotton per acre			
No.	1971-72-73 tillage	1971-72-73 traffic	1971	1972	1973	Av.
1	Deep	Controlled	3649	2736	2830	3075
2	Shallow	Controlled	3672	2703	2833	3069
3	Deep	Tractor	3329	2398	2457	2728
4	Shallow	Tractor	3220	2041	1954	2405
5	Deep	Tractor, sprayer	2862	2086	2380	2443
6	Shallow	Tractor, sprayer	2764	1857	1890	2170

EMPLOYMENT and RURAL DEVELOPMENT

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Dept. of Agricultural Economics and Rural Sociology

EMPLOYMENT is a basic consideration in rural area development. Jobs must be available for rural residents to remain in the area and, equally important, an available labor force is a basic need to attract an industry to a given rural area. Thus, an assessment of nonemployed heads of households in rural areas may shed some light on a crucial element of rural development – potential labor supply for new and expanded industry.

Alabama's portion of Southern Regional Project S-79 provides employment data about open-country areas of Clarke, Monroe, Fayette, and Tallapoosa counties. Selected individual and household characteristics were obtained by surveying employed and nonemployed household heads.

Of the 420 households in the sample, 38% were headed by a person who was not employed. This nonemployed household head is likely to be aged, black, female, and poorly educated. As shown in the table, age is one of the most important variables; 83% of nonemployed heads are 55 or older, as compared with 21% of those employed. More than a third (37%) of the nonemployed heads are female, but females make up only 6% of the employed heads. Racial effects were less, however, with blacks making up 22% of nonemployed and 14% of employed heads.

Level of education, which is related to age, is significantly different between the two groups. Almost half of nonemployed heads but only 15% of the employed heads were in the sixth-grade or less education group. A positive indication regarding education is that 63% of all employed heads have at least 10 years of schooling.

Six household characteristics indicate differences between families headed by employed and nonemployed persons.

- Family type varies with employment status – 84% of employed heads' families were the complete nuclear type (head and homemaker with or without children) as compared with 46% of families with nonemployed heads.
- Findings reveal that 29% of the nonemployed heads reside in one-member households and another 42% in two-member households. The other 29% of families are three-member or larger. These families include children and are likely to be on government welfare.
- Nearly three-fourths of families with nonemployed heads own their own homes, a distinct advantage for those on limited income. However, 29% either pay some kind of rent or live rent free.
- Total family income shows considerable variation. Almost half of the nonemployed heads' families have less than $2,000 annual income, as compared with 7% of those with employed heads. At the other extreme, 20% of families with employed heads have $11,000 or more, but none of the nonemployed heads' families receive this much income.
- Even though family heads are nonemployed, 19% of these families report most of their income from wages and salaries. This income was earned by some other family member, usually the homemaker or a child. Thus, these households are not as bad off economically as might first be concluded. Also surprising is that only 8% reported government welfare as the major source of family income. The majority of this nonemployed group reported that most of their income is from social security or other pensions.
- Responding to questions about possession of 26 material items (a measure of level of living), employed heads' families reported an average of 17. Families of nonemployed heads are relatively well off, having an average of 13 of these items.

Age is apparently the major reason that most of the nonemployed heads are not gainfully employed; consequently, employment potential for them is limited. One of the more encouraging signs, however, is the position of the young, employed household heads in the rural areas. Families of this group appear to rate well on selected socioeconomic variables, and they have the potential to do even better. For example, since 62% have at least a tenth-grade education, their chances for higher level jobs are enhanced. These workers and their children provide a potential labor force for new and expanded rural industry.

SELECTED INDIVIDUAL AND HOUSEHOLD CHARACTERISTICS OF EMPLOYED AND NONEMPLOYED HOUSEHOLD HEADS

Characteristics	Household heads, by category		
	Total (420)	Employed (260)	Nonemployed (160)
	Pct.	*Pct.*	*Pct.*
Individual characteristics			
Age			
Under 35	23.1	34.7	4.3
35-54	32.1	44.2	12.5
55 and over	44.8	21.1	83.2
Race			
White	82.9	85.8	78.1
Black	17.1	14.2	21.9
Sex			
Male	82.1	94.2	62.5
Female	17.9	5.8	37.5
Education, years			
0-6	27.3	15.0	47.5
7-9	25.7	22.3	31.3
10 and over	47.0	62.7	21.2
Household characteristics			
Family type			
Complete nuclear	69.3	83.5	46.3
Other	30.7	16.5	53.7
Size of family			
1 member	13.8	4.6	28.8
2 members	33.3	27.7	42.5
3 members	52.9	67.7	28.7
Home tenure			
Own home	75.5	78.2	71.1
Pay cash rent	13.7	13.4	14.1
Other rent or rent free	10.8	8.4	14.8
Family income, dollars			
Under 2,000	22.4	6.9	47.5
2,000-4,999	25.2	17.3	38.1
5,000-7,999	23.8	30.4	13.1
8,000-10,999	16.4	25.8	1.3
11,000 and over	12.2	19.6	0
Major source of income			
Wages and salaries	61.5	87.2	19.2
Profits and fees	6.1	8.5	1.9
Social security or other pensions	26.4	2.7	65.4
Government welfare	3.9	1.2	8.3
Other	2.1	.4	5.2
Level of living items			
0-4	5.0	3.8	6.9
5-8	10.0	5.0	18.1
9-12	10.5	6.9	16.3
13-16	21.2	16.2	29.3
17-20	30.8	37.5	20.0
21 and over	22.5	30.5	9.4

Evaluation of Fumigant and Contact Nematicides for Control of Plant Parasitic Nematodes in Alabama Potatoes

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THE POTATO PLANT is subject to attack by a variety of plant parasitic nematodes and soil borne fungi. Among the economically important nematodes there are the golden cyst nematode, the potato rot, and root-knot nematodes. Other nematodes that may be important through their direct activities or indirectly in association with soil borne parasitic fungi are: lesion, stubby root, and spiral nematodes. In the southern part of Alabama the predominant plant parasitic nematodes are root-knot nematode (*Meloidogyne incognita*) and spiral nematodes in the genera *Helicotylenchus* and *Rotylenchus*. The most ubiquitous of the spiral nematodes is *Helicotylenchus dihystera*. Because of the lack of information on the importance of soil borne diseases on potatoes in south Alabama and on the performance of nematicides in this area, tests were conducted in the past 3 years to obtain information on these subjects. Experiments were located at Theodore at the Frito-Lay farm in cooperation with Dr. Jim Weber and Mr. Ray Miller of the Frito-Lay Company. A test conducted in 1972 was designed to determine the yield of potatoes in soil sterilized with methyl bromide, the yield obtained with the fumigant DD (dichloropropane-dichloropropene) and that from untreated soil. Results (Table 1) indicated that nematodes were partly responsible for losses in potato yields. Since the DD treatment is particularly effective against nematodes and to a lesser extent against fungi, and methyl bromide is a broad spectrum sterilant, the higher yield response obtained with methyl bromide indicated that soil borne pathogens other than nematodes were contributing to yield losses. Work during 1973 at the same location was directed to compare the standard fumigant DD to a number of commercial granular contact nematicides. This work was particularly important since an effective granule applicable at planting time eliminates the need for chisels and pre-plant applications required by the fumigant. Table 2 presents representative data from these experiments. The results indicate that moderate to good nematicidal activity can be obtained with the use of granular nematicides when applied at 8 lb. active ingredient/acre. However, of the granular nematicides tested only Nemacur 15G approximated the yield response with DD. Since DD has some fungicidal activity it is likely that the higher yield response obtained with it is in part attributable to its non-nematicidal activities. Present research is directed to the evaluation of fungicide x nematicide combinations to obtain adequate control of plant parasitic nematodes and soil borne disease causing fungi.

TABLE 1. EFFECT OF TWO SOIL FUMIGANTS ON PLANT PARASITIC NEMATODES AND YIELDS OF POTATOES IN A TEST AT THEODORE, ALABAMA

Treatment	Rate (gal./acre)	Root-knot[1] nematode larvae	Galling[2] index	Spiral[1] nematodes	Yield (percent over control)
DD	12	0	2	5	19
Methyl bromide	55	2	1	0	48
Control	----	27	9	47	0

[1] Numbers per pint of soil.
[2] Based on a susceptible tomato bioassay. 0 = no galls, 10 = complete galling.

TABLE 2. THE EFFECT OF VARIOUS CONTACT COMMERCIAL NEMATICIDES ON PLANT PARASITIC NEMATODES AND POTATO YIELDS

Treatment	Rate (lb. a.i/acre)	Root-knot[1] nematode larvae	Spiral[1] nematodes	Yield (percent over control)
Control	----	99	40	0
DD	12 gal.	16	17	48
Mocap 10G	8	18	9	17
Nemacur 15G	8	56	7.5	37
Vydate 10G	8	9	7	6

[1] Numbers per pint of soil.

Pre-Commercial Thinning In Natural Pine Stands

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DIRECT OR NATURAL SEEDING of pine results in too many seedlings, causing individual trees to grow slowly for several years. Examination of this type of stand has shown that the growth rate begins slowing down around age 6 to 8 years. Reduced diameter growth may delay commercial harvesting and thus potential income by 10 to 15 years.

On the Fayette Experiment Forest of the Auburn University Agricultural Experiment Station, an area was site-prepared (bulldozing and disking) and direct seeded in 1961. Additional natural seeding came from trees of an adjoining area. Seedling establishment was excessive and by 1968, pine trees over 4½ ft. tall averaged 7,400 stems per acre. A thinning study was applied in the spring of 1968 with the following treatments: Check (no treatment), hand-thinning to 1,000 stems per acre, broadcast application of 150 lb. of nitrogen per acre,[1] bulldozing 9-ft. strips between 18-in. undisturbed strips, applying "Tordon 10K pellets,"[2] soil sterilant, in lines 11 ft. apart (9.1 lb. per acre), and applying the sterilant in strips 9 ft. apart (11.1 lb. per acre).

After 4 years, none of the thinning treatments showed significantly greater height growth than the check, although the fertilized seedlings averaged 1½ ft. taller than the untreated ones (Table 1). The soil sterilant damaged leaders of the surviving pines, and this damage is reflected in significantly reduced growth where Tordon was applied at the 9-ft. spacing. The damage was evident for 2 years after treatment, but subsequent height growth paralleled that of the check.

Stocking Effect

Five years after treatment, all thinning methods had reduced stocking considerably below the check (Table 2). No treatments except hand-thinning and bulldozing reduced the number of seedlings sufficiently to encourage best growth, and even these are now ready for re-thinning. Basal area measurements including all sized trees showed large variations, with the fertilized and check plots highest. Basal area of dominant and codominant trees, however, was significantly higher on the hand-thinned plots than on the check. The differences in basal area between the bulldozed and fertilized plots and the check were not significant at the 0.05 level.

The average diameter of dominant and codominant trees was the measurement with greatest relative differences between treatments. Both the bulldozed and the hand-thinned treatments had significantly larger average diameters than the check (Table 3). In contrast to a study at Camden, Alabama, where a disked-strip treatment reduced diameter growth, thinning by bulldozing here increased growth, undoubtedly because roots were not damaged by the bulldozing as they were by disking. Fertilization increased diameter growth through the fourth year, but no further growth increase in relation to the check could be discerned. Growth on plots treated with the soil sterilant was retarded for the first 2 years, then it increased steadily through the fifth year.

Thinning Results

Thinning overly dense, young loblolly pine by hand or by bulldozing will definitely shorten the time before a commercial thinning can be made. Although fertilization as applied here had no significant influence, the potential is favorable. Based on these short term (5-year) results, the damaging effect of the soil sterilant during the first 2 years dissuades use of the sterilant for thinning.

[1] Ammonium nitrate (NH_4NO_3): 33.5% N at 450 lb. per acre ($3.25/100 lb.).
[2] 10% active material of potassium salt, 4-aminos 3, 5, 6, Trichlotopicolinic acid ($1.50/lb.).

TABLE 1. AVERAGE HEIGHT OF DOMINANT AND CODOMINANT TREES 4 YEARS AFTER TREATMENT

Treatment	Height
	Ft.
Fertilize	11.8
Hand-thin	10.9
Check	10.3
Bulldoze	9.2
Tordon, 11′	8.9
Tordon, 9′	6.5

TABLE 2. STAND CONDITIONS JUST BEFORE TREATMENT AND 5 YEARS LATER (PER ACRE BASIS)

Treatment	Stocking			Basal area		
					After 5 years	
	Original	5 years	Reduction	Original	All trees	Dom. & codom.[1]
	Number	*Number*[2]	*Per cent*	*Sq. ft.*	*Sq. ft.*[2]	*Sq. ft.*
Hand-thin	5,899	1,080	72	51.1	92.3	69.77
Bulldoze	6,679	1,069	84	54.4	67.5	57.78
Fertilize	7,962	3,545	56	54.1	129.3	57.15
Check	7,698	4,525	41	53.1	120.6	45.28
Tordon, 11′	6,830	2,225	67	48.8	67.4	44.71
Tordon, 9′	9,308	2,149	77	57.8	62.0	35.29

[1] Approximately 600 trees per acre.
[2] Disregarding occasional ingrowth from trees originally less than 4.5 ft. tall.

TABLE 3. AVERAGE DIAMETER OF DOMINANT AND CODOMINANT TREES 5 YEARS AFTER TREATMENT

Treatment	D.B.H.
	Inches
Bulldoze	5.0
Hand-thin	4.8
Fertilize	4.6
Tordon, 11′	4.2
Check	3.8
Tordon, 9′	3.7

Boneless Beef from Cows, Bulls, Heifers, and Steers

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LEAN, BONELESS BEEF is in great demand for use in processed meat products and ground beef. An ample supply of fat beef is available from fed cattle, but lean beef is in short supply. Domestic boneless beef is primarily obtained from cull cows and bulls, and not enough of these animals are marketed to meet demand. As a result, the meat processing industry imports nearly 2 million lb. of lean boneless beef and veal annually.

The study reported here was designed to determine carcass composition of various classes of cattle.

Ten head each of cows, bulls, heifers, and steers grading Utility or lower were purchased at auction, full fed silage with minimum supplement about 90 days, and then slaughtered. The study was repeated a second year using 9 each of cows and bulls and 10 each of heifers and steers. Each sex class was fed separately.

The 78 carcasses were Federally graded for quality and yield grades and separated into bone, lean, and fat trim components. Weights of these components were taken from the forequarter and hindquarter of each carcass. Tenderloins were weighed separately. Tables 1 and 2 summarize the carcass data.

The animals had less than 0.1 in. of backfat at time of slaughter. Females had a lower dressing percentage than males (45 vs. 51%) even though they were not pregnant when slaughtered. The dressing percentage for cows was significantly lower than for heifers (44 and 47%, respectively), but it was almost identical for bulls and steers.

Bull carcasses yielded the highest percentage of lean meat. The percentage lean was remarkably similar among sex classes, ranging from 69 to 73%. Heifer carcasses averaged about 24% bone, contrasted to approximately 22% for the other sex classes.

There appeared to be about 2% more boneless lean in the forequarter than in the hindquarter of all classes of animals in the test. However, the tenderloin and the kidney were included in weight of the hindquarter but were not included in the percentages of lean. Actually there was more meat in hindquarters than in forequarters by approximately 2% if percentage lean and percentage tenderloin are added together. The forequarter had considerably more bone than the hindquarter of all carcasses, regardless of sex class.

Results of this study indicate that bulls have the highest percentage of lean meat, followed in order by steers, cows, and heifers.

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TABLE 1. CARCASS TRAITS OF COWS, BULLS, HEIFERS, AND STEERS

Trait	Means, according to sex class[1]			
	Cow	Bull	Heifer	Steer
Live weight, lb.	835	908	570	823
Carcass weight, lb.	364	467	268	423
Dressing percentage	43.5	51.4	47.2	51.3
Fat thickness, in.	.06	.04	.06	.10
Ribeye area, in.	7.74	9.85	6.48	8.76
Yield grade	1.7	1.3	1.7	1.7
Quality grade	Cutter	Utility	Utility	Standard

[1] Based on 19 cows, 19 bulls, 20 steers, and 20 heifers.

TABLE 2. CARCASS COMPOSITION OF COWS, BULLS, HEIFERS, AND STEERS

Trait	Means, according to sex class			
	Cow	Bull	Heifer	Steer
	Pct.	*Pct.*	*Pct.*	*Pct.*
Carcass composition				
Lean	71.3	73.3	69.4	72.0
Bone	22.7	21.9	24.5	22.2
Fat	3.8	2.6	3.6	3.4
Tenderloin	1.8	1.6	1.9	1.8
Forequarters				
Lean	72.1	74.4	69.9	73.1
Bone	26.7	24.4	28.3	25.5
Fat	1.5	1.1	1.5	1.3
Hindquarters				
Lean	70.4	72.2	68.9	71.2
Bone	18.5	18.8	20.4	18.6
Fat	6.2	4.6	5.7	5.7
Tenderloin	3.6	3.2	3.8	3.6
Kidney	1.0	1.0	1.0	1.0

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