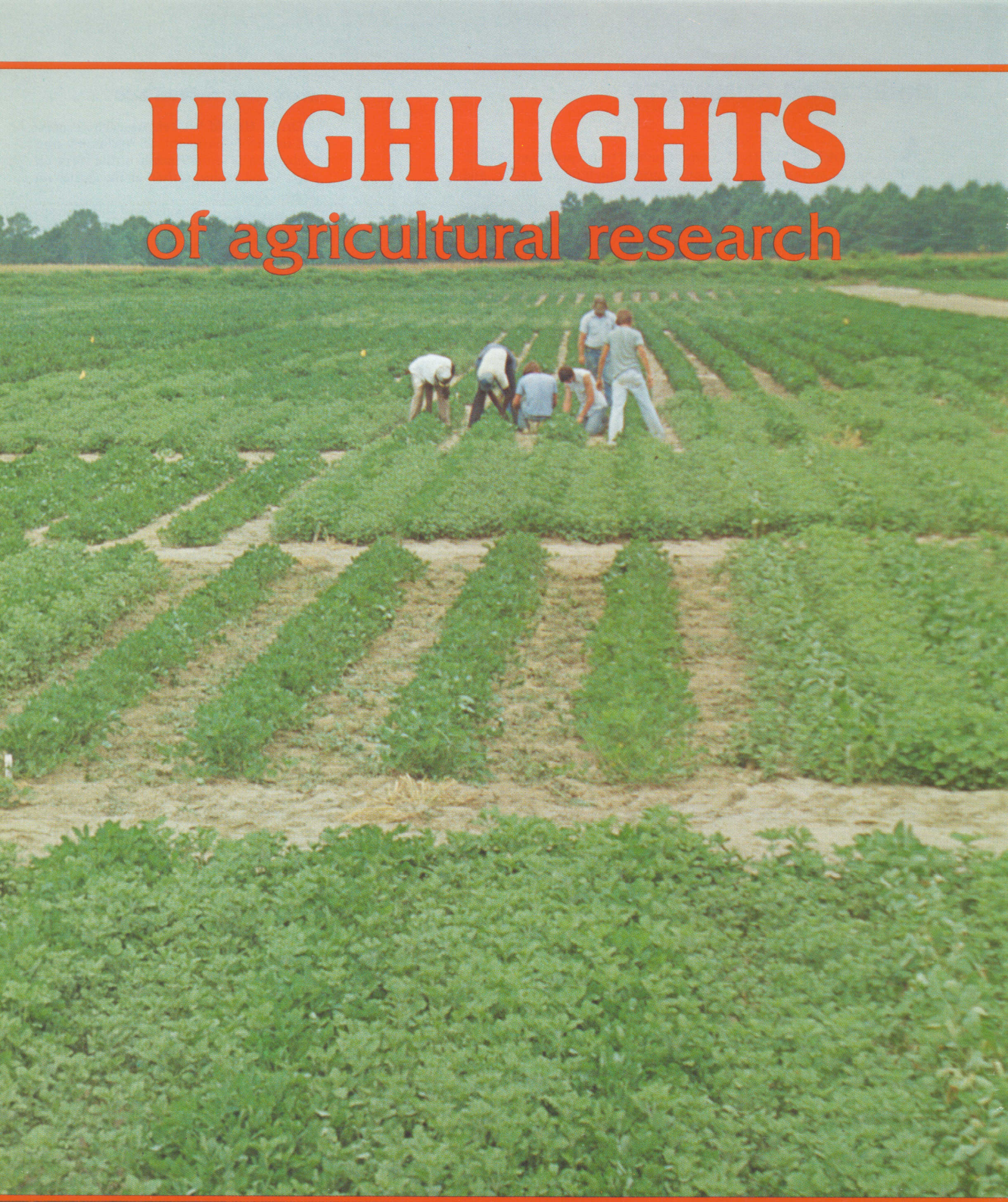
HIGHLIGHTS
of agricultural research



Vol. 29 No. 1
AGRICULTURAL EXPERIMENT STATION
GALE A. BUCHANAN, DIRECTOR

Spring 1982
AUBURN UNIVERSITY
AUBURN UNIVERSITY, ALABAMA

DIRECTOR'S COMMENTS

ALABAMA FARMERS face a multitude of tough problems in 1982. Such things as consistently low market prices, high interest rates, and escalating costs of production inputs appear to present almost insurmountable obstacles to farming. These factors are severe enough to make the perennial problems of drought, storms, freezes, weeds, insects, and diseases appear insignificant in comparison.

GALE A. BUCHANAN

Despite serious problems facing agriculture in Alabama and most of the nation, there are some reasons for optimism. I am encouraged by efforts of all agriculturally related organizations to help farmers cope with their present situation. We at the Alabama Agricultural Experiment Station are pleased to be a part of this overall team.

Agricultural lending agencies and institutions are making every effort to sort out farmers' debts and to make loans to those who can effectively use the funds. The Soil Conservation Service is making an extra effort to combine its programs of soil and water conservation with more efficient farm production systems. The ASCS is working diligently to implement federally funded agricultural programs on a fair and equitable basis. The Alabama Cooperative Extension Service has intensified its efforts to provide information concerning farm management, commodity marketing, and credit options.

In addition to the traditional publicly supported agricultural organizations, commodity, trade, and farmer-oriented groups are keenly concerned about the current agricultural crisis. A highly cooperative spirit seems to exist among such organizations in Alabama, with the overall goal being to benefit farmers.

The Alabama Agricultural Experiment Station's role continues to be important, although special approaches are needed along with our traditional research to provide know-how for improved efficiency of farm production.

We are intensifying our research on irrigation of agronomic and horticultural crops—both production and engineering aspects—to minimize the effect of drought on crop yields and quality. Major efforts are underway to develop more cost-effective systems of controlling such crop pests as insects, weeds, and diseases. These studies go beyond the traditional search for control methods, with emphasis being given to "when" control will be profitable and to identify maximum-return treatments.

Multi-cropping is also getting close attention in our research as a means to help farmers best utilize such fixed cost resources as land, irrigation systems, and farm equipment. Reduced tillage systems and use of legumes as a source of nitrogen are practical approaches being taken to reduce production costs.

In the animal area, we are identifying breed combinations and individual animal characteristics that are associated with high meat-production efficiency. Such efficient animals, along with least-cost feeding practices, can go a long way toward solving the major problems facing the livestock industry. Our poultry research continues to develop disease prevention and other production management systems, including energy-saving plans, to keep meat and egg production as efficient as possible.

These are the most difficult times agriculture has faced in the last 40 years. However, I remain firmly optimistic that, in due course, we will see a turn-around of the situation and a more favorable climate for agriculture in this State. Until this turn-around occurs, continued effort by all agricultural support organizations can be extremely helpful.

may we introduce . . .

Dr. R. Harold Walker, Associate Professor in the Department of Agronomy and Soils, who is senior author of the story on page 3 and junior author of the stories on pages 11 and 16.

A native of Mississippi and graduate of Mississippi State University (B.S., M.S., and Ph.D.), Walker joined the Agricultural Experiment Station faculty at Auburn in 1978. He had previously served as a specialist with the Alabama Cooperative Extension Service during 1974-78, and as a plant science representative for Eli Lilly during 1973-74.

Walker's research responsibilities involve weed control with row crops, with major attention to soybean weeds. He also teaches weed science courses and coaches Auburn University's award-winning weed judging team.

Walker helped organize the Alabama Society for Weed Science and has served in various leadership positions, including being its president.

HIGHLIGHTS of Agricultural Research

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ON THE COVER: Economics of various weed control systems for peanuts was studied during 1978-80, see story page 11.

Hazards of MSMA and DSMA for Peanut Weed Control

R. HAROLD WALKER, A. E. HILTBOLD, and GEORGE GRANADE, Department of Agronomy and Soils

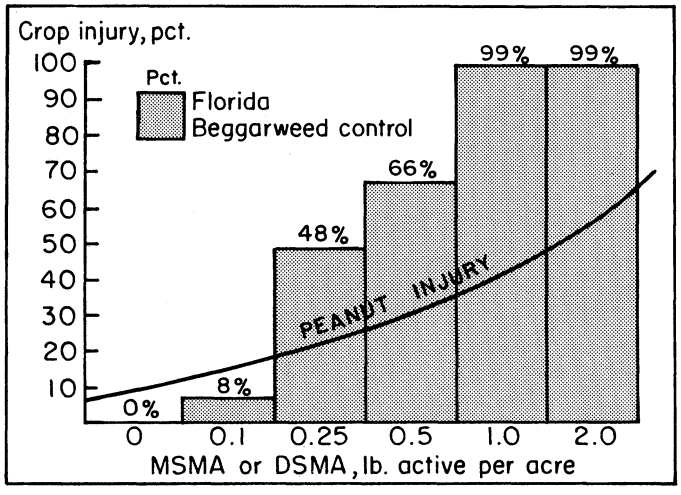


FIG. 1. Effect of MSMA and DSMA on peanut injury and Florida beggarweed control, 1979.

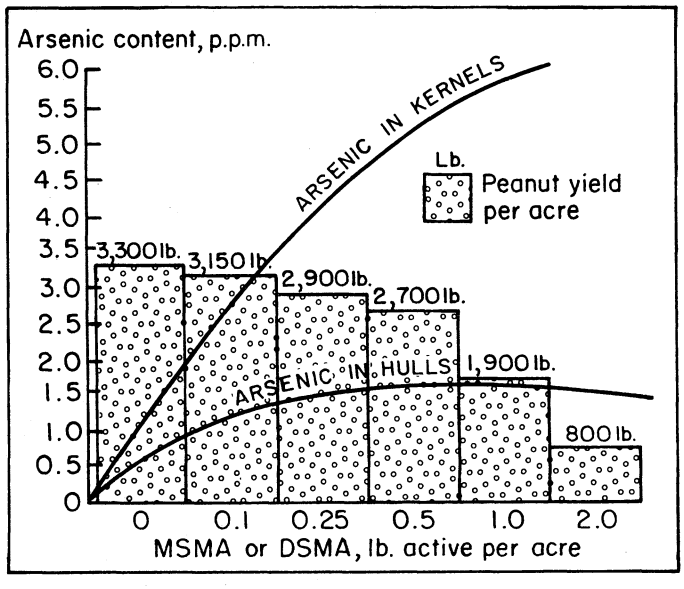


FIG. 2. Effect of MSMA and DSMA on peanut yield and arsenic level of peanut kernels, 1979.

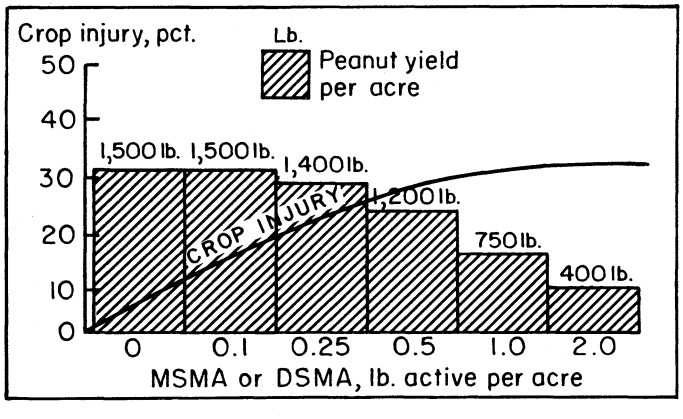


FIG. 3. Effect of MSMA and DSMA on peanut yield and injury, 1980.

ASK ANY ALABAMA PEANUT PRODUCER to name the most troublesome weed in that crop, and Florida beggarweed will likely be the answer. This weed is so tough that growers sometimes resort to risky tactics to control it. One such practice is the use of MSMA and DSMA.

These arsenic-containing herbicides have been rumored to control Florida beggarweed at relatively low rates, presumably providing an economical treatment. However, this practice is a loser from several aspects:

1. These herbicides are not registered for use in peanuts.
2. Peanut kernels and hulls from treated plants may contain illegal arsenic residues, so such peanuts can be declared nonmarketable by authorities.
3. Peanut yields can be reduced by these herbicides.

To gain insight into this risky practice, experiments were conducted by the Alabama Agricultural Experiment Station at the Wiregrass Substation, Headland. Two tests were conducted in 1979 and one in 1980. MSMA and DSMA were applied August 10 for both 1979 tests and August 6 (mid-season) and September 4 (late) in 1980.

Peanut plants at time of treatment were approximately 15 in. tall and Florida beggarweed averaged 24 in. tall. Weed control, crop injury ratings, and peanut yields were collected each year. Peanut samples from the 1979 experiments were analyzed for arsenic residue in kernels and hulls. Results are illustrated in the graphs.

Florida beggarweed control was generally acceptable with MSMA or DSMA applied at 0.5 lb. per acre, considering that weeds averaged 24 in. tall and some were 4 ft. Peanut injury, judged visually, was acceptable with rates of 0.5 lb. per acre or lower in all experiments, figures 1 and 3. However, peanut yields were reduced in two of the three experiments by the 0.5-lb. rate. Even greater reductions occurred at higher rates, figures 2 and 3.

MSMA caused more injury to the crop and resulted in a higher arsenic residue level in the peanut kernel than DSMA. Residues in the peanut hulls were about the same for both.

Time of application showed little effect in the 1980 results, a year when yields were severely cut by drought, but MSMA caused more crop injury and yield reduction than DSMA, as shown here:

Herbicide and time of application	*Crop injury, pct.*[1]	*Peanut yield per acre, lb.*
Mid-season		
DSMA	9	1,439
MSMA	19	1,009
Late		
DSMA	5	1,379
MSMA	20	1,225
No herbicide	--	1,490

[1]Data are averages of all herbicide rates.

The data were summarized to show the effect that can be expected from each 0.1 lb. active ingredient per acre of DSMA or MSMA applied:

1. A yield decrease ranging from 67 lb. (1980) to 125 lb. (1979) of peanuts per acre.
2. An arsenic increase of 0.33 p.p.m. in kernels.
3. An arsenic increase of 0.08 p.p.m. in hulls.

Fortunately, Florida beggarweed can be controlled without resorting to MSMA or DSMA. Weeds that escape "at-cracking" treatments of Lasso®, Dual®, or Amiben® plus either Premerge 3® or Dyanap® can be controlled with postemergence applications of Premerge 3®. These early applications are more effective since they generally control beggarweed before it competes with peanuts.

TOMATOES DO BEST WITH COMPLETE TILLAGE

J. L. TURNER, Department of Horticulture
C. E. EVANS, Department of Agronomy and Soils
B. D. DOSS, USDA-SEA (Retired)

NO-TILL PRODUCTION may work for some crops, but not for tomatoes. Land preparation ahead of planting was necessary for top production in recent Alabama Agricultural Experiment Station tests.

Land preparation methods were compared in field trials at the E. V. Smith Research Center, Shorter, during 1977, 1978, and 1979. Tropic was the test variety. Rye was grown on all plots as a cover crop and was mowed 2 weeks before land preparation and left on all plots, with one exception. One treatment had the straw removed to determine the effect of rye on tomato production.

In preparation for planting, all plots were chiseled in the row to a depth of 15-18 in. with a tractor-drawn subsoiler. Then four soil preparation treatments were established:

1. Complete tillage—entire plots were rototilled, rye straw removed.
2. Complete tillage—entire plots were rototilled, rye straw incorporated.
3. Strip tillage—a 24-in. strip centered over the row was rototilled, rye straw incorporated.
4. No tillage—no additional tillage after subsoiling.

Six-week-old plants produced in the greenhouse at Auburn were set by hand and spaced 15 in. in the row. One pint of a starter solution (containing 1 lb. of 20-20-20 fertilizer in 50 gal. of water) was applied to each plant at planting.

The tomatoes were staked 10-15 days after planting. Plants were tied with twine when they were 8-10 in. tall and subsequently after each 8-10 in. of additional growth. Plants were neither pruned nor irrigated. Recommended pesticides were applied weekly to control insects and diseases.

Fruit was harvested weekly at pink and red ripe maturity beginning in late June and ending in late July. Marketable yields were graded into three size groups: large, 3¼ in. diameter and larger; medium, 2½ to 2⅞ in. diameter; and small, 2¼ to 2⅝ in.

Early season plant growth was greater on no-rye plots than on rye-incorporated plots. This is reflected in the plant height differences given in the table.

Complete tillage without rye straw residue produced the highest yield every year of the test. All of the tillage treatments outproduced the no-tillage treatments, with one exception. In 1979, the no-tillage treatment made slightly more than the strip-tillage treatment.

The 1977 growing season was dry through June, resulting in the low yields given in the table. In 1978, there was good rainfall distribution early in the growing season, and plant development and fruit set were good for all treatments. Early plant growth was good in 1979, but the latter half of the growing season was dry. This year, as in 1978, highest marketable yields were produced on the complete tillage, no-rye treatment.

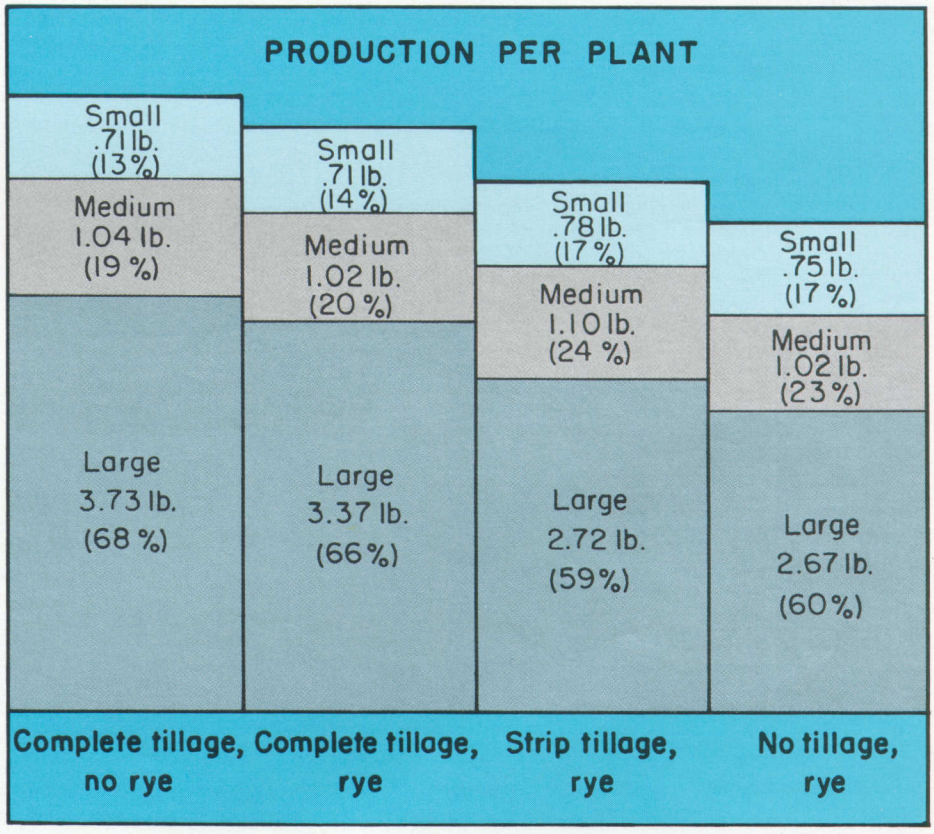
Fruit size also was affected by tillage treatment. Complete tillage without rye produced the highest yield of large size tomatoes, see graph.

The 3-year averages indicate that complete tillage without rye incorporation produced the highest total yield, the highest percentage of marketable fruit, and the highest percentage of large tomatoes. Complete tillage with rye straw incorporated produced approximately ½ lb. less fruit per plant than the complete tillage without straw. Strip tillage and no-tillage produced the lowest yields.

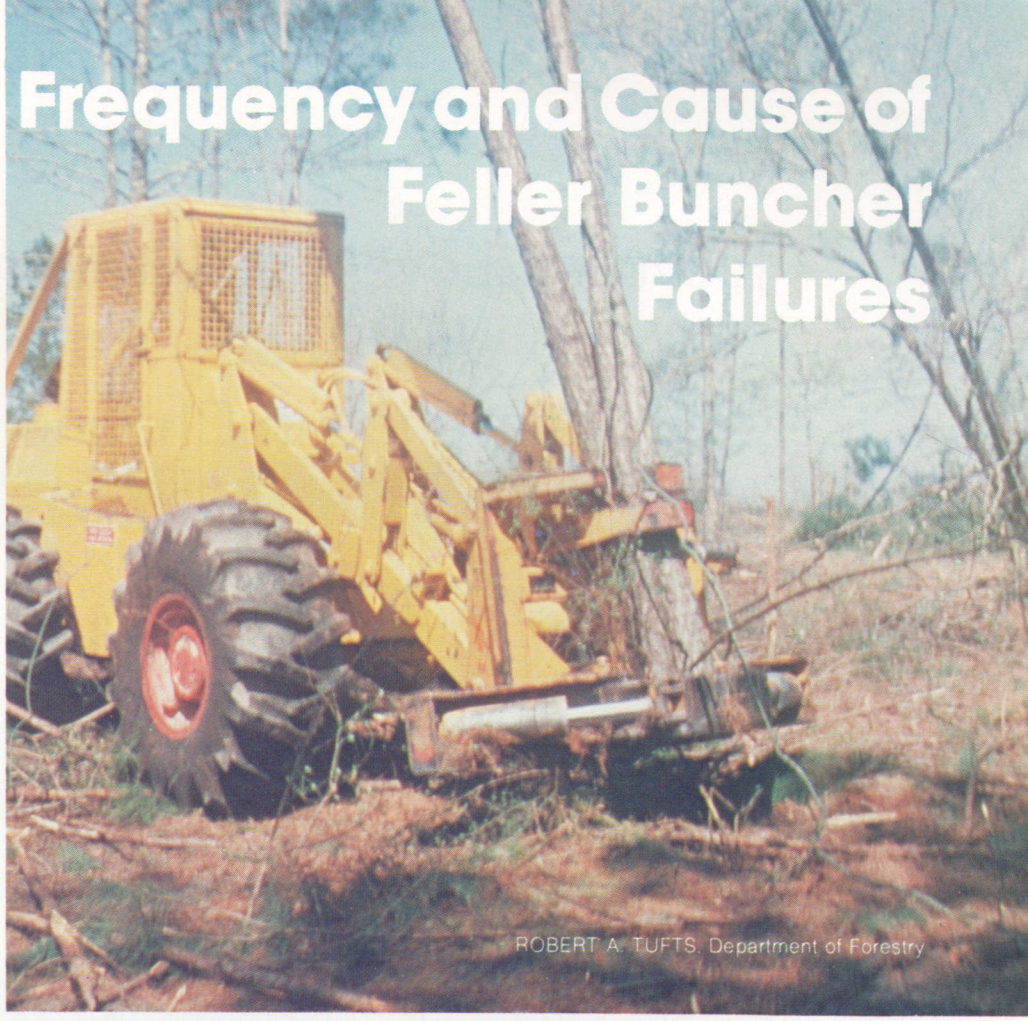
Results of the Auburn tests emphasize the importance of soil preparation for tomatoes, whether for commercial production or in a home garden. Apparently, tomato plants can more effectively utilize soil minerals and water in well prepared, loose soil.

EFFECTS OF TILLAGE TREATMENTS ON TOMATO YIELDS

Treatment	Marketable yield/plant				Av. plant height
	1977	1978	1979	3-year av.	
	Lb.	*Lb.*	*Lb.*	*Lb.*	*In.*
No cover crop					
Complete tillage (80 in.)	3.15	5.93	7.37	5.48	39
Rye cover crop					
Complete tillage (80 in.)	2.63	5.41	7.26	5.10	36
Strip tillage (24 in.)	2.34	5.45	6.01	4.60	36
No tillage	1.82	5.27	6.23	4.44	35



Frequency and Cause of Feller Buncher Failures



ROBERT A. TUFTS, Department of Forestry

THE FELLER BUNCHER (a machine that shears trees near the ground line, picks them up, and deposits them in a bunch for skidding) has greatly increased the productivity of timber harvesting operations. However, the adverse environmental conditions in which these machines work create a need for better equipment maintenance management. This management of equipment "downtime" requires information concerning the frequency and cause of equipment breakdowns.

Unlike agricultural equipment which operates in a relatively uniform environment, timber harvesting equipment encounters a wide range of environmental conditions. Because of this, breakdowns are more frequent.

A study of the frequency and cause of failures of rubber-tired feller bunchers was conducted over a 2-year period by the Alabama Agricultural Experiment Station. Data on 10 machines covered 13,236 operating hours and included 531 failures (machines taken out of service for repair) and 640 separate repairs (sometimes more than one item was repaired once the machine was taken out of service.)

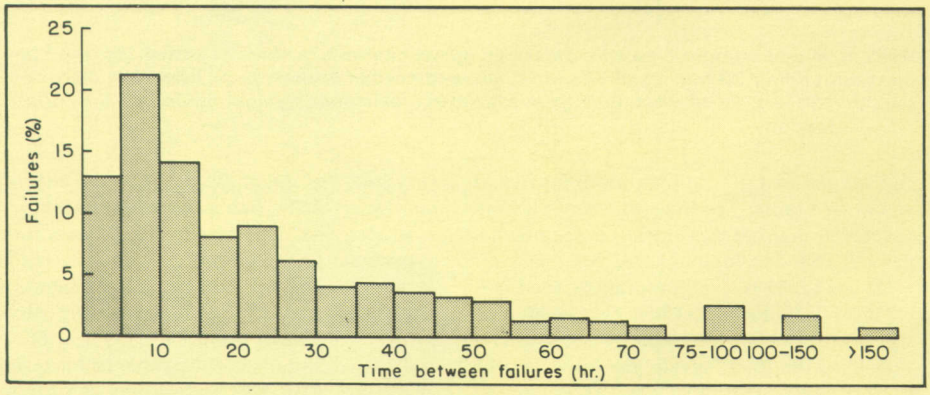
The frequency of failures for the rubber-tired feller bunchers studied is shown by the graph. The time between failures is the time, in hours worked, between successive failures of the same machine. The average time between failures for the 10 machines was 24.9 hours. In other words, once a machine is repaired and put back into service, on the average, it will work 24.9 hours before it must be taken out of service because of the next failure. Even though the average is 24.9 hours, the probability that a feller buncher will fail within 25 hours or less of the previous failure is 65.5%, as shown in the graph.

Once the frequency of failure is known, it is necessary to determine the reasons for the failures so repair facilities and parts needs can be determined. The major categories of the 640 repairs are presented in the table.

The hydraulic system was responsible for over one-third of all repairs. However, most of these were minor involving only hydraulic hoses and fittings. Repacking cylinders also occurred frequently. These results indicate that a mechanic should have an adequate knowledge of hydraulics and a suitable inventory of hoses, fittings, and materials to repack cylinders. In addition, since more than one out of 10 repairs required some form of welding, a portable welder should be available.

Two other categories are significant. Shear repairs, which include reshimming the head, sharpening the blades, and changing pins and bushing, are important because of their frequency. And, drive train repairs, which usually require sending the machine to the shop, are significant because of their severity.

As mechanization increases investment in production and support equipment, the timber harvester must manage his operations more effectively. To do this, he needs as much information as possible. Data of this type will enable him to plan for downtime and minimize adverse effects because he will know when to expect a failure, what parts he will probably need, and the training his mechanic should have to be effective.



Percent of failures by time between failure classes.

LIST OF PARTS REPAIRED AND FREQUENCY OF FAILURE BY MAJOR CATEGORIES FOR RUBBER-TIRED FELLER BUNCHERS

Parts repaired	No.	Pct.
Hydraulic system		37.5
Hoses, fittings, and leaks	184	
Hydraulic pipes	6	
Cylinders	29	
Valve bank	18	
Pump	3	
Shear (other than hydraulic)	80	12.5
Welding	78	12.2
Drive train		6.9
Leaks and lines	19	
Transmission	10	
Planetary	9	
Power transfer dump valve	6	
Brakes	35	5.5
Wheels and tires	26	4.1
Cables and linkage	24	3.7
Center section	14	2.2
Exhaust system	13	2.0
Electrical system	4	0.6
Miscellaneous	82	12.8
Total	640	

Elevated Levels of Vitamin C Increase Disease Resistance in Channel Catfish

TOM LOVELL,
Department of Fisheries and
Allied Aquacultures

LINUS PAULING, the Nobel Prize winner in chemistry, made vitamin C controversial by claiming that megalevels would increase resistance of humans to the common cold. Although researchers do not agree on the effectiveness of pharmacological doses of vitamin C, the feeding of elevated levels of vitamins A and E has proven effective in increasing resistance of animals to infection. Higher than normal levels of vitamin A reduced mortality in chickens infected with coccidiosis. Ten times the normal requirement of vitamin E increased resistance of chickens to pathogenic *Escherichia coli.*

However, previous research at the Alabama Agricultural Experiment Station has shown that channel catfish, unlike other farm animals, require vitamin C in the diet for normal growth, bone development, wound healing, and resistance to bacterial infections. A dietary level of 30 mg/kg would prevent this vitamin C deficiency syndrome. Because of their high sensitivity to vitamin C deficiency, and since this vitamin has been identified with stress and immune responses in various animals, it was hypothesized that channel catfish might benefit from higher than normal doses of vitamin C during infection.

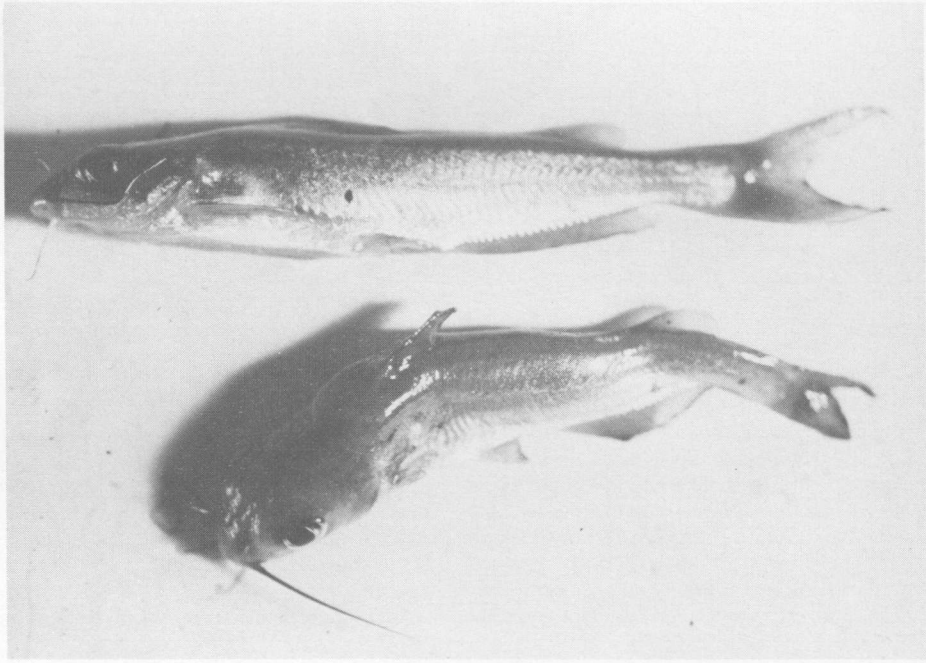
A study was conducted to evaluate effects of vitamin C level on resistance of channel catfish to pathogenic bacterial infection. Fingerlings were fed diets containing vitamin C at levels of 0, 30, 60, and 150 mg/kg under controlled laboratory conditions. After 14 weeks, when fish fed the vitamin C-free diet had become scorbutic (deformed spinal columns), one-half of the fish in each diet treatment were injected with a virulent strain of the pathogenic bacterium *Edwardsiella tarda;* the other half were injected with a saline solution and served as a control. One-half of the infected fish and one-half of the controls were placed in water at 72° F and the remaining fish were placed in water at 89° F. Mortalities were measured over a 96-hour period at the two temperatures.

Scoliosis and lordosis (lateral and vertical curvature of the backbone) were found in fish fed the diet devoid of vitamin C after 14 weeks, see table. The lowest level of vitamin C fed (30 mg/kg) was sufficient for normal growth and development.

At the lower water temperature, the highest level of vitamin C (150 mg/kg) provided significantly more resistance against infection than the lower levels, see table. At the higher water temperature, all levels of vitamin C reduced mortalities, but there was no increased benefit in feeding above the requirement for normal growth and development. Mortality rates were significantly higher in infected fish held at the lower water temperature than at the higher temperature.

These results indicate that increasing the dosage of vitamin C up to five times the normal requirement will increase resistance of channel catfish to infection at 72° F, where the natural resistance of the fish is very low, but not at 89° F, where the natural resistance of the fish is near maximum.

Practically, this research indicates that supplementing commercial catfish feeds with higher than the normal requirements of vitamin C may be beneficial during early spring when water temperature is near 68° F and catfish are most vulnerable to bacterial infections. Also, the body stores of vitamin C in overwintered fish are low at this time.



Diets devoid of vitamin C caused deformed spinal columns in channel catfish (bottom) and diets containing 30 mg/kg of vitamin C allowed normal growth (top); however, diets containing 150 mg/kg of vitamin C gave maximum resistance against bacterial *(Edwardsiella tarda)* **infection.**

MORTALITY RATES OF CHANNEL CATFISH FED VARIOUS DIETARY LEVELS OF VITAMIN C AND INFECTED WITH E. TARDA AT TWO TEMPERATURES

Dietary vitamin C (mg/kg)	No. deaths per no. fish infected	
	72° F	89° F
0	20/20	10/20
30	17/20	4/20
60	12/20	4/20
150	4/20	2/20

NEW DEVELOPMENTS IN MARKETING BROILERS

MORRIS WHITE and JOEL SMITH
Department of Agricultural Economics and Rural Sociology

EXPENDITURES for food have first claim on consumer disposable income.

These expenditures go primarily to two groups: farmers who produce raw commodities and marketing agencies that add processing and a multiple array of services. Expansion in demand for raw commodities results mainly from population growth. Over the past several years the increase in the supply of agricultural products has been greater than the population increases. On the other hand, changes in life styles and living habits have resulted in increased consumer needs for further processed products and desires for additional services. Although disposable personal income increased 2.4 times during the past 10 years, the proportion consumers spent for food has varied less than 1% and was only 0.2% greater in 1980 than in 1971. Additional increases in consumer incomes cannot be depended upon to furnish much additional income to producers of raw products.

American consumers have been exposed to an unlimited array of advertising and promotional techniques. Any act or practice that had a potential for attracting consumer dollars was tried. Sometimes in an intensively competitive situation temporary price wars developed, which benefited buyers but did little to help competitive sellers. With development of fewer but larger-volume firms, including manufacturers, processors, and retailers of food products, the use of price as a form of competition diminished and other forms of competition intensified. These ranged from actual product quality to frills that prove attractive to consumers.

Among food commodity groups, firms in the poultry industry have been among the first to respond to changes as they develop in the food market. Contributing factors include a continuous study of markets that reveals developing changes, product quality control throughout production, processing and distribution, and keen competition among firms in the industry, and with firms that provide competing and potential substitute foods.

Data reveal that, for whatever reason, per capita consumption of poultry is increasing, see table. Total per capita consumption of red meats and poultry was 3.4% greater in 1981 than in 1972, while per capita consumption of poultry was 23.5% greater in 1981 than it was 10 years earlier. Approximately three-fourths of the 63 lb. of poultry eaten per capita in 1981 was in some form of young broilers.

Output from broiler processing firms in Alabama was 42% greater in 1980 than in 1971. However, Alabama continues to rank third among major broiler producing states, a rank it has had for many years.

Information obtained in 1980 from operators of broiler processing firms in Alabama revealed important changes in the total volume of processed broiler products, in the physical forms into which these were processed, and in product packaging methods.

The significant development with respect to the physical form of broiler products was that operators of initial processing plants have added cutup operations to activities they perform. In 1965, 98% of broiler products were shipped as whole broilers, but in 1980 about half, 49.7%, were shipped in this form. Other important forms in 1980 were cutup fryers, 23%, and fryer parts, 19%.

Packing broiler products in ice continues to be the most prevalent method of preparing broiler products for shipment. In 1980, approximately 81% was ice packed, 9% was frozen, 3% was chill packed, and 7% was shipped in various other packs.

Producers and processors of food products are concerned about consumer opinions and acceptance of products offered for purchase. A survey of 226 randomly selected heads of households in the Birmingham Metropolitan Area made by the Alabama Agricultural Experiment Station provided information about their purchases of broiler products.

Consumers purchase broiler products from one or two stores. Only 7% reported purchasing at more than three stores. The primary reason for purchasing broiler products from stores where purchases were made was "convenience," and 90% of the time consumers purchased broiler products at the store where they shopped most often. "Freshness" and "price" ranked next as reasons reported for purchasing broiler products. Approximately two-thirds of the consumers purchased broiler products either on a weekly or every other week basis. Only 2% reported purchasing broiler products only when they were offered as a special.

Efforts of processors to supply products consumers desire appeared to be correct. Although 35% expressed a preference for whole broilers, those preferring fryer parts and cutup fryers were almost as numerous at 34% and 30%, respectively.

Another relatively recent practice in marketing broilers is to market them under a brand name. Forty-three percent of the Birmingham consumers reported that they bought only name branded broiler products; and 72% said that more than half of purchased broiler products were name branded. Only 12% of interviewed consumers reported buying no branded broiler products. A consumer's decision to buy name branded products was a belief that branded products were, in some way, better or fresher than nonbranded, and was not due to having purchased a non-branded product that was "bad."

When asked for an opinion about relative prices of name branded and non-branded products, 50% reported that the price of branded products was higher than that for non-branded products. Twenty-eight percent said prices were about the same, and 18% reported that they did not know if there was any difference in prices. Two out of three consumers were willing to pay more for name branded broiler products. About 13% indicated that they would be willing to pay as much as 5¢ per pound more, and 11% stated they would pay 10¢ per pound more, if necessary, for name branded broiler products.

PER CAPITA CONSUMPTION OF RED MEAT AND POULTRY, UNITED STATES, 10-YEAR PERIOD

Year	Per capita consumption			Prop. poultry was of total
	Red meat	Poultry	Total	
	Lb.	*Lb.*	*Lb.*	*Pct.*
1972 ...	154	51	205	25
1973 ...	143	49	192	26
1974 ...	152	50	202	25
1975 ...	146	49	195	25
1976 ...	155	52	207	25
1977 ...	151	53	204	26
1978 ...	147	56	203	28
1979 ...	145	60	205	29
1980 ...	148	61	209	29
1981 ...	145	63	208	29

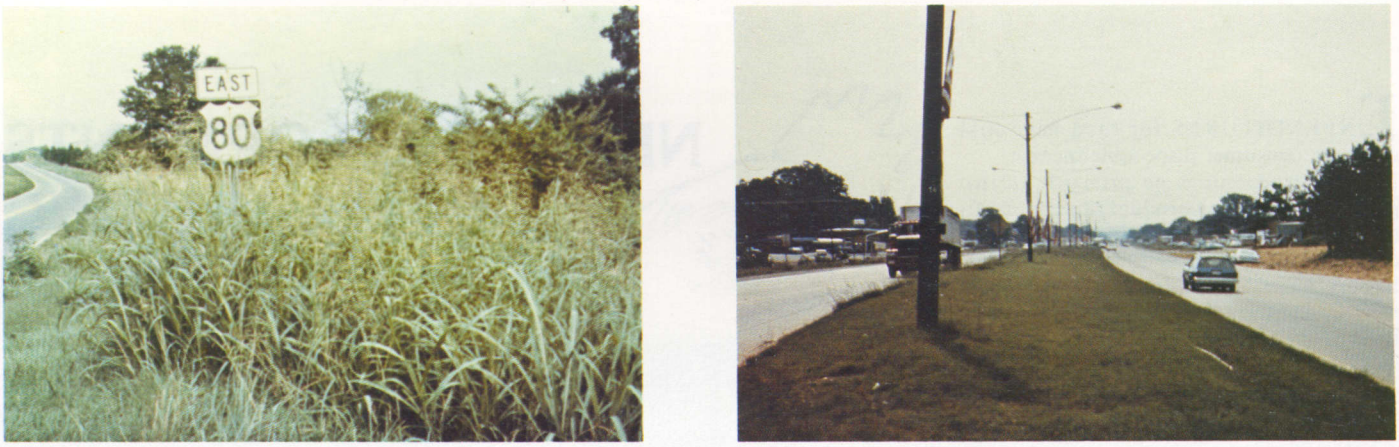


FIG. 1: Left area of highway prior to initiating herbicide program; note the taller growing species and uneven appearance. Right area, which has been sprayed for 3 years, has an excellent stand of common bermudagrass.

RAY DICKENS, Department of Agronomy and Soils

Spraying Reduces Maintenance Costs On Alabama Highways

In 1977, Alabama spent approximately $3.3 million mowing and spraying turf on state and federal highways. In the 1980-81 fiscal year, these costs were about $4.7 million. Why, in times of high fuel prices and rampant inflation, have the increases in vegetation maintenance costs been so moderate? The primary reason has been a reduction in mowing with a corresponding increase in the use of selective herbicides.

In 1977, research was begun by the Alabama Agricultural Experiment Station to develop a highway vegetation management program that would provide acceptable aesthetic and safety standards at minimum cost to taxpayers. This work was funded by the Alabama Highway Department in cooperation with the Federal Highway Administration[1].

One of the first studies initiated was a comparison of the fan-cage sprayer to other application systems available. Results of 2 years' testing showed that vegetation control from fan-cage sprayers was as good or better than that obtained from conventional boom sprayers, see table. Because of the lower price of the fan-cage sprayer and since units could be mounted on tractors formerly used for mowing, it was decided to employ this applicator in the program.

Several dozen herbicides were evaluated alone and in combinations for vegetation control. MSMA, a commonly used herbicide in cotton, effectively controls johnsongrass and many broadleaf and grass weeds with little or no injury to the desirable common bermudagrass turf.

MSMA is not highly toxic to man or animals and is labeled for home owner use in controlling lawn weeds. Another point in favor of this herbicide has been its relatively low per-acre cost.

Roadsides in many areas of the State that were primarily johnsongrass and broadleaf weeds at the onset of the program have now been converted to low growing dense stands of common bermudagrass, figure 1. The MSMA is providing Alabama motorists with safer, more attractive roadsides at lower costs to the taxpayer. Mowing cost approximately $18 per acre in 1981 compared to herbicide application at $15 per acre. Johnsongrass is controlled no more than 2 to 3 weeks by mowing, whereas, it is completely eliminated by the MSMA treatments. Other vegetation is controlled about twice as long by spraying as by mowing.

Although MSMA controls most species adequately, certain broadleaf weeds require the addition of 2,4-D for effective control. Like MSMA, 2,4-D has been proven extremely safe to man and animals at normal use rates. However, even small amounts of 2,4-D are injurious to several crop species, especially cotton, tomatoes, and grapes. Therefore, studies were conducted to evaluate other herbicides to replace 2,4-D and avoid injury to desirable plants caused by drift of the spray from the target area.

Several herbicides showed promise in small plot tests and were further evaluated during 1980 in large scale applications made on highway rights-of-way by Highway Department personnel. Diuron (Karmex®) and hexazinone (Velpar®) appeared the most promising as substitutes for 2,4-D of the materials evaluated, figure 2.

Research continues in an effort to find more economical and effective materials and machines to further reduce vegetation maintenance costs.

[1]Contents of this report reflect the views of the author and not necessarily the official views or policies of the Alabama Highway Department or the Federal Highway Administration.

COMPARISON OF VEGETATION CONTROL OBTAINED FROM MSMA AND GLYPHOSATE APPLIED BY THREE APPLICATION SYSTEMS

Application system	Vegetation control			
	MSMA		Glyphosate	
	1977	1978	1977	1978
	Pct.	*Pct.*	*Pct.*	*Pct.*
Fan-cage	67a[1]	63	70a	62a
Directed stream	25b	50	38c	39b
Conventional boom	31b	51	60b	45ab

[1]Means followed by same letter are not significantly different ($P \leq 0.5$) by Duncan's Multiple Range Test.

FIG. 2: Excellent control of broadleaf weeds obtained from combinations of MSMA and diuron in southern Alabama.

BENCHMARK FINANCIAL RATIOS FOR AGRICULTURE

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GOOD FINANCIAL MANAGEMENT is a necessary ingredient for successful and profitable farm management. To be a successful manager a farmer must be able to thoroughly analyze all financial aspects of the farm business. He must make a basic financial analysis using the balance sheet, the profit and loss statement, the cash flow statement, and the statement of change in financial position — and interpret all information within these instruments.

A relatively simplistic and straightforward method for analyzing such complex data is through the use of ratio analysis. Ratio analyses can assist in the interpretation of data presented in financial statements in several ways. First, they can help in determining the profitability of the farm operations during a given period of time. Ratios can also assist in developing performance trends and in comparing changes in the operation over time. Ratio comparisons over time make it easy to see significant changes in financial relationships.

An important use of ratios is comparison of the data from an individual farm to that derived from other similar operations. A major problem in making such comparisons is that standards or benchmark data are not readily available. Organizations such as Robert Morris Associates and Dunn & Bradstreet publish annual reports which give ratio data for most major industries. The agricultural industry, however, is not included in those analyses. The major reason for agriculture not being included is that sufficient primary financial record data are not available.

A research project was initiated by the Alabama Agricultural Experiment Station to help fill this void in agricultural financial information. Data were obtained from the Federal Land Bank of New Orleans on more than 1,900 borrowers from Alabama, Louisiana, and Mississippi. Personnel at the Bank carefully screened the data so that complete confidentiality with regard to identification of individual borrowers was preserved.

Thirteen financial ratios were developed for analysis. These ratios were grouped into three basic areas.

The first group of ratios shows liquidity, or the ability of the farm business to meet its obligations in the current operating period. Ratios included in this category were:

Current Ratio = Current Assets ÷ Current Liabilities

Sales to Working Capital Ratio = Gross Sales ÷ Working Capital

The second category of ratios indicates the solvency of the farm business or its ability to cover all financial obligations with its total holdings. Ratios included here are:

Fixed Assets to Worth Ratio = Fixed Assets ÷ Net Worth

Leverage Ratio = Total Liabilities ÷ Net Worth

Net Capital Ratio = Total Assets ÷ Total Liabilities

Intermediate Ratio = Intermediate Assets ÷ Intermediate Liabilities

Long-term Ratio = Fixed Assets ÷ Fixed Liabilities

The third category includes several ratios which indicate the level of performance and profitability of the farm business. These are:

Sales to Worth Ratio = Gross Sales ÷ Net Worth

Sales to Net Income = Gross Sales ÷ Net Income

Sales to Assets Ratio = Gross Sales ÷ Total Assets

Sales to Fixed Assets Ratio = Gross Sales ÷Fixed Assets

Return on Investment Ratio =Net Income ÷Total Assets

Return on Equity Ratio = Net Income ÷ Net Worth

The data given in the table are the upper quartile, median, and lower quartile values for each ratio, categorized by farm size. Small farms were those with gross sales of $20,000 or less, while those with sales between $20,000 and $40,000 were classified as medium size farms. Those with gross sales over $40,000 were designated as large farms. The number of farms is different for some categories because data were not available to calculate all ratios for all farms.

SELECTED FINANCIAL RATIOS BY FARM SIZE FOR ALL FARMS, FEDERAL LAND BANK OF NEW ORLEANS DATA

Type of ratio	Size of farm					
	Small		Medium		Large	
	No. of farms	Ratio	No. of farms	Ratio	No. of farms	Ratio
Current ratio	363	19.83	55	10.24	234	5.28
		6.53		3.39		2.13
		2.04		1.60		1.28
Sales of working capital	1,369	.14	144	.85	437	.88
		.05		.50		.61
		.00		.27		.43
Fixed assets to net worth	1,368	1.96	144	1.61	437	1.35
		1.40		1.18		1.04
		1.03		.92		.79
Total liabilities to net worth	1,368	1.58	144	1.16	437	1.28
		.93		.68		.75
		.48		.33		.44
Total assets to total liabilities	1,368	3.08	144	3.98	437	3.25
		2.08		2.46		2.32
		1.63		1.86		1.78
Intermediate ratio	850	6.10	87	6.17	317	7.88
		3.26		3.78		3.85
		1.89		2.64		2.31
Sales to net worth	1,367	.06	144	.48	437	.74
		.02		.22		.44
		.00		.07		.25
Sales to net income	395	3.00	144	2.58	437	3.84
		2.00		1.88		2.82
		1.09		1.58		2.22
Return on total investment	1,365	.03	144	.10	437	.12
		.01		.06		.08
		.00		.03		.05
Return of equity	1,364	.03	144	.22	437	.25
		.01		.10		.15
		.00		.04		.08
Sales to fixed assets	1,370	.04	144	.29	437	.71
		.02		.20		.40
		.00		.06		.23
Sales to total assets	1,368	.03	144	.21	437	.35
		.01		.14		.23
		.00		.04		.16
Fixed assets to long-term liabilities	1,371	2.35	144	3.21	437	2.50
		1.60		2.00		1.70
		1.30		1.40		1.33

Foreign Land Ownership in Alabama — *How extensive is it?*

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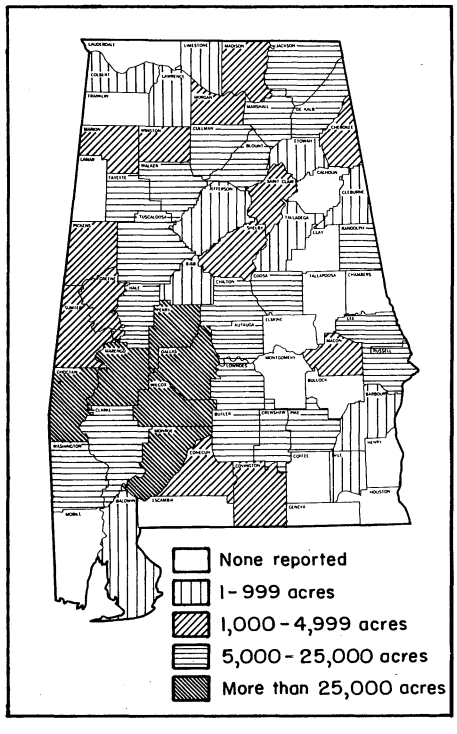
FOREIGN LAND OWNERSHIP is an issue which received much attention in the middle and late 1970's. Concern was expressed by many individuals and groups at various levels relative to this issue. However, little information was available on which to evaluate the nature and extent of foreign land ownership. Congress attempted to remedy this situation with passage of the Agricultural Foreign Investment Disclosure Act (AFIDA) of 1978.



Foreign ownership of agricultural land in Alabama.

Disclosure reports made by Alabama landowners in compliance with this legislation were provided to the Alabama Agricultural Experiment Station for detailed analysis. Analyses of data from 249 reports submitted prior to August 1981 indicate that foreign individuals and entities owned or partially controlled approximately 566,000 acres of agricultural land in the State, see figure. This represented 1.9% of the privately owned land and 1.7% of the total land area of the State.

Ownership Distributed in Most Counties

Parcels held by foreign interests were distributed through 51 of the 67 counties in Alabama. The largest concentration of ownership was in the southwestern portion of the State. Wilcox County had the most foreign ownership reported, 90,267 acres or 16% of the State's total foreign ownership. This represented 16% of the total land area in this county. Foreign ownership was also prominent in Perry, Monroe, Choctaw, Dallas, and Marengo counties at 8.7%, 7.3%, 7.1%, 6.2%, and 5.9% of the total foreign ownership for the State, respectively. These six counties accounted for 51% of the total reported foreign-owned acreage and 45% of the reported parcels in the State.

Forestry is Dominant Use

Forestry was the dominant use to which foreign held land was allocated. Ninety-five percent of the respondents reported that at least part of the parcel was allocated to forest use. Size of these units averaged 2,300 acres, and ranged from 4 to 66,290 acres. Use differed substantially from the national average, with forestry accounting for 41% of the parcels. Crop, pasture, and other agricultural uses accounted for the remainder of the parcels in the State. Multiple uses were present on 11% of the parcels. Important changes in use are not expected since 90% of the respondents noted no planned changes.

Organizations Most Common Type Owners

Organizations were the most common type of owners of foreign held land. Of the 249 parcels reported, 241 were owned by organizations. Average size of these units was 2,350 acres, with a range of 5 to 66,300 acres. Organizations were almost totally corporations, 99%.

Seventy-two percent of the organizations reporting ownership indicated that their organization was created under Alabama law. Another 19% gave the United States as the government or country under whose law the organization was created. Seven respondents each, 3%, recognized the United Kingdom and Netherlands Antilles in this manner.

The largest portion, 79%, of the organizations owning land in the State listed Alabama as their principal place of business. Another 1.7% of the firms identified other states as being their principal place of business. Only 4% identified their principal business location as being outside the United States.

Seventy percent of the foreigners owning land in Alabama held a whole fee interest in the property, while 2% possessed a partial fee interest. The remaining 28% reported other types of interest held, primarily long term leases or long term timber cutting and management contracts.

Average size of the eight parcels held by individuals was 67 acres, with a range from 38 to 163 acres. The United Kingdom (3), Canada (2), Egypt (1), Iran (1), and Syria (1) were identified as countries where the individual owners held citizenship.

Method of Acquisition

In most cases, agricultural land purchased by foreigners was acquired on a cash basis. Fifty percent of these acquisitions were paid in cash, 15% involved credit, and 6% gained ownership by direct trade of assets. Inheritance or gift accounted for 1% and the remainder was classified as other.

Summary

The current foreign ownership situation in the State does not merit great concern in terms of traditional agriculture. The largest portion of foreign owned land is devoted to the production of timber. Few of these owners identified their principal place of business as being outside the United States. This situation should not result in complacency, however. Ownership should continue to be monitored, especially at county levels and in areas where foreign ownership is extensive.

Herbicide, Cultivation, or Hoe

Which Combination is Best for Peanut Weed Control?

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TRADITIONALLY, acceptable weed control has been based more upon achieving a high level of weed control with minimal crop injury and less upon the net return offered by that treatment. However, it is increasingly important for peanut producers to be able to identify not only the most effective, but also the most economical weed management components. Researchers at the Alabama Agricultural Experiment Station have attempted to evaluate the optimum mix of commonly used weed control components of herbicides, cultivations, and hand hoeing.

Experiments were conducted at the Wiregrass Substation, Headland, from 1978-1980. Treatments included commonly used preemergence and postemergence applied herbicides applied alone or as tank-mixes; these treatments were also combined with two cultivations or two cultivations plus two hand hoeings. Land was selected that had a mixture of common weed species, such as sicklepod, Florida beggarweed, Florida pusley, annual morningglories, and crabgrass. Peanut yield, weed control and crop response ratings, and hoeing times were recorded each year.

Costs of herbicides, cultivations, and hoeings ($3.35 per man hour) were used to prepare an enterprise budget[1] for each treatment. Individual treatment yields were converted to gross profit based on a support price of $550 per ton of peanuts. Gross returns and individual treatment costs were then combined to calculate a net return for each treatment.

If Balan® at 1.5 lb. per acre (no cultivation) is selected as the standard treatment and all other individual treatments compared to it, highest net profits were returned in 1978 when Vernam®, Lasso®, Premerge 3®, or Premerge 3® + Amiben® were used with two cultivations, table 1. During 1979, no differences could be detected among any of the treatments, indicating the need for only minimum weed control.

However, 1980 results showed that most herbicides combined with two cultivations produced higher net returns than Balan® applied alone. Herbicide treatments without cultivation that produced higher net profits included Dyanap® (CR) and Premerge 3®+ Lasso® (CR). The most consistent treatments for the 3-year period were Vernam® (PPI) + two cultivations, Lasso® (PRE) + two cultivations, Premerge 3® (CR) + two cultivations, and Premerge 3® + Amiben® (CR) + two cultivations.

In 1978 treatments where no herbicides were applied, no more than two cultivations could be justified, table 2. A single cultivation was sufficient for 1979 and 1980.

When the data are grouped, table 3, some trends are apparent. First, herbicides alone applied at cracking (CR) showed trends of higher net profits than preplant incorporated (PPI) and preemergence (PRE) applied herbicides. This is predictable since CR treatments generally are more effective for broadleaf weed control. However, when two cultivations were combined with the herbicides, the particular herbicide group made little or no difference. Also, herbicides plus two cultivations showed trends of producing highest net profits and therefore indicating optimum weed control efforts. Another apparent trend is that two hoeings added little towards higher net returns in peanuts.

Results suggest that many peanut producers probably include too much weed control efforts in their production system. However, it must be kept in mind that broadleaf weeds were the predominant species in these experiments. In areas where Texas panicum is a problem, these results would probably change. Studies involving Texas panicum are planned for future investigations.

[1]Budgets prepared by Neil R. Martin and Donnie Parrish, Department of Agricultural Economics and Rural Sociology.

TABLE 1. INFLUENCE OF HERBICIDES AND CULTIVATIONS ON NET RETURNS OF PEANUTS

Treatment	Method of application	Rate (lb. a.i. per acre)	Cult. (no.)	Net returns (dol. per acre) 1978	1979	1980
Balan	PPI[3]	1.5	—	153	72	-109
Balan	PPI	1.5	2	338	245	117
Vernam	PPI	2.5	—	189	30	-63
Vernam	PPI	2.5	2	421*[2]	143	188*
Balan + Vernam	PPI	1.5 + 2.5	—	180	194	- 16
Balan + Vernam	PPI	1.5 + 2.5	2	351	145	219*
Lasso	PRE	4	—	325	58	4
Lasso	PRE	4	2	502*	165	256*
Premerge 3	CR	4.5	—	206	35	119
Premerge 3	CR	4.5	2	431*	152	247*
Dyanap	CR	4.5	—	164	245	203*
Dyanap	CR	4.5	2	282	143	308*
Premerge 3 + Lasso	CR	1.5 + 3	—	282	—	184*
Premerge 3 + Lasso	CR	1.5 + 3	2	393	176	310*
Premerge 3 + Amiben	CR	1.5 + 3	—	313	121	104
Premerge 3 + Amiben	CR	1.5 + 3	2	524*	116	208*
Weed check	—	—	—	100	-304	-77

[1]Average peanut yields: 1978-2,980 lb. per acre; 1979-2,096 lb. per acre; 1980-2,383 lb. per acre.
[2]Asterisk indicates a higher net profit within a column when compared to Balan at 1.5 lb. per acre (p = .05).
[3]PPI = preplant incorporated; PRE = applied to soil surface immediately after planting; CR = applied when peanuts and weeds were cracking and emerging from the soil.

TABLE 2. NET PROFIT OF PEANUTS AS INFLUENCED BY NUMBER OF CULTIVATIONS[1]

No. cultivations	Net profit (dol. per acre) 1978	1979	1980
1	123.73*[2]	55.60	76.03
2	331.04	190.65	132.84
3	276.17	201.85	106.88
4	320.38	72.63	157.28
5	205.64	-78.58	114.80

[1]No herbicides applied.
[2]Asterisk indicates a lower profit (p = .05).

TABLE 3. NET PROFIT OF PEANUTS AS INFLUENCED BY VARIOUS WEED CONTROL INPUT GROUPS

Weed control groups[2]	Net returns (dol. per acre)[1] 1978	1979	1980
PPI and PRE	212	89	-63
At cracking	242	134	153
PPI and PRE + 2 cult.	416	175	195
At cracking + 2 cult.	408	147	269
PPI and PRE + 2 cult. + 2 hoe	433	196	289
At cracking + 2 cult. + 2 hoe	398	199	293

[1]Averaged across treatments within a grouping.
[2]Groups include PPI, PRE, and CR herbicides that appear in table 1.

Differences in BODY COMPOSITION, MUSCLE GROWTH of Two Types of Chicks

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Since the rate of protein synthesis in muscles and concentrations of DNA and RNA were similar for broilers and Leghorns at each age, it appears that faster growth of broilers may be due to their increased ability to increase the number of nuclei in their muscle cells. This produced more total RNA, which synthesized more muscle protein. Broilers may be able to increase the number of nuclei because they have a greater number of muscle cells.

These data can be related to similar differences between cattle selected for either meat production or milk production. The results suggest that beef cattle may produce muscle growth faster than dairy cattle due to a greater number of both muscle fibers and muscle cell nuclei.

ANIMAL GROWTH is the result of increases in body muscle, fat, bone, and organ weights. Although researchers have established many of the factors that influence rate and efficiency of growth of livestock, little is known about how genetically superior animals grow faster or have better carcasses than other animals in the same herd.

A study designed to identify some of the physical and physiological differences between fast growing and slow growing animals was conducted at the Alabama Agricultural Experiment Station. Because swine and cattle require long periods and large costs to reach mature size, the study used broiler and Leghorn roosters to compare rates of muscle growth, production of muscle protein, and changes in body composition of birds selected for meat production with those selected for egg production.

Male Corbic-Corbic broiler and Hy-Line Leghorn chicks were obtained from McElrath Farms, Albertville, on the day of hatching. All birds were debeaked, vaccinated for Marek's disease, and provided a standard medicated growing ration formulated to produce maximal growth.

Birds were sacrificed twice weekly for the first 8 weeks and biweekly to week 14. Two wing muscles were removed from the sacrificed birds to determine muscle size and to estimate the rate of protein synthesis in the muscle. The muscles also were analyzed to determine concentrations of DNA and RNA, which are indicators of the number of muscle nuclei and the degree to which the body is attempting to synthesize muscle proteins, respectively. The edible and inedible portions of the carcasses were analyzed to determine the amounts of protein, fat, and moisture present at each age.

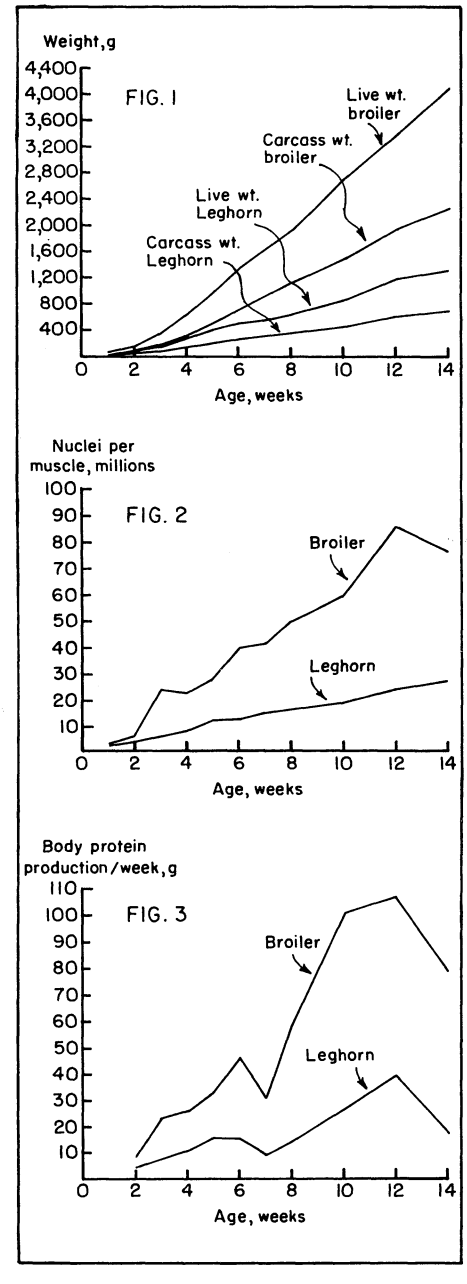
Although birds from both strains averaged 1.4 oz. live weight at hatching, broilers weighed twice as much as the Leghorns by week 3 and three times as much by week 8, figure 1. Carcass weight as a percentage of live weight was similar between strains and increased from 37% at week 1 to 56% at week 8. After week 2, the broilers consistently had a higher percentage of carcass fat than did the Leghorns. Similarly, the weight, volume, and length of wing muscles were consistently greater in the broilers at each age after week 2. The observation that muscle length was still increasing at the end of the 14-week period indicates that skeletal growth was not yet complete.

The concentration of DNA in muscles was similar between strains at each age and decreased as the birds grew. Total DNA in wing muscles was similar for broilers and Leghorns initially, but the broilers showed a much faster increase in total muscle DNA. The increase in total DNA was the result of an increase in the number of nuclei in the muscle cells, and the broilers displayed a greater ability to increase the number of nuclei.

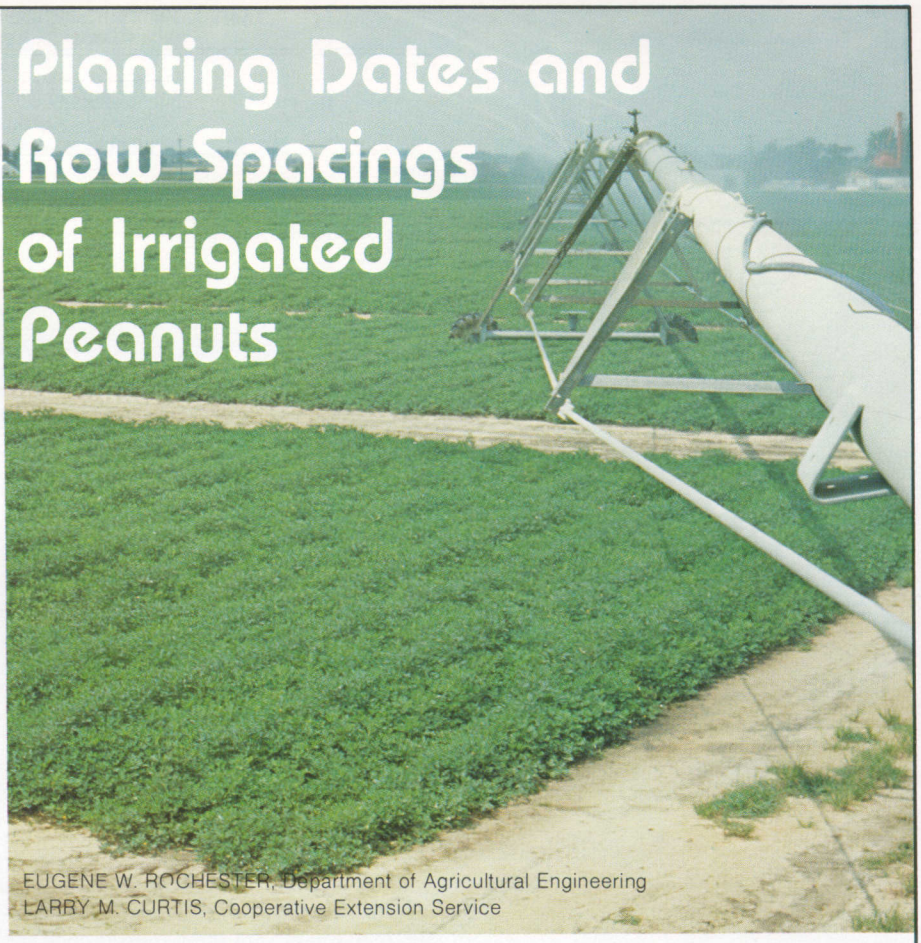
The concentration of RNA in muscles was also similar between broilers and Leghorns at each age. As observed for DNA, the total amount of muscle RNA was greater for the broilers due to their larger size. As a result of the greater total amount of muscle RNA and DNA, the broilers were capable of synthesizing more muscle protein per day, which resulted in faster growth.

Laboratory experiments revealed that the rate of protein synthesis per gram of muscle was similar for broilers and Leghorns—greatest at week 1 and declined thereafter. This was found to be related to the concentration of RNA and DNA.

Total protein in the body increased with age, but protein production reached a peak on week 12 for both broilers and Leghorns. This indicated that the birds had reached a point of their growth curves such that the major portion of future weight gain would be in the form of body fat, figure 2. The decrease in protein production coincided with a slight decline or stabilization of the total muscle RNA values.



Planting Dates and Row Spacings of Irrigated Peanuts



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MAXIMUM UTILIZATION OF RESOURCES continues to be a key ingredient in the successful use of irrigation in Alabama. With that in mind, a study was initiated 2 years ago at the Wiregrass Substation, Headland, to evaluate date of planting and row spacings of irrigated peanuts.

Planting dates ranged from early May until late June and extended well beyond the traditional planting dates.

An overview of the water applied and rainfall received on the various planting dates during 2 years of distinctly different weather patterns is presented in table 1. Major differences in total rainfall between the 2 years are not apparent although there was 1 to 5 in. more rainfall in 1981 than during the 1980 growing season.

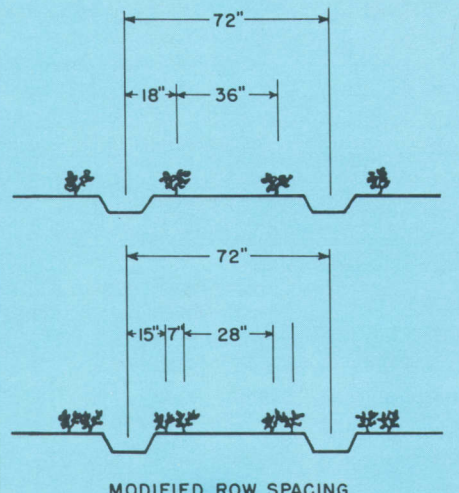
Total irrigation application in 1981 was much less than in 1980 and reflects the better distribution of rain in 1981 since irrigation policies remained the same. Much less (total) irrigation water was applied to the 1981 crop. Irrigation varied with planting date depending on rainfall timing, but no clear trend is apparent.

In 1981, irrigation requirements increased with late planting; however, in 1980 the middle planting required the most water. Growing time to maturity was also affected by planting date and showed a decrease with late planting in 1981, but showed mixed results in 1980.

Yields of peanuts planted in conventional row spacings ranged from 3,770 to 4,450 lb. per acre with the 1980 year showing a tendency for a small decrease in yield with later plantings, table 2. However, the 2-year average yields for each planting date show a significant trend for decreased yields with the later planting dates. The decreases from the first to the last plantings are 275 and 205 lb. per acre for the 7-in. and the 36-in. spacings, respectively.

Alternate planting patterns indicate potential for increased yields. One such pattern utilizing twin rows and a 10% increase in seeding rate, see figure, was included in this study with yields reported in table 2. A comparison of the two planting patterns reveals an average increase in yield in both years for the twin 7-in. pattern. The 2-year average increase of 578 lb. per acre was highly significant.

In summary, the results from the 2-year study indicate late planting of peanuts under irrigated conditions can be accomplished without large losses of yield and without necessarily increasing water requirements. However, longer term studies are needed to verify these preliminary findings. Likewise, the twin 7-in. row pattern continues to show promise in increasing yields under these irrigated conditions.



MODIFIED ROW SPACING

TABLE 1. WATER APPLICATION AND GROWING TIME FOR 1980 AND 1981 FLORUNNER PEANUT EXPERIMENT, WIREGRASS SUBSTATION, HEADLAND

Planting date	Rainfall	Irrig.	Total water applied	Growing period
	In.	*In.*	*In.*	*Days*
1980				
5/7	18.2	13.8	32.0	139
6/3	12.1	16.1	28.2	135
6/18	15.6	12.8	28.4	138
1981				
5/8	19.6	5.0	24.6	145
6/5	16.9	6.5	23.4	129
6/18	16.0	7.2	23.2	126

Left: Conventional 36-in. row spacing above with modified 7-in. spacings shown below.

TABLE 2. IRRIGATED PEANUT YIELDS[1], WIREGRASS SUBSTATION, HEADLAND, 1980 AND 1981

Planting dates	Row spacing				
	Twin 7"	2-year av.	36"	2-year av.	Diff. (twin-36)
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
5/7/80 ...	4,980		4,450		+530
		4,845		4,185	
5/8/81 ...	4,710		3,920		+790
6/3/80 ...	5,090		4,190		+900
		4,585		4,100	
6/5/81 ...	4,080		4,010		+ 70
6/18/80 ..	4,690		4,190		+500
		4,570		3,980	
6/18/81 ..	4,450		3,770		+680
2 yr. av. diff.					+578

[1]All treatments harvested at two dates with yields reported from first dig.

Structure of the Slaughter Industry in the Southeast

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THE SOUTHEASTERN UNITED STATES is a beef and pork deficit region. During the last 20 years the number of slaughter plants has declined in the region because of demographic shifts of consumers, development of a large scale cattle-feeding industry, changes in government legislation, growth of new and large scale packing plants, and fluctuations in livestock inventories. This decline has deterred the growth of a feedlot industry because competition for slaughter cattle is reduced. In recent years the demographic and economic situation of the region has changed which could influence the future structure of the slaughter industry.

Slaughter Industry Structure

To determine the structure of the slaughter industry in the Southeast, a survey was conducted by the Alabama Agricultural Experiment Station in 1979 of 1,600 packing plant managers in 12 states. A mail questionnaire was sent to all state and federally inspected plants in the region except Virginia. Approximately 22% of plants surveyed responded to the questionnaire.

The largest percentage, 45%, of plants reported slaughtering both hogs and cattle, followed by plants killing only hogs, 15%, and only cattle, 7%. Approximately 33% of the plants were custom plants slaughtering only a small number of cattle and hogs. An estimated 10% of the plants had either gone out of business or stopped slaughtering livestock.

The dual purpose plants had the lowest throughput, killing rate, and used capacity in 1979 compared to the single specie plants, table 1. The economic justification for these plants is their ability to spread costs over more animals and flexibility in obtaining available supplies. Plants killing only hogs had the highest annual throughput. Generally, these plants are the largest type in the Southeast Region. The cattle only plants are relatively small compared to some of the large meat packers in the Midwest which can kill 4,000 animals per day.

TABLE 1. PRODUCTION CHARACTERISTICS FOR PACKING PLANTS IN THE SOUTHEASTERN UNITED STATES, 1979

Item	Southeastern plants slaughtering					
	Cattle only		Hogs only		Cattle and hogs	
	Number of plants	Average production	Number of plants	Average production	Number of plants	Average production
Hogs						
Annual production	--	--	53	72,270 hd.	156	17,288 hd.
Production per hour	--	--	50	55 hd.	146	26 hd.
Use of capacity	--	--	41	81%	118	58%
Cattle						
Annual production	25	17,192 hd.	--	--	156	3,138 hd.
Production per hour	24	15 hd.	--	--	147	7 hd.
Use of capacity	19	74%	--	--	120	49%

Location of Animal Supplies

Plants in the Southeast reported they obtain 90% of their supplies of live animals within 300 miles. In general, cattle are not imported in large numbers into the region for slaughtering. Reflective of the large cow/calf inventory in the Southeast, cows were the predominant type of cattle killed, table 2. Plants killing only cattle slaughtered a larger percentage of cows than dual purpose plants. The number of heavy heifers slaughtered was greater than in dual purpose plants. The percentage of fat cattle killed by plants was relatively low for all plants.

In general, further processing of the carcass is an accepted activity in plants in the region. This activity allows plants to further capture value-added of the intermediate product. Plants which killed only cattle reported the lowest processing rate, 66%, while plants killing only hogs had the highest, 95%. Processing was done by an average of 80-85% of dual purpose plants. The majority of cattle from single purpose plants sold either carcasses or processed products but less in the form of primals and sub-primals. Hog killing plants sold few carcasses and more primals and sub-primals than cattle only plants. All hog killing plants reported selling processed products. Dual purpose plants sold more processed beef than cattle only plants, and 33-38% of all plants handling cattle purchased box beef for either processing or reselling.

Summary

The survey of the slaughter industry in the Southeast revealed unused capacity in both hog and cattle packing plants in 1979. Slaughter capacity is not seen as a constraint if more cattle feeding occurs in the region. With further increases in transportation costs and grain prices, the opportunity for finishing cattle on forage and limited grain could increase. With adjustments in demand for beef to leaner meat and hamburger, the large number of cows in the regional inventory could make the industry more attractive in the future for investment. The current level of processing by plants is indicative of this trend in the regional market.

TABLE 2. TYPES AND AVERAGE NUMBERS OF CATTLE SLAUGHTERED BY PACKING PLANTS RESPONDING TO THE SURVEY, SOUTHEASTERN UNITED STATES, 1979

Type	Plants slaughtering					
	Cattle only			Cattle and hogs		
	Number of plants	Average annual slaughter	Percent of total	Number of plants	Average annual slaughter	Percent of total
Cows	25	10,639	65	156	1,335	51
Heavy steers	25	1,666	10	156	334	13
Heavy heifers	25	1,599	10	156	538	20
Lightweight cattle	25	2,413	15	156	408	16
Total	25	16,317	100	156	2,615	100

Includes all commercial packing plants in the survey. Total average annual slaughter does not equal total production because not all plants slaughtered a particular category of animals.

Improving Peeling Efficiency of Red Delicious Apples

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W. A. GRIFFEY, Piedmont Substation

MANY FRUITS and vegetables are not well adapted to mechanical peeling because of irregular shapes and cavities. Their sensitivity to heat treatment also creates problems in conventional caustic peeling. Successful thermal peeling requires rapid transfer of heat to the tissues to be peeled—for a minimum duration—followed by cessation of heat and rapid cooling.

Red Delicious apples are especially troublesome to peel, either mechanically or chemically, because of their rather truncated shape, thick skin, and waxy coating. Commercial peeling of apples is commonly done mechanically, which results in relatively high peeling losses. These high losses can be reduced through caustic peeling. However, the use of caustic solutions is often complicated, results in reduced product yields, and necessitates costly waste disposal operations.

Efficient Peeling Sought

The objectives of a study by the Alabama Agricultural Experiment Station were to improve peeling efficiency by (1) development of technology for superheated steam peeling, and (2) refinements in conventional caustic and steam peeling methods.

Steam peeling tests were conducted using unwaxed Red Delicious apples. The fruits were graded to ensure a mean diameter of 2.5 in. and a mean weight of 5 oz.

A tumbling batch-type laboratory pilot model steam peeler of ¼ bu. capacity was adapted to accept either saturated steam at 100 p.s.i.g. or superheated steam at 100 p.s.i.g. and a mean inlet temperature of 732° F. Another design feature provided for direct injection of cold water at 68° F into the peeling chamber through the steam diffuser system. This distributes water among the fruit, accelerating the reduction of pressure within the chamber and rapidly cooling the product.

EFFECT OF PEELING TREATMENT ON PEELED YIELD, HEAT PENETRATION, AND TOTAL SOLIDS OF RED DELICIOUS APPLES

Peeling treatment	Mean peeled yield	Mean heat penetration	Total solids
	Pct.	*mm*	*Pct.*
Superheated steam + water	97.5	2.5	18.1
Saturated steam + water	96.5	3.1	18.0
Superheated steam	95.9	3.4	18.2
Saturated steam	95.3	3.4	18.2
Detergent abrasive lye	91.7	5.7	17.8
Detergent lye	87.4	5.9	17.7
Lye	85.8	6.4	17.7
Mechanical	82.7		18.9

Pre-wash System Developed

All caustic peeling tests were conducted in a laboratory-size, ferris wheel peeler varying only the time required to attain optimal peel for the pretreatment being tested. To improve effectiveness of caustic peeling, a simple and inexpensive method that could be used commercially was designed to vigorously prewash the apples and disrupt the waxy coating. In this apparatus, individual fruits were fed between rotating corn silking brushes in a tank charged with highly agitated warm water and detergent.

Similar tests were run with the same apparatus charged with warm water, detergent, and size 80 grinding silica. Purpose of the silica was to disrupt the cutin layer through minute scratches which would allow the caustic solution to come into contact with the skin of the fruit. Optimal peeling periods in the caustic bath were 4 minutes with no prewash, 3 minutes and 40 seconds with a detergent prewash, and 3 minutes with an abrasive prewash.

A mechanically peeled control was run with peeling knives set to a peel thickness of 1.9 mm.

High Peeling Recovery

Superheated steam used in conjunction with direct injection of cold water into the steam atmosphere of the steam peeling chamber resulted in a higher recovery of peeled apples than with any of the other peeling treatments, see table.

Peeled yields in excess of 95% were attained in peeling treatments using superheated steam or saturated steam—with and without cold water injection. All of these peeling treatments yielded a smooth, well blanched surface without disrupting the integrity of the apples.

The agitated prewash brushing treatment resulted in significant improvements in the yield of lye peeled fruit, see table. Yields were 85.8% for lye peeling, 87.4% for lye peeling following detergent prewash, and 91.7% for fruit treated with a detergent and abrasive prewash before lye peeling. The use of these prewashes before steam peeling had no effect on steam peeling efficiency.

Mean heat penetration into the flesh of the apple is directly related to the duration of the heating portion of the peeling process. Greater penetration occurred in lye peeling than in steam peeling, see table. Superheated steam peeling with cold water injection into the peeling chamber resulted in a significantly lower heat penetration than other peeling processes.

Steam Peeled Apples Attractive

Color and appearance of the apples peeled by all steam peeling methods were rated excellent. Color of the lye peeled fruit was visibly less brilliant. Mechanically peeled apples darkened faster than either the lye peeled or steam peeled fruits and lacked the smooth surface attained by lye peeling or steam peeling.

Water uptake during peeling and washing, measured by total solids, was slightly higher in lye peeled apples than in those peeled by steam.

Conclusions from this study are that steam peeling with superheated steam and flash cooling by cold water (1) increases yields, (2) saves labor, (3) eliminates the need for expensive caustic solutions and caustic solution disposal, and (4) results in higher quality apples for further processing. While caustic peeling of apples is a major improvement over mechanical peeling, it requires the additional step of mechanically or chemically penetrating the cutin layer to achieve satisfactory yields. Steam peeling appears to be more efficient for firm ripe apples.

Competition by Common Cocklebur Reduces Yields of Cotton

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COMMON COCKLEBUR *(Xanthium pensylvanicum* Wallr.) is a highly competitive weed that is widespread in cotton. This weed infested approximately 1.2 million acres of cotton in the United States in 1980. Nearly half of Alabama's cotton acreage, about 152,000 acres, was infested that year.

A widespread, robust annual weed, common cocklebur can reach heights of 7 to 8 ft. A single plant can produce as much as 30 lb. of green weight in a full growing season under favorable conditions.

Common cocklebur is capable of producing an abundance of seed, which are formed in burs that cling to clothing and machinery. This characteristic aids in the dispersal and infestation of seed in almost any crop situation. Each bur contains two seed, each of which usually germinates at different times during the growing season or over two growing seasons. This enables the plant to perpetuate itself over a long period and supplies an added dimension to the competitiveness and control of common cocklebur.

Research to document the degree of competitiveness of common cocklebur at different densities in cotton was begun in 1978 by the Alabama Agricultural Experiment Station. The Prattville Experiment Field was the site for the project.

Cotton was planted in plots that consisted of five rows spaced 42 in. apart and 50 ft. in length. Trifluralin (Treflan®) was applied preplant incorporated at 0.75 lb. active ingredient per acre for control of annual grasses and small-seeded broadleaf weeds. Recommended insect control and cultural practices were followed.

Immediately after planting, a number of common cocklebur seed were planted adjacent to the cotton drill in hills at equal intervals. After the cotton and common cocklebur had emerged, the cocklebur was thinned to one plant per hill yielding the final desired densities of 0, 2, 4, 8, 16, and 32 weeds per 50 ft. of row. These densities were selected to determine the degree and range of interspecific competition cocklebur exerts on cotton. The set densities were maintained throughout the growing season, with all other weeds removed by hand hoeing as needed.

Cotton was harvested by hand from the center row of each plot. Rows on either side of the hand harvested row were machine harvested. Machine harvesting was done with mature cocklebur plants remaining in the row. The hand harvested row was harvested after cockleburs had been removed. The two machine harvested rows were combined to determine the seed cotton yields reported in the table.

A comparison of machine harvested and hand harvested yield at the highest density, 32 cocklebur plants per 50 ft. of row, revealed no differences because of method of harvest. This suggests that machine harvesting is efficient at high densities of common cocklebur. Percent trash for hand or machine harvested seed cotton yields was not documented, but there was not an excess amount of trash observed in machine picked samples. This could be an expected trend since earlier studies with pigweed and sicklepod showed that a density of 16 weeds per 50 ft. of row reduced harvesting efficiency less than 2% and increased trash content only 4%.

MACHINE HARVESTED SEED COTTON YIELDS AND PERCENT YIELD REDUCTION FROM VARYING DENSITIES OF COMMON COCKLEBUR

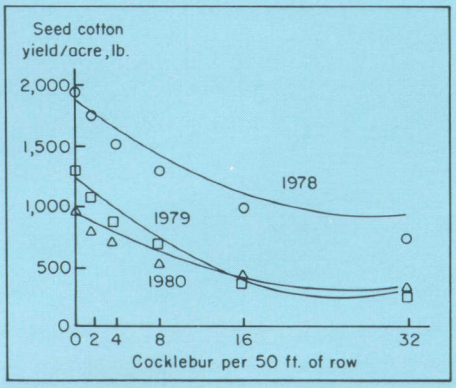
Weed density		Seed cotton/acre			Av. reduction
No./ 50 ft.	No./ acre	1978	1979	1980	
		Lb.	*Lb.*	*Lb.*	*Pct.*
0	0	2,026	1,329	1,004	--
2	500	1,808	1,074	817	17
4	1,000	1,556	908	750	27
8	2,000	1,380	760	597	35
16	4,000	1,226	416	429	56
32	8,000	925	321	336	66

Seed cotton yield reductions averaged 17% at a density of two cocklebur plants per 50 ft. of row (about 500 per acre) to 66% at a density of 32 plants per 50 ft. (about 8,000 per acre), see table. Seed cotton yields were reduced significantly in 2 of 3 years at a density of two cockleburs per 50 ft. of row when compared to weed-free cotton. Significant yield reductions occurred at all other densities for all years when compared to the check.

The graphic presentation of results shown indicates that seed cotton yields were reduced with increases in weed density up to 16 cockleburs per 50 ft. of row. No further yield reductions were apparent to densities greater than 16. This type of response was observed regardless of the type of harvesting done.

Line equations developed from regression analysis enables prediction of yield losses for each common cocklebur plant per 50 ft. of row. Averages for the 3 years show that per acre losses of seed cotton yield amounted to 89 lb. with hand harvesting and 68 lb. for machine harvesting.

Data from the Auburn tests indicate the potential for tremendous yield losses from common cocklebur if left uncontrolled. Significant yield reductions were apparent even at weed densities as low as 500 plants per acre (2 per 50 ft. of row). Therefore, a high level of control is necessary to eliminate yield losses from this highly competitive weed.



Influence of varying densities of common cocklebur on seed cotton yields.

Regional Beef Cow Inventories as Derived from Consumer Demand for Beef

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CATTLE PRODUCERS are plagued with an economic problem of highly variable income. A contributing factor, the cattle cycle, has been observed throughout the past century. This cycle includes periods when herd numbers are low and prices are rising, followed by periods when herd numbers are high and prices are falling.

Changes in beef production resulting from this cycle have a widespread effect on farming in the United States because large amounts of resources, particularly land, investment capital, and feed grain, are involved. The structure of the beef industry permits allocation of resources to be shifted among geographic regions and production stages at various phases of the cycle in the interest of efficiency. For these reasons efficient allocation of resources is a concern among producers, consumers, and policymakers.

Objectives of a recent study by the Alabama Agricultural Experiment Station addressed these concerns through a computer model of the United States' beef industry. Objectives were to study effects of different phases of the cycle upon optimum allocation of the brood herd. This area of the industry was chosen because cow-calf producers feel that they bear the greatest burden of economic adversity from the cycle.

A linear programming model was developed to meet objectives of the study. Five beef producing regions (West, Great Plains, Southwest, North Central, and Southeast) and six consumption regions (Pacific Coast, Mountains and Plains, South Central, Midwest, South Atlantic, and Northeast) are included in the model. Unique to this model, compared to previous industry models, is the inclusion of consumer demand for table cuts and hamburger to derive the requirements and allocation of the live animal portion of the industry. Model solutions are neither duplicates of present nor predictions of future industry organizations, but instead serve as reflections of economic pressures on the beef industry. Optimal resource allocation is based upon production costs and product price levels for 1980. Programming strategy was to optimize the model under an assumed set of conditions and then, by modifying the size of the national cow herd, to analyze changes in the model results. Results describe organizations of the beef industry which maximize returns above all variable and some fixed costs. Variable costs are assessed on all activities in the model. Activities which require expansion of facilities above current resources used are also assessed fixed costs.

Initial solutions of the beef industry model were used in an iterative process of model validation. The requirement of the validation process was that the base model solution adequately simulates production, marketing, and spatial characteristics of the beef industry. A principal characteristic used for direction in the validation process was the spatial distribution of the national beef cow inventory. Table 1 contains model results for location of beef cows at the end of the validation process. Points to draw from these data are that the model overestimated beef cow numbers in the Southwest and Great Plains regions and underestimated cow numbers in the other regions. The Southeast result of about 96% of observed data was judged to be an adequate representation of the beef industry in this region.

TABLE 1. REGIONAL BEEF COW INVENTORIES FROM OBSERVED DATA AND BEEF MODEL SOLUTION

Region	Cycle average	Model solution	Difference
	——1,000 head——		*Pct.*
West	3,955	3,878	-1.9
Great Plains	6,993	8,223	+17.6
Southwest	3,350	3,623	+8.1
North Central ..	10,720	9,947	-7.2
Southeast	16,578	15,925	-3.9
Total	41,596	41,596	0

Source: Agricultural Statistics, USDA, Washington, D.C. (selected issues).

TABLE 2. REGIONAL BROOD COW ALLOCATION FOR MODEL SOLUTIONS: LOW, BASE, AND HIGH COW HERD INVENTORIES

Region	National beef cow industry[1]		
	Low	Base	High
	—1,000 head and (pct. of base)—		
West	3,073	3,878	4,161
	(79.2)	(100.0)	(107.3)
Great Plains	8,233	8,223	8,622
	(100.0)	(100.0)	(104.9)
Southwest	3,557	3,623	3,896
	(98.2)	(100.0)	(107.5)
North Central ..	9,765	9,947	10,325
	(98.2)	(100.0)	(103.8)
Southeast	12,072	15,926	18,707
	(75.8)	(100.0)	(117.5)
Total	36,689	41,596	45,712
	(88.2)	(100.0)	(109.9)

[1]Low, 36,688,885 head, is the low inventory level observed of the past cattle cycle, 1970-79; base, 41,596,010, is the simple average over the same period; and high, 45,711,970, is the highest observed inventory level.

To assess the impact of the cattle cycle on resource allocation, three model solutions were compared. In these solutions the size of the national cow herd was fixed and the model determined the optimum geographic location of production to meet regional consumer demand. The three herd sizes used were the low, average, and high inventory numbers for the cow herd during the most recent cattle cycle, 1969 to 1978.

The effect of the cattle cycle on the regional allocation of the brood herd is listed in table 2. Data in the table indicate that cow-calf production is more variable in the Southeast and West, while production in the interior of the country remains relatively more stable during a cattle cycle. The most variation is observed in the Southeast where inventories drop nearly 24% from the average herd when the national cow inventory decreases. During the high part of the cycle, inventories increase 17.5% above the average herd. Model results indicate that cow-calf producers in the Southeast experience the widest variation in income due to shifting resource allocation during a cattle cycle.

Deer Control in Fruit and Vegetable Fields

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AFTER 3 FRUSTRATING YEARS of trying to establish a research plum orchard at the E. V. Smith Research Center, Shorter, experiments were initiated for studying ways to prevent deer injury to plum trees.

Poor growth and performance of the trees during the first leaf of growth in 1977 were not initially attributed to deer damage since there was a drought during the spring and summer. After discovering deer damage during the second leaf, the trees were sprayed with a strong tabasco pepper sauce solution (a treatment reported to be effective in Pennsylvania). However, the deer continued to browse the plum trees.

A report in the January 1979 issue of *BioScience* stated that workers at the New York Botanical Garden's Cary Arboretum discovered that bags of human hair would repel deer for a distance of about 1 yd. To determine the effectiveness of this method, preliminary experiments were initiated in March to evaluate the repellent effect of human hair when deer began browsing on the plum trees. Hair was obtained from local barber shops and beauty salons and packaged in cotton bags (3.5 oz. per bag). Bags were hung in trees and 3.5 oz. of loose hair was placed at the base of each tree. The hair was replenished every 3 weeks until the last application in early June. No deer browsing occurred on trees with human hair placed in or under them. Deer continued to browse on the unprotected trees.

After the initial success of this method, dacron bags filled with 0.7 oz. of human hair were hung in each tree, see figure. Trees that were badly damaged previously remained free of any additional deer damage. Deer tracks, previously abundant in the orchard, were absent for 10 months.

Research was expanded to the Hazelrig Fruit Farm near Hayden, where deer had been a continuing problem. Treatments consisted of bags of hair placed in each tree, in alternate trees, in perimeter trees, and no bags as a control. Results over a 2-year period indicated that a 0.7-oz. bag of human hair in each tree or in the perimeter trees gave protection from deer injury for 10 months, table 1.

Additional knowledge of deer control was gained in experiments with southern peas and sweet potatoes at the Horticulture Farm, E. V. Smith Research Center. When 0.7-oz. bags of human hair were suspended 2 ft. above the ground and spaced 5, 10, or 15 ft. apart along the perimeter of the area, deer did not enter the areas or browse on the crops, table 2.

TABLE 1. DEER BROWSING INJURY TO PLUM TREES DURING 2 GROWING SEASONS

Repellent bag location	No. of damaged trees per plot	Severity of browsing injury[1]
	Av.	*Av.*
Every tree	0.06[2]	0.06[2]
Alternate trees	0.14[3]	0.14[3]
Perimeter trees	0.00	0.00
None	10.25	3.50

[1]Browsing index: 0 = No injury, 1 = 1-20% growing tips injured, 2 = 21-40% tips injured, 3 = 41-60% tips injured, 4= 61-80% tips injured, and 5 = 81-100% tips injured.
[2]One twig removed from one tree.
[3]One twig removed from each of these trees.

TABLE 2. DEER BROWSING INJURY TO SOUTHERN PEAS AND SWEET POTATOES

Repellent bag spacing	Southern peas	Sweet potatoes
Ft.		
5	0[1]	0[1]
10	0	0
15	0	0
20	1	1
None	5	3

[1] Browsing index: 0 = no injury, 1 = 1-20% plant damage, 2 = 21-40% plant damage, 3 = 41-60% plant damage, 4 = 61-80%, and 5 = 81-100% plant damage.

Distribution of Cholesterol, Lipoprotein—Cholesterols, and Triglycerides in Plasma of Adolescent Females

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WHETHER OR NOT you will have coronary heart disease depends a lot on a number of cardiovascular risk factors. One of these is an elevated total cholesterol (TC) level in plasma. Another is the distribution of cholesterol among different plasma lipoproteins. A major portion of the total cholesterol in plasma exists as low density lipoprotein-cholesterol (LDL-C), a moderate amount as high density lipoprotein-cholesterol (HDL-C), and the lowest portion appears as very low density lipoprotein-cholesterol (VLDL-C). Low levels of HDL-C and elevated LDL-C levels comprise the major risks. Individuals with normal plasma cholesterol levels and low levels of HDL-C may be susceptible to development of severe coronary atherosclerosis.

Recently, a cross-sectional study was conducted by the Alabama Agricultural Experiment Station on the lipoprotein-cholesterol levels in 103 girls ages 12, 14, and 16 years. They were selected from east central Alabama, and approximately one-half were black and one-half white. About 40% of the girls were 12 years of age, 40% were 14 years old, and 20% were 16 years old. Fasting blood samples were obtained for plasma TC, lipoprotein-cholesterols, and triglyceride (TG) analyses. All analytical methods were those as outlined by the Lipids Research Clinics laboratory methods. Cholesterol analysis in different fractions was done by the direct cholesterol reagent and lipoprotein-cholesterols were isolated by preparative ultracentrifugation.

Plasma TC, HDL-C, and LDL-C levels declined with increasing age of the girls. No consistent differences were noted for VLDL-C levels with age. During childhood, cholesterol levels tend to increase to about 12 years of age; then decline through adolescence and then increase with age throughout adulthood. TG levels tended to increase with increasing age and showed a high level at 16 years.

About 25% of the total subjects had HDL-C levels below 38 mg/dl (milligrams per deciliter). Any value below 38 mg/dl may indicate a high risk of coronary heart disease. Similarly, about 28% of the total subjects had LDL-C levels above 135 mg/dl. Any value above 135 mg/dl may indicate a high risk of coronary heart disease.

About 12% of the girls had TC levels greater than 205 mg/dl; this value is the 90th percentile level and it has been arbitrarily used to describe severe elevation of blood cholesterol levels. In this group of girls almost all had elevated levels of LDL-C with only a small number having elevated HDL-C levels. The girls in this group were divided equally between the two races.

The black girls at each age had higher levels of TC, HDL-C, and LDL-C than the whites. At 16 years, blacks had a greater amount of VLDL-C and TG than whites.

This report has attempted to describe some of the relationships of plasma cholesterol, triglycerides, and different lipoproteins with coronary heart disease. High HDL-C levels may have a protective role against the development of coronary heart disease, whereas high levels of plasma total cholesterol and LDL-C may have an adverse role. In this random sample of 103 adolescent girls, approximately 25% have TC and/or lipoprotein-cholesterol levels which may constitute increased risk for heart disease. Next year the same girls will again be analyzed for their plasma cholesterol, triglyceride, and lipoprotein profiles. This will provide longitudinal evaluation on these parameters which will show if the risk factors change as the girls become adults. It will also be important to see if certain nutrients in the diet of this important population group can be modified to allow us to lower LDL-C levels but not HDL-C levels.

This information indicates a clear need for data on the distribution of the lipoprotein-cholesterols in our population, their physical characteristics, and factors that determine their levels in plasma. Much information concerning lipoprotein-cholesterol is from adults, with only limited data collected on children. It will be important to ascertain when the various risk factors begin in childhood and if they persist through adulthood and, finally, relate to the development of coronary heart disease. The measurement of these parameters in early development is important in order to establish a means of identifying subjects at risk for coronary heart disease at a time when preventive measures may be employed.

MEAN PLASMA TC, HDL-C, LDL-C, VLDL-C, AND TG LEVELS BY AGE AND RACE IN ADOLESCENT FEMALES

Age	Race[1]	TC	HDL-C	LDL-C	VLDL-C	TG
		mg/dl	*mg/dl*	*mg/dl*	*mg/dl*	*mg/dl*
12.....		185	45	122	19	58
	B	187	46	124	19	57
	W	182	44	120	20	59
14.....		178	44	117	18	59
	B	179	46	119	16	57
	W	178	42	116	19	60
16.....		170	43	108	19	69
	B	176	44	114	24	72
	W	163	42	104	16	65

[1]B = blacks; W = whites.

Boron application failed to affect soybean yields, even on sandy soils where boron deficiencies are more likely to occur.

B FERTILIZATION OF SOYBEANS

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MANY LEGUMINOUS CROPS, such as vetch and the various clovers, require boron (B) fertilizer for maximum seed yields on Alabama soils. But this is not the case with soybeans, which also is a legume. Soybeans have not responded to boron fertilizer in research by the Alabama Agricultural Experiment Station at any test location.

Current Auburn research on boron for soybeans was started by the late J. I. Wear because of scattered reports from other Southern States that applying boron increased yields. Because lime applications are known to reduce the availability of soil boron to plants, these experiments at three Alabama locations included both limed and unlimed plots. The experiments were confined to lighter textured soils where boron deficiencies are more prevalent on other crops in Alabama.

In the recent study, boron fertilizer (Solubor®) was applied to soybeans in field experiments at the Sand Mountain Substation, Crossville, and Plant Breeding Unit, Tallassee, from 1977 through 1980 and at the Wiregrass Substation, Headland, from 1978 through 1980. Test soils at these locations were Hartsells fine sandy loam, Wickham loamy fine sand, and Dothan sandy loam, respectively.

Soil pH and hot water extractable boron content were, respectively, 5.7 and 0.155 p.p.m. at the Sand Mountain substation, 6.1 and 0.086 p.p.m. at the Plant Breeding Unit, and 6.1 and 0.107 p.p.m. at the Wiregrass Substation. The soybean variety Essex was grown for the first 2 years at the Sand Mountain Substation, with Forrest, which is known to be sensitive to boron deficiency, used for the next 2 years. Bragg variety was grown at the other locations throughout the test.

Boron treatments of 1 and 2 lb. per acre were applied broadcast to selected limed and unlimed plots and incorporated by disking before the soybeans were planted. Lime was applied to the limed plots as needed during the experiment to keep the pH near 6.5.

There were no yield increases at any of the three locations from applied boron, see table. This was true even under unfavorable conditions of high pH and the sensitive Forrest variety at the Sand Mountain Substation.

RESPONSE OF SOYBEANS TO BORON (B) AT THREE LOCATIONS

Treatment, boron/acre	Soybean yield per acre				
	1977	1978	1979	1980	Av.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*
SAND MOUNTAIN SUBSTATION					
Not limed					
No B	43	34	36	13	32
1 lb. B	44	31	36	13	31
2 lb. B	42	32	36	14	31
Limed					
No B	45	33	36	14	32
1 lb. B	45	35	37	14	33
2 lb. B	45	35	35	15	33
PLANT BREEDING UNIT					
Not limed					
No B	38	36	24	30	32
1 lb. B	38	33	24	28	31
2 lb. B	40	34	28	30	33
Limed					
No B	43	36	36	31	37
1 lb. B	43	35	35	31	36
2 lb. B	41	35	36	29	35
WIREGRASS SUBSTATION					
Not limed					
No B	—	22	15	33	23
1 lb. B	—	21	18	29	23
2 lb. B	—	18	16	26	20
Limed					
No B	—	21	20	37	26
1 lb. B	—	23	19	39	27
2 lb. B	—	23	19	35	26

As in earlier field experiments in Alabama, boron fertilizer was not needed for maximum soybean yield. Applying sufficient lime to bring the pH of these soils to 6.5 did not induce boron deficiency. Since there has been no identification of Alabama soils deficient in boron for soybeans, boron is neither tested for nor recommended for soybeans by the Auburn University Soil Testing Laboratory.

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