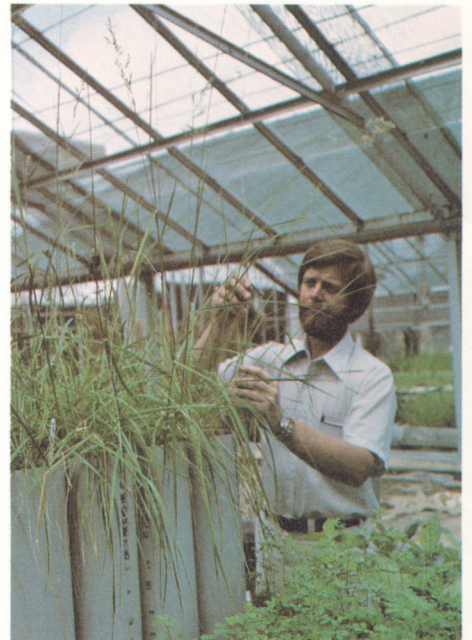
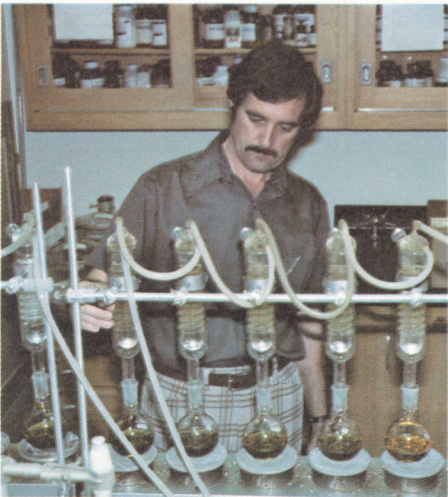
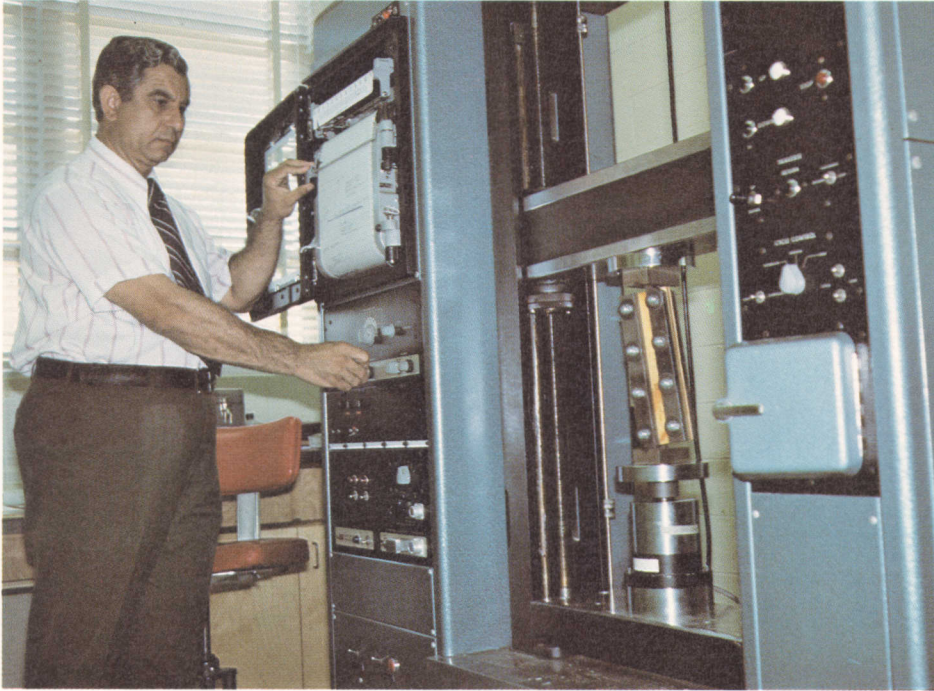


1978 in review





A year of significant service

The report of 1978 work of your Alabama Agricultural Experiment Station is for a year that saw cash farm sales in Alabama reach \$1.9 billion. This exceeded the previous high dollar income of 1976 by approximately \$300 million but, unfortunately, more than this amount is required to offset increased costs. Therefore, net farm income was below 1976. Increased costs at every turn, relative to prices received, continue to keep farmers from enjoying as high personal income from on-farm labor and investment in farm production as other segments of our economy receive.

The Alabama Agricultural Experiment Station is the single organization charged by the Alabama Legislature to conduct a program of research in the public interest. The assignment is broad but also quite specific. Specifically mentioned are problems related to management, conservation, and wise use of our soil, water, and other natural resources including game and fish, and the production, processing, marketing, manufacturing, and distribution of all products of the farm and rural communities. It also provides "as future changing agricultural conditions may demand it, for (research on) other important agricultural and economic problems having for their object the development of a more permanent, more profitable, and diversified agriculture."

The changes in agriculture as a result of the efforts of this and other State Agricultural Experiment Stations and the research arms of the U.S. Department of Agriculture have exceeded predictions, but it has not been enough. Knowledge is the frontier of freedom. It has to be continuously moving forward if the needs and responsibilities of man are to be fulfilled. We cannot stand still. We who have the responsibility for carrying out the charge are distressed when we see both Federal and State appropriations falling

short of inflation so that essential programs that have been built over the years cannot be maintained in face of inflation. We know the long process required to train scientists and to develop the capability for attacking problems with ingenuity, imagination, and skill. We know that most meaningful research requires consistent effort. We must put our priorities in this State and Nation where the greatest benefits accrue. History is clear: when agricultural research is postponed, the benefits are lost. Research in the public interest must continue to progress. This requires that funding be increased to match inflation and also to allow new problems to be researched.

We are fortunate in this State that we now have, in final stages of completion, State funded field research facilities that give us the capacity to conduct the needed program of research. Alabama cannot afford to let these facilities be underutilized.

Dean and Director R. Dennis Rouse (left) and Dean and Director Emeritus E. V. Smith at the recently completed Main Station.

In 1978, Mr. and Mrs. Solon Dixon gave to the Auburn University Foundation land on which to build a Forestry Education Center in Escambia and Covington counties and then gave the money to build this Center, which will give Auburn a facility for forestry and wildlife teaching, research, and continuing education that is in keeping with the importance of forestry and wildlife to Alabama.

The Land Grant University concept is a concept of cooperation. All people benefit from its agricultural research programs. The work reported for 1978 typifies the attention the Agricultural Experiment Station scientists give to the problems you and I face in our daily lives.

We are confident this work merits your interest and support. We are equally confident you will continue to advise us in regard to our program as you have in the past. We cherish this partnership with all the citizens of this State.

R. Dennis Rouse
Dean and Director



New facilities in use



Dedication of the E. V. Smith Research Center on November 9, 1978, made 1978 one of the most significant years in the history of the Alabama Agricultural Experiment Station. Some 1,000 leaders of agriculture, business, and government were on hand to help dedicate the new facility to the improvement of Alabama agriculture, and through it to the betterment of living for all citizens of the State.

This relocation of the Main Station to a new farm with all new equipment and facilities is a dream come true. With this modern research unit in full operation, Auburn University is now second to none in the quality and capability of its Main Station. The combination of modern buildings and equipment and ideal agricultural land on this 3,200-acre research farm offers unlimited opportunities for productive research on problems facing producers of livestock and field and horticultural crops in Alabama.

The contrast between this modern research facility and the old Main Station on the Auburn campus is sharp. Whereas the old Main Station was on land unsuited to modern farming operations, with constant squeezing to make room for campus buildings, the new center has adequate land for field scale experiments that can relate directly to on-farm situations. And the modern buildings, equipment, irrigation systems, and experimental pastures make the old facilities at Auburn appear like something out of the 19th century. Its location at Shorter, halfway between Auburn and Montgomery, makes the center reasonably convenient for project leaders at Auburn.

Four major areas of research have been relocated to the E. V. Smith Center: field crops; fruit, vegetable, and nut crops; dairying; and beef cattle breeding and nutrition. Each of these units has a headquarters and service center equipped to support field research. Feed storage and feeding barns fill the needs of beef breeding and nutrition research, and the modern confinement dairy facility offers the latest in dairy buildings and equipment. Irrigation systems are furnished for use with field and horticultural crop studies.

In addition to major research areas, other departments will utilize the new



Auburn friends from across the State were on hand for dedication of the new E. V. Smith Research Center.

center for specific projects. Agricultural engineers will work on engineering problems associated with modern irrigation equipment and tillage systems, and entomologists will give attention to insect problems associated with agricultural production. Disease problems of field and horticultural crops and pines will be studied by plant pathologists.

Concurrent with development of the E. V. Smith Research Center is a continuing program of construction and upgrading of on-campus agricultural research facilities. Two construction projects—a utility building at the Turfgrass Research Unit and a fish nutrition laboratory at the North Auburn Fisheries Unit—were completed and progress was made on several others. The Seed Technology Center was nearing completion at the end of the year, and

renovation was underway to improve the usefulness of the Livestock Judging Arena, Lambert Meats Laboratory, and the Poultry Annex. In addition, cattle handling facilities and fences were replaced at the site of the former on-campus dairy unit.

Additions and improvements on and off campus provide an optimistic outlook for the future. Opportunities for research have never been better, as the research program takes advantage of the facilities and equipment now available. Results of this research will help Alabama agriculture reach new heights in the years ahead. Importance and beauty of agriculture will be obvious to visitors to Auburn University in the years ahead as the former Main Station area is converted into the agricultural show place that a major Land Grant University deserves.

The Seed Technology Center was nearing completion at the end of 1978.



Timely research findings spotlighted



AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

Financial Management and Farm Growth

Management is a critical requirement for successful farming under current economic conditions. This was graphically demonstrated by a comparison of four levels of management using a multiperiod linear programming model designed to simulate growth of a farm firm over a 5-year period.

Farmers with below average and average levels of management were characterized by low productivity and limited credit availability. Thus, they did not have the necessary cash flow to meet ever-increasing capital requirements over the 5-year period. Farmers with improved and superior levels of management, through increased efficiency and productivity, developed successful operations. Generally, row crop enterprises dominated in the optimal solution, but farmers with superior management found it most profitable to expand livestock enterprises.

Current Conditions Complicate Credit

The increase in farm input prices and the increasing cost of farming have not only intensified the cost-price squeeze for farmers, they also have created problems for Alabama bankers who make farm loans. Bankers interviewed in an Auburn survey cited lack of good farm management, poor record keeping, low cattle prices, and the State usury law that limits interest rates to 8 percent on loans under \$25,000 as problems involved in financing farm operations.

Bankers generally had problems in analyzing farm loan requests. Few used special financial forms designed for farm borrowers. The generally conservative lending attitude of the sample bankers reduced the chances of a farm borrower obtaining adequate credit from a single source to carry out his farming operations.

Catfish and Tilapia Compared

Production and marketing trials for catfish and tilapia were continued during 1978 to obtain economic information for

present and potential producers. It was found that newly hatched tilapia could be grown to marketable size in one growing season, thus alleviating the problem of overwintering fingerlings. Tilapia were readily accepted by buyers when offered with channel catfish.

Cotton Marketing Improvements Possible

An Auburn marketing study identified better cooperation, coordination, and communication among ginners, warehousemen, merchants, and mill representatives as steps to alleviate serious cotton marketing problems. A reduction in the number of times cotton is handled and installation of universal density presses at gins could lower marketing costs. Eliminating duplication, such as repeated sampling of bales, could contribute to marketing efficiency. Different procedures in stocking and breaking out bales at warehouses would be beneficial to some warehouse operations. Research indicated that development and use of a computer system for bale record keeping and location would be feasible.

Who Uses Suspension Fertilizers?

A survey in six Tennessee Valley counties identified younger farmers and those particularly attracted to labor savings options as the most likely users of suspension fertilizers. Availability of dealer credit and custom services tended

to attract suspension users more than users of conventional fertilizers. There was no indication from the research information that fertilizer users believed that type of fertilizer affected crop response.

More Park Land Needed

To serve present and future Alabama State Park visitors, land in parks must be increased about 41 percent by the year 2000. Projections for that date indicate a potential for over 20 million visitors to Alabama parks, with about a fourth being from out of state.

Data on park users, gathered to help plan ahead for Alabama's parks, show that most park visitors are families with children under 16 years of age, from urban backgrounds, and are well educated, middle income individuals. As an average, visitors traveled 117 miles to reach the park of their choice.

AGRICULTURAL ENGINEERING

Measuring Machine Capacity and Reliability

An Auburn developed formula to predict machine capacity was found to be highly accurate. For planters, cultivators, sprayers, moldboard plows, harrows, and cotton pickers, the prediction formula was in error by 5 percent or less when

In an economic comparison of four levels of management among Alabama farmers, successful operations were associated with superior management.



compared with actual machine capacity measurements. The formula uses 14 specific input coefficients to indicate capacity in acres per hour. Included are such things as field size and shape, row length and arrangement, row end turning space and condition, and certain aspects of machine management. Results indicate that the prediction formula can be a valuable aid in determining machine sizes and numbers needed for a specific farm enterprise.

A new study underway concerns farm machinery reliability, with attention being given to frequency, duration, and possible cause of farm machinery breakdown. These data will be correlated with such things as total hours of use or acres covered, soil type, farm size, and crops grown. Results will be used to determine coefficients of reliability for specific categories of machines. These coefficients will be useful to individual farmers in planning for effective machinery utilization.



The problem of non-uniform watering by hose-towed irrigators, caused by speed variations as the hose is wrapped around the takeup drum, is getting attention in Auburn research.

Automatic Control of Tractors Nearer

Recent advances in microelectronics have increased the feasibility of automatic control of the farm tractor. A small computer (microcomputer) can now be put on the tractor and add only 2-3 percent to the cost. Research is now seeking to incorporate a microcomputer with the present experimental control system that uses buried electrical cable to provide automatic tractor guidance for plowing, planting, and cultivating. The microcomputer allows for better and more flexible control. Facilities used with this project include a vehicle guidance simulator on which there is a model tractor. The simulator is used to perform the initial testing and development which is necessary before a control system can be placed on a tractor in the field.

Waste Water Recycling from Lagoons

The potential for reusing waste water from manure disposal lagoon systems was established in last year's research. Dairy and swine waste were loaded into laboratory models at rates of 0.025, 0.5, 1.0, and 2.0 pounds of volatile solids per 100 cubic feet per day. Over the year, chemical oxygen demand, total kjeldahl nitrogen, ammonia nitrogen, and total solids contents of the dairy systems have approached steady state values. Thus, selection of a loading rate for dairy waste would seem to be based on the desired level of treatment over a long period. The swine systems have not stabilized to the degree that the dairy models have. Only the two lower loading rates show any sign

of having approached steady state conditions. This suggests that loading a swine recycling system at rates greater than 0.5 pound (volatile solids) per 100 cubic feet per day should be avoided.

In the dairy and swine systems loaded at the highest rate, fecal coliform levels were about the same in the primary lagoon of each system. The secondary lagoon of the swine system contained roughly the same concentration of fecal coliforms as did the primary lagoon. In contrast, the dairy secondary lagoon showed a definite decrease in fecal coliforms. Salmonellae persisted only a few days in the dairy system and was not present after 32 days in the swine system. These results indicate that effluent probably could be safely recycled 32 days after a system was contaminated by bacterial pathogens.

Minimum Tillage Soybeans Successful

Minimum tillage soybeans yielded about as well as those grown following any other method of land preparation in 1978. If multiple planting of other crops is planned, then the minimum tillage method of planting soybeans should fit into the production program. This system allows planting of soybeans soon after the other crop is harvested without a long delay for land preparation. Getting a stand of soybeans may be difficult with minimum tillage if the previous crop has used up available moisture at planting time; however, moisture is not lost by land preparation. Another problem is that residue from the previous crop may

complicate minimum tillage planting.

There are indications that fair yields can be obtained with soybeans where the rippers are operated 7 to 8 inches deep at time of planting. This shallow ripping would be desirable for farmers who use tractors with less than 100 horsepower to operate the minimum tillage planters.

Hose-Towed Irrigators Evaluated

Varying speed of hose-towed irrigators as they move along the travel lane was a problem identified in 1978 evaluations. The biggest variation is caused by the polyethylene hose layering on top of itself as it is wrapped around the takeup drum. This increases the effective diameter of the drum and causes the irrigator to move faster (about 11 to 12 percent change in speed per layer depending on hose and drum diameter). The effect of changing speed is to overwater the first section of the field and underwater the last section. Speed controlling devices are being installed on some irrigators to help eliminate this problem.

Pressure requirements of a system with 850 feet of 4½-inch inside diameter hose were 135 p.s.i. (at ground elevation) to deliver 535 gallons per minute. Another system, with about 1,250 feet of 3½-inch inside diameter hose, required 162 p.s.i. to deliver 440 gallons per minute. These values translate to 27 and 32 kilowatt hours per acre-inch and an energy cost of \$1.34 and \$1.60 per acre-inch applied (@ 5¢ per kilowatt hour). Operational conditions can be expected to influence energy requirements.

AGRONOMY AND SOILS

Soil Calcium Needs of Peanuts

Soil fertility experiments continue to show that soil calcium is more likely to be deficient for peanut growing than any other fertilizer nutrient. The characteristic symptom of calcium deficiency has long been recognized as unfilled fruit cavities, commonly called "pops." But these same deficient soils seem to grow luxuriant vines that continue to flower late into the season, thus indicating different calcium needs of vines, flowers, and nuts. These differences have been confirmed in growth chamber and greenhouse experiments at Auburn.

Defining "critical" calcium as the minimum soil level required for maximum growth, it was found that peanuts had three distinctly different critical calcium requirements. Vines had the lowest requirement, fertile flowers had an intermediate need, and pod filling had the highest. Increasing soil calcium stepwise from a very low level first increased vine growth, with subsequent applications causing an increase in percentage of fertile flowers and a corresponding decrease in vine growth. Additional calcium beyond that required for maximum flower fertility caused an increase in pod fill and a further decrease in vine growth.

Soil Compaction Versus Soybean Yields

How repeated tillage compacts soil—and reduces yield—was shown in a 1978 seedbed preparation study at the Marvin Agricultural Engineering Research Unit. Plant height and yield of Bragg soybeans were reduced 11 and 13 percent, respectively, by a second disking (following turning with a moldboard plow and disking). With three diskings, reductions in plant height and yield were 14 and 25 percent, respectively, over a single disking. In another soybean test, an artificially compacted subsoil reduced yields 39 percent. Then bahiagrass was grown for 2 years on the Coastal Plains soil. Roots of the bahia opened up the compacted subsoil, and yields were restored to that of a non-compacted soil.

In-row Subsoiling and Corn Yields

A subsoiler-planter that subsoils directly beneath the row was used at nine locations to evaluate subsoiling and no-tillage on corn production. No-till with in-row subsoiling produced 14 to 70 percent greater yields at six of the locations than did land that was conventionally prepared and not subsoiled. Moisture extraction from lower depths was greater where the soil had been subsoiled. Stands on no-till

treatment were only about 80 percent of those on conventionally prepared treatments.

Corn Planting Time, Hybrids Compared

Early planted corn (mid-February to early March in the Gulf Coast Area and mid-March to mid-April in other areas of the State) made higher grain yields than corn planted in later spring. These results were from a non-irrigated date of planting test at 10 locations. An irrigated test in southern Alabama gave similar results.

Three years of sampling for aflatoxin content failed to identify any hybrid with consistently high or low content of this fungus-produced toxin. Preliminary results indicate that irrigated corn had lower incidence and severity of aflatoxin than non-irrigated corn.

Tall Fescue Gives High Beef Yields

Results of a 3-year grazing trial at the Black Belt Substation show that tall fescue has the potential for better animal performance than is now being realized in most pastures. Average steer gains of 1.78 pounds per day and 434 pounds per acre were obtained, which is much higher than usual.

Efforts to find reasons for poor gain on fescue identified a toxic fungus, *Epichloe typhina*, as a potential cause. None of the fungus was found in grass furnishing the high daily gains, while severe fungus infestation was found in pastures at the Black Belt and Piedmont substations where steer performance was poor.

Nematode Resistant Sericeas Released

Several root knot nematode resistant sericea inbred lines have been developed cooperatively by the Alabama and Georgia agricultural experiment stations and USDA-SEA. Serala 76 and Interstate 76 are new varieties developed from these lines. Being resistant to three species of root knot nematodes, these varieties should produce longer lasting stands and make higher yields than susceptible varieties when grown on infested soils.

Serala 76 is a fine stemmed, tall growing variety similar to Serala in stem type and height. It is more resistant to the cotton root knot nematode than Serala. Interstate 76 is intermediate between Serala and Interstate in height and has a more open growth habit than Interstate. Both Interstate 76 and Interstate are fine stemmed, dense, and profusely branched, and both have a high level of resistance to the cotton root knot nematode. Interstate 76 has produced higher yields of forage than Interstate in Alabama tests.



Fluridone, an experimental herbicide, has controlled a wide spectrum of grasses and broadleaf weeds without appreciable injury to cotton in recent year tests.

Weed Control in Cotton, Peanuts

The most effective experimental herbicide evaluated for cotton weed control in recent years is fluridone, a Lily Research development. During the past 2 years it has effectively controlled a broad spectrum of grasses and broadleaf weeds in cotton without causing appreciable injury to the cotton. Its extremely high level of effectiveness against nutsedge makes it particularly attractive.

Of more than 300 herbicide treatments evaluated for peanuts, the Dual-Dyanap program was one of the most effective. Treatments that included a preplant incorporated treatment followed by an "at cracking" or an "at cracking plus layby" treatment were generally most effective. Another experiment involving over 60 herbicide and mechanical control treatments showed that a chemical treatment combined with a modest amount of mechanical cultivation would be most effective. Peanuts produced approximately 50 percent yield with no weed control, indicating that peanuts are much more competitive against weeds than are other agronomic crops.

Soybean Weed Control Advances

Cultural and chemical methods were combined in weed control systems designed for sicklepod (coffeeweed) control in soybeans in the Tennessee Valley area. Control systems showing the most promise, on Essex soybeans planted May 5, 1978, in 30-inch rows, were: **system 1**—Dual + Sencor applied preemergence, one shallow cultivation, and Sencor + 2,4-DB + surfactant as a post-directed spray; **system 2**—Lasso + Lexone applied preemergence, one shallow cultivation, and Lorox + 2,4-DB + surfactant applied as

post-directed spray; and system 3—Sencor (pre), and Paraquat + surfactant post directed. Systems 1, 2, and 3 increased yields 18, 17, and 10 bushels per acre, respectively, over weedy plots. Sicklepod control ratings made August 21 were 100, 98, and 89 percent, respectively, for systems 1, 2, and 3.

Blazer, a new herbicide from Rohm and Haas Co., is the first material other than soil applied herbicides to show potential against balloonvine, a serious weed for soybean seed producers. A single application of Blazer ($\frac{3}{8}$ - $\frac{1}{2}$ pound per acre) applied postemergence over the top to 3- to 15-inch tall balloonvine plants gave 88-98 percent control. Multiple applications at lower rates also were effective. Soybean injury was only slight. Several morningglory species, hemp sesbania, and common cocklebur also were controlled by Blazer, which currently has an experimental use permit.

Alfalfa Shows Great Potential

Alfalfa has shown tremendous potential as a high quality hay and silage crop that requires no nitrogen fertilization. Improved commercial varieties have yielded 4 to 8 tons per acre in trials over the State. Stands of adapted varieties last 2-3 years in the southern part of the State and even longer further north. A 4-year-old stand at the Black Belt Substation made over 5 tons per acre in 1978.

Virus Resistance in White Clover Sought

Evidence is accumulating that viruses are an important factor in the lack of persistence of white clover in pastures. Serological tests of white clover during the first summer after establishment revealed that 41 percent of the plants were virus infected. Predominant viruses found were peanut stunt virus, white clover mosaic virus, and clover yellow vein virus. More than one kind were found in many infected plants. An intensive breeding program is seeking to develop a virus resistant white clover for Alabama pastures.

Irradiation Induced Variation in Centipedegrass

Exposing centipedegrass seed to gamma radiation produced several selections which appear morphologically distinct from "common" centipede. It was found that radiation treatment generally decreased rate of growth, stolon growth, and stolon numbers. Several selections showed improved cold tolerance in laboratory tests. The development of numerous dwarfs presents the possibility of developing a low-growing, dense type centipedegrass for home lawns.



ANIMAL AND DAIRY SCIENCES

Largest litters were produced by crossbred sows bred to Duroc boars in Auburn breed comparisons.

Feeding Sows During Gestation

A 16 percent protein ration with vitamin E added gave best results among gestation rations compared in Auburn tests. Sows receiving a 16 percent protein diet farrowed larger litters and had more pigs per litter at 21 days and at weaning than others getting 12 percent protein gestation feed. Adding vitamin E to the 16 percent ration resulted in significantly greater numbers at birth than from the 16 percent feed without vitamin E or the 12 percent protein feed with or without added vitamin E.

Breed Affects Pork Production

Duroc sired litters were significantly larger at 21 days and at weaning than were litters sired by Hampshire and Spot boars. Crossbred Duroc-Landrace and Yorkshire-Landrace sows produced significantly larger litters (1.0 to 1.5 pigs) than purebred Landrace sows. Such differences are important factors in efficiency of pork production, and this information should be utilized in systems of production.

Improving Restructured Fresh Meats

Quality of sectioned and formed pork chops was improved by addition of salt or salt plus tripolyphosphate. This treatment improved flavor, juiciness, textural properties, and cooking loss over restructured chops containing no additives.

Impact of Bull Performance Test

The Auburn program of evaluating performance of prospective beef bulls has had a sizeable impact on the State's

purebred and commercial cattle industries. This is best illustrated by the highly significant improvement in performance traits since the program began. In 1951, average daily gain for the 140-day test period was only 1.94 pounds. That average increased to 2.70 pounds for the period 1970-76, and reached a peak of 3.12 pounds in 1977-78. Average weight per day of age has improved correspondingly, going from 1.93 pounds in 1951 to 2.78 pounds in 1977-78.

Economical Growing-Finishing of Steers

A combination system of growing-finishing steers produced high quality beef at reasonable cost in tests at the Gulf Coast Substation. Daily gains averaged 2.0 pounds for 197 days of grazing on rye-ryegrass-clover, followed by 2.4 pounds daily during the finishing phase.

In a similar study at the Lower Coastal Plain Substation, high quality beef steers were ready for slaughter at the end of 213 days of grazing on wheat-ryegrass-clover pastures. These cattle gained 2.0 pounds per day, and 86 percent of them produced USDA Choice and Good carcasses with no post-grazing feeding period.

Dairy Cow Feeding Comparisons

High producing dairy cows performed as well on a corn silage-concentrate blended ration containing (dry matter basis) 50 percent concentrate and 15 percent crude protein as those receiving a 60 percent concentrate-18 percent crude protein feed. Dropping either concentrate to 40 percent or crude protein to 12 percent caused cow performance to decline.

ANIMAL HEALTH RESEARCH

Internal Parasite Removal

The experimental drugs Albendazole and Fenbendazole were 95 percent effective in removing gastrointestinal nematodes from cattle. In addition, Auburn tests show the drugs were effective against liver flukes and tapeworms. These drugs are not on the market at present.

Bovine Leukosis Under Study

Bovine leukosis, also referred to as lymphosarcoma or leukemia, is a disease of dairy and beef cattle. The virus associated with the disease (bovine leukosis BLV) infects approximately 15 percent of the cattle population, but only a few infected animals actually have clinical signs of the disease. Efforts are in progress to determine the mode of transmission of the virus, the factors required for the virus to cause the disease, and the role of this virus in cattle diseases other than leukosis. Tests for early diagnosis of the disease are in the development stages.

Wildlife Not Guilty

Culture studies so far indicate that wildlife is not involved in transmitting bovine brucellosis to cattle. This is the early finding from tests of samples taken from 26 different wildlife species.

BOTANY AND MICROBIOLOGY

Soybean Bloom, Pod Losses

Most of the potential soybean yield never gets past the bloom stage. In Auburn studies with Bragg soybeans, more than three-fourths of the potential pods abscised during development. Most abscissions occurred as full bloom or later flowers or as young pods. Of the remaining

pods, more than half abscised at later stages of development.

Only a small number of floral buds abscised. Over 90 percent of potential pods on terminal racemes abscised, and more than 60 percent of these were lost during a 14-day period in mid-August when flowering reached its peak.

Treatment of terminal racemes was tried, using selected concentrations of NAA, TIBA, and Benzladenine (BA) alone or in combination. The only treatment to give a significant increase in pods on racemes was the highest BA concentration. Further experiments using cytokinins are in progress.

Soil-plant Water Transport Studied

Opportunities for studying water transport processes in plant roots, stems, and leaves are greater with a lumped circuit analog developed at Auburn by scientists in Botany and Microbiology, Agronomy and Soils, and Civil Engineering departments. Circuit elements of the analog are identified in terms of physiological variables (hydraulic conductivities, water capacities, and cell dimensions), which can be measured in the laboratory. The model has been solved to predict distributions of water potential as functions of position and times in plant tissues of selected cell thicknesses.

Studies of water transport in the soil-root system support a previous finding that water flow from roots to soil occurs, but is very low. Inhibitors of cell growth have different effects on negative water transport, with some increasing the magnitude of water transport and others causing cessation of water flow from roots.

Rapid Screening for Aflatoxin

A new method for analyzing corn for aflatoxin, developed in 1978 at the Agricultural Experiment Station, allows rapid and accurate screening of samples. Identified as FL-1, the new method is as sensitive and accurate as official AOAC

methods, while being less costly and having improved health and safety features. The method utilizes an iodine derivative of aflatoxin that increases the intensity of aflatoxin B₁ fluorescence, which is measured in a common Coleman photofluorometer. This reduces the inaccuracies that may occur by visual estimation on TLC plates.

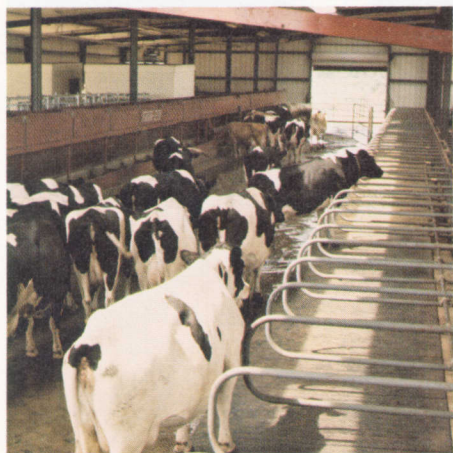
The FL-1 method breakthrough made possible development of a rapid screening method (FL-IRS) for identifying aflatoxin-contaminated samples of corn. Aqueous methanol extracts of samples and checks were treated with iodine solution and compared for fluorescent intensity. Samples that fluoresced greater than the checks were labeled aflatoxin positive, whereas those that fluoresced less than the checks were labeled aflatoxin negative.

In screening 170 samples of corn, the FL-IRS method was more accurate than the black light test, mislabeling only one sample containing more than 20 p.p.b. aflatoxin compared to four by the black light test. *The black light test falsely labeled 47 samples as contaminated compared with only 14 false positives with the FL-IRS screening method.* The speed, accuracy, and economy of the FL-IRS method warrants its use for large-scale screening of corn for aflatoxin.

Good Control of Apple Sooty Blotch and Fly Speck

Prevention or control of sooty blotch and fly speck has been a problem of long standing in Alabama apple culture. Work in 1975 showed that captafol possessed remarkable activity in suppressing inoculum of the causal fungi. Trees sprayed with captafol had fruit ratings of

A 50 percent concentrate-15 percent protein blended ration proved adequate for high producing cows (left); a large portion of potential soybean production is lost because of bloom abscission (center); and control of sooty blotch and fly speck continues to get attention in apple research (right).



2.4 for sooty blotch and 1.5 for fly speck (based on disease scale of 0-5). The results also established that infection may commence during the spring, indicating that control measures should begin before pollination rather than waiting 3-7 weeks after petal fall as is generally recommended in other states.

Spray tests conducted since 1975 have shown that sooty blotch and fly speck can be reduced to trace proportions with captafol. Ratings in 1978 were 0.9 and 0.2, respectively, for sooty blotch and fly speck.

MDMV-infected Corn Susceptible to Leafspot

Continuing laboratory studies have confirmed earlier findings that corn infected with maize dwarf mosaic virus (MDMV) was more susceptible to subsequent infection by the leafspot fungus. In addition, 1978 research indicated that the fungus has greater inoculum potential on MDMV-infected corn than on virus-free corn. The fungus not only produces more spores (conidia) on MDMV-infected corn, but the spores are larger and, when subsequently inoculated into healthy corn, show a higher germination rate, greater appressorium formation, and form more lesions and larger lesions than do spores originally from virus-free plants. This means that more total inoculum and apparently more virulent inoculum of the fungus is produced on corn that is also infected with MDMV. Studies to date on the mechanism for predisposition and inoculum potential effects of MDMV infection in corn indicate that certain carbohydrates and nitrogen-containing compounds tend to accumulate in infected tissues, and these may be involved in the increased susceptibility and inoculum potential phenomena.

New Fungicide for Pine Seedling Rust Control

The experimental systemic fungicide bayleton has proved to be extremely effective in protecting southern pine seedlings against fusiform rust. Applied as a foliar spray at a rate of 0.5 pound per acre, bayleton protected pine seedlings for 21 days following application and eradicated rust infections that occurred up to 7 days prior to application. Thus, it may be possible to protect pine seedlings throughout the fungus spore flight period (late April to mid-June) with a total of three sprays. This will be a considerable reduction from the 30-50 applications of ferbam currently being used throughout the Southeast. The possibility of obtaining a label for use of this compound on pine seedlings appears promising.

Pesticides and Soil-borne Plant Pathogens

Some undesirable interactions between pesticides and soil-borne plant pathogens showed up in tests with fumigant nematicides. Under laboratory conditions, EDB and DD had little effect on *Sclerotium rolfsii*, except at exaggerated rates. DBCP at equivalent field rates stimulated the fungus and resulted in increased production of sclerotial initials and greater mycelial growth. DBCP vapors stimulated germination of natural sclerotia.

In field studies, recommended dosages of DBCP for control of nematodes resulted in increased incidence of southern blight (white mold) on Florunner peanuts. Results show that DBCP has some undesirable side effects on peanuts, but these effects are not necessarily produced by other related nematicides.

Results of other studies during the year indicate that several chlorinated nitrobenzenes possess nematicidal activities. Some, such as the tetrachloronitrobenzenes, are used as commercial fungicides and may have possible use for control of nematodes and soil-borne fungal pathogens.

FISHERIES AND ALLIED AQUACULTURES

Maintaining Aquatic Resource Quality

Information needed to maintain the quality of Alabama's aquatic resources is being gathered in studies of plankton communities from 12 locations in 8 State rivers. Plankton communities are good

indicators of the quality of the aquatic environment of streams and impoundments. Phytoplankters are important primary producers, fixing carbon and releasing oxygen to the surrounding waters through photosynthesis. Zooplankters feed on free-living bacteria, phytoplankton, and organic detritus and in turn are themselves food for many aquatic organisms, including young fishes.

Qualitative and quantitative estimates of phytoplankton were based on actual organism identification and counts made with the aid of microscopes and the measurement of chlorophyll content. Qualitative and quantitative zooplankton estimates were based entirely on organism identification and counts. Total organic content and total organic carbon content of waters also were estimated. Identifying the plankton organisms as they were counted provided important information on the qualitative structure of the communities. On occasions, estimates of the rate of production of organic matter by phytoplankton were obtained by use of a radioactive carbon tracer technique.

Fishing Changes in West Point Reservoir

A "boom" followed quickly by a "bust" describes largemouth bass fishing during the first 2 years of the West Point Reservoir. The abundant initial year class of bass was responsible for superior fishing early in the life of the 25,888-acre impoundment. High natural mortality and heavy fish harvest resulted in a population structure change, according to Auburn sampling and tagging studies. The result was a fishing "bust" after 2 years.

A stocking rate of 4,000 fish per acre with maximum daily feeding rate of 50 pounds per acre was most profitable in tests in a static pond with no supplementary aeration.



The initial standing stock of 654 largemouth bass, or 25.2 pounds, per acre in August 1975 was reduced to 0.7 largemouth bass, or 1.4 pounds, per acre by August 1977. Total yield from the 1975 year class was 19.1 pounds per acre, of which 95 percent was harvested during the first year of impoundment. Natural and fishing mortality reduced the standing crop of 1975 largemouth bass by 88.2 percent (58.6 percent natural and 29.6 percent fishing) in the first year and 86.2 percent (69.1 percent natural and 17.1 percent fishing) in the second.

Catfish Stocking and Feeding Rates

Problems with low dissolved oxygen in channel catfish ponds increased with high stocking and feeding rates. Highest dollar return per acre in Auburn comparisons resulted from intermediate stocking and feeding rates. In static ponds with no supplemental or emergency aeration, a stocking rate of 4,000 fish per acre with a maximum daily feeding rate of 50 pounds per acre was most profitable, returning \$712 per acre. This compares with \$540 for 2,000 fish per acre and 30 pounds feed per acre per day and \$290 with 8,000 fish and 70 pounds feed per day.

Managing Ponds for Larger Sunfish

Small impoundments can be managed to result in larger prey species (sunfish) in the harvest. One such procedure used in Auburn research is stocking 5-8 adult largemouth bass with 1,000 bluegill sunfish per acre in new or recently renovated ponds to create a "bass-crowded" condition. After 1 year these populations are characterized by a low prey-predator biomass ratio, with 60 to 85 percent of the fish being of harvestable size and largemouth bass comprising 20 to 25 percent of the total weight of fish in the pond.

During the first summer after stocking, bluegills averaged greater than 0.25 pound, compared with approximately 0.10 pound from conventionally stocked ponds. Sustained largemouth bass harvest from "bass-crowded" populations cannot be as great as from ponds with balanced populations. Restricting the harvest will maintain a greater number of largemouth bass in the population.

Easier Sampling of Fish Populations

An Auburn-developed method of sampling fish populations in the shoreline area of reservoirs offers accurate results with small manpower input. It proved its worth in estimating the number and standing stock of young of the year and



A sampling method that utilizes rotenone poisoning of a small shoreline area proved successful for gathering population data in a large impoundment.

adult fishes in a large (25,935-acre) mainstream impoundment. A surface area of 0.02 acre was surrounded with a net and the fish were poisoned with rotenone. Quantitative estimates compared favorably with data from the more conventional cove sampling with rotenone done in late summer.

Approximately 125 sites were sampled each year (1977 and 1978). The weekly samples yielded data that made it possible to estimate reproductive success and time of spawning for many species to determine mortality rates for those species, and to relate availability of prey species to shoreline predators. The sampling technique required only two people and little specialized equipment, but collected more species each year than were taken in cove rotenone samplings (total of eight) or by extensive and frequent electrofishing. It also provided reasonable quantitative estimates of fish populations in the shallow areas.

New Fish Diseases Identified

Two previously undescribed fish diseases—one affecting golden shiners and the other a catfish disease—were studied. The one affecting golden shiners is caused by a virus, the "golden shiner virus." This virus causes a chronic mortality in golden shiner ponds from June through September, resulting in a relatively low mortality.

The second new disease, referred to as "enteric septicemia of catfish" (ESC), occurs in cultured catfish. It has been implicated in 17 disease cases over a 2-year period. ESC is a disease primarily of

fingerling channel catfish where an acute systemic infection occurs. Control of ESC may be accomplished by oral medication with Terramycin.

Catfish Off-flavor Removed

The muddy off-flavor that often develops in pond-raised catfish was successfully removed in last year's Auburn tests. Catfish with intense off-flavor were held in clean, flowing water following removal from a pond with a dense growth of blue-green algae (*Microcystis flos-aqua*). After 4 days the off-flavor was almost gone, and after 8 days in the flowing water it was not detectable by sensory means.

Geosmin, a compound with intense earth-musty odor, was isolated from off-flavor, pond-raised fish and identified as causing the problem.

Fishing Benefits Economy

Economic benefits from fishing on the West Point Reservoir were estimated to total about \$1.73 million annually. This translates to \$9.56 per fisherman-day, \$2.29 per fisherman-hour, or \$7.25 per pound of fish harvested.

A roving creel survey was used to collect information on county of origin and fishing trip expenses for fishermen visiting West Point Reservoir during its first two fishing seasons. A use prediction model was developed which explained 76 percent of the variation in attendance from participating counties on the basis of county population sizes and distances of counties from the reservoir.



Six brands of feller-bunchers were evaluated on 10 logging operations during the year, with attention given to tree size, slope, and ground condition effects on performance.

FORESTRY

Classifying Surface Mined Soils

Revegetation of surface mined lands should be more successful in the future, thanks to Auburn developed classification systems that indicate soil capabilities and potential for erosion. The soil materials classification, which considers soil texture, soil color value, and soil acidity, provides lime and fertilizer guides for forage production.

Two methods are used in classifying surface mined areas for their erosion potential: one predicts the relative ease with which a soil material will erode and the other predicts total erosion that can be expected without vegetation. Results provide the basis for decisions regarding the time of revegetation, time of regrading, amount of mulch to use during revegetation, and placement of water diversion structures.

Plywood Shear Stress Evaluated

An evaluation of structural properties of southern yellow pine completed at Auburn provides information needed for better and safer utilization of southern pine plywood in structural uses where high shear stresses develop. The property, "rolling shear," of plywood is the shear stress that develops in the core or cross bands of plywood veneers with the grain perpendicular to the grain of the face veneer. The evaluation established that shear stresses perpendicular to the grain are several times weaker than those parallel to the grain; therefore, any shear

failure in plywood occurs in the cross plies. The evaluation was made using the most often used thicknesses and veneer ply arrangement of plywood in the dry and wet conditions.

Forestry Chemicals Cooperative Serves Industry

Work of the Auburn University Forestry Chemicals Cooperative is making effective herbicides available for forestry uses. Research under this project made possible the use of several new herbicides in 1978, resulting in weed control cost savings and healthier seedlings. Prior to this time, forest nurseries had relied almost entirely on fumigation, hand weeding, and mineral spirits for weed control.

With several forest industries and chemical companies added to membership of the Cooperative, research has been expanded to include silvicultural herbicide uses. Major attention is being given to herbicide development for brush control in site preparation and release, and herbaceous weed control for plantation establishment. The major objective is to provide forest managers with cost effective herbicides to reduce competition and increase wood production.

Feller-buncher Performance Comparisons

Productivity rates for the various feller-buncher machines, being developed under different types of logging conditions, should provide valuable information to purchasers of these popular machines that shear trees and place them in

piles. The Auburn study is concerned only with drive-to-tree rubber-tired type (other types are drive-to-tree track-laying feller-bunchers, swing-to-tree rubber-tired type, and swing-to-tree track-laying type). Time and production studies were taken for six brands on 10 logging operations. Such environmental influences as tree size, slope, and ground conditions were recorded along with cycle time elements and volume produced. Data analysis will soon be completed.

Forest Economy Ranks High

A 1978 study of the forest economy of Alabama found that only the heavy metals industry exceeds the forest industries in importance. While ranking second among Alabama industries, the data further indicate that Alabama's forest industries are growing more rapidly than any other major industrial sector in the State. Based on these data, researchers forecast that the forest industries will be the largest industrial sector in Alabama in 4 or 5 years.

Another part of the study is gathering primary industrial data, through a mailed questionnaire to all manufacturing sectors in the State's economy. Results are being tabulated into a State input-output model, which will allow researchers, planners, and decision makers to systematically forecast how planned expansions of major industrial activities will affect the State's economy.

A history of the forest economy of Alabama is also being prepared.

More Productive Trees in the Making

Pines suited to dry, sandy sites, sweetgum with better quality, and pines resistant to fusiform rust are specific objectives of forest tree breeding research underway.

Although longleaf pine grows on severely dry sites, faster growth would be desirable. Therefore, a substitute is being sought through interspecific hybridization—crossing longleaf, slash, loblolly, and shortleaf. Many crosses have already been made, and these crosses will be tested for performance under varying conditions.

In the sweetgum improvement test, seed have been collected from 161 parent trees. Seedlings from these seed will be used to establish an open-pollinated progeny test. After evaluating, the progeny test will be converted to a seedling seed orchard. The ultimate result should be improved sweetgums for production as pulpwood, construction wood, and dimension wood—important current uses for sweetgum.

Methods of testing pines for resistance to fusiform rust are being compared to aid

the breeding program that is attempting to develop resistant open-pollinated varieties. An efficient method of identifying rust resistance is needed to select parents for breeding open-pollinated varieties. Since resistant trees cannot be recognized by sight, testing for resistance is necessary. Three types of tests are used, but they vary in reliability and time required. Comparisons of the three tests are being done with 180 selected slash and loblolly parents from the state-wide pine breeding program.

HOME ECONOMICS RESEARCH

Housing Satisfaction Related to Family Structure

Data from the southern region indicate that families with female heads had lower scores on socioeconomic and housing measures than male-headed or husband-wife families. Female-headed families were much more likely to reside in small towns than in rural areas, in contrast to male-headed families. Compared to traditional husband-wife and male-headed families, female-headed families reported less satisfaction with type and size of home, outside appearance, storage space, and room arrangement. Households headed by males were less satisfied with school quality and location with respect to work, shopping, medical facilities, schools, and churches.

Rural single-person households were much better satisfied with their housing than were their urban counterparts. Rural single-person families had higher degrees of home ownership, residence in single-family dwellings, and length of residence. Urban respondents expressed high levels of satisfaction with public services and housing location.

Prolonged Liquid Protein Use Questionable

Feeding a commercial liquid protein (made from collagen) as the sole protein source in an otherwise nutritionally adequate diet to rats caused depressed appetite and feed intake. Intake was sufficient for maintenance but not for growth. Elevated levels of nonessential amino acids were found in the blood plasma of the rats. In a second experiment, liquid protein was combined with vitamins and minerals and fed to obese rats for 13 days in amounts proportional to those suggested for human consumption. The effects included rapid weight loss, slight fatty infiltration of livers, and significant reductions in calcium levels in blood plasma.

Finish Affects Fabric Soiling, Cleaning

Type of finish (durable press, flame retardant, and bleached and scoured) was found to affect both degree of soiling and ease of soil removal from a cotton/polyester fabric. The durable press fabric picked up the most soil and the flame retardant the least. However, soil removal during laundering was lowest for the flame resistant fabric and highest for the durable press fabric. Water hardness and type of detergent also affected soil removal. A high phosphate detergent removed the most soil, especially when water hardness was high. A liquid, no phosphate detergent removed the least soil. Carbonate and 8 percent phosphate built detergents were intermediate. As water hardness increased, soil removal decreased.

HORTICULTURE

Proper Liming for Top Potato Yield

Liming potato soils is like walking a tightrope: there is little margin for error. Letting soils get too acid slashes yield, but at pH 5.4 or higher the potato scab organism thrives. Growers have traditionally maintained soil pH below 5.4 to avoid potato scab development. Too often, however, widespread use of acid-forming nitrogen fertilizer has caused soil acidity to reach the level where production is limited. This can be easily overlooked because plant symptoms may not be obvious. Top growth may look the same on highly acid and limed plots, but tuber yields will be less on the low pH plots.

Fortunately, maximum yields can be realized in the soil pH range in which potato scab does not usually occur, so proper liming pays off in increased yield. At the Gulf Coast Substation on a Malbis fine sandy loam soil, maximum yield occurred at a soil pH of 5.3. At higher pH (up to 7.0), yields remained the same, and more acid plots (down to pH 4.8) made less. In a 5-year study in grower fields in the Sand Mountain Area, maximum yields were at pH 5.3, and more acid soils had sharply reduced production. Liming some of these fields to pH 5.7 or higher resulted in common potato scab infections.

Drip Irrigation for High Density Pecans

High density pecan orchards require heavy early production to facilitate tree size control. With high yields, vegetative growth is reduced and pruning may subsequently be used to hold down tree size. Drip irrigation has been far superior

to sprinkler irrigation in accomplishing this early production-small tree size.

In Auburn tests, drip irrigated trees yielded 917 pounds per acre in the seventh growing season. From sprinkler irrigated trees, production was 631 pounds. Tree size under drip irrigation was only 62 percent that of sprinkler irrigated trees. Nut size and kernel filling under drip matched that of sprinkler irrigation.

New Houseplants with Chemicals

New and interesting houseplants can be created by using growth inhibiting and stimulating chemicals. A tall, tropical vine, *Clerodendrum thomsoniae* (southern bleeding heart), was converted to an attractive, compact, upright plant by treating with chemicals to retard the plant's vining habit. Preliminary tests with cacti indicate that chemicals can be used to increase and hasten plant production and flowering of these slow-growing plants. Chemicals which have been used successfully to stimulate branching on plants such as azaleas are also being tested on plants like dieffenbachia, which do not branch freely, to create a different shaped plant.

Tissue Culture Propagation of Cucumbers

A "cloning" process is proving successful in the Auburn cucumber breeding program. The system permits propagation of large numbers of plantlets from single gynoecious (all female) plants selected in the breeding process. The procedure consists of growing axillary buds in test

The compact, attractive appearance of the plant at right, in comparison with the normal vining habit at left, illustrates the effect of growth inhibiting chemicals on the southern bleeding heart.





Broiler breeder hens were force molted in cages in as little as 6 weeks, about half the time required under normal methods, using an Auburn developed method. This hen is in about the mid portion of the molting process.

tubes on a medium completely balanced in nutrients and growth hormones. Once roots and tops are established, the young "test tube plants" are transferred to soil in pots where they grow to maturity. Before they produce flowers, some of the plants are sprayed with a plant hormone, gibberellic acid, to stimulate staminate (male) flowers on plants normally producing pistillate (female) flowers. Hand pollinations are made and seed produced to continue the breeding process of selection and inbreeding. When lines have reached uniformity after several years, they are then used as the female parent in production of gynoeious hybrids, the primary type of cucumber used in commercial pickle production.

Good Crops of Fall Tomatoes

Fall produced tomatoes responded favorably to trickle irrigation and liquid nitrogen last year in cooperative Agricultural Experiment Station-USDA-SEA research. Irrigation increased marketable yield 20,000 pounds per acre, nearly double the production without irrigation. At the 120-pound N rate per acre, marketable yields ranged from 20,460 pounds per acre with dry ammonium nitrate and no irrigation to 50,490 pounds with trickle irrigation and weekly applications of liquid nitrogen.

Methods of applying N also affected production. Applying 120 pounds N in trickle irrigation water in two applications increased yields 8,400 pounds per acre over the same amount of N applied dry mix to the soil. Dividing the N into eight weekly applications in the irrigation water increased yields 2,850 pounds over the two applications. Irrigation also increased the percentage of large size fruit (71 percent vs. 45 percent) and reduced percentage of cull tomatoes (15 percent vs. 34 percent for nonirrigated).

POULTRY SCIENCE

Feeding of Broiler Breeders

In a comparison of full feed and various restriction levels, broiler breeder hens that received the highest levels of feed had the lowest fertility and hatchability percentages, heaviest egg and chick weights, and lowest quality eggshell. The one exception was fertility of eggs collected during the 6-week production period—it showed no effect from feeding regimes. Hens were artificially inseminated at 6, 14, and 27 weeks of production with eggs collected for 9 days after insemination for determination of ration effect. Feeding regime did not influence duration of fertility for the first 9 days after insemination at the 6-week production period but did at the 14- and 27-week periods of production. Fertility and hatchability declined among all treatments with advancing age of birds.

Restricted fed hens exhibited higher egg production, better shell quality, lower egg weight, lower feed conversion, and lower body weights than full fed hens. A peak feeding level of 145 grams (about 5 ounces) per hen per day was sufficient for single-caged broiler breeder hens.

Forced Molting Effects

The increased egg production normally observed after a forced molt in White Leghorn hens can be attributed largely to a decrease in the incidence of shell-less eggs, not to a change in ovulation rate. In Auburn tests, broiler breeder hens were successfully force molted in cages in as little as 6 weeks. This compares with 12 weeks normally experienced in commercial floor raised broiler breeder hens.

The thymus of chickens was found to regenerate, as evidenced by increased

lymphocyte content of the thymic cortex, during a forced molt. This raises the possibility of extensive immunological implications.

Efficiency of Solar Energy

Solar energy supplied approximately 50 percent of the energy required for broiler production during winter months. This was true with both finned tube convectors and heated concrete slabs delivering the heat. In early spring about 85 percent of needed energy was supplied by solar, while solar was adequate for all needs in late spring.

In the test, broilers were brooded using finned tube convectors covered with a hover, heated concrete slabs, finned tube convectors with forced air onto the tubes to improve hot air dispersion, and vertical wall collectors on the sunny side of the building.

Fall comparisons showed that the combination of wall collectors and forced air with fins had the lowest auxiliary heat cost, \$6.50 per thousand birds. Using wall collectors without forced air was intermediate at \$8.50 per thousand, while the finned tubes alone required \$22.35 worth of auxiliary heat per thousand birds.

Blood Group Alleles and Disease Resistance

The Auburn immunogenetic laboratory's collection of about 70 alleles (and their corresponding hemagglutinating reagents) of the B blood antigen locus of the chicken is the largest collection of material affecting a major histocompatibility locus in the world. The uniqueness of the material and the large number relative to other collections were emphasized by an extensive series of 1978 Auburn tests comparing identities of Auburn material and those submitted by a

committee concerned with a system of proposed international nomenclature.

It was previously known that some *B* alleles affect several kinds of immune responses, and the present work makes this increasingly clear. The Auburn collection can be especially important to cancer research, since it is rich in *B* alleles affecting both resistance and susceptibility to tumors caused by two avian viruses, MDV and RSB.

Vitamin C and Tumor Regression

In the continuing search for anti-cancer agents, massive doses of ascorbic acid (vitamin C) have been used in attempts to induce tumor regression. The few reports available indicate that certain types of tumors regress with ascorbic acid megatherapy. However, this did not occur in Auburn research.

To determine the mode of action of ascorbic acid on tumor cells, animal and human malignant cell cultures were exposed to varying concentrations of ascorbic acid. Though ascorbic acid caused morphological changes in both malignant and non-malignant cells, it was concluded that tumor regression was not due to ascorbic acid membrane transformation. If ascorbic acid does induce tumor regression, it must be through other mechanisms.

IBDV Affects Chick Immune Response

Young White Leghorn chicks infected with infectious bursal disease (IBDV) had reduced protection from Newcastle disease vaccination in Auburn tests. The chicks, which were experimentally infected with IBDV at hatching or at 3 weeks of age and which had no maternally derived antibodies to IBDV, showed depressed antibody response to Newcastle vaccination at 4 weeks of age. The birds also had greater susceptibility to challenge with virulent Newcastle. Infection of non-IBDV immune chickens with IBDV at hatching, but not at 3 weeks, also depressed the antibody response of chickens vaccinated at 18, 30, or 42 weeks of age. However, there was no effect on the susceptibility of those birds to challenge with virulent Newcastle vaccine.

Prior exposure to IBDV did not alter disease resistance afforded a bird by Newcastle vaccination at 18, 30, or 42 weeks of age. However, IBDV infection at hatching did render chickens that were not vaccinated against Newcastle more susceptible to challenge with virulent Newcastle vaccine at 21, 33, or 45 weeks of age than unvaccinated birds either not infected with IBDV or infected at age 3 weeks.

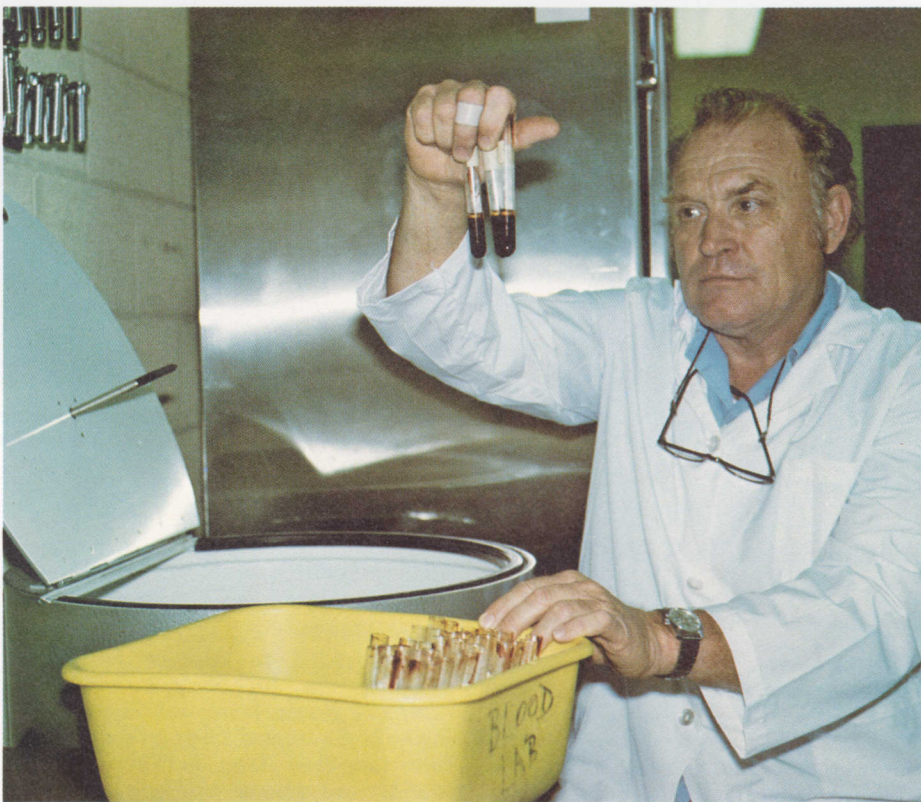
Coccidia Life Cycles Altered

Significant alterations in the life cycles and characteristics of laboratory strains of two coccidia (*Eimeria tenella* and *E. maxima*) have been accomplished by several generations of selection for short and long cycle strains. Pathogenicity has been reduced by shortening the endogenous cycle of each species, and increased by lengthening the cycles. Both short and long cycle strains are significantly different from the original strains, which have been maintained in the Auburn laboratory for several years. Not only are the short cycled strains less pathogenic than long cycled ones, they

also are less prolific.

In studies with field isolates of poultry coccidia, it was noted that the prepatent period and sporulation time of a recent isolate of *E. mitis* was considerably shorter than previously reported, and was comparable to that of *E. acervulina*. Two other strains have considerably longer prepatent periods. This species was often encountered in fresh litter from broiler houses where subclinical coccidiosis had been detected (confused with *E. acervulina* by most investigators). *E. mitis* was encountered in 16 of 20 farms of an Alabama company alone. Severe infections of this coccidia cause suppressed growth and impaired feed efficiency.

The Auburn collection of alleles and their corresponding hemagglutinating reagents of the *B* blood antigen locus of the chicken is the largest collection of such material in the world.





Auburn researchers found that drugging wild turkeys with alpha-chloralose tends to cause less stress than trapping when capturing the birds for blood sampling.

ZOOLOGY- ENTOMOLOGY

Pest Control and Cotton Maturity

Delayed crop maturity often causes problems for cotton producers. Not only can it reduce production in the short-season region of north Alabama, it also causes increased boll weevil pressure the following year in central and south Alabama.

Pest control treatments, thought to be involved in cotton maturity, have been evaluated during the past 3 years at the Tennessee Valley Substation. In 1978, a complete herbicide program including preplant incorporated and post-directed spray resulted in delayed plant maturity and decreased yield. Also, the herbicide treatment appeared to reduce plant stand by about 20 percent. Controlling plant bugs or early planting did not appear to increase maturity or yield significantly. Lack of plant bug effects may have reflected the low populations of that insect. Boll weevil populations were too low in small plots for screening tests.

Safer Drugging of Wild Turkeys

Drugging wild turkeys with alpha-chloralose should cause less stress than trapping to capture for blood sampling. In 1977-78 tests with the chemical, glucose levels were significantly lower in the treated birds on three of the four drugging dates in February and March, and plasma corticosterone was significantly lower on two of the days. There were no differences in hematocrit or plasma levels of cholesterol or total protein between control and treated birds. Hemoglobin level was significantly higher in the treated birds at the first treatment only, maybe due to hemoconcentration.

Insect Causes Soybean Lodging

Lodging of soybeans may result from attacks of the three-cornered alfalfa hopper. Lodging results because of the girdling action of the immature stage (nymph) as it circles the plant just above the ground while sucking sap. This girdling causes callus formation and greatly

weakens the stem. Later, rain and wind will break the stem at the girdle point and the plant will fall over. The result is reduced stand and yield. High rates of Namacur and Furadan applied at planting reduced girdling and lodging in 1978 tests.

New Approach to Insect Control

Diflubenzuron offers a totally new approach to insect control. It is essentially non-toxic to warm blooded animals but inhibits synthesis of chitin, a substance involved in forming the outer shell of insects, and thus causes mortality when the larval insect sheds its old exoskeleton (molts) and attempts to form a new one. In seeking practical field rates in 1978 tests with diflubenzuron, surprising low rates (0.5 to 2.0 ounces per acre) were effective against several destructive insects on soybeans. Laboratory tests indicated much lower rates were required to reach the LD₅₀ level for early instar than for later stages of insects, indicating that early treatment in the field might require even lower rates.

Woodcock Populations Checked

Some 635 woodcock were flushed during 1978 visits to 37 Alabama counties to check for huntable populations. This total amounted to a rate of 2.27 birds per hour of search. There were times and places where woodcock were exceptionally abundant and as many as 50 of the game birds could be flushed in a day. At other times several hours were spent in what appeared to be good habitat with no flushes. Areas where researchers encountered appreciable numbers of woodcock during the hunting season were visited during the presumed nesting season. Thorough searches with trained hunting dogs in 17 counties located 16 woodcock broods and 4 active nests.

Pine Engraver Beetle Predator

Feeding habits of *Lasconotus pusillus* (one of the Coleoptera) suggest this beetle as a possible predator control agent on pine engraver beetles. In the laboratory, *L. pusillus* adults readily consumed *Ips* eggs and newly hatched larvae; late-instar larvae readily fed on *Ips* late-instar larvae and pupae. Also, adults fed, survived, and oviposited, eggs hatched, and larvae developed to adulthood on a ground phloem medium. Development from egg to adult took 35+ days.

In the field, *L. pusillus* adults arrived at freshly felled pine shortly after the attacking *Ips*. Adults appeared in *Ips* galleries only after tunneling had progressed to the egg-niche stage. Larval development occurred in *Ips* galleries, but no pupae were ever found in *Ips*-infested material. The only pupae observed were recovered from the soil beneath infested pine.

One of the Coleoptera beetles (*Lasconotus pusillus*) may have potential as a predator against the pine engraver beetles, such as the *Ips* beetle shown in the inner bark of an infested pine.

Scale Resistant Euonymus

Spreading euonymus, winged euonymus, and winter creeper euonymus showed good resistance to euonymus scale in Auburn variety comparisons. These exhibited no plant damage and little or no infestation over a 3-year period. Common evergreen euonymus was much more susceptible to attack by this scale insect. The resistant varieties would be preferred for planting where low maintenance plants are desired.

White Fringed Beetles on Sweetpotatoes

The white fringed beetle, *Graphognathus* sp., an important pest on several crops, has been spreading into new areas of Alabama in recent years. Sweetpotato production in central Alabama was particularly affected in 1977, so control tests were established in 1978. Granular fonofos, carbofuran, and aldicarb gave satisfactory control. Aldicarb was less effective against other soil insects, such as wireworms.



Research shared with users



Field Days and Other Meetings

Each substation and experiment field hosted one or more field days during 1978 to allow farmers to view new research underway, to hear results of latest findings, and to discuss specific farm problems with project leaders from the Main Station. The total of 35 field day programs and area meetings at outlying units and commodity conferences on campus brought thousands of visitors to the Agricultural Experiment Station.

In addition to formal meetings, informal visits to outlying units served as a point of contact for thousands of Alabamians with their Agricultural Experiment Station. The outlying units continue to serve as show windows for citizen viewing of Auburn research.

Publications reporting results of Agricultural Experiment Station research are available to farmers, professional agricultural workers, and others who can use the information.

The Printed Word and Other Media

Major methods used in disseminating results of research included printing and distributing of Agricultural Experiment Station publications, preparation and release of stories to the mass media (newspapers, magazines, radio, and television) and technical articles published in professional journals.

Station publications produced during 1978 totaled 44, with 152,500 copies printed. These went to farmers, professional agricultural workers, members of the agribusiness community, government leaders, and selected groups in other states and foreign countries. In addition to publications reporting research findings, seven brochures were printed to inform the public about various aspects of

Auburn service, and 292 technical articles in professional journals informed the scientific community of research done by Agricultural Experiment Station faculty.

The 712 releases and cutline stories distributed to newspapers, magazines, specialty publications, and radio and television stations brought to the attention of a wide variety of people information about the efforts and accomplishments of Auburn agricultural research. Feature articles and research columns in farm magazines took practical research from laboratory to farm.

Exhibits portraying agricultural research were shown at 10 strategic locations throughout Alabama during the year. These consumer oriented exhibits were viewed by thousands at fairs, shopping centers, commodity conferences, and other special events.



Projects underway during year



AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

Crop, Livestock, and Poultry Management

Changing Role of Selected Agricultural Credit Agencies
Development of Models for Evaluation of Credit Worthiness of Agricultural Borrowers
Efficiency of Identification, Assembly, and Transportation of Cotton to Mills and Export Outlets
Evaluation of Irrigation Potential for Alabama Freshwater Food Animals
Supply, Pricing, and Marketing Alternatives for Cattle, Beef Systems in the South
Characteristics of Liquid Fertilizer Users
Regional Resource Allocation Model for the Livestock Sector

Marketing

Alternative Structures for Increasing Efficiency in Inter- and Intra-regional Grain Marketing Systems
Marketing Performance of Selected Milk Pricing Systems for Southern Region
Price Discovery and Informational Flows for Major Agricultural Commodities in the Southern Region
Short-run and Long-run Demand for Broiler Meat
The Status and Relation of the Coastal Zone to Alabama's Economy
Organization and Efficiency of the Fruit and Vegetable Production-marketing Subsector in the South
Development, Production, and Marketing of Christmas Trees

Resource Use and Planning

An Econometric Analysis of Variations in Rural Land Value
Effects of Investments in Recreational Resources on Income and Employment in Barbour and Marshall Counties
Efficient Vehicle Routing and Scheduling for Agribusiness Firms and Public Services
Estate Planning for Farmers
Financial Management and Farm Growth
Law for the Alabama Farmer

Rural Development

Defining and Achieving Life Goals
Implementation of Continuance Planning in Outdoor Recreation, VI
Public Services and Economic Development in Rural Communities
Social Organization for Development of Low Income Rural Counties

AGRICULTURAL ENGINEERING

Cotton Production

Cotton Plant Water Potential as Influenced by Various Tillage and Traffic Practices
Engineering Systems and Energy Needs for Cotton Production

Farm Machinery

Automatic Direct Digital Control for Steering Tractors
Determining Farm Machinery Reliability for Southeast Field Conditions

Fish Production

Freshwater Food Animals

Grain Quality

Grain Quality Inspection Systems

Irrigation

Evaluation of Irrigation Potential for Alabama

Nut Culture

Factors Influencing Vegetative and Reproductive Development of Young Pecan Trees

Poultry Production

Reproduction Performance of Artificially Inseminated Broiler Breeders Maintained in Cages
Selected Environmental Factors on Feathering, Skin Lesions, and Growth of Broilers
Utilization of Solar Energy in Poultry Production
Environmental Influences on Poultry

Soybean Production

Herbicide-tillage Interactions on Soybeans and Soil in Monoculture System

Waste Control

Animal Waste Treatment and Recycling Systems
Conserving and Feeding Crop Residues
Evaluation of Wastewater Reuse Lagoon Systems
Process for Making Animal Feed from Waste from Cattle in Production Units

AGRONOMY AND SOILS

Beef Production

Beef Production on Selected Forage Systems
Developing Pasture, Hay, and Silage Management Systems for Cattle

Cotton Production

Evaluation of Cotton Varieties and Strains

Dairy Production

Energy and Protein Levels in Silage-concentrate Blended Rations for Dairy Cows
Evaluation of Phalaris and Phalaris-ladino Clover Pastures for Dairy Cattle

Environment

Classification of Coal Surface Mine Soil Material for Vegetative Management and Soil Water Quality
Fertilizers and Organic Wastes Applied to Soils

Forage Crops

Chemical Profile and Nutritive Value of Forage Genotypes
Forage Legume Viruses
Plant Germplasm — Its Introduction, Maintenance, and Evaluation
Productivity and Quality of Phalaris, Annual Cool Season Grasses, and Legumes

Grain Crops

Grains Crops Variety and Experimental Strains Testing

Plant Breeding

Breeding Phalaris and Tall Fescue for Improved Winter Forage Production
Breeding White Clover for Persistence and Yield
Genetics, Breeding, and Evaluation of Sericea and Vetch

Soil Chemistry, Microbiology, and Fertility

Availability of Residual and Fertilizer Phosphorus
Conservation Tillage-fertility Practices of Vegetable Crops
Cotton Production by a Conservation Cultural System
Diagnosis and Correction of Manganese and Molybdenum Problems in Legumes
Distribution and Significance of Mineral Components in Alabama Soils
Effects of Soil Acidity and Calcium on Soil Solutions and Yield of Crops

Enhancing Biological Dinitrogen Fixation in Soybeans and Other Legumes
 Factors Affecting Plant Nutrient Use Efficiency in Soil Profiles
 Nitrate Movements in Soil Profiles
 No-till Corn Production as Affected by Fertilization
 Relationships Between Micronutrients in Soils, Uptake and Response by Plants
 Response of Cotton, Peanuts, and Soybeans to Lime and Fertilizers
 Role of Nitrification Inhibitors in Nitrogen Economy for Cotton and Corn
 Soil Testing and Plant Analysis

Soil Physics

Effect of Grass Roots and Tillage on Crop Performance
 Movement and Retention of Water and Solutes in Selected Southern Region Field Soils
 Movement of Metabolites and Heat-flow in Plant-soil Systems
 Plant Root Characteristics in Relation to Root Performance
 Water Movement in Selected Alabama Soils
 Water Transport Phenomena in Soil-plant Systems

Soybean Production

Cropping Systems and Moisture and Fertility for Soybeans
 Herbicide-tillage Interactions on Soybeans and Soil in Monoculture System
 Soybean Variety and Experimental Strain Evaluation

Turfgrass

Breeding Centipede and Tall Fescue for Lawns
 Control and Maintenance of Highway Vegetation
 Production and Management of Turfgrass

Vegetable Production

Soil Fertility and Fertilizer Requirements for Vegetable Crops

Weed Science

Biology and Control of Weeds
 Chemical Weed Control in Alfalfa
 Chemical Weed Control in Grain Sorghum
 Competitiveness and Control of Weeds in Soybeans
 Cultural and Environmental Effects on Herbicide Persistence
 Economic Thresholds of Weed Populations in Cotton, Soybeans, and Corn
 National Agricultural Pesticide Impact Assessment Program
 Threshold Levels of Weeds on Harvesting Efficiency in Soybeans

ANIMAL AND DAIRY SCIENCES

Animal Health

Significance of Microflora of Healthy Bovine Udders in Mastitis Control
 Effect of Environmental Stress and Endocrine Function on Growth and Reproduction of Swine
 Feet and Leg Unsoundnesses among Confined Dairy Cows

Breeding

Breeding Methods for Beef Cattle in the Southern Region
 Effects of Breed and Breed Crosses on Milk Production and Other Factors in a Grade Beef Herd
 Evaluation of Crossbred Beef Cattle
 Genetic Improvement of Efficiency in the Production of Pork
 Performance Testing of Prospective Sires
 Selected Reproductive Phenomena in Cattle and Swine
 Reproductive Physiology of Farm Animals

Evaluation of Pastures for Yearling Beef Steers in North Alabama
 Growing and Finishing Stocker Cattle in the Gulf Coast Area
 Growing and Finishing Systems for Beef Steers in North Alabama
 Growing and Finishing Systems for Steers in the Coastal Plains
 The Kinetics of Bacterial Thymidylate Synthetase and its Inhibition by Substrate Analogs
 Evaluation of NPN-preformed Protein in Supplements for Cattle
 Evaluation of Zeranol Ear Implants in Beef Production

Forage Production

Beef Production on Selected Forage Systems
 Marketability and Acceptability of Beef Produced Under Forage and Forage-grain Management Systems
 Grazing Management of Low-tannin Sericea and Alfalfa
 Steer Performance on KY31 Tall Fescue Pasture as Affected by Soils



Dairy Production

Comparison of Urea and Soybean Meal in a Silage-based Complete Feed for Dairy Cows
 Effect of Level and Quality of Protein on Lactation in Cattle
 Evaluation of Phalaris and Phalaris-ladino Clover Pastures for Dairy Cattle
 Relationships between Bacterial Quality of Raw Milk and the Subsequent Pasteurized Milk
 Buffered Diets for Dairy Cattle Confined on Concrete

Feeding

Effect of Feeding Systems and Animal Size on Efficiency of Beef Production

Nutrition

Chemical Profile and Nutritive Value of Forage Genotypes
 Energy and Protein Levels in Blended Dairy Rations
 Gluconeogenesis and Amino Acid Metabolism in Ruminants
 Relationship of Nucleic Acid and Polyribosome Contents to Growth of Muscle of Beef Cattle
 The Chemical Nature of Possible Toxicity of Products Formed During the Ozone Disinfection of Drinking Water Containing Organic Substances
 The Quantitative Relationship Between Heat Production and Metabolic End Products in Anaerobic Bivalves
 Metabolic Role of Uric Acid Riboside and Nucleotides in Cattle Red Blood Cells

Relation of Digestive Enzymes to Growth of Pigs
Relationship of Diet to Cholesterol Concentrations, Pool Size, and Turnover in Protein Content of Rations
Oxidation and Conjugation of Carcinogenic Hydrocarbons in Marine Animals
Relation of Feedlot Performance and Physiological Responses to the Metabolic

Meat

Factors Responsible for Tenderness Variation in Meat
Livestock Waste as Animal Feed
Processing and Marketing of Commercially Cultured Catfish

Waste Management

Animal Waste Treatment and Recycling Systems
Conserving and Feeding Crop Residues
Evaluation of Wastewater Reuse Lagoon Systems
Lagoon Waste Management and Recycling Systems for Confined Dairy Cattle
Processes for Making Animal Feed from Waste from Cattle in Production Units
Animal Health and Food Safety Aspects of Feeding Animal Waste
Ensiling and Feeding Value of Packing House Waste Products
Evaluation of Hemicellulose Extract as Cattle Feed

ANIMAL HEALTH RESEARCH

Cattle

Bovine Respiratory Viruses: Mechanisms Which Affect Virus Replication and Respiratory Tract Disease
Hereditary Immune Competence to Internal Parasites: A Means of Predicting Resistance
Neurology of the Reproductive System of the Bull
Pathogenesis and Therapy of Intestinal Parasites in Calves
Persistence of Infection in Calves Born to and Nursing Brucellosis-infected Dams
Relationship of Anatomical Conformation of Feet and Legs to Lameness Diseases of Dairy Cows Confined to Concrete Floors
Reproductive Diseases of Cattle
Transmission of Brucellosis from Cattle to Non-ruminant Wildlife Mammals

Poultry

Relationship of Blood Pressure to Blood and Aorta Tissue Lipids and Atherosclerosis in Turkeys

BOTANY AND MICROBIOLOGY

Biological Control

Biological Control of Selected Arthropod Pests

Diseases

Ecology and Control of Soil-borne Fungal Pathogens of Forest Tree Seedlings
Biochemistry and Physiology of *Cronartium fusiforme* on Southern Pines
Ecology and Control of Fusiform Rust on Southern Pines
Viruses and Mycoplasma-like Organisms (MPLO) Causing Diseases of Corn and Sorghum
Viral Diseases of Selected Grasses: Identity, Control, and Role in Predisposition
Rhizosphere Ecology as Related to Plant Health and Vigor
Soil-borne Pathogens of Peanuts, Their Complexes and Control
Disease Control Systems for Peanuts and Soybeans
Plant Diseases in Relation to Forage Crop Breeding
Forage Legume Viruses
Epiphytology and Control of Apple and Peach Diseases
Epiphytology and Control of Some Diseases of Peaches and Apples
Epiphytology and Control of Scab and Brown Leafspot of Pecan
Activities of Nematicides and Fungicides on Non-target Soil Nematodes and Fungi
The Effects of Seed Treatment Fungicides on the Rhizobium Host Infection Process in LDB Legumes
New or Unusual Plant Diseases in Alabama

Peanuts

Implementation of AMI Method for Determining Peanut Harvest Dates in Alabama
Fungal Spore Germination Inhibitors and Stimulators Associated with Surface Waxes of Peanuts

Fungi and Mycotoxins

Ecology and Taxonomy of Some Alabama Fungi
Chemistry and Physiology of Mycotoxins
Mycotoxicology of Stored Feeds and Seeds
Production of Mycotoxin (Other than Aflatoxin) by Fungi Isolated from Cottonseed

Herbicides

Minimum Tillage and Double Cropping on Weed Populations and Persistence and Fate of Herbicides

Fate and Effects of Atrazine in Salt Marsh Ecosystems
Effects of Herbicides on Submerged Water Plants

Morphology, Physiology, Taxonomy

Distribution and Habitats of Alabama Poisonous Vascular Plants
Flower and Pod Abscission in Soybean (*Glycine Max.* (L.) Merr.)
Effects of Environmental Stress Factors on Some Energy-related Processes of Plants
Changes in Lipid Metabolism and Competition of Water-stressed and Phytohormone Treated Plants
Water Conservation in Cotton by Drought Induced Leaf Surface Wax Synthesis
Water Transport Phenomena in the Soil-plant System
Isolation and Identification of Odorous Metabolites of Aquatic Actinomycetes

FISHERIES AND ALLIED AQUACULTURES

Aquatic Ecology

Management of Aquatic Plants for Sportfish Production in Ponds
Stream and Impoundment Ecology

Fish Biology

Ichthyology

Fish Diseases

Cooperative Fish Parasite and Disease Study

Pond Management

Aquaculture
Freshwater Food Animals, I
Freshwater Food Animals, II
Freshwater Food Animals, III
Freshwater Food Animals, IV
Sportfish Management
The Culture of Fish, Shellfish, and Aquatic Plants in a Closed System

FORESTRY

Disease Control

Ecology and Control of Fusiform Rust on Southern Pines

Forest Genetics and Tree Improvement

Breeding and Culture of Christmas Trees
Breeding Strategies for Genetic Improvement of Commercial Forest Trees in the South

Genetics, Breeding, and Evaluation of Selected Forest Tree Species

Forest Physiology and Nutrition

Growth and Nutrition Requirements of Selected Hardwoods

Leaf Reflectance and Biological Processes of Trees as Affected by Environmental Conditions

Forest Products and Technology

Evaluation of Structural Properties of Southern Yellow Pine Plywood

Forest Measurements

Total Tree Volume and Weight Equations for Selected Tree Species in Alabama

Forest Site Quality

Physiographic Classification of Southern Pine Forest Lands

Forest Stand Improvement

Variations in Height Over Age Curves of Young Loblolly Pine Plantations

Harvesting

An In-depth Evaluation of Five Forest Harvesting Simulation Models for Use in South Time and Production Studies of Feller-bunchers
Mathematical and Computer Modeling for Optimizing Forest Harvesting and Wood Utilization

Resource Economics

Forestry's Contribution to Alabama's Economy

Forest Ecology

Evaluation of Site Potential for Yellow-poplar Site Index Curves for Use in the Hilly Coastal Plain

HOME ECONOMICS RESEARCH

Housing

Quality Housing Environment for Low-income Families

Nutrition

Effect of Maternal Dietary Lipid on Prostaglandin Content of Human Milk
Influence of Dietary Pyridoxine or Tissue Depletion of B-6 in the Rat

Influence of Socioeconomic Factors on Food Habits and Nutritional Status of Older Persons

Metabolic Basis of Appetite Response to Amino Acid Imbalance and Protein Level

Metabolic and Histologic Changes in Obese Adult Female Rats Fed Liquid Protein Reducing Diets

Patterns of Food Intake and Nutritional Health of Girls

Protein Utilization and Metabolism in Nutrition

Textile Safety

Selected Factors Affecting the Consumer Use Performance of Flame Retardant Fabrics
Soiling, Soil Removal, and Durable Press Traits of Flame Retardant Cotton/Polyester Fabrics

Textile Utilization

Chemistry of Photo-degradation of Cotton Tentage Fabrics

Consumer Expectations, Consumer Satisfaction, and Performance of Upholstery Fabrics

Consumer Perception of Changes in Fabric Properties

HORTICULTURE

Breeding

Breeding Improved Tomato and Pepper Varieties for the South

Breeding Pickling Cucumbers for Resistance to Gummy Stem Blight and Cucumber Beetles

Genetics and Breeding for Pest Resistance in Muskmelons and Watermelons

Genetics and Breeding of Plums
Southernpea Breeding and Nature of Resistance to Cowpea Curculio

Management

Culture and Cultivars of Peaches
Factors Influencing Vegetative and Reproductive Development of Young Pecan Trees

Height Control in Floricultural Crops

Nutritional, Cultural, and Varietal Investigation of Apples

Regulation of Pistillate Flower Development in Pecan

Ornamentals and Landscape Conservation

Economics of Producing and Marketing Woody Ornamentals in the South

Nitrogen Requirements for Containerized Nursery Plants in Bark Growth Mixes

Identification and Control of Diseases on Ornamental Plants

Small Scale Computer Land Use Modeling in Coastal Alabama

Soil Fertility

Soil Fertility and Fertilizer Requirements of Vegetable Crops

Utilization

Quality Attributes of Selected Cultivars of Fruits and Vegetables

New Foods from the Southernpea

Varieties

Performance Trials of Commercially Important Vegetable Crops

POULTRY SCIENCE

Breeding

Artificial Insemination of Broiler Breeders
Reproductive Performance of Artificially Inseminated Broiler Breeders Maintained in Cages

Disease Control

Coccidiosis Study
Coccidia and Coccidiosis of Poultry
Development of Adjuvants for Immunopotentiality of Inactivated Microbial Antigens for Poultry

Diagnostic Services—Poultry
Genetic Bases for Resistance to Avian Diseases
Infection and Immunity in Poultry

Relationship of Blood Pressure and Aortic Tissue Lipids and Athlerosclerosis in Turkeys

Susceptibility of Eimeria Species to Coccidiostats

Environment

Eggshell Quality of Domestic Fowl
Environmental Influences on Poultry
Utilization of Solar Energy in Poultry Production

ZOOLOGY-ENTOMOLOGY

Ecology

Ecological Impacts of Wading Birds on Aquatic Environment

Reptiles and Amphibians of Alabama
Natural History of the Alabama Red-bellied Turtle

Miscellaneous

Auburn University Entomological Museum
Endocrine and Muscle Relationships in Swine and Cattle

Reproductive Physiology of Farm Animals
Structure and Function of Chemical Messengers of Arthropods

Pest Control

An Integrated System for the Suppression of Boll Weevil

Biological Control of Selected Arthropod Pests
Biology and Control of Arthropod Pests of Pecans

Biology and Control of Arthropod Pests of Woody Ornamental Plants in Alabama

Biology and Control of Selected Peanut and Soybean Insects

Biology, Ecology, and Control of Forest and Shade Tree Insects

Bionomics and Control of Arthropod Pests of Corn, Sorghum, and Small Grains

Bionomics and Control of the Face Fly and Other Diptera

Bionomics and Control of the Pecan Weevil
Biosystematics of Scale Insects of Alabama

Control Tactics and Management Systems for Arthropod Pests of Soybeans

Ecology and Management of Heliothis spp. on Cotton, Corn, Soybeans, and Other Host Plants

Insect Enemies of Bark Beetles Infesting Southern Pines

Southern Pine Beetle
Vegetable Insects Research

Wildlife Management

Ecological Studies of Wild Turkeys
Furbearer and Mammalian Predator Studies
General Wildlife Studies
Reproductive Physiology of the Wild Turkey
Woodcock Studies

The financial picture

\$2,830,516	30.9%	\$6,343,147	69.1%
Federal Appropriated Funds		State Appropriated Funds	
100%			
Expenditure of Appropriated Funds			
		Beef Cattle	12.2%
		Cotton	3.9%
		Dairy Cattle	7.0%
		Feed Grains	3.4%
		Fish & Wildlife	6.2%
		Forestry	9.3%
		Fruits, Nuts & Vegetables	8.6%
		Human & Resource Development	3.8%
		Ornamentals & Turf	3.3%
		Pasture & Forage	9.9%
		Peanuts	2.8%
Other Funds		Poultry	10.0%
Grants	\$2,502,793	Recreation	.3%
Sales	\$2,644,815	Soils, Land & Water	6.4%
Total Funds		Soybeans	5.8%
\$14,321,271		Swine	4.6%
		Other	2.5%

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