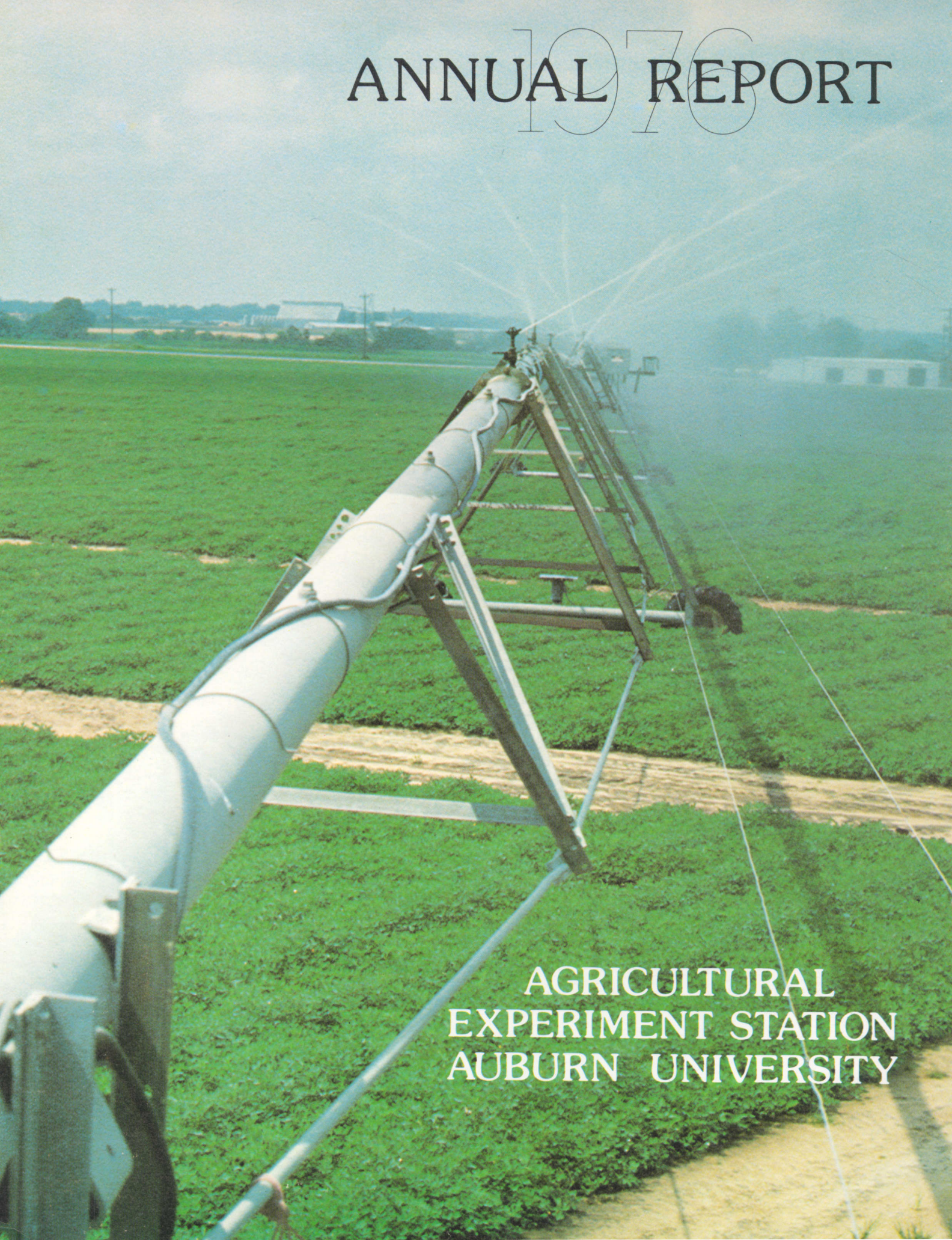


ANNUAL REPORT



AGRICULTURAL
EXPERIMENT STATION
AUBURN UNIVERSITY

AUBURN UNIVERSITY

AUBURN



ALABAMA

36830

SCHOOL OF AGRICULTURE AND
AGRICULTURAL EXPERIMENT STATION SYSTEM



Office of Dean and Director

October 1, 1977

To The Citizens of Alabama:

This report of 1976 work of your Alabama Agricultural Experiment Station is a sort of "feet on the ground, head in the clouds" report. Research conducted during the year provided solutions to immediate and practical problems of Alabama agriculture. At the same time, findings reported indicate that much of the research was looking forward to the future. An optimistic outlook for future agricultural research is evident in the status report on development of new facilities at Auburn and at the E. V. Smith Research Center.

Continuing changes in the biological world mean that we must continue to research old concerns of agriculture--crop varieties and animals better adapted to the environment and more resistant to pests, improvement in soil fertility and soil tilth, improved systems of production, harvesting, marketing, and processing of farm products, to name a few. We cannot hold our own--certainly not progress--without a program of ongoing research to furnish a continuous infusion of new genes, new materials, new methods, and new knowledge.

But new and expanded research is necessary to keep pace with changes in economic, social, and technological aspects of life that have been occurring in recent generations. In the 1930's, erosion control and minimum production costs were emphasized. The forties and fifties saw growing interest in increasing production efficiency through increased use of machinery and chemicals. The "unlimited" supply and low cost of petroleum fuels were history by the 1970's; also there were pressures to reduce chemical use because of fears about environmental damage and farming investment was soaring to all-time highs. These conditions created a critical need for expanded research to help minimize the uncertainty facing all of agriculture. Thus, even greater challenges were presented to agricultural researchers at Auburn and across the United States.

The new facilities being completed will provide urgently needed capability for dedicated scientists of the Alabama Agricultural Experiment Station to meet the challenges ahead. With the new and expanded facilities, these scientists can be even more responsive to changing needs, changing problems, and changing opportunities.

1976 was a good year in Alabama agriculture, and we look forward to even greater years in the future.

Sincerely,

A handwritten signature in cursive script, reading "R. Dennis Rouse".

R. Dennis Rouse
Dean and Director

ANNUAL REPORT / 1976 facilities, programs improved during the year

Competent and dedicated scientists are the major ingredient necessary for a successful research program, and this has long been a recognized strength of the Alabama Agricultural Experiment Station at Auburn University. But two other components are necessary for maximum returns from work of dedicated scientists: (1) adequate research facilities, and (2) a working partnership between users of research information and the scientists who generate the results. Both of these requirements showed marked advances during 1976, advances that will be of tremendous value in the future as Auburn's agricultural research arm seeks to better serve Alabama's agricultural industry.

Improvements to the Experiment Station's physical plant continue what was begun in 1973 when funds were made available for purchase and development of a new Main Station and modernization of the old facilities at Auburn. Development efforts on the new Main Station at Milstead (E. V. Smith Center) brought closer the time when this new facility will be in full operation. Construction was begun on animal and dairy research buildings and facilities, and major development work was completed on areas to be used by the departments conducting research on field crops, forages, and fruits, nuts, and vegetables.

Construction at Auburn during the year was not only changing the outward face of the old Main Station but it was providing space and equipment needed for research to solve modern-day problems. Changes in the poultry research unit provide a good example. Work is shifting from the old poultry farm, with its 1920's buildings, to a modern complex that will permit efficient research on current production problems. A solar house, put into operation during the year, is being used to develop methods of using the sun as an energy source for broiler production.

Opportunities for swine production improvements got a big boost in 1976 when the new research unit was put into operation. This half-million-dollar complex was designed specifically for climate and other environmental conditions in Alabama, permitting detailed study of production problems as they relate to Alabama growers. Impetus for this new facility came from an \$80,000 donation from Alabama Pork Producers that constructed the basic farrowing house, nursery, and growing-finishing buildings. Agricultural Experiment Station funds equipped these units and added lagoons, an automated flush system, a feed mill to grind and mix experimental rations, gestation houses, outside pens and lots, solar heating equipment for the nursery and baby pig areas of the farrowing house, and an environmental physiology laboratory. Thus, the entire production cycle of swine can be studied.

The new Forest Products Laboratory was nearing completion at the end of 1976. This facility will greatly improve the capacity of the Experiment Station to serve the forestry and forest products industries of the State. Research will be expanded to develop useful wood products that can utilize waste from logging and other forestry operations. Teamwork between this and the adjacent U. S. Forest Service Laboratory, dedicated in 1976, will give double returns from the Experiment Station's investment.

Cooperation of farmer groups, such as the contribution of Alabama Pork Producers for the new swine research facility, emphasizes continued cooperation between Auburn researchers and the people who use the research.

Another development in the area of Experiment Station-commercial agriculture teamwork was the organization of the Auburn University Agricultural Advisory Council during 1976. This group of farmers, agri-businessmen, and other agricultural



This new swine research unit, put into operation during 1976, made possible expanded research by the Agricultural Experiment Station on all phases of swine production.



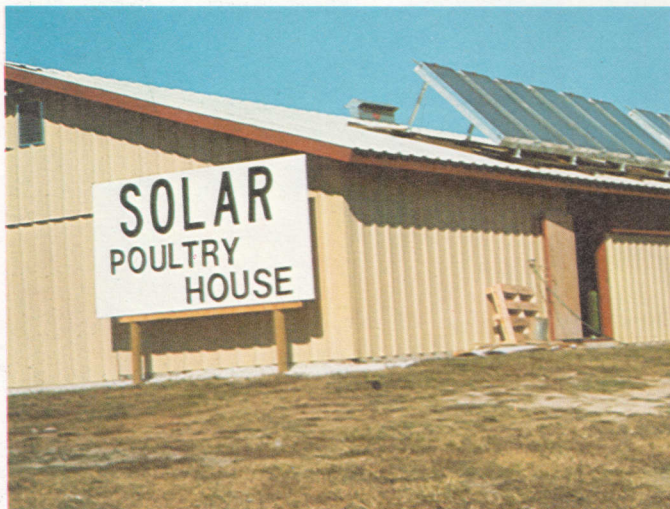
The new Forest Products Laboratory was nearing completion at the end of 1976. This research facility will be devoted to developing new uses for forestry products, with emphasis on utilizing waste from logging and other forestry operations.

leaders should result in better communication of farm problems and issues between agriculture and the Experiment Station, and consequently better orientation of Auburn's agricultural program to overcome problems as they arise. Counsel of this group of leaders will be sought as programs are planned, thereby assuring that resources for research are put to best use.

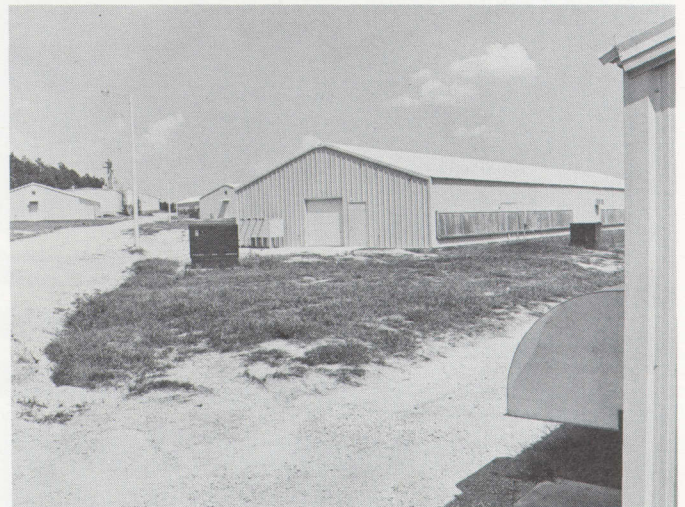
The wide range of research underway in 1976 is illustrated by the brief reports of research presented in this annual report for 1976. Although findings are given by departments, this does not mean that each department works independently. To the contrary, most projects are cooperative efforts that utilize expertise of scientists in many fields of study.

4 Financial inputs into agricultural research can be reported precisely (see listing on page 19), but returns from research cannot be computed to an exact degree. Nevertheless, realistic

analyses reveal a high return from investments in research. Data for 1939-73 indicate that each \$1 spent on agricultural research and extension nationally resulted in a constant \$4.30 increase in agricultural productivity. Future research also can be expected to be highly profitable, according to an economic analysis for the next 25 years made by a committee of scientists. They concluded that additional investment in research will provide annual rates of return of 16.5 percent for beef and forage research, 32 percent for corn research, 31 percent for research on soybeans, over 50 percent for research on swine, and 38 percent for dairy research. The committee found that agricultural productivity growth in the United States has been at the rate of 1.85 percent compounded annually. Future growth will require continued emphasis on research, at both state and federal levels of government.



Research aimed at developing methods of using the sun as an energy source for broiler production was begun during 1976 in the new solar house, one unit of the new poultry complex.



The all-new poultry research complex features a feed processing plant where experimental rations can be formulated and modern houses for studying broiler and egg production.

ANNUAL REPORT

1976

varied findings reported for the year

AGRICULTURAL ENGINEERING

Reduced Traffic Increases Cotton Yields

Data collected during 1970-76 show improved yields of cotton when traffic patterns are controlled. The study was designed to determine residual effectiveness of sub-soiling when (1) annual traffic was withheld, and (2) under normal annual traffic. All plots were deep tilled the first year of the study involving six treatments with three traffic treatments superimposed over two tillage treatments. Mean yield over 6 years in the controlled (withheld) traffic plots was 2,962 pounds of seed cotton per acre, as compared with 2,400 pounds per acre in the normal traffic plots. These data indicate that the effectiveness of chiseling remains for at least 6 years when it is not eliminated by subsequent traffic.

Irrigation of Peanuts Shows Potential

Work was begun at the Wiregrass Substation in 1976 to determine the most effective moisture policy for irrigation of peanuts. Rainfall during the 1976 growing season was at or above the average for all months except August. Only 1.9 inches of moisture was received during August, with a 25-day period of this month getting only 0.4 inch. This drought caused yields in the non-irrigated plots (3,404 pounds per acre) to be significantly lower than both irrigated treatments. Irrigation at 60 centibars yielded 4,660 pounds per acre while the wetter moisture policy of 40 centibars yielded 4,873 pounds of peanuts. Irrigation increased the gross per acre value from \$610 for non-irrigated to \$1,002 for the peanuts irrigated at 40 centibars and to \$880 for those irrigated at the drier policy of 60 centibars.



Detailed records are kept of energy requirements for broiler production in the solar house to determine the feasibility of various production systems using the solar assist.

Solar Heated Poultry House Becomes Operational

A solar heated poultry research facility was brought on line after 2½ years of design and construction by a solar energy research team of the Agricultural Experiment Station. This research unit is being used to determine operational characteristics of selected solar poultry production systems and the effect of these systems on poultry production capabilities. An automatic data logger monitors and records incoming solar radiation, temperature, and flow measurements at critical points in the water system and air temperature in the research pens. Data recorded on digital tapes are being processed at the University Computer Center. Analysis of data will be made to determine the feasibility of various production systems with the solar assist. Solar energy was estimated to furnish 70-80 percent of fuel needs.

AGRONOMY AND SOILS

Soil Acidity Affects Herbicide Persistence

Soil acidity is well known for its detrimental effects on crop growth, but recent Auburn research indicates that certain herbicides may give poorer weed control in acid soils. Atrazine used for weed control in corn was found to break down more rapidly in acid soils than in those near neutrality. Liming acid



Atrazine was found to give shorter periods of weed control in acid soils than in soils with higher pH.

soil to a favorable level for corn growth may add as much as a month longer persistence of atrazine, according to the results. Metribuzin, an effective herbicide in soybeans, also retains activity longer in limed soils than in more acid soils. Perfluidone, a promising new herbicide for use in cotton, showed an opposite response to soil acidity in the research. Its phytotoxicity increased with soil acidity.

Wet Soils May Cause Grass Tetany

The first evidence that wet soils with low oxygen levels are involved in grass tetany development came from recent Auburn-USDA research. Findings show that low soil oxygen



Birdsfoot trefoil is one of the legume crops being tested in a project seeking better forage crops for Alabama farmers.

levels reduce the magnesium content of ryegrass and tall fescue forage, and low-magnesium forage often causes grass tetany in cattle. In field tests, magnesium content of tall fescue forage produced on poorly-drained soil was below the critical level of 0.2 percent, while forage from well-drained soil had safe magnesium levels. Draining wet pastures and rotating cattle to avoid grazing poorly-drained areas should be useful in reducing grass tetany. Research is in progress to produce a high-magnesium tall fescue variety.

Fescue That Grows in Winter

Tall fescue is an important cool-season perennial grass grown on several million acres in the Southeast. Kentucky-31, the variety most commonly used, produces adequate amounts of forage in spring and fall, but is not productive during the winter months. New tall fescue lines have been developed at Auburn that show excellent winter forage production. This additional forage production should decrease requirements for stored feed and increase animal productivity on perennial pasture. Research efforts are seeking to add nematode resistance to the lines, which could make the Auburn tall fescue a valuable asset to much of the lower Southeast.

New Forage Crops On The Way

A birdsfoot trefoil being tested showed outstanding seedling vigor and forage production during its establishment year in northern Alabama. In the Black Belt, a new annual clover has exhibited good tolerance to wet soil along with superior winter forage production.

HORTICULTURE

Improved Vegetable, Fruit Crops Released

Auburn 76 FMN is the name of a new tomato variety released in 1976. This variety possesses a unique combination of three genetic disease resistances not previously available in a single variety: to Fusarium wilt race 1, to tobacco mosaic virus, and to root knot nematodes. It also possesses resistance to ripe rot of the fruit, and is high yielding.

A new southernpea variety, Freezegreen, was approved for release by the Experiment Station Release Committee. The new variety possesses a unique green seed-coat, which should

appeal to the processing trade. It also should be valuable as a source of germ-plasm for incorporating the desirable green seed-coat into other southernpea types, notably the blackeye. Freezegreen will be released to the public when there is an adequate supply of seed.

Cooperative work with USDA contributed to the release of the new potato variety Atlantic by the national potato breeding project. This new white "Irish" potato appears to be a high yielding and high quality potato well adapted to production in Alabama.

Better Alabama Apples Possible

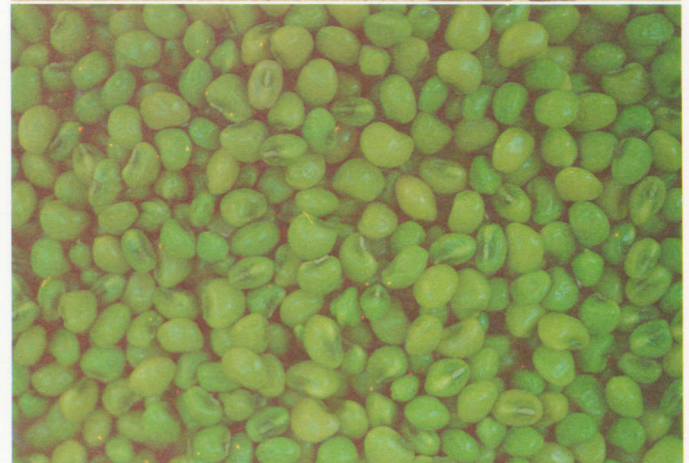
Two new non-spur Red Delicious apple varieties, Early Red-1 and Sharp Red, fruited for the first time in 1976. These proved equal in color development in Alabama to fruit grown in any section of the country.

A training system of tying apple limbs to a horizontal position has increased yield by 112 bushels per acre.

Red color development of Red Delicious apples treated with Ethephon was enhanced by addition of 2,4,5-TP as the stop drop material. In contrast, red color development was reduced when NAA was used as the stop drop material.

Food Preservation Methods Improved

Development of a canning method using a lower water level in water bath canning makes possible conservation of heat energy in home canning. In canning tests with tomato juice,



Auburn 76 FMN tomato (top) possesses exceptional disease resistance, while the new southernpea variety, Freezegreen, (bottom) has a unique green seed-coat desired by processors.



the canned product heated as fast with a 2.5-inch water level in the canner as with higher levels up to 1 inch above the jars. Time and heat energy required to preheat the water and amount of heat liberated to the kitchen area were reduced to approximately one-fourth the quantities with conventional methods.

Instant jelly concentrates were developed for the quick home processing of jams and jellies. Using the concentrates the jelly is finished by mixing sugar with water, heating, boiling 1 minute, adding concentrate, and pouring. The entire process takes only 16 minutes.

Publication was completed on a rapid spot test for ascorbic acid in tomato fruit. The new spot test proved to be useful for any sample for which the official method can be used. The method is faster, end points are sharper, and the accuracy is at least as good as with the official method.

FORESTRY

Remote Sensing of Forest Problems

An innovative study begun in late 1976 involves the relationships between environmental conditions and leaf reflectance in the biological processes of trees. If this research is successful, foresters will be able to assess nutrient deficiencies and other forms of tree stress through sophisticated aerial photography and remote sensing tools.

Aerial Photography Describes Forest Cover

In another use of aerial photography, a continuing project is developing a key for identifying forest cover types from standard, readily available aerial photographs. Results of this research have been surprisingly good. Subtle differences in forest cover types have been found tied to factors such as geology and topographic position. Thus, much more detailed description of a forest can be made from photographs than was originally anticipated. Foresters, land use planners, environmental impact assessors, and others have found the keys useful. An unplanned spin-off benefit was development of an up-to-date description of the State's forests.

Loblolly, Longleaf Pines for Reclaimed Surface Mines

Strip mine reclamation continues to get attention, with several cultural treatments tested over the past four growing

Eight-year-old slash pine growing on reclaimed surface mine (left) shows potential for such land. Slash pine selected in Baldwin County (right) is being used in efforts to breed superior varieties of forest trees for use in Alabama.

seasons on Alabama surface mines. The most pertinent of these treatments were used in three counties during 1976 and results compared favorably with the State average production on agricultural land.

Loblolly and longleaf pines appear to be the most promising trees for surface mine reclamation. Sycamore, hybrid poplars, and European black alder were surviving and growing as well as the pines at the end of 4 years, but it is questionable whether hardwood growth rates will be sustained. In older plantings, loblolly and longleaf pines have continued to make satisfactory growth.

A survey of bobwhite quail populations on the mine areas indicated that quail utilized naturally reclaimed mines for up to 25 years. It appears that quail populations are low on 5-year-old mines, reach a peak at 10 to 15 years, and then decline by 25 years. Quail eat more legume seed than any other plant seeds, and legumes are found most abundantly on 15-year-old mines.

Forest Waste Use Development

In the area of forest products, experiments proved that logging residues from southern pine forests can be used to produce commercially acceptable particleboard for use in housing construction. The residue is acceptable provided at least half of the total needles are removed. Inclusion of more than one-half the needles significantly reduced all strength and stiffness properties of the particleboard. This research shows that a material previously considered waste has commercial value.

Registration of Forest Nursery Herbicides Aided

Research that is providing data for use in registering forest nursery weed control chemicals is an area of work having immediate application. Since the Environmental Protection Agency was formed in 1973, introduction of new chemicals for forestry uses has been hampered because available data were not in the format required for registration. The Department of Forestry's nursery weed control program has been successful during the past year in registering herbicides for nursery use in several Southeastern States. Using the uniform procedures developed in this program, researchers can produce the necessary data to register chemicals needed by the forester.

Super Trees on the Way

The Department of Forestry and the Alabama Forestry Commission are cooperating to develop genetically improved varieties of forest trees for use in Alabama. Five varieties of slash, loblolly, and longleaf pine have been bred, and 250 acres of seed orchards of these varieties have been established. Older portions of these seed orchards are already beginning to bear seeds. Seed of the improved trees will be used to grow seedlings in the Forestry Commission's nurseries. Planting seedlings of the "super trees" will mean increased forest yields and incomes to Alabama landowners.

Forest geneticists are also working to develop trees that are resistant to southern fusiform rust, a serious disease that deforms or kills slash and loblolly pine. In efforts to breed rust resistant trees, 19 resistant parent trees have been found. These are being used to develop rust resistant hybrids between southern pine species.

BOTANY AND MICROBIOLOGY

How Herbicides Work

As part of the effort to learn more about the biological action of herbicides, laboratory experiments during 1976 provided information about the principal site of absorption and mode of action of the herbicide metolachlor. To determine site of absorption, the herbicide was placed in soil so that only the shoot, seed, root, or the total plant was exposed. Layers of activated charcoal prevented herbicide movement to other areas. Rates equivalent to 0.9 pound per acre for barley and 3.5 pounds per acre for corn and English peas applied in the root zone or around the seed did not measurably injure any of the three species. When applied in the shoot zone, however, the herbicide reduced the height and weight of the corn and barley seedlings but not the seedlings of English peas. When the herbicide was present in all three zones, all three species were injured. For corn and barley it seems probable that more herbicide was absorbed from the area just above the seed than from either of the other two zones tested. Other studies support the belief that the mode of action of metolachlor involves membrane damage.

Soil Fungi Problems Continue

Results of one study indicated that sodium azide initially is detrimental to fungi in general. However, the degree of inhibition following application decreased with each succeeding year of treatment so that by the third year, response to sodium azide was hardly noticeable. Bacterial populations also showed initial reductions following treatment with azide, but then rapidly increased proportional to the amount of azide applied. Thus, both fungi and bacteria developed tolerance to sodium azide in treated plots. The results also indicate that sodium azide is not an effective nematicide, does not affect mycorrhizal fungi, and is effective as an herbicide.

The 1976 work on pesticide effects on non-target organisms further substantiates the probability that herbicides, though non-fungicidal, can significantly influence the saprophytic and parasitic behavior of plant pathogens, such as *Rhizoctonia solani*, and alter the seedling disease syndrome. Such materials may affect the pathogen directly or influence the action of natural biological control agents. Information of this type will eventually show how to integrate chemical and biological control.

Continued study of *S. rolfsii* substantiates the apparently delicate balance required between microbial population and azide concentration, and the suppressive effect of azide is

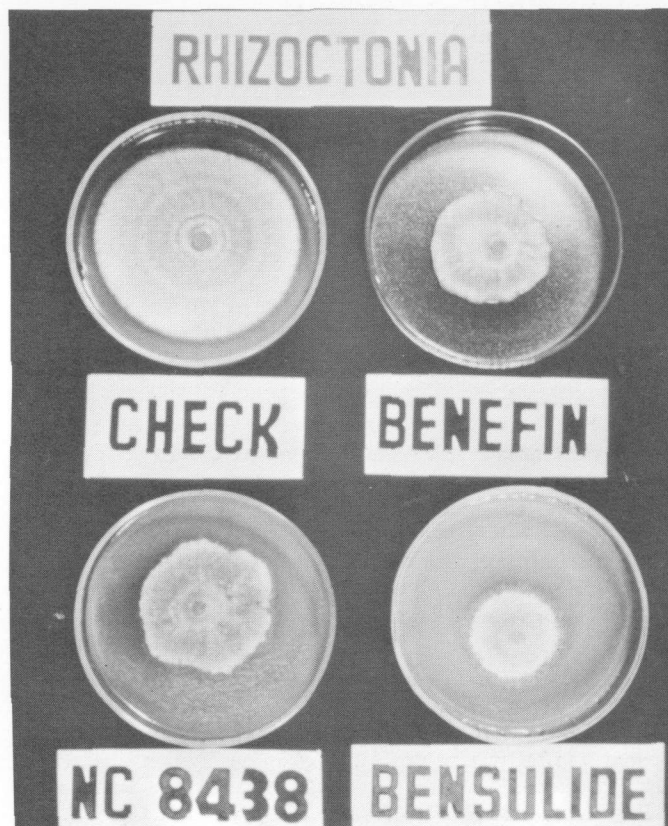
further governed by time. An important finding is that 10 common fungi which colonize and fruit on ungerminated sclerotia in azide-treated soil were less affected by azide in growth tests than was *S. rolfsii*. Inhibition of the pathogen by certain of these saprophytes was sometimes increased in presence of azide, suggesting possible integrated chemical-biological control effects.

Biological Pest Control

Continued research on biological control of arthropod pests is showing potential advantages from using combinations of biological agents. With combinations of *Bacillus thuringiensis* (BT) and nuclear polyhedrosis virus (NPV) on *Trichoplusia ni* larvae, it was noted that combinations of pathogens resulted in higher larval mortality than either pathogen used alone. However, mortalities did not exceed those expected as additive effects of the pathogens.

Turfgrass Pathogens

Non-target effects of the herbicides benefin, bensulide, and NC 8438 were evaluated on four turfgrass pathogens. Growth of all fungi at 59, 79, and 95°F was inhibited by 1, 2, and 10X concentrations of all herbicides. Degree of inhibition ranged from 0 to 90 percent, depending on herbicide concentration and fungus. Both desirable and undesirable non-target effects appear likely from use of turf herbicides. Herbicides that inhibit growth of disease-causing fungi would offer a desirable side effect. However, some herbicides may enhance development of some pathogens and diseases, representing a disadvantage.



Growth of turfgrass pathogen, *Rhizoctonia solani*, on agar containing herbicides shows considerable reduction in comparison with untreated check. This is 3 days of growth at 79° F.

Peanut Disease and Harvest Losses Reduced

Excellent control of white mold disease of peanuts resulted from a new system of applying Vitavax® whereby the fungicide is applied through the crop foliage. Before this 1976 research it had been thought that spray fungicides like Vitavax had little or no activity on the white mold fungus. Using the new method of controlling this disease, which consistently causes serious losses to producers, could well boost grower returns from peanuts.

A new procedure for determining maturity of peanuts showed promise for use in timing of harvest for top yield. The procedure utilizes a chemical determination of the amino acid arginine to predict an accurate harvest date.



Excellent control of white mold resulted when Vitavax® was applied through peanut foliage, using a method developed through Auburn research.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

Better Estate Planning Needed

Needs in the area of estate planning were revealed by a 1976 evaluation of the estate planning carried out by 204 Alabama farmers. Only 78 of the farmers, slightly less than 40 percent, had wills. It was found that attorneys who counseled the farmers did little comprehensive estate planning. Only one-third had special training in estate planning and only 29 percent had taken a tax management course. Probate procedures were found to vary among counties, especially in regard to bonding and obtaining forms to file for letters testamentary or of administration.

Dairy Investment, Production Cost High

A survey of 57 Alabama dairy farmers disclosed that the average cost of producing a hundredweight of milk was \$10.47. Feed costs accounted for 51 percent of the total. Average capital investment was \$10.47 per hundredweight of milk produced, and the average return to investment (excluding land) was 12.9 percent (\$1.35 per hundredweight). Total labor utilized per hundredweight of milk produced was 1.1 man hours, almost half of which was hired labor. In another phase of dairy research, a computerized routing program developed for wholesale delivery routes of a major milk



Tilapia and bighead carp, species suitable for growth in polyculture systems, were well received in marketing tests.

processor offered a cost savings of 16 percent and a 38 percent reduction in service time.

Cotton Marketing Contracts Vary

Types of contracts used by producers in marketing their cotton were studied as part of a regional project. Generally four types of contracts were used that covered cotton produced on a specified number of acres, while bale contracts specified the number of bales. Growers assume more risk than buyers on bale-type contracts which, as a result, should command a higher price at any given time. Forward contracting provides protection against price declines but does not permit growers to share in price increases. It was found that December futures prices were more closely related to major contract prices and served as references in contracts.

Livestock Marketing

Relatively little vertical integration has developed in Alabama's swine and cattle industries, Auburn research reveals. Meat packers and feed companies apparently are reluctant to make the required large investments in production facilities and to assume the risks associated with production and price changes. At the regional level, lack of coordination in the industry causes the flow of slaughter animals to be quite variable, which leads to extreme price variability and variable net income. Such variabilities might be alleviated by a higher degree of vertical coordination through contracting and futures market hedging.

Fish Marketing Tests

Market tests through retail outlets were carried out with catfish, tilapia, silver carp, and bighead carp grown in a polyculture system. Tilapia and bighead carp received a favorable response from consumers and sold for a farm-level price comparable to catfish. Silver carp, which biologically were most efficient in the polyculture system, received unfavorable con-



More hunting land was one of the Alabama needs revealed in recreational planning research during 1976. (SCS photo)

sumer ratings because of the presence of numerous small bones.

Youth Counseling Services Helpful

More than half of a group of high school seniors perceived themselves as users of educational and occupational counseling services. However, only about one-fourth were users of personal or marriage services. Males, blacks, and rural youths were the most frequent users of all services. Helpfulness ratings by the users revealed highly favorable reactions to educational,

occupational, and academic services, but rather negative assessments of personal and marriage services. Data on sex-role perceptions among senior girls revealed that only 16 percent held traditional family orientations (desiring to be mothers and housewives) with no desire to have a job or career.

Value of Investments in Recreational Resources

Both Guntersville State Park in Marshall County and Lakepoint Resort in Barbour County have received more out-of-state than in-state visitors since being opened to the public. The ratio of out-of-state to in-state has been 5 to 1 for Guntersville and 2 to 1 for Lakepoint. In direct payments, the Guntersville park is generating sufficient revenue to pay operating costs. Golf facilities at neither park have reached the use level estimated in the feasibility study. These two parks were used in the economic analyses because of their differences in rurality and size. Recreation planning research identified the need for such facilities as archery courts, tennis courts, softball diamonds, basketball courts, picnic tables, trails, swimming pools, campsites, hunting land, natural and scenic roads and viewing sites, golf courses, boat launching ramps, and parking spaces in all regions of the State.

ANIMAL AND DAIRY SCIENCES

Cattle Nutrition Studies Continued

Feeding a high energy or high protein creep ration increased pre-weaning average daily gain of beef calves by approximately 0.2 pound per day. However, non-creep calves gained more rapidly post-weaning.

Pre-weaning nutrition of heifer calves was found to affect reproduction of those bred at 2 years of age.

Beef cattle breeding herd replacements should be selected from the same environmental conditions to which their offspring will be subjected, according to results of new Auburn research.



Preliminary results indicate that solvent-extracted cottonseed meal contains more "free" gossypol than screw-pressed cottonseed meal. Some metabolic parameters of dairy cows were affected when they were fed a ration containing high levels of solvent-extracted cottonseed meal.

Consumption of dietary iron by dairy and beef animals at 4 times the normal level had no significant effect on hemoglobin, average daily gain, adipose tissue cholesterol, muscle cholesterol, or liver and serum cholesterol.

Swine Stress Susceptibility

Swine susceptibility to stress and sensitivity to halothane anesthesia are not identical conditions. That was the conclusion following research in which halothane sensitive pigs had higher thyroxine metabolic clearance rates and lower plasma thyroxine levels than non-stress susceptible controls. While it is accepted that pigs sensitive to halothane anesthesia are also stress susceptible, it does not follow that all pigs susceptible to hypothermic death following exposure to various types of stressors are halothane sensitive. Thus, testing of swine for halothane sensitivity will not identify all stress susceptible swine.

Animal Breeding and Selection

Breed of sire was found to significantly affect pig weight at 42 days, post-weaning rate of gain, feed efficiency, carcass length, loin eye area, and percent lean cuts. Using Duroc boars on Landrace sows resulted in better pig performance than when the sows were bred to Landrace or Yorkshire boars.

Results to date with beef cattle indicate that breeding herd replacements should be selected from the same environmental conditions to which their offspring will be subjected. Progress from selection is much greater when favorable environment is provided.

No Bacterial Health Hazards in Wastelage

Coliform bacteria in rations containing 40 to 60 percent manure died after 5 days of ensiling. Elimination of coliform was associated with a drop in pH to a range of 4.4 to 4.7. Yeasts and molds also decreased and salmonellae failed to survive the ensiling process. In an 84-day feeding trial where animals were under stress, it was determined that 11 pounds of wastelage was equivalent in feeding value to 15 pounds of corn silage.

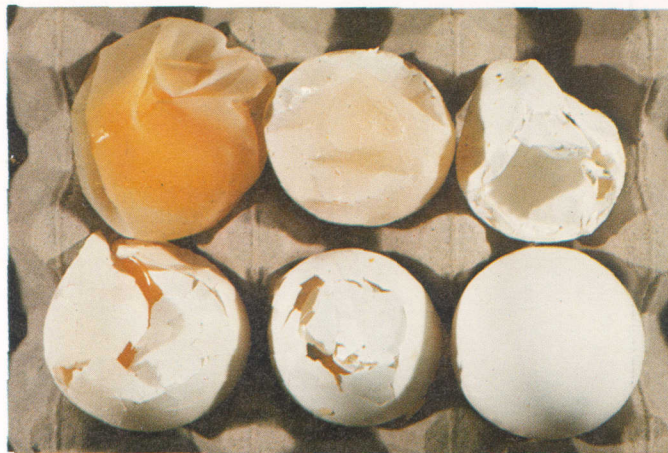
POULTRY SCIENCE

Artificial Breeding Efficiency Improved

Experiments were conducted involving the frequency of semen collection. It was determined that semen can be collected from males twice daily without reducing sperm cell numbers to the point of lowering fertility. Overall, both sperm cell numbers and semen volume output can be significantly increased by collecting twice daily. This procedure significantly reduces the number of males needed for an artificial breeding program for chickens.

Poultry Bacterin Vaccines for Fish

The adaptation of poultry bacterin (vaccine) formulations and techniques for use in the preparation of fish health bio-



Faulty eggshells such as these occur twice as often as originally thought, according to results of Auburn poultry research.

logics has resulted in the development of promising vaccines for control of two of the most important bacterial diseases of cultured catfish in the South. This cooperative effort effectively transferred animal health technology from poultry science to fisheries.

Anticoccidial Drugs Stimulate Chick Growth

It has been found that certain anticoccidial drugs fed in rations improve growth and feed efficiency of healthy chicks and turkeys with no apparent infection of any kind. Similar results were noted with chickens or turkeys inoculated with certain species of coccidia which cause significant depression in growth and poor feed efficiency among unmedicated controls. Chickens receiving the drugs significantly exceeded uninfected, unmedicated controls in growth and feed efficiency. The action of these compounds is believed to be either inhibition of normal intestinal microflora that may interfere with metabolism, or they may in some way enhance digestion or absorption and utilization of nutrients, or both.

Egg Shell Quality Problems Studied

The incidence of shell-less eggs, normally not included as part of the shell problem, was found to be approximately 8 percent of the total ovulated. Thus, the shell problem is two times that normally reported. Shell-less eggs increase with age and can be partially reduced for a few months by force molting. The same is true for pimpled eggs. Findings dispute the general belief that birds lose their ability to put shells on eggs with increased age. The amount of shell per egg stays relatively constant, but becomes thinner because eggs get larger with age. Egg shape does not appear to contribute much to shell thickness; however, shape can influence the bird's ability to produce eggs with maximum shell quality.

The incidence of body checks and abnormally shaped eggs is approximately 5 percent of all eggs laid and occurs mostly in eggs laid between 6 and 9 a.m. A direct relationship was found between number of birds in a cage and incidence of these defects.

ANIMAL HEALTH RESEARCH

Diseases, Parasites Attacked

New drugs, albendazole and haloxon, were found to be effective for the treatment of certain internal parasites in



The drugs albendazole and haloxon were found to be effective against certain internal parasites in horses and cattle.

cattle and horses. Research is continuing on procedures for improving the diagnosis of parasitisms in cattle.

Fluorescent antibody test and other techniques are being employed to identify and determine disease producing effects of certain viruses that cause respiratory problems in cattle. Other research is studying immune mechanisms of the dam and her fetus prior to birth. Fetuses are being inoculated with various vaccines prior to birth to determine possible means of protecting calves from reproductive diseases.

E. coli endotoxins are being fed orally to newborn pigs to determine the role of endotoxins as the cause of swine agalactia syndrome.

FISHERIES AND ALLIED AQUACULTURES

Diet Affects Catfish Profits

Skillful feeding to satiation, but without overfeeding, proved to be the most economical feeding practice for channel catfish production. This was true with both high protein-high energy and low protein-low energy diets. Each was fed at 100, 87, and 75 percent satiation in ponds for 110 days. Fish fed the higher nutrient diet consumed more feed and gained more weight. As feeding decreased, there was an improvement in feed conversion efficiency, coupled with a decline in yield.

Results of another channel catfish feeding study showed that twice daily feeding is better than alternate day or once a day feeding only during the warmest months of the growing season. During July and August, the fish fed twice daily ate 20 percent more than those fed once daily. It was a different story in September and October, however, when less feed was consumed by those fed twice daily. For the overall feeding period, fish fed once daily consumed practically the same amount of feed and gained nearly the same amount of weight as those fed twice daily, but consumed 27.6 percent more feed and gained 23.6 percent more weight than those fed on alternate days.

Pond Management and Water Quality

Phosphorus fertilization rates for bass-bream ponds may be reduced from 8 pounds to 4 pounds P_2O_5 per application with little or no loss of fish production.

Potassium permanganate is often recommended at 2-8 p.p.m. as a pond treatment to alleviate dissolved oxygen de-

pletion. However, laboratory and pond studies demonstrated that this treatment is ineffective as a deterrent to oxygen depletion in ponds.

Treatment of catfish ponds with weekly applications of 0.75 pound per acre of copper sulfate was ineffective in controlling phytoplankton abundance. Simazine effectively reduced phytoplankton abundance, but caused extended periods of low dissolved oxygen content that resulted in decreased fish yield and poorer feed conversion than in untreated ponds.

Hach DR-EL/2 and AL 36-B water analysis kits were found suitable for measuring water quality for management decisions. However, neither provides the type of data needed for rigorous study of water quality.

Water quality of effluents from catfish ponds, determined at fish harvest, indicated that catfish ponds are not important point sources of pollution.

Feeding Time vs. Fishing Success with Catfish

Fishing success on feeding and non-feeding days was compared in two public fishing catfish ponds stocked with 3,000 channel catfish per acre and fed pelleted feed. In 1976, the second year of fishing in one pond and third year of fishing in

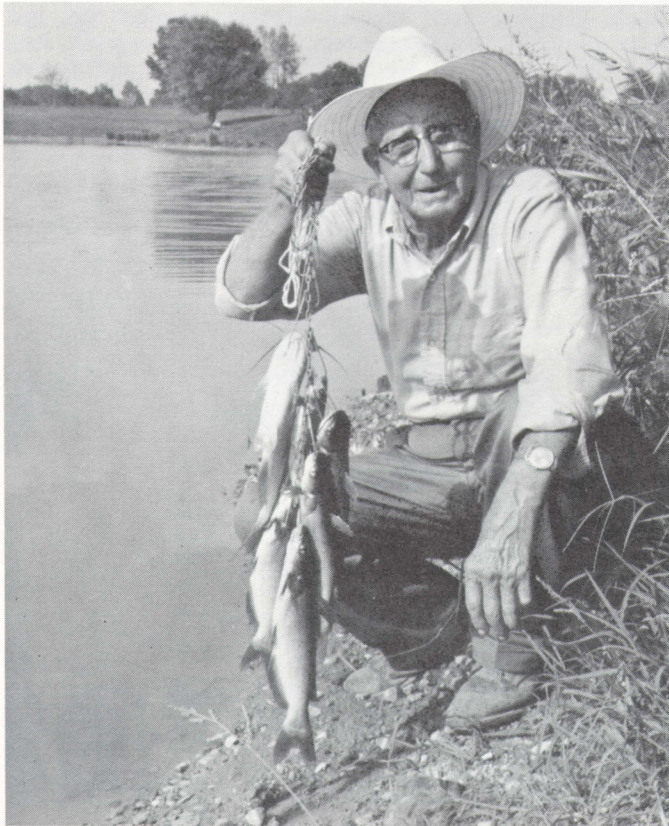


Full feeding, but without overfeeding, proved to be the most economical system for production of channel catfish.

the other, there was no difference in number or size of catfish caught per hour on 45 fed and 45 non-fed days. Feed was applied to the pond 3 days each week. Records for the ponds in the previous 1 and 2 years before the tests indicate rate of catch in ponds open to public fishing. In the first year for one of the ponds, 250 fishermen caught 396 catfish weighing 438 pounds per acre of water. They paid \$1.13 per pound for the fish (daily permits cost \$1.50 each with no limits to fishermen, but they paid 65¢ per pound for all catfish over a total catch of 2 pounds). First and second years for the other pond resulted in respective year catches of 633 pounds per acre at fishermen cost of 66¢ per pound and 174 pounds at cost of \$1.05 per pound.

Winter Feeding of Catfish

Performance of overwintering catfish on different feeding systems provides information needed in catfish pond management. Fish weighing about ½ pound each at beginning of winter lost 6.3 percent of body weight from November 15 through March 15 (123 days). The weight loss was in the form of body fat and not body protein. Fish fed floating feed to satiation when water temperature was 50°F or higher consumed feed 44 of 52 days when offered, and gained 12.7 percent in weight. The fish ate 0.3 percent of body weight when temperature was 50-55° and increased consumption to 1.3 percent at 57-60°F. Fish fed sinking pellets at the rate of 0.5 to 1 percent of body weight as temperature increased from 50 to 60° gained 4.2 percent. Those fed 0.75 percent of body weight at temperature of 55° or higher gained 7.9 percent. The only group to increase in body fat during winter was the fish fed to satiation on floating feed.



Fishing success showed no difference between fed and non-fed days in catfish ponds open to the public. (SCS photo)



Only 7 of 24 insecticides tested were effective against the soybean looper, which causes the type damage shown here.

ZOOLOGY-ENTOMOLOGY

Soybean Looper Hard to Kill

Field tests were conducted to determine the effectiveness of various insecticides against the bean leaf beetle and soybean looper on soybeans. Of the 23 insecticides tested against the bean leaf beetle, all were effective at rates of ½ pound per acre. Eleven of these controlled the beetle at rates as low as 1/8 pound per acre. The soybean looper proved to be much harder to kill. Of the 24 insecticides tested against it, only 7 were effective and several of these required as much as 1 pound per acre.

Variety Resistance to Tomato Fruitworm

Some varietal resistance was evident when 25 varieties and hybrids of fresh market tomatoes were screened for evidence of resistance to the tomato fruitworm. Showing the least damage by the fruitworm were Terrific VFN, XP 802 Hybrid, and Better Boy VFN varieties.

Growth Regulator Controls Insect

The insect growth regulator, Dimilin, effectively controlled forest tent caterpillar feeding on water tupelo forests in southwestern Alabama. Rates of 0.5 and 1.0 ounce per acre of active ingredient (both wettable powder and flowable formulations) were effective. There has been no noticeable environmental damage in this sensitive area during the 3 years of research with the growth regulator chemical.

Eufaula Canada Goose Flock Growing

The reproductive success of the resident Canada goose flock was studied during 1975 and 1976 at the Eufaula National Wildlife Refuge. During the 2 years, 75 Canada goose nests were located. Only 41 percent of these produced goslings in



Radio transmitters attached to captured and released woodcock revealed information about movement habits of this game bird.

1975 and 51 percent in 1976. Nest mortality was most often due to high water levels, but predation, competition for nest sites, and human interference also contributed. The minimum number of birds raised per successful nest was 1.5 in 1975 and 2.9 in 1976. Despite high nest mortality, size of this flock has grown more than 200 percent since 1969.

Woodcock Activity Monitored

Monitoring of 20 woodcock captured and fitted with radio transmitters revealed that their movement was primarily during daylight hours. Preferred diurnal area was forest where 30-50 percent of the surface lacked vegetative ground cover. Adult males and immature females preferred flood plains and adult females and immature males preferred adjacent areas. The nocturnal habitat was primarily unimproved pasture, apple orchards, and woodland openings.

HOME ECONOMICS RESEARCH

Too Much Protein Bad

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Diets containing 60 and 80 percent protein fed to rats caused significant appetite depression and weight loss within 24 hours. Blood ammonia, glucose, and urea nitrogen were elevated and liver glycogen stores dropped far below normal. These experiments illustrate the metabolic consequences of certain high protein reducing diets often proposed for humans. Since similar biochemical derangements are seen in individuals suffering from liver insufficiencies, abnormally high protein diets should be considered with caution.

Elderly Have Nutritional Problems

A pilot scale nutritional survey conducted in Lanett, Alabama, of apparently healthy persons 62-69 years of age revealed low dietary intakes of vitamin A and calcium by approximately half of the sample. Blood folacin levels were low in 45 percent of the subjects. Since this information was obtained during the winter when fresh vegetables were relatively scarce, low intakes of the two vitamins appeared logical. Obesity was a problem for 50 percent of the women and 37 percent of the men. This information should be useful to agencies concerned with health care education and counseling for the elderly.

Loss of Fabric Flame Retardancy

The search for causes of observed loss of flame retardancy of fabrics revealed that both chemical and physical processes

are involved. Salts applied to flame retardant fabrics were shown to alter the decomposition products resulting when fabrics are pyrolyzed. Since these decomposition products are the fuel for ensuing combustion in real-life burning, the alteration in flammability that is observed is the result of basic chemical changes. Likewise, the manner in which salts are deposited on the fabric has been shown to be a factor. New research will be concerned with how soil may alter the effectiveness of the fabric in providing protection in a work environment.

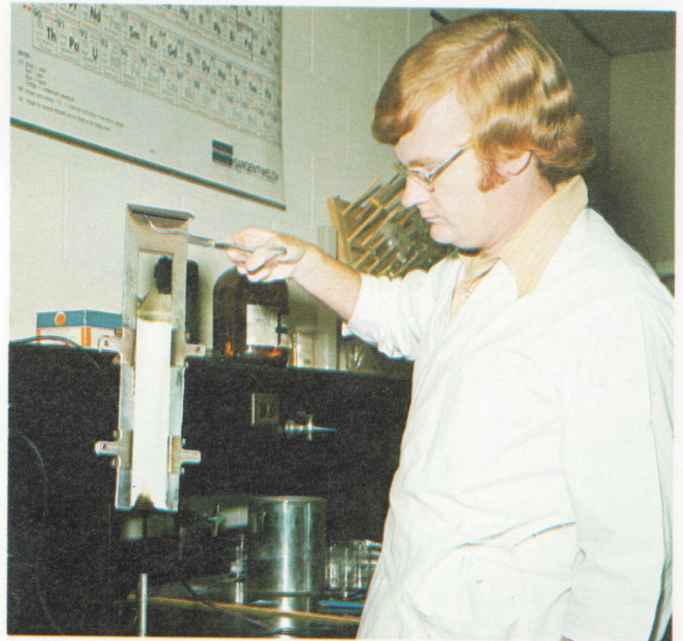
Housing Quality Reflects Income

A connection between income and housing quality showed up in a survey of 200 households in each of two predominantly rural Alabama counties. In one of the counties, 13.8 percent of the dwellings lacked an inside bathroom and 44.4 percent had no insulation. Black households had lower incomes and substantially worse housing in this county than did whites. Few of the respondents had sought help about a housing problem from any agency even though 30.2 percent of them felt that their dwellings did not meet their families' needs. This project contributed to the report of the Alabama Interim Legislative Committee on Housing.

RESEARCH DATA ANALYSIS

Data Handling Method Completed

Final testing of SAS76, an integrated data handling and statistical analysis system developed in cooperation with the North Carolina State University and the Technical Committee of Regional Project S-94, was completed and the project terminated. SAS76 is the leading data handling-statistical analysis system in many universities and has been widely accepted by industry. Data summary systems for variety tests, forage research, chemical weed control, imported tropical fish, and other research activities have been revised and improved. Programs were developed for analysis of data relating to areas such as water quality in fisheries and the effect of cotton processing on grade and energy consumption.



Fabric sample begins burning in test being used to determine factors that cause treated fabrics to lose their flame retardancy.

ANNUAL REPORT 1976

list of projects underway during the year

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

Crop, Livestock, and Poultry Management

Changing Role of Selected Agricultural Credit Agencies
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

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

Resource Use and Planning

An Economic 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
Leasing Arrangements in the Tennessee Valley

Rural Development

Defining and Achieving Life Goals
Implementation of Continuance Planning in Outdoor Recreation, V
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 for Cotton Production

Farm Machinery

Automatic Direct Digital Control for Steering Tractors
Determining Farm Machinery Capacities

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
Responses of Chickens to Variations in Air Temperature, Humidity, and Velocity
Selected Environmental Factors on Feathering, Skin Lesions, and Growth of Broilers
Utilization of Solar Energy in Poultry Production

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
Influence of Cultural Practices on Short-season Cotton

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
Reclamation of Surface-mined Lands in Alabama

Forage Crops

Chemical Profile and Nutritive Value of Forage Genotypes
New Plant Introduction, Multiplication, Evaluation, Preservation
Productivity and Quality of Phalaris, Annual Cool Season Grasses, and Legumes

Grain Crops

Grains Crops Variety and Experimental Strains Testing

Plant Breeding

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

Soil Chemistry and Soil Fertility

Availability of Residual and Fertilizer Phosphorus
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
Nitrate Movements in Soil Profiles
Relationships Between Micronutrients in Soils, Uptake and Response by Plants
Soil Testing and Plant Analysis

Soybean Production

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

Turfgrass

Turfgrass Evaluation and Management

Vegetable Production

Plant Nutrient Requirements of Vegetable Crops

Weed Control

Chemical and Biological Weed Control in Agronomic Crops
Competitiveness and Control of Weeds in Soybeans
Cultural and Environmental Effects on Herbicide Persistence

ANIMAL AND DAIRY SCIENCES

Animal Health

Endocrine and Muscle Relationships in Swine and Cattle
Role of Endotoxin in Swine Agalactia Syndrome
Significance of Microflora of Healthy Bovine Udders in Mastitis Control

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
Evaluation of Prospective Boars
Genetic Improvement of Efficiency in the Production of Pork
Performance Testing of Prospective Sires
Selected Reproductive Phenomena in Cattle and Swine

Dairy Production

Comparison of Urea and Soybean Meal in a Silage-based Complete Feed for Dairy Cows
Development of Prediction Tests for Microbiological Quality of Fluid Milk Products
Effect of Level and Quality of Protein on Lactation in Cattle
Evaluation of Phalaris and Phalaris-ladino Clover Pastures for Dairy Cattle

Feeding

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

Forage Production

Beef Production on Selected Forage Systems
Marketability and Acceptability of Beef Produced Under Forage and Forage-grain Management Systems
Relationship Between Properties of Southern Forages and Animal Response

Nutrition

Chemical Profile and Nutritive Value of Forage Genotypes
Effect of Dietary Cholesterol on Longevity in Rats and Factors Affecting Milk Cholesterol in Cattle
Energy and Protein Levels in Blended Dairy Rations
Gluconeogenesis and Amino Acid Metabolism in Ruminants
Legume Protein, Preparation, Evaluation, and Amino Acid Composition and Metabolism
Livestock Waste as Animal Feed
Relationship of Nucleic Acid and Polyribosome Contents to Growth of Muscle of Beef Cattle
Vitamin E for Swine Research in Confinement

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 Food from Waste from Cattle in Production Units

ANIMAL HEALTH RESEARCH

Cattle

Neurology of the Reproductive System in the Bull
Pathogenicity, Diagnosis, and Treatment of Cooperiosis in Calves
Persistence of Natural Infection in Calves Born to and Nursing Brucellosis-infected Dams
Resistance to and Epidemiology of Infectious Agents Affecting Bovine Reproduction
Transmission of Brucellosis from Cattle to Non-ruminant Wildlife Mammals
Virological Aspects of Bovine Respiratory Tract Disease

Poultry

Relationships of Blood Pressure and Aortic Tissue Lipids and Atherosclerosis in Turkeys
Reproductive Performance of Artificially Inseminated Broiler Breeders Maintained in Cages

Swine

The Role of Endotoxin in the Swine Agalactia Syndrome

BOTANY AND MICROBIOLOGY

Cotton Production

Influence of Cultural Practices on Short-season Cotton

Disease Control

Biochemistry and Physiology of *Cronartium fusiforme* on Southern Pines
Ecology and Control of Soil-borne Fungal Pathogens of Forest Tree Seedlings
Ecology and Taxonomy of Some Alabama Fungi

Effects of Environmental Stress Factors on Some Energy-related Processes of Plants

Epiphytology and Control of Apple and Peach Diseases

Epiphytology and Control of Scab and Brown Leafspot of Pecan

Fungal Spore Germination Inhibitors and Stimulators Associated with Surface Waxes of Peanuts

Isolation and Identification of Odorous Metabolites of Aquatic Actinomycetes

Mycotoxigenicity of Stored Feeds and Seeds

New or Unusual Plant Diseases in Alabama

Physiology and Biochemistry of Mycotoxin-producing Fungi

Plant Diseases in Relation to Forage Crop Breeding

Production of Mycotoxins (Other than Aflatoxin) by Fungi Isolated from Cottonseed

Rhizosphere Ecology as Related to Plant Health and Vigor

Soil-borne Pathogens of Peanuts, Their Complexes and Control

The Effects of Seed Treatment Fungicides on the Rhizobium Host Infection Process in LDC Legumes

Viral Diseases of Selected Grasses: Identity, Control, and Role in Pre-disposition

Ecology and Control of Fusiform Rust on Southern Pines

Viruses and Mycoplasma-like Organisms Causing Diseases of Corn

Herbicides

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

Fate and Effects of Atrazine in Salt Marsh Ecosystems

Insects

Biological Control of Selected Arthropod Pests

Pesticides

Activities of Nematicides and Fungicides on Non-target Soil Nematodes and Fungi

Plants

Distribution and Habitats of Alabama Poisonous Vascular Plants

Flower and Pod Abscission in Soybean (*Glycine max* (L) Merr.)

Implementation of AMI Method for Determining Peanut Harvest Dates in Alabama

FISHERIES AND ALLIED AQUACULTURES

Aquatic Ecology

Aquaculture Management of Aquatic Plants for Sportfish Production in Ponds

Streams and Impoundments 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

Procedures for Crayfish Culture in Alabama Ponds

Sportfish Management

The Culture of Fish, Shellfish, and Aquatic Plants in a Closed System

FORESTRY

Disease Control

Appraisal and Control of *Endothia gyrosa* on Pin Oak in Alabama

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

Forest Nursery Weed Control

Growth and Nutrient Requirements of Selected Hardwoods

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

Nitrogen Fertilization of Loblolly Pine (*pinus taeda* L.)

Forest Products and Technology

Cold Soaking of Fence Posts in Preservative Materials

Evaluation of Particleboard Constructed from Loblolly Pine Logging Residue

Evaluation of Southern Pine Plywood Properties

Forest Measurements

Effectiveness of Standardized Forest Condition Classes for Aerial Photographic Forest Inventory Purposes

Forest Site Quality

Physiographic Classification of Southern Pine Forest Lands

Forest Stand Improvement

Effects of Selected Silvicultural Practices on Timber Production and Wildlife Habitats

Precommercial Treatment of Semistagnated Natural Stands of Loblolly Pine

Regeneration

Classification of Coal Surface Mine Soil Material for Vegetation Management and Soil Water Quality

Reclamation of Surface-mined Lands in Alabama

Resource Economics

Economic Alternatives for Managed Woodlots

Resource Management

Forest Practice Alternatives in Central Alabama

HOME ECONOMICS RESEARCH

Housing

Quality Housing Environment for Low-income Families

Nutrition

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

Patterns of Food Intake and Nutritional Health of Girls

Textile Safety

Effect of Alkaline Earth and Alkali Metal Ions on Flame Retardancy of Selected Fabrics

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

Consumer Perceptions of Changes in Fabric Properties

Effect of Near Ultraviolet and Visible Radiation on Selected Non-linear Polimides

HORTICULTURE

Breeding

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

Breeding Improved Tomato and Pepper Varieties for the South

Genetic and Breeding of Muskmelon and Watermelons

Genetics and Breeding of Plums

Southernpea Breeding for Insect and Virus Resistance, and Nature of Insect Resistance

Management

Control of Developing Fruit Depressant Effect on Subsequent Fruit Set and Growth in Annual Crops

Factors Influencing Vegetative and Reproductive Development of Young Pecan Trees

Height Control in Floricultural Crops

Nutritional, Cultural, and Varietal Investigation of Apples

Peach Nutritional, Cultural, and Varietal Investigations

Regulation of Pistillate Flowering Processes in Pecan

Ornamentals

Economics of Producing and Marketing Woody Ornamentals in the South

Identification and Control of Diseases on Ornamental Plants

Soil Fertility

Soil Fertility and Fertilizer Requirements of Vegetable Crops

18 *Utilization*

Characterization of Promising Fruit and Vegetable Varieties and Breeding Lines as Food Raw Materials and Processed Foods

High-fold Freeze Concentrations of Fruit and Vegetable Juices

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 Avian and Fish Virus Antigen Systems

Diagnostic Services—Poultry

Genetic Bases for Resistance to the Avian Leukosis Complex

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

Susceptibility of Eimeria Species to Coccidiostats

Environment

Response of Chickens to Variations in Air Temperature, Humidity, and Velocity

Selected Environmental Factors on Feathering, Skin Lesions, and Growth of Broilers

Utilization of Solar Energy in Poultry Production

Eggshell Quality of Domestic Fowl

Feeding

Livestock Waste as Animal Feed

RESEARCH DATA ANALYSIS

Statistics

Development and Maintenance of Statistical Analysis System

Evaluation of Irrigation Potential for Alabama

ZOOLOGY-ENTOMOLOGY

Cotton Production

Influence of Cultural Practices on Short-season Cotton

Ecology

Ecological Impacts of Wading Birds on Aquatic Environment

Reptiles and Amphibians of Alabama

Miscellaneous

Auburn University Entomological Museum

Endocrine and Muscle Relationships in Swine and Cattle

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

Bobwhite Quail Studies

Ecological Studies of Wild Turkeys

Furbearer and Mammalian Predator Studies

General Wildlife Studies

Reproductive Physiology of the Wild Turkey

Woodcock Studies

ANNUAL REPORT

1976 / a financial accounting for the year

Research Expenditures

Source of Funds

Beef Cattle 11.3%	State Appropriated \$5,407,290	43.6%
Cotton 5.3%		
Dairy Cattle 5.5%		
Feed Grains 2.5%		
Fish & Wildlife 13.3%		
Forestry 7.6%	Federal \$2,342,484	18.9%
Fruits, Nuts & Vegetables 7.8%		
Human & Resource Development 3.1%		
Ornamentals & Turf 3.2%		
Pasture & Forage 7.7%		
Peanuts 2.9%	Sales & Auxiliary \$2,758,432	22.2%
Poultry 6.8%		
Recreation .9% ↘		
Soils Land & Water 8.7%	Grants & Donations \$1,903,589	15.3%
Soybeans 5.1%		
Swine 6.1%		
Other 2.2%		



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