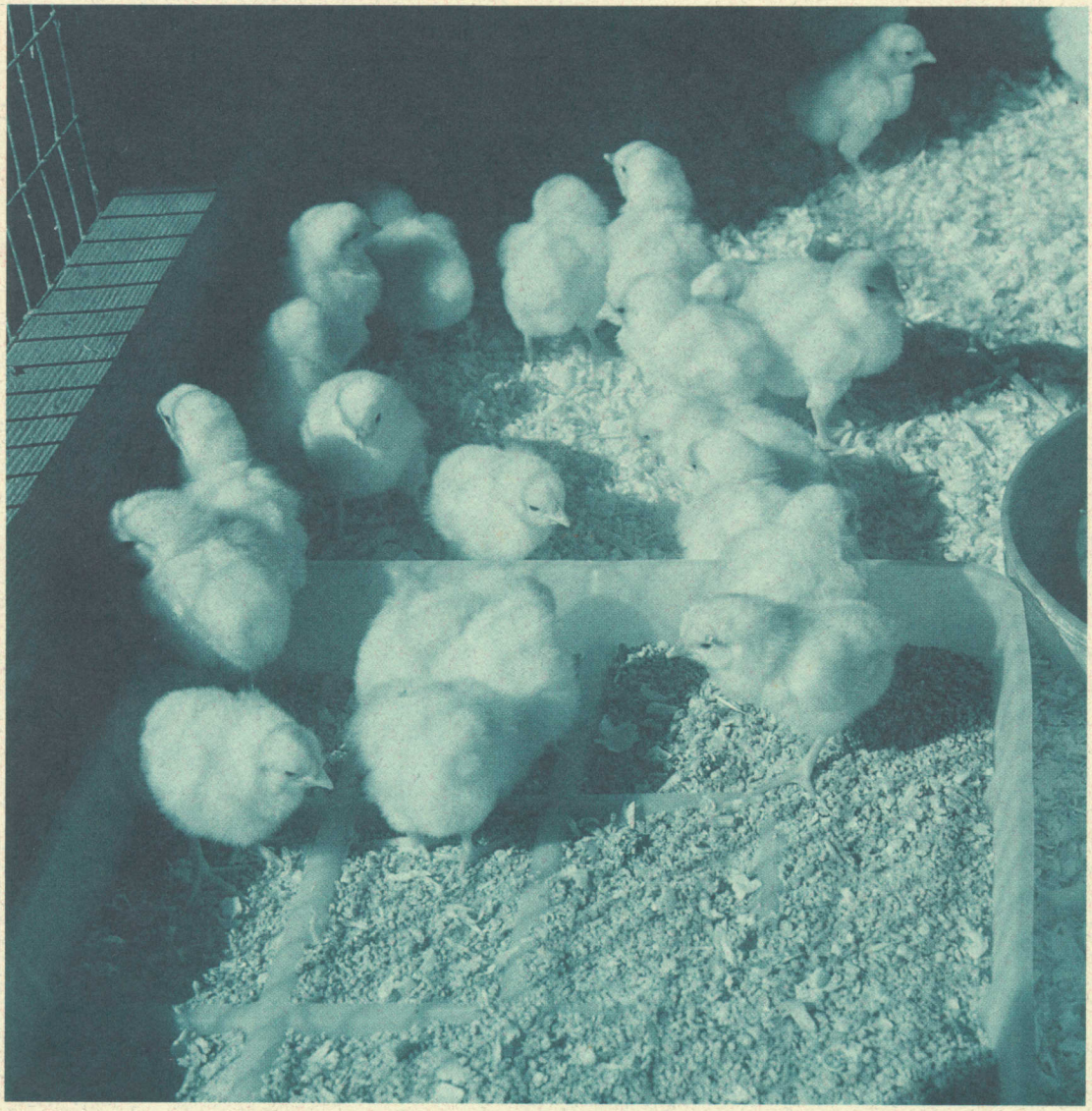
1991 Annual Report

Alabama Agricultural Experiment Station
Auburn University



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On the cover:

Alabama's poultry industry continues to grow, and along with growth comes waste disposal challenges, which AAES researchers are striving to meet.

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Foreword

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In the 1990 Annual Report of the Alabama Agricultural Experiment Station (AAES), reference was made to the significance of the year 1991. Reading the year 1991 forward or backwards, the numbers are the same, but the symbolism is different. If read from right to left, we could look backwards to the security of the past, or left to right and see the challenges of tomorrow. The faculty and staff at Auburn chose to read it from left to right and accepted the challenges presented in 1991.

The year 1991 commenced with the looming uncertainties of National and State economies. Shortly after January 1, our budgets were prorated due to lower than expected tax revenue and the challenge to continue to produce with less funds confronted the faculty. On January 15, Operation Desert Shield became Desert Storm. Faculty and staff were called to active duty; thus, placing another speed bump in the path of research.

As 1991 progressed, many more speed bumps appeared, but we continued to survive. In some of our sister states, declining budgets led to the release of valuable personnel. However, Auburn University was able to retain its faculty—thanks to the faculty's resourcefulness. In looking back, 1991 should be known as the "Year of the Faculty" in honor of their dedication, resourcefulness, ingenuity, and positive spirit.

To accommodate the decline in appropriated research funds, faculty submitted and received a record high number of extramural grants to support their research programs. Faculty joined together in research teams and shared their equipment and technical support with each other. Joint research ventures were initiated with industry, resulting in additional funds to support research, and also in the use of industries' facilities and equipment and the transfer of equipment to Auburn University.

During 1991, we moved into a much needed greenhouse complex. This complex provides a greenhouse with a totally controlled environment which is needed to answer the complex questions facing agricultural and forestry production in the state. This facility provides modern laboratory space for investigations in plant stress, biological control, and the genetic engineering of plants.

The faculty's concerns about environmental quality issues increased. Alabama has bountiful water traversing its rivers, streams, and underground aquifers, which studies show could be harvested and stored in times of plenty to be used later for irrigation of our crops. Investigations continued on converting by-products such as poultry litter, hardwood tree species, and paper refuse, which are often referred to as "wastes," into useful products that will enhance production and improve environmental quality. Dr. William Davies was selected as the Butler-Cunningham Eminent Scholar, a position that deals with environmental issues.

The Task Force presented their final report to the AAES. Faculty are using this report to identify goals and specific objectives that will ensure that the AAES's research program is responsive to the needs of the State today and tomorrow. Ultimately, the plan will provide a blueprint for identifying the many opportunities available to us in the future.

This annual report presents many significant accomplishments of our research programs. Despite the obvious benefits of this research, it is not easy to glean from it the resourcefulness required for the faculty to achieve these accomplishments. Their resourcefulness epitomizes the belief that the only difference between stumbling blocks and stepping stones is the way you use them. In 1991, faculty and staff found ways to increase the number of stepping stones!

1991:

A Big Year for Agricultural Research

The formal announcement of AU Lean® sausage at a press conference in New York City on July 24, 1991 focused national and international attention on Auburn's research program. Few achievements have focused such positive public opinion on the University, the Agricultural Experiment Station, and agriculture in general. Though other research accomplishments at Auburn may equal, even exceed, AU Lean, few have captured the interest and support of the general public as much as AU Lean.

From a scientific standpoint, the release of genetically altered carp into ponds near the Auburn campus marked a dramatic breakthrough. These tiny fingerlings, which include in their genetic makeup one extra gene that produces growth hormones, were the first such fish cleared for release into outdoor ponds. These transgenic carp will provide a model for genetic development that could someday produce farm-raised channel catfish of uniform size, with greater disease resistance and the ability to overcome many environmental hazards that currently plague commercial production.

The development of a robot that can "see" and "feel" bedding plants offers tremendous potential for the State's nursery industry. If it can be made cost effective, this robot could help producers overcome a shortage of seasonal workers and eliminate long hours of tedious human labor required to transplant bedding plants from growth cells into flats.

Environmentally, one of the State's biggest challenges is to find profitable, yet nonpolluting methods of utilizing litter from Alabama's dynamic poultry industry. One method being tested by Auburn researchers involves using litter in combination with waste paper, which is also a vital environmental concern, as a soil amendment. Initial results of placing shredded paper and poultry litter in shallow trenches, covering the trenches, then growing cotton look promising.

The awarding of a $300,000 National Institute for Health grant to Auburn researchers could provide some longterm answers to Fetal Alcohol Syndrome in infants whose mothers consumed alcohol during pregnancy. Researchers are exploring how cells perceive extracellular signals to move information across the cell membrane and into the cell nucleus to affect gene expression.

While a complete summary of research results by the Alabama Agricultural Experiment Station isn't possible due to space limitations, the following is representative of the work being done by scientists at Auburn.

McDonald's use of AU Lean ground beef in their new McLean Deluxe sandwich brought national attention to Auburn University.

Glowing Bacteria Paying Off

The development of genetically altered bacteria *Xanthomonas campestris*, which was reported in the 1990 AAES Annual Report, began paying research dividends in 1991. In this research, scientists included genes from a fish bacterium which have the ability to produce light, much like a firefly, into the genetic code of *Xanthomonas* bacteria.

Researchers determined that the bacteria, which causes black rot in crucifer crops, can survive for short periods on plant debris and in the soil in the absence of a host crop. Using the "glow-in-the-dark" bacteria, researchers also established that the bacteria grow as well on the surface of resistant as on susceptible plants without causing disease symptoms.

Poultry Virus Test

The use of latex microbeads for assaying avian antisera for the immunization response following vaccination was a significant development for AAES researchers in 1991. Latex microbeads were coupled to different viruses and were then used to perform agglutination tests with specific antigens. This procedure reduces time necessary to get results of the test and lowers cost to less than 10 cents per test. The sensitivity and specificity of the tests are comparable to other immunoassays used in the poultry industry

Herbicide Damage-Gene Link

When sensitive strains of photosynthetic bacteria are subjected to herbicides, such as atrazine or terbutryn, they respond by synthesizing specific proteins which researchers believe play a role in nontarget damage by these pesticides. Some of these proteins are the same as those produced by the plant during heat stress, but as AAES researchers found, some are specific to herbicide stress.

Researchers determined that one protein, a 55kDa, is common to sensitive and atrazine-resistant strains of bacteria. AAES researchers also determined that a simular protein is found in both the cytoplasm and the membrane of these bacteria. If future research confirms this finding, it will mark the first time a major stress protein has been identified in the membrane, and will provide invaluable information in the quest to characterize herbicide-resistant plants.

"Good" Antibodies Developed

One of the newest groups of mycotoxins of concern in agricultural products is the fumonisin group. Mycotoxicologists have had little success in producing antibodies to fight these toxins. However, AAES researchers have succeeded in adapting methodology used to develop monoclonal antibodies to combat ergot alkaloids that cause fescue toxicity in cattle grazing fungus-infected fescue to develop "good" antibodies to fight fumonisin toxins.

Auburn researchers now have two different monoclonal antibodies, called Mabs, to fumonisin toxins. The Mabs have been successfully used to detect the presence of these compounds in agricultural products.

Genetic Fingerprinting

How successful introduced wildlife species and other organisms in their environment are at finding mates and raising offsprings is critical to improving populations of some game species in Alabama, especially quail. A technique developed by researchers may help wildlife biologists to analyze breeding success of these animals under natural conditions.

A number of techniques have been tested, but the most positive findings have resulted from amplification and analysis of a section of an element known as Mys. These elements are short segments of DNA that occur hundreds of times in the chromosomes of some vertebrates. Because of the repeated nature of these

segments, they tend to harbor numerous mutations, which often are unique to individuals or families.

Once multiple copies of segments are produced, several procedures can be used to examine the resulting fragment pattern. These patterns are termed PCR fingerprints and are comparable to the more widely known DNA fingerprints that have been used successfully with humans.

Researchers are currently testing this procedure in Alabama with two introduced populations of quail and white-tailed deer.

Catfish Advertising

A catfish industry advertising campaign, financed by a voluntary $6.00 per ton checkoff on feed, demonstrated the economic effectiveness of the campaign by estimating an eight-equation econometric model that links consumer awareness of the advertising messages to consumer perceptions of catfish attributes, attitude, and purchase frequencies.

In its first year, the ad compaign increased consumer awareness of farm-raised catfish 15 percent, improved consumers perceptions of product attributes (flavor, fishy odor, and nutrition) and overall attitudes for catfish 2-4 percent, and increased purchase frequencies for at-home and restaurant consumption 11-12 percent. The increased consumer demand for catfish was estimated to have generated up to $11.04 million in additional farm income in 1988, a net return of up to $7.46 per media dollar invested.

Insects Linked to Peanut Mold

Aflatoxins are carcinogenic compounds that are metabolic products of the molds *Aspergillus flavus* and *Aspergillus parasiticus*. The presence of these potentially deadly carcinogens in food products has become a worldwide concern, and many governments have reduced allowable tolerances for aflatoxins to as low as five parts per billion. Peanut producers in Alabama are extremely concerned about this, since aflatoxin contamination is a sporadic, but widespread problem for State growers.

Hot and dry conditions are conducive to the development of *A. flavus* as well as lesser cornstalk borers, a frequent insect pest of peanuts. The larval stage of this insect feeds on peanut pegs and pods, and it has been implicated as contributing to the establishment of aflatoxigenic fungi in peanuts.

Laboratory and field tests by Auburn researchers showed that propagules that produced aflatoxigenic fungi were found in the frass (droppings) from about 29 percent of field-collected lesser cornstalk borer larvae and inside 9 percent of field larvae. Contamination of pods was positively correlated with damage from lesser cornstalk borer feeding. Contamination with aflatoxigenic fungi declined in plots treated with an insecticide aimed at controlling the lesser cornstalk borer.

Treatment for Bacterial Diseases

The symptoms of bacterial infection are largely produced by substances called endotoxin, which are released from bacteria. Auburn researchers are using sheep as a model for cattle to investigate the effects of endotoxin on the release of hormones regulating growth, reproduction, lactation, and stress. The data indicate that hormones regulating growth in sheep are released by endotoxin treatment, similar to the response in humans, and reproductive regulatory hormones were found to be inhibited.

Future efforts will focus on the mechanism for the endotoxin-induced release of hormones regulating growth. Generally, evidence

The link between lesser cornstalk borers and aflatoxins in peanuts may lead to new production methods.

suggests that products from immune system cells are released by endotoxin which, in-turn release or inhibit the secretion of specific hormones. Since USDA researchers have shown that some of these hormones may protect against the effects of endotoxins (such as fever), one result of studies at Auburn may be the development of a means to use some of these hormones as an aid in the treatment of bacterial diseases.

Alabamians Value Hunting

An estimate of the economic value of wildlife is needed in Alabama because previous economic evaluations dealing with hunting have considered only the impact of gross expenditures. By calculating the total value of hunting in the State, wildlife decision-makers are better equipped to make more informed decisions regarding wildlife management and hunting policy and land use planning.

Experiment Station research showed that resident hunters value their hunting opportunity in Alabama more than non-residents. This information could prove useful in future hunting license pricing because it would enable Alabama wildlife administrators to optimize social welfare derived by State residents through "their" wildlife resources and profits associated with hunting. The average value that hunters placed on having a license in hand was $716, more than double that of nonresidents. Also, the average price resident hunters were willing to pay to buy a yearly hunting license, $155.09, exceeded that of nonresidents by $107.

The difference in willingness to buy and sell stems from the fact that hunters feel assured a license may be purchased. But, if one could not be readily obtained, its value would be quite high. Obviously, the current license price of $15 annually is considered by hunters to be quite a bargain. These values do not mean that a hunting license is underpriced, but that Alabama has high quality and valuable wildlife resources.

Economic Effects of BST

Bovine somatotropin (BST), a new technology capable of enhancing a cow's ability to produce milk by 7 -23 percent, is expected to be available for commercial use soon. Auburn researchers determined the potential impact of BST on the size distribution of dairy farms. A three-equation econometric model was estimated to test hypotheses about the role of information and human capital in the adoption decision.

Results indicate a positive link between farm size and farmers' knowledge of BST and intentions to adopt early in the diffusion process. These results suggest that BST will likely accelerate the trend toward fewer and larger dairies in the Southeast. Other results suggest that adoption will be rapid. For example, 40 percent of the respondents indicated they would try BST immediately upon availability, although most (82 percent) would apply the hormone initially to only a portion of the herd. Only 8 percent indicated they would never use the product.

Hazardous Waste Perceptions

Strong differences in perceptions of risks were found to exist between community leaders and the general public in Sumter County, Alabama, site of the nation's largest hazardous waste landfill. According to an Auburn study, community leaders generally viewed hazardous waste as a relatively minor local issue and a minimal threat to their community. The general public was far less convinced by the company's assurances and viewed the facility with alarm. Local leaders typically downplayed short- and long-term risks associated with hosting the landfill, placing greater emphasis on the positive economic impact of jobs and tax revenues. Local residents identified hazardous wastes as a more significant problem which posed an immediate threat to their communities.

The question of differential perception of risk has important policy implications. There is mounting evidence that poor, rural, and minority communities are being targeted as disposal sites

for solid and hazardous wastes. In such communities, fiscal pressures facing local government officials and limited opportunities for economic growth available to rural and small town business leaders provide a powerful incentive to attract industry and jobs, even if these entail possible environmental risks.

The case of Sumter County raises the fundamental question of balance between understandable desires to promote economic growth and equally powerful concerns regarding protection of environmental quality. Failure to adequately identify and address these concerns creates an atmosphere of distrust within which hard choices become all the more difficult.

Litter an Environmental Threat

A significant portion of Alabama's billion dollar a year poultry industry is geographically concentrated in the Sand Mountain region of northern Alabama. Broiler production in the region generates enormous amounts of waste, primarily as litter. If managed properly litter can provide a source of fertilizer for crops and pas-

An AAES survey shows Alabama dairy farmers are knowledgeable about BST and many are willing to use it on their dairy cattle.

tures. However, in the Sand Mountain region it has been applied to relatively small areas of agricultural soils which are shallow to bedrock, sloping, and permeable to water and dissolved constituents. The combination of disposal practices and soil characteristics may be creating a potential for deleterious effects in soils due to leaching and/or accumulation of litter released nutrients and heavy metals. Thus, a study was conducted in the Sand Mountain region to determine the potential impacts of long-term land application of broiler litter on environmentally related soil properties.

Results point to significant leaching of nitrates to or near bedrock under littered soils. Phosphorus accumulated in littered soils to a depth of 22 inches. Accumulations in the soil of copper, potassium, magnesium, and calcium also were observed with long-term litter application.

Research Aids Rare Plant

Clematis socialis, commonly known as the Alabama leather flower, is facing extinction, and is known to grow at only three sites in the State. However, in 1991 AAES researchers found some of the reasons its reproduction is limited and may be able to devise a management strategy to boost reproduction of these plants in the State and keep populations vigorous and healthy.

Field research at the AAES indicates seed output of the rare plant can be boosted by spraying it with insecticides. Researchers also found that natural levels of pollination do not produce maximum seed set, and additionally, that mice destroy many of the seeds.

Deep-Placed Potassium Doesn't Pay

Interest in the potassium nutrition of cotton has recently increased in the Southeast due to increasing reports of late season potassium deficiency symptoms. One proposed methods of correcting this deficiency in cotton is by deep placement of a narrow band of potassium fertilizer under the cotton row.

Studies were conducted for three years at the E.V. Smith Research Center and Tennessee Valley Substation, and for two years at the Prattville Experiment Field to evaluate cotton response to the deep placement of potassium. Deep placement treatments were achieved using a dry fertilizer applicator that applies fertilizer at depths of 6 to 16 inches behind a subsoil shank.

At the E.V. Smith Research Center and the Tennessee Valley Substation no consistent yield responses were observed for the deep placement treatments. A yield response to deep placement of potassium was obtained at the Prattville Experiment Field, but a greater yield response was obtained by applying the same rates of K as a surface broadcast application. Results from this series of field tests suggest that, for cotton, deep placement of potassium was not superior to surface broadcast applications of potassium fertilizer.

Forest Planting Trends

A survey of timber-owning companies in Alabama showed that half of them replant every acre harvested. Those who did not replant 100 percent cited economic reasons. The replanting effort devoted to reestablishing plantations rose from 21 percent of all acres in 1985 to 38 percent in 1990, and that number is expected to rise to 53 percent by 1995.

The frequency of use of site preparation methods changed slightly from 1985 to 1990. In 1985, chop and burn was the most commonly used method, but by 1990 it dropped to number 3. Chemical site preparation was number 3 in

Research is bringing the Alabama leather flower back from near extinction.

1985, but rose to number 1 in 1990. The most intensive and expensive method -shear, rake, pile, and burn - was number 2 in 1985 and 1990, indicating a continued use of highly mechanized site preparation methods.

Pine Mortality Explained

Planting of pine trees on land in the Federal Conservation Reserve Program has been a popular land-use practice in the past years. However, unexpectedly high mortality of seedlings on some sites has been a problem.

Research showed that mortality of seedlings on these abandoned agricultural fields was associated with: (1) root feeding insects such as white grubs and white fringe beetles, (2) root pathogenic fungi such as *Fusarium* and *Macrophomina* with possible interactions with several species of nematodes, and (3) presence of a plow pan may exacerbate these biotic stresses during dry years. Herbicides used in past agricultural production of soybeans, and those used to control herbaceous competitors during pine establishment were not responsible for mortality observed.

Ally® for Winter Forage

Overseeding winter forages into bermudagrass sods is a common practice in the Southeast to improve forage quality, to extend the grazing period, and to add nitrogen to the soil in the case of legumes. However, research has shown that Ally®, a recently registered herbicide for control of Pensacola bahiagrass, has potential to persist in soil long enough to cause re-cropping problems to sensitive plant species.

Ally is registered for use on bermudagrass at 0.011 pound of active ingredient per acre, but rates used in these studies were one and one-half and three times this rate. Few problems were encountered when overseeding these winter forage species after the application of Ally at 0.032 pound active ingredient per acre as late as July 15, and for two consecutive years.

Poultry Disease Detection

Tibia dyschondroplasia (TD), a debilitating disease of chickens, cost Alabama's poultry industry millions of dollars annually in loss of birds and loss of productivity. Researchers at Auburn have used a Lixi Scope, an atomic powered portable x-ray device, to detect TD, and subsequently segregated chicks into high incidence and low incidence breeding groups.

In 1991, 35 percent of third generation chicks in the high incidence group developed TD, while only 5 percent in the low incidence group had the disease. These findings demonstrate that TD can be dramatically reduced by selective breeding of birds with a genetically low inclination for the disease.

Alabama Forest Survey

A survey of over 700 forest owners in the State revealed that income from timber sales, keeping land in the family, and appreciation of beauty are the three primary benefits gained from owning timberland. More than one half of the owners questioned have harvested timber, planted trees, or undertaken some other forest management activity in the recent past.

While a majority of those surveyed characterized themselves as politically conservative, they indicated support for regulating or controlling forest management practices where necessary to protect environmental values such as endangered species habitat and wetlands.

Responses to a forestry knowledge quiz in the survey indicate that owners lack basic knowledge about forests and forest management techniques. About one half of the respondents gave incorrect replies to each of the 10 true/false questions.

Herbicides and Plant Interference

Herbaceous weed control has become an accepted practice by forest managers throughout the South. In the search for inexpensive and effective herbicides, considerable interest has been directed toward imazapyr, the latest herbicide registered for silvicultural purposes.

Imazapyr (Arsenal) was tested at four rates (0.1, .2, .4, .8 pounds of active ingredient per acre), on three application dates (late fall, winter, and early spring), and at eight locations (three planted to slash pine and five to loblolly pine).

Though it suppressed height growth of slash pine, especially with the early spring applications, little damage was detected for the late fall and early winter applications indicating that imazapyr can be used safely on slash pine in preplant and site preparation situations.

Loblolly pine was more tolerant than slash pine to imazapyr demonstrating no significant damage even at the highest rates.

Weed control improved with increasing rates of imazapyr and spring applications provided better weed control than fall or winter applications. It provided exceptional control on established *Panicum* spp. and also demonstrated that poor height growth occurred when herbicides were applied concurrent with a late-season planting of pine.

Forest Weed Control Pays

The value of effective weed control in planted Coastal Plain slash pine plantations was demonstrated, where two years of broadcast weed control following planting increased 7-year-old pine volume by 705 cubic feet per acre (130 percent) and basal area by 38 square feet per acre (86 percent). Mean tree dominant height was 38 feet with weed control compared to 21 feet for the untreated check.

Much of the competing vegetation on the weed control treatment had recovered by age 7 with bare ground averaging 47 percent for two years of broadcast weed control, compared to 25 percent for the check. The large response at this location is indicative of the loss of potential growth due to competition on bedded and fertilized Coastal Plain sites.

Hardwood Regeneration

Hardwood forests in Alabama are under increasing demand for wood products and are highly valued for other uses as well. Managing these forests for specific uses such as wood production or game habitat is generally more complex than managing pine stands, primarily because a wider diversity of species (with varied ecological characteristics and values) is involved.

Basic information regarding the establishment and development of hardwood seedlings, especially high quality oaks, under varied conditions was obtained in 1991. Group selection harvests, creating openings ranging from 3/4 acre to 3 acres, have been highly successful in providing for the establishment of large numbers of cherrybark, water, and willow oak seedlings. Researchers discovered that timing of the harvest is an important factor in improving oak establishment success in areas where it has been a problem. The cuttings must be timed to provide release to the current year's new seedlings before they die in the dense understory shade.

Stream Organisms Not Hurt by Velpar®

Reestablishment of harvested pine stands requires some form of site preparation. Current reforestation practices favor the intensive use of mechanical equipment that results in a loss of ground cover, can reduce site productivity, and cause soil erosion for years. Herbicides provide an alternative site preparation technique that does not contribute to erosion; however, there is some concern that these chemicals may produce adverse impacts on nontarget organisms, especially in adjacent streams.

Stream ecologists at Auburn, working with the Southern Forest Experiment Station, evaluated the effect of one chemical, hexazinone, the active ingredient in Velpar®, on the aquatic life in small streams on the treatment sites. This herbicide is currently registered for noncropland and right-of-way use and is being used for site preparation by the forest industry.

Two small watersheds (178 and 237 acres) in the upper Piedmont of Alabama were treated with Velpar, one treatment as a pelleted form and one in a liquid form. An adjacent watershed (301 acres) served as the control. Each watershed was drained by a small first-order stream. All three watersheds were clear-cut during 1988 and 1989, and in 1990 Velpar was aerially applied at a rate three times higher than any previous studies.

Aquatic invertebrates were apparently insensitive to Velpar because no direct toxicity effects were detected. Among invertebrate communities few differences were measured among the three streams in total number of different species, number of intolerant forms, or species

Weed control proved vital in slash pine tree plantations in Alabama's coastal plain region.

diversity. No indirect effects were measured either, because shifts in community structure were not evident. Fish communities exhibited low diversity in all streams (e.g., only eight different species). No differences in fish density or diversity were detected among the streams following application of Velpar.

Catfish Disease Vaccine

Currently, vaccinating channel catfish is not a routine procedure, however, current research at Auburn is making it more practical. Specifically, researchers have developed a method to vaccinate commercially grown catfish against enteric septicemia, which is a deadly bacterial disease of catfish.

Fry and fingerlings can be vaccinated by immersing the fish in a solution of bacteria killed with formalin. Also the bacterial cell can be broken and divided into several different components. One of these components is a protein, called an immunodominant "protein" that is responsible for producing immunity to *Edwardsiella ictaluri* in the fish.

Catfish can be immunized by immersing the fish for two minutes in either the whole cell preparation or the "protein" fraction. Fish that are vaccinated with the "protein" develop immunity in about 4 weeks; however, a second booster vaccination is important to obtain a highly protective immunity. By vaccination with the immunodominant "protein" mortality of infected fish was reduced by over 50 percent.

Salinity Affects Shrimp, Fish

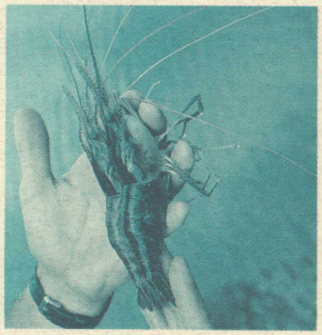
Shallow coastal waters, especially estuaries provide key nursery habitat for many species of marine fish and shellfish that are of economic importance. Larvae or juveniles enter shallow nursery habitats during their growing season and then move into marine habitat as adults. A recent study indicates salinity is the major physical factor affecting distribution and abundance, followed by water transparency.

As part of the two-year study, researchers collected all the fish and shellfish from within 259 small areas that were blocked off with nets in Weeks Bay in the Mobile Bay Estuary. Biological information (zooplankton and bottom fauna) and physical information (water depth, clarity, bottom type, temperature, and salinity) were also recorded at each site. The researchers collected over 46,000 fish (57 species) and 4,800 shrimp (seven species). As expected, most were juveniles.

Ultrasound Carcass Evaluation

The carcass characteristics of 27 market barrows and 27 market gilts were evaluated at various times with real-time ultrasound (Aloka 210 DX) from approximately 44 pounds until slaughtered at three endpoints. The hogs were randomly assigned to a slaughter weight group of 200, 220, and 240 pounds at weaning time.

The accuracy of ultrasound longissimus muscle area prediction was lower for 240 pound hogs than the two lighter groups, whereas the accuracy for prediction of last-rib fat was lower for 200-pound hogs than the two heavier groups, as indicated by higher absolute differences. Last-rib fat and longissimus muscle area tended to be over-estimated and tenth-rib fat tended to be under-estimated by real-time ultrasound. Prediction of last-rib fat by ultrasound was more accurate for gilts than barrows as indicated by a larger absolute difference. Muscle score and ultrasound last-rib fat were highly related to the USDA Grade as shown by a high correlation between USDA Grade and Ultrasound USDA Grade.



Salt content of Mobile Bay estuary waters is the prime physical factor affecting shrimp populations.

Color Added to Aquarium Fish

The commercial value of many ornamental fish is dependent on good coloration. The source of color pigments is a group of compounds called carotenoids.

In Auburn tests, three commercial sources of carotenoids were added at various concentrations to a nutritionally complete diet made from commercial ingredients and fed to cherry barbs (*Barbus titteya*) and tiger barbs (*B. tetrazona*) in a recirculating system for four weeks.

A red extract from pepper fruits, consisting primarily of capsanthin, at 200 p.p.m. in the feed provided the most intense pigmentation in cherry barbs, better than that provided by a yellow extract from marigold flowers, which contained mainly lutein, or canthaxanthin, a red synthetic pigment used to enhance color in salmon flesh. A combination of capsanthin (200 p.p.m.) and lutein (200 p.p.m.) was best for the tiger barbs, followed by capsanthin alone, then lutein. The best coloration provided by these supplemental pigment sources was equal to or superior to coloration developed by fish grown in ponds.

Newspaper Mats for Plants

Research indicates that 10 sheets of newspapers can be used as a capillary irrigation mat to successfully water and grow plants. Newspaper used as capillary irrigation mats breakdown rapidly when composted. The use of newspaper capillary irrigation mats and subsequent composting conserves water and nutrients and reduces runoff in the environment during production and reduces the disposal problem of newspapers in our environment.

In Auburn research, comparable plant height and area, flowers per plant, and plant quality were obtained with potted chrysanthemums irrigated with an overhead hose, commercial fiber irrigation mat, and the newspaper mat.

Omega-3 From Fungi

Omega-3 long chain polyunsaturated fatty acids have become a focus of considerable research because of the health benefits derived from them, reduction in risk from cardiovascular disease, cancer, and immune disorder.

Currently, the only commercial source of these fatty acids is the oil of certain marine fish, which is viewed as a limited source. This has prompted a search for alternate sources of these nutritionally important fatty acids.

Researchers at Auburn have discovered a fungus that has the potential for producing substantial quantities of one such fatty acid, eicosapentaenoic acid (EPA). AU scientists also developed a method for greatly enhancing EPA production.

New AU Watermelons

Disease is a major factor limiting production of watermelons in Alabama. Gummy stem blight, anthracnose, and Fusarium wilt are three of the most serious diseases, causing reduced yields of melons in certain fields in Alabama. Although satisfactory control of gummy stem blight and anthracnose may be accomplished with the proper application of organic fungicides during normal weather conditions, no control measure is effective during periods of high humidity and high rainfall.

The discovery that certain plant introductions were resistant to gummy stem blight and race 2 anthracnose led to development of multiple disease resistant breeding lines that produce high yields of excellent quality fruit. This research resulted in the 1991 release of AU-Golden Producer and AU-Sweet Scarlet varieties that are resistant to gummy stem blight, Fusarium wilt, and anthracnose (*Colletotrichum laginarium* race 2).

Both melons are superior to current varieties of their type in yield, quality, and disease resistance. And, taste tests indicated the edible quality (color, texture, and taste) was higher in AU-Golden Producer and AU-Sweet Scarlet than in other varieties of their types.

Scab Resistant Pecans

Scab, a fungus disease, is the most destructive and widespread disease of pecans. Cultivars vary greatly in susceptibility, and genetic resistance is a primary goal in breeding and selection of potential new cultivars for humid locations.

Scab occurrence was rated on 63 pecan clones at five locations in Alabama in a year of high disease incidence. Locally selected clones of seedling origin, Deakle's Special, Dixie, and Gafford, were entirely free of scab symptoms on both nuts and leaves from unsprayed trees. Advanced USDA selections 70-3-34 and 70-2-9 had low scab incidence.

These findings suggest the possibility of development and release of new pecan cultivars with a much greater tolerance to this destructive disease. As a result of development of scab resistant cultivars, chemical spraying of pecans may be reduced dramatically, with savings to the farmer and less risk to the environment.

Mulch Color Important

Summer yellow crookneck squash research at the E.V. Smith Research Center indicates that aluminum colored plastic mulch may be an ideal color to use as a cultural practice method to maximize total summer squash yield. In addition to discouraging light-sensitive, disease-causing insect pests, controlling weeds, conserving fertilizer and moisture, and elevating plant temperature, the aluminum plastic boosted squash yields by two to three fold over those produced on other color mulches.

Research results also have shown that different colors of mulches have a definite effect on yield, growth, and development of a specific plant species or family of species. These research findings allow the user of the materials the option of tailoring a specific color of mulch to the appropriate species to attain maximum yields.

Alabama's Apparel Industry

Alabama is one of only two major apparel-producing states in the U.S. that did not lose a sizable portion of its apparel employment in the last decade. The economic health of the textile/apparel industry is critical to the rural revitalization of the State since the industry, with over 100,000 workers, is located in every county in Alabama.

When over one-fourth of all retailers in the U.S. are in financial difficulty, there is a compelling need for Alabama apparel producers to develop partnerships with strong, financially healthy companies (retailers, suppliers, and other apparel producers); identify new market niches and distribution channels; and position themselves to deliver an increasingly varied mix of quality products in an ever-shorter time frame.

Education and training are keys to being able to accomplish all three of the above listed needs. While many of Alabama's apparel producers are too small to have well developed education and training programs, the researchers have utilized the concepts of networking to develop and promote training options for a more qualified work force. Innovative education and training approaches are being developed to team apparel firms, local community or technical colleges, AAES researchers, and economic development officials from the State.

Research may lead to scab-resistant pecan varieties.

Biological Fungicides

The development of biological based foliar fungicides continued during 1991. Formulations were developed that allow control on several unrelated hosts and at levels approaching that of the best commercially available fungicide on tomatoes and potatoes. Research has identified a protocol that allows for selection of biocontrol bacteria that prosper on a wide range of host plants. Bacteria identified through this protocol when combined with amendments, provided control of early blight of potato and tomato near equal to that of Bravo® in field trials. Excellent control of Septoria leafspot, bacterial speck, and bacterial spot of tomatoes also was confirmed.

Biological control projects included the selection and use of plant growth-promoting rhizobacteria (PGPR) for control of cotton seedling and peanut root rot diseases, both fundamental and applied in nature. Researchers have selected one strain which provided seedling disease control superior to the best synthetic chemical pesticide at five Alabama test sites.

Researchers also identified a number of

Biological fungicides provided disease protection for tomatoes and potatoes comparable to the best available commercial fungicides.

PGPR that induce cucumbers, normally susceptible to anthracnose, to be systemically resistant. These bacteria survive in the rhizosphere and, by an as yet unidentified signal, induce systemic resistance.

Unlike other induced resistance research, there is no necrosis of host tissue involved in the induction, even though the same pathogenesis related proteins are involved in the resistant reaction. Induction of these proteins has provided resistance against a broad spectrum of plant pathogens, including viruses, bacteria, and fungi. This research suggests that farmers could use bacterial seed inoculants to induce these crops to be resistant to diseases.

Factors Affecting Move Decisions

Over 40 million Americans change residences each year. This large number reflects the fact that the average American moves 14 times over the course of his or her lifetime. The decision to move is affected by a wide range of factors, though most are job-related, research at Auburn identifies some noneconomic variables that are related to the migration decision-making process for men and women.

Results indicated that for women, willingness to move to another community was predicted by, the willingness to take a better job that required moving, having held a number of different jobs in the past ten years, dissatisfaction with their current community, less residence stability (less likely to be home owners and fewer years lived in a current home and state) and currently living in a larger rather than smaller community. In contrast to the number of variables that predicted willingness to move, only the likelihood of actually looking for a new job within the next two years predicted the intention to move for women.

The findings indicated that men who were willing to consider moving to another community for a better job, had held a number of different jobs in the past ten years, and did not live in a close proximity to most of their relatives were more willing to consider moving to another community. Only community dissatisfaction predicted the intention to move within the next two years for men.

Different Fat for Baby Formula

The physiology of newborn pigs is similar to that of human infants in many respects. Experiment Station researchers have taken advantage of this in studies designed to determine the type of fat that is best to use in infant formula.

Fish oils and some seed oils, such as canola oil, contain omega-3 fatty acids, and small amounts of this type of fat is present in breast milk. Omega-3 fatty acids are believed to play an essential role in the developing eyesight of infants, and thus, nutritionists have proposed that a source of these fatty acids be added to infant formula.

Omega-3 fatty acids also have the potential to serve as therapeutic agents in combating respiratory disease in the newborn. In respiratory disease, excessive amounts of compounds called eicasanoids are produced by the lungs. In a recent Auburn study, the relationship between dietary omega-3 fatty acids and lung eicosanoid production was studied in newborn pigs. When formula containing fish oil or canola oil was fed to pigs during the neonatal period, production of eicosanoids in the lungs was reduced in comparison to pigs fed formula containing corn oil or coconut oil. One eicosanoid, thromboxane A_2m, causes narrowing of the airways in the lungs; thus, inhibition of this eicosanoid by omega-3 fatty acids in fish oil or canola oil could be beneficial to the infant.

Iron Supplement for Pigs

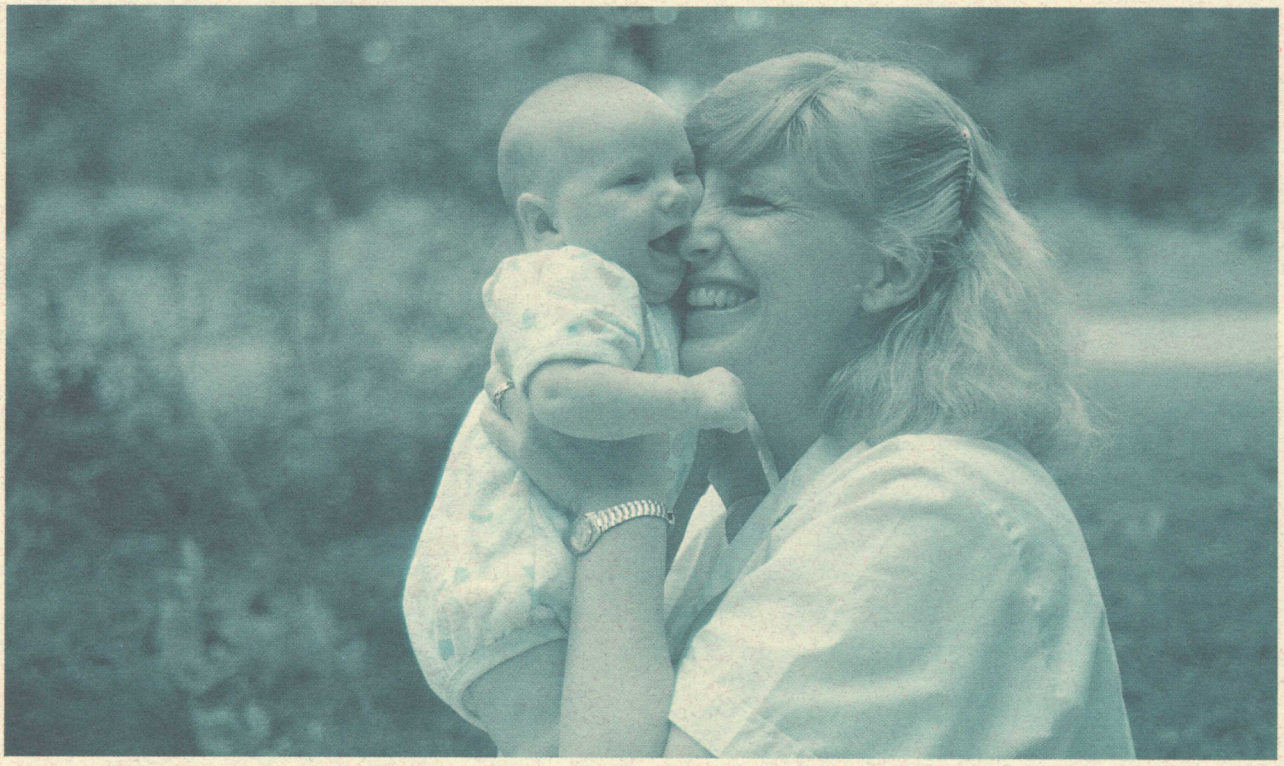
In swine research at Auburn, 12 litters of pigs were treated with either 100 milligrams iron dextran or 50 milligrams iron dextran at three days of age. Half of the pigs given 50 milligrams also were given oral iron free choice.

Pigs receiving 50 milligrams of iron dextran had lower packed cell volume than pigs receiving 100 milligrams, while oral iron had no effect on packed cell volume. There was no treatment effect on pre- or post-weaning weight gains, however, there was a trend for more variation in weight gain for pigs given oral iron.

The results demonstrate the necessity of 100 milligrams of iron dextran for prevention of anemia in young pigs. However, the effects of anemia on performance are reduced with adequate environmental conditions.

Poultry Infection Test

Mycoplasma gallisepticum and *M. synoviae* induced respiratory infections and subsequent production losses continue to plague the poultry industry. Accurate diagno-



Baby formulas containing fatty acids from fish oil or canola may be beneficial to infants.

sis of mycoplasmal infections is difficult due to spurious serologic reactions and the emergence of antigenically variant strains.

Auburn researchers have developed a monoclonal antibody-based test system to overcome confusing serological responses caused by the presence of cross reacting antigens. This immensely improved specificity of the test results. Two agglutinating monoclonal antibodies, each specific for *M. gallisepticum* and *M. synoviae*, were conjugated to protein A containing *Staphylococcus aureus* (Cowan Strain 1) and used in a rapid coagglutination assay.

Coagglutination procedures have been used successfully in the identification and classification of a number of bacterial pathogens. In contrast to Sepharose and latex particles used previously to immobilize and amplify the agglutination reaction, staphylococcal protein A is advantageous because it permits the proper orientation of the antibody molecules. Staphylococcal protein A possesses four highly homologous regions comprised of approximately 60 amino acids that bind selectively to the Fc region of the immunoglobulin molecule.

The reaction enables orientation of the antigen-binding (Fab) parts outwards. The availability of monoclonal antibodies that have an affinity to protein A, concomitant with the specificity for conserved antigens of *M. gallisepticum* and/or *M. synoviae*, makes these reagents ideally suited for the rapid and specific diagnosis of *M. gallisepticum* and *M. synoviae* infections in poultry.

Johnsongrass Withstands Heavy Grazing

Johnsongrass has been recognized as a good emergency feedstuff for several years. In addition, it has been used as a good hay source. However, little is known with respect to continuous grazing of johnsongrass. Therefore, research was initiated to determine what stocking rate is optimal for continuously grazing johnsongrass and to evaluate what effect stocking rate has on forage utilization. An 18-acre pasture was seeded with johnsongrass (25 pounds per acre) on May 16, 1990. The field was irrigated from a waste lagoon just prior to planting and again on June 14, 1990.

On June 21, 1990, 30 medium-framed, crossbred steers were assigned to six different paddocks of varying sizes (five steers per paddock). This provided stocking rates of 1.5, 2.0, and 2.5 steers per acre. Average initial weight was 490 pounds. After 42 days, 60 additional cattle were added (10 per paddock) and left for 14 days, then removed. After 70 days, the trial was terminated as a result of dry weather resulting in inadequate amounts of forage.

Because the stand of johnsongrass had been established the previous summer, researchers were able to start at a much earlier time in 1991. In April, 60 pounds of N per acre was applied and on May 17, 48 medium-framed, crossbred steers were assigned to the six paddocks (eight steers per paddock) to provide stocking rates of 2.4, 3.2, and 4.0 steers per acre. Average initial weight was 491 pounds. The duration of the trial was 87 days.

The two-year study indicates johnsongrass will withstand continuous grazing of 2.5 steers per acre (initial weight - 500 pounds). If grazing begins in early to mid-May, one can expect 80 days of grazing or more. However, animal performance in August and September is quite low when forage quality is limiting.

Altering protein intake and using Compudose® improved steer efficiency in AAES tests.

Compudose® Improves Early Steer Gain

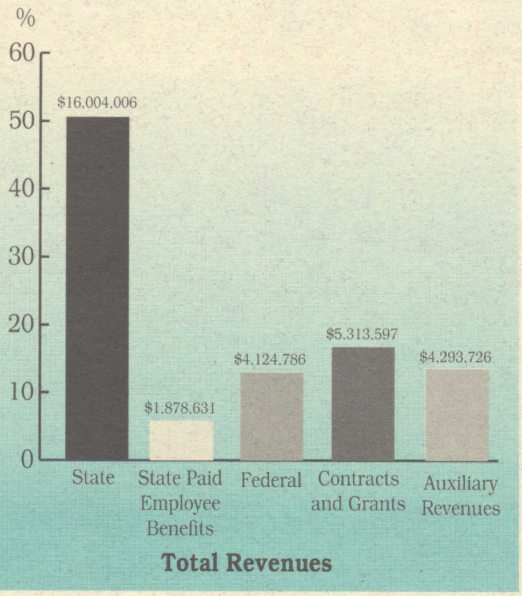
A study conducted using 48 crossbred beef steers showed that the rapid period of growth following feed restriction could be further improved by altering dietary protein intake and implantation with Compudose® .

Initially, steers were limit-fed a 35 percent concentrate diet to gain 2.2 pounds per day, during a 66-day restriction period. At the end of this period, one-half of the steers were implanted with Compudose and all were fed 80 percent concentrate diets containing 9, 12, or 15 percent crude protein (CP) for 56 or 98 days.

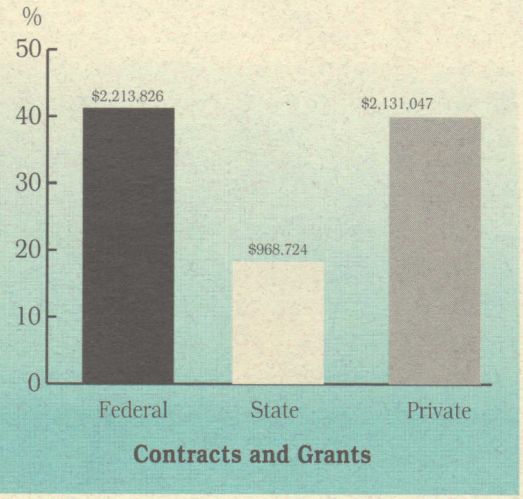
Results showed that dietary protein intake affected the average daily gain (ADG) of steers only during the first 14 days of compensatory growth, with steers fed 12 and 15 percent CP gaining faster than steers fed 9 percent CP. These early changes in ADG resulted in steers fed 9 percent CP weighing less than steers fed 12 or 15 percent CP on days 56 and 98. In contrast to dietary protein, Compudose increased ADG from days 21 to 56, plus compensatory growth, which resulted in the implanted steers weighing more on days 56 and 98 than nonimplanted steers.

Carcass data obtained from steers slaughtered on days 56 and 98 showed that additional time on feed increased hot carcass weight, ribeye area, backfat thickness, and yield grade. Quality grade was not affected by the additional days on feed, with all cattle grading Select. Feeding diets containing 12 or 15 percent CP improved carcass characteristics compared to 9 percent CP only during the first 56 days on feed. Compudose had no effect on carcass characteristics on day 56 and 98. Although carcass characteristics were improved with the additional time on feed, ribeye steaks from cattle on feed for 56 days were as acceptable as steaks from cattle on feed for 98 days, based on taste panel evaluations for flavor intensity, juiciness, and overall acceptability.

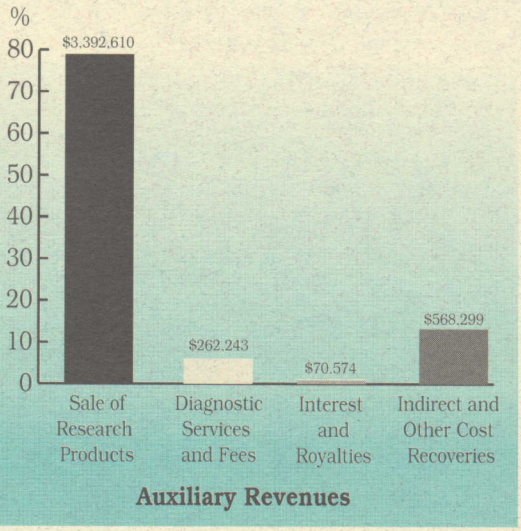
Alabama Agricultural Experiment Station
Report of Revenues
For the fiscal year ending September 30, 1991



Total Revenues



Contracts and Grants



Auxiliary Revenues

Director's Research Awards

Paul A. Backman

David A. Stringfellow

Dr. Paul Backman, professor of plant pathology, was the recipient of the 1991 Senior Director's Research Award and Dr. David Stringfellow, associate professor in the Department of Animal Health Research, was the recipient of the junior level Director's Research Award.

The Director's Research Awards are given annually to reward career research achievements by scientists at the professor level, often referred to as the Senior Award, and associate and assistant professor level, often called the Junior Award. Each award includes a $10,000 grant from the Agricultural Experiment Station, which can be used at the scientist's discretion to further his or her research efforts.

Paul A. Backman

In addition to being a former winner of the Junior Director's Research Award, Backman is internationally recognized as one of the world's foremost soybean and peanut pathologists. In recent years, his research has centered on biologically-based fungicides used to control a wide range of disease pathogens that attack many fruit, vegetable, and agronomic crops.

Backman gained national recognition for his pioneering work in identifying soybean stem canker. His work on epidemiology and control by either resistant varieties or chemicals has saved soybean producers throughout the South millions of dollars. The Auburn researcher was also instrumental in developing AUSIMM, the first of its kind interactive soybean integrated pest management computer consultant.

Despite his innovative work with soybeans, Backman is best known for his work with peanut diseases. In pioneering research with biological control, he demonstrated that seed treatment with the bacterium *Bacillus subtilis* could decrease damage from *Rhizoctonia solani*, increase Rhizobium nodulation, increase root mass, and improve soil, water, and nutrient utilization by peanuts. This work resulted in the development of the commercial biological product Quantum 4000, which is the first plant growth promoting seed inoculant registered for use.

David A. Stringfellow

Stringfellow, who conducts research in the Department of Animal Health Research in the School of Veterinary Medicine, came to Auburn in 1980 with the U.S. Department of Agriculture to work on a regional brucellosis program. While working on the project, he earned a masters degree in epidemiology and microbiology, which later became the primary focus of his research on the epidemiological aspects of bovine embryo transfer.

Since joining the Auburn faculty in 1984, Stringfellow has established one of only two laboratories in the world that are devoted primarily to the study of embryo-pathogen interactions. He is best recognized for studies on the potential for spread or control of the transmission of *Brucella abortus* through embryo transfer. This research has led to development of a number of primary cell lines from bovine embryos and one from an ovine embryo. These cell lines are the first, and only, ones of their kind from these mammalian species.

His diligent work has led to an international effort to establish the use of embryos as the safest method of transporting embryos worldwide. Stringfellow's pioneering work also has played a key role in the continued expansion of markets for bovine embryos in the United States.