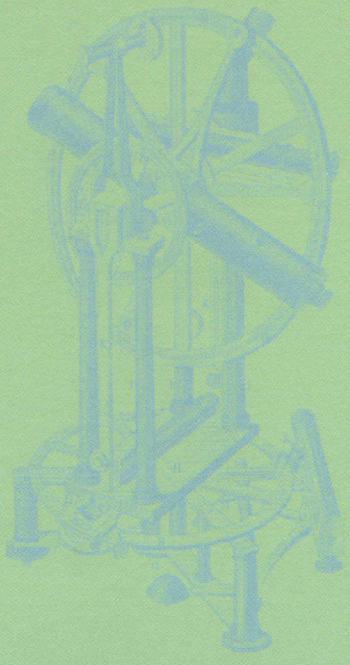

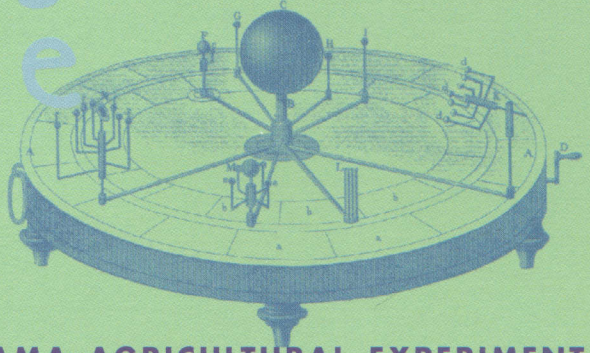

2000 ANNUAL REPORT OF THE ALABAMA AGRICULTURAL EXPERIMENT STATION

AUBURN UNIVERSITY

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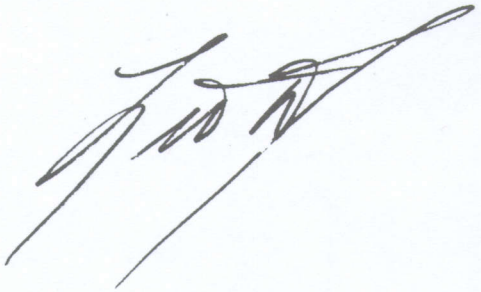
charting a course

Contents

Letter from Director Luther Waters

What we heard at area meetings held throughout Alabama during 2000 has convinced me that we must do a better job of telling people what the Alabama Agricultural Experiment Station (AAES) does and how its programs positively affect their lives. During 2001 we hope to chart a steady and progressive course that will enhance agriculture, forestry, and the lives of all Alabamians.

To that end we are taking this opportunity in the 2000 AAES annual report, millennium edition, to look at our past, examine where we are at present, and look ahead at our future course. We welcome you to these pages and invite you to join us in our progress.



Introd

One of Alabama's best-kept secrets is its Alabama Agricultural Experiment Station (AAES). With researchers in the biological, agricultural, veterinary, and human sciences, the AAES has been quietly doing its job of providing scientific support of Alabama's agricultural and forest industry for more than 100 years. Results of this work are apparent in the continuing success of agriculture and forestry in the state, both of which make major contributions to Alabama's total economy.

What is not well known is how AAES research directly serves the non-agricultural segment of Alabama's population. Development of superior food, fiber, and ornamental crops–along with more efficient methods of producing and processing–translate into better and more affordable consumer products. But this is only part of the story. Projects on such widely varying

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topics as clothing and textiles, biology and cell systems, wildlife and fisheries management, housing and equipment, social and political organization, environmental protection, and human nutrition are examples of non-farming research that contributes to the well being and happiness of all Alabamians.

AAES Scientists: Most AAES research at Auburn University is conducted by faculty members in five colleges and schools–Agriculture, Forestry and Wildlife Sciences, Human Sciences, Sciences and Mathematics, and Veterinary Medicine–most of whom hold joint teaching, research, and extension appointments. However, research by faculty of other University units may be funded to take advantage of special expertise needed to solve specific problems.

Although the AAES is headquartered on the Auburn campus, it blankets the state with research and extension centers representing every soil and climatic region of Alabama. Scientists from any school or college at Auburn or at other land-grant institutions in the state can use these outlying centers in AAES-sponsored research to address specific agricultural and forestry problems that may arise in different areas of Alabama.

A Look at our Past:
AAES History

The Alabama Agricultural Experiment Station (AAES) traces its beginning to February 23, 1883, when it was created by an act of the Alabama Legislature and located at Auburn (home of Alabama A&M College, which later became Auburn University). The legislation established the Station's mission of service–to conduct scientific research to enhance the establishment and maintenance of permanent and effective agricultural and forestry industries in the state–which still serves as the guide for AAES programs of work.

Work of the AAES began in a humble fashion, with a couple of researchers working on the few problems they were able to address with limited resources. From this beginning developed today's program of research that encompasses thousands of individual experiments that seek answers to problems that are important to the well being of all citizens of Alabama.

In the beginning: 1883-1900

In February 1883, at the insistence of Alabama farmers, who needed protection from unscrupulous commercial fertilizer dealers, the Alabama Legislature passed the Hawkins' Bill. This bill provided for the inspection and certification of fertilizers sold within the state. Alabama's land-grant college at Auburn was given the task of performing analyses of fertilizer samples, receiving in return one-third of the proceeds collected from a fee charged to the fertilizer sellers. The majority of the funds provided to the college was spent in performing the fertilizer analyses, but some money was left to buy land for the Agricultural Experiment Station at Auburn.

A small demonstration farm had been operated as a teaching laboratory for agricultural classes since the Agricultural and Mechanical College of Alabama was established in 1872 as the state's land-grant college. With money advanced by the state in 1883, the college's trustees purchased another 226 acres for farm research plots and employed a Virginia-educated scientist, James S. Newman, as the Experiment Station's first director and the College's second professor of agriculture.

Director Newman began investigations on Station farms plots devoted to cotton, oats, wheat, sweet potatoes, and a variety of fruits and vegetables–all with the help of a staff that included only a chemist and his two laboratory assistants. At the time, Newman also was directing experiments on the Canebrake Experiment Station, near Uniontown, after its creation in 1885 by a Legislature determined to aid the state's most important farming region, the Black Belt.

Beginning in 1887, when the U.S. Congress passed the Hatch Act to provide $15,000 annually to each state for an agricultural research station, the Auburn Station was able to expand its program of experiments for Alabama farmers. In the next year, Director

J. F. Duggar

Newman enlisted the aid of cooperating farmers to test different mixes of fertilizers and cotton cultivation practices on the variety of soils found across the state. In 1893, the cooperative arrangement was extended to corn growers and in 1901 to farmers with pasture lands.

The federal money also allowed the Station to add to its scientific staff P.H. Mell, who was employed in 1888 as the Station botanist. And, in 1889, an outstanding biologist was found in G.F. Atkinson.

In 1892 C.A. Cary joined the College and Station as a veterinarian and also served the Station as a dairy and meat inspector. Cary also administered the Experiment Station-sponsored farmer meetings that were forerunners of the Alabama Cooperative Extension System.

In 1896, J. F. Duggar established a plot to test and demonstrate the advantages of rotating cotton with nitrogen-restoring legume crops–a project known as the "old rotation," which has been carried on continuously on the same plots since 1896. A horticulturist and an entomologist also joined the Experiment Station staff in 1896.

> Change is the law of life, and those who look only to the past or the present are certain to miss the future.
>
> **JOHN FITZGERALD KENNEDY**

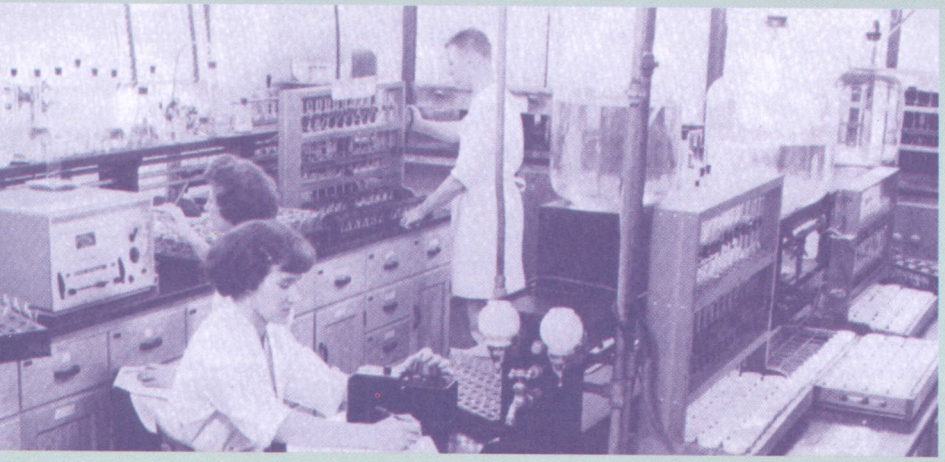
Early progress: 1900-1950

A host of new concerns was added to the AAES agenda in the first half of the 20th century. With increased funding and a larger, more specialized corps of scientists, the Experiment Station was able to address problems as they arose: the boll weevil invasion of the 1920s, the persistent economic depression of the 1920s and 1930s, and the special demands of war in the 1940s.

In 1906 annual federal appropriations to the Station tripled and agricultural investigations were enlarged. Further financial help came in 1907 when the state legislature replaced the cumbersome fertilizer tax with direct appropriations.

Under Marion Funchess, who served as director of the AAES from 1924 to 1951, a system of outlying units was created. Confronted by a long-standing agricultural depression, the Alabama Legislature moved to link research more directly to conditions of a particular location. In 1927, research substations were established to conduct experiments on five major Alabama soil regions and experiment fields were founded for 10 important but less extensive soil regions. Between 1943 and 1948, five additional substations followed, two of which were devoted specifically to horticultural crops, and in 1946 a plant breeding unit was established.

As Funchess had envisioned, cooperative research on outlying units has played an important role in the Experiment Station's research program and made major contributions to agriculture and forestry in Alabama. In addition to



affording the obvious advantages of attacking and solving problems unique to the area where the unit is located, outlying units that blanket the state serve as a window through which Alabamians can watch research firsthand.

Modern methods: 1950-2000

In the last half of the 20th century, Alabama agriculture has changed greatly. Farming has become more diversified and business oriented and farm numbers have decreased as individual farm size increased. The AAES has changed a great deal too, to provide the knowledge necessary for farmers and consumers to adapt to their rapidly changing world.

During the 1950s and 60s the Station staff become larger and more specialized as beef cattle, poultry, and wildlife conservation became topics of increased research interest. The Station's office and research facilities as well as the outlying units grew as well.

During the 1970s a 3,200-acre tract in Shorter, Alabama, was developed for agronomic and horticulture research and the bulk of beef and dairy cattle field work. This complex was named in honor of E.V. Smith, director of the Experiment Station for 21 years.

In more recent years, Alabama farmers like those in the rest of the nation have faced the grave problems of consistently low market prices, high interest rates, and escalating production input costs. Cost-efficiency has thus become extremely important in agriculture, and the Experiment Station has directed much of its research toward finding ways to lessen the severity of the persistent cost-price squeeze. Multi-cropping studies seek to make the most efficient use of land, labor, and equipment, while reduced tillage investigation holds promise for soil and energy conservation. As proper timing of fertilizer and pesticide applications has become more important for economic and environmental reasons, research into these areas has increased. Feed-efficient methods of producing livestock, poultry, and fish have also become of greater concern to Station scientists. Technological advances have introduced Global Positioning System applications and advanced genetic research results to farming as well.

In an effort to better meet the needs of those they serve, the AAES has joined with the research/experiment stations at Alabama A&M University and Tuskegee University to create the Alabama Agricultural Land Grant Alliance (AALGA). AALGA is a commitment by these institutions to pool their expertise and their resources to strengthen their research effort.

As the 21st century begins, the Alabama Agricultural Experiment Station is engaged in a search for the most efficient way to use its funds–much as it had been when it was formally established in 1883. The story of the Station's performance in the face of today's challenges belongs not to the past, but to the future.

Where we are now:
Economic Opportunities

> I could use a hundred people who don't know there is such a word as impossible.
> **Henry Ford**

The marketplace of taste

The ultimate success of a commodity product such as cotton largely depends on the ability of the apparel/textile industry to use this fiber in clothing and textile products that successfully compete in the "marketplace of taste." An AAES project in the College of Human Sciences is developing an online method to study consumers' visual preferences for clothing and home furnishings. In other words, why do these shoppers leave stores empty-handed?

This information helps the textile industry identify key consumer segments most interested in innovative home textile designs, determine the sources of consumer dissatisfaction with apparel and home textile products, and learn of shoppers' stylistic preferences and emerging tastes. The development of an online research tool provides producers and retailers with rapid-response feedback to changing consumer tastes so that cotton-based products can retain a competitive advantage in the domestic and international marketplaces.

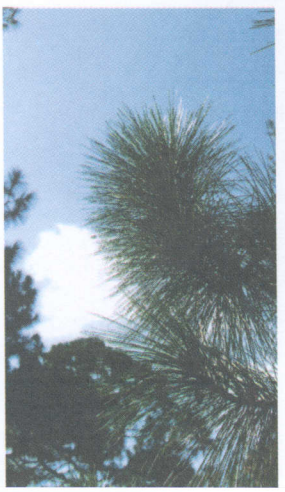
Long live the longleaf pine

When settlers first began building their homes and communities throughout the Southeast, longleaf pine forests covered some 90 million acres ranging from Virginia to Texas. Today only about three million acres of longleaf forest remain, but interest in the longleaf pine is growing.

AAES researchers in the School of Forestry and Wildlife Sciences are studying ways to sustain the longleaf pine ecosystem, promote sensible management of natural resources, and expand economic trade opportunities for agricultural producers and other rural partners. The longleaf pine forest is central to maintaining a diverse ecosystem. Its timber is more valuable than that obtained from other pine tree species. The longleaf pine is more disease and insect resistant. It is very tolerant of fire, and longleaf forests provide habitat for a multitude of insects, bird, animals, and other plant life that cannot be found in other types of forests.

Poinsettias – big business for the floriculture industry

Poinsettias are more than traditional floral decorations for the holiday season. They are big business in the floricultural industry nationwide and also in Alabama. Research underway at the Ornamental Horticulture Research Station in Mobile is helping ensure the stability of that market and expand it by identifying new cultivars that fit the needs of both growers and consumers.



According to the 1999 floricultural crop survey, poinsettias represented approximately one-third ($228 of the $765 million) of the United States and more than one-half ($5.4 of the $10.1 million) of Alabama's wholesale potted flowering plant markets. Through the years, improved cultivars have greatly

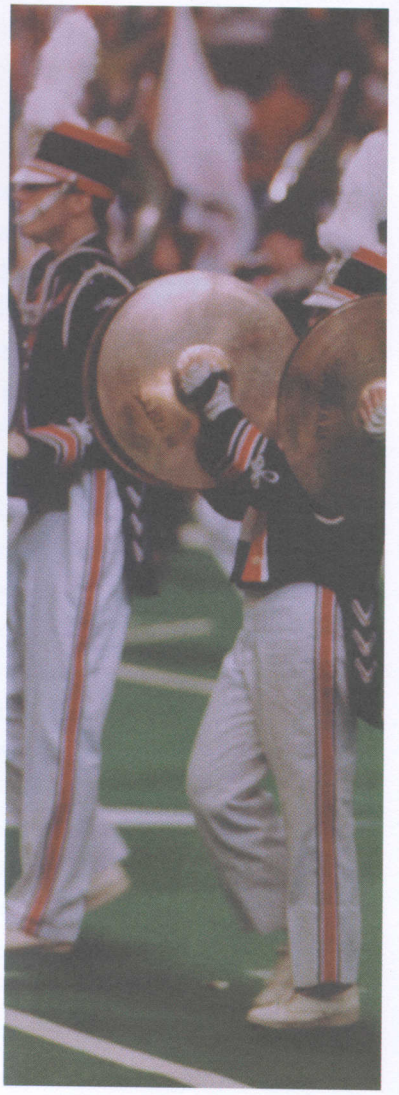
increased post-harvest longevity; added a variety of colors, patterns, and flower shapes; and improved handling and growing characteristics. These breeding improvements are a primary reason that poinsettias continue to increase in popularity as a symbol of the Christmas season in many parts of the world.

Results of this study indicate that the development of new cultivars is expanding the choices of both Alabama consumers and growers alike. Many of these cultivars appear to be well suited for production in Gulf Coast growing conditions, and unique poinsettias are attracting the attention of consumers looking for new options in their floral holiday decorating.

This Grass Is Greener

Golf course and athletic field managers as well as homeowners recognize the results of wear and compaction on turfgrass. Worn spots, torn turf, and bare patches are visible signs of the effects of foot and vehicle traffic on golf courses; soccer, football, and other athletic fields; and lawns. Foot and vehicle traffic also causes soil compaction, which decreases depth of rooting, hinders water and nutrient uptake by the grass, and increases turf stress. Applying fertilizer and aerifying the soil are two solutions to alleviating soil compaction and turf wear. But little is known about the effects of specific aerification practices.

In an effort to answer some of these questions, AAES researchers recently studied the effects of frequent aerification on Auburn University's Marching Band Practice Field, a hybrid bermudagrass (Tifway) field that receives a great deal of traffic throughout the year. They found that the more frequently aerified plots greened earlier in the year, had less annual bluegrass (an undesirable weed) on them, and were also softer.



Quality of Life

> The ultimate measure of a man is not where he stands in moments of comfort and convenience, but where he stands at times of challenge and controversy.
>
> **Martin Luther King, Jr.**

Children on track

People involved with children have long known that the quality of family and peer relationships is associated with children's behavior and confidence levels. Results from a long-term study on social development of children, conducted by AAES researchers in Human Development and Family Studies, indicate that relationships and experiences at particular points in time–switch points–play an important role in a child's social development. Switch points are those points in development when individuals seem to be on one track and some influence alters that path. These influences include pivotal relationships between the parent and child or teacher and child; between the child and an after-school care giver; in peer associations; and in mentor relationships.

A variety of economic and social factors are also being considered, such as the family's income level; their neighborhoods; and whether they live in urban, rural, or sub-rural settings. Another component of the research is to understand how young children's personality characteristics may shape the kinds of social experiences they have later in life. Underway since the subject group was age four, the study will be completed in 2002 when participants are 19.

Pasture progress

For Alabama cattle producers, the red imported fire ant is a widespread and often troublesome pest in pastures. Control of this insect is desirable, but conventional methods can be expensive and labor-intensive. Most even require that cows be removed from the pastures during and after treatment.

In research over the past year, AAES entomologists found that treatments applied to the entire pasture area were more effective than treatments applied only around the perimeter of the pasture. Future research will focus on perimeter treatment methods, which may be effective on a smaller scale and with different application patterns. These results will help scientists develop management plans that employ efficient application of environmentally safe insecticides to reduce treatment costs and labor for landowners.

Ticked off

Ticks are a natural part of the outdoors, feeding on a wide range of wild animals, livestock, household pets, and humans. In an effort to better understand the tick species involved, particularly in relation to people and the five tick-borne diseases documented in Alabama, AAES entomologists are conducting an on-going study of the occurrence of these blood-feeding parasites on Alabamians.

Five types of ticks were recovered from Alabamians during this study: the lone star tick and the American dog tick, which were the most common; and

the brown dog tick, the Gulf Coast tick, and the black-legged tick, which were found less frequently. Of these ticks, all except the brown dog tick serve as carriers of diseases in humans. For this reason, identification of ticks removed from human hosts, together with an appreciation of the role that each tick plays in the transmission of human pathogens, is central in assessing the potential health risks posed in individual cases of tick infestations.

Perennial friends

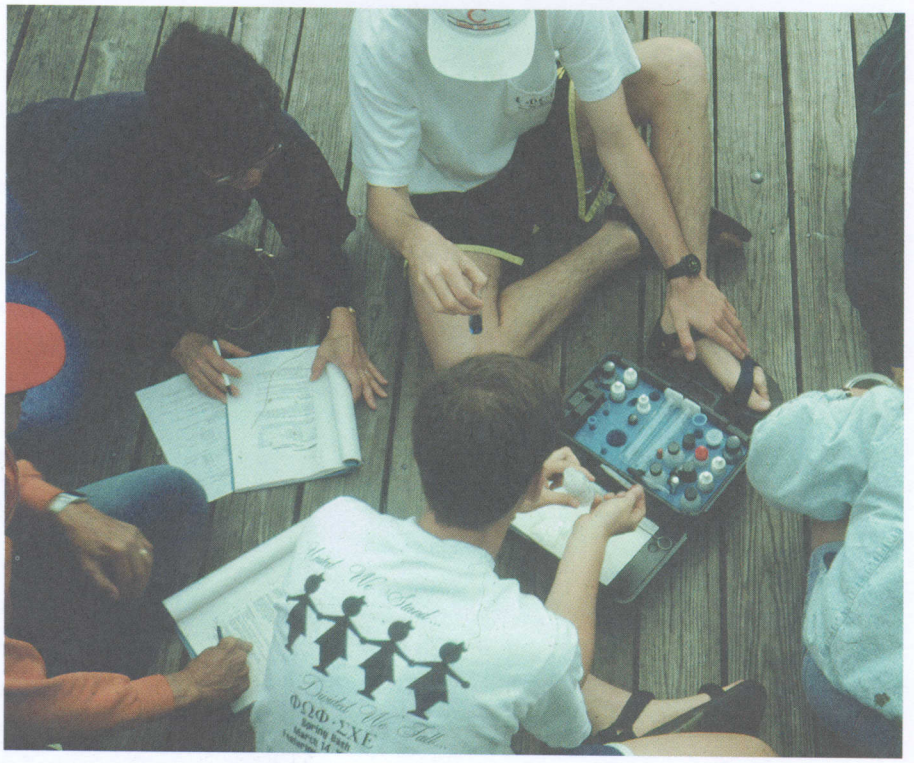
Perennials are like old friends; they return year after year to fill a garden with color and fragrance. This may be one reason that flowering perennials continue to gain popularity in Alabama and that ornamental, bedding, or landscape plant production and retailing are multimillion dollar businesses in Alabama.

To help consumers and plant retailers know more about the best perennials to select, AAES researchers evaluated the performance and appearance of more than 50 flowering perennials at the E.V. Smith Research Center in Shorter. The four perennials that received the highest overall rating during this trial were purple loosestrife (Mordens Pink), pink coreopsis and thread-leaf coreopsis (Moonbeam), and white sage or Mexican bush sage (*Salvia*). Selections included in these trials were based on the plants landscapers and homeowners commonly find available in local nurseries or retail garden centers.

Keeping an eye on our water supply

Alabama is blessed with a plentiful supply of water and with many people who are dedicated to protecting that resource in their local environment. AAES personnel have tapped into this grassroots interest to establish Alabama Water Watch, an organization that trains local volunteers to monitor the quality of Alabama's lakes, streams, and wetlands. This information is shared with governmental agencies and environmental, industrial, civic and commodity groups that help protect our water supply.

Alabama Water Watch has been recognized as a premier water quality monitoring program by the EPA, Alabama Department of Environmental Management, the Southeast Watershed Forum, the Alabama Environmental Council, the Alabama Planning Association, and others. It presently serves more than 75 active community groups statewide. The Alabama Water Watch program currently serves as a model for similar programs in many other states and countries, such as the Philippines, Ecuador, Brazil, and China.



Agriculture and the Environment

> Success is not measured by the position one has reached in life, rather by the obstacles overcome while trying to succeed.
>
> **Booker T. Washington**

Cleaner air in the Great Smokies

Few of the thousands of visitors to the Great Smokey Mountains National Park notice the damage being caused by ozone. An AAES scientist in the School of Forestry and Wildlife Sciences and colleagues from Appalachian State University and Newcastle University in England are studying the effects of ozone on the park's ecosystem.

The Great Smokey Mountains National Park is one of the most diverse parks in the United States in terms of plant and animal life, but it is affected by the many metropolitan areas around it, like Atlanta, Cincinnati, and Knoxville. Through their research, scientists are providing information to help federal land managers make informed decisions in order to keep these parks healthy. They are also developing plans for educating the public about the harmful effects of ozone on our nation's forests.

Impact on water quality

Cattle grazing in watershed areas contribute non-point source pollution to nearby creeks. In Alabama this is a particularly severe problem in the Flint Creek watershed area. AAES scientists are monitoring a selected small watershed within this area to measure runoff and runoff water quality. Their results will be used to create a computer model, which simulates runoff and water quality. Use of this model will help scientists to determine the effects of various best management practices on local streams and waterways and to advise land and livestock owners on the impact of their activities on water quality.

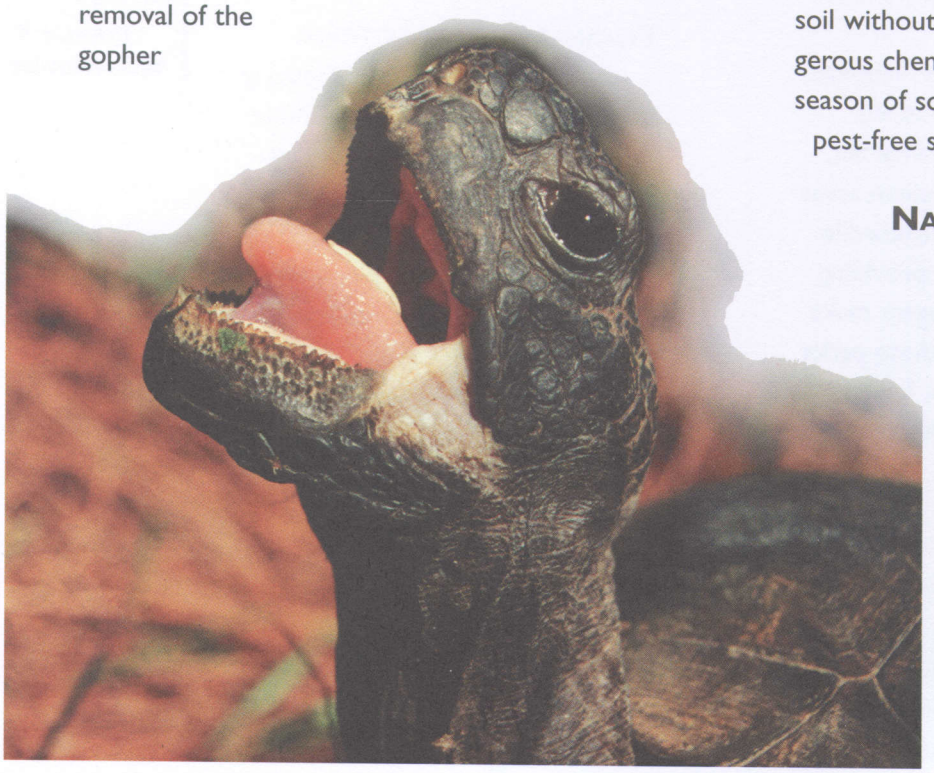
Toxin-eating bacteria

A natural way to effectively and efficiently clean up contaminated groundwater is to use bacteria that literally eat the toxic substances. AAES researchers are studying how bacteria, which are naturally present in contaminated groundwater, break down agrochemicals and other organic pollutants.

The bacteria produce hydrogen sulfide gas. This gas causes toxic metals contaminating the groundwater to be precipitated as solid minerals, thus eliminating the contaminant. Eventually the process can permanently remove the contaminants without the water having to be pumped out of the ground for purification. In field tests, groundwater was found to be free of contaminants within one month after applying the technology.

THE GOPHER TORTOISE–A KEYSTONE SPECIES

A "keystone species" within a community is one that can have a widespread impact on other animal life within that ecological setting. Removal of these so-called keystone species may drastically alter the ecological balance of the community says an AAES scientist in the Department of Biological Sciences. The gopher tortoise, which digs its burrows mostly in longleaf pine forests, is one such species. More than 350 other animal species use its burrows for food and shelter and removal of the gopher tortoise would change the entire community. Through this study of the gopher tortoise, researchers are providing the information needed by conservation officials to develop best management practices on lands containing these state and federally protected tortoises.



USING THE SUN TO SANITIZE THE SOIL

AAES scientists at Tuskegee University and Auburn University are working together to perfect a chemical-free way to sanitize the soil–soil solarization. This method uses clear plastic laid on top of the soil to form a heated environment that rids the soil of weeds, insect pests, and diseases. It is being tested for use by gardeners and small farmers as a way to "clean" soil without using expensive and potentially dangerous chemicals. Results have shown that one season of soil solarization yields three years of pest-free soil.

NATURAL ALTERNATIVE TO METHYL BROMIDE

Developed by an AAES researcher in collaboration with researchers in Turkey, a completely natural alternative to ozone-depleting methyl bromide has been approved by the EPA. Methyl bromide, the most widely used fumigant in the world, has been shown to contribute significantly to depletion of ozone and the U.S. Congress mandated its elimination by 2005. The natural alternative to methyl bromide is developed from herbs indigenous to the eastern Mediterranean region of Turkey, is at least as effective as methyl bromide as a soil-sterilizing fumigant, and carries none of the environmental and human health risks.

Health and Nutrition

> Let me tell you the secret that has led me to my goal. My strength lies solely in my tenacity.
>
> **Louis Pasteur**

Jellyfish treating arthritis

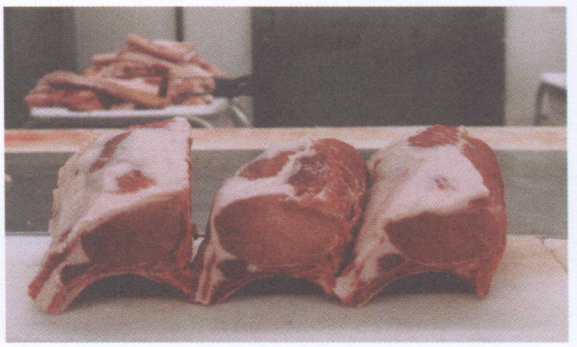
AAES research shows that one species of jellyfish could treat rheumatoid arthritis. An AAES scientist in Nutrition and Food Science has determined that the cannonball jellyfish, which is native to the Gulf of Mexico, may contain type II collagen.

Collagen is a protein found abundantly in cartilage and other animal tissues. There are different forms, but type II collagen aids patients suffering from rheumatoid arthritis if administered orally. Collagen is easily extracted from jellyfish and research thus far on the effects of collagen on rats as a treatment for arthritis symptoms appears positive.

This research also holds potential benefits for human medicine. The saliva of blood-sucking insects contains compounds that dilate blood vessels and thin blood in their victims. These substances may be useful in the treatment of cardiovascular disease, diabetes, some types of cancer, and even in wound healing.

Using DNA against insect pests

AAES entomologists are studying the DNA of blood-sucking insects' saliva for keys in developing a vaccine against the pests. So far their focus has been on the horn fly, a major pest of cattle in the United States. They have discovered that blood-feeding insects have a variety of proteins in their saliva, which are injected into the blood vessels when the insect bites its victim. These chemicals keep blood vessels open and prevent clotting, which enables the insect to tap into its victim's blood supply. The vaccine being developed would cause an immune response against the proteins in the saliva of the insects so that the insects could not feed and thus transmit pathogens.



Where's the beef?

In contemporary western civilization, excess weight, obesity, and associated maladies have reached epidemic proportions in the human population. To curb this, many people have been

controlling their fat intake, and one place that they have cut back is in consumption of high-fat animal products. In response, livestock producers have been trying to provide the market with leaner animals that provide lower-fat meats to the consumer.

By looking at the molecular level, AAES scientists are trying to find ways to lower the fat content of pork and beef products while still maintaining animal production efficiency and providing a tasty product to consumers. This research already has resulted in leaner meats on the market, but further research is needed to improve the quality of meat products. This information may also help the medical community learn more about fat development in humans.

Silent Spring

Feeding birds is a winter past time that many Alabamians enjoy. And the arrival of finches marks the beginning of the winter bird-feeding season for many.

In the mid 1990s, 60 percent of the population of house finches east of the Mississippi River–or roughly 100 million birds–died from a bacterial infection, which causes the equivalent of conjunctivitis–or pinkeye–in humans. Since the disease peaked, the mortality rate of the disease has dropped by about 50 percent each year.

Two AAES scientists are working with a geneticist from Washington State to study this infectious disease. Among other things, the team will be looking for an explanation of the steep decline in the rate of mortality caused by the bacteria. One hypothesis is natural selection–that the weakest birds were largely killed off at the peak of the epidemic leaving far fewer birds that are genetically less susceptible to the disease. Another thing they're looking at is why and how the mortality rate dropped so rapidly.

Production Agriculture

> Some succeed because they are destined to; most succeed because they are determined to.
>
> **Anatole France**

Great pumpkins

Commercial pumpkin production in Alabama has grown from under 200 acres in 1994 to more than 1,200 acres in 1999. Much of this growth has been due to small and part-time growers looking for alternative crops with which they can diversify their operations. Many of these operations have limited financial, land, and workforce resources.

To address the concerns of this growing industry in Alabama, a three-year study focusing on side-by-side comparisons of growth and development of pumpkin as affected by different cover crops, tillage systems, and different rates of nitrogen is underway by AAES researchers at the North Alabama Horticulture Station in Cullman. Initial results indicate that there is a positive benefit to using a living mulch. Vetch-covered plots yielded significantly more than all of the other covers. Bare-ground plots produced the lowest yield compared to any of the other treatments. Results will help small farmers produce great pumpkins more economically and efficiently.

Color control

Vegetable crop production is an intensive enterprise that often requires significant inputs of chemicals, irrigation measures, and labor. Plastic (polyethylene) mulches have been shown to help reduce the need for some of these inputs, to increase yields, to control erosion, and to regulate crop growth, thus preserving valuable resources and ensuring a higher quality crop harvest.

AAES scientists are studying a wide range of colored plastics to see which colors provide the most benefits to a crop. Mulches in blue, brown, black, reflective, and clear plastic were applied to cultivated vegetable crop such as tomatoes, summer squash, okra, and melons. Results show that various colored mulches will stimulate crop growth and deter insect pests. Clear plastic mulch can be used to solarize soil, which helps control soil-borne insect and disease pests.

Catfish savvy

Alabama ranks second in catfish production in the United States, producing more than 100 million pounds of catfish at a value of some $80 million. Keeping this industry viable and increasing catfish production could ensure that this valuable industry continues to benefit Alabama's economy.

One study of channel catfish by AAES scientists in Fisheries and Allied Aquacultures is looking at the effect of protein content on feed, feeding rate, growth, and feed conversion; the effect of fish size on feed conversion efficiency; and the effect on water quality on feed consumption. This information will help catfish producers make better use of their feed to raise

higher quality fish at a lower price and also protect the environment.

Holding on to soil

For many years farmers in Haiti and other developing countries have used farming practices that depleted the fertility of land, requiring them to abandon farming sites and clear new ones. Finding better soil management practices that sustain crop production and reduce soil erosion and degradation, while increasing farmers' incomes, is vital to ensure that developing countries can sustain their land and their economy.

AAES researchers in Haiti are studying a soil conservation system called alley cropping. In this system, nitrogen-fixing trees are planted in hedgerows; then crops are planted in the alleys of the hedgerows. The trees, which help hold the soil against erosion, are closely pruned to provide nitrogen-rich mulch. The research also has helped identify better ways to manage hedgerows to optimize crop yields. Currently results are being analyzed to see how alley cropping compares to other soil conservation practices.

Egg-zacting vaccines

Reoviruses cause a variety of economically important diseases in young chickens. While producers favor a mass form of egg vaccination, because it is rapid and labor saving, currently available reovirus vaccines cause disease if given while the chicks are still in embryonic stages. A team of AAES scientists is developing a safe and effective vaccine against reovirus that can be administered to the eggs.

So far this research has produced a vaccine that does not cause disease in chickens, and which helps chickens develop resistance to an arthritic form of reovirus. Future studies will focus on finding the right combination of vaccine and antibody to use that will be safe, efficacious, and economically feasible for commercial producers. They also will determine if the vaccine immunizes chickens against the intestinal form of reovirus.

The AAES team is the only group in the nation exploring this area of study. Improved control of reoviruses in chickens will save poultry producers money and ultimately reduce the cost of poultry products to consumers.

Keeping cattle healthy

Respiratory and digestive diseases take a heavy toll on the cattle industry every year. According to the USDA, in 1995, calf death losses due to these diseases cost the industry $794 million. That figure did not take into account the significant losses incurred in treatment costs and decreased growth and feed efficiency when such problems strike.

While the ultimate goal of animal health researchers is to wipe out diseases, a more realistic objective is to at least reduce the severity of these illnesses. AAES researchers at Auburn University's College of Veterinary Medicine may have found a way to achieve that objective, through the use of a common growth implant, Synovex.

In their studies, researchers discovered that pretreatment of calves with Synovex reduced the severity of the disease response in steers suffering from either coccidiosis, a severe diarrhea disease in cattle, or endotoxemia, a disease characterized by fever and reduced feed intake. These results provide evidence of a previously unknown beneficial effect of implants on the animals' well being.

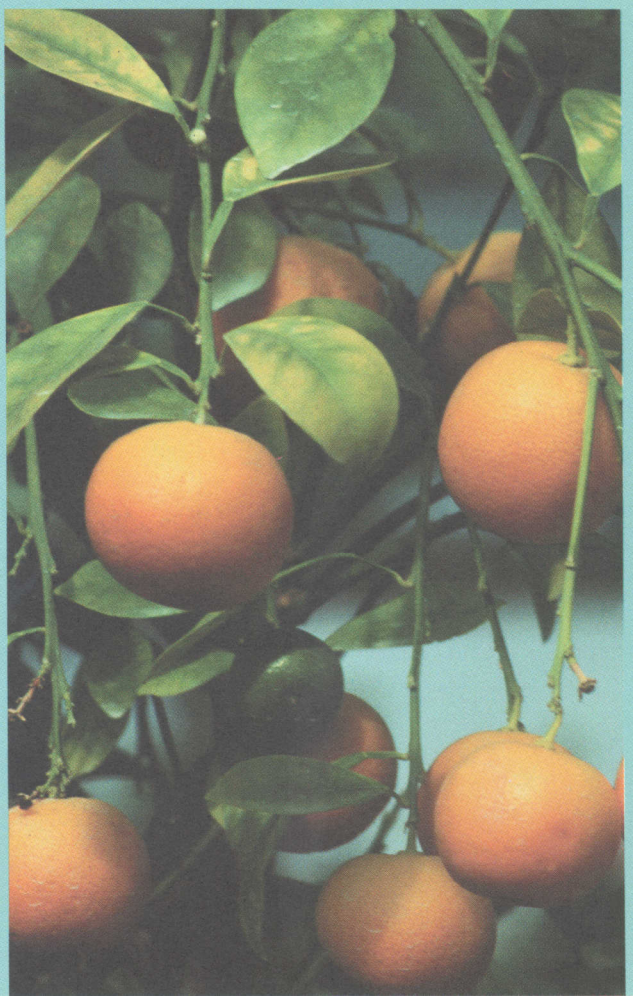
Future DIRECTIONS

> Do not go where the path may lead, go instead where there is no path and leave a trail.
>
> **RALPH WALDO EMERSON**

REVIVING A CITRUS SENSATION

A hundred years ago, Baldwin and Mobile counties were a hub of satsuma orange production, with Alabama producers shipping 700 train car loads of satsuma oranges per season to markets in Chicago, New York, and Boston. However, the industry was constantly challenged by Mother Nature in the form of disease, hurricanes, and especially frigid weather. In fact, several back-to-back severe winters with temperatures dipping as low as six degrees, combined with The Great Depression and the loss of Alabama's market to states that provided more consistent supplies of citrus fruits, finished off Alabama's commercial satsuma industry in the 1930s.

Satsumas, however, may be making a comeback thanks to AAES research. A decade ago, researchers at the AAES's Gulf Coast Research and Extension Center (GCREC) and in Auburn's Department of Horticulture began studying freeze protection systems for satsuma trees. The study has shown that coating the trees' trunks with a layer of ice via a sprinkler system located under the trees' canopies effectively



insulates the trees from deadly cold temperatures. Using this system, the researchers and several private growers in the area have had bumper crops of satsumas even during recent cold, severe winters.

The next step in revitalizing the industry is to establish a consistent market for Alabama satsumas. Researchers will be conducting marketing studies and addressing pest and disease control problems on satsumas. Another study to evaluate new varieties of satsumas for Alabama also will be established at GCREC. Though Alabama will never rival Florida and California in the citrus market, satsumas and other select citrus fruits could provide a new option for area farmers who are looking for alternative crops.

Plotting protein

Protein, the building block of life, makes up the mass of every life form and is essential in the diets of all animals. It also is the tie that binds DNA molecules in their spiral forms. Understanding proteins is a key step in deciphering myriad health and nutrition problems, as well as a giant step in decoding genetic mysteries. AAES researchers in Animal and Dairy Sciences are becoming intimately familiar with the molecular structure of proteins through their Nobel-quality biochemical work.

A part of Auburn University's Peaks of Excellence program, AAES proteomic research is focusing on molecular processes that, if disturbed by genetic, pathogenic, or environmental factors, affect the well being of humans, animals, and plants. Already the researchers have identified and even mapped proteins that link DNA strands into a chromosome. Once these basic processes are understood, the information can be used to optimize the efficiency or direct the nature of biological processes. Using these tools, scientists will better understand how organisms adapt to changing environmental conditions in the wild and may also lead to the design of pharmaceutical agents and genetically modified organisms with medical or other commercial value.

Pregnant possibilities

In livestock, just as with humans, many factors affect embryos as they grow and develop before birth. Understanding those factors and finding ways to optimize the maternal uterine environment that supports embryos during pregnancy are key steps to increasing the productivity of livestock as well as the health of human babies.

Auburn University Animal and Dairy Sciences researchers are studying the causes of embryonic mortality in economically important animals, such as cattle, pigs, and sheep. Their work focuses on the uterus and uterine glands, which provide the environment that supports embryonic growth and development. Working with colleagues at Texas A&M University, the Auburn scientists have determined that exposure of developing uterine tissues to specific hormones during defined periods of early life can have permanent and profound effects on uterine development in large domestic animals. These effects, which can be mimicked by some environmental pollutants, reduce the capacity of uterine tissues to support

pregnancy. Using state-of-the-art molecular techniques, AAES scientists are now trying to identify the developmental switches that must be thrown to insure that uterine tissues develop and function properly.

This research, which is part of Auburn University's Cell and Molecular Biosciences Peaks of Excellence program, has already revealed factors affecting reproductive efficiency in domestic animals, and may help solve fertility issues that affect people.

Gulf Coast waters

Alabama has the largest artificial reef program in the nation, with more than 14,000 ocean-floor reefs providing habitat for a wide range of commercial and sport fish in the Gulf of Mexico. The reefs off coastal Alabama have been a boon to the commercial and sport fishing industries, as catches of popular reef fish such as red snapper and grey triggerfish have increased dramatically through the years.

Though the success of these reefs is undeniable, no one has ever explained why they are so effective in attracting certain species of fish. One popular theory is that the reefs provide a new link in the food chain. Over time, corals, sponges, and other encrusting organisms take up residence on the reef. Small fishes come to feed on these organisms, and larger fishes are drawn to feed on the smaller. A complete reef food web is created.

> The business of life is to go forward.
>
> **Samuel Johnson**

To date, however, the food chain theory has not been scientifically proved. To determine whether artificial reefs actually produce food and cause the food chain effect, AAES researchers in Fisheries and Allied Aquacultures are studying the diets and populations of red snapper, gray triggerfish, and other commercially and environmentally important fish and aquatic animals in reef habitats. Results suggest that the reefs are providing food and thus ideal habitats for a wide range of fishes. Knowing more about how these reefs affect marine animal populations will help Alabama retain its vital commercial and sport fish industries, protect populations of various aquatic animals, and answer basic questions about aquatic life beneath the Gulf Coast waters.

aaes Projects Approved as of October 1, 2000

PROJECTS

Department of Agricultural Economics and Rural Sociology

Impact Analysis and Decision Strategies of Agricultural Research
G. Traxler

Fruit and Vegetable Supply-chain Management, Innovation, and Competitiveness
J. Adrian

Evaluation of International Markets for Southern Commodities
C. Jolly, P. Duffy, H. Kinnucan

Farm-level Economics of the Alabama Crop and Livestock Sector
P. Duffy, N. Martin, L. Johnson, E. Simpson, G. Traxler

Rural Restructuring
J. Molnar, L. Bailey, G. Howze

Selected Rural Social Change Issues: Population and Farm, Alabama Rural Health Care, And Status Attainment Among CoAg Graduates
J. Dunkelberger, K. Tajeu, S. Strawn, B. Wilder, G. Howze, N. Thompson

Citizen Involvement in Natural Resource Management
C. Bailey

Economics of Agricultural and Resource Policies
R. Taylor

Economic Implications of Federal and State Environmental Laws and Regulations On Alabama Agriculture
W. Hardy, J. Hurst

Exploratory Research in Rural Economic and Social Issues
L. Johnson, P. Duffy, W. Hardy, J. Molnar

Potential Climate Change and Variability: Impact And Mitigation Strategies in the Agricultural Sector
U. Hatch

Effect of Biotechnology Developments, Vertical Coordination, and Seed Market Concentration on U.S. Competitiveness in Agriculture
G. Traxler

Strategies and Institutions for Risk Management in Agriculture
R. Nelson, J. Novak

Department of Agronomy and Soils

Plant Genetics Resources Conservation and Utilization
J. Mosjidis

Phenology, Population Dynamics, and Interference: A Basis For Understanding Weed Biology And Ecology
R. Walker

Utilizing Potassium Buffering Capacity to Predict Cotton Yield Response to Potassium Fertilizer
G. Mullins, C. Mitchell

Soil Testing, Feed, Forage, and Plant Analysis
H. Bryant

Soil Management Practices for Sustainable production on Densely Populated Tropical Steeplands
D. Shannon, C. Jolly

Genetic Improvement of Tall Fescue and White Lupin
E. Van Santen

Occurrence, Measurement, and Mapping of Plant Micronutrient and Trace Elements in Alabama Soils
J. Odom

Breeding Improved Soybean Cultivars Adapted to the Southern United Sates
D. Weaver

Exploratory Research in Agronomy and Soils
J. Touchton

Inheritance and Linkage of Isozymes and Agronomic Traits in Red Clover
J. Mosjidis

Mineralogical Controls on Colloid Dispersion and Solid-phase Speciation of Soil Contaminants
J. Shaw

Surficant-enhanced Removal of Dense Non-aqueous Phase Liquids from Porous Media
J. Dane

Nutrient Management in Sustainable Agricultural Systems Using Continuous, Long-term Research Plots
C. Mitchell

Integrated Sustainable Production Practices for Cotton (*Gossypium hirsutum*)
C. Monks, M. Patterson, C. Burmester

Alternative Tillage and Soil Fertility Management Practices on Peanut Seed Quality And Yields
D. Hartzog, J. Adams

Sustainable Management Strategies for Enhanced Environmental Quality, Biodiversity, and Productivity of Grazed Landscapes
M. Miller-Goodman

Weed Management in Peanut and Herbicide Activity as Influenced Byabsorbents
G. Wehtje

Weed Biology and Management in Southern Turf
R. Walker, D. Teem

Soil Microbial Taxanomic and Functional Diversity as Affected by Land Use and Management
Y. Feng

Development of Geospatial Training for Precision Agriculture Practitioners
P. Mask

Reducing the Potential for Environmental Contamination by Pesticides and Other Organic Chemicals
Y. Feng

Department of Animal and Dairy Sciences

Nutritional Systems for Swine to Increase Reproductive Efficiency
L. Chiba

Plant Tissue Chemistry Response to Ozone Stress with Implications to Ruminant Herbivory
R. Muntifering

Relationships Among Early Handling, Learning Ability, and Reactivity of Foals
C. McCall

Effect of Dietary Manipulation on Survival and Growth of the Neonatal Pig
L. Frobish

Effects of Genetic Selection for Lean Growth Efficiency on Pork Muscle Quality
D. Kuhlers, S. Jungst

Biochemical Factors Involved in Muscle Growth and Meat Quality
C. Kerth, D. Kuhlers

Exploratory Research in Animal Sciences
W. Bergen

Cellular and Molecular Organizational Events Affecting Porcine Uterine Capacity
F. Bartol

Supplementation Strategies for Stocker Cattle
S. Schmidt

Nutritional Systems for Swine to Increase Reproductive Efficiency
L. Chiba

Synchronization of Ovulation in Beef Cattle for Timed Insemination Without Detection of Estrus
D. Coleman

Regulation of Lipogenic Genes in Porcine and Bovine Adipose
W. Bergen, J. Wower

Metabolic Relationships in Supply of Nutrients For Lactating Cows
K. Cummins

Functions of P68 RNA Helicase in Pre-mRNA Splicing
Z. Liu

Enhancing Production and Reproductive Performance of Heat-stressed Dairy Cattle
K. Cummins, P. Moss

Department of Biosystems Engineering

Development and Application of Comprehensive Agricultural Ecosystem Models
K. Yoo

Engineering Systems for Improved Transportation
S. Taylor

Develop and Assess Precision Farming Technology and Its Economic and Environmental Impacts
J. Baier, L. Johnson, L. Curtis, T. Grift

Department of Entomology and Plant Pathology

Biology and Control of Urban Arthropod Pests in Alabama
A. Appel

Impact and Management of Green June Beetle and Other Scarabeild Grubs in Alabama Pastures
K. Flanders

Biology and Management of Insects of Trees in Alabama
L. Hyche

Analysis of CDNA, Recombinant Protein, and Immunogen. H Fly Thromb
E. Cupp, M. Cupp

Integrated Management of Arthropod Pests of Livestock and Poultry
G. Mullen

Pyrethroid Resistance in Cotton Bollworm, Helicoverpa Zea, and Other Insect Pests
N. Liu

Mites of Importance to Plant and Animal Health in Alabama
G. Mullen

Ecology of Fire Ants and Big Eyed Bugs in Cotton and Soybeans in Alabama
M. Eubanks

Taxonomy of Weevils of the Tribe Anthonomini
W. Clark

Improved Pecan Insect and Mite Pest Management Systems
J. McVay

Control of Cole Crop Pests with Novel Pesticides and Intercropping
M. Eubanks

Development, Evaluation and Safety of Entomopathogens for Control of Arthropod Pests
B. Moar, R. Smith

Physiological and Molecular Basis of Resistance to Bacterial Infection in Plants
S. Tazun

Exploratory Research in Plant Pathology
K. Bowen, G. Morgan-Jones

Integrated Biological Control of Tomato Viruses and Nematodes
J. Kloepper, J. Murphy, R. Rodriguez-Kabana

Roles of Plant and Soil Bacteria in Agroecology-disease Suppression and Plant Growth Promotion
J. Kloepper

Integration of Host Resistance, Cultural Practices, and Biocontrol for Peanut Diseases and Nematodes
J. Kloepper, R. Taylor

Managing Foliar and Soil-borne Plant Diseases in Sustainable Agricultural Systems
K. McLean

Managing Plant Parasitic Nematodes in Sustainable Agriculture with Emphasis on Crop Resistance
K. McLean

Risk Assessment of a Plant-associated Bacterium Genetically Engineered with Lux Genes
J. Kloepper

Biological Control of Soilborne Plant Pathogens for Sustainable Agriculture
K. McLean, J. Kloepper

Department of Fisheries and Allied Aquacultures

Production of Recreationally Important Marine Fishes from Estuarine Nursery Areas
S. Szedlmayer

Population Assessment of Bass and Crappie in Alabama Reservoirs
M. Maciena

Effects of Feeds and Feeding on Fish Performance and Water Quality in Warmwater Aquaculture
D. Davis

Identification Of DNA Markers for Genotyping Sub-species Populations of Fish
Z. Liu

Factors Affecting Growth, Survival, and Recruitment of Age-0 Sport Fish
D. Devries, R. Wright

Microbial Pathogens of Cultured Crustaceans and Molluscs
Y. Brady

Improved Culture Practices of Crustacean and Molluscan Shellfish in Alabama
D. Rouse, R. Wallace

Habitat Requirements for Coastal Marine Fisheries
S. Szedlmayer

Distribution and Abundance of Fishes in Relation to Landscape Variability in Alabama's Rivers and Streams
E. Irwin

Genetic Maps of Aquaculture Species
Z. Liu, R. Dunham

New Research in Aquaculture, Fisheries Management, and Aquatic Ecology
J. Jensen

Linkage Mapping of Quantitative Trait Loci in Catfish
Z. Liu, R. Dunham

Genetic Improvement of Catfish
R. Dunham, Z. Liu

Effects of Water Hardness and Salinity on Fish Health
J. Grizzle

Ecology and Conservation of Alabama Non-game Fishes
C. Johnston

Coastal Alabama Seafood Harvest (CASH) Project
D. Rouse

Red Snapper Research Project
B. Wallace, R. Phelps

Alabama Water Watch
B. Deutsch, B. Duncan

Environmental Management in Pond Aquaculture
C. Boyd

Department of Horticulture

Improved Cultural Practices and Cultivars for Small Fruit Production
D. Himelrick

Environmental Modification for Intensive Vegetable Production in Southeastern States
J. Brown

Crop Thinning, Nitrogen Nutrition, and Cultivar and Root Stock Evaluation of Tree Fruit Crops
R. Ebel

Environmental Influences on Growth and Physiology of Landscape Tree Selections
D. Eakes, J. Sibley

Scheduling Irrigation for Vegetable Production in The Subhumid Southeastern United States
E. Simonne

Effects of Temperature Conditioning/ Uv-c Treatments on Antioxidative Properties in Ripening Tomato
F. Woods

Cultural Practices and Cultivar Evaluations For Pecans
W. Goff

Evaluation of Satsuma Orange Cultivars in Alabama
W. Dozier, R. Ebel, F. Dane, F. Woods

National Agricultural Program to Clear Pest Control Agents for Minor Uses
C. Gilliam

Improving Yield and Quality of Selected Cucurbit and Solonaceaous Crops in Alabama
J. Kemble

Multidisciplinary Evaluation of New Apple Cultivars
W. Dozier, R. Ebel, A. Powell

Post Harvest Quality and Safety in Fresh Cut Vegetables and Fruits
F. Woods

Evaluation of Temperature Stresses on Container Grown Landscape Plants
D. Findley

Accelerated Flowering, Chilling Requirements and Growth Regulation of Herbaceous Landscape Plants
G. Keever, R. Kessler

Genome Mapping and Tagging of Useful Genes in Citrillus
F. Dane

Department of Poultry Science

Reduction of Body Fat in Broiler Chickens
J. Renden, E. Moran

Mechanism for the Induction of Immunity Against Infectious Bursal Disease Virus
J. Giambrone, S. Ewald

Maximizing Profits in Commercial Leghorns While Minimizing Prolapse, Nitrogen and Phosphorus Pollution
D. Roland, D. Zhang, W. Berry

Genetic Bases for Resistance and Immunity to Avian Diseases
S. Ewald, R. Norton, F. Hoerr

Poultry Production, Processing, and Water Quality
J. Blake, J. Hess

Factors Associated with Genetic and Phenotypic Variation in Poultry: Molecular to Populational
W. Berry

Avian Respiratory Diseases: Pathogenisis, Surveillance, Diagnosis, and Control
R. Norton, E. Moran, S. Bilgili, D. Conner

The Poultry Food System: a Farm to Table Model
E. Moran, S. Bilgili, D. Conner

Water Quality Issues in Poultry Production and Processing
J. Blake, J. Hess

School of Forestry and Wildlife Sciences

Mourning Dove Mgt: Human Dimensions, Food Preference Trials, Hunting Field Plantings
R. Mirarchi

Effects of Burkholderia Cepacia on Conifer and Hardwood Seedling Growth, Ecotypic Specialization and its Rhizosphere Competance
S. Enebak, A. Chappelka

Effects of Forest Understory Mgt. On Stream Water Quality: Impact of Prescribed Burning on Watercheistry, Benthic Invertebrates and Periphyton
J, Feminella

Invasion of Eurasian Watermilfoil: Ecological Impacts and Reasons for Success
G. Hepp

Carbon and Nitrogen Dynamics in a Carbon Dioxide Enriched Forest Ecosystem: Implication for Air, Water, and Soil Quality
D. Gjerstad, B. Runion

Department of Consumer Affairs

Mass Customization: Identifying Process and Management Strategies for Alabama's Textile and Apparel Producers
C. Anderson

Building Cons Based Textile/apparel Brand Image Strategies: A Cross National Study
S. Forsythe

Development of Textile Materials for Environmental Compatibility and Human Health and Safety
B. Slaten

Community Economic Development by Merchandising
L. Anderson

National Textile Center
C. Warfield

A Web-based Methodology to Assess Young Lead User Preferences for Home Textile Products
M. Soloman

Department of Human Development and Family Studies

Early, Middle, and Late Relationships with Parents and Peers
D. Sollie

Predicting Marital Dissolution: A Four Year Prospective Longitudinal Study of Engaged Couples
L. Lamke

Early Family Experiences and Emotional Competence in Children: Links to Social, Academic, and Physical Well Being
J. Mize, G. Pettit

Dynamics of the Allocation of Family Work: Implications for The Quality of Family Life in Early Marriage
J. Pittman

Preschool-age Children's Friendships: Maintenance and Implications
B. Vaughn

Transitions in Rural Alabama: An Evaluation of a Youth Development Program
A. Vazsonyi, J. Kerpelman

Department of Nutrition and Food Science

Effects of Diet on the Regulation of Feeding and Body Weight
D. White

Monoclonal Antibody-based Enzyme Immunoassay for Detection of Species Adulteration in Raw and Cooked Muscle Foods
P. Hseih

Value Added Processing: Irradiation
J. Weese

Chemical Reactions in Foods as Affected by the Properties of Water and Ingredients
L. Bell

Nutrient Analysis and Interactions
S. Gropper

Thermal-stable Species Marker Proteins for Detection of Meat Species Adulteration
P. Hsieh

N-3 and N-6 Fatty Acids in the Maternal and Infant Diet
M. Craig-Schmidt

Department of Biological Sciences

Tobacco Chloroplast DNA Replication Origins and Origin-binding Protein
B. Nielsen, N. Singh

Molecular and Cellular Aspects of Heat Stress on Yield and Composition of Proteins and Fatty Acids
J. Cherry, N. Singh

Immunization with a Recombinant Immunogen Containing Brs Virus Fusion Protein and a Mucosal Adjuvant
S. Roberts

Analysis of Organelle Structure and Replication in Higher Plants
B. Neilsen

Rapid Detection and Subtyping of Food and Waterborne Bacterial Pathogens
J. Barbaree

Ecological Relationships of Animals and Metal Hyperaccumulating Plants
R. Boyd

Fungal Growth and Host Response to Tunneling Activities of The Asian Ambrosia Beetle
R. Dute

Wetland Habitat Types in Alabama: Classification and Inventory
G. Folkerts

Zeta Protein Kinase C Signal Complexes–a Novel Growth Signaling Pathway
M. Wooten

Life History of Gopher Tortoise Burrows: Key Resource of Longleaf Pine Ecosystems
C. Guyer

Role of the Apical Sensory Organ and Neurotransmitters in Settlement of the Oyster Crassostrea Virginica
S. Kempf

Ecological Relationships of Insects and Metal Hyperaccumulating Plants
R. Boyd

Song and Ornamental Plumage in the House Finch: A Study of Signal Content in a Multiple Signal System
G. Hill

Influence of Season and Frequency of Fire on Bachman's Sparrows and Henslow's Sparrows in Longleaf Pine Forests of The Gulf Coastal Plain
W. Robinson

Ecology of Bats (Mammalia: Chiroptera)
T. Best

Yolk Processing During Insect Development
J. Bradley

Use of Cobalt-60 Irradiation for Inactivation of Protozoan Cysts
C. Sundermann

Simplified Techniques for the Analysis of Motility in Vertebrate Cilia and Flagella
A. Moss

Department of Animal Health Research

Impact of Control and Prevention Programs for Bovine Viral Diarrhea Virus on Bovine Respiratory Tract Disease
K. Brock

Immunologic Studies of Bovine Neosporosis and Equine Protozoal Myeloencephalitis (epm) and Development of DNA-based Vaccines
B. Blagburn, C. Dykstra

Bovine Respiratory Disease: Risk Factors, Pathogens, Diagnosis, and Management
K. Brock

Mycoplasma Cell Adherence: Adhesins and Accessory Regulatory Mechanisms
V. Panangala

Reciprocal Communication Between The Endocrine and Immune Systems in Ruminants
J. Sartin

Joint (Interdepartmental) and Miscellaneous

Development and Evaluation of Control Strategies for Diseases of Landscape Plants
K. Tilt, A. Hagan

Weed Control in Nursery and Landscape Crops
C. Gilliam, G. Wehtje

Raw Soybeans and Whole Kernel Corn as Diet Supplements for Captive White-tailed Deer
K. Causey, R. Muntifering

Animal Manure and Waste Utilization, Treatment, and Nuisance Avoidance for Sustainable Agriculture
D. Hill, R. Muntifering, W. Wood, T. McCaskey

Systems for Controlling Air Pollutant Emissions and Indoor Environments of Poultry, Swine, and Dairy Facilities
E. Simpson, J. Donald, C. Flood, J. Blake

Technical and Economical Efficiencies of Producing, Marketing, and Managing Environmental Plants
J. Adrian, D. Eakes, K. Tilt

Ensuring Food Safety by End-point Testing of Cooked Meat Products
P. Hseih

Escherichia coli O157:H57, a Food-borne Pathogen: Laboratory and Field Studies
J. Barbaree, B. Nielson, S. Price

Control of Nutrient and Pesticide Residues in Landscapes by Phytoremediation
C. Gilliam, G. Wehtji

Cellular and Molecular Mechanisms of Induced Systemic Resistance Mediated by Rhizobacteria
J. Kloepper, Dodo, S. Tazun

Physiological and Molecular Basis of Resistance to Bacterial Infection in Plants
S. Tazun

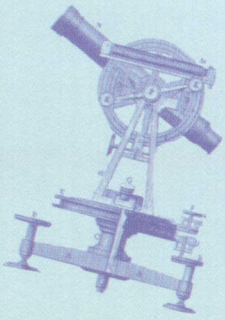
Microchips for Evaluation of Temperature as a Risk Factor for Campylobacter in Poultry
D. Conner, J. Barbaree, P. Hseih

Marine & Estuarine Environmental Educ./Research Program/ Laboratory Dev. for Chem., Pulp, and Paper Processes
L. Curtis

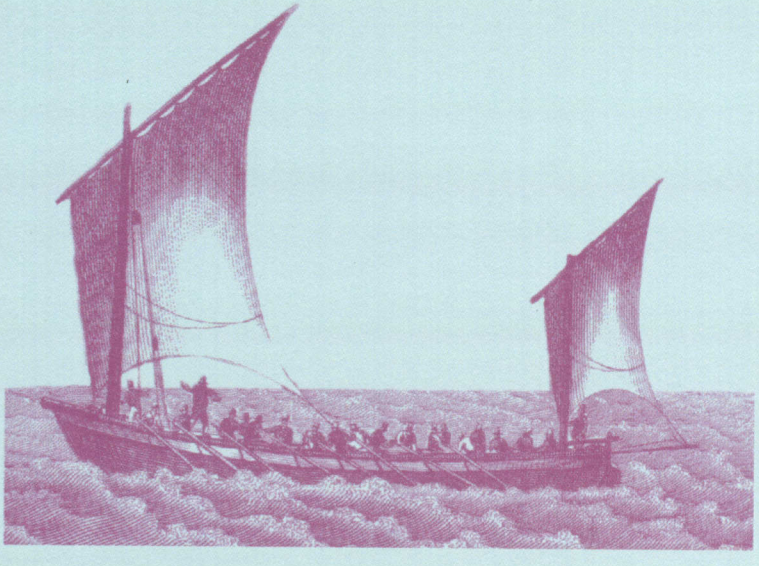
Enhancing Food Safety Through Control of Foodborne Disease Agents
D. Conner, J. Barbaree, S. Price

Enhancing Food Safety Through Control of Foodborne Disease Agents
D. Conner, J. Barbaree, J. Weese, C. Wei, S. Price, J. Wright, F. DeGraves

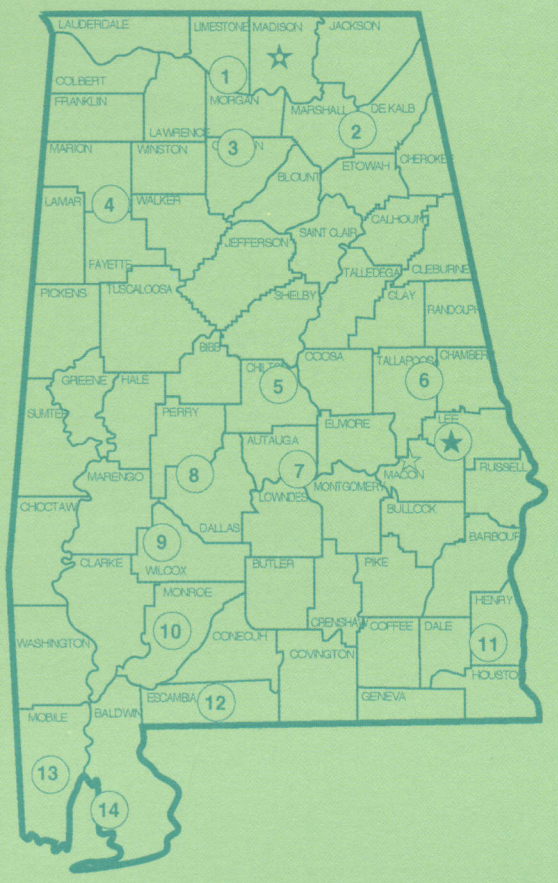
Financial Highlights 2000



TOTAL REVENUES		**$39,210,741**
State		**$22,907,865**
Federal		**$ 4,628,246**
Contracts and Grants		
Federal	**$6,306,376**	
State and Local	**$ 436,000**	
Private	**$1,259,889**	
Indirect Cost Recoveries	**$1,030,287**	
Total		**$9,032,552**
Auxiliary Sales and Services		**$2,344,434**
Investment Income		**$ 297,644**



Alabama's Agricultural Experiment Station System
AUBURN UNIVERSITY

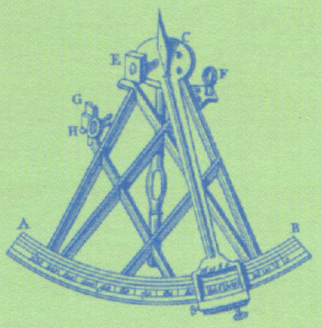


★ Main Agricultural Experiment Station, Auburn.

☆ Alabama A&M University

☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Research and Extension Center, Belle Mina.
2. Sand Mountain Research and Extension Center, Crossville.
3. North Alabama Horticulture Station, Cullman.
4. Upper Coastal Planins Station, Winfield
5. Chilton Area Horticulture Station, Clanton.
6. Piedmont Research Station, Camp Hill.
7. Prattville Experiment Field, Prattville.
8. Black Belt Research and Extension Center, Marion Junction.
9. Lower Coastal Plain Research Station, Camden.
10. Monroeville Experiment Field, Monroeville.
11. Wiregrass Research and Extension Center, Headland.
12. Brewton Experiment Field, Brewton
13. Ornamental Horticulture Station, Spring Hill.
14. Gulf Coast Research and Extension Center, Fairhope.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