

**South Carolina
Agriculture and Forestry Research**

FY 2001

**ANNUAL REPORT OF
ACCOMPLISHMENTS**

SUBMITTED TO CSREES-USDA

March 1, 2002

Clemson University
Clemson, South Carolina

**AGRICULTURE AND FORESTRY RESEARCH
AT CLEMSON UNIVERSITY**

ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

March 1, 2002

A. Planned Programs

Agriculture and Forestry Research spent much of FY 2001 preparing to transition to a project-based funding research support system and part of this transition was a detailed review of methodologies for assigning research initiatives to goal areas. Project-based funding is now fully implemented and all investments in projects and programs are being managed for reporting and accountability purposes. Budgets are currently being developed for the state fiscal year 2002-2003 which begins July 1, 2002, and Hatch funds will be managed in the same project-based fashion. Initially, AFR had intended to reflect the multi-goal nature of the majority of the initiatives underway. Research projects and programs typically impact across multiple goal areas. It became apparent that it was difficult to track and report outputs, outcomes and impacts for projects and programs in multiple goals, and while it was possible, it could not be done in a clear, concise and easily communicated fashion. A detailed review of the process used to assign research projects to the five goal areas was conducted, and this process, which involved consultation with the research faculty, resulted in shifts in the classification of research projects from one goal to another by focusing on the primary goals and objectives of the research. This process had the effect of reflecting research initiatives in all five goal areas in 2001, whereas the initial assessment of activity by goal area projected the majority of the effort occurring in goals One and Four and a small effort in goal Five. This shift is reflected in the narrative descriptions of the goals and the key themes and in summary form in the following table:

**AGRICULTURE AND FORESTRY RESEARCH
Planned vs. Actual FTE and Expenditure by Goal Area for FY2001**

Goal	Planned FTE's	Actual FTE's	Planned Expenditures	Actual Expenditures
Goal 1	27.23	19	3,038,451	\$2,736,051
Goal 2	-0-	10	-0-	506,630
Goal 3	-0-	7	-0-	696,142
Goal 4	13.99	5	1,646,603	550,982
Goal 5	1.49	10	406,003	549,932
Totals	42	51	5,091,057	\$5,039,737

In 2001, 54% of the total AFR research investment was in Goal area 1. The other 46% was distributed as follows: Goal 2, 10%, Goal 3, 14%, Goal 4, 11% and Goal 5, 11%. Agriculture and Forestry Research actual investments in Plan of Work Programs in FY2001 were 98.9% of the planned level, or \$51,320 below plan. It is important to refer to Section D, Evaluation of The Success of Multi and Joint Activities below where figures show that Agriculture and Forestry Research invested \$799,607, or 118% more than required for the state to invest in support of critical regional projects.

The modification to the Plan of Work, which will be submitted before June 30, 2002, will reflect further movement towards balancing the commitment to the five goal areas and new programs will be put in place after merit review to insure that investments for 2002 meet or exceed the planned levels.

Project-based funding makes it possible for Agriculture and Forestry Research to make decisions on the level of investment in each project and then to determine the number of projects, which are related and cooperating in programs, which comprise the Plan of Work. This report reflects Hatch and state projects which are reported on the CRIS system. The name of each research scientist and the number needed to access that scientist's project on the CRIS system is presented in the narrative for each key theme. This makes it possible to immediately access additional information on each project and program presented in the narrative.

FY 2000 Annual Report of Accomplishments and Results

1. Goal One: An agricultural system that is highly competitive in the global economy.

Planned FTEs in goal one were initially set at 27.23. There were 19 FTEs assigned to projects in this goal area. Planned Expenditures were set at \$3,038,451 and the actual amount spent for the period was \$2,736,051.

Research in the five key themes under goal one has produced approaches to lowering saturated fat content in milk, designs for a pasture-based feeding system to improve animal health and lower producer costs, ways to manipulate the immune response to better protect animals and humans from existing and emerging diseases, a partitioned aquaculture system which can triple catfish production compared to traditional ponds and a patented system to automate ornamental horticulture. These initiatives are carefully orchestrated with the Cooperative Extension Service so that technology developed through research is transferred to the citizens of the state.

FY 2000 saw a shift in research emphasis away from dairy profitability and animal immunology and towards aquaculture, ornamentals and vegetable initiatives and the number of projects and expenditures reflect these changes. Agriculture and Forestry

Research began a major programmatic transition towards a project-based funding approach which will keep faculty current on investment levels in their research and enhance accountability reporting capabilities.

Planned expenditures for dairy profitability were set at \$964,705 and actual expenditures in two research projects approached \$583,096. In animal immunology, spending for 2000 was projected at \$678,834, and actual expenditures were closer to \$219,790. Spending was significantly lower than anticipated as a result of a university initiated “faculty buy-out program” designed to shift research faculty to teaching responsibilities. This program was part of a response to significant state reductions in funding to research, extension and regulatory functions at Clemson. One key faculty member previously involved in the animal immunology initiative was shifted to a full time teaching role.

The Aquaculture research program significantly increased in scope and actual spending approached \$783,426 up from planned levels of \$327,620. This increased effort is the result in part of the success of the Partitioned Aquaculture System (PAS), which combines intensive production techniques with intensive waste management to dramatically increase yields while minimizing environmental impact. Initial research has used catfish but the system is useful for all types of fish, including saltwater species. In the patented system, catfish are confined in a small area of the pond so that their health and feed can be closely controlled and they can be protected from predators. A slow moving paddlewheel continuously circulates water over the fish and through a series of raceways, removing the fish waste from the confinement area. The self-contained system processes waste internally with no discharge into the environment.

The initiative for ornamental horticulture was designated a key theme under goal one as part of a research redirection when additional funds became available from university faculty buy-outs described in several key themes throughout this report. This strategic reinvestment amounted to approximately \$587,643. The field crops program was also included as a key theme under goal one as part of a research redirection. There has been a significant impact from the research initiatives in that area to include the release of two new varieties, the Santee Soybean and the Patriot Sweet Potato, a joint release with USDA. This strategic reinvestment amounted to approximately \$505,308.

Key Theme: Dairy Profitability

Clemson researchers are lowering the saturated fat content in milk – while it’s still in the cow – by adding fatty acid to the cow’s diet. The scientists have developed a patented feed formula that combines fatty acid and ammonia. This combination uses the natural chemicals and processes in the cow’s digestive system to lower the overall fat content in the milk. The process also changes the remaining fat to the more healthful monounsaturated form found in canola or olive oil.

The scientists are also studying the use of a pasture-based feeding system that eliminates manure build-up in confined areas, improves animal health, and lowers producer costs. By segmenting pastures into smaller sections and moving cattle from one section to another, dairy farmers can provide year-round grazing as the primary feed source, as an alternative to feeding grain in confined areas.

Another study is examining more environmentally sensitive ways to manage livestock waste generated in confined areas. By passing the waste through a settling basin and then through man-made wetlands, solids can be extracted for use as organic fertilizer. Remaining water can be recycled to irrigate pastures. This reduces the amount of waste sent to lagoons and reduces the need for chemical fertilizers, while improving grass production in dry months. This research is funded with Hatch and matching state funds and was state specific.

J. Bertrand, H-S 1700109 (864) 656-3135 jbrtrnd@clermson.edu

T. Jenkins, H-S 1700046 (864) 656-2707 tjnkn@clermson.edu

Key Theme: Animal Immunology

Scientists are investigating the effects that chemicals in the environment may have on the immune and reproductive systems of animals and humans. These researchers are studying the effects of naturally occurring – as well as man-made – environmental contaminants to identify risk factors and to investigate remediation methods. Studies are investigating the evolutionary development of immunity, as well as ways to manipulate the immune response to better protect animals and humans from existing and emerging diseases. The scientists are also investigating methods to improve food animal production and reproductive efficiency by enhancing the animals' natural immune systems.

Other studies include the relationships of the immune system, reproductive system, nervous system, and endocrine system; and how these systems can be affected –both positively and negatively – by changes in the diet or in the environment. This research is funded with Hatch and matching state funds and was state specific.

A. Bodine, SC-1700110 (864) 656-3120 abodine@clermson.edu

T. Scott, SC- (MRF) 1700148 (864) 656-3163 trscott@clermson.edu

Key Theme: Aquaculture

A partitioned aquaculture system developed by Clemson scientists triples catfish production compared to traditional ponds. The system uses a small enclosure to contain the fish while circulating water through a series of channels to remove their waste. This approach improves the health of the fish, as well as boosting production levels. At the same time, it reduces the amount of water and land required for commercial production. The researchers are also investigating

economically viable production systems for other species, such as crayfish, tilapia, red drum, and southern flounder. Their research uses laboratory facilities, as well as the state's waterways, to study aquaculture, fisheries management, and environmental protection. This research is funded with Hatch and matching state funds and was state specific.

T. Schwedler, SC-1700064 (864) 656-2810 tschwdl@clemson.edu
J. Tomasso, SC- 1700085 (864) 656-2809 jtmss@clemson.edu
A. Eversole, SC- 1700061 (864) 656-5328 aevrsl@clemson.edu
D. Brune, SC- 1700056 (864) 656-4068 debrune@clemson.edu
J. Collier, SC- 1700062 (864) 656-4047 jcllr@clemson.edu

Key Theme: Ornamental Horticulture

Ornamental horticulture contributes some \$200 million each year to South Carolina's economy and is the fastest growing segment of agriculture today. To support this growth, Clemson research and extension efforts are developing and providing the information needed by both commercial growers and homeowners. Research spans all phases of greenhouse and nursery production, including light management, tissue culture propagation, disease control, and optimizing chemical efficiencies while protecting the environment. In addition, genetic studies have developed the means to certify that plants are disease-free, as well as to improve disease resistance through selective breeding. Butterfly studies include both the insect and its interactions with various plants.

A patented system that can boost production and profits in commercial nurseries has been developed by Clemson Scientists. The Acclimatron™ uses automation to produce micro-cuttings that are placed in sealed trays in a computer-controlled hydroponic growing system. The closed system protects the cuttings for diseases and pests, allows water and nutrients to be recycled, and eliminates the need for cuttings to be planted directly into the field or into containers for growing to saleable size. The result produces high quality, healthy plants that command premium prices and are produced in a manner that is both environmentally sensitive and cost effective. A new company called Southern Sun has been formed to produce and market the system of trays, transplants, and computerized greenhouse equipment and was state specific.

J. Adelberg, SC-1700158 (864) 656-3011 jadlbrg@clemson.edu
J. Faust, SC-1700135 (864) 656-4966 jfaust@clemson.edu
J. Cullen, SC-1700055 (864) 656-5041 jculin@clemson.edu
S. Jeffers, SC-1700177 (864) 656-7157 sjffrs@clemson.edu
S. Lewis, SC-1700068 (MRF) (864) 656-5741 slewis@clemson.edu
N. Rajapakse, SC-1700059 (864) 656-3579 nrjpks@clemson.edu
W. Bauerle, SC1700208 (864) 656-7433 bauerle@clemson.edu

Key Theme: Field Crops

Impacts of the field crops initiative include the innovative set of management practices being developed for crop production on the Coastal Plain are dramatically reducing the amount of water, sediment, and nutrients that move off site during rainfall events. Besides conserving and protecting natural resources, these practices may also be of value in reducing problems associated pollutants in runoff water originating from animal waste. High yielding, pest resistant soybean cultivars grown in pest-infested areas will adversely affect plant pest populations and also reduce the usage of pesticides to control these pests. Direct beneficiaries will be both producer and consumer. This research is funded with Hatch and matching state funds and was state specific.

E. Shipe, SC-1700048 (864) 656-3524 eshipe@clemson.edu

D. Graham, SC-1700152 (864) 656-3507 dgraham@clemson.edu

J. Frederick, SC- 1700140 (843) 662-8920 jfrdrck@clemson.edu

Goal Two: A safe and secure food and fiber system

Planned FTEs in goal two was initially set at -0-. There were 10 FTEs assigned to projects in this goal area. Planned expenditures in this goal area were set at -0-, the actual expenditure level was \$506,630.

The Food Safety Program under goal 2 was focused into the following interrelated research topic areas:

- Packaging and processing effects on safety and quality of poultry products,
- Processing and packaging of meat and poultry products for quality enhancement,
- Packaging materials on chitosan and other biopolymers,
- Development and efficacy of anti-microbial food packaging materials,
- Phytochemicals as modulators of disease, functional properties of a soy protein concentrate produced by ultrafiltration,
- Modifying milk fat composition for enhanced manufacturing qualities and consumer acceptability,
- Bioavailability and digestibility of food components, food demand, nutrition and consumer behavior,
- Characterization of endothelial cell internalization of Ap4A,
- Harvesting and post harvest handling protocols for optimizing active content, and in vitro culture of medicinal plants and investigation of their active ingredients.

Approximately \$560,188 was invested in the Agriculture and Forestry Research program in 2002. The figure planned for this period was \$295,993. The actual investment was higher due to increasing demand from stakeholders and the growing concern among the public in general about the issue of food safety. The research programs were closely coordinated with the cooperative extension service.

Key Theme: Food Safety

To reduce the cases of food-borne illnesses, Clemson scientists are investigating more effective safety measures in food production and processing. Their studies include using antimicrobial rinses to inhibit disease-causing bacteria in fresh meats and using proteins called bacteriocins that can kill bacteria and prolong shelf life in a variety of foods. One bacteriocin being studied may inhibit spoilage in plant crops while they are in the field; another could protect food products against staphylococcus bacteria. The scientists are also investigating the genetic sequence of bacteriocins to determine exactly how these proteins work to inhibit bacteria.

Another area of study is a small pasteurization system for apple cider. If this system proves effective and economical, it could make roadside cider sales much safer by eliminating bacteria in the cider that can cause illnesses. This research is funded with Hatch and matching state funds.

A promising new acne treatment has been identified by Clemson University food microbiologists. The discovery came about as the scientists searched for proteins that act as natural food preservatives. The protein is called a bacteriocin, a tiny bit of antibiotic-like matter produced by bacteria.

The bacteriocin discovered by the researchers did not work as a food preservative, but it was 100 percent effective in controlling acne bacteria in laboratory tests. The discovery has been patented while it undergoes further testing to determine how it works and to develop a method to increase production. Because of the technical challenges, it will probably be several years before the product can begin clinical trials; but the Clemson discovery holds tremendous promise as a topical treatment for millions of acne sufferers around the world. This research is funded with Hatch and matching state funds.

Food packaging films that fight bacteria and that are edible are among the innovations being developed by Clemson scientists. One study is testing the digestibility of heat-pressed films made from soy and corn protein that could be recycled as animal feed instead of being sent to landfills. Another study is testing a food packaging film that contains natural antimicrobial ingredients, which protect consumers against common meat-borne bacteria, such as E. coli, salmonella and listeria.

The scientists are investigating packaging films made from shrimp and crab shells that may also have medical applications, such as treating burns or wounds. In another study, the researchers are seeking ways to improve the packaging used to ship fresh fruits and vegetables for distribution to grocery stores or as gifts to consumers. Another investigation found that adding honey prior to cooking turkey meat increases the product's shelf life and quality by preventing oxidation. The natural qualities of the honey also enhance the flavor, aroma and color of the meat.

To apply science to the popular herbal medicine movement, Clemson scientists are studying the growth and medically active ingredients in ginkgo, echinacea, goldenseal, common mullein and St. John's Wort. They are also investigating the possibility of producing these plants and extracting their useful ingredients for potential commercial applications by South Carolina growers. Other studies are being conducted in cooperation with the Medical University of South Carolina to seek the specific compounds in raspberries, strawberries, grapes, and walnuts that inhibit tumor growth. This research is funded with Hatch and matching state funds.

Crab shells are being turned into food supplements and other valuable products through a new process developed by Clemson scientists. The process is a closed-loop system that extracts the remainder of food-grade meat from the shells, then reduces the shells to their primary materials – chitin and calcium – with no discharge into the environment. The chitin can then be converted into chitosan and glucosamine, products that are in high demand by the food supplement industry, the medical profession, manufacturing, and agriculture. Calcium is also used as a food supplement.

Through ultra-filtration technology, the new system uses 100 percent of the shellfish, compared to only 10 percent in traditional seafood processing operations. As a result, both processors and environmentalists are excited about the system. This research is funded with Hatch and matching state funds and was state specific.

S. Barefoot, SC-1100026 (864) 656-7610 sbrft@clemson.edu
R. Thomas, SC-1700129 (864) 656-5697 rthms@clemson.edu
D. Camper, SC-1700087 (864) 656-5743 dcamper@clemson.edu
J. Rushing, SC-1700124 (843) 766-3761 jrshng@clemson.edu
P. Dawson, SC-1700069 (864) 656-1138 pdawson@clemson.edu
K. Cooksey, SC-1700121 (864) 656-4613 kccokse@clemson.edu
B. Kunkel, SC-1700099 (864) 656-5690 bkunkel@clemson.edu
R. Hilderman, SC-1700108 (864) 656-3586 hilderr@clemson.edu
V. Haley-Zitlin, SC-1700104 (864) 656-7716, vivianh@clemson.edu

Goal 3: A healthy, well-nourished population.

Planned FTEs in goal three were initially set at -0-. There were 7 FTEs assigned to projects in this goal area. Expenditures were not initially planned under this goal, But with the dynamics described at other locations in the narrative the investment in this goal was \$696,142.

Agriculture and Forestry Research invested \$696,142 in research initiatives in the area of fruit. This is significantly lower than the \$1,307,643 originally planned for 2000 where

the fruit program was presented in goals one and four, and was the result in part to the retirement of key faculty in the fruit area and the buy out of other key faculty by the university. Funding projections for initiatives under goal three will be revisited and likely revised in an anticipated modification, which is planned for submission no later than June 30, 2002. Cooperative extension worked closely with research faculty in the fruit area. This research is funded with Hatch and matching state funds and was state specific.

Key Theme: Fruit

Efforts to improve fruit crops in South Carolina have produced a new variety of peach rootstock, trademarked as Guardian™, that protects trees from nematode damage. Another study found that grafting an interstem section of a cold-hardy variety delays blooming and protects peach crops from late season cold snaps. Other studies are comparing tree training systems, planting densities, and fertigation to maximize yields and profitability per acre. In addition, the scientists are evaluating alternative fruit and nut crops to diversify South Carolina production, including Kaki persimmons, Asian pears, chestnuts, and paw paws. The scientists are also developing integrated pest management practices to minimize the use of pesticides; producing chromosome maps to identify important genes in fruit production; and improving post-harvest handling technologies to ensure a high quality, safe product for consumers.

South Carolina is known for its abundant peach crops, but late freezes and a variety of pests can threaten production levels and growers' incomes. The fruit program was formed to address these challenges and to investigate new fruit industries for the state. Research efforts in peaches include constructing chromosome maps to identify the genes responsible for disease resistance, cold hardiness, fruit quality, and other desirable traits. The scientists are also investigating the use of interstems to delay blooming and are continuing to test the new Guardian™ peach variety developed to withstand nematode damage. Reflective plastic mulch is being tested to improve peach and apple harvests by increasing the amount of sunlight reaching the trees' inner branches. This produces more fruit and a deeper red color that commands premium prices. Alternate fruit and nut crops are also being evaluated to diversify South Carolina production, including Kaki persimmons, Nashi pears, Chinese chestnuts, and American paw paws. In addition, the researchers are studying integrated pest management practices to minimize the use of pesticides and are developing improved post-harvest handling technologies to ensure a high quality, safe product for consumers.

Clemson scientists have joined colleagues at North Carolina State University and the University of Georgia to create a Regional Virtual Small Fruit Center. The center will provide growers with production and pest management expertise from scientists at all three universities, via a web page based at Clemson. This research is funded with Hatch and matching state funds and was state specific.

G. Reighard, SC-1700005 (MRF) (864) 656-4962 grghrd@clermson.edu
D. Layne, SC-1700101 (864) 656-4961 dlayne@clermson.edu
C. Gorsuch, SC-1700181 (864) 656-5043 cgrsch@clermson.edu
S. Scott, SC-1700063 (864) 656-5745 scott@clermson.edu
A. Abbott, SC-1700120 (864) 656-3060 aalbert@clermson.edu
D. Kluepfel, SC-1700141 (864) 656-5728 dklpfl@clermson.edu
G. Schnabel, SC-1700159 (864) 656-6705 schnabe@clermson.edu

Goal 4: Greater Harmony between agriculture and the environment

Planned FTEs in goal four were initially set at 13.99. There were 5 FTEs assigned to projects in this goal area.

Agriculture and Forestry Research planned to invest \$481,401 in the water quality area in 2001 and an additional \$1,165,202 in other programs with components in goal four. Actual expenditures approached \$550,982 in the key theme under goal four of water quality.

Key Theme: Water Quality

Scientists are working to balance economically viable development with good water quality in South Carolina. The researchers are studying the ways that housing developments, golf courses, agriculture, and urban development can cause movement of fertilizers, pesticides, and other contaminants into surface and ground waters.

They are also investigating the use of natural and man-made wetlands to remove and process these contaminants before they enter the state's waterways. These low-cost, low-energy, and low-maintenance best management practices will preserve the quality of our water resources and allow continued economic development throughout the state. This research is funded with Hatch and matching state funds and was state specific.

Ozone is being considered for disinfecting food processing wastewater. More specifically, work is underway to determine the efficacy of ozone to reduce biochemical oxygen demand (BOD5) and chemical oxygen demand (COD) in food processing plant wastewater that has high concentrations of fat, protein, starch or locust bean gum. These chemical moieties represent different nutritional or additive families commonly used in the food industry. This information is important for determining the resistance of certain microorganisms in food matrices when ozone is employed as a disinfecting agent. This research is funded with Hatch and matching state funds and was state specific.

J. Hayes, SC-1700100 (864) 656-4042 jhayes@clermson.edu
S. Klaine, SC-1700106 (864) 646-2377 sklaine@clermson.edu
A. Greene, SC- 1700105 (864)656-3123 agreene@clermson.edu

V. Quisenberry, (state 1000599) (864) 656-3521 vqsnbrr@clermson.edu
M. Schlautman, (SC-1700133) (864) 656-4049 mschlau@clermson.edu

Goal 5: Enhanced Economic opportunity and quality of life for Americans

Planned FTEs in goal five were initially set at 1.49. There were 4 FTEs assigned to projects in this goal area. Expenditures were originally projected at \$406,003, but actual spending came to \$549,932, as components of programs in other goals were removed and turfgrass and fire ants were selected as key themes.

Agriculture and Forestry Research planned to invest in turf grass research at the level of \$850,255 in 2000. Actual expenditures were Approximately \$332,495. There were two new turf grass releases, CN29 (Bermuda) and CU9502T (Fescue). Expenditures for fire ant research were projected at \$60,431. But, as a result of increased stakeholder demand for research in this area, and the trial release of the phorid fly, expenditures for 2000 approached \$217,437.00.

Key Theme: Turfgrass

Golf courses, commercial lawn care companies, sod producers, and property owners are all benefiting from work by Clemson turfgrass scientists. These researchers are seeking ways to improve the quality of turfgrass through breeding and management techniques while they protect the environment by reducing the use of pesticides.

Innovative management techniques are being studied, including a spray that protects warm season grass from frost damage in winter and a subsoil aeration system that protects cool season grass from heat damage in summer. The scientists are also using genetic engineering to develop a Bermuda grass that stays green year-round.

Other studies are being conducted to control insects, weeds, and diseases in a cost-effective and environmentally sensitive manner. Investigations are being conducted on commercial installations, as well as on research greens at the university's Pee Dee Research and Education Center in Florence and on the main campus. This research is funded with Hatch and matching state funds and was state specific.

B. Martin, SC-1700168 (843) 662-3526 sbmrtn@clermson.edu
B. McCarty, SC-1700163 (864) 656-0120 bmcerty@clermson.edu
S. Klaine, SC-1700179 (864) 646-2188 sklaine@clermson.edu
V. Baird, SC-1700167 (864) 656-4953 vbaird@clermson.edu
B. Mazur, SC-1700134 (864) 656-2607 amazur@clermson.edu
J. Camberato, SC-1700032 (843) 662-3526 jcmbrt@clermson.edu

Key Theme: Fire Ants

Calling on nature to help in the fight against fire ants, Clemson scientists are testing the use of biological controls from the ants' native South America. One of the ants' natural enemies is the phorid fly, which decapitates fire ants by laying its eggs inside the ants. As the larva develops, it moves into the ant's head and causes the head to fall off.

In another study, the scientists introduced a naturally occurring disease into fire ant colonies. The disease reduces the ability of the queen to lay eggs so the colony dies out over a period of six to eight months. Both these natural controls have been shown to affect fire ants exclusively.

Other studies are examining the impact of fire ants on wildlife and the economy, as well as on human health. In addition, researchers are developing best management practices to control fire ant populations while reducing pesticide use. This research is funded with Hatch and matching state funds and was state specific.

M. Horton, SC-100216 (864) 656-3113 mhorton@clemson.edu
C. Gorsuch, SC-1700181 (864) 656-5043 cgrsch@clemson.edu
G. McCutcheon, SC-1000535 (843) 766-3761 gmccthn@clemson.edu
S. Miller, SC-1700042 (864) 656-5786 smllr@clemson.edu

B. Stakeholder Input Process

Actions taken to seek stakeholder input that encourages their participation:

The Public Service Activities Advisory Board receives mailings during the year between meetings to provide policy and program updates. Speakers are brought in to introduce topics to the board in advance of the board's deliberation sessions. Board members are provided with tours of research initiatives on campus and optional presentations on topical issues after the formal meetings conclude. Every opportunity is taken to have the President of Clemson University, the Provost and other Vice Presidents speak to and interact with the board members.

The Dean and director of Public Service Research participates in meetings and events of commodity groups in the state and meets with special interest groups to continuously engage in the process of identifying research issues and opportunities in the state. Every effort is made to build working relationships with other campus units to gauge the needs of their stakeholders and to take public service research university wide.

Process used to identify individuals and groups who are stakeholders and to collect input from them:

New stakeholders are identified to the Dean and Director at events and meetings across the state and nation, from suggestions provided by existing stakeholders, and through the suggestions of faculty and staff. Input is collected though individual and group

discussion sessions, though participation on the PSA Advisory board and through survey instruments.

How collected input was considered:

Comments and recommendations provided by the PSA Advisory Board are circulated to all management levels and distributed electronically to research faculty. Reports are made back to the board on the action taken by Public Service Research in response to the Board's recommendations. The recommendations of the board and its committees are used in making decision on program development and initiation.

C. Program Review Process

There have been no significant changes in the program review process since the five-year plan of work.

D. Evaluation of the Success of Multi and Joint Activities

Agriculture and Forestry Research supported 30 MRF (Multi-state Research Funds) projects, which run on the federal fiscal year, and invested \$3,302,770 on those projects in FY2001. AFR researchers conduct research in MRF projects in all four regions of the country (Southern, Western, North Central, Northeast).

The annual CRIS reports on the contributing projects of Clemson faculty to MRF projects are due in CRIS on April 1, 2002. As MRF projects are completed, the full report of the MRF project is due in the USDA/MRF office on March 15, 2002. Three MRF projects involving AFR faculty ended in FY2001, and eight will end in FY2002.

While the actual results for FY2001 are not available at this writing, AFR has conducted a systematic and detailed review of the most recent CRIS reports on these research initiatives which were submitted in April of 2001 and has monitored the progress of each project through site visits, and discussion sessions with the faculty, their respective department chairs and with the appropriate Associate Dean for the goal areas.

Without identifying the outputs, outcomes and impacts of each individual project, it is clear through an extensive evaluation process that these initiatives are addressing critical agricultural issues, which are presented in the five-year plan of work.

1. Did the planned programs address the critical issues of strategic importance including those identified by the stakeholders?

Agriculture and Forestry Research invested approximately \$3,302,770 in thirty regional research projects. The Hatch Multi State funds come to approximately \$676,992 and the AFR match from state funds came to approximately \$2,625,778. This state match exceeds the federal requirement by approximately \$1,353,984. Of this amount \$554,377 was invested in three regional projects included in programs above including: Lewis - (Goal 1 (\$177,792), Reighard - Goal

3(\$234,961), and Scott - Goal 1 (141,164). Excluding these three projects, AFR exceeded the required state match by \$799,607, and this is a reflection on the quality of the research faculty who are in national demand for their expertise. The outputs, outcomes and impacts of regional projects are very beneficial to the citizens of South Carolina.

By their very nature, regional projects are designed by experts in the respective fields from all of the participating states, normally in the Southern Region to address critical issues identified by faculty and stakeholders in all of the participating states. The Southern Region also runs selected program concepts by identified stakeholder groups.

2. Did the planned programs address the needs of underserved and under-represented populations in the state?

AFR faculty participated in regional research projects, which addressed youth and family issues, food safety issues and a wide range of plant and animal issues. The research was geared to meet the needs of the state's population, to include those groups considered underserved or under-represented. This was accomplished through stakeholder input, and an awareness on the part of research faculty of the needs of all segments of the population. Results will be transferred to these user groups through the Cooperative Extension Service, web based communications mediums, public service announcements and outreach through the county programs.

3. Did the planned programs describe the expected outcomes and impacts?

Each regional project detailed the outcomes and impacts as a part of the application process. These outcomes and impacts were developed at the meetings, which set the regional projects in motion. The progress of these regional initiatives are monitored by AFR, the other states and by the Southern Experiment Station Directors.

4. Did the planned programs result in increased program effectiveness and/or efficiency?

The concept of regional research initiatives is built around assembling the best talent to approach a problem and allowing faculty to develop the research design to maximize the effectiveness of the program in meeting the stated goals, and in achieving the maximum efficiency by utilizing talent and resources from multiple states.

E. Multistate Extension Activities
Not Applicable

F. Integrated Research and Extension Activities

Agriculture and Forestry Research invested \$385,086 in integrated Research and Extension Activities. A review of programs and initiative activities in 2001 identified a number of clearly defined examples of integrated research and extension activities and these were substituted for the more general areas initially planned. The areas appearing on Form CSREES-REPT (2/00) below reflect the Hatch funds committed to integrated research and extension activities and they will be included in the modification of the Plan of Work in June of 2002.

U.S. Department of Agriculture
 Cooperative State Research, Education and Extension Service
 Supplement to the Annual Report of Accomplishments and Results
 Multistate Extension Activities and Integrated Activities
 (Attach Brief Summaries)

Institution: Agriculture and Forestry Research
 State: South Carolina, Clemson University

Check one: Multistate Extension Activities
 Integrated Activities (Hatch Act Funds)
 Integrated Activities (Smith-Lever Funds)

Title of Planned Program/Activity	Actual Expenditures
	FY 2001
Turfgrass	\$120,000
Water Quality	30,000
Farm Management	35,325
Marketing	107,940
Information Technology	31,500
Extension Agriculture and Natural Resources	<u>60,321</u>
Total	\$385,086

Director _____ Date _____
 Form CSREES-REPT (2/00)

Narrative Summaries:

Turfgrass: AFR provided funds to support cooperative extension staff and programs in selected counties in conjunction with on-going turf research initiatives.

Water Quality: Lab facilities were made available for analysis by the extension waste management initiative team, and selected pieces of laboratory and field equipment were made available to support extension efforts.

Farm Management: Farm services are provided which directly support extension demonstration plots and field days. These activities are ongoing and require a significant commitment of equipment and farm staff to insure quality demonstration plots and field days.

Marketing: The organizational unit which is responsible for all aspects of research and extension public relations/marketing activities are supported jointly by research and extension.

Information Technology: AFR shares the expenses for supporting the information technology office which coordinates computer support at all on and off campus.

Extension Agriculture and Natural Resources: AFR provides half of the support for the Extension position of Director Agriculture and Natural Resources