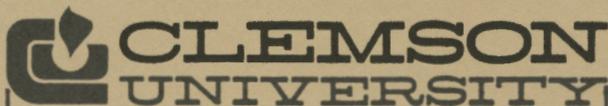


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Annual Report 1977-1978

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Annual Report 1977-1978

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PREFACE

Because of one man's dream of a better life for South Carolinians, Clemson University was established to respond to people's needs. Throughout its 85 years of service to the State and nation, Clemson has remained a "people oriented" institution. Its teaching, research and public service activities touch people's lives every day.

As a state land-grant institution, Clemson's earliest commitments were to the "study of agriculture and natural science," and later to the expansion of industrial growth. These early commitments continue, but they expand as mankind's needs change. Today, Clemson is responding to a wide range of problems affecting South Carolinians and people everywhere: developing new food sources and better food production and delivery systems; seeking a safer, better quality environment; improving health care delivery; creating innovative education programs; developing new industrial technology; broadening recreational and other opportunities for self-enrichment; and seeking to improve man's other basic needs, clothing and shelter.

Through these and other commitments, the university's nine colleges and Graduate School are exploring all fields of knowledge to improve the quality of life.

Clemson began this commitment to people when its doors opened in 1893. That day was the realization of a dream come true for Thomas Green Clemson, a man of wisdom and courage who saw the great need in South Carolina for a scientifically oriented institution of higher learning to provide the state's young people with the training needed to build a better society.

So strongly was he committed to the establishment of such an institution that he bequeathed his land and other real and personal property to the State for use in creating the "high seminary of learning" he envisioned.

Mr. Clemson was a scientist and agriculturalist who came to South Carolina from Pennsylvania in the 1830s and married a daughter of John C. Calhoun, foremost statesman in South Carolina history and vice president of the United States from 1825-32.

In 1889, the year following Mr. Clemson's death, the South Carolina General Assembly accepted the terms of his will, and, following the decision of the United States Supreme Court to uphold the will, the state of South Carolina and the full Board of Trustees proceeded to convert the dream of Thomas Green Clemson into the reality of Clemson Agricultural College.

The College also was established under the Morrill Land-Grant Act passed by Congress in 1862. Clemson, therefore, is a member of the national system of state universities and land-grant colleges.

In 1964, in recognition of expanded offerings of the institution, not only in the areas of agricultural and mechanical arts, but also in the sciences and arts, the name of the institution was changed to Clemson University.

The University now has nine colleges and the Graduate School. The colleges are Agricultural Sciences, Architecture, Education, Engineering, Forest and Recreation Resources, Industrial Management and Textile Science, Liberal Arts, Nursing and Sciences.

This report presents a comprehensive look at Clemson University, its programs and activities during the 1977-78 academic year.

ACADEMICS

Graduate Studies and University Research

Arnold E. Schwartz, Dean

Undergraduate Studies

Claud B. Green, Dean

University Extension

Samuel M. Willis, Dean

College of Agricultural Sciences

Luther P. Anderson, Dean

College of Architecture

Harlan E. McClure, Dean

College of Education

Harold F. Landrith, Dean

College of Engineering

Lyle C. Wilcox, Dean

College of Forest and Recreation Resources

Benton H. Box, Dean

College of Industrial Management and Textile Science

Wallace D. Trevillian, Dean

College of Liberal Arts

H. Morris Cox, Dean

College of Nursing

Geraldine Labecki, Dean

College of Sciences

Henry E. Vogel, Dean

College of Agricultural Sciences

AGRICULTURAL INSTRUCTION

The mandate and stipulations clearly stated in the will of Thomas Green Clemson "to afford thorough instruction in agriculture and the natural sciences connected therewith" continue to define the mission of the instructional programs in agriculture at Clemson University. The emphasis on quality education in agriculture is further augmented by the service-oriented philosophies of land-grant institutions and by the fact that Clemson is the only institution in the State at which the bachelor's or higher level degree is offered in agriculture.

Agriculture is a dynamic field of critical importance to human welfare. The traditional role of agriculture has been to provide food, feed and fiber to humankind and for domestic animals. This has become a greater challenge in light of increasing population and decreasing land area for production. It is further complicated by governmental restraints and regulations. Of course, the producer is a business man; profit is a necessary consideration in meeting the traditional challenge. In recent years the role of agriculture has expanded more into business and management and now more than ever includes conservation issues and increasing emphasis on mechanization. All programs, including instructional programs, must continuously grow and evolve; otherwise, the fundamental mission of instruction in agriculture cannot be met.

To meet Clemson's mission:

- Instruction is principles-based and problem-solving-oriented; recognition and solution of practical problems are stressed, but programs are not vocational because of the foundation of principles on which problem solving is based.
- Instructional programs are continuously reviewed and revised, from the content of the existing courses to the development of new courses, to full curricula review and revision to ensure the best total education.
- In keeping with the total educational mission and in response to the maturation of Clemson to a broadly recognized and respected university, the growth and development of graduate programs at the master's and doctoral level continue to be encouraged.
- Special programs are developed and administered to help meet the educational needs of all classes of agriculturalists in the many diverse forms of agriculture throughout the State.

Major curriculum revisions were implemented during the academic year. These reflected the efforts of recommendations made by an *ad hoc* curriculum study committee. In addition, continuing minor changes were recommended and approved, including a significant restructuring of academic programs designed to qualify students to apply for schools of veterinary medicine.

First semester enrollment for the college was nearly 1,100. In keeping with current trends, almost 40 percent of the undergraduates are women, and more than 50 percent of the students come from "nonfarm" backgrounds. This situation demands that continuing efforts be made to clearly illustrate the relationships between principles taught in the classroom and many laboratories and practices as they exist under actual conditions.

Growth in enrollment has slowed slightly according to 1978-79 predictions. However, career opportunities and demands for graduates remain high. Efforts to inform high school counselors, as well as prospective students, must be expanded so that qualified graduates will be available to fill these positions.

The total graduate program is growing slowly as funds become available. Applications continue to outnumber available support for graduate students, and demand for and placement of graduates have been good. The greatest growth in the total graduate program in the college has been in the professional master's degree programs. These have been popular and effective in preparing students for many career opportunities.

A total of 215 students graduated in agriculture this year. This number includes 160 Bachelor of Science and 29 Master of Science degrees, 20 professional degrees (Master of Agriculture and Master of Nutritional Science), and six Ph.D.'s.

Agricultural Technology Programs

The College of Agricultural Sciences continues to cooperate with the State Board for Technical and Comprehensive Education and the State Department of Education in guiding the agricultural technology programs offered at selected technical colleges in the State. In addition to the advisory role played in curriculum development, the college cooperates by sharing facilities for study and/or demonstration at Clemson as well as at several research stations.

Currently, 12 two-year programs and a single one-year certificate program are offered at eight technical colleges throughout the State. Enrollments in these have increased from 371 in 1974-75 to

545 in 1977-78. Job opportunities and salaries for graduates have been good, and prospects remain favorable. The cooperative arrangement involving Clemson which was initiated in 1966-67 has helped develop sound programs without apparent duplication among units or with programs at Clemson. Such cooperation will help ensure continued success of these technological programs.

Efforts also were made to strengthen the agricultural transfer program at South Carolina State College at Orangeburg. Relatively few students have chosen the pre-agricultural program at South Carolina State and subsequently transferred to Clemson to complete degree requirements.

Continuing Education

To help them keep pace with the rapid changes affecting agriculture, varied formats are needed to serve scientists-teachers, as well as producers and agribusiness professionals in all fields of agriculture. There is a continuing high level of interest in various types of in-service training programs, as well as conferences, workshops, seminars and professional meetings. Continuing education activities sponsored by the College of Agricultural Sciences served personnel in the Cooperative Extension Service, hortitherapy technicians, vocational agriculture teachers, and veterinarians. Continuing education credit was granted for numerous programs; more than 140 individuals received Continuing Education Units for one or more programs.

In the spring 1978, for the first time in more than 15 years, a regular course (Agronomy 622) was offered for credit off campus. Arrangements were made for faculty at the Pee Dee Experiment Station in Florence to teach the evening course. Enrollment was less than anticipated; however, reaction to the course by students and faculty was uniformly favorable. This represents another area of service into which the college will move slowly as demands and capabilities justify.

College of Architecture

Urbanization, industrial growth and development, and economic, sociological and physical change have occurred throughout America during the last three decades, but in no region has it been more dramatic than the Southeast. These, as with all rapid changes, have resulted in opportunities and problems, many of an environmental nature.

The College of Architecture embraces the spectrum of environmental design professions that includes architecture, urban design, city and regional planning, landscape design, and visual studies and importantly, the implementation of design through building construction and management. Therefore, the college is directly and deeply concerned with these very opportunities and problems.

Students of the college are involved in sequences of coordinated undergraduate and graduate studies for service in these design professions whose task it is to shape the physical environment in which we live. Their future designs will affect the quality of life of all citizens of South Carolina.

Education for the rapidly changing design professions has great need for continuing study and program assessment—study that embraces professional needs, analysis of the several curricula, the upgrading of teaching effectiveness and pinpointing the most vital areas requiring public service and research. The studies must be followed with action. Actually these studies have reoccurred each year, but were given a special emphasis in 1977-78.

In recent years the College of Architecture has developed a workable system for self-study. Areas demanding continuing or ad-hoc investigation are first explored by established committees. Among these college committees are the Curriculum Committee, the Committee on Innovative Teaching, the Research and Public Service Committee, and the Publications Committee. Each was given a careful assignment for 1977-78. It was expected that each committee would formulate recommendations which might ultimately result in the adding of new courses, the dropping of old ones and revising course content or teaching methods. Periodically more sweeping alterations in curriculum or program organization are expected.

Issues such as these were studied with considerable success during the year and many changes and improvements were implemented. One such important improvement was the development

of an updated, integrated and interrelated set of course syllabi for every offering of the college. After a long period of faculty preliminary study, the college requested and received a special grant for a workshop-retreat held at High Hampton, N. C., in December at the close of fall semester. This three-day workshop-retreat provided the optimal setting for the debate and consensus that was needed and achieved. The faculty gave up vacation time to participate. The exchange of views alone made the venture worthwhile.

These studies and changes were made in the search for excellence, despite the fact that the school had been visited by the National Architectural Accrediting Board the previous year and had received a very favorable report.

STUDENT QUALITY

The school philosophy asks that the most motivated and talented students be sought and the best selected for the College of Architecture and then put in contact with a gifted faculty.

The college has experienced a growing national reputation which has resulted in increasing numbers of young people seeking admission to its programs. Accordingly, the predicted grade-point ratios of those selected are the highest in the University. In 1977-78 a College of Architecture graduate student was one of two selected in the nation for a scholarship in the area of Health Care Facilities Planning. Another student received a National American Institute of Architects (A.I.A.) scholarship. Two students are enrolled in the college as R. F. Poole Scholars, one as a Daniel Foundation Scholar and three others received university-wide scholarships.

Students are intensively involved in professional study, yet are active in important ways. For example, the Clemson Student Chapter of the A.I.A. fielded an imaginative campaign to attract the National Student Convention of that organization to South Carolina. The campaign was successful and the event was held in Charleston during the Thanksgiving recess. The Forum was outstanding in plan and execution. It was completely organized by Clemson architectural students and resulted in much favorable comment around the country.

As an established part of the students' professional education, an internship of 1,000 hours of approved office experience is required before the first professional degree is awarded. This stipulation has further welded the relationship between the practicing professional

offices and the college and has increased the students' appreciation for continuing education opportunities, both in and out of school.

FACULTY DEVELOPMENT

One of the most important responsibilities of an architectural college is to recruit an able, creative faculty and to provide the resources and process for keeping it current and of maximum effectiveness.

An annual lecture series sponsored by the Clemson Architectural Foundation has been provided for the last 22 years to give both stimulus to the students and continuing education to the faculty. The 1977-78 series and the one planned for 1978-79 provide a catalyst for debate, dialogue and further study.

The College of Architecture arranged and hosted the program for the Southeastern Regional Architectural Schools Conference in Clemson, October 2-4, 1977. The theme, "The Architect and Construction Management," was very timely, and five speakers of national distinction led discussions. This entire offering was conceived as an exercise in faculty development.

The administration and faculty of the college have been active nationally, presenting papers and reports at 28 conferences and workshops ranging in type from the A.I.A. National Design Seminars at Harvard University, the National Society for Photographic Education Conference in Monterey, Calif., to the American Acoustic Society meetings in Providence, R. I. Participation in many of these was made possible through grants from the Clemson Architectural Foundation.

The establishment of the 1973 Charles E. Daniel Center for Building Research and Urban Study in Genoa, Italy, provides greater breadth and depth to the offerings of the college. Each of the graduate students in all the college areas may participate for a semester at the Center. Faculty members are assigned in rotation for a year of residence to serve not only as teachers but to accelerate their own professional development in an optimal setting.

CONTINUING EDUCATION

The architectural profession is moving to require participation in continuing education as a basis for the continued licensing of its members. In response the Board of the Clemson Architectural Foundation moved in 1977-78 to help the College of Architecture expand continuing education offerings and budgeted funds for this purpose. Plans have been made to offer a number of vital and timely courses for 1978-79.

The dean of the college conducted the first continuing education course for practicing South Carolina design professionals in the Overseas Center. Twenty-two participants from architecture, landscape architecture and city planning offices were involved, and were sufficiently pleased to request that such courses at the Center be an annual occurrence. Clemson alumni from Puerto Rico and Venezuela also attended. These summer institutes have great potential as a faculty development resource.

RESEARCH AND PUBLIC SERVICE

For more than 20 years the college has actively initiated its students to the solution of real-world environmental design problems by undertaking public service projects in all parts of the State. These have included city planning, community design and development, health care planning, building system development, historic restoration and preservation, low cost housing design, regional land use planning, prototype solar design studies and mental health facility systems, and urban transportation.

Of great significance have been those studies that have evolved in successive contracts over a period long enough to assess sequential outcomes and modify the following project assumptions.

The study of the central business districts of many South Carolina towns has provided valuable data as well as study process research. This was recognized by the Mary Reynolds Babcock Foundation which gave the college a three-year grant to study small and deserving towns. Work with these funds has included Andrews, Westminster, Pendleton and Belton, a deprived area of Charleston and a number of other towns.

Of particular note are research and public service conducted for, and in collaboration with, the South Carolina Department of Mental Health. The unique Village System of care delivery has received national coverage and three actual villages have been established. The Werner G. Bryan Center was dedicated this year.

The Rudolph Lee Gallery presents at least 12 major exhibits each year and provides a rich resource to the entire University and a public service to the broader community. Gallery shows are funded as a project of the Clemson Architectural Foundation; original shows are developed and circulated from Clemson as well as gallery showings of travelling exhibits in each of the visual arts, with particular emphasis on the environmental arts.

College of Education

Almost three quarters of a million students attend schools and colleges in South Carolina. The quality of these institutions depends to a large extent upon the preparation and training of teachers and other professional personnel. Since an informed citizenry is attained through a quality school system, the College of Education strives through theory and in practice to provide exemplary programs and services to state citizens. The college combines and utilizes resources of the entire University in preparing personnel for highly-specialized positions at all educational levels from kindergarten through the university.

One of the continuing purposes of the college is to interpret and to evaluate for its constituents such areas as new fields of study, the influence and stress of societal changes and progress in methodology and delivery technology.

The college is committed to identifying problems crucial to education and to promoting and providing services which will aid in their solution. It exercises leadership in obtaining the cooperation and assistance of other institutions in coping with state-wide educational concerns.

The college discharges its responsibilities through well-planned programs which provide for diverse goals in education, through research and experimentation and through in-service and staff development services.

EVALUATION OF GRADUATES

The ultimate criterion for determining the effectiveness of teacher education programs is the performance of the graduates. The College of Education raised its admission requirements in 1977 and developed a more comprehensive approach to curriculum development. The Systems Approach to Curriculum Development requires continuous evaluation and broad input from professional educators, practitioners and students.

Students in teacher education are carefully selected. They are evaluated at three check points: initial entry, at the end of 60 semester hours and prior to student teaching. Incoming freshmen not making appropriate SAT entry scores in mathematics and in English are automatically placed in developmental (remedial) mathematics and English.

Follow-up evaluation of graduates is conducted on a continuing basis. The program consists of base line career data, graduates' evaluations of the teacher education program and employer's evaluation of graduates.

Scores on National Teacher Examinations (NTE) are a part of the evaluation process. Subscores on the common examination and in the teaching field are used in program analysis. The percentage of students making the appropriate score for certification is larger at Clemson University than at any other state-supported institution.

IN-SERVICE PROGRAMS AND SERVICES

The college conducted 106 off-campus courses at 35 locations in the State, with 2,300 students enrolled. Cooperating private colleges—Columbia, Erskine, Newberry, Presbyterian and Wofford—taught 17 courses for 90 teachers who received graduate credit at Clemson.

The Department of Industrial Education conducted an institute which identified and prepared potential teacher educators for vocational education. Twenty who met the minimum requirements for teaching college level courses were given special training in preparation for teaching off-campus courses for trade and industrial education teachers. These institute participants will be employed as visiting faculty members, as the need arises, to teach in-service courses at any location in South Carolina.

In-service education continues to receive high priority in agricultural education. Graduate and undergraduate courses were taught at off-campus centers to serve present and prospective teachers more adequately. A total of 245 graduate students enrolled in graduate courses in 1977-78. These students were either pursuing a master's degree, 30 hours beyond the master's degree and/or recertification credit.

A new course, "Identifying Students With Special Needs," was offered during the fall semester. This course was taught off campus at three strategic locations: Cooper River Area Vocational Center in

Charleston, Lexington Area Vocational Center in Lexington and Enoree Area Vocational Center in Greenville. Another new course, "Modern Topics and Issues," also was offered during the first summer session of 1978. This three-week course focused on implementing Performance-Based Vocational Education Utilizing V-TECS Catalogs.

The Vocational Education Media Center received three federal grants which enabled the development of all the materials needed to conduct four two-year programs and a number of shorter vocational programs. The Center conducted 59 workshops attended by 1,149 persons and made 21 field test-site visits.

The Department of Industrial Education received grants from three different sources during the year which provided special services for vocational administrators, trade and industrial education teachers, and industrial education students.

A proposal for \$13,000 was funded by the Educational and Professional Development Act to provide an in-service institute for 70 vocational administrators in South Carolina. The Department of Industrial Education held several two-day seminars on "Refining Management Skills" for vocational education directors and trainees. A model management plan was developed to be used as a guide for all area vocational centers in South Carolina. This institute was the fourth Professional Development program sponsored by the Department of Industrial Education.

The Appalachian Regional Commission funded a \$128,000 proposal submitted by the Department of Industrial Education through the State Department of Education. This project has provided an in-service institute for 140 trade and industrial education teachers in the state's Appalachian counties. Two visiting faculty members were employed for this project and have provided an outstanding program utilizing the individualized approach to competency-based teacher education. A needs assessment was made for each of the 140 teachers and competency-based activities were prescribed to meet the identified needs of each.

The Printing Industries of the Carolinas Association (PICA) has continued to cooperate with the State Department of Education and Clemson University in supporting curriculum development activities in Industrial Education. A grant of \$27,300 was awarded to support the development of new units of individualized instructional materials and to evaluate and revise learning activity packets already in use.

The Department of Agricultural Education assisted vocational agriculture departments in program evaluation through a Standardized Achievement Testing program designed to measure the cognitive domain of students enrolled in off-farm occupation courses. This service:

- Provides standardized pre-tests and post-tests for agricultural mechanics, ornamental horticulture, forestry and sales and services.
- Develops new standardized tests in environmental sciences and natural resources occupations, turf and lawn management, pulp-wood harvesting, and other areas as the need arises.

These tests are administered as pre- and post-tests by the vocational agriculture teachers and the answer sheets are returned to Clemson for scoring and interpretation. Each teacher is able to receive feedback on how much progress students make from fall to spring, and is able to compare the performance of the students and the school with others throughout the State by percentile ranks. More than 1,300 students were tested this year.

SPECIAL ACTIVITIES AND SERVICES

The Department of Industrial Education received a \$50,000 scholarship fund which provides three \$1,000 scholarships to undergraduate students who plan careers in graphic arts. The first three recipients were honored during Honors and Awards Day. The Edgar H. Snider Memorial Scholarship became a reality through the efforts of the PICA Foundation and contributions by members and friends of PICA. Some funds came from the sales of curriculum materials developed by the Department of Industrial Education in cooperation with the State Department of Education and PICA.

The Military Science Department and the Department of Aerospace Studies sponsored the Sixth Annual Tiger Drill Meet which provided competition for Junior ROTC drill teams from high schools throughout the State.

The Department of Elementary and Secondary Education sponsored the Clemson Reading Conference and a full slate of programs and meetings of the Clemson Chapter of Phi Delta Kappa and Kappa Delta Pi. Approximately 1,000 educators participated in the 26th Annual Conference of Children Under Six.

College of Engineering

The state of South Carolina looks to the College of Engineering to provide expertise and leadership in those areas of technology that affect people's daily lives, areas such as energy, industrial development, transportation and environmental protection.

The College of Engineering strives to meet this challenge by working:

- To supply the trained engineering manpower needed for technological progress and economic development in South Carolina and the nation.
- To conduct research that expands engineering knowledge, education and practice.
- To serve the public by taking engineering education and expertise beyond the campus to the practicing professional in government and industry.

Despite budget constraints, academic year 1977-78 was a productive one for the faculty. Robert Nowack, associate professor of civil engineering and 1976 Clemson University Alumni Master Teacher, was recognized as Engineering Educator of the Year by the South Carolina Society of Professional Engineers. Thomas M. Keinath, professor and head of the Environmental Systems Engineering Department, won the second annual McQueen Quattlebaum Faculty Achievement Award for outstanding contributions to the science of wastewater treatment and control.

College of Engineering teaching classrooms and laboratories, research laboratories and special equipment are now housed in eight buildings, the last of which was first occupied in 1970. In these buildings are unique facilities for real time/hybrid computing, pilot plant testing of ceramic materials, instrument calibration, experimental surgery for biomaterials development, instructional systems development and polymer research.

Although the college is a growing and healthy organization in many ways, it is operating at its limits in others. There is little prospect for increasing faculty loads or developing major new research interests. Financial constraints over the past five years, particularly with regard to personnel, have been difficult to manage, but have produced some beneficial results. Programs have been examined rigorously and some with weak prospects for the future have been phased out. Others have been consolidated to encourage

centralization of resources where possible. Goals and criteria for achievement in the future have been more specifically identified.

The opportunities for the college to achieve these goals are good, but it will take an easing of financial constraints and the approval of additional physical facilities and special equipment to get the job done.

EDUCATION

The college offers eight undergraduate degree programs, 10 master's level and nine doctoral level programs. Six basic and four advanced level engineering programs are accredited by the Engineer's Council for Professional Development.

A five-year, dual-degree program allows students to earn basic baccalaureate degrees from Wofford, Lander, Newberry or Presbyterian Colleges, followed by a B.S. degree in engineering from Clemson. Engineering undergraduates represent about 85 percent of all students participating in Clemson's cooperative education program, which allows students to alternate during their sophomore and junior years between school and full-time work in industry, business, and agencies.

Almost 1,800 undergraduates enrolled in engineering for the 1977 fall semester, which broke the previous enrollment year record set in 1958. Projected new freshman and transfer student enrollment should boost that number by about eight percent for fall 1978.

The demand for engineers, particularly at the baccalaureate level, continues to grow. This has created strong competition among companies for graduates and has pushed salaries to record highs. The average 1978 Clemson engineering graduate had more than three job offers to choose from and began his career earning more than \$17,200. Demand for women and minority engineers continues to be extremely strong. To meet these challenges, the college has set a goal of increasing undergraduate enrollment by five percent a year for the next 10 years.

There are 172 students enrolled in master's level programs in engineering, and 26 are pursuing doctoral degrees. More than 30 students have taken advantage of the college's external Master of Engineering degree program, which allows them to pursue a professional graduate degree at home while working full time. Three students have completed requirements for master's degrees in electrical engineering; mechanical engineering also is offered externally.

To strengthen these graduate programs and accompanying research, the college has as a goal the enrollment of 400 graduate students by 1983-84.

RESEARCH

College of Engineering research expenditures for 1977-78 exceeded \$1.5 million, a record high, on 80 active projects sponsored by federal, state and industrial grants and contracts. This was a 13 percent increase in research activity over the previous year. Total research grants-in-force, including multi-year contracts, now approach the \$4.5 million mark.

Research in engineering has three essential objectives: 1) to seek new knowledge, 2) to seek answers to both short-term and long-term technical problems of the State and nation, and 3) to support advanced-level educational programs by providing basic and applied research projects for graduate students to "cut their teeth on" under the supervision of experienced engineering researchers.

Energy research projects in excess of \$1 million make up the largest single area of research interest in the College of Engineering. By seeking cost-effective energy alternatives and applying sound design principles to energy conservation, Clemson engineers are helping the State and nation move closer to energy independence.

A partial list of new projects initiated during 1977-78 will give an indication of the breadth and scope of research in engineering at Clemson:

- A comprehensive and workable conservation program for the textile industry is being developed by an interdisciplinary team of Clemson engineers, in cooperation with the S. C. Energy Management Office, under a \$445,000 grant from the U. S. Department of Energy (DOE).

- How reliable are solar cells which convert sunlight directly to electricity? Can they withstand 20 or more years of exposure to earth's environment? Two electrical and computer engineers at Clemson have a \$120,000 contract with Jet Propulsion Laboratories, prime contractor to DOE on solar cell development research, to find out.

- Reducing the number of accidental cold-water drowning deaths is the aim of a \$229,000 Coast Guard-funded research project on hypothermia. A team of systems and biomedical engineers at Clemson is conducting controlled tests of 18 different cold water protection devices and three rewarming therapies.

- Environmental engineers are testing a new low-cost method of sewage treatment at a plant in Easley. The project, sponsored jointly by the Department of Health and Environmental Control, tests an experimental "overland flow" system which uses grass to filter wastewater as it trickles down a gently sloping hill.

PUBLIC SERVICE

Because individual members have broad knowledge and experience in a dozen or more technical fields, the faculty of the College of Engineering represents a resource of considerable magnitude to the State. Faculty members willingly share this expertise by serving, at no additional pay, on regulatory and advisory boards and as expert advisers to agencies such as the State Development Board, Highway Commission and Nuclear Advisory Council. The amount of time each faculty member contributes may seem small, but the total is significant; of the 100 men and women faculty members in engineering, hours equivalent to five full-time faculty positions were devoted in 1977-78 to such service to the people of South Carolina.

Another major area of public service by faculty members is through the college's Continuing Engineering Education (CEE) program. Technology transfer to the practicing engineer and, through him, to his business or government employer has an immediate and beneficial impact on the economy of the State. During the past year engineering faculty served more than 8,000 people through 332 CEE courses, seminars, workshops and symposia, making the Clemson program one of the strongest in the Southeast.

A significant new service activity was added this past year. A Summer Engineering Program for Minority Students was initiated with the help of more than 25 business and industrial supporters. The program brought 60 youths who had completed the sophomore year in high school to campus for a two-week introduction to careers in engineering. These same students will have the opportunity to return next summer to work on more complex engineering projects while 60 more students begin the program.

College of Forest and Recreation Resources

The College of Forest and Recreation Resources engaged in a major self-analysis for all its programs in teaching, research and extension this year. The faculty determined the strengths and weaknesses in each area, set goals and priorities on what needed to be

accomplished in the next five years and developed plans on how this was to be done. The analysis was accomplished for both the Department of Forestry and the Department of Recreation and Park Administration. Significant findings from the study and other accomplishments for the year are reported by departments.

DEPARTMENT OF FORESTRY

Clemson University is the only university in South Carolina engaged in the professional aspects of forestry. Through the Department of Forestry, Clemson has the only educational program in the State that offers the Bachelor of Science degree in Forest Management or in Wood Utilization. In addition, a graduate degree program leading to a Master of Science or a Master of Forestry degree is available.

Public service programs in the department include the only forestry research conducted by a state organization and an extension forestry service that is carried out as part of Cooperative Extension Service.

Teaching

Forest Management Curriculum: The Department of Forestry has graduated 428 professional foresters since its establishment in 1956 as South Carolina's center for professional forestry education. Current enrollment in this curriculum is 212. Fifty additional freshmen and transfer students are expected to enter this fall. This offering has been accredited by the Society of American Foresters as a professional degree program since 1962.

Wood Utilization Curriculum: This undergraduate curriculum was inaugurated in 1973. The program, emphasizing the role of wood as a basic forest resource, allows for specialization in wood science, wood industries management and forest management.

Graduate Program: Twenty-six students were accepted in "full status" for graduate study in forestry. Three others were enrolled for "postgraduate" work to become eligible for graduate study. Five of the students are studying in wood utilization, the remainder in forest management. Eleven students received master's degrees during the year.

Research

Departmental faculty is organized into four multi-discipline, problem-oriented research teams. Three teams are headquartered on the main campus while the fourth makes up the majority of

the work of The Belle W. Baruch Forest Science Institute at Georgetown. Overall, 75 research projects are carried out by forestry faculty.

The mission of the forest management research team is to enhance the quality of life and economic strength of South Carolina by determining solutions to forest-based multiple-use problems through a program of team-oriented research.

This year the team worked on six research projects and initiated three new ones. Research projects included determining methods of collecting forest management information, the effectiveness of the Soil Bank Program in South Carolina, development of methods for locating forest recreation sites, utilization of satellite imagery in assessing forest fire impacts, and studies of endangered and threatened plants of the State.

Research accomplishments included the determination: of the South Carolina distribution of the endangered species *Shortia galacifolia*; that satellite imagery was economically feasible and functional when applied to forest fire impact evaluation; that soil factors of bulk density, infiltration rate, and depth of the A₀₀ and A horizon were impacted the greatest when forest sites are used for recreation; and that forestry incentive programs are working and are primarily attracting landowners who do not earn their primary incomes from their lands.

The timber production research team provides information that will help solve the major timber production problems preventing full forest productivity in the State.

Eight scientists of varying disciplines—including forest pathology, forest genetics, silviculture, and forest management—are on this team. The members cooperate with federal, state and private agencies in an effort to provide the forest landowners with solutions to their timber production problems. Research on forest protection, stand regeneration and manipulation, and improving forest site productivity also are conducted by the group.

The range of studies completed is: nutrient interception by pine foliage during prescribed burning; the performance of a promising, hardy pine hybrid in the dry Sandhills region; growth of white pine regeneration following clearcutting versus partial cutting; a performance comparison of loblolly and slash pine plantations on Piedmont and Sandhills sites; the impact of root rot on pines in the Sandhills region; the renovation and effect of sewage effluent

application on Piedmont forest soils; the beneficial effects of lifting and storing loblolly pine and yellow poplar seedlings on survival after planting; the stimulation of pine naval stores production with foliar chemical sprays.

New studies undertaken include the diversity of plant communities in the Sandhills as related to site quality and forest overstory; pine red heart fungus in relation to an endangered woodpecker habitat needs; nitrogen fixation of non-legumes in the Sandhills; and chemical weed control in Christmas tree plantations.

Other projects by team members include gaining acceptance of a promising hybrid Christmas tree for South Carolina; producing a brochure of wide interest on "An Ecotour of Interstate 26"; providing a report to the Governor's Office on energy for South Carolina; assessing the research needs of the state tree nurseries; and conducting a regional symposium on water relations of forest soils.

Efforts by the wood utilization research team were devoted to a wood residue utilization study and to studies of wood and bark properties. A five-year research plan also was completed. Recommendations include the initiation of research in wood preservatives, wood drying and the mechanical properties of wood.

The program of The Belle W. Baruch Forest Science Institute encompasses education, research and public service, but its main thrust is in research. The Institute faculty is organized into a biological productivity research team which is executing a coordinated program to describe and quantify the biological productivity of the coastal plain forest types in South Carolina. Results of the investigation will allow the inter-relationships among the forest resources to be evaluated which will enable the biological trade-offs among these resources to be determined for selected silvicultural systems.

Status of other projects includes:

1. Collection of data on two feral hog projects was completed this year. The data is being analyzed and manuscripts prepared. A total of 175 animal months of monitoring feral hog movement has been completed. Mean home range size for boars was 290 hectares and 358 hectares for sows.
2. A total of 111 songbird species were banded during the March-April banding period. Preliminary data analyses of the two-year study indicate the presence of an understory layer from 1 to 3 meters in height is critical to songbird use of forest stands.

3. Research continues on the ecology of the Red-cockaded woodpecker and the feral hog; new studies were initiated on the ecology of American woodcock and the whitetail deer.
4. A survey continues on the ground water hydrology on Hobcaw, influence of evapotranspiration on water table level and tree growth, and fresh water input into North Inlet.
5. A study was initiated on the analysis of forest succession patterns on Hobcaw. Biomass production of old growth loblolly and longleaf pine stands continues and a new project was initiated to evaluate the use of native beach vegetation on dune stabilization on DeBidue Beach.
6. Major research activities in land-use management were directed toward natural regeneration of longleaf pine, comparison of relative growth rates of loblolly and longleaf pine trees on the same sites, and a search for ecotypes of loblolly pine that are more tolerant to wet site conditions (water-logging).

Four Belle W. Baruch Fellows were supported in graduate level studies by funds from The Belle W. Baruch Foundation.

Extension

Forestry extension activities were directed at timber marketing, prescribed burning, regeneration and wood utilization.

One significant accomplishment in the timber marketing area was making stumpage price information readily available for the first time to landowners through county Extension offices. Each office now receives a monthly report on timber prices and can use this information in a variety of ways to assist landowners in practicing proper timber marketing. Another activity in the marketing area was a series of landowner meetings around the State.

The addition of a forestry specialist to the Pee Dee Extension Team will permit a more effective program to be carried on in the Pee Dee region of the State.

Other activities include short courses and workshops for forestry employees in topics such as kiln drying, pulpwood production and log and lumber grading.

DEPARTMENT OF RECREATION AND PARK ADMINISTRATION

Teaching

The department's faculty spent countless hours of study which resulted in the adoption of substantive changes in the curriculum. These changes should lead to a level of professional preparation more attuned to the needs of the leisure service fields. Clemson University, through its Department of Recreation and Park Administration, was selected by the U. S. Forest Service, USDA, as one of two institutions offering programs which will be used initially to improve the competencies of its professional employees in recreation resource management. The first graduate student through this program will be enrolled in the fall 1978 semester.

Research

The department's research program expanded considerably during the year with support from the U. S. Forest Service and from the U. S. Army Corps of Engineers.

Research topics include:

1. Relationships between the Public and Private Sectors in Supplying Forest Recreation.
2. Inventory of Non-Developed, Rural Recreation Resources in South Carolina.
3. Impact of Different Boot Sole Configurations on Hiking Trail Soils.
4. Visitor Analysis—Regional Visitor Center at Hartwell Lake.
5. The State of the Art of Data Collection Techniques Concerning Wilderness and Dispersed Area Recreation Use.

The most recent project grants presented have included:

1. Forecast of Recreation Demand for the Upper Savannah River Basin with Emphasis on Clark Hill Reservoir and Adjacent Public Lands.
2. An Information System to Assess the Existing Supply, Developmental Characteristics and Desired Relationships Between Public and Private Suppliers of Outdoor Recreation In and Near Urban Areas.
3. Analysis of U. S. Forest Service Inventory Data of the Non-Developed Rural Recreation Resources in South Carolina.

Extension

The department continues its service to people and their needs. Growth is common in programs operated through the Outdoor Laboratory. Sessions were held for the mentally retarded and for the emotionally disturbed through Jaycee Camp Hope and Camp Logan, respectively. Camp Sertoma continues to serve the underprivileged, and with an additional sponsorship of Lions' International, was expanded to include an experimental session for blind youngsters. The session was so successful that four weeks of camping for the visually impaired have been planned for the summer of 1979, and for the first time, a one-week camping session has been planned for hemophiliacs for August 1978. The South Carolina Jaycees met its commitment of \$125,000 for the Outdoor Laboratory. Sertoma International of South Carolina concluded its fund-raising efforts and has \$100,000 which will support construction of the third sub-camp in the Laboratory. A federal CETA grant helped improve the overall operation of the Lab. A subsequent proposal has been submitted for funding next year.

Substantial progress has been made toward the completion of Kresge Lodge, the central kitchen and dining facility at the Laboratory. Funds have been provided by the legislature to complete the Outdoor Laboratory. The completion, including Kresge Lodge, will enable the department to serve even more than the 60 groups which used the Laboratory during 1977-78.

College of Industrial Management and Textile Science

"We're growing to meet your needs."

That certainly sounds like the tag line for a TV commercial, but it also concisely describes what's happening in the College of Industrial Management and Textile Science. Expansion—both in physical space and in terms of undergraduate majors—continues to be a key word in this college's activities as it enters its second year of being accredited by the American Assembly of Collegiate Schools of Business.

As the 1977-78 year ended, work on the first phase of the renovation of Serrine Hall, which houses this college, was also nearing completion. This is the first major renovation of Serrine Hall since it was built in 1938.

The initial phase of the \$2-million plus project will be ready for the opening of fall semester, 1978-79. This portion of the total

project, which will provide some 38,000 square feet of additional usable space, includes utilization of the 16,000-square-foot attic which will become Sirriner Hall's fourth floor.

This new area is completely air-conditioned and heated and provides needed space for laboratories and other activities. Phase two should begin in the fall of 1978.

As in the previous year, this college was again the largest at the University in terms of undergraduate majors—1,775 for fall 1977 compared with 1,640 the previous year, a 7 percent increase. The college has experienced a 15 percent increase in undergraduate majors since the fall of 1975 when 1,523 were enrolled.

It's these students and the faculty who teach them who are accomplishing the most outstanding work in this college. And we are equally as proud of our students after they have become alumni. Graduates are well-absorbed by industry, government and institutions.

Also, it is significant to include that this college continues to receive substantial funds from the Sirriner Foundation—support which allows many things which just would not be possible with tax dollars alone. In 1977-78, the Foundation made available \$85,000 to benefit this college's programs.

Following is a look at the four departments within the college and the Office of Professional Development.

DEPARTMENT OF TEXTILES

Textile Department activities reflect balanced efforts in teaching, research and public service, as well as a strong dedication to maintaining the tradition associated with being the academic arm of the textile industry in South Carolina.

Major efforts have been directed to critical reviews of academic course offerings and curricula emphasis, research capabilities and direction, and public service responsibilities and objectives. Documented results of this self-study are forthcoming in a booklet, "A Profile of Clemson Textiles."

This work will include a review of our mission; how we evolved; how we are organized; and how we serve the textile industry in terms of teaching programs, research capabilities, and public service activities.

Enrollment in textile courses is at a level comparable to recent years. All 1978 graduates who actively sought employment received placement offers.

Several presentations were made to industry gatherings and individual textile firms emphasizing the cooperative education dimension of textile education. Response was encouraging and several programs have been initiated within the State.

Another area of student-industry relationship that has been explored by textile faculty involves a positive summer intern program. A trial program is already under way. Should this approach to encouraging more familiarity of students with industry, and industry with textile students prove to be as beneficial as anticipated, arrangements can be made to place all interested students in productive summer intern positions during 1979.

Departmental objectives focus on having the world's best academic program dedicated to the textile industry. To do this requires informed, motivated and dedicated students as well as faculty and facilities. Positive industry interaction and expanded recruiting emphases are key elements in obtaining these quality students.

DEPARTMENT OF INDUSTRIAL MANAGEMENT

Effective teaching and high quality programs continue to receive the major emphasis in the department. A \$91,800 grant to the college has resulted in a stronger administrative management curriculum with a concentration in safety and health. Received from the National Institute for Occupational Safety and Health, the \$91,800 have made possible the recruitment of faculty with the training and experience necessary to emphasize the managerial aspects of safety and health programs and to modify the curriculum to more closely suit the needs of the industrial community. The market for graduates of this program continues strong. Current enrollment is 125 students.

Departmental programs continue to grow, although at a somewhat slower rate than that of the mid-seventies. Spring enrollment in programs administered by this department included 967 undergraduates, 54 on-campus graduate students, and 175 in the Clemson-Furman MBA program.

DEPARTMENT OF ECONOMICS

Teaching basic economics to undergraduates has always been a key responsibility of this department's faculty. This year saw that responsibility increased once again as students in record numbers enrolled in the introductory courses.

For example, in a given semester, almost 80 percent of the department's 1,800 students were enrolled in entry level courses. For many, the introduction to economics which they receive in these one- and two-semester courses represents their total exposure to the important concept underlying our American enterprise system. Because of this, the department, where possible, has placed seasoned teachers in the classroom with freshmen and sophomore students. This approach is being expanded, and plans are under way for larger sections of introductory economics to be taught by full professors.

Along with increased enrollments at the introductory level, the 1977-78 year brought additional student interest in advanced courses as well as record numbers of majors and minors in economics. To further enhance undergraduate programs, the faculty has thoroughly reviewed the Bachelor of Arts and Bachelor of Science programs in economics, and in the process, has introduced changes based on student, alumni and faculty suggestions. Thus, the 1978-79 year began with a "new slate"—two undergraduate programs which include 150 majors.

Carrying economics outside the classrooms of Sirrine Hall, a tradition in the department, was continued this year as the faculty prepared and delivered three forums for the larger university community. Work with public school teachers in the field of economic education has also expanded. With significant support from the Sirrine Foundation, other private gifts and federally funded projects, Dr. Holley Ulbrich developed a year-round program which reaches 300 public school teachers and every school district in South Carolina.

Besides this impact in state, the materials and programs developed for teachers are used in Georgia and Colorado.

DEPARTMENT OF ACCOUNTING AND FINANCE

This department continued in an environment of growth. A total of 103 students were graduated with a major in accounting or financial management. With approximately 200 new accounting and financial management majors accepted for fall enrollment, this department served some 600 majors among the 2,000 students enrolled each semester in courses in accounting and finance.

About 50 percent of the May graduates in accounting accepted employment in public accounting as compared with a typical 25 to 30 percent going into public accounting from most accounting programs. Employment opportunities for graduates were excellent in 1977-78 which translated into reasons for the additional new students seeking admission for enrollment at Clemson for the study of accounting and finance.

In accordance with the widely accepted view that the education of an accountant for entry into the profession should require completion of a five-year program, the department initiated a letter of intent to propose a five-year program including a master's degree. Students in this proposed program would complete the present four-year curriculum and receive the Bachelor of Science degree in accounting. Those qualified to enter graduate school would be invited to enter the fifth year.

The Master of Professional Accounting would be awarded to those who successfully complete the fifth year, with expectation that the graduate should pass the Uniform Certified Public Accountant's examination or the exam for Certified Management Accountant.

During the next year, the department will prepare a proposal for a five-year program to be submitted for approval when the State Commission on Higher Education again considers new programs.

OFFICE OF PROFESSIONAL DEVELOPMENT

More than 1,000 different companies were represented by the 4,324 persons who attended 135 short courses, conferences and seminars sponsored by this office. It is noteworthy to add that this office marked its 20th anniversary in 1978. Since its establishment, more than 20,000 persons have participated in the 600 plus programs conducted by this office.

In the past year, a total of 95 management courses were presented, 28 textile courses, eight in economics and three in accounting. The majority of the participants came from the Carolinas,

Georgia, Tennessee and Virginia. Internationally, 21 person attended from Canada, three from Puerto Rico, and 24 from other foreign countries such as Germany and Brazil.

College of Liberal Arts

It has been said that no university can ever become a great university without a strong program in the humanities and the social sciences. The College of Liberal Arts recognizes that dictum. It is founded upon the idea that a self-governing society requires of its citizens a basic general education which will enable them, regardless of their occupational or professional interests, to lead fuller lives, more useful lives and to contribute to the general welfare.

But even with those lofty ideals, the College of Liberal Arts, like all colleges at Clemson, is steeped in a tradition of practical endeavor.

SERVICE

The college sponsors a two-week summer course for South Carolina school teachers on Energy Alternatives, surely one of the most pressing problems the youth of today must face as the adult decision makers of tomorrow.

The Department of Languages also has a very practical, business orientation as it encourages Clemson students to major in fields such as engineering and textile science and minor in a modern foreign language. That is a forward-looking career option when you stop to remember that South Carolina is fourth in the nation in the amount of foreign investment in the State.

Through the Robert A. Taft Seminar in Government and Practical Politics, the Department of Political Science provides the state's teachers with practical knowledge of how government works, and arms them with information to involve young people in government decision making. It is a measure of the quality of the College of Liberal Arts that this program has been called the finest in the United States by the Taft Institute's director.

One important contribution of the college to the University is sponsorship of a large number of student and university organizations and extracurricular activities, many of them open to the public without charge.

The Department of English sponsors the Clemson Players, the Debating Team, and assists with management of the *Tiger*, the *Chronicle* and the *Calhoun Literary Review*. It presents annually a

well-known and widely attended Children's Literature Symposium. In 1977 it initiated an innovative course designed to give special instruction to freshmen with poorly developed verbal skills, and it continues to conduct a writing laboratory open to students with any type of writing deficiency. It also offers workshops throughout the State for public school teachers and for industrialists and businessmen interested in business and technical writing.

The Department of Music sponsors and manages the Concert Band, the Marching Band, the University Chorus, the Liberal Arts Chamber Music Series and the University Concert Series.

The Department of Languages sponsors annually a foreign language and drama festival with several dozen casts from four states competing in four languages, and a language declamation contest which draws more than 100 participants from several states. It also conducts a foreign study program in France and South America.

The Department of Political Science sponsors the university's Model United Nations Representation Team, which received an outstanding delegation award.

The Department of Psychology sponsors a popular club for its major students and provides consultation services to mental health centers of the State.

ORGANIZATION AND INFLUENCE

The College of Liberal Arts is made up of the Departments of English, Languages, Music, History, Political Science, Psychology, and Sociology. All departments except Music offer the Bachelor of Arts degree; English and History offer the master's degree as well.

Though only about 15 percent of Clemson undergraduates major in the various disciplines of the liberal arts, the influence of the college is extensive because approximately one-third of the teaching of the entire University is done under its auspices. Sixty-five percent of the faculty hold the doctorate; graduates of the college readily enter the outstanding graduate and professional schools of the country.

PROFESSIONAL ACTIVITY AND SCHOLARSHIP

An unprecedented five members of the History Department received fellowships from the National Endowment for the Humanities. The department is also assisting the local National Public Radio outlet in the research and production of a series of programs in women's history entitled "Women Themselves," and it is continuing its pro-

gram on the history of opera entitled "Plots and Prologues." A unique facet of the department's work is a history book review service used by over 80 newspapers in more than 39 states.

The Department of English publishes the "South Carolina Review," a distinguished journal providing a forum for distinctive literary scholarship and original poetry and fiction. Two issues of the Review were published to commemorate the journal's tenth anniversary, one issue of which was devoted largely to an analysis and appreciation of the work of James Dickey.

The "Journal of Political Science" continues to be sponsored by the Department of Political Science and edited by members of the political science faculty.

Both the Department of Political Science and the Department of Sociology extended their public service activities during 1977-78 by furnishing consultation to political units and social service agencies throughout the State.

College of Nursing

A number of significant advancements were achieved within the College of Nursing during the year.

- The Department of Continuing Education was formally established with the appointment of Judith Chodil as director. Chodil previously served as associate director of Continuing Education at New York University.

- Gloria Tanner, associate professor of Nursing, was appointed assistant to the dean for Research Development. Tanner will continue her own research interests and assist other faculty members with initiating and developing specific research projects. She also is involved in compiling a feasibility study for a doctoral program in nursing.

- Dedication of the \$3.5-million College of Nursing building was held April 3. Jessie Scott, assistant surgeon general, was guest speaker for the occasion, which was well attended by other national, state and local friends of nursing and the University.

- The Baccalaureate Program's honor society was recognized by Sigma Theta Tau, the national nursing society, with Gamma Mu Chapter installed April 3 at the college with 96 inductees.

EDUCATION PROGRAMS

Enrollment in the Baccalaureate Degree Program was 376 at the end of the year, including the May graduates. That number includes 124 first-year students and 78 seniors who graduated. Nursing student Kim Christy received the American Association of University Women award, the Phi Kappa Phi award and the Faculty Scholarship award for scholastic achievement during her four years at the University. She graduated with a 4.0 grade-point ratio.

Seven new students entered the graduate program, increasing total enrollment to 19. Four students who completed their course studies and met their thesis requirements received Master of Science degrees in Nursing. A federal traineeship of \$20,000 awarded to the college provided for the payment of tuition and maintenance of eight students. A \$3,000 Alumni fellowship was awarded to Wanda Cain.

The Associate Degree Program admitted 50 freshmen and graduated 41 students. Age range of the students in this program is 18-40 years. Three men are enrolled and four practical nurses were given advanced standing, having passed first semester challenge exams. Graduates are serving in staff positions of hospitals, many remaining within the northwestern part of the State.

CONTINUING EDUCATION

Development began on a broad design for continuing education, directed toward meeting the needs of nurses, individuals in allied and health disciplines and the general public. Emphasis has been focused on the nurse population to be served. More than 500 nurses attended 28 continuing education offerings during the year.

The Emergency Medical Services (EMS), Critical Care Nursing/Continuing Education Project (supported by monies awarded by the EMS Division, Department of Health, Education and Welfare to the South Carolina Appalachian Region, EMS Council) reached more than 340 registered nurses working in critical care units of hospitals in the Appalachian region.

A two-day workshop on Nursing Theory Development—first of its type to be held in the State—attracted 20 nurse educators and administrators. Participants came from within the State as well as from Florida, Kansas, Tennessee, Maryland, Arkansas and Georgia.

RESEARCH

Research is now beginning to emerge within the college, with emphasis on clinical studies. Gloria Tanner was awarded \$2,000 by the University Research Committee for her study on "Therapeutic Control of Blood Pressure in Individuals with Essential Hypertension as a Function of Locus of Control." Veronica Rempusheski is collaborating with Robert Borgman of the College of Agricultural Sciences on "Blood Pressure Screening: The Younger and Older South Carolinian." She presented a paper to the South Carolina Academy of Sciences at its meeting in March. Several papers from the College of Nursing were published this year. Opal Hipps' "Nursing Electives: How Many and What Nature?," appeared in the September issue of *Nursing Outlook*, and Gloria Tanner's paper, "Heart Failure in the MI Patient," was published in the February issue of *The American Journal of Nursing*.

College of Sciences

Extensive planning was conducted in 1977-78 toward the establishment of a new, separate Department of Computer Science, effective July 1, 1978. The college was host to two large annual meetings, the South Carolina Academy of Science and the Mathematical Association of America.

The college continues to carry one-third of the teaching load of the University as a result of programs for its own majors coupled with its service function to the other eight colleges. The number of majors has remained almost constant, a result of leveling in enrollment for the University as a whole. Continued concern over environmental and energy problems, as well as interest in health affairs, has maintained a constant pressure towards strong interest in study in the sciences.

DEPARTMENT OF BIOCHEMISTRY

The Bachelor of Science degree program in biochemistry initiated in 1975 had 48 students enrolled in 1977-78. In addition to the undergraduate majors, 22 students were pursuing graduate degrees in biochemistry. About 800 total students were enrolled in biochemistry courses. Four Master of Science and one Bachelor of Science degrees were awarded.

Two undergraduate majors deserve special recognition. Cynthia Sessions of Columbia studied at Oak Ridge National Laboratory as a summer student research participant. Jane W. Cutler of Green-

ville received the Michelin Scholarship to study in France for the summer.

Seven outside research grants were held by faculty members: two from the National Institute of Health, one each from the National Science Foundation, Water Resources Research Institute, Muscular Dystrophy Association of America, South Carolina Heart Association and NATO. The sponsored research included projects dealing with a serum enzyme and its regulation to muscular dystrophy, the maturation of red blood cells, and herbicide degradation.

Nine papers were given at national meetings, 11 at regional meetings, 14 outside seminars were presented by faculty members and six manuscripts were published.

Eighteen seminar speakers visited the department. A. Krall of the Medical University of South Carolina presented a minicourse on "Oxidative Phosphorylation," and E. E. Baillie and J. H. Keffer of Anderson Memorial Hospital presented a minicourse on "The Clinical Applications of Biochemical Measurements."

BIOLOGY PROGRAM

Two new introductory biology courses are now offered in the Biology Program. "Principles of Biology" is a two-semester sequence designed for science majors in the College of Sciences. The pilot program for this course began in 1976 with an enrollment of 90 students. Approximately 300 students enrolled in this course during 1977-78. "General Biology" is a two-semester sequence designed for students from a variety of disciplines. Most of these students are job-oriented and do not plan postgraduate education. This course was begun in the fall of 1977 with a total enrollment of 843 students. Approximately 1,200 students are expected to participate in this course during 1978-79.

The offices, preparations facility and four teaching laboratories housing the Biology Program were renovated during the summer of 1977. Equipment for the teaching program was purchased through a National Science Foundation Instructional Scientific Equipment Program Grant. A complete audio-visual system was also purchased with National Science Foundation funds and is being used for instruction in the laboratories. Audio-visual materials are presently being developed for teaching the handicapped.

Two new faculty members were added to the Biology Program staff. A faculty of five, together with graduate assistants from

biochemistry, botany and zoology, are responsible for the laboratory and lecture instruction for the 1,500 students enrolled in the program.

The faculty participated in several high school student tours and lecture programs during 1977-78. Requests for service activities of this nature have increased in number and are encouraged by the faculty.

DEPARTMENT OF BOTANY

The department introduced relevance courses at the undergraduate level and new graduate level courses to expand the breadth and coverage of the field of botany during the year. The department's traditional course offerings continue to be well attended; however, following a large increase in introductory plant physiology enrollment, there has been a commensurate increase in the enrollment of graduate level physiology and plant cell biology courses. The majority of students served by these courses are enrolled in graduate plant science curricula in agronomy, forestry, horticulture, bioengineering, zoology and plant pathology, as well as botany.

Sponsored research activities included investigation into aquatic fungi as mosquito control vectors; a floristic survey of the controversial Trotter's Shoal Dam Site; and investigation into the biology of noxious aquatic weeds. Research in intermediary photosynthetic pathways and ultrastructural relationships continues, as did the writing of a new plant anatomy text. Initial steps toward "computerization" of the herbarium were taken. This move to automated cataloging of the growing plant collection will make Clemson one of only three schools in the country that uses the computer for this purpose and will make possible the retrieval of a large variety of types of plant lists.

Because of the increased use of computing services by all biological sciences in the college, the department has made room available and now maintains and supervises a remote computing facility for the departments housed in Jordan Hall.

The department continues to serve the general public, industry, agribusiness and occasionally the medical profession in identification of higher and lower plants and fungi.

DEPARTMENT OF CHEMISTRY AND GEOLOGY

R. A. Abramovitch became head of the department in August 1977.

Enrollments in chemistry and geology courses have been increasing, necessitating an active search for more teaching assistants.

The University appointed a committee for the renovation of Brackett Hall, and the detailed plans for Phase 1 of these renovations were submitted to the administration.

A total of 26 papers were published by the faculty in refereed journals, and 22 papers were presented at scientific meetings. In addition, numerous invited lectures were given throughout the country and in Europe. Ten grants to faculty members have been funded by federal, state and private agencies. There are seven post-doctoral fellows in the department, an all time high. These came from many countries, including Poland, Czechoslovakia, Switzerland and India, as well as the United States.

A distinguished Industrial Seminar Speaker program, aimed particularly at the undergraduate and graduate students, was begun in 1977-78. In addition, the department had 27 seminar speakers representing several countries, including Israel, Poland, England, Finland and Brazil, as well as the United States. Other highlights include Robert D. Hatcher's election to the presidency of the South-eastern Section of the Geological Society of America, Joe F. Allen's presentation of a two-day workshop in curriculum development and instructional methods to the Division of Sciences at Mississippi College, George M. Haselton's participation in the International Symposium on the Genesis of Till at the University of Stockholm and H. Keith McDowell's receiving the prestigious Alfred P. Sloan Fellowship.

The student affiliate chapter of the American Chemical Society, an organization for developing professional attitudes in undergraduate chemical students, received national recognition by the society for the fifth consecutive year.

DEPARTMENT OF MATHEMATICAL SCIENCES

Prompted by the National Sciences Foundation (NSF) grant "An Alternative in Higher Education in the Mathematical Sciences," interest continued to run high in the graduate programs of the department. Eleven faculty members visited the department for at least a semester last year to learn about Clemson's new graduate programs in the mathematical sciences or to contribute to those programs. In an August 1977 conference at Clemson, representatives from government, business and industry, as well as from academia, deemed the master's program in mathematical sciences at Clemson the model graduate program for the 1980s. Members of the faculty were called upon to present the new M.S. degree program or its justification to mathematical scientists at meetings or conferences in Pullman, Wash.; Atlanta; and at Clemson. Part of the meeting of the Southeastern Section of the Mathematical Association of America, hosted by Clemson in the spring of 1978, was devoted to such a presentation. The department also hosted a meeting of the Classification Society.

The department's unique blending of mathematics, computer science, statistics and operations research in the mathematical sciences is reflected in the undergraduate degree programs with their various applied sciences options. The number of undergraduate majors in programs of the department grew to nearly 200. Demand for their services as mathematical scientists in government, business and industry is high.

The undergraduate enrollment in courses of the department has grown so that it is now one-eighth of that of the whole University.

One faculty member continues into his eighth year as project director for a research contract in statistics with the Office of Naval Research. The NSF Grant "An Alternative in Higher Education in the Mathematical Sciences" is in its third year.

The department renders public service in many ways. One of the faculty served as a member of the prestigious Conference Board of the Mathematical Sciences. Another was elected president of the Southeastern Section of the Mathematical Association of America (MAA) and is also in charge of the Advanced Placement Program in Mathematics for the Educational Testing Service. Another was elected a fellow of the American Statistical Association, while one of his colleagues is a journal editor for that association. Another was named chairman of the Education Committee of the Society for Industrial and Applied Mathematics (SIAM). Others are spon-

sored lecturers for SIAM and MAA. John D. Fulton was appointed head of the department, effective July 1, 1978.

DEPARTMENT OF MICROBIOLOGY

The department has developed an emphasis in the field of marine microbiology. An important food supply for fish in shallow coastal waters is the sea-grasses, about which little is known. It has been found that bacteria are associated with their root systems, and studies are under way to determine how these microbes contribute to the growth and development of the plants.

A project dealing with crude oil pollution in South Carolina coastal waters revealed that crude petroleum can be transformed either by microbial degradation, microbial emulsification or physical weathering. The findings show that the degradation products are more toxic to marine life than the original petroleum.

Marine bacteria play an essential role in recycling nutrients in the oceans for use by plants and animals. It has been found that when these bacteria are attached to particulate matter, they are more efficient at recycling the nutrients.

Coastal wetlands are responsible for generating most of the food and nutrients for near-shore marine life. Several projects were continued concerning the microbial ecology of coastal salt marshes. The objective is to understand how nutrients are produced and consumed in this ecosystem.

Departmental research has revealed that some clinical cases of gonorrhea do not respond to treatment with penicillin. A recently completed study indicates that two new drugs, Renoquid and Trimethoprim, when used in combination, may provide an alternative means of treatment.

In one study it was found that a bacterium which causes major destruction of crops, such as tomatoes and other vegetables, is susceptible to very low concentrations of copper and zinc. The possibility of controlling the disease with these metals is being investigated.

The first research grant awarded to Clemson by the National Cancer Institute was obtained by a microbiology faculty member to support an investigation of how proteins react with genetic material. The study will enhance knowledge of how cells control their growth, which is of paramount importance to an understanding of how normal cells change into cancerous ones.

Each person in the United States generates approximately 800 pounds of waste cellulose per year. Much of this is recycled by microbes that produce cellulase enzyme, which breaks down cellulose into a mixture of sugars. How this enzyme is produced and how its production is controlled are being investigated, with the ultimate objective of being able to dispose more efficiently of cellulosic wastes.

A small scale, continuously operating laboratory reactor has been developed that allows studies of the anaerobic conversion of cellulose to methane gas by a mixture of two kinds of bacteria. Such a laboratory system will give information that will aid in the development of large scale biological reactors for generating methane as a supply of fuel.

DEPARTMENT OF PHYSICS AND ASTRONOMY

During 1977-78 the educational, research and public service activities of the department continued to function actively. Undergraduate enrollments in physics and astronomy courses were at an all-time high.

The department's activities in the area of research and graduate studies continued to be productive. The phenomenon of "Josephson Tunneling," in which superconducting electron pairs penetrate a thin insulating film between two superconducting metals, has led to an increased understanding of superconductivity and to the construction of superconducting microwave oscillators and switching devices. Josephson tunneling devices to date have always involved a thin planar insulating layer between two metallic electrodes. Studies at Clemson have revealed some interesting and fundamental differences between planar Josephson tunneling devices and cylindrical Josephson devices, in which a thin cylindrical insulating layer separates two superconducting metals. Cylindrical Josephson devices have been constructed and studied in the department's laboratories, and the full range of their potentialities is being explored. There is a substantial possibility that their use will lead to significant advances in superconducting memory and switching devices.

Another area of departmental research had to do with the physical properties of sodium and potassium azide crystals. These substances are used in automotive installations to inflate air bags, since they easily and almost instantaneously detonate to produce large volumes of harmless nitrogen gas. But they must be stable

in automotive applications, and not be subject to spontaneous detonation. The stability of these substances is critically dependent upon the presence of small traces of metallic impurities in the crystalline material, and upon the presence of imperfections and dislocations in the crystal lattice. Department studies are directed toward understanding the diffusion and electromigration of impurity atoms in these crystals, and the effect of crystal imperfections and dislocations on diffusion and electromigration phenomena. Efforts are being made to obtain federal funding for these studies.

The department's planetarium continued to be a popular educational and public service facility. During the year it was completely remodeled to improve its effectiveness as an educational aid. Apart from its usefulness as an instructional facility, it serves as a unique and interesting way of introducing elementary and secondary school students to the study of the solar system, the galaxy and the universe. Its presentations were attended by more than 5,000 adults and public school students in 1977-78.

DEPARTMENT OF ZOOLOGY

The department initiated four new or revised courses that are part of the revised and modernized zoology curriculum for undergraduates that will be effective in August 1978. Majors included approximately 200 undergraduates and 40 graduate students. Thirty-seven B.S. and six M.S. degrees were awarded.

Many small improvements to Long Hall and to new facilities in Jordan Hall have enhanced both the department's teaching and research capabilities. In Kinard Annex a fish culture facility was installed and significant improvements to the building have made it suitable for graduate student offices. The major addition to the physical plant during the year was the procurement of the Old Insectary and surrounding site for use as a Field Station. Shop, greenhouse, aviary and field support laboratories and storage areas for a boat and other field equipment are pivotal for environmental training and research programs.

Through the donations of family, friends, faculty and students, the Byron Ross Ingram Jr. Memorial Scholarship Fund was established and the first scholarship award will be made in 1978-79.

Research activities with support from several agencies (NSF, EPA, AFOSR, and WRRI, among others) have continued along several lines, including studies of nutrient cycling at Cowetta

Hydrologic Laboratory; problems of bird-aircraft collisions, specifically and, more generally, migration and orientation of birds; and biogeochemistry of fresh-water systems in the Southeast. Other projects in areas of cell biology, physiology, ecology, behavior, developmental biology, and population genetics are under way.

Service activities included the availability of the department's vertebrate collections to campus and community visitors. Specimens include 5,500 clutches of bird's eggs in the H. L. Harlee Collection, one of the largest collections of eggs in the country.

Graduate Studies, University Research and Computer Center

THE GRADUATE SCHOOL

Enrollment for the fall semester dropped from the year before by about 100 students. Total enrollment was 2,261, with 202 in doctoral degree programs, 519 in Master of Arts and Master of Science degree programs, 1,021 in professional master's programs, 39 in Education Specialist degree programs, and 480 students with undeclared majors. Of the total, about 500 were enrolled off campus. In addition, 159 students were enrolled in the Clemson-Furman Master of Business Administration program.

A total of 683 advanced degrees was awarded during the academic year, 31 of which were doctor of philosophy degrees.

The second annual workshop for graduate advisors in August 1977 was attended by approximately 80 faculty and staff.

Guidelines and procedures for employing graduate students were established in cooperation with the Office of Business and Finance. Such information in definitive form was not previously available to departments. A new section in the "1978-79 Graduate School Announcements" gives the broad general guides to graduate student employment.

OFFICE OF UNIVERSITY RESEARCH

This office is responsible for providing information and assistance on university research to faculty members, departments, colleges and other administrative units. It is the liaison office between the university and all public and private national and regional research-related organizations and agencies.

The office prepared the applications for the university's initial Biomedical Research Support Grant. Current responsibilities include

initiation, direction and executive support of the ad hoc faculty committee required by the award and preparation of the required reports. Another volume in a continuing series, "Clemson University Faculty Publications," was prepared, edited and printed during 1977-78. A record number (271) of research, equipment and training proposals, submitted on behalf of the faculty, were processed by the office during the year.

COMPUTER CENTER

In 1977-78 the Computer Center experienced a staff turnover of greater than 30 percent, including a large proportion of the managerial staff. Despite the difficulties of recruiting in a highly competitive marketplace, the Center is again fully staffed and operating efficiently. Efforts to train new employees have been successful, but will need to be continued for some time.

Computer usage continues to grow at a rapid rate. Academic usage is burgeoning, new administrative systems have been implemented, and major new systems for off-campus users, notably the Department of Social Services, are in production or in development. In recent years the growth rate of computer usage has been approximately 50 percent a year, and this trend appears to be continuing.

To cope with the increasing demands on the hardware, the Center has installed additional memory, disk drives and terminal equipment. The system is close to being saturated, however, and it is expected cutbacks in service will have to be made in the fall.

To better support academic users, the Academic Support group has been strengthened and re-structured. The group provides expert assistance to academic users with computing problems. In response to faculty and student interest, a graphics center has been established and a committee formed to study the computer-assisted graphics needs of the University.

The systems staff has spent considerable time in the conversion to a new operating system, MVS. This conversion should be complete by late summer 1978. The new operating system is expected to provide some increase in machine performance, but not enough to compensate for the increase in computer usage.

It has been a year of change at the Computer Center, but a year in which much progress has been made. Almost all vacant positions have been filled and it is anticipated that as the staff gains experi-

ence, the center will not only provide computing facilities to the University, but will also become a highly productive research and development center. Insufficient computing power remains a problem, but one which is being actively addressed.

DIVISION OF ADMINISTRATIVE PROGRAMMING SERVICES

The Division of Administrative Programming Services (DAPS) is responsible for the creation and maintenance of information systems which meet the needs of the university administration. Information systems to meet these needs fall into two major categories:

- Operational information systems that support the routine operation of the University. These systems create as a natural by-product of their operation an up-to-date university database of accurate operational information.

- Management information systems that can assist university administrators evaluate the consequences of alternative decisions. These systems will use the information from the university database created by operational systems.

The Division of Administrative Programming Services is rapidly approaching a shift in its efforts from major new development of operational systems to the analysis, design and implementation of management information systems. Within the fiscal year the student database is expected to be operational; this, together with the financial database implemented two years ago, provides the nucleus information necessary to support management reporting.

The key to successful implementation of management systems is effective communication. Requirements definition for management information systems will require more communication between university executives and the management of DAPS. The accomplishments of the past four years have been to build the foundation of operational information from which management systems may draw to meet critical executive management information needs.

Operational Information Systems

During the fiscal year, DAPS has implemented or done detail design work on new operational information systems. Listed are brief descriptions of each:

1. A Physical Plant job order system for tracking progress against work done and to charge appropriately for this work.

2. An improved internal budgeting system and procedures for the spring budget.
3. A Communications Center inventory and billing system.
4. A revised and updated payroll computation system.
5. Detail design of a position control system.
6. Implemented all phases of a centralized student collections system.
7. Implemented a student registration system to simplify procedures and forms on registration days.
8. Documented the student scheduling system.
9. Redesigned and implemented a football scouting system.
10. Redesigned and implemented a rents system that ran alone on the old IBM 360/20 computer. This was the last system running on this computer and we were then able to replace it with a much cheaper remote job entry station.

Management Information Systems

The program costing software acquired from the National Center for Higher Education Systems has been implemented using all available information from fiscal year 1976-77. DAPS has discussed the results of these runs with several university administrators. The next step will be to evaluate this approach to determine if further work is warranted.

DIVISION OF INFORMATION SYSTEMS DEVELOPMENT

The Division of Information Systems Development was established at the University in 1974 to provide skilled assistance to governmental agencies in the design, implementation and production maintenance of computerized information systems. During the year this division continued to provide vigorous assistance and support to the special needs of the University and other governmental agencies as a backup support for state government.

Contracts during the year included:

Appalachia II District Health Department—Maintenance was performed on the system developed to handle health care and appointment requirements of the department.

Carre, Inc.—Developed and implemented a system as part of an Environmental Protection Agency grant to maintain records on closed-cycle textile dyeing for subsequent statistical analysis.

Division of Administration—Office of the Governor—Maintenance and refinement continued on the system which maintains records for persons trained under the Comprehensive Manpower Program.

Department of Social Services—Several areas were entered into to support DSS in its growing computer information system requirements.

(1) Education and Training—Programming techniques, database management and interactive program development were stressed.

(2) Management Accounting and Control System—Completed first phases of the conversion of this accounting system from the state of Mississippi. The system was operational starting July 1978.

(3) IV-D—A system for child support enforcement including data capture and payment distribution was enhanced, and testing for production was begun.

(4) Title XX—The system developed by DISD was enhanced and maintained.

(5) Project Control System—A project control system to meet the needs of Clemson University and DSS was placed into production.

(6) Management Information System—Selected an automated system for transfer with modification to South Carolina and assisted in selecting a health-care consultant for DSS.

IPTAY—Maintained and improved a system to keep records on Clemson University IPTAY members, their contributions, and their benefits.

Mental Health Centers—Continued maintenance and development on a system for maintenance of patient and staff records.

Lander College—Continued development and support of Lander's data processing needs in student and alumni records, payroll, and course-load prediction.

Plant and Pesticides Regulatory Service—Maintained and enhanced a system which maintains records of plant pesticides and applicators who are licensed to use them.

Robert Muldrow Cooper Library

A major highlight was completion of the third floor or upper-level construction of the library. Planned in the library's original design, the additional area provides space for chairs and tables for 100 readers and shelving for thousands of books. After completion of the upper level, construction began on the intermediate level below the ground floor and completion of the basement. Both areas will be used for books and readers. This expansion, to be completed in mid-1979, will provide an additional 50,000 square feet of finished space.

The National Agricultural Library and Southeastern regional land-grant institutions completed this year their joint project of microfilming agricultural publications for each of the Southeastern states. The library now has a microfilm copy of most publications published by the South Carolina Agricultural Experiment Station, Clemson's Cooperative Extension Service and the university's College of Agricultural Sciences from 1888 through 1969.

A highly significant reference service was initiated through the Lockheed Dialog Information Retrieval Service. This service provides quick access to bibliographic information in some 70 indexing and abstracting sources in a data base in California. In a matter of hours users of this service receive a bibliography on a subject of particular interest which, by traditional methods of searching, would take days or even weeks. The retrieval service is utilized extensively, particularly by researchers in scientific fields.

The program of introducing students to library resources continued through freshman orientation lectures and library assignments, and by conducting 145 classes in special subject areas.

Special Collections is preparing a brochure describing 11 major manuscript collections, all of which have been reported to national and regional bibliographies. Attention also is being given to other special materials in the Robert Muldrow Cooper Library. During the past two years these special collections have attracted researchers from 18 states, many representing prestigious institutions. Among scholars examining the James F. Byrnes Papers were a member of the faculty of York University, Ontario, Canada; a master's candidate from the University of Belgrade, Yugoslavia; a professor of history from the University of Helsinki, Finland; and a historian from the National Archives of the Federal Republic of Germany.

Changes in the library's administrative organization created greater specialization of duties and more efficient operation.

Because of medical necessity, Associate Director Dorothy C. Porter, retired at the end of the fiscal year. Mrs. Porter made significant accomplishments during her years of dedicated and outstanding professional service, first as head of the Social Sciences and Humanities Division and most recently as associate director. Much that she initiated will reach fruition in the months and year ahead.

Computer applications to library processes and networks, along with the projected change in 1980 by the Library of Congress from the traditional card catalog to a data base accessible through cathode ray tube terminals, requires intensive study, training and planning by the cataloging staff to keep abreast of new developments. Clemson will have to consider a similar innovation in the near future. The Acquisitions Department, with assistance from DAPS, has been investigating computer applications to acquisition of books.

Clemson is a selective depository for U. S. Government documents publications. The heavily-used collections contain 191,266 volumes and 43,912 units of microfiche. New publications are selected each year further strengthening the collections to support curricula and research at Clemson.

The library receives regularly some 12,557 journals, reports, transactions and proceedings in English and many foreign languages. Collections now total approximately 731,000 volumes. The library also has 17,418 reels of microfilm and 334,299 units of microfiche and microcards.

Students

The 1977-78 academic year marked the third year of stabilization in Clemson's enrollment in keeping with the Board of Trustees' goal of limiting on-campus enrollment to approximately 10,000 full-time students. A total 11,274 students registered for classes—9,710 full-time and 672 part-time students on-campus and the remaining 892 in various off-campus programs. Of total enrollment 2,566 were graduate students. Physical limitations are a primary reason for limiting enrollment, along with an insistence on maintaining the quality of Clemson education and the person-to-person character of the educational experience at the University.

Computerized preregistration helped a record number of students get off to a smooth start for fall classes. About 92 percent were preregistered and had their course schedules completed before they arrived on campus to begin classes.

The new school year saw some shifts in on-campus total enrollment (undergraduate and graduate) among the university's nine colleges. The College of Industrial Management and Textile Science, number one in enrollment in 1976-77, was replaced at the top by the College of Engineering, which had 1,889 students enrolled. The College of Industrial Management and Textile Science with 1,862 students, was followed in order by the Colleges of Education, Sciences, Agricultural Sciences, Liberal Arts, Forest and Recreation Resources, Nursing, and Architecture. Engineering had the largest percentage increase with 12 percent, while Industrial Management and Textile Science grew 7 percent. Agriculture and Education enrollments increased slightly, and the other colleges experienced some decrease in enrollment.

As opportunities for higher education have become increasingly accessible, more and more freshmen are entering college with advanced standing. In the fall semester more than 400 new high school graduates entered Clemson with advanced standing earned by means of College Board Advanced Placement courses, departmental examinations, concurrent enrollment in college or summer college attendance.

The continuing popularity among students of the national Advanced Placement Program is underscored by the fact that about 266 (almost 15 percent) of 1977 Clemson freshmen participated in the program. The majority of the 266 received credit for one or more courses based on the total of 354 examination papers submitted, and earned a total of 1,069 credit hours through advanced placement testing. According to the College Board, the number

of score reports received by Clemson placed Clemson seventh in the Southeast behind the University of Virginia, University of North Carolina, Duke, Vanderbilt, William and Mary and the University of Tennessee.

At Clemson, as at most institutions, performance in high school is the best single predictor of success in the freshman year. Thus, it is of particular significance that the class ranks of entering freshmen have improved to the point that 35 percent of freshmen entering in August 1977 ranked in the top 10 percent of their class; 62 percent ranked in the top 20 percent, and 95 percent ranked in the top 50 percent. Much publicity has been given to the significant decline in the past decade of SAT scores. The average SAT of recent freshmen at Clemson has been affected very little by this trend. In 1977 the freshmen class averaged 985. This compares with an average of 899 reported by College Board for all high school seniors. It is also the highest average among state-supported institutions in South Carolina.

Of 5,466 new applications for admission for 1977-78, 3,754 were accepted and 2,477 actually enrolled (including freshmen and transfer students). South Carolina residents account for 80 percent of the 11,274 Clemson students, including those enrolled in off-campus programs.

Fall semester enrollment comparisons for recent years are shown below:

Fall Semester Enrollment Comparisons

<i>Year</i>	<i>Undergraduate</i>	<i>Graduate and others</i>	<i>Total</i>
1968-69	6,615	674	6,839
1969-70	6,203	818	7,021
1970-71	6,679	1,359	8,038
1971-72	7,300	1,590	8,890
1972-73	7,686	2,071	9,757
1973-74	7,910	2,202	10,112
1974-75	8,171	2,415	10,586
1975-76	8,576	2,785	11,361
1976-77	8,620	2,763	11,383
1977-78	8,708	2,566	11,274

The 1977-78 figures include 733 students attending off-campus institutes and 159 in the Clemson-Furman University Master of Business Administration degree program.

Clemson students come from all 46 South Carolina counties, 46 states, Puerto Rico, the District of Columbia, and 43 foreign countries (164 students).

Enrollment of Women at Clemson reached an all-time high during the 1977 fall semester. There were 4,511 of which 3,274 were on-campus undergraduates. Enrollment of undergraduate coeds increased about 6 percent over last year. Women students now constitute 38 percent on-campus enrollment and about 40 percent of total enrollment.

The Clemson student body continues to be a working group who receives a significant amount of financial assistance in the form of loans, grants, scholarships and work assistance. In 1977-78 approximately 2,560 students earned an estimated \$3,246,873 working for the University. (This figure does not include earnings from off-campus employment.) Clemson awarded 276 long-term loans totaling \$244,125. The University also approved and certified 600 guaranteed student loans from a variety of lending institutions. Excluding athletic grants-in-aid and donor-selected scholarships, 1,327 scholarships and grants valued at \$905,359 were awarded. In all, it is estimated that 40-50 percent of the student body received financial assistance administered by Clemson.

The Clemson University Student Government has grown into a dynamic, progressive body in the past few years. Through legislative provisions, Student Government has established a Student Traffic Review Board, extended hours in the student bank and generally become more involved in the governance of the University. Services for students provided by Student Government in 1977-78 included refrigerator rentals, Xerox machines and ice machines. A shuttle service from parking areas to residence halls, Emergency Medical Training for students serving the university emergency vehicle, and legal aid to students have also been provided.

Student organizations continued to grow in number and quality in 1977-78.

Several national professional honoraries were chartered on the Clemson campus, including Beta Gamma Sigma in the College of Industrial Management and Textile Science, Phi Delta Kappa in the College of Education, Sigma Theta Tau in the College of Nursing, and Tau Alpha Pi in the Department of Engineering Technology. The Clemson University student chapter of the Ameri-

can Chemical Society was named by ACS as one of the outstanding groups in the nation. In the area of fine arts, the Clemson Players entertained large audiences with "Hot L Baltimore," "As You Like It," "A Streetcar Named Desire," and "Once Upon a Mattress." Other organizations continued projects which have become a part of Clemson tradition—the Alpha Phi Omega Book Exchange, the American Society of Civil Engineers Concrete Canoe Race, Blue Key's Tigerama and Mortar Board's Miss Clemson University Pageant. They also raised money for charities including UNICEF, World Hunger, Muscular Dystrophy, the March of Dimes, multiple Sclerosis and the American Cancer Society.

Sororities and fraternities grew to include 19 percent of female undergraduates and 14 percent of male undergraduates in 1977. Clemson recognizes six NPC sororities, one NPHC sorority and a colony of another NPHC group. Although social in nature, these sororities stress scholastic excellence, achieving an overall 2.95 grade-point-average in the spring of 1978. Clemson fraternities have raised thousands of dollars for charities through dance marathons, bike-a-thons, pancake-eating contests, walk-a-thons and other endeavors.

Moneymaking projects are not all Clemson students take part in. As an engineering project, five mechanical engineering students designed, constructed and drove an all-terrain vehicle in the 1978 Southeastern Mini-Baja competition in Orlando, Fla., winning third place in maneuverability in the 15-mile endurance race. This third place complemented the year's winning streak for student organizations begun when the three student publications, *The Tiger* newspaper, *The Chronicle* literary magazine and *Taps*, the 1977 yearbook, swept the 13 top awards at the S. C. Collegiate Press Association Convention. *The Tiger* newspaper was also named to the 1978 All-American team of college newspapers.

Additional information about Clemson's student body is given in the charts that follow.

**Fall Semester 1977 Enrollment by Colleges, and Degrees Awarded
December 1976 - August 1977**

	<i>Main Campus</i>	<i>Degrees</i>					<i>Total</i>
	<i>Enrollment</i>	<i>Associate</i>	<i>Bachelor's</i>	<i>Master's</i>	<i>Specialist</i>	<i>Doctorates</i>	
	<i>Fall Semester</i>						
Agricultural Sciences	1,085	0	135	62	0	7	204
Architecture	473	0	106	33	0	0	139
Education	1,572	0	272	336	12	0	620
Engineering	1,889	0	211	77	0	8	296
Forest & Rec. Resources	748	0	156	20	0	0	176
Ind. Mgt. & Text. Science	1,862	0	322	19	0	6	347
Liberal Arts	918	0	200	14	0	0	214
Nursing	493	42	93	3	0	0	138
Sciences	1,257	0	200	42	0	11	253
Non-degree	85
TOTALS	10,382	42	1,695	606	12	32	2,387

Degrees awarded since 1896 total 37,399 of which 273 have been associate degrees; 31,239 bachelor's degrees; 5,372 master's degrees; 48 education specialist degrees; and 467 doctorates.

Acceptance Rate of Applicants

<i>Year</i>	<i>Rate</i>
1967	79%
1968	79%
1969	79%
1970	87%
1971	87%
1972	83%
1973	83%
1974	84%
1975	77%
1976	69%
1977	69%

Retention Rate of Students (Freshman Class)

<i>Year</i>	<i>Score</i>
1965	77%
1966	79%
1967	76%
1968	80%
1969	82%
1970	78%
1971	84%
1972	82%
1974	83%
1975	83%
1976	83%

Number of Teachers (Full-Time Equivalent Teaching Faculty)

<i>Year</i>	<i>Teachers</i>
1970	571.2
1971	580.1
1972	614.8
1973	578.4
1974	591.8
1975	602.5
1976	611.3
1977	654.4

**Number In Freshman Class
(New Students)**

<i>Year</i>	<i>Number</i>
1950	640
1960	1,363
1965	1,479
1966	1,388
1967	1,559
1968	1,632
1969	1,468
1970	1,774
1971	1,853
1972	1,919
1973	2,034
1974	1,949
1975	1,901
1976	1,861
1977	1,838

Number and Percent of Black Students

<i>Year</i>	<i>Number</i>	<i>Percent</i>
1972	179	2
1973	211	2
1974	216	2
1975	338	3
1976	307	3
1977	336	3

**Student-Faculty Ratio
(Full-Time Equivalent)**

<i>Year</i>	<i>Ratio</i>
1969	12.6 : 1
1970	13.1 : 1
1971	14.6 : 1
1972	14.6 : 1
1973	16.8 : 1
1974	17.9 : 1
1975	18.3 : 1
1976	17.6 : 1
1977	16.3 : 1

Average College Board Score of Freshmen

<i>Year</i>	<i>Score</i>
1960	998
1965	1003
1966	995
1967	1005
1968	1005
1969	1015
1970	1005
1971	997
1972	995
1973	982
1974	984
1975	983
1976	996
1977	985

Number of On-Campus Students in Summer School

<i>Year</i>	<i>Number</i>
1950	948
1960	1,015
1965	3,216
1966	3,539
1967	3,980
1968	4,820
1969	4,472
1970	4,428
1971	4,692
1972	5,232
1973	6,267
1974	5,997
1975	6,275
1976	6,100
1977	6,301

Average College Board Score of Freshmen

Number of Dorm Beds and Percent Being Utilized

<i>Year</i>	<i>Beds</i>	<i>Percent</i>
1960	2,900	100
1965	3,624	97
1966	3,920	99
1967	4,348	97
1968	4,780	95
1969	4,764	94
1970	5,190	93
1971	5,174	97
1972	5,174	100
1973	5,330	102
1974	5,592 ^a	101
1975	5,616 ^b	103
1976	5,625 ^c	103
1977	5,662 ^d	103
1978	5,933 ^e	104

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- ^a Includes 252 beds in the Clemson House.
 - ^b Includes 262 beds in the Clemson House.
 - ^c Includes 271 beds in the Clemson House.
 - ^d Includes 308 beds in the Clemson House.
 - ^e Includes 312 beds in the Clemson House.

Current Operating Funds

REVENUES AND ADDITIONS BY SOURCE

Student Fees	\$ 7,166,394	8.28%
State Appropriations:		
Educational & General	29,697,453	34.31%
Agricultural Research & Public Service	16,400,730	18.95%
Federal Appropriations:		
Educational & General (Morrill-Nelson)	121,374	.14%
Agricultural Research & Public Service	7,272,000	8.40%
Sales & Services of Educational Departments	1,246,283	1.44%
Miscellaneous Sources	2,821,144	3.26%
Endowment Income	93,638	.11%
Sales & Services of Auxiliary Enterprises	14,095,771	16.29%
Federal Grants & Contracts	4,009,973	4.63%
State Grants & Contracts	1,070,969	1.24%
Local Grants & Contracts	65,906	.08%
Private Gifts, Grants, & Contracts	2,482,683	2.87%
TOTAL REVENUES & ADDITIONS	\$86,544,318	100.00%
Brought forward from 1976-77 for:		
Encumbrances and Restricted Funds Balance	3,551,598	
TOTAL FUNDS AVAILABLE	\$90,095,916	

EXPENDITURES BY FUNCTION

Instruction	\$19,195,074	22.88%
Research—Departmental	4,548,312	5.42%
Research—Agricultural Experiment Station	10,276,921	12.25%
Extension & Public Service	3,030,308	3.61%
Extension & Public Service—Cooperative		
Agricultural Extension Service	12,956,879	15.45%
Extension & Public Service—Regulatory Service	3,143,712	3.75%
Academic Support	4,276,606	5.10%
Student Services	2,697,605	3.21%
Institutional Support	5,063,497	6.04%
Operation & Maintenance of Plant	5,518,610	6.58%
Auxiliary Enterprises	12,221,442	14.57%
Scholarships & Fellowships	956,725	1.14%
TOTAL EXPENDITURES	\$83,885,691	100.00%
Transfers and Other Deductions	2,817,695	
TOTAL EXPENDITURES, TRANSFERS AND OTHER DEDUCTIONS	\$86,703,386	
Balance, 6/30/78 for Encumbrances and Restricted Funds Balance		
	3,392,530	
TOTAL EXPENDITURES & BALANCE	\$90,095,916	

STUDENT AID FUNDS

Fiscal Year 1977-78

Revenue

Loan and Interest Payments	\$ 103,960.74
Gifts/Grants for Scholarships, Grants, Fellowships, Other Stipends	1,899,348.55
Endowment Income	84,739.29
Investment Income	158,941.24
Other Income	22.86
TOTAL	\$ 2,247,012.68

Disbursements

Educational Loans	\$ 228,353.00
Grants for Scholarships, Fellowships and Special Purpose Stipends (Including Grants-in-Aid)	948,049.61
TOTAL	\$ 1,176,402.61

Public Service Programs of the College of Agricultural Sciences

L. P. ANDERSON, DEAN

The College of Agricultural Sciences administers state-wide public service programs in addition to its program for Resident Instruction. Among its public service functions are administration and coordination of the varied activities and services of the South Carolina Agricultural Experiment Station, the Cooperative Extension Service, the Division of Regulatory and Public Service Programs, and the Livestock-Poultry Health Department. Reports for these divisions follow.

South Carolina Agricultural Experiment Station

W. CECIL GODLEY, DIRECTOR

The South Carolina Agricultural Experiment Station is responsible for conducting the only state-funded program of agricultural research. It operates a statewide system of research stations which is administered from the College of Agricultural Sciences at Clemson University.

The research program of the Experiment Station is conducted by scientists working out of 10 departments in the college. Home economics research is centered at Winthrop College. Branch stations are located at Pontiac near Columbia, Florence, Blackville, Summerville and Charleston. Each branch emphasizes research most relevant to its particular area of the State.

The Experiment Station, established in 1889 under federal laws, operates under state control with annual appropriations supplemented by federal appropriations. The South Carolina station has a counterpart in every state and cooperates with these stations and other governmental agencies by sharing information and developing cooperative and complementary research programs.

The challenges faced by researchers multiply yearly. In addition to constant pressures to increase yields of crops to meet a growing world population, researchers must find new ways to protect the environment while fighting insects, weeds and crop diseases. Reacting to changing needs and interests in the state's agriculture, S. C. Experiment Station researchers keep abreast of the newest methods for getting the most from natural and human resources.

HIGHLIGHTS AND ACCOMPLISHMENTS

The following summary can serve only as a microcosm of the extensive work of the South Carolina Agricultural Experiment Station. The projects highlighted are just a few of over 200 active projects under study by station scientists during the fiscal year from July 1, 1977, to June 30, 1978.

Agricultural Economics and Rural Sociology

Economists and sociologists are looking for new and better ways to understand, develop and use South Carolina's human and natural resources.

Research was conducted this year in the area of financial management. An analysis of selected agricultural loans in South Carolina indicated that it is difficult to predetermine which Farmers Home Administration loans will eventually be classified as "bad" loans. A loan officers' handbook was prepared as a result of this research. Another study used a technique called "discriminant analysis" to evaluate loan applications. Data from three PCA offices were used to test the procedure. The results indicate that this technique can be a useful aid in loan application evaluation.

Several research reports were completed on tobacco. Using projected costs and returns, maximum rental rates that a grower could pay for tobacco poundage varied from 24 cents to 39 cents. When prices received for tobacco harvested and cured using the conventional method were compared with mechanically harvested and bulk barn tobacco, prices of the former were significantly higher for three of the eight tobacco grades. The significant differences in prices received could be defined in terms of bulk versus conventional barns rather than hand versus mechanical harvesting.

A study of the feeder pig market in South Carolina indicated that feeder pig prices were seasonally high during April and September and lowest during July and October. Prices of feeder pigs were found to be directly related to quality of pig, current prices of slaughter hogs and the number of pigs per lot sold. Another report indicated that beef producers can decrease feed costs as much as 35 percent by feeding rations containing 50 percent broiler litter silage. Litter used as fertilizer has an industry value in South Carolina of a half million dollars but a value of \$3.5 million when used as a protein concentrate substitute.

A study on mechanical harvesting of fresh market tomatoes indicated that it is not economically feasible at the current cost-price

ratio. Custom rates for most farm operations will be ready for farmers this fall so they will be better able to make machinery-related decisions. Also, budgets for sprinkler irrigation of corn and soybeans and fresh peach budgets have been released.

Rural communities often see industrial plant location as a primary means of achieving economic growth and improvement in per capita incomes. A model has been prepared to provide guidance to local developers, aiding them in determining community characteristics attractive to industrial plant locators and helping them find those characteristics amenable to change. A two-stage process is described. A preliminary report was also prepared on financing of local governments.

Agricultural Engineering

Significant accomplishments have been made in several research areas during the past year. At the same time, much new research has begun in response to high priority needs.

Studies have been initiated, in cooperation with the University of Florida, to develop an alternate plant cutting mechanism for the fresh market tomato harvester previously developed. The new cutting mechanism allows crops produced on plastic mulch to be harvested while leaving the mulch intact.

In the tree fruit mechanization area, studies are under way to determine what effect thinning with mechanical shakers has on fruit size and yield as compared with conventional hand thinning. The new fruit handling/bin filling system that collects fruit from mechanical harvesters was improved by adding automated components along with electrical indicator lights to control the fruit flow.

Engineers developed new equipment for incorporating herbicide and granular nematicides during planting of such crops as corn, cotton and soybeans. This equipment has been tested in research plots and on a field scale and has produced excellent results. With the new system, planting and pesticide application can be accomplished with fewer field operations and less fuel. Weed control and yields have been as good as or better than conventional systems.

Significant gains in understanding of the tobacco bulk curing process have been made this year. Data have been collected on the relationship of air flow, humidity, temperature schedules, loading density, tobacco types (including once-over harvesting of low

profile versus multi-pass harvesting of conventionally produced tobacco) as related to bulk curing energy requirements and tobacco quality. Data were also collected from rural substations that will be useful in designing curing schedules which allow electrical demand loads to be reduced.

A promising method of objectively determining crop response to various cultural practices (irrigation, cultivation, and pesticide application) is by computer simulation of crop growth and yield with and without the practice. At the present time corn and tobacco irrigation is being managed in experimental fields by a computer program using crop growth stage, weather since the crop emerged, and probability forecast of rain.

Cotton and soybean crop growth simulators are being developed as research and management tools. Emphasis is on root growth, water relations and tillage effects.

Research has been initiated to investigate the interactions between cultural practices and energy requirements for irrigated crop production. The effects of minimum tillage, subsoiling and variable fertilization rates are being studied on corn during the first year.

The development of a computer-based automatic control system for a soybean combine has also been initiated. Design of the system is complete and should be on-board the combine for the 1978 harvest.

In other new research, possible agricultural uses of low level waste heat from the Savannah River plant have been evaluated. Greenhouse warming and enhancement of methane production appear to offer the greatest potential uses of this waste heat.

Several applications of solar energy are being investigated. A low-cost, self-help solar water heater was tested for six months. A pilot size solar/refrigeration cycle grain drier was developed and tested. Also, the development of a multiple use farmstead energy unit was begun with computer investigation of probable duty-cycles. Technical feasibility and capabilities of the solar assisted unit are being determined as a function of the expected duty-cycle.

Construction began on two experimental solar residences located at the LaMaster Dairy Center. A solar greenhouse-residence demonstrates the compatibility of a solar heated residence and an integral greenhouse. A solar earth-insulated residence demonstrates utilization of the constant subterranean environment to decrease residential heating and cooling requirements.

Agronomy and Soils

Agronomists focus much of their effort on finding practical ways growers can increase yields and quality of farm crops.

They conduct research on chemical weed control of agronomic crops on a statewide basis. Experimental and existing herbicides are being evaluated on different soil types using various application techniques, herbicide combinations and timing of treatments.

Researchers found this year that excellent control of rhizome johnsongrass in corn could result from a soil-incorporated treatment with Sutan+ at $1\frac{1}{2}$ times the normal rate for annual weed control. To achieve maximum control, the johnsongrass rhizomes were cut into small sections by repeated diskings prior to Sutan+ treatment. Herbicides are in development which provide better control of cocklebur and other broadleaf weeds in soybeans. Tests have shown that performance of one of these products is improved when applied with certain spray adjuvants.

Official crop variety testing is of great interest to growers and agribusiness, and much effort is spent each year identifying new adapted varieties that out-perform currently-used varieties in yield and/or quality. Crops being evaluated are tobacco, cotton, soybeans, peanuts, grain sorghum, small grains, alfalfa and sunflowers. For some crops, time of planting is an important consideration in variety selection.

Powdery mildew is the primary disease organism that parasitizes the South Carolina wheat crop. Races of the disease are in a constant state of change; therefore, replacement varieties must be continuous. The present goal is to use as many diverse sources of germ plasm as possible to combat the changes in mildew races.

Developing high yielding varieties for early and late planted soybeans is the ultimate objective of the soybean breeding program. Strong interest exists in varieties that can be planted after small grains and other crops such as watermelons, which have high yielding potential.

A relatively new nematode pest of soybeans found in South Carolina is arenaria root knot (peanut). Complete loss of beans can result in heavily infested fields unless resistant varieties are used. South Carolina was responsible this year for releasing Govan, an arenaria resistant variety with good yield potential. Breeders anticipate that a second variety, which has resistance to both arenaria and incognita as well as a high yield potential, will be released in 1979.

Recently a cotton variety, S.C.-1, was released jointly with USDA. This variety has high yield potential and superior quality. Seed supply is being developed in 1978, and growers should be able to obtain seed stock in 1980.

Researchers are developing improved fertilization and cultural practices to help plants use nutrients and water more efficiently. They are studying coarse-textured soils in regard to plant nutrient leaching and accumulation in subsoils. Irrigation studies help determine relationships between cultural practices, growth regulators, and water availability and needs of agronomic crops. Nitrogen fixation by soybeans is being investigated. Tests are conducted to determine relationships between nematode infestation roots and inoculation of soybeans by nitrogen fixing organisms.

Animal Science

Producing high quality animals economically and efficiently is the goal of animal scientists.

In a cooperative study with USDA, 60 steers were fed in dry lot for 98 days using ammoniated aflatoxin corn. Steers on ammoniated aflatoxin corn gained significantly faster than those on the aflatoxin corn ration. There was no significant difference in feed efficiency.

Angus and Angus crossbred females responded favorably (20 percent overall) when Yuchi Arrowleaf clover grazing was available, and the "larger" breed crosses showed a marked improvement in reproduction. Small breed (straight Angus and Polled Herford-Angus crosses) showed a 10 percent increase in conception rates on clover pasture while the larger crosses showed an increase of 29 percent in conception rates.

Prostaglandin F_{2a} and progestational compounds effectively control estrus in cows. By using these treatments it is possible to inseminate cows at a predetermined time.

Researchers found that heifers treated with the progestational ear implant reach puberty earlier than non-treated control animals. The average date of conception was 15 days earlier in treated heifers with 19 percent more treated heifers pregnant at the end of the breeding season.

A preliminary study on the diagnosis of phenylketonuria (PKU) during fetal life was conducted with ewes. Results obtained so far have encouraged further development of a method for the diagnosis of PKU during fetal life in the human.

Culbac produced a significant increase in daily gain when it was added to a starter pig ration. This product was added to a pig ration with an antibiotic. The addition of dry fat to a milk-soybean meal ration produced similar results to a corn-soybean meal ration for growing-finishing swine.

Gilts and sows were fed levels of calcium and phosphorus at approximately one and a half times that of NRC, and the results indicate that one more pig was raised per litter on the higher levels.

The porcine stress syndrome causes sudden death in some of the fastest growing pigs. In all probability, the soft exudative pork condition found upon slaughter is part of the same disease and results in a poorer quality pork product. The porcine stress syndrome was identified by elevated blood serum levels of an enzyme which leaked from the diseased muscle tissue.

In the area of meats research, a formed ham product was developed using cubes and strips of lean meat from hams of sows. The product is relatively lean and considered highly acceptable by the consumer. It was found that adding 5 percent potassium sorbate to the brine allows the amount of nitrite to be reduced to one-third of the normal level in pumped hams.

Dairy Science

Nutrition and reproduction efficiency of dairy animals is of vital concern to dairy scientists. They are also interested in new and innovative ways to get high quality dairy products to the consumer.

Interest has been growing in the use of complete rations in livestock feeding programs, particularly since a large part of the forage now fed is silage. In addition to silos being an efficient structure for storing forages, modern mechanization has made them even more attractive from a labor standpoint.

The Dairy Science Department has conducted studies seeking to increase silo efficiency through the use of ensiled complete rations. These are rations in which the concentrate and green chopped forage are mixed prior to ensiling rather than mixing ensiled forage with concentrate prior to feeding. Previous studies with lactating cows have shown that ensiled complete rations can maintain body weight and daily production of 20 kilograms of milk. However, recent data indicate that mineral absorption and retention may be lower in animals fed an ensiled complete ration. This may reduce production under long term feeding and may also be a factor in limiting daily production to 20 kilograms of milk.

It has been found that colostrum, the milk produced during the first four days postpartum, is an excellent feed for young calves. Many cows produced 150 or more pounds of colostrum during this period. Stored efficiently, this milk could provide most of the milk needed to raise a calf until weaning at four to six weeks. Although organic acids have shown promise as colostrum preservatives, potential problems of liquid additives such as organic acids are handling and corrosiveness. The use of dry chemicals can reduce problems associated with liquid acids. An experiment to evaluate benzoic acid and sodium benzoate as preservative showed them to be effective additives for colostrum when fed to calves.

Recent research has indicated that the feeding of citrus pulp concurrently with AFB₁ to lactating dairy animals may induce the liver to higher production of AFM₁ with subsequent increased levels of AFM₁ excreted in the milk. The feeding of low levels of AFM₁ (0-2 ppb) in milk to young dairy calves resulted in no physiologically adverse effects, nor significant tissue residues.

Aflatoxin B₁ fed to Holstein heifers 15 to 18 months of age at a chronic, medium level (2 or 4 milligrams per animal per day from 30 days prior to insemination to 90 days after pregnancy) had no adverse affect on pregnancy rate or growth rate.

A procedure was established this year to assay for progesterone levels in milk. By determining the progesterone levels in milk samples from cows 19 to 21 days after inseminations, open cows can be identified.

Studies concerned with the procurement of high quality milk and methods for its processing and distribution were emphasized in dairy research programs. One study was made to determine the effect the length of storage of raw milk prior to processing had upon the shelf life of the pasteurized product. Preliminary results indicate the longer the storage time of raw milk prior to processing, the shorter the shelf life of the pasteurized milk.

Studies of milk distribution practices indicate many inefficiencies which contribute to the high cost for distributing milk. If some of these practices could be eliminated, less energy would be expended, less labor would be required, less materials and returned milk would be wasted. Many such practices are imposed upon the milk processor due to the policies of the supermarket chains.

Entomology and Economic Zoology

Entomologists investigate all means of controlling insects in agricultural crops. They pursue their goal in many ways, such as

studying the insect's habits, getting to know its natural enemies and finding what conditions promote its growth.

In a new project, Clemson entomologists are collecting insects from field crops throughout the State to test them for insecticide resistance—the ability to tolerate high doses of insecticides. A survey of the tobacco budworm is in progress. This serious pest of cotton and tobacco is very difficult to control with insecticides. Tobacco budworm larvae (caterpillars) are brought to the laboratory where they develop to small green moths. The offspring of these moths are tested by placing measured amounts of insecticides on the larvae in minute droplets of solvent. Farms which have insecticide resistant budworms can be identified by comparing the results of these tests.

Future studies will include insect pests from soybeans and corn. Insecticides used in these tests will include the new pyrethroids as well as the conventional organophosphates and carbamates. The information gathered in this study will be useful to extension entomologists and county agents as a basis for insecticide recommendations and will serve as background information for future insect resistance studies of native insect populations.

Work is continuing in the area of beneficial insects. Researchers are identifying those insects that keep down populations of pests in soybeans by feeding on their immature forms or otherwise diminishing numbers. They are also studying the impact of insecticides on beneficial insect populations and evaluating the relative benefits of chemical applications versus natural controls.

Food Science

Food scientists are interested in what people eat and how it affects their physical well-being. In addition to nutrition, researchers look for better ways to process and package foods for market.

More than 15 million American women are currently using oral steroidal contraceptive formulations as a means of birth control or as a means of treatment for menstrual disorders. Many beneficial and adverse side effects associated with oral contraceptive use have been reported, including the altered metabolism of many nutrients.

In a study done by station researchers, significant reductions in serum vitamin B₁₂ and folic acid levels were found in 107 users of oral contraceptives relative to 76 non-users. Five percent of the women had serum levels of vitamin B₁₂ considered deficient and

41 percent were deficient in folic acid. However, tissue levels of vitamin B₁₂ appeared to be normal as evidenced by no increase in methyl malonic acid excretion after valine loading. Women thought to be deficient in vitamin B₁₂ are currently being administered an oral vitamin B₁₂ supplement. Alterations in protein metabolism in oral contraceptive users were suggested by significant reductions in total serum proteins and serum albumen levels. Significant increases in serum protein fractions were also noted in the oral contraceptive users. Significant increases in urinary specific gravity and creatinine excretion confirms the implication of altered protein metabolism in oral contraceptive users.

Peanuts are an important source of oil and protein. As there is a serious lack of dietary protein in many parts of the world, efforts have been under way to more effectively utilize the peanut for human food. Fermented foods from peanuts, such as cheese and related products, offer excellent possibilities as high protein foods. Research in the Food Science Department has demonstrated that fermentation of peanut emulsions offers the possibility of masking undesirable flavors and odors while imparting desirable flavors to the finished product.

It was also observed that when lactic acid bacteria were used to ferment peanut emulsions, the optimum production of lactic acid is not always attained. In many instances the production of lactic acid was minimal. Apparently a substance or substances in peanut emulsions inhibit the normal production of lactic acid. Investigations are under way to ascertain the nature of the inhibitory substances.

Preliminary data suggest that the inhibitory substances may be lipid in nature, and research is under way to evaluate this possibility. An explanation for the inhibitory effect of peanut emulsions on lactic acid bacteria is essential if the use of peanuts to produce fermented food products is to be a reality.

The effects of initial nitrite concentration and vacuum level on the color stability, nitrite residual concentration, and microbiological profile of chopped ham is currently under study. Current and pending actions by the U.S.D.A. and F.D.A. are to reduce nitrite levels to a minimum necessary to provide adequate color, flavor intensity, and protection from *Clostridium botulinum*. It is known that *C. botulinum* will grow under the conditions of vacuum packaging, but growth is inhibited by the action of the nitrite ion on the organism.

Studies in the Food Science Department have used the permitted level of nitrite, 156 ppm, and three reduced levels, 100 ppm, 50 ppm and 20 ppm, in preparing chopped ham. After cooking to 154°F, the products were vacuum packaged at 28-29 inches of vacuum (traditional) and at 10-12 inches of vacuum. Color stability was evaluated both from the visual interpretation by reflectance spectrophotometry, and chemically by pigment analysis of formed nitric oxide heme pigments. Nitrite not utilized in color formation and flavor development, the "residual," is being monitored as well as the microbial outgrowth.

Results to date indicate that a low vacuum level (10-12 inches of vacuum) is insufficient to keep color from fading from light pink to a light brown. In addition, the nitrite residual appears to be more rapidly depleted under low vacuum conditions. The type of film used to vacuum package the cured meat also appears to be critical. Film of a low oxygen permeability appears to maintain color stability and nitrite residuals better than a film of higher oxygen permeability.

Home Economics

Research in home economics includes a wide variety of topics involving individuals as youth who are planning careers, as members of families and as consumers. In 1977-78 studies included a determination of factors underlying career choices; nutritional health of young girls and of pregnant teenagers; and properties of fabrics, particularly fire resistant finishes and comfort.

Data collection was completed on a four-year project studying the nutritional health of adolescent girls. General indications are that both black and white subjects tend to have acceptable levels of proteins, triglycerides and cholesterol; black subjects, however, tend to have greater height, weight, skinfold thickness and dental caries. Final results will be issued in a series of bulletins prepared by the technical committee of the regional project. Another nutrition study involves the iron status of pregnant teenagers. Data are being collected from a regional obstetrical clinic. Since iron deficiency anemia has a high incidence rate in this area of the country, it is hoped the study will help uncover some of the causes and lead to better nutritional health of pregnant women.

A regional project has just begun to study factors influencing career aspirations of low income youth, how these factors change over time and the actual careers entered by the subjects.

Three textiles studies are active: the effects on fire resistant fabrics of laundering temperatures, agitation speeds and detergents; a comparison of laboratory testing and opinions of athletes wearing sample uniforms of selected fabrics (cotton and/or other fibers); and a study of the effects of laundering on the durability of men's undershirts (in response to consumer complaints of unusually short wear life). The project concerning comfort of athletic apparel could easily lead to additional comfort studies, since comfort is a topic little researched in the past and is now becoming an important factor in the choice of fabrics for athletic use.

Significant results are anticipated from a study of career choices of women majoring in home economics and agriculture in the Southeast. This is the first study attempting to identify choice factors of women in this area of the country.

Horticulture

Research with vegetables, fruits, ornamentals, turfgrasses and postharvest handling is the concern of horticulturists.

Developing new and improved varieties is an important aspect of their work. This year, three new vegetable varieties—'Carolina' downy mildew-resistant collard, and 'Charlestowne' and 'Root,' aphid-resistant turnips—have been released to seed companies. An attempt is being made to develop okra varieties that are suitable for mechanical harvesting.

Research is under way to develop improved varieties of southern peas. An experimental line, SC-14, appears very promising. It resembles an earlier release, Colossus, in that the peas are large and easy to shell, but SC-14 is much more vigorous in growth than Colossus and appears more productive. To document the superiority of this new variety, Clemson breeders have placed SC-14 in the southern pea regional trials and expect to have a report of performance by October 1978. If this line continues to show promise, it may be possible to release a new southern pea variety soon.

The rising cost of energy used in the production of nitrogen fertilizer materials has necessitated development of more effective and efficient fertilization practices on high maintenance turf. Preliminary data indicate that several of the new slowly soluble materials not only reduce the loss or waste of nutrients in ground water but also give superior turf quality.

An F₄ line of watermelons, which has shown resistance to race 2 anthracnose in the greenhouse and field, is being tested in replicated field trials this year with reputedly resistant plant introductions.

Horticulturists have led in organization, funding, and implementation of a Prunus Nursery Stock Certification Project. Through assistance from grower organizations, special state funds were obtained to establish a repository of virus-free, true-to-name *Prunus* budwood and seed sources to support the nursery stock certification program. Two technicians have been hired, and repository and indexing facilities are under development at the Sandhill Station. Development of this project has required close coordination of grower interests, commercial nurseries in several states, and various university departments and divisions.

Recent research has shown that azalea plant quality, as determined by the plants when in full bloom, was not unreasonably lowered by pruning until after the August 3 pruning date. This is important since flower bud initiation commences with the shortening of the day-length in June the summer prior to blooming, and obviously flower buds were removed by the pruning operation. Also, it was noted that although new growth was stimulated by the pruning operations, no significant amount of winter damage was sustained by any of the plants pruned and over-wintered under lath. This allowed for cuttings to be taken and rooted later than is normally recommended, yet still leaving the stock plant in a saleable condition the following spring.

A greenhouse for the handicapped has been developed to further the horitherapy program. Special features include a modular work table at wheelchair height, as well as wide aisles, low benches, storage, sink and work areas.

Plant Pathology

Preventing and curing plant disease is the goal of plant pathologists. Disease severely cuts into the profits of farmers and nurserymen and causes consumers and homeowners to pay higher prices for groceries and ornamental plants

Several major problems adversely affecting the performance of white clover in the Southeast are caused by viruses. The work of plant pathologists who are screening for resistance to at least three viruses affecting white clover is progressing satisfactorily. One technique is proving to be of considerable help in screening for resistance in white clover. This technique, ELISA (enzyme linked immunospecific assay), makes it possible to readily distinguish between two viruses which otherwise are practically indistinguishable. It should be pointed out that resistance to one pathogen and/or a virus does not necessarily provide resistance to a second pathogen.

Therefore, it is absolutely necessary to be able to distinguish between diseases that look much alike but which are caused by separate entities.

The fungus, *Aspergillus flavus*, was frequently found in close association with roots of both corn and soybean. Corn growing under conditions of severe drought stress was invaded by this fungus in mid-July while corn growing with adequate moisture was not invaded until 3 or 4 weeks later, indicating that aflatoxin production on corn is more severe during years with drought.

Plant tissue culture systems have been developed which can be used to screen chemicals or potential herbicides and/or growth regulators. This technique will enable plant physiologists to do much of the screening work in the laboratory which will save time, energy and money.

Basic work on peach trees in plant physiology, particularly on peach tree short life, is providing scientists with an understanding of the scope of the problem. Basic laboratory work has already resulted in a method to biochemically identify peach rootstocks and scions. In years to come, it may be possible to screen plants for resistance to this disease complex biochemically in the laboratory.

A new research project has been approved to work on diseases of vegetable crops grown in the mountain and Piedmont areas of South Carolina. It has been operational during the growing season of 1978.

CBR is potentially a serious fungus disease of peanuts in South Carolina. Control procedures are being investigated which include chemical means as well as control by identifying resistant cultivars and recommending their use. Studies on the response of other plants (crops and weeds) to this disease are also being conducted along with intensive laboratory investigations on the biology of the fungus.

Benomyl has been a very effective fungicide for controlling peach fruit decay; but, in the last year or so, it has lost some of its effectiveness because the fungus responsible for brown rot decay has—at various places in South Carolina—become resistant to this chemical. Investigations are under way to either find suitable substitutes or to provide mechanisms whereby this fungicide will retain its effectiveness.

The nematicide DBCP caused considerable alarm in 1977 when human fertility problems were found to be associated with its

manufacture. This chemical is one of the most effective and economical materials available for controlling nematodes (microscopic round worms) affecting peach tree roots. Peach tree roots affected by certain specific kinds of nematodes present a widespread and serious problem in South Carolina, as well as surrounding states. DBCP is the only chemical that can be applied to roots of living trees after the trees have been set without causing extensive tree damage or even death. The search is on for substitute materials that will control nematodes affecting peach trees.

Poultry Science

The Poultry Science Department continues a broad range of research activities dealing with laying hens, broilers, turkeys, quail, pigeons, guineas and rabbits.

Physiology, nutrition, disease and management research was conducted this year with emphasis on those problems with significance to the commercial poultry industry.

Egg shell quality continues to be a major poultry industry problem and station research gave considerable emphasis to this subject. Researchers investigated the effect of added trace minerals and the relationship of these to calcium level. They observed the electron microscopy and oxygen consumption of the shell gland. The relationship of egg shell specific gravity to percent shell and to the number of cracked eggs was studied.

Research with poultry diseases included fowl cholera and leucocytozoon disease. Leucocytozoon disease appears to be at a low point in its cyclic effect on turkeys. This complicates study of the disease, but research results were reported which indicated that the infective organism can persist for long periods of time after a single exposure to the disease-carrying insect which transmits it.

Work was continued on fowl cholera vaccine with emphasis on its application to chickens. Its wide acceptance for use with turkeys has markedly reduced the disease in that species, but new techniques are necessary to make the vaccine applicable to chickens.

Research work with the minor species of poultry continues with comparison between Bobwhite quail and the Japanese quail. For marketing purposes, Japanese quail from selected strains have proven to be rapidly growing birds that reach market age in much less time and at less cost than the Bobwhite quail. Studies on the nutritional requirements and management needs of these birds are under way. The guinea appears to have much potential as a

gourmet food item. Additional work on the protein requirements of this bird are under way. Feed efficiency, at this point, is much inferior to that of the chicken and researchers attempt to improve this inferiority.

Research was started on processing and product quality as related to production practices. The effect of feeding, breeding and harvesting on processed broiler quality and yield are under study.

Edisto Station

Research at the Edisto Station at Blackville is concentrated on crops best adapted to marketing capabilities and to the soil and climate of the upper Coastal Plains.

Work involves plant breeding, insect and disease control, weed control, nutritional and tillage studies; and variety tests on corn, soybeans, grain sorghum, cotton, watermelons, cantaloupes and sweet potatoes. Forage production for beef cattle and mechanized production and storage of hay are also being investigated.

Major emphasis is given to beef cattle production with an experiment designed to determine the genetic-environmental interactions that arise from three crossbred groups of cattle on two forage regimes.

During the past year a center-pivot irrigation system was installed with a capability of irrigating 56 acres. Provisions were also made for irrigating an additional 50 acres with traveling gun systems. Research to determine optimum cultural practices with these systems is under way.

Using a strong team approach to problem-solving, researchers at Edisto work with their colleagues in agronomy, entomology, horticulture, plant pathology, agricultural engineering and animal science. Many scientists stationed at Clemson carry on special projects at the Edisto Station.

Pee Dee Station

Research on all phases of tobacco production continues at the Pee Dee Station at Florence with emphasis on extending harvest, production systems, resistance to insects, disease resistance and mechanization. Improving curing procedures while maintaining quality and conserving energy occupies high priority.

Intensive research continues on corn and cotton variety improvement, weed control, insect control, insect and disease resistance, and tillage methods. All phases of soybean production are given a high priority in the research program.

Aflatoxin in corn produced by the mold, *Aspergillus flavus*, is receiving close study by the corn breeder and pathologist. Commercial hybrids vary in parts per billion of aflatoxin and are being investigated thoroughly to determine source of tolerance or resistance.

A center pivot irrigation system has been installed and plans have been made to study corn hybrids, cotton and soybean varieties under irrigation. Tillage methods for soybeans are being investigated.

Sandhill Station

At the Sandhill Station near Columbia, research continues on fruits, nuts and vegetables.

Research was conducted on chemical thinning, weed control, nematode control, disease control, breeding, mechanical harvesting, peach tree short life, and rootstock evaluations on peaches, nectarines and plums. Additional plantings of stone fruit varieties were made for use in the Peach Certification Program to supply propagating stock for nursery use and for conducting virus indexes. A 32' x 100' greenhouse was erected as a support facility for the Peach Certification Program.

Small fruits are being tested and evaluated. A blueberry variety trial was installed to study the feasibility of producing blueberries on Lakeland sandy soils. A variety trial of muscadine grapes was renovated and other cultivars added to the planting to evaluate their adaptability to the Sandhill area.

Pecan varieties and selections were evaluated for adaptability to South Carolina, disease resistance, early production, yield and quality indices. Studies were continued on tree spacing, chemical weed control, growth regulators, insect control, nematode control, disease control and irrigation.

In the area of vegetable research, evaluations were conducted to compare virus expression in two southern pea varieties 'Purple Hull' and 'Worthmore.'

Boars and gilts were evaluated using specified production traits at the South Carolina Swine Evaluation Center. Purebred swine producers purchased these animals and utilized them to improve their swine herds.

Truck Station

Research at the Truck Station at Charleston features a systematized approach to commercial vegetable production in the State. Introduction of a tomato integrated pest management program, testing of a rapid method for determining disease-infested lots of cabbage seed, and release of disease resistant collard varieties are examples of this approach. The research base is broadened by cooperative research with nearby federal and neighboring state institutions.

Rice, tea and sunflower investigations continue to expand the informational base for South Carolina agriculture.

The urban research and demonstration area at the Truck Station is much visited by garden clubs, 4-H groups, school biology classes and individuals. Paved parking allows all-weather utilization of the self-guided tours through an arboretum and plots of ornamentals, vegetables and lawn grasses.

FUNDS FOR THE EXPERIMENT STATION OTHER THAN THOSE FROM FEDERAL SOURCES

Classification of Expenditures and Receipts for 1977-78

	<i>State Appropriation and Operating Revenue</i>
Classified Positions	\$ 2,121,366
Faculty and Staff	1,863,936
Graduate Assistants	181,139
Students and Other Temporary Help	234,478
Fringe Benefits	633,045
Travel	82,430
Supplies and Other Expenses	1,740,900
Equipment	354,419
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Total Expenditures	\$ 7,211,713
Receipts from State Treasurer (Regular Approp.) .	6,530,898
Operating Revenue Receipts	858,210
Unexpended Balance Brought Forward from Previous Year	90,276
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Balance Forward	\$ 267,671

FEDERAL FUNDS

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION, 1977-78

	<i>Hatch</i>	<i>Regional Research Funds</i>
Classified Positions	\$ 426,209	\$ 76,259
Faculty & Staff	441,433	158,246
Graduate Assistants	136,170	22,476
Students & Temporary Help	59,430	20,495
Fringe Benefits	111,142	28,254
Travel	37,975	7,398
Supplies & Other Expenses	385,802	46,049
Equipment	159,735	1,416
Total Expenditures	\$ 1,757,896	\$ 360,593
Receipts for the Year from the Treasurer of the United States	\$ 1,757,896	\$ 360,593

ACTIVE RESEARCH PROJECTS, 1977-78

Agricultural Economics and Rural Sociology

Analysis of opportunities to develop rural tidelands industries through improved financial management.

Implications of alternative federal energy policies on South Carolina economy, with emphasis on agriculture.

Local factors affecting industrial plant location in rural communities of the South Carolina Coastal Plains.

Marketing performance of selected milk pricing systems for the Southern Region.

The economics of peach production in South Carolina.

Public investment alternatives to meet projected manpower needs in South Carolina.

Efficiency of identification, assembly and transportation of cotton to mills and export outlets.

Supply pricing and marketing alternatives for cattle, beef systems in the South.

Land tenure adjustments and the South Carolina economy.

Electrical peak loads and the changing tobacco curing process.

A comprehensive econometric model of the U. S. tobacco industry.

Social organization for development of low-income rural counties.

Defining and achieving life goals: a process of human resource development.

Minimizing the adverse effects of potential water shortage in South Carolina.

Benchmark study for evaluating use-value assessment of farm land in South Carolina.

Analysis of agricultural loans in South Carolina.

Economics of farm machinery management.

A cost and return analysis of irrigating corn and soybeans with sprinkler irrigation.

Non-point source pollution from grassed and forested land in the Piedmont of South Carolina.

Feasibility of mechanizing the production of vegetables for fresh market and processing.

Agronomy and Soils

Sulfur supply of air, rainwater and soil as related to agronomic and horticultural crop needs.

Adaption and breeding of a cool-season forage grass species.

Plant analysis for complementing soil tests in evaluation of nutrient availability.

Interaction of representative pesticides with dominant South Carolina soils and model soils.

Heat-drought tolerance in *Trifolium spp.* and soybeans.

Sorghums for silage production.

Hybrids for supplementary summer pastures.

Soil-water and plant water relations in soybeans as related to root growth.

Soil biophysical factors affecting soybean root growth, nitrogen fixation and yields.

Cytogenetic studies of white clover and related species.

Tobacco production.

Tobacco breeding and genetics.

Diagnosis and correction of boron and manganese problems in crop production.

Development of weed control practices in corn, cotton and soybeans.

Production, propagation, evaluation of interspecific forage legumes through cell and callus culture.

Minimum tillage and double cropping on weed populations and persistence and fate of herbicides.

Diagnosis and correction of manganese and molybdenum problems in legumes.

Enhancing biological dinitrogen fixation in soybeans and other legumes.

Chemical, physical and mineralogical properties of selected soils of South Carolina.

Cotton breeding.

Selection of tall fescue and hardinggrass for persistence in coastal bermudagrass in the Piedmont.

Primary root development in soybeans on compacted Coastal Plains soils.

Development of soybean varieties adapted to South Carolina.

Movement and retention of water and solutes in selected southern regional field soils.

Corn breeding.

Rhizosphere ecology as related to plant health and vigor.

Small grain breeding.

Evaluation of selected varieties and advanced experimental strains of cotton.

Evaluation of corn hybrids and advanced breeding lines.
Evaluation of selected varieties and advanced experimental strains of soybeans.
Evaluation of varieties and experimental strains of wheat, oats, barley and rye.
South Carolina soybean yields as influenced by row spacing.
Evaluation of selected grain sorghum hybrids.

Animal Science

Genotypic and phenotypic response of crossbred cattle under different levels of management.
Factors influencing nitrogen utilization in the equine.
Comparison of methods of measuring composition in the live animal.
Roasted corn in diets for growing-finishing pigs.
Productivity of gilts fed two levels of calcium and phosphorus in confinement.
Fat addition to growing-finishing swine rations.
EMME as a selection instrument for swine.
Forage systems for backgrounding and finishing cattle.
Caloric density of diets for 3-week-old pigs.
Regulation of reproduction in beef and dairy cattle with exogenous hormones.
Monensin and corrugated paper boxes in growing and finishing rations for steers.
Marketability and acceptability of beef produced under forage-grain management systems.
Ensiled poultry manure for cattle.
Forage systems for production of beef from conception to slaughter.
Toxicity studies on ammoniated aflatoxin corn in beef cattle (steers).

Dairy Science

Innovative materials handling for packaging and distributing milk.
Ensiled complete rations for lactating cattle.
Waste disposal management in the dairy industry and its relation to surface water quality.
Feeding value of fermented colostrum for preruminant calves.
The role of energy compounds and hormones in regulating lipid metabolism in ruminants.
Effect of age and quality of raw milk on the shelf-life of the processed fluid product.

Aflatoxin B₁ consumption and stability of related metabolites in milk and tissue.

Role of the uterus in embryonic survival and mortality.

Improving reproductive efficiency in South Carolina dairy herds.

Factors affecting nitrogen economy of the bovine.

Entomology and Economic Zoology

Alfalfa insect pest management.

Insect pest management.

Development of pathogens for use in a pest management system for soybean insects.

Bionomics and control of insects on cotton.

Insects as hosts and vectors of viruses.

Biology, ecology and management of peach insects.

Ectoparasites of poultry and synanthropic flies associated with poultry and livestock, their biology and control.

Culture of warm water fishes.

Studies of the economically important species: *Mercenaria mercenaria* and *Macrobachium rosenbergii*.

Pathological relationships between insects and biological control agents.

An integrated system for the suppression of the boll weevil.

Control tactics and management systems for arthropod pests of soybeans.

Tobacco insect investigations.

Biology and control of insects attacking ornamental and greenhouse plants.

Analysis of predation of *Mercenaria mercenaria* by decapod crustaceans.

Ecology and management of wood ducks (*Aix sponsa*) in South Carolina.

Anatomy of the larvae of the velvetbean caterpillar, *anticarsia gemmatilis*.

Freshwater food animals.

Development of alternative control methods to mirex and chlordane for the imported fire ant.

Some important aspects of reproduction in feral swine populations in South Carolina.

Development and evaluation of soybean cultivars resistant to insect pests.

Biology and control of arthropods affecting man and animals.

Epizootiology and transmission of leucocytozoonosis in poultry.
Development of a grower treatment algorithm for insect pests of cotton.

Bionomics and control of billbugs injurious to corn.

Participation in the Pesticide Impact Assessment program.

Bionomics and control of the pecan weevil.

A *Baculovirus* as a management tool for velvetbean caterpillar populations in South Carolina.

Control of arthropods on apples.

Control of vegetable insects in the Piedmont of South Carolina.

Identification and distribution of insects of economic importance in South Carolina.

Food Science

Oral contraceptives and nutritional status.

Composition, nutritive value and stability of poultry meat and egg products.

Quality of dried sausages.

Microbial injury and food quality.

Factors influencing nutrient absorption.

Relations of nutrition to porcine stress syndrome.

Zinc and cadmium status of children and adolescents in South Carolina.

Nutritional impact of fat-altered diets.

Regulation of pituitary function during post-partum-anestrus in young beef cows.

Postharvest physiology of fruits.

Parametric studies on packaging of new foods.

Enterotoxigenic clostridia and bacilli in foods.

Nutritional effects of jejunoileal by-pass surgery.

Quality maintenance and control in the marketing and storage of vegetables.

Utilization of oilseed materials as human food.

Effect of light on postharvest fruit.

Behavior of offspring as influenced by nutritional aberration and ethanol.

Home Economics

Patterns of food intake and nutritional health of girls.

Needs for child care and potential for rural family and community development.

- Effects of laundering temperature and agitation speed on fire resistant finishes.
- Activities of the South Carolina day care centers for the aged.
- Laboratory and consumer evaluation of comfort in fabrics from cotton and/or other fibers.
- Defining and achieving life goals: a process of human resource development.
- Erythrocyte protoporphysine and iron status of pregnant teenagers.
- Effects of home laundering on the durability of fabrics for men's undershirts.
- Career projections and attainment of low income youth: changes over time.

Horticulture

- Cultural management of centipede grass.
- Detection and evaluation of plant growth-environment relationships.
- Breeding edible Southern peas.
- Cultural and management practices for pecans.
- Development and evaluation of rootstocks for peaches.
- Influence of environmental factors and chemical growth regulators on growth and development of floricultural crops.
- Evaluation of woody ornamental plant material with respect to variety, production, propagation and marketing techniques.
- Uses of seaweed and other organic materials in economically important horticultural crops.
- Quality maintenance of mechanically harvested horticultural crops for fresh market.
- Delayed ripening and senescence in peaches and other fruits.
- Establishment and maintenance of scionwood and seed increase blocks for peach tree certification.
- Vegetable culture.
- Breeding watermelons and evaluation of watermelon and cantaloupe varieties.
- Improvement of turfgrass nutrition and associated management practices.
- Tea, *camellia sinensis*, culture, ecology, propagation and pest control.
- Coastal lawn grasses, fruits and ornamentals.
- Evaluation, improvement, horticultural crops and varieties.
- Nutrition, management, horticultural crops and varieties.

Growth regulators and orchard designs for production of peaches.
Peach breeding.
Quality maintenance and improvement of processed horticultural crops.
Evaluation of strawberry cultivars for South Carolina.
Container growing medias and nutrient sources.
Nitrogen requirements for containerized nursery plants in bark growth mixes.
Production, histology, breeding and genetics of mutagen induced dwarf pecans.
Plant germplasm—its introduction, maintenance and evaluation.
Improved practices for culture and management of peaches and grapes.
Evaluating and selecting superior fruit cultivars.
Vegetable variety testing and improvement.
Evaluation and improvement of flowering plants with relation to variety and productive techniques.
Development of weed control practices for vegetable crops.
Apple production.
Evaluation of vegetable varieties and cultural practices.

Plant Pathology and Physiology

Integrated plant disease control and farming systems with field and vegetable crops.
Etiology, epidemiology and control of pecan diseases.
Bacterial canker and other factors associated with peach tree short life.
Peach tree short life: a physiological approach.
Disease control on vegetables.
Nature and extent of variation in rootknot and cyst nematodes.
Epidemiology of the *Aspergillus flavusoryzal* group of fungi and control of aflatoxin in corn.
Cause and control of diseases of shade and ornamental trees.
Reduction of aflatoxin development in corn by cultural practices and breeding.
Control of cylindrocladium blackrot (CBR) of peanuts and soybeans.
Epidemiology and control of fruit diseases in South Carolina.
Varietal, cultural and chemical control of nematodes in cotton and soybeans.
The causes and control of diseases of cereal grains in South Carolina.

Preharvest application of fungicides and their effect on cottonseed quality and seedling disease.
Chemical, cultural and varietal control of fungal diseases of soybeans.
Hoplolaimus columbus—effect of biophysical factors on distribution, production and pathogenicity.
Tobacco disease control in South Carolina.
Forage legume viruses.
Viruses and mycoplasma-like organisms causing diseases of corn and soybeans.
Mycotoxins of corn and other feed grains.
Causes and control of diseases of ornamental crops.
Physiological and biochemical mechanisms of herbicidal action.
White clover pathology, virus and other diseases.

Poultry Science

Artificial insemination and fertility studies with caged breeder chicks.
Improvement of egg shell quality through nutrition and management.
Improving production efficiency of meat type poultry.
Environmental effects on chickens.
Immune response of chickens and turkeys vaccinated against fowl cholera disease.
Leucocytozoon disease of turkeys: hematology, immunology and control.
Composition, nutritive value and stability of poultry meat and egg products.
Nutrition requirements of market age rabbits.
Rabbit coccidiosis: pathological effects, prevention and control.
Reproduction characteristics and nutritional requirements of guineas, pigeons, and quail.
Eggshell quality in avian species.
Turkey reproduction-physiological, nutritional and environmental interactions.

EXPERIMENT STATION PUBLICATIONS, 1977-78

Bulletins

- SB 600—Comparative Analysis of Prices Received for Mechanically and Conventionally Harvested Tobacco. C. Stassen Thompson and Raleigh Ward.
- SB 601—Cost of Storing and Drying Corn in South Carolina. Larry L. Bauer, James Donald and Daniel B. Smith.
- SB 602—Employment Characteristics and Labor Force Participation of Female Graduates of Clemson University. Nancy J. Pettigrew and James M. Stepp.
- SB 603—Optimum Number, Size, and Location of Fluid Milk Processing Plants in South Carolina. William A. Thomas and R. Kenneth DeHaven.
- SB 604—A Price Analysis of South Carolina Graded Feeder Pig Auctions. J. S. Lytle and William Gomez Camacho.
- SB 605—Dietary Iron for Prevention of Anemia in Pigs. M. E. Reid, D. L. Handlin, J. Gillingham, R. G. Bursey and W. E. Johnston.
- SB 606—Feed Mill Costs and Capital Requirements in South Carolina. Lewis D. Malphrus and Larry J. Boyleston.
- SB 607—The Economics of Time-Shared Ownership of Resort Property. J. C. Hite and W. D. Blackmon, III.
- SB 608—Consumer and Laboratory Evaluation of Children's Flame-Retardant Sleepwear and Attitudes Towards Care Instruction Labeling. Kenneth C. Laughlin and Frances M. Buddin.
- SB 609—A Multi-Year Study of the Cost of Module Builder Systems for Handling Cotton in South Carolina. Thomas J. Burch and John W. Hubbard.
- SB 610—Economic Analysis of Broiler Litter as a Feed for Steers. C. Stassen Thompson and Dee L. Cross.
- SB 611—The Length of the Growing Season in South Carolina. Alex J. Kish.
- SB 612—Organizational and Economic Viability of the Sea Island Farmers Cooperative, Frogmore, South Carolina. Jerold F. Pittman and Stephen R. Pettigrew.

Circulars

- SC 177—Performance of Field Crop Varieties in South Carolina 1976. E. B. Eskew.

SC 178—Performance of Field Crop Varieties in South Carolina
1977. Ben Eskew.

Research Series

Agricultural Economics and Rural Sociology

- 398—S. C. Cash Receipts from Farm Marketings, 1975 Revised,
1976 Preliminary. R. M. Foster and J. E. Faris.
- 399—Costs of Producing Peaches in South Carolina. L. L.
Bauer, J. A. Brittain and G. L. Watkins, III.
- 400—South Carolina Crop Statistics, State and County Data,
1972-1976 Revised, 1977 Preliminary. R. M. Foster and
J. E. Faris.
- 401—South Carolina Livestock and Poultry Statistics, State and
County Data. R. M. Foster and J. E. Faris.

Agricultural Engineering

- 23—Residential Heating. E. B. Rogers, Jr.
- 24—Simulation of Root Growth and Water and Nitrate Up-
take and Transport in the Soil Under Field Conditions.
B. Bar-Yosef and J. R. Lambert.
- 25—Mechanical Harvest of Fresh Market Peaches. Doyle
Gibson and C. E. Hood.

Agronomy

- 97—Alfalfa Variety Performance in South Carolina. J. S. Rice.

Animal Science

- 34—Beef Cattle Research Highlights.
- 35—Annual Swine Research Reports.

Dairy Science

- 60—Comparison of Two Methods for Analysis of Aflatoxin M₁
in Milk. A. B. Bodine, J. J. Jantzen and F. M. Crawford.
- 61—Effect of Fluid Intake and Dry Matter Concentration on
Scours and Water Intake in Calves Fed Once Daily.
B. F. Jenny, S. E. Mills, W. E. Johnston and G. D. O'Dell.

Horticulture

- 177—1977 Herbicide Evaluation on Vegetable Crops. W. L.
Ogle and W. P. Clark.
- 178—A Hortitherapy Program for the Visually Handicapped.
Phyllis R. Gilreath.

- 179—Flowering Annuals Variety Trials—1976. A. J. Pertuit and D. A. Ferguson.
- 180—Efficacy of Rates and Formulations of Ethoprop for Control of Soil Insects and Nematodes in Sweet Potatoes. Max G. Hamilton and Randall P. Griffin.
- 181—Soil Insect and Nematode Control Investigations with Sweet Potatoes. Max G. Hamilton and Randall P. Griffin.
- 182—Soil Insect and Root Knot Nematode Control Investigations with Sweet Potatoes. Max G. Hamilton and Randall P. Griffin.

Poultry Science

- 36—Exposure of Broilers to Continuous High Temperature Stress. K. V. Vo, M. A. Boone and W. E. Mulliken.
- 37—Mineral and Amino Acid Composition of Egg Shells from Eggs of Varying Specific Gravity. D. P. Holder.

Technical Bulletins

- TB 1063—Economic Considerations in Curing Tobacco Under a Selected Controlled Power Interruption. W. J. Lanham and J. G. Alphin.
- TB 1064—A Bibliography of the plum curculio *Conotrachelus nenuphar* (Coleoptera: Curculionidae). Rodney Holloway.
- TB 1065—Controlling Self-Incompatibility in *Trifolium Repens* L. Janet C. Hair, Pryce B. Gibson, O. W. Barnett and E. A. Rupert.
- TB 1066—The Effect of Maturation on Food Preference Behavior in Bobwhite Quail. Ronald J. Kendall, D. Lamar Robinette and Raymond Noblet.

TECHNICAL CONTRIBUTIONS

July 1, 1977 - June 30, 1978

- 1482—Degradation of Fluometuron by *Rhizoctonia solani*. R. W. Rickard and N. D. Camper.
- 1483—Validation of a Physiological Day Equation: Development of the Mexican Bean Beetle on Snap Beans and Soybeans. J. L. Bernhardt and M. Shepard.
- 1484—Macromolecular Synthesis in Callus Tissue. Linda W. Young and N. Dwight Camper.
- 1485—The Juvenile Female Rat as a Physiologic Castrate. L. Stephen Frawley and Donald M. Henricks.
- 1486—Effect of Cholera Preventative Treatments on Reproductive Performance of Turkey Hens. J. E. Jones, W. T. Derieux, B. L. Hughes and J. W. Dick.
- 1487—Scanning Electron Microscopy of the Adult Mouth Parts of the Horn Fly and the Face Fly. Jane T. Paysinger, Raymond Noblet, Theodore R. Adkins, Jr. and Edward A. Vaughn.
- 1488—An Extension of the Ontogenetic Model of Cotton Yield. Smith Wordley, Jr., H. Ramey, Jr., T. W. Culp and J. H. Turner, Jr.
- 1489—Efficiency of Producing Hatching Eggs via Artificial Insemination and Natural Mating of Broiler Breeder Pullets. B. L. Hughes.
- 1490—Electrolyte Content of Blood and Bone in Chickens Subjected to Heat Stress. K. V. Vo, M. A. Boone and A. K. Torrence.
- 1491—Physiological Reactions of Chickens to a Lifetime of Constant Temperature Stress. K. V. Vo, M. A. Boone and W. E. Johnston.
- 1492—Response of Coliform Populations in Poultry Waste Digesters to Three Insecticides. P. E. Ballington, H. D. Skipper and R. O. Hegg.
- 1493—Gonadotropin Synthesis and Release in the Juvenile Female Rat. L. Stephen Frawley and Donald M. Henricks.
- 1494—Improvement of Techniques for Determining Populations of *Criconemoides xenoplax* in Dry Soil. Ernest G. Lawrence and Eldon I. Zehr.
- 1495—Influence of Drying on Plant-Water Stress, Photosynthetic Rates, and Yield on Cotton. J. E. Carson, C. J. Phene, D. N. Baker, J. R. Lambert and J. M. McKinion

- 1496—Shell Gland Oxygen in Hens Producing Eggs of Low or High Specific Gravity. D. M. Huntley and D. P. Holder.
- 1497—Corn and Cotton Root Growth and Response to Environment: I. Soil Impediments and Water Potential. Bar-Yosef and Jerry Lambert.
- 1498—Corn and Cotton Root Growth and Response to Environment: II. Osmotic Potential and Oxygen and Nitrate Concentrations in Nutrient Solutions. Bar-Yosef and Jerry Lambert.
- 1499—Partial Purification of Polyphenol Oxidase Using a Hydrophobic Resin. W. H. Flurkey and J. J. Jen.
- 1500—The Persistence of Gametocytes of *Leucocytozoon Smithi* in Peripheral Turkey Blood. John W. Dick.
- 1501—Effect of Soil Fumigation and Pruning Date on the Resumption of Growth of the Vascular Cambium of Peach Trees in a Short Life Site. George E. Carter, Jr.
- 1502—Daily Midafternoon Closure of Waterfowl Hunting: Implications for Law Enforcement and Management. Jay D. Hair.
- 1503—Winter Foraging Behavior and Aggression of Diving Ducks in South Carolina. William C. Alexander and Jay D. Hair.
- 1504—The Status of Our Knowledge of Root Rot of Camellias Caused by *Phytophthora cinnamomi* in 1977. Ngo Huy Can and Luther W. Baxter, Jr.
- 1505—Wood Duck Brood Mobility and Utilization of Beaver Pond Habitats. Gary R. Hepp and Jay D. Hair.
- 1506—A Progress Report on the Development of Resistant Cultivars of *Camellia Sasanqua* to Canker Caused by *Glomerella cingulata*. Luther W. Baxter, Jr., Susan G. Fagan and Mary G. Owen.
- 1507—Degradation of Nitratin by *Rhizoctonia solani*. N. D. Camper and Kathryn L. Ellers.
- 1508—Mold Spore Populations in Bark Residues Used as Broiler Litter. Dang Thi So, J. W. Dick, K. A. Holleman and Peter Labosky, Jr.
- 1509—Vaccination of Broiler-Type Chickens Through the Drinking Water with a Live, *Pasteurella Multocida*, Vaccine. John T. Rice, B. W. Bierer and J. W. Dick.
- 1510—Subcutaneous Vaccination of Broiler-Type Chickens with a Live, Avirulent *Pasteurella Multocida*, Vaccine. John T. Rice, J. W. Dick and B. W. Bierer.
- 1511—Removal and Utilization of Nutrients by Chinese Waterchestnut in Catfish Ponds. Charles L. McCord, Jr. and Harold A. Loyacano, Jr.

- 1512—Development and Oviposition Activity of *Pediobius foveolatus*: Influence of Temperature and Time of Exposure to Hosts. G. T. Gale and M. Shepard.
- 1513—Life Cycles, Growth, and Population Bioenergetics in the Snail *Helisoma Trivolvis* (SAY). Arnold G. Eversole.
- 1514—The Effect of Photoperiod on the Deep Body Temperature of Domestic Turkeys and Its Relationship to the Diurnal Periodicity of *Leucocytozoon smithi* Gametocytes in the Peripheral Blood of Turkeys. Thomas C. Gore and Gayle Pittman Noblet.
- 1515—Effect of Substituted 2,6-Dinitroaniline Herbicides on Tobacco Callus Tissue Growth. Jannie B. Huffman and N. D. Camper.
- 1516—Pheromone Monitoring of Peachtree Borers and Lesser Peachtree Borers in South Carolina. Curtis Gentry, Rodney Holloway and D. K. Pollet.
- 1517—Evolution of the Caddisfly Genus *Ceraclea* in Africa: Implications for the Age of Leptoceridae (Trichoptera). John C. Morse.
- 1518—Effect of *Eimeria* species on the Appearance of Radioactivity in the Blood of Chicks Fed Radio-labeled Glucose or 3-0-methyl-D-Glucose. Gayle Pittman Noblet and D. E. Turk.
- 1519—The Hydraulic Press for Measuring Leaf Water Potential of Corn, Cotton and Soybeans. D. C. Reicosky, V. L. Quisenberry, D. E. Deaton and J. S. Rice.
- 1520—Effects of Tobacco Budworm Control at Different Treatment Levels with Several Insecticides on Flue-Cured Tobacco. A. W. Johnson.
- 1521—A Comparison of Aquatic Insects in Natural Inlets with those in the Heated Effluent from the Oconee Nuclear Station—Littoral Zone. Vicki M. Ferguson and Richard C. Fox.
- 1522—Effects of Inoculation of Pines with the Pitch Canker Fungus. Helmuth Kraus Sch. and Wesley Witcher.
- 1523—Sequential Sampling Plans for Soybean Insects. Merle Shepard.
- 1524—Predation of *Mercenaria mercenaria* by *Panopeus herbstii*. Jack M. Whetstone and Arnold G. Eversole.
- 1525—Ultrastructure of Cell Gland Tissue from Hens Producing Good and Poor Egg Shells. D. M. Huntley and D. P. Holder.
- 1526—Cytoplasmic Estrogen Receptors and Estrogen Concentrations in Bovine Uterine Endometrium. D. M. Henricks and R. B. Harris, Jr.

- 1527—Influence of Added Manganese, Magnesium, Zinc, and Calcium Level on Egg Shell Quality. D. P. Holder and D. M. Huntley.
- 1528—Calosma Sayi: Seasonal History and Response to Insecticides in Soybeans. James F. Price and Merle Shepard.
- 1529—The Influence of Color in Trapping Lesser Peachtree Borer and Peachtree Borer Males in Traps Baited with Each Respective Sex Attractant. Stanley H. Childers and Rodney L. Holloway.
- 1530—Evaluation of Several *Nicotiana tabacum* Entries for Resistance to Two Tobacco Insect Pests. Albert W. Johnson.
- 1531—Antagonistic Effect of CPTA and Far-Red Light on the Carotenogenesis of Lutescent Tomatoes. Joseph J. Jen and Ronnie L. Thomas.
- 1532—Effects of Host Age, Route of Infection, and Quantity of Inoculum on the Susceptibility of *Heliothis virescens*, *Spodoptera eridania*, and *S. frugiperda* to *Beauveria bassiana*. Wayne A. Gardner and R. Noblet.
- 1533—Degradation of Ioxnyl by a Soil Fungus, *Fusarium solani*. JeMin C. Hsu and N. D. Camper.
- 1534—Effect of Fluid Intake and Dry Matter Concentration on Scours and Water Intake of Calves Fed Once Daily. B. F. Jenny, S. E. Mills, W. E. Johnston and G. D. O'Dell.
- 1535—An Evaluation of the Health Status in Thirty-Nine Peach Orchards. Rodrigo Alconero, Robert Campbell, Jere Brittain, and Briscoe Brown III.
- 1536—Response of Young Chickens and Turkeys to Virulent and Avirulent *Pasteurella Multocida* Administered by Various Routes. William T. Derieux.
- 1537—Response of Ground-dwelling Arthropod Predators in Soybeans to Reduced Tillage. James F. Price and Merle Shepard.
- 1538—Tobacco Hornworm and Sucker Control with Tank Mixes of Royal MH^R and Dipel^R and Several Other Insecticides. Albert W. Johnson.
- 1539—Endogenous Estrogens in Bovine Tissues. D. M. Henricks and A. K. Torrence.
- 1540—Evaluation of Factors that Contribute to Peach Decline. R. Alconero, R. Campbell, J. Brittain and B. Brown.
- 1541—Effects of Water-Borne Mirex on the Survival and Production of *Macrobrachium rosenbergii* (De Man). Stephen E. Summer and Arnold G. Eversole.

- 1542—A Technique for Analysis of Historical Biogeography and Other Characters in Comparative Biology. John C. Morse.
- 1543—Susceptibility of Certain Soybean Cultivars to Damage by Stink Bugs. Walker A. Jones, Jr. and M. J. Sullivan.
- 1544—*Calosoma sayi* and *Labidura riparia* Circadian Activity and Response to Noctuid Prey in Soybeans. James F. Price and Merle Shepard.
- 1545—Efficacy of Quinaldine and MS-222 on American Eel. Michael J. Hinton and Harold A. Loyacano, Jr.
- 1546—Changes in Sulfhydryl Groups of Soluble Protein Fractions in Fermented-Dried Sausage. J. C. Acton, L. H. McCaskill and R. L. Dick.
- 1547—Effect of Skin Content on Some Properties of Poultry Meat Loaves. J. C. Acton and R. L. Dick.
- 1548—Influence of Polyethylene Mulch and Magnesium Salts on Tomatoes Growing on Loamy Sand. U. S. Jones and T. L. Jones.
- 1549—Fungicide Application and Evaluation Techniques Used in Pecan Field Trials in South Carolina. R. W. Miller and C. E. Drye.
- 1550—Comparison of Growth Rate, Body Weight and Feed Conversion Between Coturnix D₁ Quail and Bobwhite Quail. J. E. Jones and B. L. Hughes.
- 1551—The Separation of Gametocytes of *Leucocytozoon smithi* from Whole Peripheral Turkey Blood. C. W. Henry and J. W. Dick.
- 1552—Evolution and Testing of a Five-Day Water Yield Model. T. V. Wilson, J. E. Ligon and A. G. Law.
- 1553—Effects of Infection by *Beauveria bassiana* on Soluble Hemolymph Proteins from Noctuid Larvae. Wayne A. Gardner, Roy M. Sutton and Raymond Noblet.
- 1554—Overwintered Mexican Bean Beetles: Emergence From Overwintering Sites, Fecundity, Fertility and Longevity. J. L. Bernhardt and M. Shepard.
- 1555—A Coupled System for the Quantitative Analysis of Indole-3-Acetic Acid and Abscisic Acid. George E. Carter, Jr.
- 1556—Changes in Rumen Metabolism Induced by Chemical Inhibition of Methane Production *In Vitro*. R. L. Stewart and R. L. Edwards.

- 1557—Cross Infectivity of a Nuclear Polyhedrosis Virus of the Velvetbean Caterpillar to Seven Noctuid Hosts. G. R. Carner, J. S. Hudson and O. W. Barnett.
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Cooperative Extension Service

WAYNE T. O'DELL, DIRECTOR

The Cooperative Extension Service is Clemson University's outreach educational program for the citizens of South Carolina.

In the six decades since the Cooperative Extension Service came into existence, farm families have played a vital role in shaping a dynamic and changing agriculture to fulfill their needs and solve their problems. The Extension Service has worked hand-in-hand with South Carolina's farm families to help them shape a better life.

Funded by federal, state and county governments, the Extension Service was established in 1914 as part of a nationwide system designed to carry education from land-grant universities to the people.

Extension is built around the concern and dedication of local citizens and community leaders who help guide extension programs. In every community of every South Carolina county, citizens serve as volunteer leaders and members of program planning committees and advisory boards.

Extension was originally conceived to help rural people, but with changing social structures, advances in transportation and communication and changes in economics, Extension has broadened its scope of activities to include many urban and suburban problems. Extension responds to the needs of the people it serves.

Through Extension, Clemson maintains an office in each county seat of South Carolina, staffed by county agent personnel and extension home economists. At the University a professional staff of extension subject matter specialists compiles information from research results and translates this into usable data for the people of South Carolina. This ensures a constant flow of information to producers, homemakers and youth in all counties of the State.

Extension's efforts are organized into six broad categories: Agricultural programs; 4-H and youth development; home economics; community and resource development; special programs for farmers in "low-income" agriculture; and 1890 programs conducted by South Carolina State College in cooperation with the Clemson University Extension Service.

In agriculture, extension specialists and county staffs work with producers, those with large operations and small, keeping them

abreast of new developments in production practices, marketing and management.

Extension home economists update homemakers, rural and urban, on new developments in food, clothing, home management and a number of other specialized areas.

Extension's unique 4-H program challenges young people to learn by doing and offers them opportunities in many fields—agricultural, home economics, leadership and many others—to make them more aware of their potential as productive citizens.

Extension staff members are teachers. They carry Clemson University's outreach educational program to all areas of South Carolina and are at home in any classroom—tobacco field, dairy barn, assembly hall, homemakers' kitchen or 4-H camp. Extension is developing and carrying educational programs to the people to help them increase incomes and maintain desirable levels of living in their communities.

AGRICULTURAL PROGRAMS

Scope of Activity

Agricultural producers in South Carolina face a challenging future as the world demands increase in quantity and quality of food and fiber. To play an important part in agriculture's future, farmers in the State must continually increase their expertise in crop and livestock production. They must pull together the basic components of farm business management, which include improved record keeping, sound financing practices, progressive labor relations, and thoughtful estate planning. They must also be increasingly aware that successful farming does not stop with production; crops must be marketed. The total farm management package also includes an ability to obtain necessary input items in an efficient manner.

Progressive agriculture is not complete without proper attention to recreation and conservation. Forestry and wildlife add to the beauty and protection of our resources. Educational effort in agriculture and natural resources comprises an extremely important part of Clemson Extension Service activity. Research and current information are generated in 12 separate on-campus departments for transmission to producers. The greater part of this information comes in response to questions and problems which arise in the counties of the State.

County extension agents have the responsibility for maintaining close personal contact with citizens involved in agricultural produc-

tion, agribusiness, natural resource activity, and home-owner and consumer interests relating to agriculture. Extension specialists work from within the academic departments to keep a two-way flow of information moving—problems and needs moving in, solutions and assistance moving out.

To accomplish these goals and provide these services, numerous programs encompassing 12 departments in production agriculture were carried out by the Extension Service during the year. Highlights of some of those activities follow.

Agronomy

In January and February, a series of 11 regional corn-soybean production meetings were held around the State with a total of almost 2,500 growers attending. These meetings, referred to as "Showdown '78," featured a cooperative effort with 35 agribusiness firms who sponsored the meals. Growers attending were updated on the latest production and marketing practices for both corn and soybeans, which together are grown on almost 2 million acres in South Carolina.

During the summer of 1977, a team of Clemson extension personnel conducted a soybean on-farm demonstration with a small limited-resource farmer in Sumter County. The objective of this effort was to demonstrate to small farmers the yield-increasing potential of several key recommended production practices for soybeans. Treatment included variety choice, pest control and deep tillage. Yields obtained were 50-75 percent greater than the farmer's yields in the same field the previous year. A tour to show results was attended by 125 limited resource farmers from the area.

The tobacco extension program focused heavily on an educational effort to encourage more growers to break the flowers out of their tobacco crop early. Ten thousand new bulletins were distributed to growers through local county extension offices showing stages of flower development and yield loss when topping is delayed. Posters were also placed in areas where growers frequented.

During the past year, the number of soil samples submitted to the soil-testing laboratory by farmers and home owners totaled 56,448. Soil testing has made possible the wise use of fertilizer, increasing production efficiency. During the past six years, the use of agricultural limestone has increased from 350,000 tons per year to 706,000 tons per year.

Pasture fertilization and establishment demonstrations were conducted at five locations, and corn fertility demonstrations were conducted at nine locations.

Cotton production meetings and tours of demonstration projects and research have emphasized the importance of using recommended practices in a timely and accurate manner. It is only in this way that cotton yields can be increased to profitable levels.

Forage educational programs continued to emphasize growing legumes for improved quality in pasture and hay crops. Limited availability of seed of several new alfalfa varieties with improved yield potential and disease resistance resulted in variety recommendation changes and a number of new alfalfa plantings. Dealing with problem areas, such as drought, severe armyworm damage and disease, took up much of the time and effort expended on forages. Extension agents, farmers and other agencies renovated or re-established large acreages of fescue pastures during the fall. There was a marked increase in the acreage of arrowleaf clover in the lower Piedmont.

Animal Science

This unit is responsible for development and implementation of education programs to teach efficient production and management of beef cattle and swine. It is also providing outreach information for the increasing ranks of horse owners and events.

County swine meetings and workshops continue to play a large part in the educational program. These meetings are held to provide county producers with the latest knowledge in management, nutrition, housing and breeding of swine.

The past year was one of the busiest in history in terms of demand on time and building plans for swine units. Staff members assisted with farm layout and building designs for units with 100 or more brood sows.

A swine tour for county personnel was conducted with approximately 63 agents attending. The purpose was to show and explain the newer designs of swine housing, how they are constructed and operated, and the management practices necessary to make the designs work.

Graded feeder pig sales continue to grow in volume and quality of pigs sold. These sales offer an excellent educational opportunity to demonstrate the difference in quality and the extra dollar value it brings.

The S. C. Swine Evaluation Center serves both the purebred and commercial swine producers in the State. Since the first sale of

tested boars in August 1974, 149 individual buyers have purchased a total of 404 boars at the test station. Twenty-eight purebred breeders have received performance evaluations on their boars through this program. The performance records and sale averages presently rank in the top 10 percent of test stations in the United States.

The horse industry continues to make a substantial contribution to South Carolina's economy. Current research is needed on management systems in order for the professional horseman to remain competitive.

The interest and participation in 4-H horse events continue at high levels. The state 4-H horse show set another record of 550 entries, making it one of the largest 4-H livestock activities. The 4-H horse camping program attracted 250 4-H'ers, and the newly instituted trail riding programs at Myrtle Beach and Winnsboro are popular. Selected South Carolina 4-H winners from the state 4-H horse show also participated in the regional contest in Waco, Tex.

The S. C. Bull Gain Test is continuing to have an impact on the beef cattle industry in the State. There were 95 bulls consigned to the 1977-78 test, and several new performance records were set. The quality and performance of these bulls were reflected in the sale, which saw a new record price of \$5,800 established. This program along with the on-the-farm performance testing program is enabling the purebred breeders to improve the performance of their herds from which come the bulls used to sire commercial calves.

Implanting beef calves with a growth promotant is now a recommended practice following extensive on-farm demonstrations in 1976 and 1977. Several confirming demonstrations were conducted this year, and many beef farmers have adopted the practice in routine management.

Grass tetany in cattle is a continuing concern. Incidence of the nutritional disorder was expected to be high in early 1978 but did not develop. Success of the on-going educational program on magnesium supplementation, management and feeding practices is evident in reduction of this problem.

Aflatoxins in grain were at a high level in 1977 and of much concern to livestock producers. Staff efforts to provide information have been invaluable in reducing losses because of aflatoxins.

Agricultural Engineering

Environmental concerns have received much attention in the past year. Extension agricultural engineers have taken an active role in writing a water quality plan relating to agriculture and in encouraging public evaluation by informing farmers of public hearings on the plan. Extension engineers assisted in planning and designing livestock and poultry operations in such a way that water, air and soil resources are protected. In both these activities, a close working relationship with the South Carolina Department of Health and Environmental Control has been maintained.

Agricultural engineers have helped at least 10 growers design open-channel flush systems for swine production. Four on-farm demonstrations were developed. There are now approximately 20 hydraulic syphon systems in operation in South Carolina.

Extension agricultural engineers participated in 11 statewide corn-soybean production meetings (Showdown '78). In addition, three television programs were devoted to proper harvesting of corn and soybeans. Agricultural engineers also provided technical assistance in the first detoxification of aflatoxin contaminated corn in South Carolina.

Due to expansion of sunflower acreage, agricultural engineers have assisted individual growers with their combine adjustments and participated in two area sunflower production clinics.

Vegetable production is an integral operation for many small farmers and homeowners. In addition to the numerous individual contacts, engineering staff members discussed irrigation techniques at two vegetable production clinics.

Five on-farm demonstrations, three production meetings and five television programs have been presented to explain proper harvesting and curing of tobacco.

Three on-farm demonstrations, using a "black light" and fluorescent granules, were held to show farmers how best to apply granular nematicides. A nematicide incorporation demonstration was used to show growers the results of using various incorporation tools.

Two statewide irrigation meetings were held in June 1977 and 1978, along with many county irrigation meetings.

A South Carolina Irrigation Society was organized through efforts of extension agricultural engineers. This society promotes the use of well-designed, efficient irrigation systems such as sprink-

ler, drip, surface and subsurface. The use of mechanical-move irrigation systems is becoming quite common in the State.

Engineering-related safety measures such as fire prevention/detection, poison prevention, home insulation and electrical safety are being addressed. Safe transport of agricultural equipment on roadways and proper operating practices for machinery and equipment are included in user education for youth and adults.

A campaign was developed to help homeowners reduce household energy requirements. All media were utilized in this effort including six new leaflets for distribution to homeowners. Fifteen counties were assisted in local programs emphasizing household energy conservation and alternative methods of home heating.

A major effort was made to publicize the solar-heated house developed by the Rural Housing Research Unit of USDA located at Clemson. An educational exhibit of this solar system was developed, and programs were presented to some 15 audiences both in- and out-of-state.

Dairy Science

Among highlights of the group activities conducted or coordinated by dairy extension personnel during the year were:

- (1) Annual Dairymen's Conference at Clemson attended by 128 dairymen from across the State.
- (2) State 4-H Dairy Conference held at Camp Long in Aiken County with approximately 100 boys and girls attending. The morning sessions of this Conference emphasized 4-H dairy subject-matter training.
- (3) 4-H Dairy Heifer Project, with about 60 animals being placed with 4-H boys and girls from all over South Carolina. Many of these boys and girls are from rural areas but do not live on dairy farms.
- (4) Work with S. C. breed clubs continued, and during the year, quite a bit of assistance was given to the S. C. Guernsey Cattle Club in hosting the American Guernsey Cattle Club Annual Meeting. About 350 people from all over the United States attended.
- (5) Junior dairy shows at the 1977 S. C. State Fair in Columbia were attended by 4-H boys and girls showing about 175 animals.
- (6) Two special schools were held, one for milk weighers and samplers and one for butterfat testers. The S. C. Department

of Agriculture cooperated in sponsoring these events. Two or more schools are usually conducted each year.

A new program this year was an artificial insemination refresher course for dairymen across the State in an effort to help improve breeding efficiency in dairy herds. A majority of the dairy herds in South Carolina are bred by artificial insemination. This allows dairymen to use, on the average, better sires than they could afford individually and also removes the danger of having a bull on the farm. The use of artificial insemination, however, does create some problems because it takes thorough understanding of reproductive physiology as well as a scientific technique. A lack of information in these areas or lack of proper management procedures has resulted in some dairymen having poor breeding efficiency. Approximately 70 dairymen participated in eight artificial insemination refresher courses held across the State.

An urban 4-H program was very successful. Special meetings on the production, processing and use of dairy foods were attended by 1,250 4-H'ers at six participating schools. Demonstrations using a model cow and packages of dairy products were included in the explanation. Lectures were given at the high school level through elementary grades.

Entomology—Economic Zoology

The year 1977-78 was one of the worst years ever experienced by extension entomologists. Plagues of armyworms and other caterpillars caused heavy losses to turf, forage, grain, cotton and soybeans. Leafminers also destroyed the tomato crop in Beaufort County. Shortages of vital pesticides contributed to the problem. New experimental pesticides were employed on an emergency basis to combat the worms and leafminers with some success. Plans were made to have the more effective, new family insecticides available early in 1978 to avoid the destruction suffered in 1977.

A successful tomato pest management program was organized in the coastal area to combat tomato leafminers. As a result, growers experienced no significant problems with leafminers during 1978. A series of soybean pest-management clinics was held with emphasis on training farmers and farm employees to scout soybeans and recognize treatment thresholds in order to accomplish better pest control with less insecticides.

Entomology participated in urban plant problem clinics in Charleston, Columbia and Greenville at popular shopping malls.

Many specimens and control requests were received and acted on through the plant problem clinic at the main campus which is a regular service function of the Extension Service. Many homeowners were advised on termites and borers attacking homes. Departmental training programs for pest control operators contributed to improving the competence of this industry in providing better service to the public.

Aquaculture (fish farming) programs for farm ponds and commercial ventures, in particular farm pond management and beaver management programs, received considerable public attention during 1977-78. Other programs in the wildlife area included testing to develop a field rodent repellent for watermelons and providing assistance to pine plantation managers on quail management.

The Entomology and Economic Zoology Department continued to provide leadership for the pesticide certification training program. More than 16,000 applicators have now been trained to use restricted pesticides.

Food Science

A food science extension specialist position was funded by the Coastal Plains Commission to provide seafood processing advisories. Technical assistance to the seafood processing industry emphasized: (1) increasing the yield of mechanically picked crab meat; (2) formation of "lumped" crab meat from pieces; (3) proper handling of scallops aboard ship to minimize expiration losses; (4) quantifying seafood processing waste discharges; and (5) developing understandable interpretations of existing food regulations pertaining to seafood manufacturing procedures, sanitation, labeling and packaging.

Commodity preservation demonstrations which utilized the best available technology included: (1) development of a process for "heat-and-serve" chitterlings; (2) assurance of the adequacy of thermo-pressure processing conditions for non-carbonated soft drinks; (3) incorporation of selected soft drink bottling wastes into animal rations; (4) a commercial process for an enzyme-modified milk with low lactose content; and (5) assistance to the state's 22 community canneries in standardizing equipment and operating procedures to improve the canned quality of home garden produce.

Mass media, workshop and information booths were utilized to answer consumer questions and distribute educational materials demonstrating proper methods of food handling and sanitation.

Emphasis was placed on minimizing the incidence of food-borne illness associated with the food service industry and home-prepared meals.

Food processing and professional associations were strengthened through continued leadership and committee participation, organization of technical meetings, preparation/distribution of newsletters and speaking to several businessmen/community service organizations. More than 800 contacts with South Carolina food-related companies continuously advised them of changes in state and federal food regulations.

Forestry

Extension forestry activities were directed at four major topics during the year: timber marketing, prescribed burning, regeneration and wood utilization.

In the area of marketing, several activities were undertaken. Stumpage price information was made available to landowners through Clemson University county extension offices. Each office receives a monthly report on timber prices. These offices can use this information in various ways to assist landowners in proper timber marketing. This is the first time stumpage prices have been readily available to landowners. A series of landowner meetings on marketing also was held around the State.

In several counties, such as Sumter, Abbeville and Charleston, meetings were held demonstrating the use of fire in forest management. In other counties, such as Florence, Saluda and Lexington, forest management meetings dealt with a variety of topics.

A significant step in program development was the addition of a forestry specialist to the Pee Dee Extension team. This position will permit a more effective program to be carried on in the region.

Other activities included short courses and workshops for forestry employees on topics such as kiln drying, pulpwood production and log and lumber grading. Extension foresters also were involved in professional organizations by delivering papers on timely subjects and serving in leadership roles.

Horticulture

Extension horticulture is responsible for disseminating information on fruit, vegetable and ornamental crops in South Carolina, with orientation toward production, post-harvest handling and pest management.

All-practice demonstrations are used in turf, pecans and tomatoes to show proper cultural methods. Rejuvenation of old orchards is a major development in pecans with shortcourses being held each year to provide new technology for old orchards. Shortcourses also have proven quite successful in reaching a large percentage of the nursery, flower growing and bedding plant industry. These shortcourses cover a broad range of topics but center on providing recent research results. Attendance at each school includes more than 75 percent of the respective total industry. Special schools relating to management of ornamentals were started in 1977.

Almost every county in South Carolina now has a direct-to-consumer market for vegetable and fruit sales. Extension has had a major role in developing crop production technology for low-income producers who wish to grow and sell local produce. Through a joint 1862-1890 grant, specialists have provided training for vegetable production paraprofessionals in Anderson County. In addition, training literature, production guides and visuals have been produced. The program has been successful in reaching more than 120 part-time farm families, providing a means for better nutrition as well as a market for excess produce.

Home horticulture interest of South Carolina residents remains at an all time high. A team approach was used by ornamental and vegetable specialists involving other support departments to offer three metropolitan-area plant problem clinics (a total of seven days per specialist). More than 40,000 persons were instructed on plant problems and care and even more were reached through an educational display. Lecture clinics are offered in many counties for direct instruction.

Home vegetable gardening is at an all time high with an estimated 90,000 acres being cultivated in South Carolina. Because many of these gardeners are new, they have demanded assistance. This unit has provided radio, television, visual and instructional materials for use by county staff. In larger areas instructional classes have been taught by specialists. In Charleston, Extension co-sponsors a demonstration vegetable garden for observation by the public. More than 175,000 copies of the vegetable garden manual have been distributed to South Carolina residents in the past two years.

Management of fruit, vegetable and ornamental crops with irrigation has been a new goal of the department. Considerable specialist consultation was required because where irrigation interests have been high, there has also been intense interest in new crops.

Variety evaluation for processing is a responsibility of extension staff members. South Carolina canners and freezing plants work closely with Extension in making variety determinations.

A full-scale, week-long school was held for peach growers. Growers attending were instructed on most up-to-date practices of fertilization, pest control and growth regulator application and handling. Schools for apple growers continue.

Horticulture extension staff has been involved in pesticide certification training. Members have presented numerous lectures in all categories. Subcommittee chairmen for categories 3 and 10 are within this division. The members were responsible for organizing training and developing study materials for the respective categories.

Plant Pathology

Extension plant pathology personnel serve in several capacities. As a service unit, the work is directed to a team approach with personnel of extension commodity units and other service units. Results have been good since growers have had the benefits of a more thorough and integrated kind of information they need.

The unit plays an important role in recognition and control of plant parasitic nematodes in the State. Test demonstrations were held on several farms and follow-up grower meetings held at the sites. Accurate information has been gathered on nematode occurrence, spread and control for several field, fruit and vegetable crops in 1977. The Plant Problem Diagnostic Clinic processed 2,600 plant specimens for diseases and other problems and 3,850 soil samples for nematodes in 1977. These specimens and samples came primarily through county extension agent offices.

Work continued on the 10-point program designed to reduce or stop premature death of peach trees. Grower field meetings were held in a number of counties.

Since the nematicide DBCP was deleted from use on some crops in 1977, considerable on-farm evaluation of substitute nematicides was conducted during the year. It was found that growers were often misusing granular nematicides, and a program was developed to prevent this malpractice.

A plant pathology 4-H program was initiated for South Carolina in 1977, and a workbook, complete in most aspects of the program, was prepared. Emphasis will be on use of lay leaders to carry on the county work, allowing county extension staffs to devote more time to agriculture, homemaking and other activities.

Extension plant pathologists also became more involved in integrated pest management programs in 1977.

Poultry Science

With the addition of a new faculty member in the department, programs have been developed in poultry and egg products technology. These include reduction of in-plant losses and processing efficiency in broiler processing and reduction of shell-breakage and increased quality of egg products.

Computer programs on cash flow for poultry farmers continue to be used as a decision-making tool. More and more potential producers are using it to assist in choosing the best enterprise, the most acceptable contract and the potential profitability of the enterprise.

Several producers have received information on reducing brooding costs of chickens and turkeys. Insulation information, proper winter ventilation and partial house brooding information have been distributed to potential as well as existing producers who are seeking to reduce costs due to the energy crisis.

Youth programs in poultry are growing at an impressive rate. Poultry 4-H judging teams from 15 counties competed in the state contest. At least 30 counties participate in the poultry barbecue competition and more than 20 in the pullet chain. Embryology has been revitalized as a project. More than 5,000 youths received a lecture-demonstration by poultry specialists, creating considerable interest in not only poultry, but all the life sciences. Eggonomics has been taken as a new national 4-H competition. The name of the competition is "National 4-H Egg Preparation Demonstration Contest," and it will be held in Louisville, Ky., each year as part of the National 4-H Poultry and Egg Conference.

Production-Marketing Economics

Providing a flow of educational information to farmers, extension agents, agribusinesses and the public about the agricultural situation and outlook is a basic function of extension's production-marketing economics group.

About 30 outlook presentations were made during 1977-78 for farmers and agricultural lenders. A special outlook edition of Palmetto Economics was published in December. In addition, several radio, television and press releases were prepared.

Farmers faced critical production, marketing and financing decisions for the 1978 crop year.

To aid them in making these decisions, the following programs were conducted: 13 marketing-management workshops; four farm management-marketing workshops; 20 county meetings of approximately 2.5 hours in length; three training sessions with agricultural lenders; 11 corn-soybean "Showdown" inter-disciplinary meetings with approximately 1,700 farmers in attendance; six training sessions on farm management, marketing and policy for county extension agents; a statewide workshop for peach producers; and several management schools for managers of co-ops for low income and commercial farmers.

In support of these educational meetings, 14 *Outlook Updates*, 13 *Management Marketing Memos*, and 7 *Extension Reports* were prepared. These materials covered a broad range of information on outlook, financing, planting decisions and agricultural policy. Estimated costs and returns (budgets) for the major field crops were prepared and used extensively in production, policy and lending decisions.

The Marketing Information Center, a division of extension production-marketing economics, provides marketing information to the fruit and vegetable industry through reports issued during harvest. Additionally, the staff has responsibility for coordinating a weekly fact sheet on marketing information concerning all crops and livestock.

With the increased emphasis on forward contracting and hedging, cash flow analysis and budgeting, producers needed to be able to look logically at alternatives before making commitments. Computer programs dealing with cotton, corn, soybeans, wheat, livestock, cash flow analysis and enterprise budgeting have been written and are currently available to producers. These programs were used extensively in 1977-78.

Farmers and consumers are faced with problems in estate planning and income tax management. Six schools for tax practitioners were conducted with 800 in attendance. These schools keep tax preparers updated on changes in the tax laws and forms. Estate planning sessions were conducted in several counties to provide farmers and consumers with information on the new estate tax law and the need to plan for estate transfer.

A "mini" extension office was established in Dutch Square Mall in Columbia. A major portion of the planning and implementation of this project was originated by personnel in the extension production-marketing group. This office has reached many people, par-

ticularly homeowners, who normally would not have had access to extension's educational programs.

EXTENSION HOME ECONOMICS

Scope of Activity

Extension home economics extends the resources and educational programs of the land-grant university to the people of the State.

Through six subject matter areas (Child Development and Family Relations, Clothing and Textiles, Family Resource Management, Food and Nutrition, Home Furnishings, and Housing), extension home economics provides leadership in the design, implementation and evaluation of programs that contribute significantly to family development and stability.

As a result of home economics efforts, families are better able to identify their needs and opportunities, make decisions, utilize resources and acquire competencies to interact effectively with others and to improve their quality of family living.

Highlights of home economics programs during 1977-78 include:

Child Development and Family Relations

This program is reaching broader audiences than in past years, while maintaining programs for traditional groups.

Family life programs, in the form of one or more meetings, were conducted in about 85 percent of South Carolina counties. In addition, more than 60 percent of the counties had special interest programs in some area of family life. These special interest programs were aimed particularly at families with young children, families with teenagers, and the aging population.

More than 100 programs on a wide variety of topics were conducted to appeal to the various audience groups needing and desiring information. Topics included: preparation for marriage, family communications, child development, babysitting, tensions, death and grief, selecting toys, family development, human relations, values, aging and retirement.

A new program was initiated this past year in three counties, reaching 38 families with young children. This Parent/Child Interaction Project is being expanded this year to nine additional counties and will reach an estimated 150 young families with an in-depth educational program.

Extension home economists are continuing to help coordinate community agencies in assisting families through local resources.

As a result, several interagency planning councils have been formed and others are in the planning stages.

Radio, newsletters and news columns are being used to convey educational information to the various audiences in all 46 counties.

Clothing and Textiles

The continued stress in the economic situation has forced families to alter their budgets. Clothing gets a smaller share of their expenditures, according to economists.

Extension's role in clothing programs is to help families protect their clothing investment. One topic on which county extension home economists receive many questions is the removal of stains from clothing. As a result, an exhibit was developed to help individuals become more aware of how to keep clothes clean and wearable, and thus extend clothing life. The exhibit, known as "Stained Jane," has been on display in large shopping malls, department stores and many other public places. Along with the exhibit, a stain removal leaflet has been made available for homemakers to post near the washing machine.

Various programs and reference materials relating to selection of clothing were prepared; some topics included men's wear, maternity wear, color and texture coordination, what to look for in quality, and sewing machine use and care.

Extension home economists received training on how the performance of textiles and design of apparel can aid in lowering fuel bills. Two programs were prepared for home economists to show families how to wear more or less clothing in order to be comfortable when saving energy.

The national trend toward metrication was considered this year and resulted in interdisciplinary training for extension home economists by several faculty members. Metrics in clothing included clothing selection and construction.

Thirty-five 4-H girls from all parts of the State had an opportunity to learn how to effectively groom themselves through a fashion clinic conducted in Columbia. This program, initiated in 1974, is partly supported by the South Carolina Textile Manufacturers Association and a fabric manufacturing company.

Family Resource Management

In an effort to make more effective use of agents' time, a pilot project has been established in Lexington and Richland counties. A branch office has been established at Dutch Square Mall in Co-

lumbia, providing the public information and help in all areas of home economics and agriculture. One agent working alone can meet and talk with 400 clients in one day. In one month, 9,000 direct contacts were made. Coordinator for the project is a family resource management specialist at Clemson.

Work with computer-assisted teaching continues. During 1977-78 many South Carolinians were counseled in money management, heat and air conditioning home analysis, estate planning analysis and food recall analysis.

In January 1978, a three-day, in-depth training session on energy conservation was presented to approximately 200 field staff members. Extension home economists, agricultural economists, agricultural engineers and foresters, along with state energy officials and power company personnel, worked together to provide current material on energy conservation. To aid field staff members in presenting energy programs in their local communities, about 20 leaflets on various aspects of energy use were prepared and made available for public distribution. Many counties have since presented programs on topics related to the energy situation, and others are planning programs for 1978-79.

In the spring of 1978, an interdisciplinary team of home economists, including foods, management, clothing and furnishings, presented Metric Inservice Training to about 150 field staff members. Three one-day training sessions were designed to provide field staff skills needed to prepare consumers for the advent of metric measurement. A 10-lesson home study course was prepared to help field staff members effectively reach their clientele. In addition, two leaflets were developed and made available to the general public. A newsletter on developments in metric measure also is being sent on a regular basis to all county home economists.

Consumers are demanding that public agencies provide answers and education related to foods and nutrition. Nutrition specialists in extension home economics are meeting this challenge. They have recognized that old approaches to nutrition education are ineffective, and new and innovative methods are needed. The following programs were made available to all counties to answer the needs of citizens: (1) three workshops assisted consumers in stretching their food dollars; (2) educational materials were developed emphasizing energy conservation as it relates to food; and (3) a 10-lesson home study course on the metric system was

developed. A variety of educational materials and supplies are available to assist county extension agents in teaching this subject.

The 4-H audience is of primary importance to extension nutrition. In 1977, 6,997 boys and girls participated in the foods and nutrition projects at the county level. An additional 1,017 joined activities in food preservation. Quality project books and educational materials for agents and leaders have been provided.

Expanded Food and Nutrition Education Program

Backed by the belief that knowledge of foods and nutrition will improve health and lifestyles, the Expanded Food and Nutrition Education Program (EFNEP) has been reaching out to South Carolina limited resource families since 1969. As of March 1978, a total of 43,001 families in 31 counties had benefited from the work since its inception. The program is now concentrated in 18 South Carolina counties, with a total of 6,011 homemakers enrolled as of June 30, 1978.

This program uses paraprofessional program assistants to provide nutrition education in individual homes and small groups. Four series of lessons were developed for use in this program this year. These include 20 basic nutrition lessons for beginning homemakers, eight gardening lessons, three food preservation lessons and 13 intermediate nutrition lessons. Through the use of educational materials, the 161 program assistants in the adult phase are influencing the lives of limited resource families in South Carolina.

The 4-H EFNEP reaches approximately 5,300 youths in 17 counties annually with lessons and activities relating to foods and nutrition. More than 50,000 youths have been reached in 30 different counties since the program began. This year, 13 paraprofessionals were hired to work exclusively with 4-H EFNEP to make the program available to a larger audience.

Home Furnishings

The escalating costs of all goods and services caused a revived interest in do-it-yourself decorating among clientele of all ages and socio-economic levels. To help families and individuals cope with this problem, programs in the area of home furnishings were conducted in 43 counties. These were handled through workshops, special interest groups, club meetings, home and garden clinics and some individual contacts.

An interdisciplinary team, including personnel from home economics, agricultural engineering, economics, forestry, horticulture,

public utility companies, South Carolina Energy Management Office and representatives from ES-USDA, provided three days of in-depth training in energy conservation to county extension staffs. As a result, many families have taken steps to make their homes more energy efficient. They are conserving energy through the way they furnish their homes and the clothes they wear.

The counties report waiting lists for the interior decorating short course, and an increasing number of teenagers are taking the 4-H short course, "24-Hour Room Service," a seven-lesson series designed to help youth improve their home environments.

A team including nutrition, furnishings, clothing and family resource management provided a one-day per district inservice training in metrics for county extension professionals. All of the trainings and short courses have been successfully followed up by individual assistance and special interest programs.

Housing

Housing may be considered the total home environment, including furnishings, landscaping, major and small household appliances, cost factors, safety and storage. Major emphasis during the year was in the area of energy conservation, including winterizing homes, insulation and do-it-yourself repairs. Energy conservation will continue to be a major emphasis in years to come. With this in mind, an intensive multidisciplinary three-day inservice training was held in January for extension agents from every county.

Housing or housing related programs were conducted in about 90 percent of the counties. Programs on energy conservation, as related to housing, were conducted in 80 percent of the counties. Topics included energy conservation, winterizing the home, insulation and solar energy. Other programs conducted in various counties included home improvement, interior design, storage, proper laundry techniques, simple home repairs, appliances, home ownership, safety, mobile homes, moisture and mildew control and home security.

In addition, extension home economists have made wide use of newsletters and mass media to disseminate housing information to the people of South Carolina.

4-H AND YOUTH DEVELOPMENT

Scope of Activity

Emphasis in 4-H continues to be on the development of the individual and growth in human relationship skills. Extension's 4-H youth program directs efforts toward working with youth from all segments of society.

In 1976-77, a total of 72,829 youth was involved through organized 4-H clubs in the State. An additional 5,390 were reached through the youth phase of the Expanded Food and Nutrition Educational Program, and 19,178 were involved through the special television series "Mulligan Stew."

Leadership Training

During 1977, 1,498 adult volunteers and 931 teen leaders served the 4-H program. More trained leaders are needed.

The traditional rural-oriented 4-H program areas have been updated and innovative programs are continually being developed and added to meet a wide variety of needs and interests of today's young population.

Continued effort is being given to receiving and utilizing the support of local resources, both human and physical. More than 200 donors support the 4-H program at the state level in addition to support at the county level.

Urban 4-H

A special urban thrust began in late 1974 in Charleston County with employment of a full-time professional and five volunteer service assistants to develop and direct the program. The number of youth reached in Charleston during 1977-78 totaled almost 20,000.

Youth in this program are enrolled as regular 4-H members. The entire economic spectrum is represented, and the racial breakdown is about equal. Some of the more popular projects include clothing, bicycle, foods, public speaking, child care, electric, dog care, wood-working, automotive and crafts. One of the strongest assets of the program is the use of local volunteer leaders.

The urban program has been expanded to include Columbia, Greenville and Spartanburg.

4-H Community Resource Development

Abbeville County currently has 3,204 youth from ages 9-18. Approximately 1,200 of them are enrolled in Abbeville's 4-H and

CRD programs. Twenty-five adult volunteer leaders assist with the program.

Teen Leadership

Statewide efforts have been made in the past five years to involve more teens in 4-H. A 29 percent increase, or 4,716 more teenagers, was involved in 4-H programs during 1977 than in 1972.

New programming, which has contributed to maintaining and expanding 4-H teen enrollment, includes teen leader retreat, citizenship shortcourse, organizing of county teen leader clubs and recognizing outstanding teen leader clubs annually.

During the past five years, 1,194 teens and 105 adults from all counties have participated in training at State 4-H Teen Leader Retreat. One hundred ninety-one teens and 14 adults have participated in citizenship training in Washington, D. C.

4-H Camping

A great variety of educational and recreational activities is being offered at the two state 4-H camps, Camp Cooper and Camp Long. During the summer of 1977, 4,300 youth, extension agents and volunteer leaders attended camp for one week. Special interest camps included horse, dairy, electric, environmental awareness, EFNEP and Teen Leader Retreat.

Another phase of the camping program included work with a research unit from Clemson University that is interested in hypertension among young people. The camp and its personnel cooperated in measuring blood pressure, taking hair samples and body weights. South Carolina has a high rate of heart disease; hopefully, this joint effort will aid in learning more about this disease.

COMMUNITY AND RESOURCE DEVELOPMENT

Scope of Activity

The Community and Resource Development Extension program provides education and technical assistance to groups interested in taking collective action to improve the quality of life in their communities.

The objective of the CRD effort is to improve the decision-making process regarding the development of community resources. Improvements in community facilities, services, environment and economic conditions enhance the quality of life for those living in rural areas and make those areas more attractive to people and

industries. In most cases, CRD projects benefit the whole community and require that a large number of citizens share the costs as well as the benefits.

Through the CRD program, emphasis is placed on assisting community leaders, governing officials, organizations and other agency professionals to understand and solve community problems and to obtain maximum benefits from community resources through wise utilization.

Leadership and Problem Identification Surveys

The county extension worker's knowledge of community individuals and influence is used to assist areas in expanding their leadership resource pool, increasing public participation in community affairs and identifying priority issues facing the community. Through follow-up and feed-back meetings to discuss survey results, participants gain a greater knowledge of resources available to address community problems.

Six surveys were conducted during the year in small towns with populations ranging from 1,000 to 2,500 persons. CRD specialists and county extension workers continue to work closely with leaders and local government officials in communities in which surveys were conducted.

Environmental Improvement

Extension continues to participate in the Governor's Beautification and Community Improvement Program. County extension offices provide administrative and organizational support to county Beautification and Community Improvement committees which compete for honors and awards at the local and state level. Much of the county extension CRD work is conducted through these committees. Local committees are engaging in an expanding range of projects that encompass all facets of community improvement.

Comprehensive Community Planning

CRD specialists and county extension workers are participating in numerous local and areawide planning activities through membership on planning commissions, committees of regional planning and development agencies and through involvement with professional planners in rural planning activities. Activities during the year included a county meeting on agricultural land use issues, participation in the development of a county multi-purpose com-

munity facility for civic recreational and agricultural events, regional committee participation in planning for senior citizen needs, and participation on a regional land use planning and development policy committee.

Through joint participation with the Soil Conservation Service, Extension continues educational and technical assistance in conducting numerous recreation and conservation projects through the Low Country Resource Conservation and Development demonstration project.

In the area of land-use education, Extension utilized slide-tape presentations, county fair exhibits, publications, pamphlets and mass media to inform citizens of the need to be involved in land use decision-making processes.

Federal Assistance Program Retrieval System (FAPRS)

Through this program, coordinated by Extension in South Carolina, computerized information is provided on the status of any grant and loan program listed in the Catalog of Federal Domestic Assistance. Programs are classified by problems for which they can provide assistance and eligibility criteria for applicants. Persons may utilize the service by completing a request application form available through local county extension offices and the state CRD office. Over 50 requests for grant and loan information have been processed since the system has been in operation.

1890 EXTENSION PROGRAM

Scope of Activity

The primary aim of the 1890 Extension Program is to provide educational training for enrolled low-income families in agriculture and natural resources, youth development, home economics and community resource development.

The program, which is conducted by South Carolina State College in cooperation with the Clemson University Extension Service, provides education and outreach to segments of the population not in touch with traditional uplift programs.

Small Farmer

The small farmer project in agriculture and natural resources initiated in Anderson County in 1976 has proven to be a desirable procedure for providing leadership to limited resource farmers. Four agricultural technicians and one clerk were employed to implement the program.

An increased number of 1890 program families are producing quality vegetables in excess of home consumption needs. These families are utilizing a local community market to sell their excess vegetables and increase their income. As funds become available, this program will be extended to other counties seeking such services.

Home Economics Program Extended

Home economists introduced and provided new educational training for hard-to-reach families which encouraged a willingness to improve the quality of life through creative and productive use of resources available to them. Extension of the educational programs was accomplished through home visits by paraprofessionals, group meetings, leaflets, demonstrations, tours, exhibits and community projects.

Community projects provided new education opportunities for more than 350 limited resource families. These included bazaars, fair exhibits and quilting bees.

Rat Control Projects

In the area of community resource development, rat control projects are being conducted in three phases: a series of workshops to teach living habits of rats and mice, instruction on how to kill existing populations, and demonstrations on how to minimize the environmental conditions conducive to rat growth and development.

Through cooperation among county environmentalists and other officials in Georgetown, Hampton and Marlboro counties, 1890 personnel successfully conducted four community-wide rat control programs.

Anti-coagulant poison bait was used to kill rats in homes of 1,112 families in 13 communities. Baiting began in early December 1977 and continued through mid-February 1978. Test results revealed rat populations were lowered.

The rat control program in 1973 was operating in one community of each of the four counties. In 1978 the program was expanded to six communities in Hampton, five in Georgetown and six in Marlboro counties. This project has been in such demand over the last five years that it will be continued for another five years.

Summer Camp Conducted

The seventh annual 1890 summer camping program was conducted at Camp Harry Daniels in Ellore. A total of 281 youths, ages 9-16, from limited resource families attended.

The camp served as a model community with each participant assuming the role of someone who provides a community service. Camp counselors served as advisors. This experience allowed the youths to become more familiar with the functions of a community.

Camp activities are designed to enhance behavioral goals among youths, both socially and psychologically. Recognition serves as an incentive to promote ideals of youths. Ribbons and certificates were awarded for outstanding accomplishments.

SPECIAL PROGRAMS

Small Farmers and Limited Resource Families

The farmer in the United States is constantly faced with rising production costs and changing cultural practices. With the introduction of modern machinery and pesticides, the average farmer can produce enough food for 57 people, but the small farm with limited income is still a way of life for many rural South Carolina residents.

The problems of the small farmer are not unique, but are compounded by the fact that limited operating capital and acreage do not usually justify necessary machinery and other production practices required to maintain profits and efficiency. Basic to problems many of these people face is a lack of real income as well as a lack of knowledge in basic farm management in such areas as planning, soil preparation and fertilization, pest management, livestock management, and harvesting and marketing farm products.

According to latest available data, about one-half of the farms being operated in South Carolina are grossing less than \$2,500 annually. With agriculture becoming more sophisticated, Extension has the obligation of developing with these small farmers a program aimed at solving their problems under prevailing conditions and with the resources available to them, including labor, equipment and investment potential.

Particular emphasis is placed on providing technological assistance, increasing incomes through efficient production, marketing and resource management, and improving living standards through increased knowledge.

Activities involving small farmers and limited-resource families include livestock and row-crop demonstrations with the latest in scientific methods of production, workshops and demonstrations on the production and marketing of horticultural crops and the production of home gardens for the family and community. Educational information is also provided through personal contacts, tours, workshops and the media.

Sumter County

In Sumter County, a soybean field demonstration for small farmers was set up to provide necessary information relating to machinery use, pesticide application and variety selection for optimum yields. A field with a record of low yields was selected for the demonstration.

Soil was tested and fertilized accordingly. Some sections were subsoiled and treated with a nematode fumigant and preplant herbicides. Four soybean varieties were planted in conjunction with recommended herbicide, tillage and fumigant treatments. A pre-emergence herbicide and insecticide treatment was given each plot.

Before harvesting, a tour was held for approximately 200 small farmers from across the State. Equipment which the small farmer could afford and utilize was on display, and extension agricultural engineers explained the proper adjustments and use of each tool.

Soybean yields were significantly increased by demonstrated practices, but the most measurable and significant result was that two local farmers bought a two-row subsoil bedder for their farms. Their capacity to produce and survive as small farmers has been greatly enhanced due to a desire for a positive change. It is hoped that many of the small farmers who toured the demonstration will take the initiative to make necessary transitions for their continued existence.

Lee County

Another program in Lee County was designed to help low-income families subsidize their incomes by growing feeder pigs for market and to encourage farmers with small grain acreage to market grain through hogs, thereby receiving more money for each bushel of grain. In the past year, 36 families have increased their incomes through this approach. Quality and numbers of feeder pigs also increased. Tours of swine sales, three management workshops and personal visits by extension specialists were conducted to educate these families about feeder pig production.

Greenwood County

Greenwood County extension personnel have developed educational programs in gardening designed to help low income families produce some of their food. This was accomplished on an individual basis and through group meetings on how to garden, choosing sites, tools, varieties, planting maintenance procedures and use of pesticides. For areas with limited gardening space, Extension is conducting four community garden sites involving 60 families. Each family was given an area along with tools, fertilizer, lime and seed. During the growing season, demonstrations were given on cultivation, pest management and harvesting procedures. Program aides instructed individual families on cooking vegetables and canning and freezing of surplus. The families now operate their gardens independently, except for initial soil preparation by Extension.

**APPROPRIATIONS FOR THE
COOPERATIVE EXTENSION SERVICE
1977-78**

State Appropriations	\$ 7,016,837
Federal Smith-Lever	3,619,788
Federal Nutrition Fund	1,630,581
Federal Smith-Lever 1890 College	555,507
Federal Smith-Lever Cotton Project	135,919
Federal Rural Development Fund	63,648
Federal Farm Safety Program	55,969
Fees	60,310
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Total Appropriations	\$13,138,559

**EXPENDITURES BY OBJECT CLASSIFICATION
1977-78**

Classified Employees	\$ 2,934,318
Faculty	5,649,530
Graduate Assistants	10,298
Students & Temporary Help	151,990
Fringe Benefits	1,507,954
Travel	806,141
Supplies & Other Expenses	1,009,433
Equipment	437,384
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Total Expenditures	\$12,507,048
Balance Carried Forward June 30, 1978	631,511
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Total	\$13,138,559

Division of Regulatory and Public Service Programs

L. H. SENN, DIRECTOR

This division of Clemson University operates several consumer protection-type programs that are closely related to the agricultural sector. The philosophy for having regulatory programs at Clemson is that certain regulations can be enforced more effectively when strong educational approaches are used. Regulatory and Public Service Division personnel use this technique as a normal procedure.

It maintains close coordination with the Cooperative Extension Service and the S. C. Agricultural Experiment Station and solicits their aid when additional educational and research efforts are needed. Strict enforcement is used only against recalcitrant offenders.

The major objective of this division is to ensure that consumers buying lime, fertilizers, pesticides and seed get the qualities indicated on tags or labels. It also enforces regulations of the Crop Pest, Bee Disease and Abandoned Orchards Acts and imposes quarantines when needed.

The division also was given the responsibility for enforcing the new South Carolina Pesticide Control Act. During 1976 the South Carolina Agricultural Liming Materials Act was passed and enforcement responsibilities were given to the division.

The following report highlights the activities of the division during 1977-78.

PLANT PEST REGULATORY SERVICE

South Carolina Pesticide Control Act

Registration: A total of 524 companies registered 5,509 products. The number of pesticide samples collected and analyzed was 1,729. Ninety-three (5.4 percent) were deficient in one or more components. Registration fees collected totaled \$89,081.25.

Four Section 18, specific exemptions, and 22 Section 24, special local need registrations, were issued in accordance with the Federal Pesticide Control Act. The Section 18 exemptions granted were the same as last year, with the use of methomyl being approved for armyworm control on coastal bermudagrass. A Section 18 request for the use of ferriamicide for the control of imported fire ants was also filed with the Environmental Protection Agency, but was not acted upon prior to June 30.

Certification: Pesticide dealers and individual applicators must be certified and licensed in order to sell, purchase and/or apply "restricted use" pesticides. The totals of licenses issued for 1978 are as follows: private, 12,174; commercial, 1,051; noncommercial, 649; and pesticide dealers, 494. The department collected \$46,448.00 in certification fees.

Certification examinations were administered quarterly at three successive locations per exam throughout the State. The locations were established on a rotational basis. Department personnel were involved in 10 other training programs for various types of applicators whereby examinations were administered at the conclusion.

Enforcement: Thirty-six separate residences were inspected for structural pests in response to homeowner complaints of differing reports from pest control firms on the appropriate treatment. As a result, eight informal hearings were held with warning letters being issued to two firms. No action was taken against the others, as evidence was inconclusive.

Three investigations were conducted due to complaints of alleged pesticide drift. Two involved aerial application of pesticides and one involved ground application of herbicides. Warning letters were issued in two of the cases.

Sixteen "stop sale" notices were issued for the sale and distribution of unregistered pesticide products by dealers, pest control firms and others, and the sale of "restricted use" products by noncertified dealers. Two warning letters were issued to separate dealers for selling pesticides in illegal and unlabeled containers.

Four new pesticide regulatory specialists were employed in November and have already given an added impetus to the overall pesticide program by providing assistance and information to farmers, pesticide dealers, formulators, applicators and surveillance for compliance with the Act.

The Crop Pest Act

Nursery Inspections: A total of 727 nurseries, greenhouses and vegetable transplant growers was inspected and certified to sell plant material. Nursery dealers certified in the State total 826. An additional 425 nurseries and dealers were visited for compliance checks.

Pests encountered were of a general nature, i.e. mealybugs, spider mites, lacebugs, scales, crown gall and anthracnose that are normally associated with greenhouse and ornamental stock.

The Bee Disease Act

Approximately 3,200 bee colonies were inspected with only 0.09 percent found infected with foulbrood. A total of 1,760 colonies were inspected and certified for movement to other states, primarily North Carolina, Georgia, Ohio and New Jersey.

Cooperative State—Federal Programs

Imported Fire Ant: A fall aerial treatment program was conducted in Bamberg and Allendale counties. A total of 270,000 acres was treated; 169,831 in Bamberg County and 100,169 in Allendale County.

Pasture treatment work continued with Mirex 10-5 bait being applied with jeep-mounted electric seeders. A total of 1,936 acres in five counties was treated prior to December 31, 1977. After this date, all Mirex 10-5 bait in 50-pound bags had to be repackaged into one- or five-pound packages and broadcast application to pastures was no longer permissible. Authority for all sales and distribution of Mirex 10-5 bait ceased on June 30, 1978, in accordance with mandates by the Environmental Protection Agency.

Pest Detection: Imported fire ants were found for the first time in Chesterfield County. A total of 17 gypsy moths were caught in the State this season. Sixteen were found in 15 traps in Horry County and one was trapped at a KOA campground in Florence County. A new virus disease of dogwoods was found in Oconee County. It was previously unreported in the United States, and its significance and distribution within the State is unknown at this time.

Witchweed: Infestations, comprising 427 acres, were found on nine new farms, all of which were within the current quarantine areas. A total of 10,006 acres received one or more herbicide applications for witchweed control for an aggregate of 27,244 acres treated. Seventy-three farms, comprising 977 acres, were released from quarantine.

**DEPARTMENT OF FERTILIZER INSPECTION
AND ANALYSIS**

The Department of Fertilizer Inspection and Analysis is responsible for enforcing the provisions of the South Carolina Law, 1954, 1970 and 1978 and the South Carolina Agricultural Liming Materials Act, 1976.

Some of the major activities of the department for the July 1, 1977-June 30, 1978, period follow:

Fertilizer usage data—tons (1st report—Final report may vary slightly)	842,790
No. of fertilizer samples procured and analyzed ..	5,981
No. of lime samples procured and analyzed	378
Total number of lime samples not meeting guarantee	53
Percent of lime samples deficient	14.0
Number of irregularities other than underweight ..	22
Penalties collected, payable to state treasurer (Deficiencies where consumers not identifiable) . \$	33,037.42
Fines collected, payable to state treasurer	910.00
Fertilizer registration fees collected, payable to state treasurer	5,071.00
Lime registration fees collected, payable to state treasurer	670.00
Lime permit fees collected, payable to state treasurer	1,490.00
Fertilizer taxes turned over to state treasurer	196,966.55
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Total monies sent to state treasurer	\$238,144.97

Fertilizer Movement in 1977-78

Fertilizer movement was erratic during the entire fiscal year. Corn failure due to drought, poor forage yields due to drought and armyworms, and declining prices of corn, cotton, soybeans and cattle caused indecision on 1978 crop choice. As a result, the orderly movement of fertilizer became a problem. There was a reduction of 14.5 percent in fertilizer tonnage in 1977-78 compared to 1976-77. Even though this reduction was considerable, it was not as great as had been predicted in March. The delay in fertilizer delivery resulted in 73.8 percent of the fertilizer used for the entire year to be delivered in March, April, May and June. This short period of heavy movement contributed to problems associated

with inadequate quality control, mislabeling, sampling pressure, laboratory over-loads and reporting delays.

Changes in Fertilizer Law

There has been a tremendous amount of work by the Farm Bureau and other representatives of farmers, the fertilizer industry represented by the South Carolina Plant Food Educational Society, the Fertilizer Advisory Committee and the Department of Inspection and Analysis during the past two and one-half years in working toward changes in the fertilizer law to make it more relevant to the present situation. After a number of draft revisions, the bill (S-501) (R-707) was passed by the Senate, referred to the House where other amendments were added, agreed upon by a free conference committee and finally was signed by the Governor on July 18, 1978. These amendments allow for greater flexibility in meeting farmer's requirements, allow for more realistic investigational allowances and eliminate some paper work in registration. The Fertilizer Institute has stated that South Carolina has a law that is one of the most modern in the nation. A number of changes will be required in the administration of the law and additional personnel will probably be required in the performance of sampling and analytical work.

Agricultural Liming Materials Act

The Agricultural Liming Materials Act which became effective July 1, 1976, was fully implemented. There were still a few instances of guarantees not consistent with requirements but most problems were resolved. Independent truckers hauling from the mines to farms are still not fully cognizant of requirements of the law. A total of 378 lime samples was taken during the year, 53 of which were deficient beyond allowances.

DEPARTMENT OF SEED CERTIFICATION

Seed certification is a program of standards imposed on seed and plant production that ensures varietal purity and good germination. Participation of farmers in the program is voluntary.

The Clemson University Department of Seed Certification was designated by law in 1945 as the official agency for certifying seed and plants in South Carolina. Standards of seed certifying agencies in the United States must meet standards for certification of seed in Federal Seed Act Regulations.

Field work of the department in 1977-78 involved inspections of 56,763 acres of crops, the second largest acreage ever certified in South Carolina. This work included inspections of 69 varieties of 13 crops for the 329 farmers and 27 seed-producing firms participating in the program. Each field was inspected to determine that the crop was true to variety and free of noxious weeds.

Major crops in the program with acreages inspected were soybeans (34,930), cotton (10,191) and small grains (8,196). The soybean acreage was an increase of more than 12,000 acres over 1976-77 and the largest acreage of any crop ever certified in South Carolina.

In addition to field inspection work, the department issued 1,014,377 tags for use on certified seed, a quarter of a million more than ever issued previously in one year.

Unfavorable weather which plagued seed crops production in 1976-77 continued until late summer of 1977, reducing considerably the yields of cotton and soybeans. As a result of drought and severe insect infestation, cotton inspected for seed certification in 1977 was the poorest in the past 15 years. These stress conditions were so detrimental to the crop that essentially no cottonseed from the 10,191 acres that were field-inspected met seed quality standards for certification. Even though soybean yields were reduced by the drought, rains in early September helped set and mature a reasonably good seed crop.

With the economics of small grains production at a low ebb, there was little interest in planting small grains in the fall of 1977. Much of the grain seeded in the fall of 1977 was planted for annual grazing to supplement pastures severely depleted by drought in the summer. However, as harvest time approached in 1978 the small grain economic picture improved, resulting in essentially the same acreage being certified as in 1977. Yields of small grains inspected for certification in 1978 were the best noted in several years. Large acreages of oats averaged over 100 bushels per acre in many areas.

Harvesting of early maturing soybeans for certification was completed under favorable weather conditions in the fall of 1977. However, harvesting of the two major acreage varieties, Bragg and Ransom, was delayed two to three weeks because of excessive rainfall. Seed quality of these varieties was considerably lower as a result. In order to provide an adequate supply of seed for plant-

ing the 1978 crop, the germination standard for certified soybean seed in South Carolina was lowered from 80 to 70 percent.

With no better than break-even prices being offered for cotton lint at planting time in 1978, most producers of certified cottonseed in South Carolina reduced their acreage considerably. Acreages were further reduced by cold, wet weather which resulted in poor stands, some of which were eventually plowed up after replanting as many as three times.

Failure to get acceptable stands of cotton caused growers to replant the land in soybeans. An adequate supply of soybean seed was available and in spite of having to use much seed with substandard germinations, stands were generally acceptable and complaints minimal. The only complaint of consequence on certified soybeans was with Hutton variety seed from one location. These seed germinated satisfactorily in the seed testing laboratory but obviously lacked the vigor needed to produce satisfactory stands when planted at several locations throughout the State. Lack of adequate soil moisture in late June 1978 prevented planting of some soybean fields until too late to be economically feasible to plant.

Livestock-Poultry Health Division

C. E. BOYD, DIRECTOR

The Livestock-Poultry Health Division conducts a number of regulatory programs in the field of consumer protection and in the area of animal health and diagnosis of various disease problems in South Carolina livestock.

The division's three main areas of responsibility are the administration of the state Meat and Poultry Inspection Program, the Livestock Regulatory Programs, and the Diagnostic Laboratory.

The Animal and Plant Health Inspection Service, USDA, cooperates with the Livestock-Poultry Health Division in carrying out certain animal disease eradication programs conducted on a national basis. It also provides 50 percent of the funds for administering the South Carolina Meat and Poultry Inspection Program.

Highlights of the division's activities during 1977-78 follow:

MEAT AND POULTRY INSPECTION

A total of 138 red meat plants in 44 counties and 46 poultry plants in 17 counties were under state inspection at the end of the fiscal year. The full-time staff consists of nine veterinarians, 69 inspectors, a compliance-evaluation officer, and one secretary. More than 100 million pounds of red meat and poultry and almost 200 million pounds of processed meat and poultry products were inspected at state-inspected plants during the year. This division's responsibility covers the wholesomeness of meat and poultry and food products slaughtered and processed at all processing plants in the State, except for a small number of plants that operate under federal jurisdiction.

LIVESTOCK REGULATORY PROGRAMS

These programs are conducted in cooperation with the federal government.

Brucellosis

This division continues to monitor dairy herds in South Carolina by the Brucellosis Ring Test four times a year and to test all replacement cattle at stockyards to prevent the introduction of brucellosis in animals imported from neighboring states. Extensive use of two screening programs to find infected herds, the Market Cattle Identification and Brucellosis Ring Test, played an important role in eradicating brucellosis in South Carolina.

Swine brucellosis eradication efforts have been increased this year. A new federal regulation became effective May 23, 1978, which requires all swine moving interstate, except for slaughter, to be tested for brucellosis prior to movement. It also requires all sows and boars moving interstate to slaughter be identified so they can be traced back to the herd of origin.

Hog Cholera

The United States was declared free of hog cholera on January 31, 1978. The last outbreak in the U. S. was confirmed in New Jersey on August 1, 1976, and the quarantine was released on September 13, 1976. No additional cases were disclosed during 1977. The last case reported in South Carolina was in November 1972.

Pseudorabies

A regulation covering imported swine became effective this year. The regulation states, "All breeding swine must be negative to an official test for pseudorabies within 30 days prior to entry into South Carolina". The regulation was necessary to protect the swine industry from the extensive outbreak of pseudorabies in the mid-western states. The State has had only one known infected herd and no additional infection was reported this year.

ANIMAL DISEASE LABORATORY

The laboratory is staffed by six veterinarians and 11 technicians. A new histopathologist was added to our diagnostic laboratory staff in January 1978, which has greatly expanded our diagnostic capabilities. The laboratory provides diagnostic services in animal pathology, bacteriology, virology and serology for the state regulatory programs, as well as diagnostic help to practicing veterinarians and livestock and poultry owners in the State. The laboratory is in a position to isolate and identify many diseases of animals which are impossible to differentiate clinically. During this year, the laboratory handled more than 3,000 cases and conducted more than 200,000 laboratory tests and examinations.

