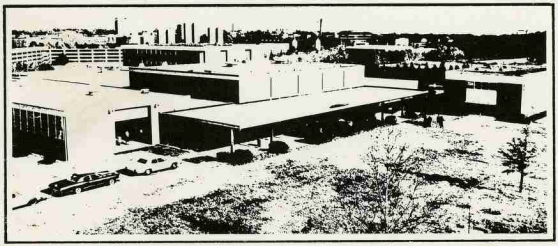
A Department Grows To Maturity



A Department Grows to Maturity

The History of Agricultural Engineering at N. C. State University 1914 to 1977 A Contribution to the Nation's Bicentennial

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FOREWORD

The restless energy, imagination and resourcefulness of G. W. Giles, Professor Emeritus and former Department Head, have contributed this illustrated description of the evolution and growth of Agricultural Engineering at North Carolina State University. He had expressed the intention of writing a history of the department prior to Dean J. E. Legates' request for such documentation for the School of Agriculture and Life Sciences.

The chronological account developed in this History may be best understood in a national context. The foresight and wisdom of a few individuals organized Agricultural Engineering in 1907 as a learned profession. They brought together the two inventions of man, agriculture and engineering—the fusing of both physical and biological sciences with engineering. Agricultural Engineering had its beginning and growth as a professional society for the development and management of resources, and mechanization of agricultural production. During this period of development agriculture has been changing from a-way-of-life to a well managed industry. Now we are challenged by the demand for greater reliability in agricultural production with total mechanization and at least partial automation.

Agricultural Engineering was delayed in the Southeastern United States by three primary conditions: (1) an abundance of labor, (2) relatively small-sized farms, and (3) complexity of operations to be engineered. Following World War II the inevitable consequences of low production per man hour began to plague the socio-economic well being of the region. Farm labor began seeking more gainful and dignified sources of employment. The competitive position of agriculture in the region was being lost to other sections of the country and to foreign producers. These conditions resulted in the commonly recognized need for an expanded and integrated extension, research and teaching program in Agricultural Engineering at North Carolina's Land Grant Institution.

What you are to read in the following History is the progressive response of the department to the changing needs of agriculture. Rather than a syllogism in logic, the text portrays a classical example of dynamic programming to the point where production problems in agriculture must be solved more comprehensively by taking account of new resource constraints as well as interactions with the surroundings—an agricultural system that provides the right balance between a high level of reliable production, conservation of energy and protection of the environment.

F. J. Hassler, Head
Biological and Agricultural Engineering

AUTHOR'S NOTE

This History is a story of people, places and activities. An effort was made to tell the story chronologically in as factual, unbiased and condensed manner as possible. Any major ommission or misrepresentation of fact is unintentional. Many people contributed to its preparation. Particularly, credit is extended to H. M. Ellis, F. J. Hassler and R. W. Skaggs for their critical review and helpful suggestions; and to Mrs. Elizabeth Nordan and many of the staff for their help. Some of the photographs were taken especially for this history by R. A. Mills, G. G. Powell and A. H. Graves. Special credit is extended to W. L. Carpenter, Rheba Hamilton, Julia Zeigler, and Betty Williams in the Department of Agricultural Information for the professional services in connection with the editing and printing. All in all it was a team effort.

ABBREVIATIONS MOST FREQUENTLY USED

B.—Bachelor
B.S. — Bachelor of Science
M. — Master
M.S. — Master of Science
Ph.D. — Doctor of Philosophy
A.E. — Agricultural Engineering
B.A.E. — Biological and Agricultural Engineering
J.—Joint, School of Agriculture (and Life Sciences since 1958) and School of Engineering
ARS-USDA — Agricultural Research Service of the United States Department of Agriculture
S.C.S. — Soil Conservation Service
R.E.A. — Rural Electrification Administration
A.S.A.E. — American Society of Agricultural Engineering

DEDICATION

A successful Department involves teamwork of people who work behind the scenes, "the unsung heroes", as well as in the fore. Gertrude B. Weaver, wife of the former first Head, was a devoted member of the former group. She is shown above on the day that the new building was dedicated to her husband's memory. We now proudly dedicate this history to her in recognition of the other segment of the team.

Gertrude was patient, understanding, considerate and one to whom one could turn to for counsel. In addition, she was a mother of three fine boys, all of whom are married and successful. She is indeed a lady of simple grandeur and represents all that is good about America and our way of life.

Gertrude was a companion and gave support to David in carrying out his responsibilities, aspirations and duties, during the downs as well as the ups. She is beloved by all who knew her, both now and then.

In the photo she is shown between former Governor Robert Scott on the left and State Senator J. J. Harrington on the right; an experimental machine for harvesting tobacco leaves is in the background. Both of these officials, in a sense, were also members of the team, because they helped get a part of the new physical plant.

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CHAPTER I. THE EARLY YEARS

Introduction

Professional engineering applied to agriculture at what was then North Carolina College of Agriculture and Mechanic Arts (Now N. C. State University) started in extension around 1914. Later, in the early 20s professionally recognized teaching was carried out and lastly, about 1940, a research program was started.

In those early years the three activities, extension, teaching and research in Agricultural Engineering were not closely coordinated administratively. Both Extension and Experiment Station work started with the State Department of Agriculture but was later moved to the campus. Today they are all under the Head of the Department and in one building, Weaver Laboratories, named after one of the profession's distinguished leaders and to whose wife this history is proudly dedicated. It is called the Department of Biological and Agricultural Engineering more in keeping with its uniqueness, expanding role and responsibilities.

Our First Engineers

H. M. Lynde and F. R. Baker were the first professional Agricultural Engineers, starting in 1913-14. Lynde was Drainage Engineer and Baker, Assistant Drainage Engineer. Such a start was natural since the drainage difficulties, particularly in eastern North Carolina, along with those associated with the construction of rural roads were undoubtedly some of the State's major problems. These two men were listed in the College catalog among a group identified as employees of the N. C. Agricultural Experiment Station and N. C. Agricultural Extension Service. It is believed that their work was wholly extension as it is defined today. Their work was in cooperation with the Office of Roads and Rural Engineering of USDA. F. D. Bartel replaced F. R. Baker during the fiscal year 1918-19. A year earlier E. R. Raney was added as an Extension Farm Machinery Specialist, the first recognition of the latter's need. Bartel remained on the extension staff into the 20s. He left to accept a position as Chief Engineer of the Penny Farms in Florida.

Starting around 1918 there were some service courses in farm equipment taught by Professor of Agriculture C. L. Newman in the Department of Agronomy. Newman had B.S. and M.S. degrees from Alabama but apparently was not an engineer. Also at that time Agricultural Drawing, Shop Work and Gas Engines were taught in Mechanical Engineering; Farm Drainage in the Department of Soils.

The Instructional Program

The instructional program really got under way in fiscal 1920-21. R. E. Bosque, possessing a B.S. degree in Agriculture from the A & M College of Texas, was hired as Professor of Agricultural Engineering. H. D. Lewis, with a B.S. degree in Agricultural Engineering from Mississippi Agricultural and Mechanical College, filled a newly created position of Instructor. Then in 1922 C. R. Bohanan was hired as Instructor. He held a B.S. degree in Agriculture from the University of Georgia.

During the formative years, and even up to the early 40s the instructional program, and later a very modest research program, was a section in the Department of

Agronomy. Actually a 4-year specialized course in Agricultural Engineering was offered starting in 1920-21 but attracted no students for several years. A total of 10 courses were offered in the 4-year program covering a wide range of subjects such as Farm Machinery, Farm Survey and Terracing, Farm Buildings and Concrete, and Farm Engines. Graduates received a B.S. degree in Agriculture, the same as for all other Departments except Agricultural Economics, Forestry and Landscape Architecture. This policy was consistent generally with other land grant colleges and explains why many of the early Agricultural Engineers held degrees in Agriculture, with or without a major in Agricultural Engineering.

To our knowledge the first student to graduate under this first program, was A. S. Knowles in 1935. See Figure 1. Following graduation, Knowles went into the extension service from which he retired in 1965 after 30 years of service. He was Extension Chairman of Brunswick County for 16 years after serving in Wayne and Hoke Counties.

In 1936 two more students, George Raleigh McColl and Milford Edmund Aycock, graduated among a total class of 17 in the School of Agriculture. McColl entered the U.S. Army, following graduation, as a private and left as a lieutenant colonel. He served as Assistant Farm Agent in Catawba County, and Superintendent of the Home for Boys near Conover. He passed away in April 1951.

Aycock has also earned a distinguished record. Recently retired as Vice-President of the Wachovia Bank and Trust Company, he is today a county commissioner in Wake County. His first job following graduation was in Vance County, surveying terracing lines. The equipment he used was the well-known "Bostrom" level which cost not more than $20 each; the level was designed especially for terracing and similar farm jobs and was used in our resident courses.

The School of Agriculture also offered 2-year courses of study including one for specializing in farm shop and one for farm mechanics. The catalog stated "with the present condition of shortage and high priced labor, it is realized that the gas

Fig. 1. Abner S. Knowles, B.S. in Agriculture, major in Agricultural Engineering, June 1935, was the Department's first graduate.

engine and tractor must be used. . . . to a far greater extent. . . ." It is interesting to note that even with this early 1920 observation it took about 40 years before North Carolina fully realized that reduced costs, labor, and drudgery achieved in part with the use of machines were necessary to keep many agricultural products competitive and in plentiful supply.

Also in 1920 at the request of the United States Veterans Bureau a special rehabilitation short course with a major in farm mechanics was offered for men disabled during the first world war. Its purpose was to prepare former soldiers for farming. No records are available as to those completing these courses of study.

A Master of Agriculture degree course of study was offered in various fields but not in Agricultural Engineering at that time. Our first master's degree program came in 1948.

Physical Facilities Were Meager

In the early years the extension engineers were located in a building near

the capitol but were moved to Ricks Hall on the college campus in the late 20s. The teachers were in Patterson Hall, the main agricultural building. Teaching laboratories, consisting largely of gasoline stationary engines and perhaps a few pieces of farm equipment, were first located in the basement of a building designed for general college shop work and foundry. It exists today under the name of "Park Shops." This basement laboratory was probably where courses in gas engines were offered by Mechanical Engineering to students in agriculture in the earlier days. In 1924, this equipment was moved into about one third of the basement of Patterson Hall. The college catalog speaks with pride of the farm engines laboratory containing 13 different types of stationary gasoline engines and three farm lighting plants; also of the loan of modern equipment by several branch houses and manufacturers who served this State and Region. The laboratories were well equipped with instruments for teaching surveying and terracing. The farmshop was small and rather insignificant. A hand turned post drill for metal work was mounted on the doorway post because of the lack of space. However a rather spacious and well-equipped drafting room was used in teaching farm buildings and related subjects. Although the space was somewhat lacking, the rear entrance during and following a rain was worse. One literally had to walk a plank to avoid the "pond."

One interesting sidelight: The courses covered the operation of a hydraulic ram. The ram was a device that elevated a portion of the water from a flowing stream several hundred feet by using the energy of the remaining water. One wonders if the use of a ram will return to our mountain and piedmont areas due to the shortage and/or cost of fossil energy. The ram is receiving some attention in India.

D. S. Weaver Joins The Faculty

Important changes occurred during 1924. Two teachers were added, J. B. Bookhardt and D. S. Weaver. Little is on record about Bookhardt, his activities and

Fig. 2. Eric R. Edgerton was the first graduate receiving a B.S. in Agricultural Engineering in June 1938.

departure. Weaver was hired at the Associate Professorship level. He held a B.S. degree in Agriculture from Ohio State University in 1920 and served on the faculty there and at Mississippi State College prior to coming to North Carolina. In 1925 he earned an M.S.A.E. here. From that point he embarked on an enviable career that started with pioneering rural electrification, followed by being in charge of all three sections of Agricultural Engineering and later as Head of the Department, separate from Agronomy. He ended his career as Director of the Agricultural Extension Service. He became one of North Carolina's most distinguished and beloved leaders. Talented in many fields he served on numerous state and federal agencies, such as "President of the North Carolina Board of Farm Organizations and Agencies." He retired as Director of the North Carolina Agricultural Extension Service in 1961 and passed away in 1966. In 1970 the Agricultural Engineering Building shown on the cover was dedicated in his name. It is appropriate that in the Bicentennial year on May 14 he was enshrined in the North Carolina Agricultural Hall of

Fig. 3. David S. Weaver was the first Head of the Department, from 1940 to 1948. Weaver Laboratories was named in his honor.

Fig. 4. Howard M. Ellis, In Charge of Agricultural Engineering Extension from 1948 to 1969, was a distinguished extension specialist.

Fame—perhaps one of the highest honors that can be bestowed to a North Carolinian who has worked in the field of agriculture. His portrait is shown in Figure 3.

Under Weaver's leadership Agricultural Engineering advanced steadily. The teaching program was removed as a section in Agronomy and became a full fledged department in 1939-40. A 4-year course of study leading to the Bachelor of Science degree in Agricultural Engineering was started a few years earlier. The first student to graduate under this program was E. R. Edgerton in June 1938. See Figure 2. He entered the U. S. Army in 1939 and made it a career, retiring in 1967. He served in many areas including Okinawa and Korea. Among his honors is an Army Commendation Medal with two clusters.

The next school year (1938-39) following Edgerton's graduation the department was sufficiently strong to apply for and receive authorization from the American Society of Agricultural Engineers to establish a Student Branch. The charter members, 16 students, are shown and identified in Figure 5.

The new 4-year B.S. program was organized into three general areas of specialization namely: (1) Power and Machinery, including rural electrification, (2) Farm Structures, including sanitation, materials of construction and equipment and (3) Land Reclamation, which included irrigation, drainage, soil erosion control and other forms of mechanical improvement of agricultural lands.

Many of the other departments also began offering B.S. programs, however a general curriculum and degree in Agriculture continued. The schedule of the various curricula offered in Agricultural Engineering through 1976 and the total students graduating each school year by the type of program is presented in Table II in the Appendix. Also a roster of graduates by year and program is presented in Table III. One will note that the kinds and number of programs offered over the years were many and varied, an indication of our growing pains and a willingness to be responsive by trying new approaches.

Bookhardt as well as the previously mentioned extension staff had departed by 1930, leaving only Weaver. He continued as a full-time teacher handling the courses required by those who specialized in Agricultural Engineering. A. T. Holman was employed as an "Extension Specialist in Farm Engineering" for a short period of a year or two at that time.

Extension Excels

We are extremely proud of extension's leadership in terracing, drainage, irrigation, and farm pond development. All these activities started before what is now known as the U.S. Soil Conservation Service became active in promoting the practices. Our total program involved the concept of soil building as well as conserving.

It all started when E. R. Raney was rehired as Chief Engineer of a project of what was then called the Soil Erosion Service. His office was in High Point. In 1934 Raney was employed by N. C. State College and placed In Charge of Agricultural Engineering Extension. He soon needed help and in 1935 employed H. M. Ellis. As Agricultural Engineering Specialist, Ellis, a native North Carolinian, had earned two degrees from N. C. State College; a B.S. in Civil Engineering in 1929 and a B.S. in Sanitary Engineering in 1934. In 1934 he was employed by the Soil Erosion Service (original name, changed later) in High Point as Assistant Agricultural Engineer. His portrait is shown in Figure 4.

Under Raney, Ellis helped organize the first county terracing association. They eventually reached 52 in number. He is credited with incorporating the associations for the legal protection of its members. In order to keep the hourly paid machine operators busy, farm pond construction was a natural addition for slack periods. Also in 1935 Ellis started holding meetings with county agents to discuss the various aspects of surface and subsurface drainage. The idea took root and resulted in many field demonstrations. The first

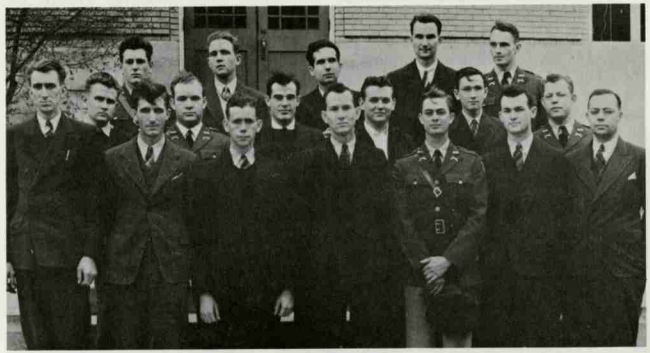


Fig. 5. Charter members of the North Carolina State College Student Branch Chapter of A.S.A.E., 1938-39. Front row (left to right) G.W. Giles, faculty advisor; E.P. Barnes, president, Raleigh; D.M. Griffin, vice-president, Reidsville; L.B. Trevathan, secretary, Mt. Airy; W.E. Garrard, treasurer, Durham; W. C. Warrick, reporter, Clayton; D.S. Weaver, Head of Agricultural Engineering Department. Second Row: J.A. Mitchiner, Youngsville; E.L. Hobbs, Raleigh; T.L. Reeves, Sanford; C. H. Lockhart, Hillsborough; H. K. Sanders, Jr., Roxboro; W. S. Huggins Clarkton. Third Row: R. B. Armstrong, Asheville; P. F. Hoch, Poughkeepsie, N. Y.; D. L. McLaurin, Rowland; F. A. McGoogan, Raleigh; L. B. Altman, Raleigh.

Fig. 6. The huge gable roof barn, now practically extinct, was featured in early exhibits and construction plans of the Extension Service.

two were held in Lenoir County and resulted in the formation of a corporation there and the purchase of four carloads of tile. The low bidder and awardee was an out-of-state manufacturer, causing quite an uproar within North Carolina. Later, ditching by the use of dynamite was an exciting and successful effort.

Ellis spearheaded the expansion of sprinkler irrigation from 2,000 acres under irrigation in 1952 to over 80,000 in 1963. In 1956 in recognization of his accomplishments, he received the Man-of-the-Year Award from the U.S. Sprinkler Irrigation Association.

In the early days of irrigation a gentleman asked Ellis for the brand name of a unit he had seen. He could only remember that the sprinklers went round and round and that the pipe was connected by simply pushing one end in the other. The question was welcome because it was progress. So too was another question, frequently asked of all agricultural engineers, "what is agricultural engineering?" It was natural since the profession was not as well known as say civil or mechanical.

Ellis started the first Rural Safety Council and program in North Carolina. In 1962 he received a Meritorious Service Award from the National Council for his work. Particularly noteworthy was the farm building plan service he helped develop to perfection. This service was started by Raney. The plans were of real benefit to farmers. At that time there were no consulting engineers, nor architects with expertise in the farm area. An educational exhibit of the times that was kept in the teaching laboratory is shown in Figure 6. It is interesting to know that pressure for this work came directly from the county agents. They were expressing a real need.

Special credit for helping to develop the plan service must go to Mrs. D. B. Dosher working under D. S. Weaver. At its height the plans numbered about 400. Mrs. Dosher worked on those plans, and general art work not only for Agricultural Engineering but other departments as well. She was endeared in the hearts of all who knew her. She always had a kind word and was graciously willing to help anyone

with their problems. Most importantly she was a skilled draftsman and artist. She retired in June, 1974 after serving 32 years. She is shown in Figure 36.

Prior to Mrs. Dosher, J. H. Walsh was employed as Extension Architect in 1939. He had a degree in Architectural Engineering from Iowa State College. He came to us from the University of Arkansas where he held a position similar to ours.

One of the developments of all this activity was the publication of an illustrated book of the best 150 available building plans. These were selected from among a total of 1500 supplied by the 12 southern states. It was published by USDA.

R. G. Broaddus was also added as Assistant Extension Agricultural Engineer in 1935. In addition to the terracing program he also worked in the area of farm buildings and water systems. Broaddus also came out of the Anson County project where he was a camp engineer. This latter job came after he received a B.S.A.E. from Virginia Polytechnic Institute in May 1934. So, Raney respected both Ellis and Broaddus for their work in the conservation program and he brought them to Raleigh for more responsible positions at the first opportunity. Broaddus left the service in 1939 for 1 year to manage a freezer locker plant, returned to extension work and some teaching, later to be Secretary of the State Rural Electrification Program. In 1941 he was called into service as 1st Lieutenant and remained after the war's end as a career officer.

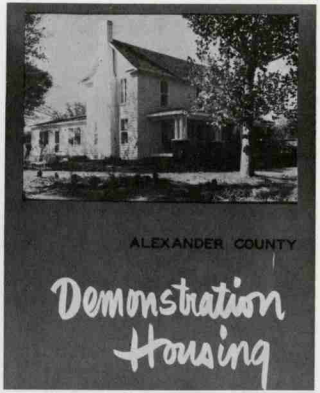
E. R. Raney passed away in 1936 and D. S. Weaver was placed in charge of extension work in Agricultural Engineering. After Weaver took over following Raney's death J. C. Ferguson and D. E. Jones were employed in Extension. Ferguson carried the title of Cotton Gin Improvement Specialist. He had a B.S. Degree in Industrial Management from North Carolina State and came to us from an Instructor's position in Mechanical Engineering.

Reviewing the records during the World War II years one gets the impression that it was a very difficult period, to say the least, for the extension faculty. Many personnel changes were necessary. Out of a total of six specialists, four were called into military service; Richardson, Ferguson, Boraddus and Jones. Only Weaver and Ellis remained.

J. B. Richardson, Assistant Extension Agricultural Engineer was employed in 1939. Mississippi was his native state and he had acquired his B.S.A.E. from their State College. His M.S.A.E. was earned at Iowa State College. With experience in Mississippi and South Carolina he joined our faculty to work on farm machinery and safety. In 1941, however, he left for

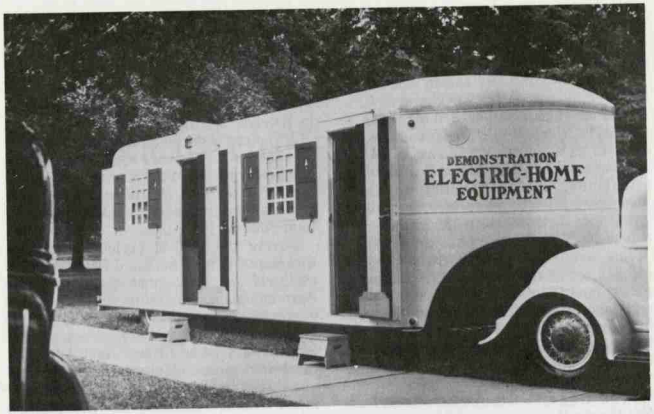
Fig. 7. J.C. Ferguson stands beside the no-till planter he adapted for moisture conservation situations such as the pasture land shown.

Fig. 8. PHOTOS ILLUSTRATE THE SCOPE OF EXTENSION WORK IN THE EARLY YEARS.



A. The cover of this extension leaflet shows a farm home improvement project of the 50s.

B. "Dynamite supplants labor in ditching," read the Beaufort County headlines in 1946. Howard Ellis is second from left.



C. This demonstration unit on electricity was widely used in 1937.

D. Farm pond engineering preceded similar work of the Soil Conservation Service. Pictured is such a pond on Harmon Farm near Candor, 1942.

military duty. Broaddus was hired to fill the position but after a month or two he too, as indicated earlier, went into military service.

In 1942 two new Extension Specialists were employed, J. O. Blickle and C. L. McCaslan. Blickle had earned his B.S.A.E. and M.S.A.E. at Ohio State University. He came to us after about 21 years of varied experiences in both public and private institutions, the last being on farm machinery with a manufacturer in both USA and Canada. Here he actually occupied Ferguson's position.

The problems associated with mechanization during the war years were particularly acute. Machines, repair parts and labor were all in short supply—yet food was a vital need. One of the utterances during this period paraphrased Kipling:

"For the want of a bolt a machine was lost!
For the want of a machine a crop was lost!
For the want of a crop a soldier was lost!
For the want of a soldier a battle was lost!
For the want of a battle a victory was lost!

Blickle was attracted to an extension position at the University of Ohio, in his native state, and departed in 1944.

McCaslan remained with us until he passed away in 1948. Little is on record of his previous experiences but it is believed he came here from Clemson University. We do know that he earned an undergraduate degree, probably in agriculture, at Clemson. McCaslan was concerned with many problems especially in the area of hay drying, farm buildings and cotton ginning. His gin improvement work was particularly important because it was part of a state-wide multidiscipline program called "The one-variety." The objective was to produce a more uniform and higher quality of cotton fiber.

D. E. Jones was Assistant Engineer in Rural Electrification. He took up the work that Weaver pioneered. Unfortunately Jones had to go into the Navy in 1941. When he returned he became associated with the National Rural Electrification Authority in Washington D.C.

The next engineer to take up rural electrification extension work was H. J. Rideout, Jr., with a B.S. degree from V.P.I. in 1939, who was hired from South Carolina in 1945. He resigned in 1947 to accept the position of Rural Service Manager of the Edison Electric Institute in New York City. Today he is a Senior Vice-President of Carolina Power and Light Co. in Raleigh, North Carolina.

J. C. Ferguson remained with the extension service for 36 years with the exception of a 5-year period in the Armed Services as mentioned earlier. He retired in 1966 but has continued to serve the Department in numerous ways.

During the 1936-41 period mechanization began to take hold and Ferguson was assigned to work part time with an Agronomist in promoting side placement of fertilizer simultaneously with the planting of cotton and corn. They used a two-horse-drawn "Iron Age" planter carried from one demonstration to another in a utility trailer. This citation is another in an eviable record of interdisciplinary projects that distinguished Agricultural Engineering over the years.

One day during the transition period following prohibition Ferguson, as a cotton gin specialist, was returning late at night with a small cast iron replica of a cotton gin, when he was stopped by a patrolman and was asked what made the back end of his car sag. "Just a little gin" came the reply. "Let's see it," said the officer. Whereupon the officer not only saw another kind of gin but got a free lecture on how to improve cotton gins.

One of Ferguson's major contributions, and it came after he retired, was the adaptation of equipment for no-till planting. This was part of the total effort to shift to moisture and energy conserving systems. Some estimates are that within the next five or 10 years more than 50 percent of the corn acreage in North Carolina will be planted with this type of practice. Figure 7 shows Ferguson with one of his early adaptations being used to plant in heavy pasture sod.

It can be said that in the earlier years of our growth the extension work was really on-going and outstanding. It was our pride and joy and covered a very wide range of programs. Figure 8 shows some of these undertakings.

CHAPTER II. A TIME OF EXPANSION

The Instructional Program Inches Forward

In 1936 G. W. Giles with an M.S. degree in Agricultural Engineering from the University of Missouri joined as the sole teacher for 1 year while Weaver was on a year's leave as Principal Engineer for the Federal Rural Electrification Administration. R.E.A. was established in 1935 by a Congressional Act. At that time only 11 percent of the U.S. farms had electricity. Some assistance had to be provided. North Carolina had one of the nation's first rural electrification programs with D. S. Weaver and Jane S. McKimmon of Home Economics as the main leaders. Giles continued on following Weaver's return in 1937, and remained with the department until 1961 with the exception of about 2 years during World War II. During the latter period he taught Diesel Engineering to U.S. Navy Ensigns in a special school on the campus.

In the early years the teaching budget was meager, something on the order of $250 per year, outside of salaries, and completely out of line with needs. For example, it is recalled that the total equipment allocation for 1 year was less than $50. The shop needed a ½-inch portable electric drill to supplement the hand turned one. The purchase order for this one item took all the equipment money for that year. "You folks spend money like it was water," was one reaction to that purchase.

Our First Research Project

There was no research in Agricultural Engineering until 1937. Its need did receive minimal official recognition back in 1930 when R. Y. Winters, Director of the Agricultural Experiment Station, in a report to North Carolina made this brief statement, "the Station has no provision for research in Agricultural Engineering."

Eventually this simple recognition led to specific appropriations. It started out in an intrusive way when Giles in 1937 on his own initiative, without formal approval, used his free summers (teachers were paid for 9 months only) and his own money to work on the lespedeza harvester shown in Figure 9. Local junk yards were the source of materials.

This activity was not wasted, even though the machine never amounted to much; however, to our knowledge it was the first axial-flow threshing principle which is used today commercially. One day Director Winters said "If you are that dedicated and firm in your belief of the need for improved equipment, I am going to allocate a few hundred dollars out of my contingency fund." Later, under the prodding of D. S. Weaver, Giles and notably E. R. Collins of the Agronomy Department, appropriations were provided Agricultural Engineering for the development of a one-row mule-drawn cotton planter. The "One Mule Farmer Needs a New Machine" was the lead line. Collins was a co-leader. Thus was born not only a truly cooperative research project between Agricultural Engineering and another campus discipline, Agronomy, but also an avenue for direct and continuing appropriations for research. The resulting machine shown in Figure 10 was produced commercially by the Blue Company of Laurinburg, N. C. The mule-drawn machine, however, really never "got-off-the-ground." Tractors were on their way and progressive farmers turned their at-

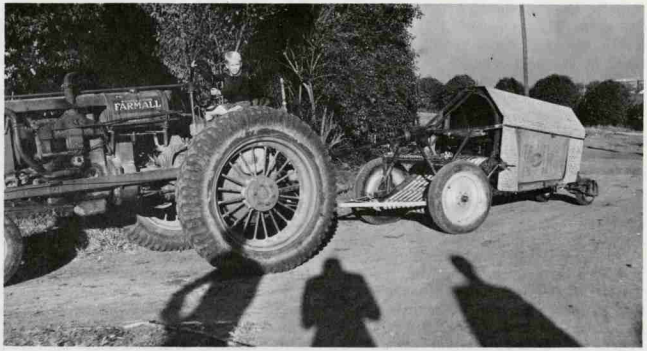


Fig. 9. The first research project was the development of a lespedeza seed harvester in 1937-38. It used one of the first axial-feed auger type threshing cylinders.

tention in that direction. Three benefits did result: appreciation by farmers of the potential of higher yields and more efficient use of fertilizer, recognition that often leadership lags the realities of the time, and that it is most difficult to help the subsistence level farmer adopt more costly advanced technologies. It is interesting to note that the drive gears were fabricated with teeth of round rod screwed into flat plates—they worked like a charm.

Particular credit must go to L. D. Baver, a young soil scientist, who was appointed Associate Director in 1940 and Director of the Experiment Station in 1941. He recognized the need for expanding research in Agricultural Engineering and saw to it that an increased yearly budget was provided, including additional staff.

Teaching and Research Space Problems

Laboratory, classroom and office space remained a critical problem for many years following 1940, brought on in part by the expanding teaching and research staff. Extension was taken care of fairly well with office space and coordination in Ricks Hall. Weaver maintained his office there. Many moves took place for the instructional and research groups. The first was from Patterson Hall to the judging pavillion attached to the rear of Polk Hall. Imagine a class of students sitting on concrete bleachers attentive to a teacher surrounded by a jungle of gas engines, drafting tables, instrument lockers, etc.

Lacking sufficient space the Farm Shop was broken out and moved to Tompkins Hall, where it was jointly administrated and financed by Agricultural Education and Agricultural Engineering. Agricultural Education furnished the space and the equipment, and did so generously. This endeavor must be recorded as another truly cooperative on-campus venture. Figure 11 shows one of the fall 1940 classes. Particular credit must go to J. K. Coggins of Agricultural Education. He and Giles made this one of the outstanding shops for its purpose in the United States. The program was excellent and a highlight of the times for Agricultural Engineering.

Today the shop is back in the Agricultural Engineering building with even finer facilities and programs under G. B. Blum, Jr. and E. L. Howell (see Figure 35). Their work is a shining example of teamwork. Blum has B.S.A.E. and

M.A.E. degrees, and Howell the same but in Agricultural Education, all from N. C. State University. Shop course work was required for both Agricultural Engineering and Agricultural Education students.

From the livestock judging pavilion the physical plant, with the exception of the shop, was moved to a newly built wooden structure southwest of Polk Hall, where the Bureau of Mines and Cox Hall buildings now stand. It was built mainly with second hand lumber by the maintenance department of the College and was proclaimed as "taking care of Agricultural Engineering". However, its small size and dirt laboratory floors hardly befitted the needs of a growing important university discipline. The floor was gradually concreted on a "do-it-yourself" basis.

About 1944 there was pressure for a U.S. Bureau of Mines building to be built in the existing Agricultural Engineering location. The availability of U.S. Government money prevailed and Agricultural Engineering was moved to a wooden structure located along Western Boulevard just east of the existing Forestry complex. The building had been abandoned by the National Youth Administration of the depression years. Its some 10,000 square feet of floor area, including two offices, was heated by two pot-bellied coal-fed stoves. Yes, we wore coats while working in the winter. The situation was depressing.

From the NYA shack period, however, everything was on the upgrade. A. F. Hendricks, B.M.E., M.S. Mechanical Engineering and B.S. Electrical Engineering all from the University of Tennessee was hired from TVA in 1942 to teach courses in farm equipment. The degree man, as he was called jokingly, also did some research in sweet potato harvesting. He resigned in 1944 to join ARS-USDA.

Peanut Production and Processing Research

N. C. Teter, Associate Professor, was hired in 1942 as the department's first full-time researcher. He earned a M.S.A.E. degree from Iowa State College and was on the staff there before coming here. He was hired for farm structures and drainage

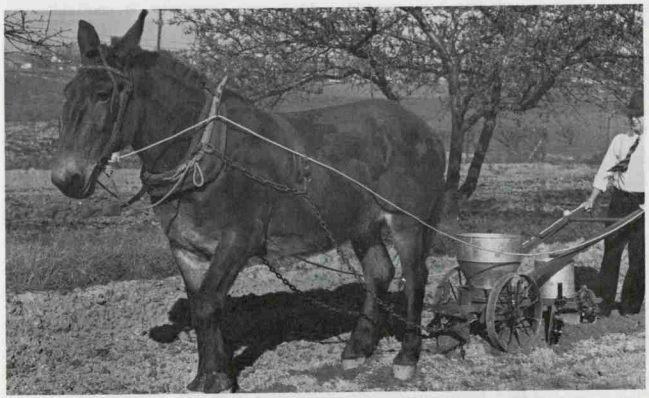


Fig. 10. The second research project was a one-row planter with side placement of the fertilizer. Dean of Agriculture I.O. Schaub is shown above operating the first prototype.

research. One of his main projects was on the value of crop residue for insulation purposes. This project was in line with one of the American Society of Agricultural Engineers recommendations, "development of farm crops for industrial uses." Army service interrupted his work from 1944 to 1946. After returning he started the first research work in North Carolina on artificial curing of peanut and plant tops in contrast to curing on the stack pole in the field. Numerous alternatives were investigated with Giles handling the field mechanical operations and developments. This included clipping the tops in advance of digging. One exciting approach, harvesting the green nuts in one trip, will be covered later. A new building for drying research was constructed on the Upper Coastal Plains Research Station at Rocky Mount. In 1947 the Turner stationary peanut picker was converted for combining from the windrow. The department's first outside financial assistant in support of study on a problem in connection with the pursuit of an M.S. degree came in the early 50s. The position was called "Research Assistantship". The Scott-Viner Co. of Columbus, Ohio supplied a beet harvester and money for the position. The goal was to harvest the peanuts in a once-over operation and dry them from a green state. The rear of the machine is shown in the door of the shop, Figure 18. The once-over harvesting principle was a "first" for the world—really a pioneering effort that was ahead of its time. Work has continued elsewhere but the rising cost of drying from a completely green state has been an insurmountable obstacle.

T. H. Garner, having earned his B.S. degree in the department in 1952, was the recipient of this first assistantship. Under the program he earned the M.S. degree in 1956, and was immediately promoted to instructor—to work full time on cotton mechanization research and to teach a power and machinery course. Having aspirations for more education he dropped back to one-fourth time in 1960 to pursue work leading to the Ph.D. degree. In 1962 he resigned to join the Clemson University faculty. However, he continued to pursue the degree efforts by commuting, summer work, etc. We cite Garner's academic accomplishments because he represents so

Fig. 11. One of the first farm shop classes (Agricultural Education students) held in Tompkins Hall in the fall of 1940. The Honorable James Graham, present Commissioner of Agriculture in North Carolina is standing fourth from the right. Brice Ratchford, former President of the University of Missouri, is standing sixth from the left. Can you identify the others?

Fig. 12. Broome Brothers was one of several commercial hybrid seed corn dryers built in the state as a result of J.W. Weaver's work.

many students of that era who so cherished the value of education that few obstacles were insurmountable.

The Lilliston Corporation of Albany, Georgia sponsored the department's second outside-financed Research Assistantship starting in 1953. It was for investigations of pertinent aspects of mechanical harvesting such as cylinder speed. The recipient was W. T. Mills who earned a B.S.A.E. degree from the University of Georgia in 1949. He came to us at the completion of a tour in the U.S. Army. In 1955 he completed his M.S.A.E. and continued on as a faculty member until he resigned as Assistant Professor in 1961. Yes, he was hired by the Lilliston Co. as Research Analyst. The Lilliston Assistantship was also terminated at the same time. During his tenure here he made the first departmental use of high speed photography—the peanut picking action of various principles.

Another worker in the peanut mechanization program was B. M. Cannon, Research Assistant Professor who came to us from Georgia in 1952. He resigned in 1954 to go into commercial feed processing.

Teter resigned in 1952 to do research at the Virginia Research Station at Holland. He was replaced by J. M. Williams and after 2 years by J. W. Dickens who had received his M.S.A.E. degree here in the spring of 1955 under an instructorship position. Dickens had served as superintendent of the Whiteville Tobacco Research Station and assistant superintendent of the Oxford Tobacco Research Station before returning for his M.S.A.E. He has remained with the department but as an employee of the ARS-USDA. He represents one of the fine examples of our relationship with the U.S. Government research organizations. More will be said later about Dickens federal-state peanut work of recent years. Also the systems approach using the computer will be described later.

E. O. Beasley, who earned his B.A.E. here also worked on the project while pursuing his M.S.A.E. degree. He received the latter in 1962. In 1964 he resigned his Research Instructorship to join Holding Technical Institute as Instructor. He returned in 1967 as Extension Assistant Professor to work in the farm machinery area. Pest control, cucumber, horticultural and general crop mechanization received his attention. He is shown in Figure 37 with one of his later research and demonstration projects—a reduced tillage planter. It subsoils, beds and plants in one trip on old cropland that has been leveled by discing. Conventional plowing, etc., are

eliminated, time and energy saved.

Actually Beasley occupied the postion that Ferguson vacated when he retired. As an Extension Specialist Ferguson had been involved in peanut mechanization work almost from the beginning. Mostly it was in connection with the field days for farmers, first at the research station near Rocky Mount, later at a new station near Lewiston, N. C.

The net result of all this effort and similar endeavors in other peanut growing states was a two-step windrow combining operation, partial drying in the windrow and lastly artificial drying. The system is used by almost all farmers today. Labor costs were reduced by 80 percent and only two persons were needed for the harvest—a notable contribution to peanut production and processing operations.

Crop-Drying Work Gains Impetus and Respect

Hybrid corn development was underway in the 1940s and the need was soon felt for supplemental drying for commercial purposes. J. W. Weaver, Jr. was hired specifically for this job in 1945. He had a B.S.A.E. degree from Virginia Polytechnic Institute and considerable experience in barn curing of hay with the Tennessee Valley Authority. By 1949 there were 21 corn-drying and processing plants in the State. This number doubled by 1952. One of the commercial dryers Weaver assisted in developing is shown in Figure 12. From the corn work he moved into hay-drying research work in cooperation with C. D. Grinnells of the Dairy Husbandry Section of the Animal Science Department. His "drying-in-the-bale" work was unique. This was done in the barn, on hay wagons and on a specially designed platform in the open. Most successful was drying in a covered wagon filled randomly with bales from an ejector type baler. Figure 13 shows Weaver and E. S. Coates atop a loaded platform dryer talking to a visiting group. This photo serves to show the team work among the Agricultural Engineers. Coates graduated here in 1950 with a B.S.A.E. and joined the department as Research Assistant working with Weaver on a hybrid corn storage project at the

Fig. 13. Supplemental alfalfa hay drying was an exciting experiment of the 50's. J.W. Weaver, Jr. (kneeling), principal investigator, and Edwin Coates, Extension Specialist, explain the research to a visiting class.

Plymouth Experiment Station. In 1951 he was promoted to Extension Specialist to work on the processing of the state's major crops: grain, peanuts, hay and tobacco. He also assisted with the 4-H Club Farm Electric Program. In 1961 he went into private practice as a Consultant in the crop processing field.

Weaver is credited with starting the department's first venture into the modeling technique of experimentation. Figure 14 shows some miniature bales and reduced-size drying equipment. This approach allowed one to control variables, such as air temperature, more precisely at less cost than when using full-size field equipment. J. W. Weaver, Jr. is in the foreground and S. H. Usry in the back. Usry was Assistant Professor and assisted with the Processing research from 1947 to 1956. Previously he was with the S.C.S and had earned a B.S. in Engineering from the University in Chapel Hill in 1934. He left to join the N. C. State Board of Health, working on mosquito control. Weaver ended his career by teaching full time and retiring in 1969 after 26 consecutive years with the department.

Physical Facilities Increased

1946 marked a special upturn of fortunes with the first of five appropriations coming directly from the General Assembly for a satisfactory physical plant. The farm leaders and the university officials began to sense the need for more engineering applied to agriculture.

The first appropriation was used to build a three-story wing as an addition to what is now known as Clark Hall, but at that time housed U.S. agricultural agencies such as the Soil Conservation Service. Consisting mainly of a stack of three large laboratories, with two offices on each floor, it proudly sported an elevator that could accommodate the largest and heaviest of any farm tractor manufactured at that time. See Figure 15. The front portion on the right was occupied by U.S. Government Agricultural Agencies. Completed in 1947, the wing contained about 20,000 gross square feet of floor area. The appropriation was $108,000. We retained possession of the NYA building, using it for storage until it was dismantled in 1959.

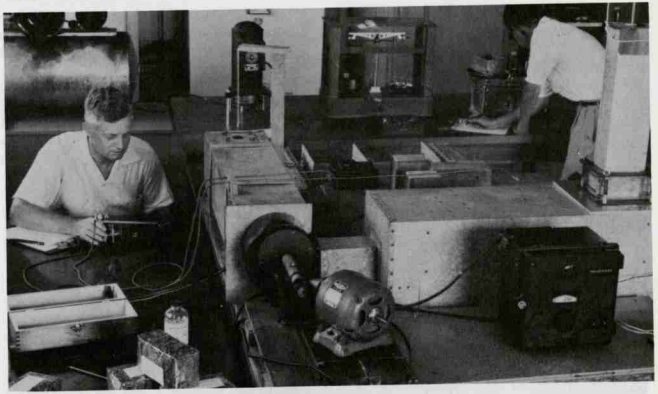


Fig. 14. The department's first model experimentation in the laboratory was with drying hay in the bale. Note the miniature bales in the foreground. J.W. Weaver, Jr. is on the left and S.H. Usry is on the right.

Some Administrative Changes

In 1948 Weaver was selected as Director of the Agricultural Extension Service. To fill his place Ellis (Figure 4) was promoted to "In-Charge" of Agricultural Engineering Extension, and Giles (Figure 28) as the Head of the department which at that time involved the teaching and research aspects only.

Extension was nicely quartered on the top floor of Ricks Hall, while teaching and research occupied the new building.

We Honor "Mangum" of Terrace Fame

The new wing to Clark Hall was named Mangum Hall in honor of the inventor of the first broad-based terrace. This terrace was constructed near Wake Forest in the year 1885. The Department, Extension and the ASAE Student Club were instrumental in getting a historical marker placed along N. C. Highway 98 near its location.

Figure 16 shows some of the officials who participated in the dedication flanking the marker. Figure 17 shows a cross section of a Mangum terrace constructed under the supervision of Ellis in Nash County in 1942. When finished the drainage channel on the uphill side would measure horizontally approximately 14 feet. The backslope would also be gradual so that the entire terrace could be farmed. This type of terrace was improved over the years by widening both the channel and the downslope base. This was possible because larger power earth moving equipment became available, thus supplanting the animal drawn type.

An Expansive Approach to Building Needs

The hope was that the building connected to Mangum Hall on the front, consisting mainly of offices and meeting rooms, would eventually become a part of the department. These aspirations were to be denied, however, and having no space to expand at that location a major decision was made to strive for additional appropriations to start anew at a location having expansion opportunities.

This completely new venture, in effect turning our back on Mangum Hall, required a lot of help beyond the university officials. Some, but by no means all, of the agricultural leaders who sensed the validity of this new approach were S. T. Proctor, farm equipment dealer of Fuquay-Varina and a leader in the N. C. Farm Equipment Dealers Association; R. F. Shaw, Executive Vice-President of the N. C. Farm Bureau; B. C. Mangum, farm equipment dealer and successor to Shaw; J. E. Eagles, a member of the N. C. House of Representatives from 1961-1969 and a farmer in Edgecombe Co.; J. C. Eagles, a tobacco warehouseman of Wilson. They gave tremendous help and support to the cause.

Fig. 15. Mangum Hall was built in 1947. The door to the farm equipment size elevator is at the far left of the building.

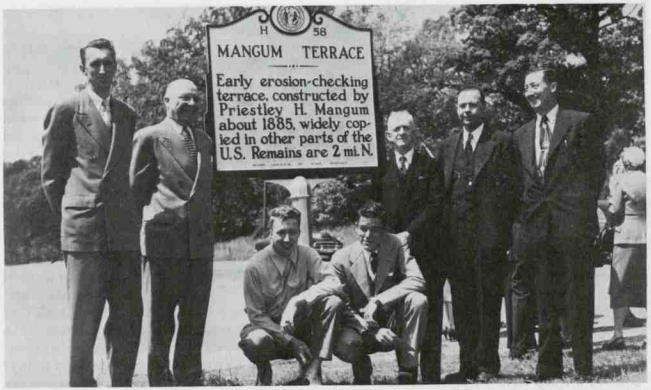


Fig. 16. The above picture was taken at the erection of the historical marker at the site of the first Mangum Terrace in the United States. Standing (left to right) are G.W. Giles; J.H. Hilton, Dean of Agriculture; Priestly H. Mangum, III; D.S. Weaver, Director of Extension; and H.M. Ellis. Kneeling are F.Z. Blevins (left) and B.S. Sutton representing the ASAE Student Club.

N. W. Weldon, a research staff member working on tobacco curing at the Oxford Research Station, was especially effective in helping to get this second appropriation, and the third one as well. In recognition of his contribution a color portrait hangs in the main lobby of the now existing Weaver Laboratories. More will be said about the tobacco curing work at Oxford later. Mr. Weldon remained on the research faculty until he retired in 1960. He passed away in 1972.

The second appropriation, for an expansive-type building, was secured in 1953. It amounted to $400,000. The building was completed in 1957. It provided a floor area of about 37,000 gross square feet. Pursuant to plans, the new building was started at the corner of Dan Allen Drive and Western Boulevard. It was really unwanted space at that time and considered by many to be "off-the-campus." Also a major transmission electrical power line with massive steel support structures transversed the area, and a large hill dominated its center. It had plenty of space in its favor, however, and was located in the only direction for the University to expand groundwise. Admittedly, the second appropriation was used to spread out as much as possible in order to "nail down the territory," so to speak. However, plans for a complete building were made at that time and approved by the University officials. The

temporary disadvantage was three scattered facilities, Western Boulevard, Mangum Hall and Ricks Hall.

The third appropriation amounting to $350,000 came in 1957 for approximately 34,000 square feet. It was completed in 1960. The money was used to fill in some of the vacant spaces and to add the administrative wing in front. See No. 2 in Figure 31.

A Research Shop of Excellence

The research shop was moved into more spacious quarters in the new first unit. Figure 18 shows a corner view at that time. Three typical projects are identified in the caption along with three of the mechanics. R. B. Greene, Head of the Shop, is the man on the lathe in the right background. Greene, a native North Carolinian accepted the position in 1943, coming here from Purdue University.

The shop's name does not truly convey its wide range of activities. It actually serves many other departments, except class instruction. We appreciated the vitalness of good shop equipment and mechanics to fabricate, and repair—yes, to contribute ideas, too. Recently, new road signs that grace the entrance to the outlying experimental research stations were made in this shop.

Greene had one charge, "to develop the best equipped and managed shop for such purposes in the nation." With a budget under his control, he did exactly that. And, he did it starting almost from scratch around the pot-bellied stove of the abandoned NYA shack. He retired in 1973 holding the position of Instrument and Shop Supervisor and with five full-time mechanics under his supervision.

Greene was replaced by R. G. Gaines who earned a B.S. Degree in Agricultural Engineering Science in 1966 in the department. Following graduation he had worked with E. G. Humphries on cucumber and sweet potato harvesting and H. D. Bowen on electrostatic dusting and plant-growth studies.

Figure 19 shows the shop as seen today; the photo was taken from about the same position as shown in Figure 18. All the shop staff appear in the foreground flanked by Gaines on the left and Greene on the right. The shop staff are identified by name in the caption. In the near background is an experimental cucumber harvester built by the shop. Humphries, project leader, is standing beside the machine and technician H. D. Burns is in the seat. The privilege of working in the

Fig. 17. H.M. Ellis holds the rod indicating the depth of a completed broad-base Mangum Terrace on the William Collins farm, Nash County, in 1942.

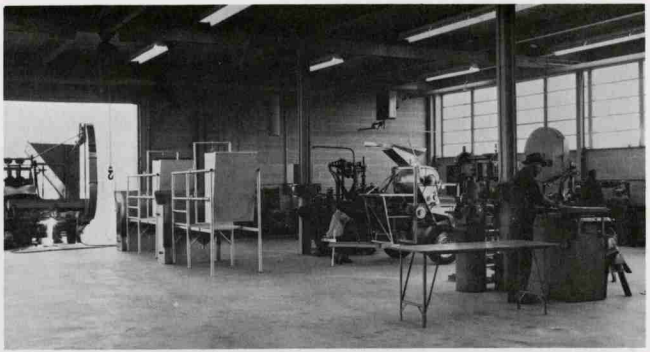


Fig. 18. This is how the Research (Service) Shop in Weaver Laboratories looked in the late 50's. Typical projects included an experimental once-over peanut harvester (in the doorway), two animal stalls for animal industry research (to the right of the doorway), and a plot grain thresher for agronomy. D.L. Dunston is kneeling beside the thresher, W.W. Wheeler is at the bandsaw and R. B. Greene works at the lathe in the far background. Absent is W. H. Hare, mechanic.

Fig. 19. This photo of the shop in Weaver Labs taken from the same position as that in Fig. 18, shows the changes over 20 years. In the foreground (left to right) are R. G. Gaines, instructor and shop supervisor; B. C. Powell, Charles Sherwood and David Buffaloe, mechanics; L. T. Averett, Jr., instrument maker; D. L. Dunston, maintenance mechanic; and Ralph Greene, consultant and former instructor and shop supervisor. H. D. Burns, agricultural research technician, is seated on the experimental cucumber harvester in the background with E. G. Humphries, faculty leader, standing beside it.

Fig. 20. Charles A. Routh was the first M.S. graduate in agricultural engineering in 1952. His thesis pertained to the evaluation of the finger-wheel hay rake a development of the 40's, illustrated on the next page.

shop was encouragingly extended to all faculty and graduate students of the department.

Faculty of Excellence Remains Top Priority

During all this concern with a physical plant the importance of acquiring highly trained additional professional staff for upgrading and expanding teaching, research and extension education remained at the top of the priority needs. Table I in the Appendix indicates that in 1976 the total faculty and staff amounted to 80. The faculty were recruited from all parts of the United States, as well as North Carolina. This philosophy of bringing in "outsiders," so to speak, started in the 40s and was viewed with skepticism by some at that time. In no way did this detract from the excellent contributions of those who were born and educated in North Carolina and remained with the department. They are: C. F. Abrams, Jr., E. O. Beasley, G. B. Blum, Jr., J. W. Dickens, H. M. Ellis, J. C. Ferguson, J. W. Glover, R. G. Gaines, E. L. Howell, E. G. Humphries, W. H. Johnson, R. E. Sneed, C. W. Suggs, W. C. Warrick and R. W. Watkins. They and their work are mentioned throughout this historical recording with pride.

It is believed that this department was a leader in the nation in planned intermixing faculty members of various training and geographical backgrounds as opposed to hiring a majority of one's own graduating natives. This intermixing policy resulted in a total team of greater strength and values unachievable by other means. In 1976, and beyond, the uncontested emphasis is clearly on filling vacancies with the best equipped talent whether from North Carolina, the nation or the world. The philosophy as expressed above must be recorded as one of our great achievements during this first 60 some years.

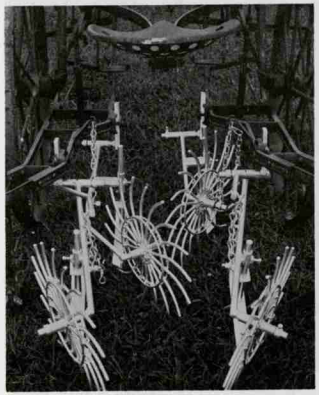
Two other faculty, one in teaching and one in research were employed from outside the state. One was I. L. Williams who came to us as Associate Professor from Louisiana State University in 1947. He had earned a B.S. from Texas A&M and a M.S. from Iowa State University. The second was E. N. Scarborough, Research Assistant Professor in 1948. Scarborough had just earned his M.S.A.E. degree from Iowa State College. Williams was a full-time teacher in the field of farm machinery. Scarborough did research on weed control in cotton and also taught power and machinery. Both, however, ended up as head of a department in another state. Williams left in 1952 to join Texas Technical University at Lubbock and Scarborough in the same year to join a commercial company, later going to the University of Delaware at Newark.

A Master of Science Program Gets Under Way

After a Bachelor of Science degree in Agricultural Engineering was firmly established, it soon became evident that provision should be made to further one's formal education both in depth and breadth. The next major step occurred in 1948 with the initiation of a Master of

Fig. 21. THE FINGER-WHEEL DEVELOPMENTS.

A. The world's first finger-wheel rake is used on sweet potato vines.



B. The finger-wheel was used for cultivating row-crops and was later adapted to the tractor.

C. This is a foreign manufacturer's version in use in Iran.

TWO DISTINGUISHED GRADUATES WHO REMAINED WITH THE DEPARTMENT

Fig. 22. George B. Blum, Jr. earned the first Master of Agricultural Engineering degree in 1956. As an undergraduate teaching coordinator he has twice received the University's "Outstanding Teacher Award."

Fig. 23. Charles W. Suggs earned the first Ph.D. in Agricultural Engineering in 1959. He is shown here with the world's first tobacco leaf harvester which he helped develop. His hand rests on the unique leaf stripper widely used in commercial harvesters today.

Science program. C. A. Routh was the first student to earn this honor in June 1952. Figure 20. Following graduation he has had an exciting and productive career starting as an Assistant Engineer with the Western Electric Co. He has had 24 years as System Engineer for Western Electric and Bell Telephone Laboratories working on the following government projects: Nike-X, Hercules, Underwater Sound and Safeguard. He is presently Senior Engineer with Western Electric. Out of the 24 years he served two in the U.S. Army, part of that time at the Aberdeen Proving Ground.

The Finger Wheel Invented

Routh's thesis was "Leaf and Moisture Loss from Alfalfa Caused by Certain Field-Handling Methods." One of those methods was the use of what is sometimes called the finger-wheel rake. This rake must be recorded as one of our beneficial contributions to agriculture, worldwide. The author has seen one at work as far away as Iran. The U.S. Chamber of Commerce records about one fourth of the manufactured rakes in the United States to be of the finger wheel type. In Europe perhaps 90 percent of the rakes are of this type. One European manufacturer is selling their rakes in the United States.

This new finger wheel principle was first invented for removing sweet potato vines for silage. See Figure 21. One day someone said lets try that thing in an adjoining hay field. It worked. Today, after numerous changes and developments by many, both here and abroad, it found its greatest usefulness in raking hay over terraced and uneven terrain—with less loss of plant leaves. Legal documentation places the first work here and, accordingly, Giles was awarded one of the early U.S. Patents. George Wood of Edenton, N. C. is one of the major manufacturers and has made tremendous contributions to its development and growth. He first worked for Teter on peanut drying thence with Giles on the rake, finally resigning to go into the manufacture of the rake.

It is interesting to note that the principle was also used at that time for cultivating row crops, particularly peanuts. Figure 21B shows it adapted to a horse-drawn cultivator. Like many an invention it was ahead of its time and fell by the wayside temporarily. Today one of the popular mechanical cultivators in the United States utilizes the basic principle of the finger wheel.

Educational Programs Improved

The Master's program was redefined in 1954 to strengthen the opportunities in both science and technology. Two programs were offered: (1) a terminal-type professional study, for the technology oriented student, leading to the Master of Agricultural Engineering and (2) a Master of Science program designed primarily for preliminary study to the Ph.D. We previously mentioned that Routh earned the first M.S. in 1952.

The first student to graduate under the Master's degree in the area of technology was G. B. Blum, Jr. in January 1956. See Figure 22. E. J. Matthews was a close second, graduating in May 1956. Blum remained with the department starting as an Assistant Instructor in 1950. He became a full professor in 1976. More information concerning his outstanding teaching abilities will be mentioned later.

It was also evident that the undergraduate course of study needed restructuring. One reason was to provide a better foundation to each of the two Master's degree programs: Two undergraduate programs emerged: (1) B.S. with a major in Agricultural Engineering Technology; the freshman year for this curriculum was common to all curricula in the School of Agriculture (now School of Agriculture and Life Sciences); (2) B.S. in Agricultural Engineering; this has a common freshman year with the School of Engineering and is administered by the Freshmen Engineering Division.

The latter B.S. program came as the result of a study by a joint committee selected by the Deans of Agriculture and

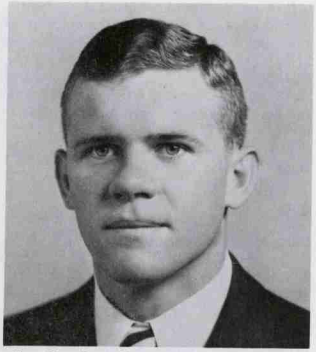


Fig. 24. Paul M. Wagoner was the first graduate of the four-year mechanized agriculture curriculum in 1955.

Engineering in 1955. It was jointly chaired by C. G. Brennecke, Head of Electrical Engineering and Giles. The result was joint administration of the B.S.A.E. degree. The 1959 catalogue contains this statement under the School of Engineering section: "Since Agricultural Engineering involves two distinct technical fields, Agriculture and Engineering, this curriculum is a joint responsibility of the two schools and is so administered." However, the first students to graduate under this latter program was in 1960. These graduates were listed under the School of Agriculture (and Life Sciences) through 1973. Those graduating in 1974, '75, and '76 were listed under the School of Engineering.

One will note in Table II in the Appendix that for 4 years (1955-1959) students normally receiving a B.S.A.E. degree now were awarded a Bachelor's degree. This period was transitional, moving to joint administration with the School of Engineering for the Science type of curriculum only.The Bachelor's degree terminology conformed with the requirements of the School of Engineering. However, in the academic year, 1958-59, the School of Engineering switched to B.S. degrees, and of course Agricultural Engineering conformed. As indicated earlier, the first students to actually graduate under the joint program came in 1959-60 school year.

The move to joint administration was particularly strengthening. The department head had the advantage of sitting on both schools' administrative council. It is not unusual today for a faculty member in Agricultural Engineering to teach a course in the School of Engineering, say in mechanics; secondly, the faculty of the School of Engineering begin to respect the knowledge and the competence of the Agricultural Engineer. Joint administration tied more tightly the marriage strings of Agriculture and Engineering, technically and scientifically.

We also started in the 50s a program leading to a B.S. degree in Mechanized Agriculture. After a few years, however, it was incorporated into the not-too-different B.S. degree with a major in Agricultural Engineering Technology (given by the School of Agriculture and Life Sciences). A total of 37 students earned their Mechanized Agriculture degree. The first to graduate was P. M. Wagoner in 1955. See Figure 24. After graduation, Wagoner operated a major equipment dealership. Today he is an engineer with the Duke Power Company.

A significant consequence of the technology program was the formation of the "Technology Club" in 1954-55. However, it was not until 1969-70 that it applied for and was authorized under the ASAE National Council of Student Mechanization Clubs. Its official name was "The N. C. State University Agricultural Engineering Technology Club of ASAE." This complements and parallels the Student Branch Chapter, ASAE, mentioned earlier. Blum was their first faculty advisor.

Also a notable consequence of joint administration was the accreditation of the department by the Engineering Council for Professional Development in 1958. To achieve the rating required among other values a high level of excellence in both the faculty and physical facilities. On site inspection was one of the rigors of the examination.

CHAPTER III. THE ADDITION OF SCIENCE

Strengthening the Science Aspects

It has been evident up to this point in time that our emphasis was on technology—the application of science—a classical function of our profession. Yet, the world was rushing headlong into the development of physical sciences, for example atomic energy and the transistor. It was high time to apply engineering science to the workings of the biological plant—the world's greatest collector of the sun's limitless energy and to coordinate technology with science. We started with graduate and research programs, and of course science trained faculty, to complement the on-going programs of technology.

F. J. Hassler, with a Ph.D. degree from Michigan State University, who joined the department in 1950, is credited with developing much of the graduate programs direction and strength; he was placed in charge of this aspect of the department's development. Hassler had pioneered in achieving his own academic training, and guided a similar approach at this institution. The emphasis was on mathematics and the basic sciences: the best tools to equip one for work in the scientific area.

Hassler started out doing tobacco curing research at the Oxford Tobacco Research Station but was transferred to Raleigh in 1954. This move is recorded as the first real start of emphasizing the science aspects of our teaching and research program. The Master of Science program had been started in the early 50s, but needed strengthening. Additional new faculty with advanced treaining in mathematics and physical and biological sciences were gradually added as these kinds of positions became available.

The last step in strengthening our total academic program was to provide a Ph.D. degree program for those completing the M.S.A.E. This third degree was necessary for a student in science to achieve a more complete theoretical and working knowledge in basic mathematics, physical and biological sciences. University approval, both here and at Chapel Hill, to offer the Ph.D. came in 1957. It is particularly noteworthy that this was the first Ph.D. program in Agricultural Engineering in the South and the seventh in the Nation.

Some Notes Relating to the Ph.D. Program

The first student to receive the Ph.D. degree in Agricultural Engineering was C. W. Suggs in 1959. His thesis was "The Effect of Workload and Environment on Some Physiological Responses in Man." Appropriately, the chairman of his Advisory Committee was Hassler.

The Director of Research for Suggs' program (now usually called Major Professor) was W. E. Splinter. Splinter came to our faculty as Associate Professor in 1954 after receiving a Ph.D. degree in Agricultural Engineering from Michigan State University. He resigned in 1968 to become Head of the Department of Agricultural Engineering at the University of Nebraska.

Suggs remained on the staff at North Carolina and has a distinguished record of research accomplishments not only in environment-work relationships but also in tobacco mechanization. See Figure 23.

He had graduated with a B.S.A.E. in 1949 and spent some time in industry before returning for continuation of his academic training.

Hassler has an enviable record at North Carolina. Notably he is credited with developing the method and equipment for curing flue-cured tobacco in bulk and in later years became Head of the Department.

The full story of our flue-cured tobacco research is quite exceptional and dramatic. Accordingly, it will the discussed later.

In 1950 the late William Neal Reynolds gave N. C. State University 10,000 shares of Reynolds stock to establish 10 distinguished Professors of Agriculture. The income from these securities represents approximately $20,000 annually. Hassler was named to one of these Professorships in 1961 concurrent with his appointment as Head of the department. Only a total of 23 such awards have been made to date.

H. D. Bowen was another young Ph.D. in Agricultural Engineering with a science background that was recruited for the program. He came to us in 1953 after graduating from Michigan State University. The author believes that no departmental member has had a greater impact on both students and faculty. Some excerpts from a Citation of Merit by Gamma Sigma Delta put his qualities aptly, "unremitting in his pursuit of excellence and a constructive discontent for anything less Dr. Bowen teaches scholarship by example. . .' 'With ingenuity, imagination, originality and perserverance he demonstrates the "why" and "how" of engineering to pace rather than follow. . . ." "A conspicuous sincerity of purpose, contagious enthusiasm, an acknowledged uncertainty of reality, and ample evidence that the clock is a necessary inconvenience."

The "Western Electric Fund Award" for the southeast which Bowen received in 1967 also attests to his excellence in creativity and teaching. He has chaired 11 Ph.D. and 12 M.S. degree advisory committees and won several ASAE awards for scientific papers. His research covered a wide field including electrostatic dusting and environmental interactions relating to seed germination and plant growth. Figure 37B is a photo of Bowen and a machine he developed. It is called "Edathatron" meaning soil machine. It is used for studying soil-plant-weather interactions, which can not be done in the greenhouse or field.

Technology Strengthened

To ensure that the technological aspects of our teachings were maintained in quality and coordinated, Julian M. Fore, Professor, with a background of experience with the Tennessee Valley Authority, Michigan State University, two commercial companies and a M.S.A.E. degree from Purdue University was placed "in-charge." He came to us from Massachusetts in 1956.

One of the programs Fore supported was the education of countless numbers of North Carolinians who, for various reasons, do not elect to pursue a four year program. Society as a whole can only be adequately served by providing a wide variety of educational opportunities. Thus a two year program was initiated in 1960 for those who desire to work in the agricultural industrial field. Such programs are organized under the Agricultural Institute of the School of Agriculture and Life Sciences. Excellence of the training offered is maintained by using the regular faculty of the four year programs. Farm Equipment Sales and Services was offered by the department with the first graduates receiving a diploma of "Associate in Applied Agriculture—Farm Equipment Sales and Service" in May 1962. Starting in 1972 the latter part of the diploma read ". . . Agricultural Equipment Technology." Through May 1976 a total of 138 students have graduated. Their names are recorded in Table III-B in the Appendix.

Research the Essential Element

In recording the past and looking to the future the department has always recognized the importance of research not only to society but to our instructional and extension education activities too. That is why the reader will find it woven

Fig. 25 (Top). The world's first bulk barn was installed on the Stone Brother's farm in Robeson County in 1960. Harry and A. F. Stone hold a bulk unit while A. F. Stone holds a conventional one-stick unit. (Bottom) Large metal racks stacked in front of modern commercial bulk barns contrast sharply with the original wooden sticks and facility.

throughout this historical episode. Research activities exist for the purpose of solving problems—this being the means by which progress is achieved. If we are to teach students, particularly those who go into graduate study, we must have available dynamic problem solving laboratories, equipment and activities. The new technologies of agriculture, carried to the farmers by the extension and industrial workers, are based in large measure on the results of research.

There was a period, early in our history in which we had little or no research. We were justly criticized then by the lag or lack of research especially by those who worked directly with farmers. But not today. Once research "got going" it has performed superbly.

Major Accomplishments in Tobacco Research

North Carolina has always been a leader in flue-cured tobacco research and extension. This was natural since its monetary value was the highest of any agricultural product in the state and of any other state in the United States. Its quality is in demand all over the world.

Our research was directed mainly at two labor intensive operations—harvesting and curing. Curing started first, cooperatively with the ARS-USDA at the NCDA Experiment Station at Oxford, N.C. in the '40s. O. A. Brown of ARS-USDA headed the project. P. E. Green, Jr., Research Assistant Professor was our first faculty contributor. He came to us in 1948 after earning a M.S. degree in Electrical Engineering from N. C. State College. The team at Oxford felt a need for more instrumentation. Green left in 1949 to pursue the Ph.D. at Massachusetts Institute of Technology. N. W. Weldon, Research Assistant Professor, was an early faculty member on this program. He was transferred from the Department of Agronomy and Assistant Farm Superintendent, U.S.D.A. and N.C.D.A. in 1949. He earned his B.S. at N. C. State in 1917. He had a wealth of practical experience in the total tobacco program and thus was a valuable contributor of the time.

The early experiments were centered on improving the structure of conventional barns, usually a 16-foot cube, and its heating and air control system. Without question progress was made. The ridge-type ventilator was a significant development. Extension bulletins were written to aid the farmer in building and operating improved equipment. Commercial interests were quite active and helpful. All in all it was a period of intense interest, debate and revolutionary fervor. One sidelight might be recounted. The high combustible temperatures and bone-dry tobacco occurring towards the end of the cure resulted in many burned barns and crop losses. In an attempt to remedy this problem, one manufacturer designed and constructed aluminum additions. The first trial was on a North Carolina farm, with the press, state officials, and farmers in attendance. Since it was off season the barn was loaded with paper, rather than tobacco leaves, and ignited. The result was a fire of such intensity that it melted the complete structure. It was just one of those disappointing happenings, tragic at the time but really insignificant from a long backward look.

The real technological change came when Hassler, who replaced Green, conducted somewhat uncommon theoretical investigations, the results of which caused old-timers to shake their heads. His analysis of the curing process was based on the measurement of leaf tissue temperature with imbedded thermocouples. In pursuing the chemical and physical changes taking place in a leaf during certain curing phases, a drop of hot solder fell on a leaf. The sudden application of a specific temperature had arrested the chemical changes within the leaf. This led to the determination of the dynamics of the yellow to brown color change as a function of time-temperature. These relationships provided the predictability for successfully curing leaves packed in bulk rather than the necessity of stringing on sticks. The circumvention of stick curing opened the way for mechanizing the harvesting, as well as the curing operation.

Bulk curing was the name of the new concept. It involved curing the leaves packed tightly in racks supported and protected in a low profile building. It was undoubtedly one of the department's most valuable contributions to the region's agriculture. In the past 10 years more than 30,000 of the bulk curers were manufactured and sold in North Carolina. They handle about 50 percent of the crop today and are growing in volume yearly. Some of the commercial racks and containers today are so large that farmers find a chain hoist or hydraulic tractor lift necessary in handling them. The man-hours per acre were cut from about 200 to 70. Commercial bulk curers are shown in Figure 25(bottom). Also Figure 25 (top) shows the first experimental unit which was tried on the Stone Bros. farm located about 10 miles south of Lumberton on U.S. 301. In line with our plan for scientific growth many graduate students worked with Hassler on the tobacco problems. Among these R. W. Watkins, W. H. Johnson, W. H. Henson, Jr. and W. F. McClure remained with the department in various positions to continue work on tobacco. Watkins is today an Extension Associate Professor working in research and extension. He earned his B.A.E. in 1958 and his M.S.A.E. in 1961 after which he went with industry returning in 1962 as Extension Assistant Professor. Notably, he has been engaged in on-the-farm testing of mechanical harvesters and was instrumental in developing and testing of bulk box curing (whole leaves from the harvester deposited in a large box and cured). In 1976 over 50 percent of the barns sold were of the box type in contrast to suspending leaves in a rack of the type shown in Figure 25. Watkins has also given assistance abroad. He has been in Australia for a short period at their request on bulk curing problems. They are just getting underway downunder with this new technology and needed expert advice. In 1961, Henson, who completed his Ph.D. as an ARS-USDA employee at North Carolina, was transferred to Kentucky to work on the problems of burley tobacco. McClure's work on nondestructive quality measurements will be mentioned later.

Today the major research work on curing is being carried on by and under the direction of W. H. Johnson, a native of North Carolina, who earned all three of his degrees here, the Ph.D. coming in 1961. Curing in the bulk was indeed revolutionary but one should see what goes on now. Its truly amazing. Johnson is experimenting with leaves precut in different sizes and packed in all kinds of containers and with precise control over the environment during every phase of the cure. Figure 37G shows one of the many groups who were attracted to these experiments at the Oxford Station. The container on the right is being filled with the precut leaf. Who knows but what this may be the way of the future. Some of Johnson's experiments take him to the field where tobacco is grown in high plant population per acre and handled more like a crop of hay. There are also the energy saving experiments, important for tomorrow's fossil fuel shortage. Its all very exciting to say the least. Should some of us join the old timers on that fence row, and shake our heads in disbelief? I hope not—progress is at work deserving affirmative nods.

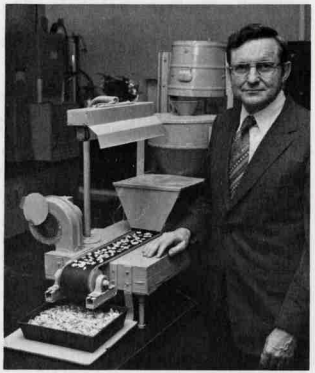


Fig. 26. J.W. Dickens, research professor and USDA employee, is shown with a peanut kernel splitter and orientator he developed. The machine is used for on-site quality checks of peanuts delivered to market.

As in the case of many investigations the development of bulk curing had its tangential effects. For one thing, it opened up opportunities and gave added support to mechanical harvesting work. There were some who said "one cannot mechanically harvest economically the individual leaves, selectively, as they ripen from base to top." But, shortage of labor and other problems quietly put this "can't be done" attitude to rest.

The first Agricultural Engineer to work on the mechanization of tobacco in North Carolina was R. W. Wilson, a native of Wisconsin. He came directly here in 1948 after earning a B.S. degree in Mechanical Engineering and B.S. and M.S. degrees in Agricultural Engineering from the University of Wisconsin. When approached about the job he replied, "I know nothing about tobacco only having seen it growing in a field along the highway." He was assured we wanted one with no preformed ideas. He successfully initiated the first work leading to selective removal of the ripe leaves mechanically and automatically. One of the devices is pointed out in Fig. 23. Wilson left the department to become associated with a commercial manufacturer of tobacco production equipent. Today he is President of Powell Mfg. Co., Inc. with three plants in the Carolinas and President of Powell Agri-systems of Canada.

W. E. Splinter, C. W. Suggs, E. L. Howell and R. W. Watkins continued the work. In 1976 there were about 2,500 mechanical tobacco harvesters on N.C. farms. They are now commonplace. There are at least three companies in the business. Each machine has a capacity of about 50 acres per year and has eliminated some 35 hours of backbreaking labor per acre. The background for Suggs' picture in Figure 23 is the tobacco leaf harvester and in particular the rubber leaf strippers. Wilson and Suggs were granted a U.S. patent on the leaf removal device. It is employed on practically all commercial U.S.-manufactured harvesters today.

Next came the mechanization of handling the cured leaves at the warehouse market, an essential link in achieving a smooth flow of the product and efficient handling systems. The work was cooperative with ARS-USDA and co-project leaders were A. H. Graves, ARS and R. S. Sowell, Station. The procedures and techniques are being widely adopted today. Figure 37D shows one aspect. A conveyor belt attached and operated by a fork lift loads, transports and unloads sheet tobacco. Graves is on the back side. Graves earned his B.S. degree in Industrial Engineering from Kansas State in 1950.

Other production aspects of tobacco have not been forgotten. B. K. Huang has worked on precision planting and transplanting tobacco. He came to us in 1963 after completing his Ph.D. in Agricultural Engineering at Purdue University. Prior, he had earned his M.S.A.E. at the University of Illinois in 1960. The mechanical harvesting dictated the need to produce a more uniform crop. In the energy conservation area Huang is experimenting with solar curing. Assisting is C. G. Bowers, Jr., a Research Assistant working full time on the project. Bowers is pursuing a Ph.D. degree, having acquired his B.S. and M.S. here.

J. W. Glover, Extension Associate Professor, who graduated here in 1950 with a B.S.A.E. degree has been active in improving the commercial bulk curers, particularly on energy conservation. He worked some with Ferguson on the earlier machinery programs and took over some of the courses voided with the retirement of J. W. Weaver, Jr. His major thrust in the last decade was on pesticide and fertilizer application, and on crop processing with emphasis on peanuts, corn and soybeans. He is shown in Figure 37I working with a modern-day sprayer. He did not join the department until 1955 spending the intervening years with industry and the U.S. Infantry.

The Quality of Products Not Forgotten

The quality of the tobacco leaf that the farmer presents to the warehouse floor for sale is an influencing element in evaluating practically all the above-described experiments. But it needs to be ascertained objectively rather than by feel and appearance.

W. F. McClure, Professor, has worked extensively on the problem, searching for a quick nondestructive measure of chemical composition. McClure with a B.S. degree in Agricultural Engineering from Clemson University earned both his M.S.A.E. (1961) and Ph.D. (1966) degrees, after coming here from the Southeastern Baptist Theological Seminary in 1958. More recently he has extended his knowledge to the quality factor in other agricultural commodities except peanuts.

The quality of peanuts weighed in for serious attention before 1958. Dickens of USDA, whom we mentioned earlier, was the leader of a U.S. government-state cooperative project. His work resulted in four noteworthy pieces of equipment and methods of use: (1) to size and shell, without breaking, grade samples of peanuts; (2) to split and orient the kernels for inspection of internal damage; (3) to take representative samples from the arriving truck; and (4) to detect aflatoxin contaminated lots of farmer stock peanuts.

The above four contributions have been singled out because they are all employed to a major degree by the peanut marketing and processing industry both here and abroad. For example, the machine for splitting and orienting the cotyledons in order to detect internal damage rapidly has been used since 1961 for grading all farmers' stock and shelled peanuts produced in the United States. Dickens is shown with the machine in Figure 26. Yes, this machine is used at the marketing plant, owned by Jimmy Carter, the 39th president of the United States, in Plains, Georgia. In 1972 Dickens was invited to Turkey and Iran as a short-term consultant on a problem of aflatoxin in pistachio nuts.

Aflatoxin is also becoming quite a threat to some of the agricultural products in the Southeast. In addition to peanuts, it is present today in corn and cotton seed in particular. T. B. Whitaker, an employee of ARS-USDA is stationed here to work on the problem. He graduated from the

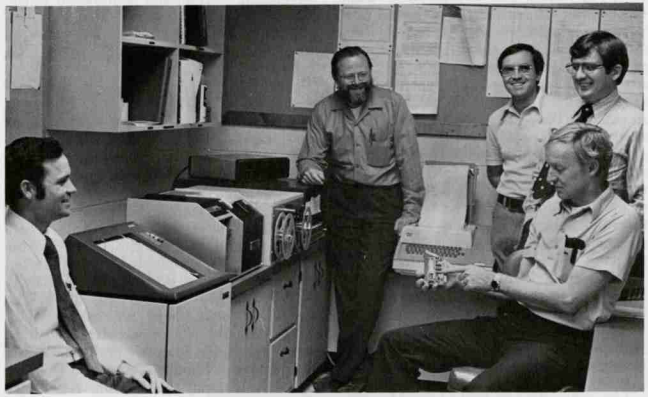


Fig. 27. Shown in the computer terminal room are members of the committee responsible for its management and operation. Left to right are R.S. Sowell (logistics and inventory); E.H. Wiser, chairman (software development and maintenance); T.B. Whitaker and C.F. Abrams, Jr. (user operation); and W. F. McClure, (hardware). McClure holds a "chip", the heart of the microcomputer.

department with a B.S.A.E.(J) in 1962 and received his M.S.A.E. degree in 1964 working under Dickens on the problem of off-flavors in peanuts due to temperature. He earned a Ph.D. from Ohio State in 1967 and returned to the job he now holds.

Soil and Water Work Continues

We started our engineering activities attacking drainage problems and have continued work in the soil and water area. In 1945 field drainage investigations using both open ditches and tile were initiated jointly with the U.S. Soil Conservation Service at the N.C. Tidewater Research Station near Plymouth with E. G. Diseker, with a B.S. degree from Alabama, in charge. Diseker an employee of USDA was transferred here. The striking thing about this experiment was that despite the large acreage employed, the results were voided by the side effect of adjacent designs. This was really a positive find and forced a different approach; that is theoretical, using mathematics, laboratory models and computers. Starting in 1954, J. Van Schilfgaarde, Drainage Engineer, a joint employee of the State and ARS-USDA did extensive work using theoretical approach. He earned all three of his degrees from Iowa State University, joining this department after achieving the Ph.D. in Agricultural Engineering. He is credited with developing some of the first successful draw-down equations for spacing of drain tile. He also recognized the need for inter-disciplinary approach and was instrumental in having two USDA personnel, C. R. Willey, a Soil Physicist and R. E. Williamson, a Plant Physiologist, located in the department. In 1964, Van Schilfgaarde was transferred to Washington, D.C., USDA. He is now Director of the U.S. Salinity Laboratory, Riverside, California.

E. H. Wiser has made a number of computer applications in hydrology. He came to us from Iowa State and earned his M.S.A.E. degree in 1959 and Ph.D. in Agricultural Engineering in 1965. He continued on as a faculty member. In the early 60s he assisted Van Schilfgaarde in

Fig. 28. G. Wallace Giles was the second Head of the Department, serving from 1948 to 1961.

developing a computer simulation model for designing subsurface drainage, a concept that has found wider use. Later he used computer techniques to predict watershed runoff.

Although the importance of removing excess water was recognized early, it was not until the late 40s that plant stresses due to lack of moisture received major attention. T. V. Wilson, in cooperation with W. G. Woltz of the Soil Science Department started the first irrigation experiments with tobacco. Wilson joined the department as Assistant Professor in 1949 after earning his M.S.A.E. from Purdue University. He graduated from Clemson University with a B.S.A.E. In addition to research he also had teaching duties. The irrigation experiment was successfully concluded and Wilson accepted a position with Clemson in 1956. We are proud of the fact that in 1972 he earned his Ph.D. here.

R. E. Sneed, Extension Associate Professor who earned his B.S. in 1959 and his Ph.D. in 1971 in this department has been active along with others from Soil Science in conducting field studies on irrigation of corn, cotton and peanuts. Later he expanded his activities into the

use of sprinkler irrigation on fruit and vegetable crops in cooperation with Horticultural Science. He has also been active in drainage extension work. Figure 37A shows him in front of a plastic tile laying machine at a demonstration.

From 1972 to 1976 Sowell and Sneed continued to work on the efficiency of water utilization especially from the crop requirements. Two computer based models emerged—one to project water requirements and one to determine optimal use of a given quantity of water.

The extension activities previously handled by Ellis were taken over by J. D. Netherton for one year starting in 1957. In 1958, he resigned to go with Oklahoma State University. Later Sneed was appointed Extension Assistant Professor to continue the irrigation work. He is well respected as evidenced by his position of technical director of the N.C. Irrigation Society. He was a short-term consultant to the Greek Tobacco Corp. who held large tobacco acreages in Uruguay, S.A. Needless to say, the number of acres of irrigated crops and the number of crops irrigated in N.C. have continued to increase as a result of all this work.

In 1965 G. J. Kriz was employed as Assistant Professor with 20 percent of his time paid by and devoted to work in the Department of Soil Science.

He holds B.S.A.E. and M.S.A.E. degrees from Iowa State University and a Ph.D. degree in Water Science and Engineering from the University of California at Davis. Although teaching some classes, his major effort was on research projects involving land forming, animal waste management, and water control for farm land in Eastern North Carolina. He led the team that developed a computer program for land forming designs for surface drainage and initiated work on subirrigation and water-control systems.

R. W. Skaggs, Associate Professor, continued Kriz's work in 1970, the year he came to us from Purdue University after earning a Ph.D. degree. He holds a joint appointment with the Department of Soil Science. He has been active on many projects including the University's Water Resources Research Institute. His most

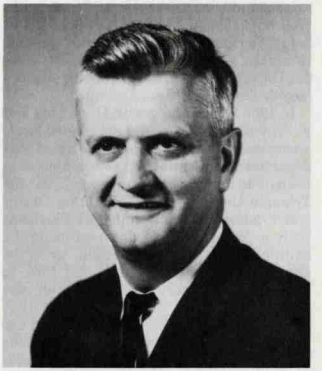


Fig. 29. Francis J. Hassler became the third Department Head in 1961 and maintains that position today.

significant contribution to date is the development of a computer-based water-management model, which includes both surface and subsurface components along with other variables. Skaggs is shown in Figure 37J at a subirrigation project at the Tidewater Research Station. During the dry season water is pumped from a well into a canal from which it flows into the drainage lines. During the wet season the canal drains by gravity. In the early days we were concerned only with drainage.

Into The Computer Age

The use of the computer must be recorded as one of our significant developments. It started in the mid 50s when W. E. Splinter procured a small analog computer for use in tobacco research. Soon after Van Schilfgaarde and graduate assistant E. H. Wiser used an IBM 650 located in Patterson Hall to develop equations for spacing of drain tile.

The main leadership in computer application, however, came from Wiser. In 1958 he used the IBM 650 to develop a water

balance model. This work was expanded in 1959 on a Univac 1105 at Chapel Hill to study irrigation water requirements. Graduate student, J. I. Sewell, also used the Univac to study water flow to subsurface drains.

In 1967 Wiser, along with D. A. Link and K. A. Jordan (background mentioned later) successfully promoted the first departmental terminal on the campus connected to an IBM 360 located in the Triangle University's Computation Center about 20 miles from Raleigh. This was truly a "milestone." Jordan was using the computer to study chicken growth-environmental relationships, and Link to optimize machinery utilization on the farm.

The terminal resulted in widespread use in the department. One can only conclude that the amount of computer usage is directly related to its accessability and ease of use.

The computer has been of unmeasurable benefit in the past 20 years, however its future may be truly revolutionary. In 1975 McClure promoted the microcomputer—small and inexpensive. It will permit the processing of data at the time of collection. Bowen (background and work mentioned earlier) envisions its wide usage for such automated operations as steering a tractor. The possibilities are endless.

The existing departmental committee responsible for the management and operation of the terminal consists of Wiser, Chairman, Abrams, Sowell, Whitaker. They are shown in one corner of the terminal room in Figure 27, with their major duties indicated in brackets after each name. The "chip," heart of the microcomputer as mentioned above, is held in the hand of McClure.

A Time of Major Changes

In 1961 Giles left the University to go with The Ford Foundation as consultant on an agricultural program in India. F. J. Hassler was chosen as his replacement and has remained so to date. He was a logical choice having pioneered the department's work into the world of truly scientific endeavors, as excellent as any other scientific discipline. The number of employees (faculty and staff) including the federal persons increased from 32 in 1961 to 71 in 1975. Giles and Hassler, the second and third department heads are shown in Figures 28 and 29.

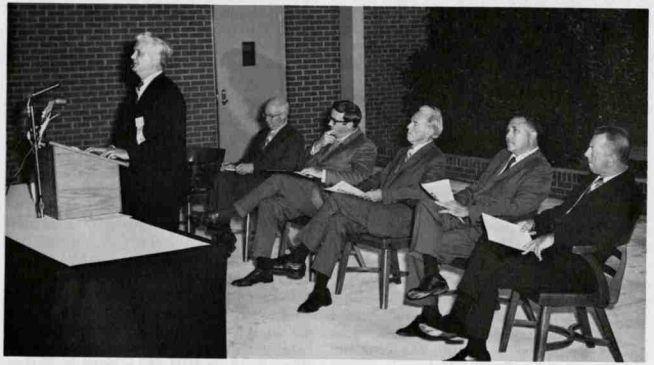


Fig. 30. There were many dignitaries present at the dedication of the David S. Weaver Laboratories in October, 1970. From left to right are Dr. F.J. Hassler, Head of the Department; Dr. H. Brooks James, Vice-President of The University of North Carolina; Governor Robert W. Scott; Dr. John T. Caldwell, Chancellor of N.C. State University; State Senator J.J. Harrington; and Rev. Oscar B. Wooldridge, Jr., Coordinator of Religious Affairs.

We can be justly proud that seven from among our faculty, have been appointed Department Heads: D. S. Weaver, Giles and Hassler at North Carolina; Parker at Kentucky; Splinter at Nebraska; Scarborough at Delaware; and I. L. Williams at Texas Tech., Lubbock.

Some of our graduates are in administrative positions. J. H. Anderson, Master of Science in Agricultural Engineering in 1954, is Director of the Agricultural Experiment Station at Mississippi State University. A. W. Snell, Head of the Department at Clemson, S. C., took a leave and earned his Doctorate here. J. I. Sewell who earned his M.S. and Ph.D. here is Assistant Dean of the Tennessee Agricultural Experiment Station.

The Fourth Building and Dedication

Funds in the amount of $475,500, for an additional 24,000 square feet of office and research laboratories, were obtained in 1967. This section was completed in 1969. It was a two-story structure which filled in the courtyard of the new building and contained the necessary foundation and structure to support a third floor.

Again the farm leadership outside of the University recognized the need for physical facilities and strived hard to meet it. For that fourth appropriation, a farm machinery manufacturer and State Senator J. J. Harrington of Lewiston N.C., was very instrumental. The total plant was dedicated as Weaver Laboratories on October 15, 1970 with Senator Harrington making the principal address. Chancellor J. T. Caldwell presided and Governor R. W. Scott dignified the occasion with his presence. These and other dignitaries are shown in Figure 30. The bronze plaque of dedication is mounted in the foyer. It reads as follows:

DAVID STATHEM WEAVER LABORATORIES
Dedicated To The Memory Of
DAVID STATHEM WEAVER
1886-1966
Agricultural Engineer
Conservationist
Teacher
Director of the Agricultural Extension Service
Father of Rural Electrification in North Carolina
Dedicated to Agricultural Mechanization

The cover page for the dedication program is shown in Figure 31. The rendering of the completed structures which appears on the cover was made by Mrs. D. B. Dosher of whom we spoke earlier. Numbers are superimposed on the various units of her drawing to indicate their order of construction and are identified in the inscription in Figure 31. Still unfulfilled is the need for an addition similar to the front office section No. 2 to go in spot No. 5, and a third story on No. 3. Number 4 is a storage building that was constructed piece-meal with Station funds. The total floor area in Weaver Laboratories now contains about 95,000 square feet (machine shed exempted).

Systems Engineering—A New Approach

As the department matured, the need to give simultaneous attention to all operations of a system became increasingly clear. One simple example is the work by Humphries on harvesting cucumbers narrated later under Fruit and Vegetable Engineering. It clearly indicated the need for an improved bed if it was to succeed. Figure 32 shows the result—a precision wide flat bed and planting. This is a far cry from the rather rough and peaked bed constructed in the early years usually with a mouldboard plow. This new seed bed and related operations has been carried out by Beasley (record narrated earlier) as a research and extension demonstration project.

Nowhere in the department's activities has the computer and mathematical modeling been more effective than when

used for evaluating and managing our expanding agricultural systems approach—both for research and farm production. The number of variables and their interactions in agriculture are becoming so complex today that it is beyond the capacity of the human mind when working with the tools of yesteryears; the slide rule calculator and field trials. The department was one of the first in the United States to recognize the need for and the potential of the systems approach in research. In 1962 D. A. Link was employed for his expertise in the methodology of the systems approach and computer technology. He came to us after receiving a Ph.D. degree from Iowa State University. From this early commitment there has been widespread growth both here and elsewhere. In 1970, Link joined the Department of Computer Science on the campus as Associate Professor and Administrative Assistant. He passed away in 1976.

R. S. Sowell, Associate Professor, earned his Ph.D. degree here in 1967 under Link. After 4 years in the Air Force, he joined the department in 1970 to work on Systems Engineering. His efforts were focused on the production and marketing of tobacco and horticultural crops. Also, Sowell and Sneed worked together on mathematical modeling to optimize the use of water for agriculture. Sneed acquired the data and Sowell did the modeling plus teaching.

Another example is recent research in the production and processing of peanuts. This work is being conducted by J. H. Young, a young scientist who joined the department after earning his Ph.D. degree from Oklahoma State University in 1966. Young earned his B.S. (1962) and M.S. (1964) in Agricultural Engineering from the University of Kentucky. He is using a modeling approach to optimize the production system. For example, plant growth is simulated in its reaction to such factors as temperature and moisture. Concurrently, the same approach is used for optimizing the harvesting and curing system. Eventually these two systems will be linked into one. It is interesting to note that this approach of today is possible because of the mass of field and experimental data collected in the past. Young is also doing some teaching of courses in processing for both the science and technology students.

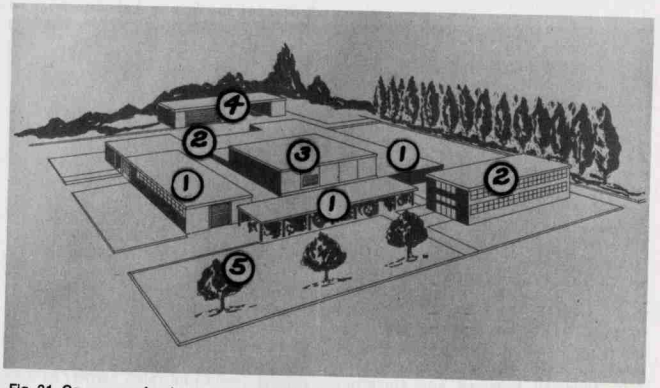


Fig. 31. Cover page for the dedication of Weaver Laboratories showed a sketch of the physical plant. Sections are numbered to indicate the period of construction: 1. First Section, 1953 appropriation; 2. Second Section, 1957 appropriation, completed in 1960; 3. Third Section (2 stories), 1967 appropriation, completed in 1969; 4. Machine Shed, built over a 10-year period with experiment station funds; 5. Space for future addition, similar to No. 2 opposite front.

Fruit and Vegetable Engineering

We have long recognized that sooner or later fruits and vegetables, particularly the harvesting aspects must be given attention. Other than sweet potato vine harvesting back in the 40s practically nothing was done until the early 60s. Since then substantial work has been on the blueberry, cucumber and sweet potato production, harvesting and processing systems.

R. P. Rohrbach who earned his Ph.D. in Agricultural Engineering at Ohio State University joined the department in 1968 as Assistant Professor to do research in blueberry mechanization, and teaching. He is in the process of developing techniques for harvesting the ripe blueberries from the plant. Progress has been made to the point of a field operated model with a fairly high degree of performance. Also progress is being made in processing and packaging the blueberries. Included are fruit cleaning, drying and maturity separation. Most exciting is an experimental machine called the "M-Belt" Maturity Sorter. It is shown in Figure 37K along with Rohrbach and McClure. We mentioned some of McClure's work on tobacco earlier. On this machine, McClure covered the electronic aspects and Rohrbach the mechanical.

E. G. Humphries, with a B.S., M.S. and Ph.D. from the department has been concentrating on the mechanical harvesting of cucumbers. He initiated and has sustained the multipick approach. The basic technology for producing the crop along with the mechanical hardware for the ac-

Fig. 32. Precision bedding and planting of cucumber seed is necessary for a successful mechanical harvester—a systems approach.

tual harvest has been successfully demonstrated. The latest version is shown in Figure 19 in the research shop being readied for the 1977 season. Humphries is standing beside the machine. Much work, of course, remains but there is little question of the outcome. It is only what and when.

It wasn't until 1972 that full attention was given to the sweet potato problem. Prior to that, Humphries worked on harvesting until J. R. Hammerle was hired in 1968. Hammerle had just completed requirements for the Ph.D. from Pennsylvania State University following an assignment in Indonesia. When he resigned in 1971, Humphries took over again. In 1972 C. F. Abrams, Jr. was hired from the University of Kentucky. A native of N.C., he earned all three of his degrees (B.S., M.S., and Ph.D.) here. His initial approach was to investigate harvesting concepts, coupled with bulk-handling methods in the field and at the packing facilities aimed at reducing labor and damage to the product. The concentration has been on a side delivery articulated conveyor part of the unit. Abrams is shown with a part of the latest test harvester in Figure 37E.

Fig. 33. Specialist in charge of Extension and the first Associate Head of the department, George J. Kriz served from 1969-1973. He was appointed Assistant Director of the North Carolina Agricultural Experiment Station, the second member to become an outside administrator here.

Structures and Environment

Actually, we have been writing about this from time to time but always in connection with a field crop, corn for example, but nothing on animal, human and greenhouse structures. Of course the extension faculty, right from the start, have always been concerned with the engineering of all farm structures. Blueprints and specifications were a part of their stock-in-trade so to speak. (See Figure 6.) And that service was and still is as good as any in the nation. Later we began to approach the problem from the environmental aspects.

R. M. Ritchie, Jr., an able Extension Specialist in Farm Structures, did considerable work in this area both from an extension and applied research approach. He came to us in 1948 from the Southern States Cooperative in Richmond, Virginia. He had a B.S.A.E. from Virginia Polytechnic Institute (1942). Blue ribbons from ASAE on two report papers: Insulated Broiler House with Working Model and Insulated Broiler House Plans, attest to his ability. Ritchie resigned in 1966 as Associate Professor after 18 years of service, to do consulting work in agricultural production, storage, processing and marketing facilities. To our knowledge Ritchie and Coates are the first faculty members to go into consulting work on a full time basis. This area of service is one of growth for our profession.

W. C. Warrick, another Extension Specialist, has been concerned with rural housing. He graduated from the department in 1941 with a BSAE, and immediately went into military service. He joined the faculty in 1945 where he remained until retirement except for a short period as an earth moving contractor. In 1970 he was transferred to Extension Home Economics in charge of Housing and House Furnishing section, but maintained his professional rank in the department. He was a nationally recognized authority on rural housing. A cover page of one of Warrick's leaflets, giving the details of a completed home remodeling demonstration in Alexander County, is shown in Figure 8A.

For teaching and research in Structures and environment, our first full-time faculty member was B. F. Parker who had earned his Ph.D. in Agricultural Engineering from Michigan State. He came here in 1954 as Associate Professor. He started investigative work on the effects of environment on hens. It was done inside the laboratory and required unique instrumentation. This approach towards finding what the animal needs and then designing the structure to provide those needs was indeed pioneering for that time. Parker left in 1956 to join the Agricultural Engineering Department at the University of Kentucky, later becoming Head of that department.

The position vacated by Parker was filled by Assistant Professor K. A. Jordan who had just completed his Ph.D. in Agricultural Engineering at Purdue University. He also earned his B.S.A.E. and M.S.A.E. at Purdue. Jordan extended the previous work to involve the use of computer modeling, which we mentioned earlier. He resigned in 1967 to go with the University of Minnesota as Professor.

Today poultry research is being carried out by G. R. Baughman, an Associate Professor. He also teaches a course in Structures and Environment. He joined the department after earning a Ph.D. in Agricultural Engineering from Ohio State University in 1971. His research involves the use of large, several thousand bird, structures. Figure 37F shows Baughman inside one of his experimental units with some of the instruments. Poultry Engineering best describes the efforts to improve energy efficiency, environment and mechanical handling of broilers. Mechanical ventilation, cleaners, insulated houses and controlled lighting are very much a part of today's management practices. But producing and marketing more broilers per unit building at less feed consumption still remains a great challenge.

Since 1966 attention has been directed to improving swine production through

Fig. 34. Frank J. Humenik became specialist in charge and Associate Head of the Department in 1973. With a Ph.D. in Civil Engineering, Dr. Humenik exemplifies intermixing and inter-discipline aspects.

engineering. Environmental control and management practices have produced results. For example, air conditioning a breeding facility at the Upper Coastal Plain Research Station has proved effective and economical. Figure 37L shows the interior of a swine farrowing house on the Exum Scott farm near Wilson, N.C. which serves both as a research and demonstration unit. During the hot season air-conditioned air is fed down the vertical tubes to the individual pens. L. B. Driggers, Extension Professor, is responsible for this area of work. A native of South Carolina, he earned his B.S.A.E. at Clemson University and M.S.A.E. from Virginia Polytechnic Institute and State University where he was on the extension faculty for nine years. He came here from that position in 1966.

In earlier years greenhouse structures and their management were of little concern. In the 70s, however, increasing costs, particularly labor and energy, threatens the floricultural industry. In 1974 Assistant Professor D. H. Willits was hired to give leadership to the problem. Actually he

Fig. 35. L.B. Driggers, G.B. Blum, Jr. and E.L. Howell (left to right) inspect a teaching aid called solaranger. The three, along with R.G. Holmes who is now at Ohio State University, have been honored for outstanding educational performance.

replaced departing R. G. Holmes whose work was of a different nature and will be recounted later under "Outstanding Teachers."

Willits came here after receiving his M.S. and Ph.D. degrees in Agricultural Engineering at the University of Kentucky. He earned his B.S.M.E. from the University of Florida. He is devoting about 85 percent of his time to the greenhouse problem and the remainder to teaching agricultural processing.

In addition to immediately attacking the cost of producing greenhouse crops largely through energy efficiency Willits and Sowell in cooperation with the Department of Horticulture are looking further down the road. They are developing mathematical models that will eventually provide the information to optimize the entire system and its management.

Human Engineering

Since humans are involved in one way or another in agricultural operations, human engineering has been part of many research projects. One faculty member, Suggs, however, has directed specific attention to the influence of various environmental factors on the response of the human. For example, the influence of vibration and noise on the operator. Huang is associated with this work as a co-leader.

Major Administrative Changes

Within the first 60 some years two faculty members have been advanced to administrative positions above the departmental level. The first was D. S. Weaver whose records were narrated earlier.

Ellis retired in 1969 after 34 years of continuous service. The extension faculty under his leadership had grown from two to eight. Above all else he helped to integrate smoothly the extension faculty and staff into the department in 1961 when Hassler was named Head. Today, in effect there is only one faculty. For example, Sneed and Glover have both extension and

teaching responsibilities, and Watkins, Beasley and Driggers are budgeted for some research. The integration of the extension faculty into the department was very significant in that it improved the effectiveness of transforming new technologies to the end-user.

In September 1969, Kriz was selected as Ellis' replacement with the title of Associate Head In-Charge of Extension for the Department. This was a new position, indicative of a growing department. In 1973 he was appointed Assistant Director of Research of the North Carolina Agricultural Experiment Station, School of Agriculture and Life Sciences. The addition of Life Sciences to the school's name was made in 1964. Kriz's portrait is shown in Figure 33.

Kriz was replaced in 1973 by F. J. Humenik who came to the department as Assistant Professor with teaching and research responsibilities. He had a B.S. in Civil Engineering, an M.S. in Sanitary Engineering and a Ph.D. in Civil Engineering, all from Ohio State University. Humenik's portrait appears in Figure 34. Prior to his advancement as Associate Professor and Associate Head In-Charge of Extension in the department he carried out research in waste management in connection with animal production. This project set an example for the nation in the land application of farm wastes. Russel Train, Administrator of EPA in Washington, D. C. visited the first two demonstration units that Humenik was influential in helping to start, one for a 300 sow unit and one for a 250,000 per week hatchery. The developed basic principles have been applied to broader applications such as slaughter houses and poultry processing, and even small municipalities. It is another example of carrying research, theoretical in the beginning, to the applied stage. Sneed, mentioned earlier, also helped with the two demonstration units.

Waste Management Continues

M. R. Overcash, Associate Professor, with a Ph.D. in Chemical Engineering from Minnesota in 1972 replaced Humenik on the waste problems of agriculture. In 1975 Assistant Professor P. W. Westerman was added to the faculty to work on the project. He came to us from Kentucky having earned a B.S., M.S. and Ph.D. in Agricultural Engineering there. Three main areas are being studied: (1) the treatment of animal waste so that it can be recycled on the farm, (2) the effect of industrial wastes on agricultural land and (3) the pollution of streams from all sources of runoff from agricultural lands. The solution to these problems are vital in today's society.

The department now has a full-yime Extension Specialist working in the waste management areas. He is J. C. Barker who earned all three degrees in Agricultural Engineering from the University of Tennessee and did some postdoctoral work at Georgia. He joined here in 1974 as Extension Assistant Professor. He appears in Figure 37C, along with Overcash and Westerman and an autoanalyzer (right) for water quality. The instrument cost something like $35,000 in 1974 and gives four simultaneous measurements.

The Maintenance and Operation of Equipment

Throughout our history in keeping with the change from animal-powered and labor-intensive farming and teaching of "how and what" of mechanical things and operations associated therewith has been a significant part of our total program. In this connection we have been a part of two notable endeavours: (1) the Southern Association for Agricultural Engineering and Vocational Agricultural (later American Association for Agricultural Engineering and Vocational Agriculture); and (2) "The 4-H Tractor Project" sponsored by some of the major oil companies.

We were one of the twelve southern states that started and financed the S.A.A.E. and V.A. organization in 1945. This association produced engineering technology publications for use mainly by high school teachers of vocational agriculture. Giles and Fore have served terms as president and both have rewrit-

ten some outdated publications. From the original 12 states that organization now encompasses all 50 and accordingly carries a name that so indicates.

The tractor project continues on and has been a proud activity of the extension engineers. Ferguson, Glover and Beasley have been particularly active.

Safety, particularly in operation is always important. Research-wise the work of Suggs during the 60s and referred to earlier on environment-human relationships will have a beneficial impact. Today it is receiving greater emphasis from Extension.

In 1975 J. F. W. Schultz joined the department as visiting Extension Assistant Professor to work on farm safety and the U. S. government's "Emergency Preparedness" program as well. Previously he was in Massachusetts doing the same type of work. He had earned a B.S. in agriculture (1948) and a M.S. in agricultural economics (1950) from that institution. He also received a Master of Education from N. C. State University in 1974.

Outstanding Teachers

Throughout our history we have longed for effective means of identifying the superior on-campus teachers, and extension educators. In 1965-66 came the "Academy of Teachers" for on-campus faculty. Members are outstanding classroom teachers selected yearly by a committee in each school. Once selected they are members for three years and eligible again after two. Proudly the departments has had three "Outstanding Teachers", G. B. Blum, Jr. in 1968-69, and again in 1975-76; E. L. Howell in 1971-72; R. G. Holmes in 1973-74. This is quite commendable when one considers that the number selected each year have varied from 12 to 32 from a total university faculty of around 700.

Appropriately an "Outstanding Extension Service Award" was started in 1972-73. Each year six in the School of Agriculture are selected by a committee from among department head recommendations and approved by the Vice-Chancellor for Extension and Public Service, and the Chancellor. Only a total of 10 are awarded annually. In 1974, L. B. Driggers was a recipient. Earlier we mentioned Driggers' work not only in extension but also research.

The aforementioned teaching and extension faculty members, with the exception of Holmes, are shown as a group in Figure 35. Holmes joined the department in 1967 as Assistant Professor and resigned in 1974 to accept a position with Ohio State University. He earned all three degrees in Agricultural Engineering from Ohio State and came to us from industry. In addition to his outstanding teaching abilities he was involved in some research, particularly strawberry mechanization and agricultural waste utilization.

Blum also has administrative qualities. In September 1969, he was appointed "Undergraduate Teaching Coordinator" responsible to the Head. In 1976-77 school year, he was elected to the University's Faculty Senate.

International Involvement

In today's world no discipline has completely fulfilled its responsibilities to society without extending its expertise to the developing countries. The department made its mark in this area with more than five years of assistance, starting around 1964, to the Indian Institute of Technology at Kharagpur, India to strengthen its post graduate training and research. The project was supported by The Ford Foundation and was directed by Hassler. Additional participating faculty were: Bowen, Hammerle, Johnson, Kriz, Link, McClure, Splinter, Suggs, Willey and Wiser.

At the termination of the grant in 1972, an independent review team cited four worthy characteristics: (1) reliance on short term "2 to 3 months" and top flight advisors; (2) degrees awarded by and at IIT; (3) thesis research at IIT, and (4) no substantive involvement of USA colleagues in the affairs and policies of IIT. These ideas most of which we believe were original in 1964 are becoming increasingly accepted and used by other institutions in their foreign help programs. Most significant was No. 1. Because the term was short the department was able to spare almost any faculty member that IIT requested. No other arrangement would have made this possible.

Another indication of extending a helping hand is in the number of our foreign Ph.D. graduates, 15 out of a total of 64. These have come from India, Iran, South Africa, China and Taiwan.

Greene was given 6 months leave of absence to assist with the training of Indian Extension Agricultural Engineers on the program Giles was associated with. Also, he spent 6 months assisting with the development of shop facilities and management in Peru, South America, as a part of the University's AID project there.

Johnson has been called to European and African countries for consultation regarding tobacco curing work. At the time he was experimenting with freeze-dried smoking tobacco.

Professor Huang is a native of Taiwan and earned his B.S. degree from the National Taiwan University where he was on the staff for several years. His advanced degrees and work here were recounted earlier. He is now a citizen of this country. Also we mentioned earlier Dickens work in Iran.

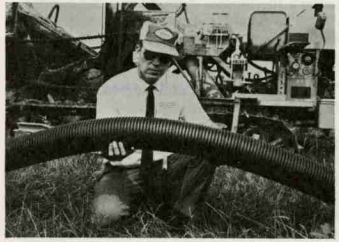
Back in the 40s there were state boundaries to be crossed, today it is countries and continents—worldwide.

The Expansiveness of Undertakings

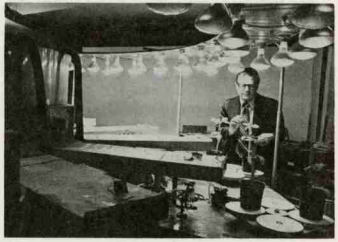
We have written in some detail about the growth in the depth and credibility of the department's work, of which we are proud. But there is another equally important aspect—"expansiveness." In reading these pages one can't help being impressed with the growing number of programs and of the improved effectiveness in transferring new technologies to students and users alike. In 1945 when Teter was hired as the department's first full time researcher who would have predicted that someday we would be working with the problems of say waste management, pumping water back through the tile that was installed for draining wetlands of eastern North Carolina, or helping a University in India develop its programs. Figure 37 A through L shows this expansiveness more forcefully than words.

Fig. 36. Some of the top departmental secretaries and staff include (left to right) Mrs. Doris Dosher, Mrs. Elizabeth Nordan, Mrs. Wilma Barnes Caldwell, Miss Susan Stoker and Mrs. Ora Crawford.

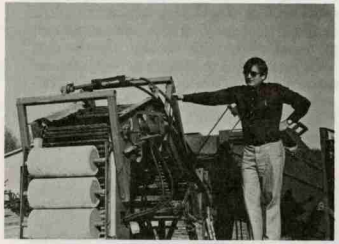
Fig. 37. ILLUSTRATIONS OF THE BREADTH OF TODAY'S PROBLEM AND TECHNOLOGY TRANSFER WORK.



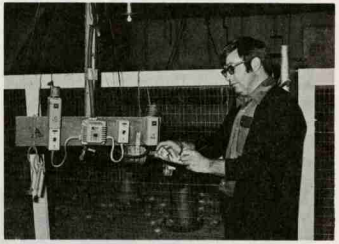
A. R.E. Sneed demonstrates laying plastic tile.



B. H.D. Bowen uses machine for studying soil-plant-weather interactions.



E. C.F. Abrams, Jr. examines side delivery part of sweet potato harvester he is working on.



F. G.R. Baughman conducts poultry engineering research.

I. J.W. Glover teaches farmers the operation and maintenance of power sprayers.

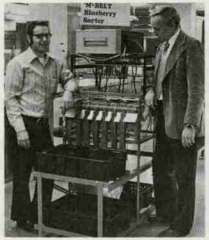
J. R.W. Skaggs checks subirrigation experiment on Tidewater Research Station.

C. Overcash, Westerman and Barker review water quality data from auto-analyzer (right).

D. A.H. Graves stands behind conveyor in mechanized warehouse trials.

G. W.H. Johnson (left) looks on as visitors observe curing tests on pre-cut tobacco.

H. E.O. Beasley demonstrates his experimental "Reduced Tillage" planter.



K. R.P. Rohrback (left) and W. F. McClure stand beside blueberry maturity sorter they developed.

L. L.B. Driggers designed this swine farrowing demonstration and research facility in Wilson County.

Scholarship—A Continuing Goal

Up to 1977 the department has graduated 547 Bachelor's degrees, 88 Master's and 64 Ph.D.'s. 138 students have completed the 2 years terminal program. The total graduates at end of the spring exercises in 1976 was 837. The roster of graduates by year and program is presented in Table III in the Appendix.

Scholarship, not numbers, has always been and will continue to be our fundamental goal. To attract and encourage students of excellence, five special fund awards have been available since 1959. The first selection committee was composed of Garner, Sewell and Blum, Chairman. The recipients by year, type of scholarship and monetary value are listed in Table IV in the Appendix.

The Tobacco Mechanization Scholarship was given by Tobacco Associates for one year only. The Surtman Foundation Scholarship was established by J. R. Surtman of Carolina Ford Co. of Charlotte and continued until the business was terminated in 1967.

The D. S. Weaver Scholarship, named after the former head, derives its funds from patent royalties on the finger wheel rake (Figure 21).

The ASAE Endowed Scholarship is of growing significance. It was initiated jointly by the Department and the N. C. Section of ASAE by soliciting individual yearly contributions from its members. Today, however, the dollar awards come from the interest on the invested principal. The principal now amounting to more than $30,000 was secured through a campaign that covered North Carolina and included industry and outside interests. Of all the active workers on this drive, which is continuing, Glover has been exceedingly successful.

We are particularly proud of the Cole Scholarship because it honors two of North Carolina's most productive citizens. The late E. M. Cole and E. A. Cole, of the Cole Manufacturing Co. of Charlotte, invented and manufactured the world's widely used inclined plate seed-metering planter. E. M. Cole was the inventor and E. A. Cole the business manager. The daughter of E. A., Mrs. Jean Cole Hatcher, past President and presently Chairman of the Board, started the award in 1959. Her son, John Cole, a graduate of N. C. State University is now President. The names of the recipients are engraved on a handsome plaque which hangs in the foyer of Weaver Laboratories. (See Figure 38.) The plaque also includes an insignia in relief that uniquely models the inclined seed metering plate. One can find this type of planter in practically every country of the world—for example the author has seen it in operation on a one-row machine, pulled by a pair of bullocks in far away India.

In line with the goal of scholarship, the N. C. Mu Chapter of Alpha Epsilon, ASAE's honor society, was formally established in 1967, largely through the efforts of Coates and Suggs. The charter members were C. F. Abrams, Jr., C. G. Bowers, Jr., A. C. DeBeer, C. R. Camp, Jr., J. W. D. Robbins, D. L. Roberts, R. S. Sowell, L. F. Strikeleather, L. M. Sykes, D. H. Vaughn, and C. W. Suggs, Faculty Advisor. Membership is based on scholarship, leadership and character. It is open to both undergraduate and graduate students enrolled in curricula leading to a B.S., M.S. or Ph.D. degree in Biological and Agricultural Engineering. This "Mu" Chapter has many activities including the development of a departmental library, and to honor the sophomore with the highest scholastic average attained in his or her freshman year.

A Valued Part of The Team

The less recognized contributions to our progress are the mechanics, secretaries, technicians and draftsmen. They are very much appreciated persons. How could we ever get along without all of them? It is impossible to credit each who have served so well over a span of 60 some years.

Miss Madge Hudgins was secretary to the first head, D. S. Weaver. The teaching and research faculty were so small however that Madge did it all. Mrs. Hattie Smith was secretary to the extension faculty. Miss Susan Stoker replaced Mrs. Smith for the Extension faculty in 1952 and retired in 1975.

Fig. 38. A replica of the Cole invention, an inclined seed metering plate with kernals of corn in place, is the insignia of the Cole Scholarship Award plaque which hangs in the foyer of Weaver Laboratories. Thirteen awards have been made to date. The plaque reads: "Dedicated to the memory of E. M. Cole 1863 to 1944, E. A. Cole 1870 to 1943, inventors, developers and producers of a revolutionary seed planter that mechanized the metering and placing of seed accurately. Founders of Cole Manufacturing Company at Charlotte, North Carolina in 1900, these talented North Carolinians made a notable contribution which improved the operation of agricultural production. They were truly trail blazers."

Mrs. Ora Crawford who started in 1946 was the first department's and later the head's full time secretary. In 1956 she was selected for a smimilar position to the Assistant and later Director of the Agricultural Experiment Station, retiring in February 1977. Miss Ann Upchurch, Mrs. Wilma Barnes Caldwell, Mrs. Ann Long followed in that order. Wilma, unmarried at the time, is back as wife of the Head of the Department of Crop Science. Mrs. Elizabeth Nordan was the last secretary first to Giles and then to Hassler. But there is something special about Elizabeth. Under Hassler she became the first "Administrative Assistant." All of these fine persons carried out their duties with efficiency and the grace that means so much in an organization that is "going and growing."

Four of these secretaries along with Mrs. Dosher are shown in Figures 36. Mrs. Dosher who retired in 1974 as supervisor of Drafting and Blueprinting was mentioned earlier. Many students and others gained valuable experience under her guidance over the years. Included in later years were L. T. Woodlief, K. A. Brown, E. E. Braswell and G. G. Powell. Powell also completed a course at the Holding Technical Institute. Mrs. Dosher's position was abolished upon her retirement. Brown carried on for a few years as Draftsman. Today the responsibility for this service is by Woodlief, Technician, and Powell, Draftsman.

As the Department grew so did the need for technical and professional assistance to the faculty. They carry various titles such as research associate, research instructor and consultant. Most are non-tenured and may or may not be in a permanent position. It is impossible to credit all herein. However, three are cited as examples. J. F. Beeman was a research instructor from 1958 to 1962, working on tobacco mechanization. Concurrently he pursued a PhD. degree. S. M. Leary, consulting engineer, has been working on tobacco curing since 1965. S. C. Mohapatra, research associate, has worked on the physiological aspects of tobacco since 1969. From 1965 to 1969 he was a graduate student in botany but located in the Department of Biological and Agricultural Engineering. Mohapatra serves to represent again our proud interdisciplinary heritage.

CHAPTER IV. CONCLUSION

Two threads have run consistently throughout this history; cooperation and progress. Working with biological material, and the associated operations and environments, is so full of complexities and entwinements that complete success in one's endeavors requires both interdepartmental and intradepartmental cooperation. Such has been one of the highlights of our background.

Progress to better serve mankind was always an overriding goal. In particular, progress was achieved by superior minds, recruited from all facets, levels and areas of our professional arena. They were given the freedom to think and to apply themselves to their full capability—and of course to be rewarded accordingly.

Consistent with our continual challenge to help improve the physical-biological systems, the department's name was changed in 1965 to Biological and Agricultural Engineering. The art and the science of understanding, developing and applying engineering principles to biological material through its complete cycle from growth to preservation and the utilization and/or conservation is the uniqueness of our profession and distinguishes it from other engineering professions. We need to be ever cognizant of the fact that the biological plant is today still the world's best collector of the sun's limitless energy. The name Biological and Agricultural Engineering befits this uniqueness.

More and more other departments and agencies are coming for cooperative research work. The department is recognized by many as having one of the ablest of faculty and staff, and the finest of equipment and facilities anywhere in the world. One indication is that the annual meeting of the American Society of Agricultural Engineers was held here in June 1977—the first time in North Carolina.

In numbers the students, staff and faculty have grown over the years. There are now 43 faculty members in the department of which 4 are USDA Cooperators. The staff numbers 37 with 3 holding USDA appointments. They are shown as a group in Figure 39. We are proud of the excellent cooperation with USDA, which provides further strength and interdisciplinary inputs for a more comprehensive approach to problem solutions and graduate instruction.

One might say that only the foundation was laid during these first 60 some years. We—concerned citizens, faculty, staff, and students—built that foundation together. In the next century lie the more difficult challenges, the opportunities and the responsibilities for the engineers to do their part in providing man's most basic requirement, food and fiber. It appears to be a formidable task indeed, particularly when viewed from the growing shortage of fossil energies and necessary interaction and evolvement in the international field.

The theme for the 1977 annual meeting of The American Society of Agricultural Engineers held in Raleigh is "Food, Fiber and the Future". No theme could be more appropriate to recognize our past and to challenge our future.

Fig. 39. Faculty and staff of the Department of Biological and Agricultural Engineering–1977 First Row (left to right): Dorothy deBruyne, Ralph Greene, Glen Morgan, Denise Goode, Melvin Hooker, Stanley Leary, Brenda Butts, Ann Morris, Brenda Mason, R. N. Misra, Sastry Putcha, Robert Gaines, Hamid Jaafari, A. Behnia, Mohan Gawande, F. J. Hassler, Head; B. K. Huang, J. W. Glover, R. P. Rohrbach, W. H. Johnson, T. B. Whitaker, G. R. Baughman, A. W. Badr, Abdul Hamid, E. G. Humphries, H. D. Bowen, J. A. Singleton. Second Row: Samuel Bingham, Larry Bright, Carl Tutor, M. J. Sheikhdavoodi, F. F. Lee, K. P. Yang, Ali Farsaie, Nancy Stagner, Wilma McClain, Thelma Utley, B. C. Powell, C. F. Abrams, P. W. Watkins, M. K. Karmous, C. G. Bowers, R. S. Sowell, J. M. Fore, L. B. Driggers, E. O. Beasley, R. Khaleel, S. C. Mohapatra, C. S. Chang, J. H. Young, J. C. Barker, Y. R. Chen, F. Mohammad, Y. K. Tang, M. D. Boyette, R. O. Evans. Third Row: A. H. Nassar, E. P. Harris, Hal Burns, Gary VanWicklen, S. W. Glass, W. F. McClure, P.W.Tillman, P. W. Westerman, D. H. Willits, M. R. Overcash, S. G. Wardak, J. F. W. Schulze, C. W. Suggs, J. W. Dickens, R. W. Skaggs, E. L. Howell, Fred Koehler, Helen Richardson, Gary Powell, L. T. Woodlief, G. B. Blum, Elizabeth Nordan, Beverly Watson, H. E. Pattee, L. T. Averett. Fourth Left End Row: David Buffaloe, E. H. Wiser, D. L. Dunston, Charles Sherwood, M. L. McLester, Fairley Guest, K. R. Reddy. Absent: F. J. Humenik, R. E. Sneed, A. H. Graves, J. D. Fish, David Temple, J. B. Preston, D. Pal, S. R. Crane, Frank Massey and Richard Korhman.

CHAPTER IV. CONCLUSION

Two threads have run consistently throughout this history; cooperation and progress. Working with biological material, and the associated operations and environments, is so full of complexities and entwinements that complete success in one's endeavors requires both interdepartmental and intradepartmental cooperation. Such has been one of the highlights of our background.

Progress to better serve mankind was always an overriding goal. In particular, progress was achieved by superior minds, recruited from all facets, levels and areas of our professional arena. They were given the freedom to think and to apply themselves to their full capability—and of course to be rewarded accordingly.

Consistent with our continual challenge to help improve the physical-biological systems, the department's name was changed in 1965 to Biological and Agricultural Engineering. The art and the science of understanding, developing and applying engineering principles to biological material through its complete cycle from growth to preservation and the utilization and/or conservation is the uniqueness of our profession and distinguishes it from other engineering professions. We need to be ever cognizant of the fact that the biological plant is today still the world's best collector of the sun's limitless energy. The name Biological and Agricultural Engineering befits this uniqueness.

More and more other departments and agencies are coming for cooperative research work. The department is recognized by many as having one of the ablest of faculty and staff, and the finest of equipment and facilities anywhere in the world. One indication is that the annual meeting of the American Society of Agricultural Engineers was held here in June 1977—the first time in North Carolina.

In numbers the students, staff and faculty have grown over the years. There are now 43 faculty members in the department of which 4 are USDA Cooperators. The staff numbers 37 with 3 holding USDA appointments. They are shown as a group in Figure 39. We are proud of the excellent cooperation with USDA, which provides further strength and interdisciplinary inputs for a more comprehensive approach to problem solutions and graduate instruction.

One might say that only the foundation was laid during these first 60 some years. We—concerned citizens, faculty, staff, and students—built that foundation together. In the next century lie the more difficult challenges, the opportunities and the responsibilities for the engineers to do their part in providing man's most basic requirement, food and fiber. It appears to be a formidable task indeed, particularly when viewed from the growing shortage of fossil energies and necessary interaction and evolvement in the international field.

The theme for the 1977 annual meeting of The American Society of Agricultural Engineers held in Raleigh is "Food, Fiber and the Future". No theme could be more appropriate to recognize our past and to challenge our future.

APPENDIX

TABLE I. Number of Faculty and Staff as of July 1, 1976.

A. Faculty
- I. Academic Rank:
  - 28—State (Teaching, Research and Extension)
  - 3—USDA-ARS (Research)
  - 2—State (Administration)
  - 33
- II. Research Associates
  - 2—Permanent—State
  - 2—Temporary—Grants
  - 1—USDA-ARS
  - 5
- III. Research Assistants
  - 4—Temporary—Grants
  - 1—Temporary—State
  - 5

Total Faculty—43

B. Staff
- I. Professionals—5
- II. Technicians—22
- III. Administrative Assistant—1
- IV. Secretary—1
- V. Accounting Clerk—1
- VI. Clerk-Typist—7

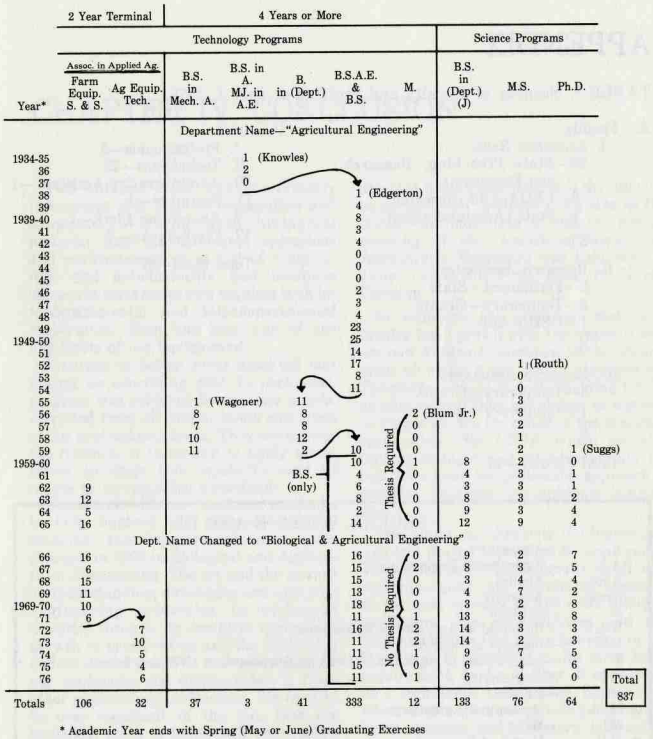
Total Staff—37

LEGEND, TABLE II AND III

A.	—Agriculture
A.E.	—Agricultural Engineering
Appd.	—Applied
Assoc.	—Associate
B.	—Bachelor
B.A.E.	—Biological & Agricultural Engineering
B.S.	—Bachelor of Science
J.	—Joint, School of Agriculture (and Life Sciences since 1958) and School of Engineering
M.	—Master
M. A.	—Mechanized Agriculture
MJ.	—Major
M.S.	—Master of Science
Ph.D.	—Doctor of Philosophy
S. & S.	—Sales & Service
Tech.	—Technology

NOTE: School Year starts at the end of spring (May or June) graduation. Summer school included with the start of a school year.

TABLE II. *Number of Graduates by Type of Program in Agricultural Engineering (thru 1964-65) and Biological & Agricultural Engineering (1965-66 thru 1975-76).*



* Academic Year ends with Spring (May or June) Graduating Exercises

TABLE III. Roster of Graduates in Agricultural Engineering, 1934-35 through 1964-65, and Biological and Agricultural Engineering 1965-66 through 1975-76.

A. Four Year and Above Programs

B. S. A.

1934-35
Abner S. Knowles

1935-36
Milford Edmund Aycock
George Ralph McColl

1936-37
None

B. S. A. E.

1937-38
Eric Ray Edgerton

1938-39
Edwin Padgett Barnes
Walter Edward Garrard
Dan L. McLaurin, Jr.

1939-40
Landy Boyd Altman, Jr.
Ralph Bronson Armstrong, Jr.
Dwight McLean Griffin
William Sheldon Huggins
Franklin Alford McGoogan
James Arthur Mitchiner
Thomas Long Reeves
Oswell Proctor Southerland

1940-41
Paul Frederick Hoch
Charles Harold Lockhart
Oliver Folger Watson
Robert Thurston McNeely

1941-42
Clarence Kay Beeman
Woodley Charles Warrick
Louis Bailey Trevathan
Henry Lewis Wall, Jr.

1942-43
None

1943-44
None

1944-45
None

1945-46
Leon David Hunnings
Harper Kennedy Sanders, Jr.

1946-47
John Colon Daughtridge
Kenneth High Farmer
James Malcolm Humphrey

1947-48
Elwood Toy Blackwell
Patrick Mathias Fowler
James William McDuffie
Charles Herbert Prout

1948-49
Stanley Orin Barefoot
Clyde Harrison Brackett
Joseph Robert Bryant
Amos Robert Butler
Alvis Montgomery Daniel
Edward Woodall Dean
John Henry Dutton
John Delton Evans
Gerald Winston Furbee
George Curtis Gasperson, Jr.
John Elliott Hollowell
Kenneth Arthur Koch
Thomas Ranson Lawing
Luther Bertie Miller, Jr.
Howard Eldon Reeder
James Ritchie, Jr.
Paul Hamilton Rogers, Jr.
Charles William Stott
Charles Wilson Suggs
Robert Lee Thompson, Jr.
Benjamin Alexander White
Finnie Edgar White, Jr.
William Stuart Wood

1949-50

William Edward Austin
Wilbert Richard Bender
George Benjamin Blum, Jr.
Edwin Smith Coats
Elvin Henry Frazier, Jr.
John Womble Glover
John Oglesby Winston Gravely
Donald Reid Gray
Roy Henry Grimm
William Howard Hasty, Jr.
Rayborn Freeman Hinshaw
Bernard Furman Ingram
Benjamin Franklin Knott
James Frederick Lee
James Harrill McBrayer, Jr.
Angus Wilton Mercer
James Ashby Miller
Thurman Greene Miller, Jr.
David Ray Moore
John Hill Paylor, Jr.
Landon Moore Proffitt
Junius Pearson Sanders, Jr.
Jack Dee Traywick
George Atlas Upchurch
William Plummer Weldon

1950-51

Vance Cecil Bason
Clarence Harold Blue
Charles Edward Clark, Jr.
Robert Edward Dew
James William Dickens
Walter Christopher Johnson, Jr.
William Rand Montague
Thomas Eldridge McPhail
John Harris Roberson
Charles Amos Routh
Joe Neal Sinclair
James Fred Wellons, Jr.
Lawrence Anderson White
James Merriman Williams, Jr.

1951-52

Frederick Zane Blevins
James Otto Byers, Jr.
Sidney Taylor Currin
John Pinkney Dail, Jr.
Thomas Harold Garner
Adam Hugh Harris, Jr.
Boliver Tremaine Harris
David Franklin Jones, Jr.
Eugene Clifton Mills
William Gordon Mitchell
Charlie King Overby
William Stevenson Patterson
Burton Davis Smith
Horace Anderson Smith
Bernard Spilman Sutton
Ray Kent Troutman
Worth Amos Wooten

M.S.

Charles Amos Routh

1952-53

B.S.A.E.

Neal Alexander Barnes
Robert Willis Brittain
Donald Jennings Haddock
Mallie Braxton Jones
James Greve Nemec
Robert Wyeth Southerland
Edward Maurice Strange
Raymond Bennett Walker

1953-54

B.S.A.E.

Julian Powell Goff
Gary York Greene
Kenneth Bryce Haywood
William Hugh Johnson
Charles Brown Maness
Charles Lee Overman
Jacob Eli Reep
Frank Delano Shepard
Robert William Taylor
Thomas Douglas Temple, III
Louis Calvin Smith

1954-55

B.A.E.

Glenn Robinson Bailey
Joe Millard Bunn
Talmadge Rudd Burgess
Donald Cekada Craft
Colbert Lee Dilday
Wayne Floyd Grainger
William Harris
Daniel Gold Lattimore
Jason Rufus Lineberger
Robert Leonard Sheppard
John Wayne Smith, Jr.

B.S.M.A.

Paul McRae Wagoner

M.S.

James Henry Anderson
William Terrell Mills
Charles Wilson Suggs

1955-56

BAE

William Jennings Brady, Jr.
James Malcolm McCormick
Ralph Kenneth Matthes, Jr.
Ora Billy Morgan, Jr.
James Edgar Morton
Jerry Page Price
William Smith Thompson
Olin Carlyle Trull

B.S.M.A.

Willis Aubrey Council
John Allen Johnson
Lorenza Wilson Locke
Gerald Carr McNeill
McVernon Prescott, Jr.
John Robert Richardson
Rex Bailey Springston
William Morris Sue

M.

George Benjamin Blum, Jr. (Jan. '56)
Edwin James Matthews (May '56)

M.S.

James William Dickens
William Hugh Johnson
Antony Markantonatos

1956-57

BAE

Bobby Ray Gay
Bobby Elmore Greene
Bobby Pink Huskey
Richard Frederick Jessup
Fred William Kiser
Frank Covington Townsend
Milton Gary Woodlief
Mosafareddin Jolfaghari

B.S.M.A.

Justin Murray Ammons
James Patterson Gilson
Cecil Conway Goode, Jr.
Richard Palmer Johnson
Willie Leonard Kilion, Jr.
Edward Seawell Massenburg
Mack Thomas Ruffin, III

M.S.A.E.

Thomas Harold Garner
Wiley Hix Henson, Jr.

1957-58

BAE

Harold Gray Barker
Eustace Orland Beasley
Abdul Aziz Turkey Al-Doory
Stephen Croom English
Ervin Grigg Humphries
Robert Cooper Kornegay
Bobby Gene McCarter
Carl Elwyn Owens, Jr.
Carl Wilburn Toney
Elijah James Tyson
John Dalas Vance
Rupert William Watkins

B.S.M.A.

Rodney Harper Fields
Albert Johnson McCracken, Jr.
Walter Lee Moss
June Gill Perry
James Franklin Rogers
Gerald Dwight Simmons
Burl Jackson Washam
William Morgan Whitehurst
Joseph Howard Williams
Joe Herman Young

M.S.

Joe Millard Bunn

1958-59

B.S.A.E.

Thomas Jefferson Barnes, Jr.
Eugene Thomas Barwick
Donald Davis
Edwin Orville Finch
Glen Carlton Hatcher
Clarence Elam Hood, Jr.
James Arlen Horton
Robert Lee Royster
Preston Eugene Sasser
Ronald Ernest Sneed

BAE

Lyman Burwell Harris, Jr.
Ivey Eugene Williamson

B.S.M.A.

Nicolos Ardito Barletta
George Stanford Bason, Jr.
Sherwood Wentz Chesson
Sherwood Jasper Hamm, Jr.
Roger Zane Hart
John Ronald Lindsey
Harold Dixon McLamb
Donald Scott Morris
Emmett Sloop Patterson
Lloyd Arlington Tyndall
Charles McLawhorn Whitehurst

M.S.

John Ike Sewell
Edward Hempstead Wiser

Ph.D.

Charles Wilson Suggs

1959-60

B.S.A.E.(J)

John Gilbert Alphin
Howard Eli Bollinger
Richard Conard Fluck
James Clyde Hutchins
George Wilbur Hawkins, Jr.
Charles Franklin Letchworth
Allen Ray Overman
Larry Hugh Patterson

B.S.

Shelby Stuart Buckner
William Harold Eddins
John Joel Locke
Richard Alton Mewborn
Arbon Wayne Overcash
Joseph Adrian Powell
Eugene Murray Simmons, Jr.
James Thomas Spence, III
Willis Cranmer Umstead
John Bruce Whitley

MAE

Boonrit Suchinda

M.S.

Ervin Grigg Humphries
Jack Dee Traywick

1960-61

B.S.A.E. (J)

Shelton Young Adcock
James Robert Cooke
Billy Hobbs Jones
Sidney Edward Law

B.S.A.E.

Daniel Marcus Boyd, III
Roy Clifton Holder
Stanley Ross King
Fountain Gwyn Voss, Jr.

M.S.

Clarence Elam Hood, Jr.
William Fred McClure
Rupert William Watkins

Ph.D.

William Hugh Johnson

1961-62

B.S.A.E. (J)

Harry Jackson Gibson
Thomas Burton Whitaker
Phillip Russell Williams

B.S.A.E.

Arthur Franklin Bordeaux, Jr.
Hugh Conrad Bowels
Java O'Neil Carey
Abdul Wahid El-Haimus
Dougald Mazatlan Priest
Howard Henry Troutman, Jr.

M.S.

Eustace Orland Beasley
Ralph Kenneth Matthes, Jr.
Preston Eugene Sasser

Ph.D.

Zachary Adolphus Henry

1962-63

B.S.A.E. (J)

Allen Joseph Barwick
Clemon Elton Bass, Jr.
James Jackson Buffaloe
Stanley Mitchell Leary
Richard Arnold Moore
Fred Gary Ricks, Jr.
Louis Alan Vance
Winfred Lee Williams, Jr.

B.S.

Elliott Burton Barnes, Jr.
Juan Jose del-Carmen
Banjamin Maynard Coston
Stancil Lawrence Dilda, Jr.
Luther William Hedspeth, Jr.
Robert William Jones
John Durell Jordan, III
Lewis Marshall Williamson

M.S.

John Gilbert Alphin
Richard Conard Fluck
Allen Ray Overman

Ph.D.

Wiley Hix Henson, Jr.
John Ike Sewell

1963-64

B.S.A.E. (J)

James Joseph Boedicker
Gerald Davis Christenbury
Allen Vaughn Dagenhart
Wilbert Harris Jenkins
John Henry Pierce
Howard Booth Rutledge
Daniel White Smith, Jr.
Jacob Alpheus Stafford
Larry Franklin Stikeleather

B.S.

Gordon Andrew Ross
David Sylvester Walker

M.S.

Johannes Maria Groot
Sidney Edward Law
William Kenneth Turner

Ph.D.

Thomas Harold Garner
Ervin Grigg Humphries
Preston Eugene Sasser
Absalom West Snell

1964-65

B.S.A.E. (J)

Cecil Bruce Currin
Thomas Tazell Cutts, III
Thomas Lynn Honeycutt
Michael Belton Hupko
Gaines Howard Liner
James Wesley McMasters
Jimmy Wayne Mabe
Roy Erwin Meece, Jr.
Glenn Alden Moore
Frank Dixon Perkinson, Jr.
Thomas Hilliard Satterwhite
James David Smith

B.S.

Daniel Wyatte Cope, Jr.
Bruce Kellum Basden
William Alexander Davis
Jimmy Oakley Hardin
Robert Hege, III
Ronald Vasco Jackson
Johnny Mack Jones
Rossie Bailey Jones, Jr.
Robert Wooten May
Steven Darrell Mundy
Richard Hardy Parker, Jr.
Thomas Wills Pritchett
Clay Hester Vernon, III
Cecil Exum Viverette, Jr.

M.S.

Charlie Grover Coble
James Robert Cooke
Richard Lyle Eide
Ching Seng Fang
Pang Feng Hwang
Jerry Marion Page
Walter Henry Pitts
Darrell Lynn Roberts
Thomas Burton Whitaker

Ph.D.

Clarence Elam Hood, Jr.
Ravindra Nath Kaul
Jerry Roy Lambert
Edward Hempstead Wiser

1965-66

B.S. BAE (J)

Charlie Frank Abrams, Jr.
Crowell Gattis Bowers, Jr.
Robert Glenn Gaines
Donald N. Newton
Frank Thomason Pharr
Robert Beatty Philbeck
Larry Moore Sykes
Roy Edward Young
Thomas Howard Young

B.S.

William Joseph Allen
Stanley Wayne Blanchard
William David Buffaloe
Walter Audry Cameron
Jerry Lassiter Causey
Ronald Vestal Chandler
Walter Patt Craver
James Warren Cutts
Kenneth Towne Greenwood
Eugene Alexander Jackson
Henry Alexander Marks, Jr.
Lloyd Willis Miller, Jr.
James Kenneth Mills
Arthur Johnny Napier
Grady Steven Walker
Clavin Lloyd Williamson

M.S.

Allen Joseph Barwick
Jogendra Singh Khalsa

Ph.D.

John Gilbert Alphin
James Forest Beeman
Richard Conard Fluck
William Fred McClure
Ralph Kenneth Matthes, Jr.
Allen Ray Overman
Byron Kenneth Webb

1966-67

B.S. BAE (J)

Larry Love Coats
John Ervin Francis
James Avery Martin
Gerald David Metzger
Charles Arthur Parrish
Robert Thomas Stretter
David Harris Vaughan
Elmer Floyd Wiggins

B.S.

David Manley Aman
David Edward Brown
Richard Harvey Faulk
James Elton Giles
Joseph Alexander Gregory
Dennis Gerald Howard
Denis Sherald Jackson
Charles Bennett King, Jr.
Wilbur Andrews Newlin
Jimmy Walter Perry
Zeno Herbert Ponder, Jr.
Ritchie Francis Smith
Kenneth Carl Walker
Tommy Ray Willard
Robert Ward Winston, Jr.

M.S.

Lung-hua Chen
Suresk Kesho Deo
Sun-fu Shih

Ph.D.

James Robert Cooke
James Arthur DeShazer
Glenn Jerrald Hoffman
Chitaranjan Saran
Farrin Scott Wright

M.B.A.E.

Arthur Edwin Bryant

M.Ag.

Narayan Prosad Chattopadhyay

1967-68

B.S. BAE (J)

Gurnie Robert Lee, Jr.
John Hamlett Merritt, III
Patrick Safrit Smith

B.S.

Charles Franklin Boyles, Jr.
Thomas Lee Caviness, Jr.
Robert Joseph Cooke
Gurney Reece Dillard
Thomas Francis Drake
Myron Eric Furbee
Manual Mejia
Neill Angus Morrison
Roy Dean Rhue
Morris Glenn Skipper
Wade Eugene Stikeleather
Ronald Edward Wheeler
Donald Wayne White
Kenneth Alvin Worthington
Alexander Columbus Yarborough, III

M.S.

Thomas Lynn Honeycutt
Eugene Wallace Rochester, Jr.
Chung-Jin Shaw
Chao-Shan Su

Ph.D.

Sidney Edward Law
Tung Liang
Robert Seago Sowell
Larry Franklin Stikeleather

1968-69

BS, BAE (J)

Dwight Delano Grady
Fred Leon Hardison
Jed Repass Newland
Bruce Henry Virkler

B.S.

Norman Lee Cox
Wilbur Ray Daniels
Gilmer Allen Edwards, Jr.
Carlton Terry Forehand
Gary Leon Icenhour
William David Johnson
Charles Thomas Kearns
Kenneth Cobb Kernodle
Charles Douglas Lattimore
James Samuel Meador
David Lynn Rose
Gerald Kevin Sawyer
Boyce Mitchell Williams

M.S.

Charlie Frank Abrams, Jr.
Ying-ren Chen
John Skelton Cundiff
Remer Judson Dekle
Frank Dixon Perkinson, Jr.
Larry Moore Sykes
Robert Carol Ward

Ph.D.

Chin Shu Chen
Sun Fu Shih

1969-70

B.S. BAE (J)

Thomas Myers Brandon
James William Rodgers
James David Sturgill

B.S.

Hiram Creagh Bell, Jr.
Arthur Lee Blackwelder, Jr.
James Hedley Davenport
Richard Hillman
Alton Ray Harris
Jerry Hiatt Hilton
Kenneth Lester Huggins
George Thomas Jenkins
Tallie Wilbur Lamm, Jr.
Benjamin Larry Lane
Cletus Edwin Lineberry
Peter Thomas Monte
John McNeill Ray, Jr.
James Brant Satterwhite, II
Robert Mike Thomas
James Carl Tutor
Edward Franklin Vernon
Ricky Lynn Young

M.S.

James Joseph Boedicker
Lynn Alan Parnell

Ph.D.

Burrie Van Dyke Boshoff
Carl Rosser Camp, Jr.
Cheng-Sheng Chang
Lung-Hua Chen
Albertus Gerhardus DeBeer
Thomas Lynn Honeycutt
Eugene Wallace Rochester, Jr.
Tarit Kumar Sarkar

1970-71

B.S. BAE (J)

Joy Nelson Autry
John William Bruce
Ray Bernard Killough
James Ray Leonard
Stephen Moen McEvoy
Ronald Leecil Marlow
Ronald Lane Parker
Alan Lloyd Sink
Frederick Alan Tedder
Henry Hulon Welch, Jr.
Alan Herbert Whitehead
Fred Daniel Wilkinson
Wallace Wayne Womble

B.S.

Lewis Jackson Alphin
Henry Mitchel Gallahan
Melvin Odell Crisp
William Staley Driver, Jr.
Thomas Christopher Hege
Lawrence Alvin Johnson
Walter Clifton McNeill, Jr.
Ronald Wayne Nifong
Anthony Louis Smith
Raymond DeWitt Smith
William Percy Woodard

M.S.

John David Ariail
Crowell Gattis Bowers, Jr.
Subhendu Mauli Chakrabarti

M.

Surapong Panichjaroen

Ph.D.

Charlie Frank Abrams, Jr.
Jackie Wayne Darmon Robbins
Darrell Lynn Roberts
Lalit Kumar Sinha
Ronald Ernest Sneed
Chao Shan Su
Larry Moore Sykes
Robert Carol Ward

1971-72

B.S. BAE (J)

Thomas Scott Allen, Jr.
Leon Blount Arthur
Elvin Fountain Barwick
Philip Earl Davis
Wallace Jerry Hare
Thomas Vernon Honeycutt, Jr.
David Seawell Lawhon
Floyd Kenneth Milem, Jr.
Robert Earl Richards
Leonard Yearby Safrit, Jr.
Frank Lewis Smith
Jerry Thomas Smith
Walter Ray Swicegood
Richard Lee Umbarger

B.S.

Carlos Afredo Botero
Gerald Wayne Chaffin
Lewis Everett Davis
Larry Randall Garren
Rodney Wayne Johnson
Randy Glensood Jones
Larry Eugene Merrill

James Ronald Pope
Lloyd Michael Pridgen
Edgar Hughey Pritchett
Richard Wade Reid
Charles Melza Rooks
John Carlton Smith
Kerr Thomas Stevens
Ronald Gene Trantham
Jesse DeWitt Williams

M.

George Jayachandra
Vim Tayaputch

M.S.

Reynaldo Bernal
John Wayne Mishoe
Mohan V. N. Rao

Ph.D.

James Joseph Boedicker
Charlie Grover Coble
Roy Edward Young

1972-73

B.S. BAE (J)

Mike Allen Avery
John Ralph Boone
Chi Ping Cheung
Walter Dean Cunningham
Kenneth Ray Forrest
James Wray Hipps
Ronald Clyde Idol
Philip Reid McLoud
David Eugene Parker
Barry Richard Sidden
Nolan David Smith, Jr.
John Bruce Stinson, Jr.
Howard Clayton Tew
Ray Clyde Woody

B.S.

George Hubert Aull, III
Rufus Wade Croom
Thomas Alton Garren
Warren Steve Harris
Raymond Gary Jones
William Alexander Jones, III
Keith Alan Lail
David McCray Peele
Edmund Warren Purcell
Franklin Dale Robertson
Robert Sherwood Skillman

M.

Narong Atsilarat
Nagat Nagib Mansi

M.S.

Bryan William Maw
David Harris Vaughan

Ph.D.

John Skelton Cundiff
Frank Dixon Perkinson, Jr.
Thomas Virgil Wilson

1973-74

B.S. BAE (J)

Henry Harvey Brice
Eric Daniel Cheek
David Ray Finch
James Daniel Fish, Jr.
Elford Vernon Fox, Jr.
Shirley Stuart Pierce, Jr.
James Carlos Rogers
Donald Joe Stewart
Steve Braxton Strawn

B.S.

Hal Douglas Burns, Jr.
Jody Ray Chamblee
Richard Eugene Harris
William Dan Nison
Owen Lee Peele
Ralph Harley Pegram, Jr.
John Lee Pierce
Jerome Wilson Prestwood
Tommy Lewis Strader
Dwight Sexton Williams, Jr.
Victor Daniel Wu

M.

Danai Triyadhen

M.S.

Douglas Richard Bower
Manjeet Singh Chhinnan
Moustafa Kamel Karmous
Larry Franklin McEver
James Howard Ruff
John Braswell Smith
John McLaughlin Van Deman

Ph.D.

Mansoor Behroozi-Lar
Subhendu Mauli Chakrabarti
Mohan Velliyur Nott Rao
Ram Narain Singh
Robert Barnard Wensink

1974-75

B.S. BAE (J)

Phillip David Cave
Donnie Ray Ellis
Hugh Conley Gilliam
Donald Richard Griffin
Garrett Lee Van Wicklen
Gary Cecil White

B.S.

Gary Stephen Brinkley
Cam Buck Comer, Jr.
Billy Worth Gilbert
Ronald Kimp Jones
Charles Ellis Martin
Frank Coleman Massey
Glenn Douglas Morgan
Robert Daniel Napier
Ray Kearney Pleasant
Philip Wayne Price
Barry Eugene Shinn
Thomas Alan Simmons
Henry Clifton Sink, Jr.
Dwain Reynolds Strader
Willis David Temple

M.S.

Abdolkarim Behnia
Karun Jumar Katur
James Blair Phillips
Bharat Shashishekhar Vedak

Ph.D.

James W. Jones
Suhas Ramkrishna Ghate
Darshan Lal
John Wayne Mishoe
David Harris Vaughan
Larry G. Wells

1975-76

B.S. BAE (J)

Reginald Davis Baird
Ted Barton Banther, Sr.
Samuel Charles Bingham
Michael Doyle Boyette
Robert Oliver Evans, Jr.
Robert Carroll Pierce

B.S.

Ronald Greene Bowling
Ned Wilson Gillispie
Tony Stillman Leary
Daniel Joseph McClure
Noah Dempsey Mullins, Jr.
Samuel Ashley Roebuck, Jr.
William Marvin Scruggs
John Calvin Springer
Randy Earl Simmons
Walter G. Smith, Jr.
Chris Stinson York

M.

Richard Lynn Phillips

M.S.

Gary Charles Elfring
Robert Randall Entrekin
Philip Reid McLoud
Lincoln Adrian Wood

B—Two Year Agricultural Institute Graduates Majoring in the Department

Diploma: Associate in Applied Agriculture—Farm Equipment Sales & Service

1962

Russell Goldwyn Atkinson
Charles Edgar Glover, Jr.
Joseph Nathan Hicks
Victor Hall Hussey
William Thomas Lawrence
Donald Lee Oehler
Elliott Goodwin Overman
Charles Henry Weaver
James Lawrence Weaver

1963

Ira Lewis Armstrong
Thomas Franklin Best
Richard Dennis Bryant
Francis Irving Byrd
Kenneth Jackson Cooke
Joseph Cameron Hancock
John William Joyner
Harold Joseph McBane
James Carey Spear

Paul Earle Taylor
Jack Ronald Williams
John Vernon Winslow

1964

Charles Eugene Cox
James Henry Greene
Albert Monroe Lane, Jr.
Douglas Adair McCartha
James Arnold Wade

1965

Taylor Everett Barrow, III
Billy Carter Berry
Benjamin Lee Bridgers
Larry Grant Christian
Charles Randall Clayton
Roger Dale Collins
Gurney Dell Corns
Paul James Gallimore, Jr.
West Porter Hunter, Jr.
Claude Lewis Johnson
James R. Patterson, Jr.
Glen Franklin Penninger
Kenneth Charles Ritter
John Lindsay Smith
Sidney Ronald Stanley
John Davis Wallace

1966

Henry Mac Allen
William James Allen
George Ivey Day
Grady Shelton Dunn
Columbus Franklin Eagles, III
Harold Leighton Frazier
John Lemuel Hedgecock
Charles Stephen Jones
Reuben Douglas Moore
Thomas Lensey Murray
Lewis Britton Norwood
Robert Russell Rose
James Robert Stanfield
Robert Young Westmoreland, Jr.
Major D. Williams, Jr.
Edwin Terry Woodlief

1967

Roger Dwight Davis
Max Randall Gilliam
Larry Giles Koontz
Alfred Boyd Little

Daniel R. Long
Roland Vance Wood

1968

Michael Hocutt Alford
Billy Joe Boyette
William Fletcher Burgess, Jr.
James Thomas Crabtree
Donald Ray Hester
Weldon Wallace Johnson
James David Long
David Thomas McCain
Howard Reed McLam
Bobby Lawrence Moffitt
Adam Clark Oliver, Jr.
James Michael Reynolds
Clinton McBride Thompson
Carl Reid Walker
Julian David Waller

1969

Donald Robert Bryant
Michael Clinton Campbell
Danny Wade Coats
Michael Aaron Davis
Ira Lee Epps
David Wayne Essick
John Wayne Essick
Walter Stephen Love
Bobby Wilson Murphy
Joseph Hamilton Stepp, III
Darrell Pleasant Terry

1970

Harvey Kenneth Adams
William Anthony Balkcum
William Thomas Boone, Jr.
Harvey Hunter Butler, Jr.
Willie Wayne Clayton
Edwin Barton Craver
John Freddie Perkinson
Curtis Theodore Simmons
Albert Green Strader, III
Joseph Aubra Suggs

1971

Donald Ray Abernathy
Peter Garrison Drake
Samuel Thomas Inman
Terry Cecil Tew
William Henry Tingen
James Richard White

Diploma: Changed to Associate in Applied Agriculture—Agricultural Equipment Technology.

1972

Irvin Ray Blackmon
Stephen Roehill Cockman
James Robert Fogleman
William Sikes Hubbard
Gary Alan Rose
Haywood Avery Watson
Steven Ray Womble

1973

Phillip Erroll Britt
William Thomas Brooks
Isaac Hall Hanff
David Stinson Honeycutt
Jimmie Moore Parrish, Jr.
Ricky Ward Satterwhite
Ceness Luther Taylor
Martin Luther Thomas
Larry Thomas Walston
Mahlon Alvin Whitehead, Jr.

1974

James William Cooke, Jr.
Jesse Gordon Parks
Gaston Fitzhugh Sealey
Roger Tyson Tate
George Oliver Winstead

1975

David Mark Gillis
Monty Earl Lockamy
Andrew Reid O'Brian
Charles Danny Ogburn

1976

Robert Lawrence DeLapp
Lawrence Cecil Martin Denning
Sandy Dean Kirkley
Frank Stephen Latta
David Ronald McKee
Richard David Plonk

TABLE IV. Scholarships and Recipients—Department of Biological and Agricultural Engineering

Cole Scholarship ($500)
1959-60 — Robert C. Short
1960-61 — Robert C. Short
1961-62 — Larry F. Stikeleather ($300 for half year)
1962-63 — Larry F. Stikeleather
1963-64 — Roy E. Young
1964-65 — Roy E. Young
1965-66 — David H. Vaughan
1966-67 — David H. Vaughan
1967-68 — James W. Rodgers
1968-69 — James W. Rodgers
1969-70 — James W. Rodgers
1970-71 — Thomas V. Honeycutt, Jr.
1971-72 — Thomas V. Honeycutt, Jr.
1972-73 — James C. Rogers
1973-74 — James C. Rogers
1974-75 — Mark B. Chamblee
1975-76 — Mark B. Chamblee
1976-77 — Mark B. Chamblee

Surtman Foundation Scholarship ($300)
1959-60 — Shelton Y. Adcock
1960-61 — Clemon E. Bass, Jr.
1961-62 — Larry F. Stikeleather
1962-63 — Jerry L. Causey
1963-64 — Donald A. Newton
1964-65 — Denis S. Jackson
1965-66 — Denis S. Jackson
1966-67 — Denis S. Jackson

Tobacco Mechanization ($400)
1968-69 — Nolan D. Smith
— George T. Jenkins

David S. Weaver ($500)
1968-69 — Thomas V. Honeycutt
— Joy N. Autry
1969-70 — Ronald L. Marlow
— James E. Richards
1970-71 — Ronald L. Marlow
— C. Frank Abrams, Jr.
1971-72 — James R. Pope
1972-73 — Barry R. Sidden
1973-74 — John L. Pierce
1974-75 — Samuel A. Roebuck, Jr.
1975-76 — Samuel A. Roebuck, Jr.
1976-77 — Edward W. Gann

ASAE ($200)
1959-60 — Java N. Carey
— Clemon E. Bass, Jr.
1960-61 — Rossie B. Jones, Jr.
— Fred G. Rickes, Jr.
1961-62 — Howard B. Rutledge
— Clemon E. Bass, Jr.
1962-63 — James Buffaloe
— Roy Meece
1963-64 — Elmer F. Wiggins
— Robert G. Gaines
1964-65 — Walter F. Congleton
1965-66 — C. Frank Abrams, Jr.
— Donald A. Newton
1966-67 — John D. Schroer
— Larry L. Coats
1967-68 — Robert D. Lineberger (1 sem. only)
— R. Dean Rhue
1968-69 — Leon B. Arthur
— David E. Parker
1969-70 — George T. Jenkins
— Thomas V. Honeycutt, Jr.
1970-71 — James R. Pope
— Robert E. Richards
1971-72 — John B. Stinson, Jr.
— James C. Rogers
(INCREASED TO $300)
1972-73 — Owen L. Peele
— Steven T. Gordon
1973-74 — Donald R. Griffin
— Mark B. Chamblee
1974-75 — Ronald D. Chappel
1975-76 — Dorsey L. Chamblee
1976-77 — Larry F. Graham

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