

## AGRICULTURAL ENGINEERING\*

### The Early Years

The pioneer developers of Extension programs in Virginia recognized the importance of engineering in agriculture when they established the position of Drainage Engineer and employed Charles E. Seitz to fill it in 1914. His office was first located in Burkeville, Virginia but was moved to the VPI campus in 1915. By the end of 1915 Seitz had made surveys for and de-signed eighteen land drainage systems in nine counties for use as demonstrations. Interest in the drainage of wet agricultural land grew rapidly. Both underground tile and open\_ ditch systems were used. Training drain- age system installers in the use of the newest technology was an important part of the specialist's work.

The need for engineering work in other facets of agriculture and for improving rural living quickly became evident to Seitz. Problems relating to soil erosion, farm mechanization, buildings, lighting systems, water supply and home improvement all had engineering implications. As time permitted, Seitz expanded his program to include work on some of those problems. When military service interrupted his work in 1917 and 1918, Mark L. Nichols was employed to replace him. When Seitz returned to Extension duty, his program was expanded to include other aspects of land reclama- tion and terracing.

The success of his Extension work resulted in steps by Seitz to es- tablish a department with a four-year curriculum leading to the Bachelor of Science degree in Agricultural Engineering. By the end of 1919, plans for the new department including extension, resident instruction and research had been approved with Seitz as department head. The new curriculum was the first of its type east of the Mississippi river.

\* **Prepared by Earl T. Swink for the Epsilon Sigma Phi History of Cooperative Extension Work in Virginia. March 1984.**

John S. Glenn was employed in 1920 to work with educational programs in the development of small hydroelectric plants, gasoline-driven farm light plants, farm water systems and other projects to serve individual farms and rural communities. Henry B. Boynton joined the staff in 1920 and began developing a farm building plan service. The plans included USDA designs along with new ones he had designed to meet specific farm needs in the state. The plan service was well established when Boynton resigned in 1922 and was replaced by M. J. Markuson who handled the work until 1925. Glenn resigned in 1922 and was replaced by James A. Waller, Jr., who was destined to be involved in many facets of the agricultural engineering Extension program during the ensuing four decades. Joseph B. Cole served on the staff in 1924-25 to handle some of Waller's work while he directed a special rural electrification field study.

After the first ten years of agricultural engineering Extension work, the programs evolved into four nationally recognized areas of specialization within the profession. These were Soil and Water Conservation, Farm Structures, Rural Electrification (later Electric Power and Processing), and Farm Power and Machinery.

#### Administration and Program Leadership

Charles E. Seitz served as Department Head and administered its programs in Extension, Resident Instruction, and Research until his retirement early in 1954. Earl T. Swink was appointed Department Head in 1954. Swink immediately established the position of Extension Project Leader in the department and appointed Garland D. Kite to fill it. Swink resigned as Department Head in 1967 and left the department to accept the position of Extension Leader, Special Programs, where he served until he retired in 1970. J. Philip Mason, Jr., became Head of the Department in 1969 and served until 1979 when he stepped down

to devote full time to teaching and research. C. Gene Haugh was appointed Department Head in 1979. When Kite retired in 1969, J. Lawrence Calhoun succeeded him as Extension Project Leader. Upon Calhoun's retirement in 1976, Harold A. Hughes was named to the project leader position.

Interest in agricultural engineering related subjects began to develop in 4-H clubs during the late thirties. To meet those needs, the Extension specialist in the technical area most appropriate to the related subject developed the activity or project in cooperation with the 4-H department. This specialist then had leadership responsibility in the department for conducting the technical aspects of the project in the state. In 1974, Richard Spray was appointed Extension Specialist for 4-H engineering programs. He served in that capacity until his resignation in 1978. Bernard L. Parsons was appointed to this position effective January 1, 1980.

The position of Extension Safety Specialist was established in the department in 1976, and Glen H. Hetzel was appointed to it. The program developed by Hetzel was planned to identify the complete range of common hazards to which people are exposed and to stimulate action by all Extension workers to help them to avoid injuries. One of his first programs was planned to train rescue squad members throughout Virginia in farm hazards, and to teach them procedures for extricating injured persons from the machine in which they were entangled.

The philosophy that specialists in agricultural engineering would always seek to collaborate with their counterparts in other departments who had concerns with the subject problem was promulgated and practiced in the department.

## Soil and Water Conservation

The early work of Seitz and Waller on drainage systems for the wet land and terracing systems to reduce soil erosion led to the eventual development of a comprehensive program on soil and water management or Virginia agriculture. Terracing work expanded rapidly, especially in the Southern Piedmont Region. In 1926 Waller held 60 terracing demonstrations in 32 counties. By 1934 county terracing associations were being organized to plan educational programs on the construction and management of terracing systems. The newly established Agricultural Adjustment Administration in the USDA, with its incentives for soil conservation, provided additional stimulus. At about the same time, Congress created the Tennessee Valley Authority. Virginia counties in the Tennessee River watershed would later benefit from cooperative TVA-Extension demonstration programs.

Beginning in 1935 Waller devoted most of his time to soil and water conservation activities with greatest emphasis on land terracing. Terracing associations were functioning in nine counties. The Soil Conservation Service was created within the USDA and working relationships between the SCS and Extension were established in the state. During 1936 County Terracing Associations started reorganizing into Soil Conservation Associations in order to expand the scope of their work. Waller reported that 16 such associations had been formed by the end of 1936. His 1937 report stated that 420 miles of land terraces had been constructed that year. In the meantime, interest in both surface and overhead irrigation systems for fruit orchards and truck crops had started developing in 1927. Requests for engineering information and assistance on irrigation increased steadily. In later years, new types of rotating overhead sprinklers were widely used for high-value field crops such as tobacco and peanuts.

A giant step forward occurred when the General Assembly of Virginia enacted the State Soil Conservation District Law in 1938. This legislation provided for the establishment of the State Soil Conservation Committee and the formation of Soil Conservation Districts or political subdivisions throughout the state to plan and implement soil and water management programs. It also provided a good mechanism for inter-agency cooperation, with the roles of Extension and the Soil Conservation Service indicated. Waller was named secretary of the state committee and served in that capacity until 1946. By the end of 1940, 13 Soil Conservation Districts serving 46 counties had been organized.

In 1942, Floyd P. Trent was appointed Soil and Water Conservationist to assist the district staffs with the engineering aspects of the program. Trent's work had hardly begun when he was called to active military duty. He was replaced by Edward W. Mundie, and the duties of the position were expanded to include educational work with all concerned public agencies to promote the effectiveness of the program. Immediately after the entry of the United States into World War II in 1942, all such programs in Extension were adjusted emphasizing food and fibre production to support the war effort. In 1944 Mundie was transferred and given overall leadership for Extension's role in the Soil and Water Management programs in the State. Seitz was appointed chairman of the engineering sub-committee of the state group in 1945.

As the Cooperative TVA-Extension Unit Test Demonstration Farm Program developed, Walter H. Dickerson was employed to handle the engineering aspects of it. His work later included some small watershed runoff studies. Ralph E. McKnight replaced Dickerson in 1945 and J. W. Propst succeeded McKnight in 1946 but resigned in 1947. James H. Lillard was

employed for a short time in 1945-46 to develop ways to give greater emphasis to the soil and water management aspects of the Unit Test Demonstration Farm Program. Richelieu C. Hines, Jr., joined the staff in 1946 under a cooperative agreement with the TVA to handle the Extension and field study work in the TVA watershed counties of Virginia. Hines resigned in 1947, and the position was terminated.

Interest in overhead irrigation for high value field crops such as tobacco and peanuts developed rapidly during the post-war years. Waller initiated a series of annual short courses and conferences for agricultural leaders and equipment suppliers in system design and management. Waller retired in 1959 after having been involved in nearly all phases of agricultural engineering Extension work during his 37 years of service.

Edward .B. Hale succeeded Waller in 1960 to handle the technical aspects of the soil and water program. Mundie was transferred back to the department in 1960 to conduct the education phase of the program and to serve as liaison to the soil conservation district staffs. During the sixties, Mundie popularized the "Natural Resources Conservation" theme in his statewide educational program. Special features included annual leadership training short courses for public school teachers and other leaders. He initiated a land appreciation program for youth, and young people from approximately 25 counties enrolled in it each year. Through these activities and his work with the district staffs, Mundie had become widely known in Virginia as "Mr. Conservation" when he retired in 1973.

Hales' work in irrigation during the sixties helped to make it an important soil and water management tool in the production of high-value crops. This also increased the demand for his services in the development of water supply resources. Increasing needs for more adequate domestic water

supplies led to emphasis on water quality and supply improvement. Concerns about the pollution of streams, lakes and ground water from agricultural, forestry and other rural enterprises resulted in programs to abate non-point sources of pollutants and the adoption of best management practices. Hale made significant educational contributions to these efforts during the 1970s. Following the Hurricane Camille disaster in 1969, Hale worked with the USDA in the development of noteworthy publications and media material on the protection of people from catastrophic floods.

The introduction of no-tillage and minimum-tillage practices in the production of some field crops in the early 60s was an important milestone in use of new technology in soil and water management in agriculture. Hales' work in this area contributed to the effectiveness of interdisciplinary team efforts in field crop production through the 60s and 70s.

## Farm Structures

The farm building plan service begun by Boynton consisted primarily of plans for buildings to house livestock and farm crops. In 1926 R. H. Chestnut replaced Markuson to handle the buildings work. Chestnut introduced the farmstead planning concept which related the location and orientation of buildings to farm lots, fields and roads. Howard H. Gordon replaced Chestnut in 1928, and under his leadership the plan service expanded rapidly to include plans for processing and storage structures for fruits and vegetables. Gordon also developed new designs for livestock, poultry and dairy structures. In spite of the depression, he reported that farmers had requested and been furnished 2,641 building plans in 1932.

In 1934, Gordon and the farm management specialist in Agricultural Economics introduced a Farm Development Program involving new concepts in farmstead planning. To implement this program, 23 demonstration farms were established in 13 counties that year. Gordon was granted a leave of absence late in 1934 and was replaced by Melvin M. Johns in the structures work. Johns resigned upon Gordon's return to duty in 1936. The farmstead planning program grew rapidly, and Jennings J. Bass was employed in 1936 to assist with it; and Frank B. Payne was also employed as draftsman. The first farm building plan book was issued in 1936 for County Extension agents' use in assisting farmers in selecting plans to meet specific needs. Upon Gordon's resignation in 1937, Garland D. Kite was employed to take charge of the structures and farmstead planning program. Bass and Payne both resigned in 1937, and A. G. Foster was employed as draftsman.

Farm building construction increased at a rapid rate. Kite reported that in 1938 plans for buildings estimated to cost more than \$1,000,000 were distributed to farmers requesting them in 94 counties. Regulations to meet-



new required dairy production standards and the need to improve production efficiency resulted in new building designs. Clopton F. Wilkinson, Jr., replaced Foster in 1939. The structures program was expanded to include plans for small lime grinding plants, stationary spray systems and work on termite control. Farmers requested over 1100 plans for dairy buildings alone in 1939.

World War II brought disruptions and change in the program. Kite went on military leave in 1941 and Wilkinson handled some field work along with the plan service until he entered military service in 1942. W. H. Dickerson's work in the TVA watershed counties was expanded to include farm buildings service in that area. John W. Sjogren of the resident teaching staff was employed part-time to handle the building plan service until the war ended. Kite and Wilkinson returned from military service in 1946. Major changes had occurred in corn and grain harvesting during the war, creating a demand for new types of storage facilities. Mechanization in poultry, dairy and swine production created needs for building design revisions for those enterprises. A new building plan book was produced in 1946-47, and the plan service was swamped to meet changing conditions. Wilkinson resigned late in 1946 and was replaced by Cecil D. Wheary. In addition to the plan service work, Wheary began developing a program to meet increasing requests from the counties for assistance on rural housing.

Wheary was appointed Housing Specialist in 1948, and Paul W. Stoneburner replaced him to handle the building plan service. Kite and Stoneburner pioneered the development of pole-type buildings for the farm. The new structural designs were more flexible in use and were more economical to build and maintain. In some cases, construction cost did not exceed one dollar per square foot. By 1951 pole-type building plans were available for housing livestock and poultry, and over 15,000 plans of all types were requested that year. Stoneburner resigned in 1951 and was replaced by Herman Glover. Kite began establishing farm fencing demonstrations in 1952, using improved methods of installing woven wire fences and gates. Plans for horizontal or trench silos were

introduced that year and became popular.

Wheary began establishing home improvement and remodeling demonstrations in 1953, and requests for house plans greatly increased. Glover resigned in 1953, and Herbert H. Gee replaced him to operate the building plan service. Through the remainder of the 50s and into the 60s, insulation and forced air ventilation of poultry and swine buildings made higher population densities possible. Building designs were updated to incorporate plans for ventilation and mechanical feeding systems.

Gee died while on educational leave in 1956, and L. Bynum Driggers was employed as his replacement in 1957. By 1960 the building plan service contained 355 production and service building plans and 70 designs for rural residences. The thrust of the Extension effort was to assist farmers in making production system changes to reduce costs.

In 1960 Kite was designated to promote the infusion of safety information into all Extension Specialists' activities as a continuing practice.

Through the decade of the 60s increased emphasis was given to more exacting engineering design of buildings to reduce construction cost and improve production efficiency. Examples were new structural designs to improve pig litter size and quality and to prevent or reduce mastitis in dairy cows. During this period, plans for fully mechanized systems for storing and feeding ensilage and grain to beef and dairy cattle were developed and came into popular use. Driggers introduced new ideas in the design of structures for swine and sheep. He also developed more appropriate designs for barns and associated facilities for the rapidly growing horse industry in the state. Driggers resigned and was succeeded by Barry H. Bingham in 1966. Bingham worked on designs for slotted floors for swine, the use of flush gutters in swine structures and the use of lagoons for animal waste.

The trend toward the use of interdisciplinary teams of Extension specialists to improve production efficiency in specific commodity enterprises

continued in the 70s. Kite retired at the end of 1969, and William H. Collins and Eldridge R. Collins both joined the staff in 1971. W. Collins had primary responsibility for the engineering work in beef, dairy and sheep production systems. His improvements in dairy facilities raised production efficiency to superior levels in Virginia. E. Collins concentrated on agricultural waste management, and he continued to make design improvements in swine production systems after Bingham resigned in 1973. Harold A. Hughes joined the staff in 1973. Hughes and E. Collins developed and field-tested improved designs of slotted floors for swine buildings. The engineering work in poultry production systems became Hughes' main responsibility. He also initiated a program on energy management in 1973. During the remainder of the 70s, energy conservation and the quest for new energy sources became a new challenge to each member of the department staff. Field studies to develop and test new technologies increased in importance during the 70s. Wheary retired in 1976 and was replaced by Jerry R. Smith in 1979. The emphasis of Smith's program was on the retrofitting and remodeling of existing homes to better manage and conserve energy.

## Rural Electrification

### Electric Power and Processing

Gasoline-driven farm light plants were the only readily available source of electrical energy for most rural people in 1920. In that year, John S. Glenn began conducting short courses on individual light plants for farm families. He also provided engineering assistance on surveying small streams and giving recommendations for small hydroelectric installations for farms and small groups of rural homes.

In 1923, Charles E. Seitz, in cooperation with leaders of farm organizations and electric power companies, developed plans for the formation of the Virginia Committee on the Relation of Electricity to Agriculture. The committee planned and constructed a 4.8-mile experimental rural power line in Henrico County in 1924 to serve the rural homes and farms along its route. The purpose of the study was to evaluate the performance of the line and the use of the service by those families it served. James A. Waller directed the project. The results of the study were published in 1926 and were very beneficial during the following decade. It was estimated that in 1926 approximately 1,500 rural homes and businesses, of which about 500 were farms, had central station electric service in Virginia.

Seitz encouraged the two largest power companies in the state to establish rural departments and place an agricultural engineer in charge of their rural development programs. By 1928 two companies had adopted his recommendation. The CREA worked with the state Corporation Commission to develop a uniform rural power line extension policy. In 1929, such a plan was announced, and it provided that the companies would finance and build rural lines where the customers served would guarantee a certain minimum revenue for a stated period of years. The first Virginia Rural Electrification Conference and short course was held at VPI in 1929.

Even with the serious economic depression of the 30s, by 1935 the power companies had built approximately 5,800 miles of rural lines to serve some 38,000 customers in Virginia. Widespread national interest in rural electrification was developing, and in 1935 Congress established the Rural Electrification Administration (REA) in the USDA. The agency was to stimulate rural line extensions and to provide employment. Earl T. Swink was employed in 1935 to conduct the rural electrification phase of the department's program in Extension and Resident Instruction. Congress made the REA a permanent agency of the USDA in 1936 and announced plans for low-cost loans for financing rural power lines. The first REA-financed electric power system in Virginia was energized in Caroline County in 1936. Intense competition developed between the power companies and the newly forming REA-financed electric cooperatives. New developments in line design lowered their cost and spurred construction throughout the state.

The Extension program was planned to provide information to people on how to obtain electric service, plan farmstead wiring systems and how to use the service to improve rural living and reduce labor in agricultural enterprises. Swink developed effective working relationships with the REA and maintained the already good cooperation of the power companies to make the Extension program move forward. The power companies already had agricultural engineers and home economists, and the electric cooperatives added such people as they became established, to work with educational programs.

The first work in electrification with 4-H club members in Virginia began in 1939. Swink developed plans with the 4-H Department to enable club members to participate in a National Rural Electrifications Contest sponsored by a large electrical equipment manufacturer. In 1939 Swink

worked with TVA agricultural engineers and others in designing a forced air hay drying system for a Pulaski County farmer. This installation was used as a result demonstration in 1940. This was the first such installation in the state, and it marked the beginning of a new technology in using forced air in the processing of agricultural crops.

In 1940 Swink assembled an informal advisory group of power supplier representatives to assist in planning educational programs in which they could cooperate. By the end of 1941, 15 electric cooperatives had been organized and were serving rural people in 75 counties. The power companies had also been expanding rapidly, and the combined systems were serving 105,000 rural customers of which nearly 45,000 were farms.

During World War II the program emphasis was shifted from large-scale expansion of power systems to the utilization of service to save labor, increase food and fiber production, preserve and conserve food, and to maintain equipment. Clinics and demonstrations on these topics were the order of the day with Extension and power supplier personnel cooperating. Considerable specialist time was spent on the establishment of community frozen food locker plants, and 35 were in operation by 1945. Joseph E. Collins was employed in 1945 to assist with Extension programs.

The advisory planning group that was formed in 1940 functioned well. In 1945 Seitz and Swink worked with that group to organize the Virginia Farm and Home Electrification Council. The purpose of the council was to coordinate and expand the education and research activities of all appropriate agencies and organizations concerned with the use of electric service on the farm and in the home. Each participating organization was represented in the council membership. Member power suppliers provided funds for establishing an office in Seitz Hall and for employing an executive secretary. The person filling this position became an adjunct staff member of

the Agricultural Engineering Department. In 1978 the status of the position was changed to enable the person filling it to be a regular Extension appointee. J. Lawrence Calhoun was employed in 1946 to be the first council secretary. The Council has been in continuous operation since its inception. The many special emphasis programs and publications it has sponsored have been significantly effective in helping rural people to derive the maximum benefits from electric service. Since 1946 the Council has co-sponsored the annual Virginia Rural Electrification Conference with the department. Calhoun resigned from the Executive Secretary position in 1949 but continued to serve in an acting capacity until 1954. Others who have served include James H. Strickler (1955-58); Donald R. Burrowbridge (1958-62); Harold R. Lezotte (1963-66); J. Lawrence Calhoun (acting 1967); Richard A. Spray (1968-69) and Richard H. Trice (1970-).

Collins resigned in 1949 and Calhoun was appointed to replace him on the Extension staff. Calhoun worked with the 4H department to change the electrification activity to a full fledged project in 1949. The first Virginia 4-H electric Congress was held in 1951 to honor outstanding achievement winners in the project. It continues to be a premier event and an important highlight of the program. In 1951 the state winner also won national honors, as have several others since then. State enrollment in the program grew rapidly to a plateau of approximately 12,000 where it has remained for many years.

Approximately 93% of Virginia's farms and rural homes had electric service by the end of 1951. Modernization of rural homes had been made possible and the service was having a growing impact on agricultural enterprises.

Under Calhoun's leadership, farm demonstrations of forced air drying systems for corn and small grain were begun in 1950. Such drying facilities now made it feasible to completely mechanize the harvesting of small grain and corn. New drying technology and equipment evolved during the 50s and 60s. It was estimated that by 1979 Virginia farmers had on the farm facilities for drying and storing 65% of the total grain crop.

Seitz retired in 1954, and Swink was appointed Department Head to succeed him. J. Lawrence Calhoun replaced Swink in the electric power and processing work. Andrew J. Lambert was employed in 1955 to fill the position vacated by Calhoun.

Statewide programs given emphasis during the 50s included improving wiring and lighting systems, environmental control in the home, pressure water systems and water use equipment, materials handling, feed processing and handling, and crop drying. The first field test demonstrations on forced air peanut drying were established by Lambert in 1957. This paved the way for the complete mechanization of peanut harvesting. Lambert was granted educational leave for one year in 1958-59, and James H. Strickler was employed to serve during his absence. Complete mechanical harvesting of peanuts was estimated to require only about 20% of the labor needed with the stack pole system. In 1977 Lambert designed and started field testing a peanut drying system using solar energy and partial recirculation of air to conserve energy.

Calhoun and Lambert began an intensive program on modified environmental control for poultry buildings in 1961. This practice greatly increased the capacity of buildings, improved production efficiency and became generally adopted by producers during the 60s and 70s.

Field test demonstrations on using forced air in bulk tobacco curers were conducted by Lambert beginning in 1962. Forced air curing of tobacco gradually led to more complete mechanization of tobacco harvesting during the ensuing years. Engineering design refinements and improved control devices contributed greatly to progress in the widespread use of forced air in agricultural production.



## Farm Power and Machinery

Extension work with agricultural machinery was very limited during the early years of the agricultural engineering program because of the lack of staff. The resident instruction staff conducted special short courses on campus for 4-H groups and others during the summer months. Assistance was also provided in response to special requests on specialized problems such as lime grinding equipment, seed harvesting and cleaning machines.

One of the major adjustments made in 1942 due to wartime needs was the development of a statewide program on the care, repair and maintenance of agricultural machinery by J. A. Waller. This intensive program involved the training of vocational agriculture teachers, Extension agents and other professional workers in agriculture to conduct machinery clinics for farmers. Most of Waller's time was devoted to this program until the end of the war.

In 1945 Waller initiated the 4-H Tractor Maintenance and Operation Program which developed into a popular 4-H project. The 4-H Tractor Operators Contest became an important part of the project. The first Eastern United States 4-H Tractor Operators Contest was held in Richmond in 1951, and Virginia continues to be host to this annual event in which winners from as many as 23 states have participated. The Virginia 4-H tractor program has enrolled as many as 1,565 members in a given year.

During the post-war years, Waller expanded the machinery program to include fruit sprayer-duster selection and maintenance clinics. He also added schools for training corn and soybean combine operators in the adjustment and maintenance of these machines to reduce field losses and maintain product quality.

Easley A. Smith joined the staff in 1956 as the first full-time Extension Farm Machinery Specialist. Smith initiated programs to provide information to farmers that would help them to select equipment that would comprise an efficient and economical mechanical system of crop production. His program goals were to reduce labor requirements; minimize field losses in harvesting and maintain product quality. Such programs were usually integrated into commodity production projects in cooperation with appropriate specialists in other departments. He also developed needed information on machinery rental and custom operator charges.

Research on curing peanuts with forced air and new developments in peanut dryers and combines resulted in field test demonstrations on the mechanical harvesting and curing of peanuts in 1957. The test demonstrations over a period of several years showed a potential saving of over 80% in the labor needed for mechanical harvesting and curing systems as compared with the traditional stack pole method. The first combine peanut harvester was sold in Virginia in 1957; and by 1980 approximately 99% of the peanut crop was harvested, cured, stored and handled by a fully mechanized production system.

Smith introduced the 4-H small engines project on a pilot basis in three counties in 1961 with 61 club members enrolled. Interest in this project grew steadily with a yearly enrollment of up to 4,870. In 1972 the Eastern U.S. 4-H Tractor Operators Contest at the Atlantic Rural Exposition was expanded to include the 4-H Small Engines Program. The 4-H Automotive Safety Program, which had been introduced in Virginia in 1960 by E. B. Hale, became a feature of the Eastern U.S. 4-H Tractor Operators Contest in 1975, when the name of this regional program was changed to the U.S. 4-H Engineering Event, Eastern Division.

Plans for the first field test demonstrations of wheel track planting for minimum tillage of corn were developed and initiated by Smith in 1961. He also began similar field trials of mulch planting of soybeans that year. Extension programs included recommendations for no-tillage in corn production in 1962. These new planting and cultural practices reduced soil and water losses and improved yields, but required major changes in machinery and crop production recommendations. By 1980 it was estimated that no-tillage crop production practices were used on more than 30% of Virginia's corn and soybean acreage.

In 1962 Smith introduced a program of training fertilizer industry representatives and bulk fertilizer distributors in the calibration and adjustment of plant food spreading equipment. The simple calibration method he developed and the training program for equipment operators resulted in much more uniform application of fertilizer on the land. The methods used became widely adopted in other states, and the bulk system of handling fertilizer increased in popularity in the next two decades.

Field demonstrations were begun in 1977 to evaluate the response of corn and soybeans to under-row ripping in the planting of those crops. The practice proved to be valuable with certain soil types and became a recommendation where such soils prevailed.

During the 1960s and 70s machinery requirements became an increasingly important economic factor in the production, harvesting and handling of all field crops. As the inter-disciplinary team system of conducting educational programs grew in Extension, Smith's work as a member of such team\$ working with field crops increased in significance.

## Agricultural Engineering Extension Staff

Roster, 1914 to 1980

Bass, Jennings J., 1936-37	Lillard, James H., 1945-46
Bingham, Barry H., 1966-73	Markuson, M. J., 1923-25
Boynnton, Henry B., 1921-22	Mason, J. Philip, Jr., 1969-79
Calhoun, J. Lawrence, 1949-76	McKnight, Ralph E., 1945-LJ6
Chestnut, R. H., 1926-27	Mundie, Edward W., 1942-44 1960-73
Cole, Joseph B., 1924-25	Nichols, Mark L., 1918-19
Collins, Eldridge R., 1971-	Parsons, Bernard L., 1980-
Collins, Joseph E., 1945-49	Propst, John W., 1946-47
Collins, William H., 1971-	Seitz, Charles E., 1914-54
Dickerson, Walter H., 1938-44	Sjogren, John W., 1943-46
Driggers, L. Bynum, 1957-66	Smith, Easley S., 1956-
Gee, Herbert H., 1953-55	Smith, Jerry R., 1979-
Glenn, John S., 1920-23	Spray, Richard A., 1974-78
Glover, Herman W., 1952-53	Stanley, James M., 1946-47
Gordon, Howard H., 1928-34 1936-37	Stoneburner, Paul W., 1948-51
Hale, Edward B., 1960-83	Strickler, James H., 1958-59
Haugh, C. Gene, 1979-	Swink, Earl T., 1935-67
Hetzel, Glen H., 1976-	Trent, Floyd P., 1942-
Hines, Richelieu C., Jr., 1946-47	Trice, Richard H., 1970-
Hughes, Harold A., 1973-	Waller, James A., Jr., 1923-59
Johns, Melvin M., 1935-36	Wheary, Cecil D., 1946-76
Kite, Garland D., 1937-69	Wilkinson, Clopton F., Jr., 1939-46
Lambert, Andrew J., 1955-	