ANNUAL REPORT

RESIDENT INSTRUCTION

AGRICULTURAL ENGINEERING DEPARTMENT

VIRGINIA POLYTECHNIC INSTITUTE

For the Year

July 1, 1929 to June 30, 1930
I. DEPARTMENT ORGANIZATION.

(a) General work of the department.

The Agricultural Engineering department is organized to handle Resident Instruction, Research and Extension work.

The Resident Instruction Division of the department is organized to handle service courses for agricultural students, elective courses for engineers, profession agricultural engineering courses for students majoring in the department, and graduate courses for fifth year students.

In the Research Division the department is handling research work in farm machinery with one man devoting his full time to this study. Other members of the staff have been doing some research work along with their regular duties.

In the Extension Division the department is handling extension projects in drainage, irrigation, terracing, farm water supply and water power, rural electrification and farm structures. While these are the main extension projects, work is also done on other general subjects when the need arises and the time is available. Information and instruction is given on numerous subjects through correspondence, bulletins and articles, etc.

(b) Staff.

Chas. E. Seitz, Prof., Head of department. Employed by Extension Division, general administration, extension projects in land drainage, irrigation and rural electrification.

Verne R. Hillman, Asst. Prof. employed by College Division. Resident instruction. Responsible for the following classes.

Ag. Eng. 211 - Technical Lecture
" " 213 - Farm Implements
" " 222-232-Farm Power and Machinery
" " 311-321-Internal Combustion Engines
" " 322 - Advanced Farm Machinery
" " 325 - Automobile Engineering
" " 425 - Farm Machinery Design
" " 432 - Rural Electrification
" " 433 - Agr. Engr. Problems
" " 435 - Automobiles, Trucks, & Tractors
Percival B. Potter, Asst. Prof. Employed by College Division, Resident Instruction. Responsible for the following classes.

Ag. Eng. — Farm Surveying and Drainage
" " — " " " " " "
" " — Household Mechanics
" " — Agr. Surveying and Drainage
" " — Domestic Engineering
" " — Advanced Agr. Surveying
" " — Drainage and Irrigation Engineering
" " — Rural Sanitary Equipment

Ralph H. Chestnutt, Instructor, employed on six months basis by College Division. Resident Instruction.

Classes.

Ag. Eng. — 111-121 — Farm Buildings
" " — 112-122 — Agr. Drawing
" " — 333 — Farm Structures

Daniel C. Heitzhu, Asst. Professor. Employed by Agricultural Experiment Station. Responsible for the research studies in farm machinery.

James A. Waller, Jr., Asst. Prof. Employed by Agricultural Extension Division. Responsible for the extension projects in farm water supply and terracing.

Howard H. Gordon, Asst. Prof. Employed by Agricultural Extension Division. Responsible for the extension project in farm buildings.

Katherine Price, Secretary for department.

(c) Development of department organization during year.

One additional agricultural engineer was added to the staff at the beginning of the year. H. H. Gordon, a graduate of N. C. State College, was employed by the Agricultural Extension Division to handle our extension work in farm structures. Before coming to V. P. I. Mr. Gordon was employed as agricultural engineer by the Agricultural Extension Division of North Carolina State College for several years. For the two years previous to coming with this department he was field agricultural engineer in Virginia for the Portland Cement Association.

II. TEACHING.

(a) Discussion of curricula and courses.

Three new courses have been added as follows:

Agr. Eng. 111—Agr. Engr. Lecture. This is a course without credit for freshmen agricultural engineering students. We do not have any
classes for our first year students, since they take all their work with the regular engineering groups. This course was added so that the first year students would secure contact with the department and at the same time learn something of the field for agricultural engineering. During the quarter each member of the agricultural engineering department staff will talk to this class about his particular field of agricultural engineering.

Ag. Eng. 211-221-231. Agricultural Engineering Drawing. Due to changes made in the engineering schedule Descriptive Geometry and Mechanism had to be dropped from the agricultural engineering curricula. This course was added to take the place as far as possible of the courses dropped.

Ag. Eng. 422. Farm Electrical Equipment. This course was added to give more training in farm electrical equipment since a number of our graduates each year are going into rural electrification work.

The following two courses have been changed:

Ag. Eng. 316-236. Domestic Engineering. An additional quarter's work of 2 hrs. credit was added to this course at the request of the students who wished more work in this subject.

Ag. Eng. 411. Reclamation Engineering. The name of this course was changed from Drainage and Irrigation Engineering as Reclamation Engineering is a broader term and is more nearly suited to the work taken up in the course.

Every effort is being made to improve teaching methods. One handicap in agricultural engineering instruction has been the lack of suitable textbooks and laboratory manuals. Laboratory manuals in several of our subjects have been prepared in an effort to partly meet this need.

An arrangement has been made to employ a combination janitor and all around man for the coming year. This will result in a better kept laboratory and allow the instructors more time to put on constructive work. Heretofore much of the instructor's time has been spent in keeping equipment in repairs, getting it ready for class and even doing some work that should be done by a janitor. It is felt that this arrangement will result in greatly improved instruction work in the farm machinery laboratory.

We have about all the students that can be efficiently handled with the available facilities. We are interested in improving the quality of students rather than the quantity until we are better equipped to handle more men.

Our graduates are doing satisfactory work. There is a growing demand for V. P. I. Agricultural Engineering graduates. For the past three years there has been a greater demand for our graduates than it has been possible to fill. All our men have secured positions upon graduation, some of the best men having several offers to choose from.

Agricultural Engineering graduates of V. P. I. are filling positions with such organizations as the International Harvester Company, J. I. Case Tractor Company, Caterpillar Tractor Company, Bethlehem Steel Corporation,
Mack Truck Organization, Standard Oil Company of New Jersey, several of the larger power companies in Virginia, the General Electric Company, the Westinghouse Electric & Manufacturing Company. Several men are with the U. S. Government in Mississippi Flood Control work and agricultural engineering research and service work with the Department of Agriculture.

For the past few years we have had numerous requests for our graduates from other colleges for teaching, research and extension work. This year there were openings in twelve different colleges. Several of our graduates are in educational work in agricultural high schools. Two are at the University of Georgia in research and teaching, one is at the University of Maryland in research and extension, several are farming and at least one is doing consulting agricultural engineering work, while one is a practicing architectural engineer in Virginia.

III. RESEARCH AND SPECIAL STUDIES.

(a) There are a great number of research problems in agricultural engineering demanding attention but with the limited facilities available for research work, comparatively few projects have been under way during the year. Some members of the staff have made studies as far as their time would allow. One member has been devoting full time to research studies in farm machinery for the Agricultural Experiment Station.

Research in Farm Machinery:

Project Name: The reduction of power and labor costs in crop production through engineering manipulation.

Object: To determine how the peak loads of power and labor at the critical periods in corn, wheat, and potato production may be advantageously reduced by the application of mechanical power and equipment. (Note: The object previously read "corn, wheat, hay, and soybeans," but is here changed so as to be correct in the crops being studied at present.)

Sub-Project No. 1 - Harvesting Wheat with Combine.

Object: To determine the most suitable harvesting period of wheat for the combine harvester, and to determine how much time in the morning must be allowed for the grain to dry before beginning to use the combine.

Sub-Project No. 2 - Drying Small Grains.

Object: To determine the most efficient method of drying small grain, harvested with a high moisture content, by means of natural ventilation with specially constructed storage bins.

Sub-Project No. 3 - Row Crop Management.

Object: To determine the most desirable method of row crop management with multiple row machinery in the production of field corn.
Sub-Project No. 4 - Harvesting Ensilage Corn.

Object: To determine the most economical equipment and methods to use in the harvesting of ensilage corn.

Sub-Project No. 5: - Potato Production Machinery.

Object: To determine the fundamental requirements of multiple row power driven potato production machinery.

Sub-Project No. 6: - New Machinery.

Object: To determine the possibilities of reducing the power load of preliminary soil tillage operations by substituting various newly developed tillage implements for the conventional mold board or disk turning plow.

The progress results on these studies are outlined in the Annual Report for the year 1929-30 to the Agricultural Experiment Station.

(b) Special Studies by Staff Members.

Prof. C. E. Seitz is making special studies on irrigation consisting of orchard irrigation, surface irrigation of general crops and overhead irrigation. A study was completed by him during the year on rural electrification development in Virginia. A bulletin is now in preparation by Professors Seitz and Hillman on Rural Electrification in Virginia.

Prof. V. R. Hillman completed a study of "Plans and Policies for Extending Electric Service to Rural Territories." The results of this study were presented in a thesis for his M. S. degree at V. P. I. in June.

Prof. P. E. Potter completed a study entitled, "A Plan and Layout for Experimental Plots to Determine Depth and Spacing of Tile, together with a Scheme of Permanent Markers for Experimental Plots." The results of this study were presented in a thesis for his A. E. degree at Kansas Agricultural College in May.

Prof. H. H. Gordon is conducting two studies in cooperation with other departments. A study of "Mechanical Refrigeration for Small Dairies" is being made in cooperation with the Dairy Department. A study of "Common Storage for Apples" is being made in cooperation with the horticultural Department.

Prof. R. H. Chestnutt has been conducting a study of the "Virginia Farm Home" as a major subject for his M. S. in Agricultural Engineering.

(c) Special Problems Assigned to Graduate Students.

Mr. Edward Shulkeum, a graduate student in agricultural engineering, completed a study entitled, "The Influence of Depth of Tile on Plant Growth." This study was the subject of his major thesis for the M. S. degree which he received in June.
Mr. J. K. Alvis, a graduate student in agricultural engineering, completed a study entitled, "Performance and Efficiency of Tractor Engines." This study was the subject of his major thesis for an M. S. degree, which he received in June.

(d) Cooperative Studies with Other Organizations.

In the study of "Mechanical Refrigeration for Small Dairies," the General Electric Company has cooperated by loaning special refrigeration equipment and consulting with us on various phases of the work. As a result of the study several changes will be made in their milk cooling equipment to make it more nearly meet the needs of the dairyman.

The Division of Agricultural Engineering of the U. S. Department of Agriculture has cooperated in the study of "Common Storage of Apples." Testing instruments have been loaned by the Government and some field work on the study is being done by a Government representative.

The department has cooperated very closely with the three leading electric power companies in the rural electrification studies.

(e) Publication and Distribution of Results.

A number of articles have been prepared for technical journals and for the agricultural press. No bulletins have been published but at least two have been in preparation and will be published the coming year.

IV. PUBLIC SERVICE RENDERED.

(a) Extension Instruction.

Extension instruction in agricultural engineering is being carried to the farmers and farm women, communities and organizations of the state.

The extension field projects in agricultural engineering which have been emphasized during the year are: Terracing, Farm Water Supply, Farm Buildings, and Rural Electrification. The extension work is handled through short courses and meetings; publicity; and field projects and demonstrations.

(1) Short courses and meetings; are given when scheduled and consist of illustrated lectures, moving pictures, laboratory work or talks at meetings, etc.

Sixteen (16) sewing machine schools were held in nine (9) counties at which 118 women were instructed on the proper care and repair of sewing machines. Ninety-four (94) old machines were repaired at these 16 schools.

Instruction was given at four county short courses for boys at which 264 boys were instructed on agricultural engineering subjects.

Instruction was given to 100 farmers and farm women at the Jamestown Adult Camp.
Some 30 meetings were attended during the year at which talks were made on agricultural engineering subjects to the several thousand farmers and others in attendance.

One of the most important of these meetings was the Institute of Rural Affairs and the Farmers' Institute of 1929 at which a special program in Farm Power and Machinery was presented.

(2) Publicity; is handled through correspondence, bulletins, circular letters, newspaper and farm journal articles, exhibits at fairs, etc.

Numerous articles have been prepared for different publications and a number of news items on agricultural engineering for the daily press. Scheduled radio talks have been given by staff members and some of these talks mimeographed and distributed. Several thousand bulletins have been sent out in answer to requests for information on certain phases of agricultural engineering. Over 2500 plans of farm buildings were furnished farmers requesting them. About 5000 letters were written by members of the staff, most of which were in answer to inquiries on special problems in agricultural engineering.

(3) Field projects and demonstrations, consist of supplying technical information and services to individuals, communities and organizations in the state through actual personal service or field demonstrations.

Individuals, county or home demonstration agents, or community organizations make application to the department for the services of the specialists. The individual project is visited, in company with the county agents, surveys and other notes are made and a detailed report, plans and suggestions furnished. Demonstrations consist of visits and meetings at projects under construction and at finished projects, in order to instruct on methods and show results obtained. The specialist endeavors to instruct in such a way that those in attendance at the demonstration can carry out the practices recommended without further assistance. Many of the projects are self-advertising, such as improved farms, new farm homes or other buildings, new operating equipment, water systems, and other conveniences in the house; and reclamation projects, such as drained fields, terraced hillsides and cleared land.

**Terracing Project.** - Seven (7) terracing schools were held in as many counties at which 340 farmers attended the lectures and 400 the field demonstrations. Fifty-four (54) acres were terraced at these demonstrations or schools. In addition ten other terracing demonstrations were given in 5 more counties at which 65 acres were terraced.

**Farm Water Supply Project.** - Water supply campaigns were conducted in fourteen (14) counties in which 476 farms were visited by the engineer and specific instructions and specifications given on installing water systems for the farm home.

In addition to the 254 farmers reached in the 9 counties about 60 farmers in 25 counties were visited and given instruction on the installation of water systems and sewage disposal systems.
Farm Buildings Projects. - At least 2500 farmers were furnished farm building plans and at least 150 farmers were given personal instruction on their farms on structures problems. The estimated value of the structures built from plans furnished by the department during the year is $2500,000.00. Numerous new plans with specifications were drawn up during the year and our entire plan service revised.

One of the most important accomplishments under the farm structures project was the working out of the dairy plan service in cooperation with the State Dairy and Food Division, whereby a standard dairy barn and milk house plan service for the state was created. Under this cooperative arrangement this department will prepare all dairy barn and milk house plans as approved by the Dairy and Food Division, Dairy Department of V. P. I. and dairy organizations and to be distributed by the Department and the Dairy and Food Division. This arrangement will prevent, (1) duplication, (2) misunderstanding and antagonism, (3) criticism, (4) wide variation in plans formerly furnished by the two state agencies. All plans now used in the state are furnished by V. P. I.

Another important accomplishment under this project was the cooperative arrangement made with the Maryland & Virginia Milk Producers' Association whereby this association has adopted our plans as standard throughout their territory. This association uses over 200 of our plans annually for their membership. This arrangement has also brought about the standardization of dairy barn plans in Maryland. The Maryland Extension Division have made copies of our standard plans and are using them for distribution.

Plans and specifications were prepared for the 4-H Club Camp at Petersburg, Virginia, and detail plans furnished the Valley Milk Producers' Association for a $50,000 creamery building. Numerous other special plans were prepared.

Rural Electrification Project. - The most important work done under this project was in connection with the state plan for making rural line extensions. Numerous meetings and conferences with electric power company officials have been necessary in putting this plan in effect. The plan, which was worked out by a committee appointed by former Governor Byrd, has resulted in many rural electric lines being built in the state. During 1929, 816 miles of rural electric lines were built in Virginia, making a total of 2860 miles of rural lines, with approximately 35,000 rural customers, of which about 6500 were actual farmers. In 1924 there were only about 500 actual farms connected for electric service and a total of about 1600 rural customers. The companies estimate that they will construct 1200 miles of rural lines during 1930 and connect over 7,000 new rural customers.

Considerable time was devoted to consultation with power companies, especially the three largest ones, in matters pertaining to the organization of rural service departments and methods of putting across the rural electrification work. Men have been trained by the department for rural service work. Three V. P. I. graduates were placed in this work during the year. One of the
problems in the advancement of rural electrification is the scarcity of qualified men to handle the rural service work for the power companies. Cooperative arrangements were completed with the General Electric & Westinghouse Electric Companies, whereby they will take several of our graduates each year for special training in rural electrification. After a period of from 18 months to two years these men will be available for rural service work with the companies in the state.

Assistance was rendered several communities in getting electric line extensions. A bulletin on rural electrification is in preparation which will be published in the fall. Cooperative demonstrations and studies are being made with some of the companies on special applications of electricity to farming.

One company especially is doing outstanding work in rural electrification and it is hoped that other companies can be organized to do as effective work.

In addition to the four main field projects in agricultural engineering namely, terracing, water supply, farm structures and rural electrification, as outlined above, extension instruction was also rendered on other projects as follows: fifteen (15) drainage surveys of 385 acres of farm land were made for tile drainage. Several irrigation surveys were made and a number of installations completed. Surveys were made for stationary spray plants for orchards and a number of plants have been installed, one of these being on former Governor H. F. Byrd's orchard at Timberville. Several surveys were made for farm water power development. Engineering assistance was also rendered on a number of miscellaneous problems.

Service has been rendered the State Dairy and Food Division as referred to under the farm buildings project. Help has been given on a variety of problems to the various agricultural departments of the college.

The head of the department has rendered assistance to the Federal Government in formulating and advising on a national research program. He was appointed by the Secretary of Agriculture to serve on the National Council for Research in Farm Operating Equipment and the National Council for Research in Farm Structures.

V. PROFESSIONAL SOCIETIES AND ASSOCIATIONS.

All members of the department staff belong to the American Society of Agricultural Engineers. The head of the department was a member of the following committees of the Society during the year: Advisory Committee of the College Division, Committee on Land Drainage, Committee on Rural Electrification, Committee on Student Branches, Prof. Hillman was a member of the Committee on Farm Mechanics in Secondary Schools and Prof. Heitshu a member of the Committee on Row Crop Machinery.

VI. PUBLICATIONS.

No bulletins were published during the year but two bulletins—Farm Water Supply and Rural Electrification were started. Numerous articles were
prepared for the press. Articles were prepared and appeared in the Country Gentleman, Electrical South, Electrical World, Electricity On The Farm and the Southern Planter.

VII. FUTURE PLANS WITH RESPECT TO ORGANIZATION, ETC.

The plans for the coming year in regard to department organization are: That where possible one man will be made responsible for a distinct branch of the agricultural engineering field with the object of strengthening each of the following divisions: Household Engineering, Farm Power and Machinery, Land Reclamation, Farm Structures, and Rural Electrification.

Prof. Hillman will be made responsible for the resident instruction and research work in rural electrification. This arrangement will enable us to develop all phases of the rural electrification field and render much more effective service in our rural electrification program. Prof. Hillman will handle the following classes for the coming year:

Ag. Eng. 111 - Agr. Engr. Lecture
" " 325 - Automobile Engineering
" " 414 - Rural Electrification
" " 422 - Farm Electrical Equipment

He will also be responsible for developing the research work in rural electrification and will assist Prof. Seitz in some of the extension projects.

Prof. Potter will devote half of his time to teaching and half to research for the Agricultural Experiment Station. He will be responsible for the instruction and research work in Household Engineering. He will handle the following classes for the coming year:

Ag. Eng. 226 - Household Mechanics
" " 316-326 - Domestic Engineering
" " 322 - Rural Sanitary Equipment
" " 411 - Reclamation Engineering. (He will be responsible for this class until Mr. Trent has had sufficient experience to handle it.)

Prof. Potter will also be responsible for developing the research work in Household Engineering which will consist of the following studies this year:

Project H-1 - Oven Regulators, Reliability Investigations. The object of this study is to compile data sufficient to answer several questions about home laundering, will be to secure information on all types and makes of oven regulators and test and calibrate them for accuracy and reliability.

Project C-1 - Home Laundering Investigations. The object of this study is to compile data sufficient to answer several questions about home laundering.

Prof. Gordon will continue to be responsible for the extension project in farm buildings.
Prof. J. W. Sjogren, who was added to the staff in September 1930, will have charge of the Resident Instruction and Research work in Farm Machinery. He will devote half his time to resident instruction and half to research for the Agricultural Experiment Station.

Prof. Sjogren will be responsible for the following classes:

Ag. Eng. 213 - Farm Implements
" " 222-222 - Farm Power and Machinery
" " 311-321 - Internal Combustion Engines
" " 327 - Advanced Farm Machinery
" " 425 - Farm Machinery Design
" " 436 - Automobiles, Trucks and Tractors

Prof. Sjogren will continue, with certain modifications, the studies in farm machinery started by Prof. Heitzhu.

S. H. Byrne, an agricultural engineering graduate of 1930, will be added to the staff as instructor. He will devote his time to teaching farm structures and drawing and do the drafting work in farm structures for the department. He will handle the following classes during the coming year.

Ag. Eng. 112-122 - Farm Buildings
" " 113-123 - Agr. Drawing
" " 211-221-231 - Agr. Engr. Drawing
" " 333 - Farm Structures

Byrne will also carry on a research project on ventilation of farm buildings as a major study for his M. S. degree.

F. P. Trent, will be added to the staff in September 1930 as instructor in surveying and drainage. He will be employed on the 9 months basis and will handle the following classes:

Ag. Eng. 134 - Farm Surveying and Drainage
" " 215 - " " " "
" " 234 - Agr. Surveying and Drainage
" " 334 - Adv. Agr. Surveying
" " 411 - Reclamation Engineering (He will assist Prof. Potter with this class the coming year.)

Trent will also handle a research study entitled, "Irrigation of Orchards."

It is planned to develop Byrne for the farm structures field, both teaching and research, for which he is well fitted by training and experience. Trent will be developed for the reclamation field, both teaching and research.

Prof. Waller will continue to be responsible for the extension projects in farm water supply and terracing.

Prof. Gordon will continue to be responsible for the extension project in farm buildings.
Prof. Seitz will continue to handle the extension projects in rural electrification, drainage, and irrigation.

Boyd Harshbarger, a graduate student in agricultural engineering will conduct an investigation of electric sterilization for small dairies as a major study for his M. S. degree.

The demands made upon the department have been so great that little time has been available for the preparation of publications. The time has arrived however where the lack of published information is a serious handicap to our work. It is therefore planned to devote more time in the future to the preparation of bulletins, circulars, etc. on the various agricultural engineering subjects. A general bulletin is now in preparation in rural electrification. This will be followed by several circulars on special phases of rural electrification. A farm water supply bulletin has also been started. An Information Series in mimeographed form will be prepared on a variety of subjects, these to be later followed by bulletins.

VIII. DEPARTMENT NEEDS.

The most urgent need of the department is for adequately equipped classroom, laboratory and office facilities. It is impossible to do the most effective work under the present crowded conditions. It is not desirable to try to add new equipment until adequate laboratory space is available to properly house this equipment. However, a truck is needed at once. It is not desirable to try to greatly increase enrollment until the department is equipped to better handle its teaching work.

A full time mechanic is needed for the department to keep equipment in repair, handle the tool room, etc. If the right type of man could be found he could handle the course in farm shop which the Agricultural Education Department have asked us to develop as soon as we secure laboratory space.

Next to laboratory the most urgent need is to provide for more research work in the department. While arrangements have been made for research work in farm machinery and household engineering for the coming year, only the equivalent of one man will be available for both of these projects. There should be at least one full time man for each project. In the farm machinery research work there is need for at least one full time assistant to the man who will give one-half his time to this work.

There is need for research in farm structures, drainage, irrigation and soil erosion. One full time man should be available for research in farm structures and at least one full time man for research in drainage, irrigation and soil erosion.

We are in need of at least one additional extension man to develop an extension project in farm machinery, so that practical field instruction can be given farmers in methods of reducing production costs by the intelligent selection and use of more efficient labor and time saving machinery. As expressed in Dept. Bul. No. 1545,

"Labor and power together represent on an average of at least 60 per cent of the cost of carrying on the farm business and since there are two items
directly subject to the control of the farm operator, great opportunities exist for the cutting down of production costs through a better understanding of the power requirements of farm operations, through the adoption of more efficient and less expensive types of power units, and by a more extensive use of power to replace human labor."

Field instruction is needed to instruct the farmers on methods of reducing their labor and power costs and thus increase income. An extension man in farm machinery could also handle extension instruction in club work in agricultural engineering for which there is already a demand.