AGRICULTURAL RESEARCH

in Texas

SINCE 1888

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TEXAS AGRICULTURAL EXPERIMENT STATION
R. D. Lewis, Director, College Station, Texas

ACKNOWLEDGMENTS

Many of the research accomplishments mentioned in this publication have been carried out by the Texas Agricultural Experiment Station in cooperation with representatives of the Agricultural Research Service and the Agricultural Marketing Service of the U. S. Department of Agriculture and other agencies of the Federal Government.

Some projects were conducted on a regional basis in cooperation with the agricultural experiment stations of other states.

Much work has been done with the cooperation of the Schools of Agriculture and Veterinary Medicine of the Agricultural and Mechanical College of Texas, Texas Agricultural Extension Service, Texas Forest Service, Texas A & M Research Foundation, Texas Technological College, University of Texas, Texas Game and Fish Commission, Texas Prison System and State Board of Water Engineers, on grants of funds from private business and associations, and in the field with the assistance of individual ranchmen and farmers.

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Director

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TAD MOSES, Agricultural Editor
The Texas A&M College System

THE MAIN PURPOSE OF AN AGRICULTURAL EXperiment station is to study the problems which the farmer or ranchman cannot solve for himself. These are the common problems of agriculture as distinguished from the individual problems one can handle on his own acreage. In the early days, when new land was available for the taking and the population was small, it was easy to evade many obstacles — for instance, the depletion of soil productivity—by bringing new land into cultivation. But as the population increased and all the suitable agricultural land was farmed or ranched, demands developed for scientific and economical methods of dealing with agricultural problems.

USE OF PUBLIC FUNDS

The desirability of spreading agricultural knowledge through aid by government was recognized early by a few of our national leaders. But it was not until the Morrill Act of 1862 that it became public policy for the federal government to encourage and give financial support through grants of land to an institution in each state which would specialize in instruction in agriculture, engineering and military science at the lowest possible cost to the individual student. The Morrill Act put into practice a concept of higher education that had developed through a century of debate. Later the public responsibilities of these land-grant colleges were extended by acts of Congress and the state legislatures to provide for research and off-campus education of farm and ranch people.

Establishment of agricultural experiment stations through the federal Hatch Act of

1887, and of agricultural extension services through the federal Smith-Lever Act of 1914, as parts of the land-grant institutions was a natural outgrowth of the practical aspects of the new philosophy in education. In many states, including Texas, agricultural research and extension have been matched by similar services in engineering.

The Agricultural and Mechanical College of Texas, the first of the nine parts of the present Texas A&M College System, is the land-grant institution of this State. Provisions of the Morrill Act were accepted by the Texas Legislature in 1866. The College was authorized by the Texas Legislature in 1871, its location in Brazos county about 5 miles south of Bryan was selected in 1872 and it accepted the first students on October 4, 1876. *This was Texas' first venture into tax-supported higher education.*

Nine states had established agricultural experiment stations on their own by 1886 and a bill had been drawn to provide them with federal grants-in-aid. Then Congress on March 2, 1887, passed the Hatch Act which established the present system of state experiment stations in connection with the land-grant colleges.

The Texas Legislature, on April 2, 1887, accepted the provisions of the Hatch Act. A subsequent bill designated the A&M College of Texas as the State's beneficiary. The board of directors of the College, on January 25, 1888, made the Station a division of the College. When the Texas A&M College System was created by its board of directors in 1948, the Station was made one of its nine parts.

The purpose for which the Hatch Act was passed is shown in its Section 2, which reads in part:

"It shall be the object and duty of said Experiment Station to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as furnished under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial

with experiments designed to test their comparative effect on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese, and such other researches and experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable. . ."

PLANNING FOR RESEARCH

Actual work of the Station dates from March 1888. Most of the first year was spent in getting ready. Shortly after a director was appointed, letters of inquiry were sent to many persons in different parts of Texas, asking for suggestions about the work to be undertaken. Upon request by the Station, influential agricultural organizations sent representatives to College Station to meet as an advisory body with the Station Council in outlining a plan of work.

After much deliberation, it was decided to take up the following subjects for investigation:

1. A study of the most practicable and economical method of feeding cattle for beef and for the dairy.
2. A study of the cotton plant disease known as cotton blight or root rot.
3. Testing varieties of fruit to ascertain which kinds are best adapted to the State, and help to designate the varieties by their proper names.
4. Testing grasses and forage plants, their adaptability to localities and their value for grazing and feeding.
5. Testing the effect of barnyard manure and commercial fertilizers for certain crops.
6. Testing the value of tile drainage for farm and garden crops.
7. Disinfection and inoculation of cattle to protect from Texas fever.

From these original seven studies or "projects," the research investigations underway have expanded by 1956 into about 375 formal research projects and a number of informal short-time exploratory tests, all grouped into 25 research programs.

BASIC AND APPLIED RESEARCH

Agricultural research is a process of intense study, evaluation and development which results in a better understanding of factors affecting the wise use of resources in the production, marketing, processing and consumption of agricultural products. Much of the progress in Texas agriculture during the past 68 years has stemmed directly from the discovery of basic information and the development of new procedures and materials through research by the Texas Agricultural Experiment Station.

Basic research is the foundation on which scientific progress is built. Without basic information, the progress of the past century would not have been possible. Basic information is necessary before applied research can be used effectively to solve problems. This is the source of understanding new principles and methods for the further improvement of our soils, plants and livestock.

Applied research is a systematic approach toward the solution of the "hows," the "whens" and the "wheres" of practical problems. Solution of practical farm and ranch problems can be speeded up greatly whenever a vigorous applied research program based on sound fundamental principles is followed.

PROGRAMS AND PROJECTS

Research by the Texas Station in the physical and biological sciences and in the economical and social sciences is organized by programs and projects. *A research program* is a generalized recognition and statement of several problems relating to a common object or situation. It implies that thought has been given to priority, order and vigor of proposed attacks of the problems involved. *A research project* is an outline of the proposed attack of a specific problem within a program. It implies recognition and clear statement of the problem, the objectives of the work or study to be done, knowledge of the work of others on the same or related problems, and the development of tentative theories and proced-

ures of initial attack.

Each project is reviewed at least annually. Some projects are terminated each year; a few not dependent on growing seasons or successive generations of plants or animals may be completed in a few months. Many are revised each year to take into account progress, new leads, new methods or greater emphasis on limited objectives.

New projects are initiated only after constructively critical reviews of the problems, objectives, proposed procedures, probable significance of the results to some phase of agriculture, and the availability of funds for the study.

Current research by the Texas Station is grouped into 25 programs which include all phases of agriculture in the State. Among these are: conservation and improvement of soils; conservation and use of water in agriculture; grasses and legumes for pastures, ranges, hay, conservation and improvement of soils; grain crops; cotton and other fiber crops; vegetable crops; citrus and other subtropical fruits; fruits and nuts; oil seed crops—other than cotton; ornamental plants —including turf; brush and weeds; insects; plant diseases; beef cattle; dairy cattle; sheep and goats; swine; chickens and turkeys; animal diseases and parasites; fish and game on farms and ranches; farm and ranch engineering; farm and ranch business; marketing agricultural products; rural home economics; and rural agricultural economics. Two additional programs are maintenance and upkeep, and central services.

PERSONNEL

The staff the first year, 1888, comprised 10 people and the director, all of whom also had teaching assignments in the College. It had increased by only 1 member in 1898, to 16 in 1908, to about 75 in 1918, to about 100 in 1928 and to about 150 in 1938.

Today there are 1,138 employees engaged in full or part-time research for the Texas Agricultural Experiment Station and cooperating agencies. Of this number, 625 are full-time employees, 484 for the Experiment Station only, 122 joint with other parts of the Texas A&M College System and 19 joint with the U. S. Department of Agri-

culture; part-time employees total 379, making a total of 1,004 employees whose salaries are paid in whole or in part by the Station. In addition, there are 134 persons cooperating with the Station whose salaries are paid by other agencies, mostly the USDA.

FIELD UNITS

Wide differences in climate, soil and other factors soon led to the establishment of experimental field units over Texas as branches of the Main Station at College Station. The necessity for conducting research under a variety of conditions was an accepted fact in the mind of early Texas research leaders. Experiments have continued through the years at College Station, but as early as 1889 field tests were underway on the State Prison Farms at Rusk, Huntsville and Harlem, on the farm of the then Prairie View Normal at Hempstead, and on the farm of the State Reform School at Gatesville. These locations are referred to in early publications as "branch stations." Tests also were underway at McGregor in 1890. Limited funds in 1891 forced the closing of all field work except that at McGregor.

The establishment of branch stations by the Texas Legislature was recommended in both the 1890 and 1891 annual reports: "at least one station in the Black Waxy belt; one in the Wichita or Abilene country wheat belt; one in the sugar belt; and one in the drier portion of West Texas for experiment under conditions requiring irrigation."

The term "substation" was first used in the annual report for 1893 to designate the location of field units. Funds were provided that year for the operation of three substations. Temporary substations were established at McKinney and Wichita Falls in 1893. Each lasted about 2 years. The first permanent substation was established by the Texas Legislature in 1894 on 151 acres of land near Beeville.

Small grain and forage experimental units also were maintained in Texas during the early years by the U. S. Department of Agriculture. As is the policy now, the Station cooperated in these federal investiga-

tions. By 1900 such cooperative work was being done at San Antonio, Dallas, Abilene and Tyler. The USDA also cooperated in some of the projects at College Station.

After the Beeville station was established, there was constant pressure on the Texas Legislature to finance it adequately, and to establish substations in the other main geographical regions of Texas. "Until other stations are operated in several distinct sections, our work . . . must prove somewhat fragmentary and lacking in system and economy," it was argued in the annual report for 1899.

The passing years have witnessed the location of the present 45 agricultural experimental field units in Texas, 31 by the Texas Station, 11 by the U. S. Department of Agriculture, 1 by the Texas Technological College, 1 by the University of Texas and 1 by the King Ranch. Their locations are shown on the back cover.

In the order of establishment, the present 21 substations and 10 field laboratories now operating under the Texas Agricultural Experiment Station are:

SUBSTATIONS

Beeville, 1894; Tyler, 1902; Chillicothe, 1905; Angleton, 1909; Beaumont, 1909; Temple, 1909; Denton, 1909; Spur, 1909; Lubbock, 1909; Balmorhea, 1909; Nacogdoches, 1909; Sonora, 1916; Weslaco, 1923; Iowa Park, 1924; Crystal City, 1929; Stephenville, 1940; Ysleta, 1942; Gonzales, 1946; Prairie View, 1947; Kirbyville, 1948; and McGregor, 1948.

The Texas Forest Service and the Texas Station cooperate in the work at the Kirbyville station.

FIELD LABORATORIES

Animal Disease, Marfa, 1930; East Texas Pasture, Lufkin, 1934; Tomato Disease, Jacksonville, 1935; Plant Disease, Yoakum, 1937; Sweet Potato, Gilmer, 1938; Fruit, Montague, 1938; Brazos River, College Station, 1940; Horticulture, Robertson and Milam counties, 1946; Dairy, Mt. Pleasant, 1949; and Poultry Diseases, Center, 1954.

COOPERATING STATIONS

There also are 11 field stations or laboratories in Texas which are owned by the U. S. Department of Agriculture. The Texas

Station cooperates in the research conducted at these locations. These field units are located in or near Big Spring, Brownsville, Brownwood, Bushland, College Station, Greenville, Houston, Kerrville, Riesel and two at Waco.

Research at PanTech Farms near Panhandle is conducted cooperatively by the Texas Technological College and the Texas Station. Research at Encino is conducted cooperatively by the King Ranch and the Texas Station. The land on the Texas Range Station near Barnhart is owned by the University of Texas.

These 45 field units occupy a total of 25,357 acres.

Some of the TAES substations were originally established at other locations, but were moved to their present sites to better represent the soils and climatic conditions of the regions they were designed to serve.

OUTLYING RESEARCH

After a lapse of many years, the Texas Station in 1948 reinstated research experiments on the holdings of cooperating farmers and ranchmen. Among the first, the Denton station has supervised fertilizer trials, variety tests and cultural practices with small grains in Grayson and nearby counties.

Many of the other field units also supervise or conduct on-the-farm research. This is being done on varying scales from Beeville, Tyler, Angleton, Beaumont, Spur, Lubbock, Balmorhea, Sonora, Weslaco, Ysleta, Crystal City, Amarillo, Marfa and Jacksonville.

Most of the research conducted by personnel at Nacogdoches, Kirbyville and Mt. Pleasant is done on a mobile basis in cooperation with land owners of the respective areas.

Farmers and ranchmen of these sections are well satisfied with the results of outlying research being done. Such a program was not so fruitful in the early years of the Station. For, states the 1900 annual report: "The early history of this Station with outlying experiments was a succession of failures in its efforts to conduct experimental investigations on land owned and controlled by others."

If only four reasons could be given for the success of outlying research as of now,

whereas it formerly was a failure, they would be:

1. Ready means of transportation of personnel and equipment are now available.
2. The "white-collar" men and women of science have proved themselves to farmers and ranchmen.
3. Farmers and ranchmen now are much more research-minded and ready to cooperate in tests than they were 50 to 60 years ago.
4. Research now is much more thorough than it was prior to 1900.

ADMINISTRATION

The organization of the Station at first provided for a Station Council composed of the chairman of the faculty of the College, the agent of the board of directors and the director of the Station. This council was abolished in 1890 and the management of the Station, under the board of directors as the "governing board," was vested in the director.

From 1909 until 1913, control of the substations was under a board composed of the State governor, lieutenant governor and commissioner of agriculture. From 1913 until 1921, the Main Station was under the A&M College board of directors, but the substations were under a board of three "qualified voters" and the lieutenant governor.

Since 1921 the direction and control of both the Main Station and the field units have been under the A&M College System board of directors through the chancellor of the System and by the director of the Station.

DIRECTORS

Dr. R. D. Lewis, the present incumbent, is the tenth director of Texas' agricultural research activities. He took office September 1, 1946, coming from Ohio State University where he had been head of the Department of Agronomy.

Vice director of the Texas Station since April 16, 1950 is Dr. R. E. Patterson, an employee of the Texas A&M College System since 1939 in the Departments of Genetics and Animal Husbandry, and assistant director of the Station from 1947 to 1950.

F. A. Gulley was the first director, and served 1888-90. George W. Curtis served 1890-92; J. H. Connell, 1892-1903; William D. Gibbs, 1903-04; John A. Craig, 1904-06.

Dr. H. H. Harrington was both president of the A&M College and director of the Station, 1906-08, and Station director alone, 1908-11. Vice Director J. H. Carson had charge of much of the Station's administrative work during the period in which Dr. Harrington also was A&M's president.

Dr. B. Youngblood served as director, 1911-26, and A. B. Conner, 1926-44. Vice Director C. H. McDowell was acting director from January 1, 1945 until September 1, 1946.

ORGANIZATION

The Texas Agricultural Experiment Station, under the supervision of a director and his administrative assistants, comprises the Main Station at College Station and the field locations previously cited. Seventeen subject-matter departments, three regulatory service groups and two general service divisions form the functional units of the organization of the Main Station.

DEPARTMENTS

The 17 departments are: Agricultural Economics and Sociology, Agricultural Engineering, Agricultural Information, Agronomy, Animal Husbandry, Biochemistry and Nutrition, Dairy Science, Entomology, Floriculture and Landscape Architecture, Genetics, Home Economics, Horticulture, Plant Physiology and Pathology, Poultry Science, Range and Forestry, Veterinary Medicine and Wildlife Management. Each department is administered by a head. Beginning in 1946, research in each department was coordinated with resident instruction and extension teaching in the Schools of Agriculture and Veterinary Medicine.

REGULATORY SERVICES

The Texas Station is charged by law with certain regulatory services affecting the agricultural welfare of the State. The regulatory service groups are the Feed Control Service, State Chemist and State Entomologist.

Feed Control Service

The Texas Feed Law became effective in 1905. As the Texas Station had made and continues to make studies of feeds, their composition and feeding value, and also is engaged in developing crops the products of which enter into the manufacture of feeds, the administration of this law was placed in the Feed Control Service of the Station.

Definitions of and chemical standards for special-purpose mixed feeds have been adopted, which assure the purchaser that such feeds are adapted to the purposes for which they are sold. Names, standards and definitions have been adopted after careful investigations. Changes are made as research in nutrition and feeding and in manufacturing processes provides sound procedures for the guidance and protection of feed users.

State Chemist

The Texas Fertilizer Law was first enacted in 1899, revised in 1911 and codified in 1925. It was revised again in 1949. The State Chemist, operating in and through the Station, is charged with the administration of this law. The first bulletin relating to the Texas Fertilizer Law was published in May 1899, and similar bulletins have been issued annually since 1906.

Fertilizer control officials, fertilizer manufacturers and fertilizer technicians have met annually since 1925 for agreement on a limited number of fertilizer grades to be sold within the State.

An Insecticide and Fungicide Law was passed by the Texas Legislature in 1943 and amended in 1955. The Commissioner of Agriculture in Austin is charged with the the administration of the law and the State Chemist is charged with the analyses of certain specified samples of agricultural insecticides and fungicides.

State Entomologist

Apiary inspection work in Texas has been conducted by the State Entomologist attached to the Station since the passage by the State Legislature in 1913 of the Foulbrood Law.

GENERAL SERVICES

General service divisions are the Statistical Laboratory and the Farm Service Department.

Statistical Laboratory

Service in the fields of statistics and accounting is provided by the Statistical Laboratory. Each accounting transaction of the Texas Agricultural Experiment Station, Texas Agricultural Extension Service and Texas Forest Service is punched on cards from which financial reports, budgets and other fiscal summaries can be prepared.

The major task of the laboratory is in planning statistically sound experiments and in processing data and statistics. Data from various experiments are collected in the field. This information is subjected to various statistical procedures to determine if there are significant differences in the results obtained. If differences are indicated, further procedures are used in an attempt to isolate them. A full report of the findings is returned to the research worker to aid him in further phases of the work or in preparing the report of his findings.

Use is made of a complement of the standard IBM punched card machines, as well as an electronic calculating punch for use in statistical calculations. Research is underway to find faster and better ways of gathering and analyzing agricultural statistics.

The laboratory is staffed with specialists trained in handling agricultural data.

Farm Service Department

The Farm Service Department, established in 1954, consists of a consolidated area formerly known as the College Farm, Main Station Farm, Brazos River Valley Laboratory and College Plantation. It services all agricultural lands assigned to departments of the School of Agriculture adjacent to the A&M College campus known collectively as the "Upland Farms." It operates 3,200 acres in the Brazos River Valley 10 miles southwest of College Station in Burleson county and known as the "A&M Plantation."

Among services provided to departments which have lands assigned directly to them are machinery and tools not possessed by the departments, labor and commonly used supplies such as fertilizers, seed and insecticides. Farm Service works closely with research leaders in the departments in accomplishing the objectives of broad research programs.

The A&M Plantation serves as an outdoor laboratory for field experiments in agrono-

my, entomology, plant physiology and pathology, agricultural engineering and animal husbandry. Complete operating records are kept and are used in farm management classes.

Farm operations are almost completely mechanized, and improvements in land, buildings and equipment are made as earnings permit.

FINANCES

The federal Hatch Act of 1887 authorized the allocation to each state agricultural experiment station of a federal grant of $15,000 annually. The Station had no other appropriated funds until 1894 when $5,000 were appropriated by the Texas Legislature for maintenance of the Beeville and two temporary substations. Additional annual federal funds of $15,000 became available under the Adams Act of 1906.

The first sizable State appropriation was made for the 1909-10 fiscal year to equip and operate the expanded field-unit program. It was not until 1912 that the first State appropriation, $2,000, became available to the Main Station. Appropriations for both the Main Station and the field units increased steadily for several years.

Funds available to the Station in the fiscal year 1923-24 amounted to $324,000, being $30,000 federal funds under the Hatch and Adams Acts, and $294,000 State appropriation, of which $155,000 were for the field units and $139,000 for the Main Station.

Additional federal aid also came to the Station under the Purnell Act of 1925, the Bankhead-Jones Act of 1935 and the Research and Marketing Act of 1946.

The Research and Marketing Act of 1946 placed great emphasis on cooperative research among the state stations and the U. S. Department of Agriculture, and required that at least 20 percent of the funds appropriated thereunder be utilized in research on the marketing of agricultural commodities.

Public Law No. 352, passed by the 84th Congress and approved August 11, 1955, amended the Hatch Act of 1887 and supplemental laws relating to the appropriation of

federal funds for the support of state agricultural experiment stations. It provided for a codification, simplification and consolidation of the Hatch, Adams, Purnell and Bankhead-Jones Acts and the Research and Marketing Act of 1946. One of the main benefits of P. L. 352 is the simplification permitted of accounting procedures.

Appropriations available to the Station for the current fiscal year, September 1, 1955 through August 31, 1956, amount to $2,230,215. Of this amount, federal appropriations account for $911,936 and State appropriations for $1,318,279.

Significant to the Station's operations for many years also have been the surplus funds above those required for effective operation and administration of the Feed Control Service and the State Chemist. The Texas Legislature authorized the Station to use these surpluses in the pursuance of its research programs.

Much research at the field units has been financed in part through the sale of crops and livestock produced as by-products of research. Grants-in-aid by corporations and individuals to investigate specified problems also have become a significant factor in the overall research program and in the accompanying training of research workers.

Estimated local funds also available to the Texas Station during the current fiscal year include: Feed Control, $325,000; State Chemist, $130,000; sales of the by-products of research, $934,000; and grants-in-aid, $200,000. These so-called "local funds" available this fiscal year are estimated to total $1,589,000.

MAIN CONTRIBUTIONS

The Texas Station has good reason to be proud of its contribution to agricultural "know-how" and to new plants and livestock. Many of its findings are now commonplace practices by Texas farmers, ranchmen and homemakers. These findings also are used in high school and college classrooms.

The most important channel through which research findings of the Texas Station are made known to farmers, ranchmen and homemakers is the Texas Agricultural Extension Service.

Extension agricultural and home demonstration agents, located in most Texas counties, provide on-the-ground information and counsel regarding problems and techniques.

The basis of the educational work of the Texas Station is the continuous stream of bulletins, miscellaneous publications, leaflets and progress reports giving the results of its research experiments.

The Texas Station maintains close working relationships with daily and weekly newspapers and farm magazines, and with radio and television stations.

Another important way in which research results are made known to and are accepted by Texas farmers and ranchmen is through the many field days held at most of the substations and field laboratories. Farmers and ranchmen in the surrounding areas watch the progress of these field research units with great interest. In addition, thousands of farmers, ranchmen and other agricultural workers visit these field research units annually.

Through all of these outlets, the Texas Station strives constantly to narrow the gap between discovery and practical application.

At least five bulletins of "experiments and observations at the College" were printed in the early 1880's by the then Agricultural Department prior to the establishment of the Station. These are referred to in early records as the "old series" of bulletins. By numbers and titles, they covered: 1. Preliminary Statements; 2. Pig Feeding; Tests of Age and Breed; Dairy Tests; 3. Effect of Salt in Pig Feeding; Notes on Grasses; 4. Acclimating Cattle (Texas Fever); and 5. Acclimating Cattle; Fertilizer Tests; Feeding Cooked vs. Uncooked Food for Cows and Hogs.

Up to September 1, 1956, the Station has published 824 bulletins, 137 circulars, 159 miscellaneous publications, 15 leaflets, 1890 progress reports and many unclassified publications. Many thousand articles have been written by staff members for farm magazines, scientific journals and daily and weekly newspapers.

EARLY ACHIEVEMENTS

Results of the Station's studies under the first seven projects started in 1888 have been of inestimable value to Texas agriculture.

The first outstanding achievement of the Texas Station was the discovery of means of inoculating cattle to protect them against splenetic or tick (Texas) fever, in line with the seventh original project listed. This hastened by many years the now widespread production in Texas of purebred and grade beef and dairy cattle. Before this discovery, improved cattle brought into tick-infested areas from above the quarantine line, with few exceptions, died from this fever. Prior to the advent of systematic tick eradication on a zonal basis, beginning in 1919, hundreds of the best bulls in Texas at the time were brought to College Station for immunization against splenetic fever.

Continued progress has been made in developing better methods of feeding and balancing the rations of beef and dairy cattle, sheep, hogs and poultry. Accurate evaluations have been made chemically as well as through feeding trials of every important feeding stuff grown in Texas and of the by-products of manufacturing processes.

Texas beef cattle today bring good prices on the central markets as grass fat cattle, from cattlemen in other states as stockers and from Corn Belt operators as feeders. Texas cattle full-fed on Texas feeds have won many blue ribbons at the leading livestock expositions of the country. The present status of the cattle business in Texas represents progress traceable to results of original research projects 1 and 4.

A much more dismal picture regarding the quality of Texas cattle and the prices paid for them is portrayed in the annual report for 1888:

"More cattle are bred and shipped from Texas than from any other state in the Union, but a glance at the livestock market reports of Kansas City, St. Louis, Chicago and New York any day in the year almost, will show that the larger part of the Texas cattle sold in those cities commands a low price per pound compared with the prices

paid for beeves from the Central and Western States. The low valuation of Texas cattle is due partly to their being inferior stock, but more especially to the poor condition in which the great bulk of these cattle are placed on the market."

Root rot is a disease of cotton that costs cotton growers many millions of dollars each year. Its study was project number 2. This study, in the third decade of the Station's life, proved that the disease is the result of a fungus growth on the roots of the plant. Many other plants also were found to be susceptible to the disease. Later studies yielded information that this fungus produces enlargements called sclerotia that will survive in the soil for several years without food, but the fungus itself must have for food the live roots of susceptible plants to survive for any great length of time. The fungus is known to attack more than 600 plant species, but it does not attack the grasses and grains and other monocotyledonous plants. Enough information has been assembled to enable the farmer to grow non-susceptible plants, or to follow rotations, including the sweetclovers, as the best known means of reducing the heretofore enormous losses caused by the root-rot disease.

Studies of tile drainage for farm and garden crops, project number 6, resulted in information by which farmers might drain their soils to advantage, or irrigate through systems of tile laid under the surface below plow-depth.

A rapid expansion of the irrigated acreage has occurred in Texas in recent decades. There was no definite report on such acreage prior to the 1940 agricultural census. The census of that year showed a total of 894,638 acres and the census of 1954 a total of 4,706,017 acres irrigated. Nearly a fifth of the Texas crop land harvested in 1954 was irrigated. Rapid expansion of the irrigated acreage contributed to the intensification and industrialization of Texas agriculture that are being shown in the tendencies toward larger, mechanized, power-operated farms.

Studies with fertilizers, project number 5, proved the value of barnyard manure and of commercial fertilizers to improve the yield and quality of crops grown on some soils.

Countless variations of fertilizer ratios and mixtures have been investigated so as to

supply the proper nutrients for each crop at the time most needed and to apply them in the manner that will yield the best results.

Certain principles have been established in the application of fertilizers to crops. Among them are: sufficient moisture and oxygen should be in the root zone to enable the plant to make the most effective use of added fertilizers, as well as of residual nutrients in the soil; the plant should be adapted to climatic conditions of the area; soluble materials are in most soils and move to some extent; nutrient elements are of little benefit to the plant when in dry soil; excessive concentrations of soluble materials in contact with either the seed or young root hairs may cause serious injury and result in a poor stand; when heavy applications of fertilizer are to be made, part or most of the nitrogen should be applied as a top or sidedressing to keep the concentrations of soluble salt in the soil solution at levels which are safe for the seed and young seedlings; fertilizers applied on the soil surface may be lost in the runoff of sudden, heavy rains; leaching from sandy soils is greater than from clays and clay loams; fixation of phosphate and potash by some soils reduces their effectiveness; since phosphate moves slowly from the point of placement, it should be applied so as to be readily accessible to plant roots; an adequate fertilization program should be based on rotations rather than on individual crops; band placement of fertilizers near the seed is desirable; applications banded too far from the seed result in a retarded growth until the roots reach the supply of fertilizer; broadcast applications of fertilizer usually are less efficient than band placement.

Recommendations to improve the productivity of a particular field are made after a soil test has shown the pH value and the quantities of organic matter, active calcium, available phosphoric acid and potash present.

Studies with forage crops and grasses, project number 4, also have yielded great returns, particularly in developing new varieties and strains better adapted to Texas' growing conditions and in determining the area of adaptation of such plants developed by other research stations and agencies. Considerable emphasis has been placed in recent years on the possibilities of making

use of the drouth resistance of native and introduced plants in breeding projects, leading to experimental and better adapted varieties and strains.

Many sections of Texas cannot compete in corn production with areas more favored with bounteous and seasonal rainfall, but Station-developed grain sorghums have equal feeding value with corn, and will produce large crops where corn usually fails. These sorghums are now widely grown on the High and Rolling Plains, the Blackland and Grand Prairies and on the Coastal Plain, especially in the Coastal Bend area. The original tall types were gradually replaced by the dwarf or combine type developed by the Texas and other stations in the sorghum belt. The combine type, which permits machine harvesting, greatly expanded the area of production. A quarter of a century of painstaking research has paid off in the development of sorghum hybrid planting seed to be offered for sale at a price farmers can afford to pay. Several hybrids developed through research by the Texas Station will be available for commercial planting in 1957. Adapted hybrids are expected to yield 20 to 30 percent more than the standard varieties now grown. All the refinements bred into combine sorghum varieties eventually will be incorporated into these hybrids. These include such improvements as dry heads for low moisture content and ease of threshing, and yellow endosperm for higher feeding value. Breeding investigations for forage hybrids and Sudangrass also are underway. Grain sorghums are now used in manufacturing processes which formerly had been users of corn.

The study with fruits, project number 3, resulted in valuable information as to varieties and means of propagation adapted to the various sections of Texas. While this project was started to cover only the testing of varieties and to establish their proper names, studies soon were undertaken to determine methods for proper cultivation and care of fruits, and this was followed soon by breeding work for the development of better and more suitable varieties.

Some work on water conservation and erosion control by means of terraces was started at the Spur station in 1925. Within a year or two, the results of this work chang-

ed the ideas of scientists as to the benefits occurring in the western Cotton Belt from terracing the land and saving precious water. This work also developed startling information as to the soil losses taking place. Coupled with previous supplemental work that had gone on for a long time, these and similar discoveries elsewhere led to the formation of the present Soil Conservation Service of the U. S. Department of Agriculture.

AFTER 36 YEARS

A look-back was taken in 1924 when in Circular 33, the Station summarized its accomplishments and endeavored to forecast the research needs of the near future.

Some of its better known accomplishments were listed as:

"Developed an experiment station system on a scale large enough to take care of the major agricultural problems of the State. This includes the establishment and operation of substations . . . so that the various problems of the several agricultural regions of the State might be studied . . .

"Developed the Texas fever immunization process . . . This process revolutionized the cattle industry throughout the tick-infested regions of the world.

"Effectually administered the pure feed law of Texas, with the result that we have the highest quality of feeding stuffs of any state in the Union or country in the world . . .

"Developed and introduced the leading strains of grain sorghums now commonly grown in West Texas . . .

"Developed the fact that cotton is a drouth-resistant crop adapted to semi-humid and semi-arid conditions, with the result that a large territory in Northwest Texas, not infested by the boll weevil, has been brought into cotton growing.

"Introduced alfalfa into Northwest Texas.

"Introduced plants, including field crops, fruits, vegetables and ornamentals, from practically every state in the Union and from foreign countries . . .

"Determined proper crop rotations and fertilizer practices for practically every section of the State.

"Determined, by digestive experiments, the feeding values of the principal feeding stuffs grown in Texas.

"Made, in cooperation with the Bureau of Soils of the U. S. Department of Agriculture, detailed soil surveys of 57 counties and areas, and reconnaissance soil surveys of 134 counties in the State.

"Determined the cause of pink root of onions, a disease which has caused serious losses to onion growers of the State, and developed methods for its control.

"Developed scientific studies of ranching in West Texas which tend to put the industry on a new basis of efficiency.

"Established and operated a wool and mohair scouring and grading plant, which has been of vast service to the Angora goat and sheep industries of Texas, by enabling the growers to perfect their breeding and to obtain better prices for their wool and mohair."

Other examples, mentioned in Circular 33, of the services rendered Texas agriculture by the Station, include "the improvement of wool and mohair production in flocks of sheep and Angora goats based on studies of the weights of fleeces and other hereditary characters in relation to environment; identifying one cause of the spread and developing measures for the control of cotton root rot ... Still more examples are the development of principles relating to the differences in ability to germinate of different lots of cottonseed, under unfavorable conditions, and tending toward the ultimate development of hardier strains possessing unusual seedling vigor for use under the erratic climatic conditions so common in the State . . .

"Service to farmers and to agriculture in general by the dissemination of newly introduced or newly developed strains of plants and animals are numerous. Specific examples of service of this nature are the introduction into Texas in 1909 of Sudangrass; . . . the introduction in 1909 of feterita, a crop which has been a valuable addition to the grain sorghums; . . . the development and distribution of Spur feterita in 1918; . . . the development of the Nessberry, a valuable hybrid of dewberry and raspberry; the development of an unusually high-yielding peanut at Nacogdoches; the introduction and propagation of the Chinese

elm which has proved to be a valuable tree for a large portion of the State; the introduction and propagation of the Arizona cypress, a valuable tree for West and Northwest Texas; the development of a pedigreed strain of White Leghorn chickens based on the actual results of high egg production; the distribution of pedigreed queen bees . . ."

TODAY'S RESEARCH

The great size of Texas, with its diversity of soil, climate, native vegetation, types of farming and market facilities, requires research peculiarly adapted to these major variations. Over 250 different soil types exist, annual average rainfall varies from above 55 inches to fewer than 10 inches from east to west, elevations of agricultural lands range from sea level to nearly a mile high, and growing seasons average from above 330 days to fewer than 180 days from south to north. Nearly every kind of crop and livestock to be found in the United States, with their accompanying pests of insects, diseases and weeds, occur in Texas.

Some outstanding research now underway and noteworthy accomplishments of very recent years are summarized under appropriate headings following. Many accomplishments of the present add further benefits on top of achievements obtained by the Texas Station in its early history under the seven original projects.

AMINO ACID CONTENT OF FARM FEEDS

The nutritive value of the protein in different food materials varies according to the amino acid composition of the protein. While some kinds of amino acids (protein structural units) can be synthesized in the animal's body, others cannot. The latter are called essential or indispensable amino acids. Normal growth and metabolism do not take place if the diet contains insufficient quantities of any of the essential amino acids.

Data on the content of the 10 essential amino acids in 115 different farm feeds have been completed and are now being printed.

ANTIBIOTICS FOR FATTENING SHEEP

The inclusion of aureomycin in 50 percent concentrate total-mixed self-fed rations has

resulted in a reduction of digestive disorders, scours and enterotoxemia, and improvement in feed efficiency.

Self-feeding now appears to be practical and safe in fattening lambs.

ARTIFICIAL CATTLE BREEDING

An exploratory study in artificial breeding indicates that a high quality buttermilk powder made from sweet buttermilk may be reconstituted and used satisfactorily as a diluting medium for bovine semen.

The buttermilk diluter has equaled or exceeded the standard egg yolk citrate diluters in maintaining sperm cells in live and highly motile condition, as judged by microscopic examination. Breeding tests are under way to determine whether it is equal or superior to standard diluters in fertilizing power and in the maintenance of conception rates in actual practice.

BEEF CATTLE PERFORMANCE TESTS

Performance testing of beef cattle began at Balmorhea in 1942, at McGregor in 1949 and at PanTech Farms in 1950. Records from about 5,000 young breeding cattle tested show that the ability to gain is highly heritable (about 55 percent), and that there is little relation between conventional standards of conformation and gaining ability. Detailed carcass evaluations made in the A&M Meats Laboratory on several hundred performance-tested steers of various breeds and crosses have failed to show differences in yields of carcasses and cuts consistent with apparent on-foot differences in body conformation. This illustrates the unreliability of visual on-foot evaluations and indicates that the importance of compactness and short legs in beef animals has been greatly exaggerated.

Extensive cooking, palatability and tenderness tests have been made on carcasses from cattle of known origin. The correlation between fatness and tenderness is low, indicating that fattening has only a slight tenderizing effect. Tenderness appears to be influenced by inheritance.

Consumer preference studies made on beef cuts indicate that the lean-fat ratio is of prime consideration to the housewife and more emphasis needs to be given this point by producers.

The advantages of performance testing

as demonstrated by years of research are now being applied on a herd basis by producers over the State and heavy demands are made on the Texas Agricultural Extension Service for help in the use of performance as a guide to beef herd selection.

THE BLUESTEMS

Cytological studies of native grasses of the bluestem genus, *Andropogon*, have contributed greatly to our knowledge of these important range forage plants.

A complex relationship exists in the silver cane, pinhole bluestem group. These grasses comprise a polyploid species series that apparently has evolved through natural hybridization followed by doubling of chromosome number. Numerous chromosome counts and observations have been made of cell division during pollen formation. Four species and one variety are known to have 60 chromosomes, six species have 120 chromosomes and one species has 180 chromosomes.

A much more satisfactory taxonomic treatment of the Andropogons has been made possible as a result of the cytological studies. Names have been or are being proposed for four species and three varieties that previously have been confused with other similar groups of plants.

Preliminary steps have been made to include side-oats grama in these studies.

BODY CHEMISTRY OF FARM ANIMALS

The capacity for egg production in chickens and rates of gain in calves are known to be heritable. Enough evidence has been obtained to indicate that such productivity in animals can be related in part to the chemistry of the blood and other tissues such as the glutathione level of red blood cells and the protein-bound iodine in the serum.

Also the body chemistry has been found to be genetically controlled, giving promise of a means of understanding the kind of metabolism controlling the heritable differences in growth and egg production.

These findings also give promise of a means of selecting animals for productivity without expensive and time-consuming feeding tests.

BRUSH CONTROL

Deadening post and blackjack oak by chemical treatment followed by good live

stock management practices have given five and six-fold increases in desirable forage within 2 years. The costs can be amortized in less than 4 years.

Steer gains on mesquite-cleared pastures at the Spur station have been 50 percent greater than gains on comparable brush-covered pastures. Differences in gains were greatest during drier years.

A thin forage cover under second-growth oak near College Station at the time of clearing increased to a dense stand of little bluestem grass and other desirable forage plants under a deferment plan of management over a 6-year period.

New brush-killing chemicals, such as 2, 4,5-T, MCP, Silvex and substituted ureas, are so potent that they can be broadcast with aerial equipment in 4 gallons of spray or a few pounds of granules per acre. They also can be applied with more intensive methods of application, and are not toxic to livestock or desirable forage plants at the recommended rates.

More than 1,750,000 acres have been sprayed by aerial application of 2,4,5-T to control mesquite following recommendations developed through research at the Spur station. Studies conducted by the Department of Range and Forestry have furnished recommended treatments for aerial applications of 2,4,5-T or Silvex for the control of post and blackjack oak which infest more than 10 million acres of Texas rangeland. Aerial application of MCP to control whitebrush, or beebrush, is being perfected at the Winter Garden station.

Aerial spraying techniques are showing considerable promise for reducing the competition by scrub hardwoods for light and moisture, and are stimulating both pine growth and forage production in East Texas.

Research is underway on the application of brush-killing chemicals in granular form. Substituted urea chemicals must be taken up by the plant roots to be effective. Their low solubility makes them difficult to spray, but they are applied easily as granules or pellets in aerial equipment normally used for seeding and fertilizing. An especially desirable feature of granular ureas is the reduction in drift hazard from aerial spraying.

Individual brush plants can be controlled with application techniques developed by re-

search. Studies at the Beeville and Sonora stations showed that prickly pear can be killed by spraying the entire plant with 2,4,5-T in diesel oil during the summer.

Recommendations for controlling post and blackjack oak trees less than 6 inches in diameter by spraying the lower 12 inches of the trunk with an oil solution of 2,4,5-T were developed through studies at College Station and the Stephenville station. Trees larger than 6 inches should be frilled and the solution applied in the frill. Other trees which can be controlled with a trunk base spray of 2,4,5-T include huisache, haw, bitter pecan, ironwood, mesquite and honey locust. Elm, water oak and liveoak require that the chemical be applied to a freshly-cut surface such as a frill or stump.

Injection of 2,4,5-T and substituted ureas into the soil at the base of the plant during the late dormant and active growing periods gives good control of post and blackjack oak, elm, honey locust and chittamwood. Preliminary comparisons indicate that the per-plant cost of treatment with the recently developed soil injection method may be considerably less than the cost of trunk base sprays. Spraying the trunk base, frills and stumps, or injecting the killing solution into the soil, usually gives higher kills than broadcast aerial sprays, but they are more expensive. These methods have been used to control scattered brush plants, and brush on small pastures, around pens, in fencerows and along utility rights-of-way.

Research is continuing to develop a chemical method of control of other brush such as Macartney Rose, blackbrush and juniper.

Research results and the experience of ranchmen have shown that permanent benefits will be realized only if brush control is integrated into the plan of management so that desirable forage plants can grow and seed the treated area after the brush has been removed.

CAGE LAYERS

Demonstration of the value of cages for commercial egg production and their association with high rates of production and high feed efficiency is a significant contribution of the Texas Station.

The laying cage system of producing commercial eggs is an intensive method of

poultry keeping significantly different from the ordinary floor type, and requires different management.

Advantage of cage layers are: egg production can be fairly uniform throughout the year; cannibalism and competition between birds can be eliminated; they give freedom from coccidiosis and roundworms; feed efficiency can be improved; and mortality will be lower.

Disadvantages of cage layers are: the initial investment is high; greater attention to details is required; flies are more troublesome; and there is the problem of multiple brooding of replacements.

CATTLE FERTILITY AND STERILITY

Exploratory studies, using tissue culture techniques, show that bovine testicular epithelium may be cultured *in vitro* as long as 40 days when a bovine serum culture medium is used and when the environmental temperature is maintained at 32° C. Some indications of possible spermatogenesis taking place in the cultured tissue were observed.

These studies were designed to determine the factors in the background of problems concerned with cattle reproductive fertility and sterility.

CLEANING IN-PLACE PROCEDURES

Milk of high sanitary quality can be produced consistently when processed in equipment that is routinely cleaned "in-place."

Savings in costs of cleaning materials and labor by this method of handling dairy plant pipelines and equipment have led to wide adoption of these procedures.

CONCRETE ON THE FARM

Research on the use of concrete for farm buildings has resulted in the design of concrete wall panels and erection procedures that make it possible for two men with a farm tractor to erect low cost concrete buildings on the farm.

CORN IMPROVEMENT

Several well-adapted corn hybrids have been developed as a result of the Texas corn improvement program. These hybrids outyield open-pollinated varieties by more than 30 percent, and they are equal or superior in yield and agronomic characteristics to other available hybrids.

Texas 26, 28, 30, 32, 15W and 17W have

been developed in recent years, and each is highly recommended under conditions to which it is best adapted. These Texas hybrids also have performed well in Arkansas, Oklahoma, New Mexico and California.

Two new hybrids, Texas 34, an insect and disease-resistant hybrid for the Gulf Coast, and Texas 36, an early, drouth-resistant hybrid, were released for production by seed growers in 1956.

Continued progress by the Texas Station in the development of male-sterile and fertility-restoring seed stocks has made possible the production of three corn hybrids—Texas 17W, 32 and 36—without detasseling.

COTTON IMPROVEMENT

After about 15 years of research, beginning with basic experiments in polyploidy and species relationships, the first cotton variety to be developed from the 3-species hybrid combining Asiatic-Arizona Wild-Upland stocks, is about ready for release.

The principal improvement made in the new variety over the Deltapine type, which was used for comparison, is a large increase in boll size. Though a significant increase in yield is not shown, the trend in trials conducted for 7 years is in favor of the new variety.

Several special fiber types have been extracted from the same 3-species hybrid material. One new strain, SPHI-4, yields about 10 percent less than Deltapine but is about 15 percent higher in spinning performance. Other agronomic characters are acceptable. Another strain, Able, is considerably higher in fiber strength than SPHI-4 but is relatively low in yield. These two strains will be released as primary breeding stocks.

Also to be released are several strains which have been extracted from varietal hybrids of Supreme x Empire, Supreme x Deltapine and Deltapine x Stoneville. These strains occasionally have shown promise in the Lower Rio Grande Valley and the Fort Bend county area. They show various slight improvements in agronomic characters and, on the average, yield better than many of the big-bolled Texas varieties. However, none is considered to be sufficiently outstanding in any major characteristic to warrant its release as a new variety. To make the stocks available for more extensive breeding,

they are being released as primary breeding stocks.

Cotton variety tests have been carried on for several years in Texas' several cotton-growing areas. Results of these tests permit farmers to select varieties for planting which are best suited to the growing conditions in their respective areas.

The Texas Station is headquarters for cotton genetics research for the entire cotton belt.

COTTON MECHANIZATION

Research on cotton mechanization has been instrumental in developing and improving equipment and practices used in crop residue disposal, planting, weed and insect control, and harvesting.

Economic evaluation of mechanical cotton harvesting on representative farms on the High Plains shows that the use of strippers materially reduced the labor requirements at harvest time and greatly increased the competitive position of cotton with grain sorghum production. Operators on both irrigated and dryland farms realized increased returns from machine harvesting over hand harvesting—the amount depending largely on the per-acre yield of lint. A minimum of 50 acres of cotton yielding 200 pounds of lint per acre was indicated to justify the purchase of a stripper at prevailing prices for equipment, labor, ginning charges and lint and seed receipts.

Mechanical harvesting of cotton is increasing in the Blackland Prairie where cotton plants must be defoliated before strippers are used. On cooperating farms in 1952, harvesting cost per bale averaged $21.35 for machine-harvested cotton and $43 for hand harvesting. Results obtained in 1953, 1954 and 1955 indicate that harvesting costs of stripper-harvested cotton averaged $12.95, $26.49 and $24.73, respectively per bale, compared with hand harvesting costs of $42.21, $36.96 and $40.40.

CULTURE OF COTTON INSECTS

The pink bollworm, previously considered as an "obligatory insect" incapable of growing on other than plant material, has been reared in the laboratory of the Department of Biochemistry and Nutrition in pure chemical mixtures for several generations.

Many important facts concerning the

nutritional requirements of these insects have been uncovered. It is hoped that the findings will aid in the future development of more effective control measures. A second purpose of the investigation was to make it possible to have the insects available at all seasons of the year for insecticide tests.

DAIRY PRODUCTS

Methods of increasing the ratio of solids-not-fat to fat in high-testing milk for the production of cheddar cheese in Texas have been investigated and the successful use of nonfat dry solids for this purpose has been demonstrated.

Homogenization of the milk for cheese making at low homogenization pressures showed that losses in fat from the milk during the cheese-making process can be reduced. A reduction in the fat "leakage" is obtained from the cheeses when they are held at temperatures between 80 and 95° F.

These findings should contribute to the utilization of milk to better advantage during periods of seasonal surplus production and should aid in producing a product of higher consumer acceptance.

DROUTH-RESISTANT GRASSES

Outstanding selections of apparently drouth-resistant grasses, which were collected during 1953-54 in West Texas, New Mexico, the southern part of Arizona and the northern part of Mexico, were planted in 1955 in evaluation plots at 13 Texas locations.

The purpose of these experiments is to develop grasses which can be established on Texas ranges and help reduce the effect of drouth on the grazing industry.

In the main testing nursery at College Station are more than 3,000 selections from over 100 species of grasses for use in the tests which will extend from the Panhandle across West Texas to the Lower Rio Grande Valley.

Preliminary examinations of plants for recovery from transplanting, for forage production and for seeding habits showed outstanding differences in ecotype responses. Studies of sideoats grama ecotypes at College Station show that significant differences exist in forage production, leaf-stem ratio, seed set, seedling vigor and competitive ability during seedling stages.

Selections of these and several other species at locations throughout the State showed promise during 1955. Expansion of these plantings and studies will be made during the next few years.

At each location, grasses will be observed for their resistance to drouth, and for their seed and forage production qualities. Each will be tested under irrigation with clean cultivation and under natural moisture conditions with clean cultivation, with natural weed infestation, and with established weed competition.

DRYING AND STORAGE OF CROPS

Results of drying and storage tests and experience gained from studies of farm storage installations show that sorghum grain and rice can be stored satisfactorily on the farm. Storage procedures developed in this research have been adopted by farmers, commercial storage operators and equipment manufacturers. The estimated total savings to Texas rice growers using on-farm storage in 1955 amounted to $300,000.

EFFECT OF DROUTH

In a study of the effects of the prolonged drouth on ranch resources, it was found that from 1944 to 1954 livestock numbers decreased 50 percent in the Edwards Plateau and Trans-Pecos areas. Sales decreased 52 percent and net worth 38 percent on 45 ranches from 1951 through 1953. Liabilities increased 37 percent and short-term debts exceeded the value of the livestock. Feed purchased averaged $25 per animal unit in contrast with a normal of about $3.00.

Ninety-two ranches receiving emergency livestock loans had short-term debts of more than twice the listed value of their livestock.

ECONOMIC STUDIES OF IRRIGATION

Irrigation expansion and increased water use during the drouth and near-drouth period of 1950-54 have caused some significant changes in High Plains water supplies and irrigated farm production requirements. Farmers have lowered pumps, dug additional wells, installed underground concrete tile distribution systems and more than doubled the hours of pump operating time in an attempt to maintain farm water supplies. On irrigated farms developed before 1950, 85 percent have increased their capital

investment by $6,642, while their irrigated acreage was increased by only 28.9 acres per farm. For the area as a whole, water use per acre increased 72 percent, pump operating time increased 35 percent and the acres irrigated per well declined 26 percent during the 5-year period. Increased investment and a lengthened pumping season have raised the per-acre water cost from $7.06 in 1949 to $15.05 in 1954.

During 1953 and 1954, farmers in the West Cross Timbers area who had a dependable, though small, water supply, found it profitable to irrigate peanuts. During these years, the net value of increased production because of irrigation ranged from $4.54 to $198.56 per acre.

In 1953, there was little difference in grade between dryland and irrigated peanuts, but, with irrigation, per acre yields of nuts were increased from 11 to 45 bushels. Nut yields with irrigation in 1954 ranged from 12 to 52 bushels above dryland yields. Also in 1954, nonirrigated peanuts graded only 48 to 52 and irrigated peanuts graded from 65 to 73. The 48 grade peanuts sold for $1.85 per bushel; 73 grade peanuts brought $4.90 per bushel.

ESSENTIAL FATTY ACIDS

It was found that growing chicks need the so-called "essential fatty acids" in their diets, but the laying hen can produce these substances and deposit them in the eggs. Both the chick and the hen can inter-convert several of these essential fatty acids.

FARM ELECTRIFICATION

Recent investigations of the use of electricity to improve the efficiency of farm operations involved the refrigeration of eggs, milk and sweet potatoes; ventilating and cooling greenhouses and poultry houses; and operating automatic poultry feeders.

Electricity was used to warm poultry and livestock waterers, to heat greenhouses, to brood chicks and to heat plant propagating beds.

Refrigerated egg coolers resulted in an increase of 64 percent in the number of grade "A" eggs delivered from the farm on a twice-a-week schedule from April 4 to August 31. When the eggs were delivered on a once-a-week schedule, the increase in grade "A" eggs was 145 percent. The increased

return, through the use of the electric refrigerator, more than paid for the entire cost of the equipment and the operating cost during the first season.

An evaporative cooling system in a greenhouse increased the production of flowers more than 300 percent from April through August. The increased returns paid the entire cost of the equipment in approximately 30 days.

An "under-heat" electric brooder, operated under farm conditions, showed a lower operating cost than either infrared or L-P gas brooders.

Electric heating cable installed in long, continuous watering troughs in cage laying houses prevented the usual drop in egg production during extremely cold weather. It also eliminated the labor required to keep the troughs free of ice.

FARM LABOR EFFICIENCY

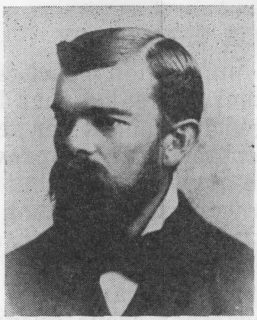
Study of peanut production practices in the West Cross Timbers revealed that labor requirements averaged 10.5 hours per acre—a reduction of 69 percent from previous methods when horse-drawn equipment and stationary threshers were used. Labor savings gained through the use of tractors, combines and other specialized equipment have increased the comparative advantage of peanuts with cotton and other crops grown in the area.

Most of the grade "A" dairies in East Texas are operated by the farm family without extra help. Labor efficiency increases as the size of the milking herd is increased. It takes 1.9 hours to produce 100 pounds of milk in herds where 16 cows are milked, compared with 1 hour for dairymen who milked an average of 64 cows. On all farms studied, there were 41 cows per farm and an average of 29 cows milked, requiring 1.5 hours of the dairyman's time to produce 100 pounds of milk.

The production of green-wrap tomatoes is the most important vegetable crop in Texas. It represents 25 percent of all vegetable shipments from the Lower Rio Grande Valley. A possible effect of the U. S.-Mexico wage agreement effective in 1950, was a 50 percent increase in labor costs per acre of tomatoes. Labor represented 25 percent of the gross cost per acre on the farms

R. D. LEWIS
Present Director

Director of the Texas Agricu Experime Station



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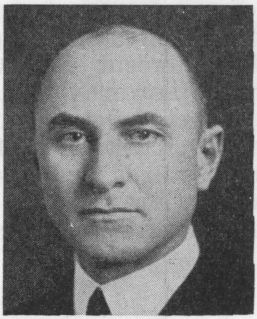
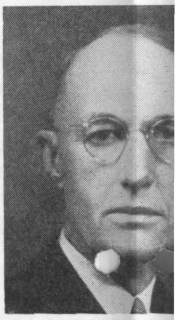
W. D. GIBBS, 1903-04

J. A. CRAIG, 19



B. YOUNGBLOOD, 1911-26



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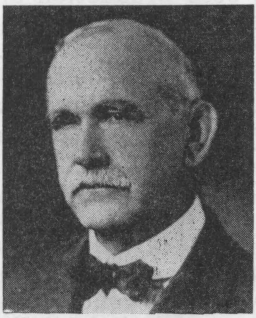

H. H. HARRINGTON, 1906-11

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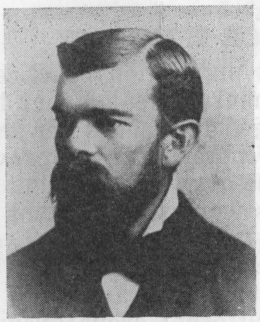
C. H. McDOWELL, 1945-46

Directors of the Texas Agricultural Experiment Station

R. D. LEWIS
Present Director

R. E. PATTERSON
Present Vice Director



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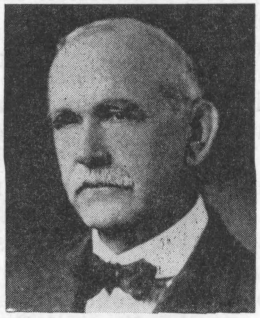
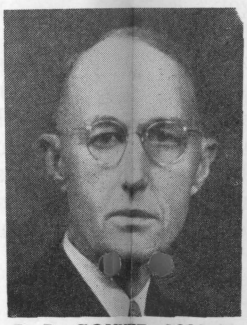


H. H. HARRINGTON, 1906-11

B. YOUNGBLOOD, 1911-26



A. B. CONNER, 1926-44

C. H. McDOWELL, 1945-46

studied. The federal minimum wage rate requirement increased packing shed costs by 25 percent in 1950 over 1949. The revised minimum wage of $1 per hour instead of 75 cents again will increase costs.

FAT DIGESTION AND ABSORPTION

The use of radioactive labeled synthetic fat clarified some of the mysteries of how water insoluble fat can be absorbed through the intestinal membranes into the body fluids and hence into the body tissue. The course of the fat was followed by a combination of chemical analyses and radioactivity measurements on samples of body fluids at various intervals of time. Information was obtained on the extent to which fatty acid molecules are split off from neutral fat during the process of digestion and absorption.

FOOD AND FIBER POTENTIALS

A tally was compiled of the Texas potential production of food and fiber if known improved practices were followed. An increase of 16 percent over a 5-year period could reasonably be realized. A similar additional increase could be obtained through more intensive use of the present cropland. More fertilizer and farm machinery would be required.

FORAGE INVESTIGATIONS

Research on cytogenetics, plant improvement, seed production and growth behavior patterns of grasses and legumes has been expanded in recent years. Cytogenetic work is developing a better fundamental understanding of breeding behavior of Dallisgrass and will aid in the development of varieties with higher fertility and better vigor. Plant improvement programs are in various stages with Dallisgrass, alfalfa, sweetclover, ryegrass, bromegrass, tall fescue and lespedeza.

Dallisgrass shows a relationship of seed set to climatic condition and nitrogen fertilization at the time of flowering. Best seed set is in late spring before temperatures get too high and relative humidity too low. A late March application of nitrogen fertilizer also gives the best seed yields.

Information is being developed on growth behavior patterns of grasses and legumes and their response in both top and root development to environmental conditions and management practices. Such information

serves as a basis for developing sound management programs for maximum sustained production and soil benefit. Cutting alfalfa in the 1/10 to ¼ bloom stage results in maximum sustained yields and optimum accumulation of root reserves, while cutting sweetclover more than twice the first year results in a drastic reduction of root reserves and death of the plants. Frequent and close utilization of small grains for forage results in serious reduction in root development and forage production. Best results are obtained with the lapse of at least a month between clippings or grazings.

Coastal Bermuda roots penetrated at least 6 feet deep in Lufkin fine sandy loam soil with a total root accumulation of more than 8 tons per acre. High rates of nitrogen fertilization did not influence root accumulation. Coastal Bermuda is an outstanding new grass and is superior to Common Bermuda in all parts of Texas except the Panhandle.

Hundreds of new plant introductions have been evaluated for adaptation to Texas soil and climatic conditions and a few, such as buffelgrass, cogwheel burclover and berseem clover, have proved to be of value.

Information has been developed by the Crystal City and Weslaco stations on high producing, good quality forage plants for irrigation in South Texas. Coastal Bermuda produced over 13 tons of air-dry forage at Crystal City in 1953. Buffelgrass produced more than 19 tons over an 18-month period at Weslaco in 1952-53.

Various crops have been tested for silage at Prairie View, Nacogdoches, Tyler, Mt. Pleasant, Temple, Iowa Park and other locations. The sweet sorghums, such as Honey and Atlas, generally are the highest producers. Cultural studies at Prairie View and College Station show that sorghum yields are about the same with planting rates ranging from 7 to 28 pounds per acre in rows and 40 to 100 pounds broadcast. Stalk size is smaller with broadcast plantings and with higher rates of seeding. Recent work at Iowa Park in seeding guar with sorghum for silage shows some promise for this practice. The main benefit is in a higher protein content of the forage.

Establishment practices have been developed for Dallisgrass and clovers in rota-

tion with rice at the Beaumont station. Best results were obtained with broadcast seedings in standing rice after the last irrigation or in rice stubble between October 1 and November 15. Establishment work with Dallisgrass at Nacogdoches and College Station indicated that best results can be obtained with an early spring seeding on a prepared seedbed. Row-seedings with a companion crop, such as oats, which also has been row-seeded, give satisfactory results in soil with a high weed population. Establishment practices for sericea lespedeza and other grasses and legumes are being studied at Kirbyville, Mt. Pleasant, Denton and McGregor.

Combinations of grasses and legumes for seasonal and year-round forage production are being studied at many locations. Oats and sweetclover have an advantage over oats alone in the Blacklands in that sweetclover extends the grazing season into the summer. Fertilization practices vary with the crop and soil, and extensive studies are necessary to develop recommendations for all areas and soils. Fertilization practices have been studied for Dallis-Bermuda-clover pastures at Angleton, Beaumont, Kirbyville, Lufkin, Nacogdoches, Mt. Pleasant and Prairie View. Other species also have been studied at these and other locations.

The primary aim of forage crops research is to develop plant materials or practices which will result in greater or more economical production of livestock or livestock products. Improved pasture practices, pasture systems and grazing management are being studied with livestock on pastures at Beeville, Angleton, Beaumont, Lufkin, Tyler and Temple. The Beeville station showed the value of a combination of annual crops for cattle production, with the growing of sorghums for silage, grazing the sorghum stubble in the fall, winter grazing of small grain and then grazing Sudan in the summer.

Work at the Angleton station shows the value of improved over native pastures. Improvement consists of preparing a seedbed, phosphorus fertilization and seeding with Bermuda, Dallis and white clover. These improved pastures have produced heifers weighing 200 pounds more than similar heifers on native little bluestem pasture at the end of two growing seasons, and calves

weighing 55 pounds more at weaning time than calves on native pasture.

The Beaumont station has developed rice-pasture rotation systems which resulted in better production from both rice and pastures. Pasture improvement consists of phosphorus fertilization and seeding Dallisgrass and white clover in the fall following rice. Cattle gains have averaged over 200 pounds per acre on the improved pastures, while average gains on unimproved rice stubble pastures were only 50 to 75 pounds.

The Tyler station has shown the value of improved pastures for dairy cattle in East Texas. Pastures improved by fertilization and overseeding with crimson clover returned $40 for each $18 spent for improvement from 1951 through 1953. Fifteen percent more milk production was obtained from a 6-acre improved pasture than from a 15-acre unimproved pasture. This station also showed the value of winter grazing over feeding silage for milk production.

FRUITS

Survey work at Weslaco has resulted in indexing citrus trees for viruses, principally psorosis; and the development of a program of certification, which provides a source of disease-free buds for propagation.

Research at Weslaco on pruning freeze-damaged citrus trees in 1949-50 produced information which was highly useful following the second freeze in 1951.

Citrus fruit quality work at College Station is giving valuable information on changes in legal maturity standards, and in responses to fertilizers and rootstocks.

Breeding work over several years to produce peaches adapted to mild winters has resulted in several selections of early, yellow freestone peaches that are now under test and which should be of value to Texas growers.

Information of value to the peach industry has been realized from testing programs with standard varieties and breeding lines at the Tyler and Stephenville stations, the Montague laboratory and at College Station. Several varieties tested under Texas growing conditions have been released from the USDA station at Fort Valley, Georgia, and are showing up well in commercial plantings.

Rootstock plantings at College Station, Jacksonville and Grapeland are giving information on the behavior of the Bruce plum on different stocks in comparison with its own roots, as now grown commercially.

Light, medium and heavy pruning of Bruce plums at Grapeland have resulted in great grower interest and the modification of some commercial practices.

Blackberry and dewberry breeding work at College Station have resulted in the development of a cross of Lawton blackberry with one of the Ness berries, and the selection of nine upright-growing plants with heavy production of fine quality fruits. These lines were propagated and are under trial at Lindale, Prairie View and College Station.

Disease-free plants of Lawton blackberry were selected in the Tyler area and propagated for planting a disease-free nursery as a source of propagating material for nurserymen.

Grape rootstock trials have been conducted at Montague for many years with American varieties, and in the past few years at Laredo, Rio Grande City and Weslaco with European table grapes.

Fruit and vegetable processing research have been expanded with the completion of the Guy W. Adviance Horticultural Laboratory at College Station. Maturity, ripening and processing studies with Bruce plums are underway. Cold storage and related studies with Bermuda onions have been transferred to this laboratory. Testing of tomato breeding lines for juice manufacture is being conducted.

GRAZING MANAGEMENT

Several new grazing studies have been undertaken on range lands at several locations in Texas during the past few years.

Results at the Sonora station show distinct advantages of grazing mixed classes of livestock over grazing by cattle, sheep or goats alone at the same stocking rates.

On the range station at Barnhart, results of studies over the past 16 years show that moderate stocking rates are desirable for maximum livestock production and soil conservation.

Experiments have been initiated on the wildlife management area near Hunt to show ranchmen the most desirable brush densities

and grazing practices for livestock-deer operations on the Edwards Plateau.

THE GUAJILLO ALKALOID

The alkaloid from the guajillo plant of West Texas was isolated and identified as N-methyl B-phenylethylamine. This alkaloid probably is responsible for the condition known as "limberleg" in sheep which have fed on guajillo for a long time.

Several pounds of the guajillo alkaloid were synthesized and are being fed to sheep to determine whether it will cause the development of the typical symptoms of limberleg. The synthetic alkaloid was toxic to small experimental laboratory animals. The chemical structure of the alkaloid suggests some possible means of counteracting its damaging effects.

HOUSE FLY CONTROL

Since the house fly has been found resistant to chlorinated hydrocarbons, considerable effort has been expended to find effective chemicals for its control in dairy barns. Several phosphate compounds show considerable promise.

HUMAN FOOD AND NUTRITION

A study is underway to determine the factors which influence eating quality in meat. Steaks from loin and round were broiled and braised in an effort to determine to what extent the cook is able to control the eating quality. It was found that methods of cooking do affect tenderness and juiciness. But no method of cooking produced meat of high eating quality from all animals. Fatness is not as important as formerly was supposed. Heredity seems to have some influence because the meat from the offspring of some sires was much more tender than that from others. These problems are being investigated further by using meat from animals of known history.

A big increase in vitamin content of corn meal and grits resulting from enrichment was found to improve the vitamin value of these cereals as prepared for eating. Regardless of the method of cooking—boiling, frying or baking—the amount of riboflavin and niacin was the same in the cooked product as in the raw ingredients. However, except in the grits and mush boiled 30 minutes, some thiamine was lost in cooking. The amount of thiamine in a loaf of corn

bread was the same whether it was baked in a tin, a glass, an aluminum or an iron utensil, and whether made with yellow or white meal, with or without flour, and with sweet milk or with sour milk, provided the proper proportion of soda was used with sour milk. The proportion of baking powder had no effect on the amount of thiamine in corn bread; but too much baking powder produced a grayish-yellow color, coarse grain and harsh texture. A corn bread loaf had more thiamine than the same amount of batter baked as muffins, and muffins had more than corn sticks.

A new method was developed for home canning. It is called the raw-pack method and is easier and more convenient than the preheated-pack method formerly used. The raw vegetables are packed in the jars, boiling water is added, the jars are closed and processing is begun immediately. Safe processing times for pint and quart glass jars were developed for blackeye peas, lima beans, carrots, cream style corn, whole kernel corn, English peas and summer squash. Homemakers using the raw-pack method are finding that the vegetables are handled less than with the preheated-pack, fewer utensils are used, the surface area required for cooking is less and the total working time is shorter.

The best ways were determined to keep, in palatable and attractive preparations, as much as possible of the vitamin C in cabbage and Southern peas. Shredded raw cabbage contained the most vitamin C. Panned cabbage, cooked with a small amount of water and none left when done, had more vitamin C than boiled cabbage, and both preparations were good in color and texture. Southern peas shelled from green pods had the most vitamin C, followed in order by snaps, peas from green pods with yellow streaks and those from all-yellow pods. The more mature the peas, the less vitamin C was left after cooking. Upon storage at 34° F., even for 1 day, there was a marked loss of vitamin C. Stored peas, while cooking, lost more of the vitamin than did fresh peas.

Utilization of vitamin C (ascorbic acid) was determined for persons who ate a controlled diet of natural foods. These foods were adequate in all nutrients except vitamin C, which was provided at each lunch and supper, either in pure powder form or in raw

cabbage. The amount of vitamin C was based on the person's body weight. Utilization was judged by the amount of vitamin C in the plasma in relation to the amount of the vitamin consumed. Cabbage as a source of vitamin C was found to be comparable with the pure vitamin powder. The amount of vitamin C in the plasma did not differentiate the older persons (62 to 68 years) from the younger ones (26 to 38 years), although all were consuming the same amount of vitamin C per pound of body weight. Each person in the two age groups had a greater amount of plasma vitamin C in winter (mean temperature 50° F.) than in summer (mean temperature 83° F.), although the diet and the respective amounts of vitamin C per person were the same in the two seasons.

INFORMATION

Information activities and materials, and certain special services of the School of Agriculture, the Texas Agricultural Experiment Station and the Texas Agricultural Extension Service are handled by the Agricultural Information Office.

Main fields of work are in news, radio, television, publications and visual aids. Included also are the bulletin and mailing rooms of the Station and the Extension Service.

Publications on subject-matter pertaining to agriculture and home economics under Texas conditions are available for the asking.

News releases are sent weekly to Texas newspapers, radio stations and agricultural magazines, and special stories and feature articles are prepared on request.

Tape transcriptions on many subjects are available to radio stations and to county agricultural and home demonstration agents who have local radio programs.

Slide sets are prepared for use by county agents and specialists. A motion picture film library also is maintained for use in disseminating agricultural knowledge.

Staff artists prepare visual material for use by other sections of the Agricultural Information Office and by other employees of the Station and the Extension Service.

Much of the time of some staff members is devoted to training county agents of the Texas Agricultural Extension Service in the techniques of handling news releases, radio

and television programs, and visual aids in their respective counties.

The former voluminous series of publications by the Texas Station and Extension Service have been reduced to four. Bulletins, miscellaneous publications and leaflets are published by each, or jointly by both. In addition, the Station continues to issue its progress reports of research results.

Texas Agricultural Progress, published jointly on a bimonthly basis, is now in its second year. It is sent free on request to Texas farmers, ranchmen, homemakers and others interested in agriculture.

IRRIGATING COTTON

Experimental irrigation of cotton was started at the Brazos River Valley Laboratory near College Station in 1953 with the following treatments: *high-moisture level*—the soil moisture level to be maintained at or above 50 percent available moisture throughout the growing season; *medium-moisture level*—the soil moisture to be maintained at or above 25 percent available moisture until the cotton began to bloom, then the moisture level would be maintained at or above 50 percent available moisture until the cotton matured; *low-moisture level*—the soil moisture to be maintained at or above 25 percent available moisture throughout the growing season; and the *check*—no irrigation water applied.

Water was applied by sprinklers in 1953 and 1954 and by both sprinkler and furrow methods in 1955.

Fifty-one inches of rain fell in the project area from October 1 to September 30, 1953. This was considerably above the long-time average of 38.5 inches. During this crop year, it was necessary to irrigate the high-moisture level plots only one time. Three inches of water were applied to these plots on August 6 and 8. These plots produced 2 bales of cotton per acre, or about 1,000 pounds of lint. The unirrigated plots produced 632 pounds of lint per acre, or an increase of about 368 pounds of lint per acre for 3 inches of water. The cost of applying the water was approximately $2.75 per acre-inch.

Only 7.48 inches of rain fell during the 1954 crop season and temperatures were above average. The high-moisture level plots

received 9 inches of water, the medium plots, 7.5 inches, and the low-moisture level plots, 4.5 inches of water. The average yield was: high-moisture level, 1,012 pounds of lint per acre; medium-moisture level, 786 pounds; low-moisture level, 665 pounds; and the unirrigated plots, 399 pounds per acre. Water cost was $2.60 per acre-inch.

The summer of 1955 was very dry, but temperatures were not as high as in 1954. Only in a few cases did they reach or exceed 100° F. The high-moisture level plots received 14 inches of water; medium, 9 inches; and low, 8.5 inches. Lint yields were: high-moisture level, 1,755 pounds per acre; medium, 1,415 pounds; and the check, 415 pounds. One of the high-moisture level plots produced 2,012 pounds of lint per acre.

There was little difference in yield and water application between the medium and low-moisture levels. The low-moisture level plots will be eliminated in future experiments.

Samples of cotton from the plots were sent to the laboratory at Texas Technological College, Lubbock, for grading and evaluation of spinning qualities. Grading showed that irrigation increased the length of staple—the irrigated plots in 1955 running from 1 to 1-1/16-inch staple — while the unirrigated plots produced cotton with a staple length of around 15/16 inch. The unirrigated cotton showed immature fibers; the irrigated cotton produced mature fibers. The grade of the unirrigated cotton was slightly higher, but the irrigated plots showed a little higher yarn strength.

There was no significant difference in the fruit dropped by the cotton irrigated by sprinkler and by surface irrigation. Yields of the cotton irrigated by sprinkler were comparable with those irrigated by surface methods receiving the same amount of water. The higher yield obtained in 1955 may have been due to a cooler summer, more experience in handling irrigation and to better insect control.

JOHNSONGRASS CONTROL

An economical method of controlling Johnsongrass is an outstanding accomplishment of the Texas Station.

Crown-oiling scattered clumps of established Johnsongrass in cotton and corn four to six times during the season at about

10-day intervals is a reliable method of eradicating 98 percent of the grass in a single season without crop injury. Costs for controlling infestations of 5 percent or less vary from $8 to $15 per acre.

This practice spread from its experimental use in 5 acres of infested cotton at College Station in 1952 to its commercial use on 73,637 acres of infested cotton land in 104 Texas counties in 1955.

Seven other chemical practices suitable for the treatment of more severe infestations of Johnsongrass have been developed, some of which Texas farmers started using in 1956.

LAND MARKET

Farmland prices have continued climbing, increasing by 1954 to 70 percent above the 1947-49 average. Land investment requirements, therefore, have continued to be one of the most rapidly rising costs in the general farm situation in Texas. Volume of land sales decreased to a very low level by the end of 1954. Farmers continued to be the most important buyers of land, consolidating or adding to acreage already owned.

LAND TENURE ARRANGEMENTS

The tenure system on the High Plains is a major barrier to full mechanization of the cotton harvest. Through special lease provisions, however, tenure as a barrier is being reduced in importance.

Long-term and written leases are not necessary for the successful operation of Blackland Prairie rented farms except in livestock-share arrangements. Livestock-share arrangements on a 50-50 basis are growing in importance in this area, but usually are not the sole enterprise under a lease.

A survey in Wharton county revealed that 70 percent of the farm families had attained practically no economic security, more than half of the families had income from sources other than farming operations, nearly a third of the farm operators had no life insurance, more than three-fourths of the farm operators did not intend to retire and 23 percent definitely opposed social security OASI coverage for farm operators. Results of this study were similar to the results of studies conducted in four other states.

Acreage of forestlands in 14 counties in Southeast Texas is concentrated heavily in large ownerships. Less than 1 percent of the owners holding over 5,000 acres own 43 percent of the land. Small owners, 21 to 5,000 acres in size, own 45 percent of the land and make up 47 percent of all owners. Timber management programs and assistance would reach the largest number of owners and acreage of timber by concentrating on these small owners.

LIGHT TRAPS

Light in the near ultraviolet region of the spectrum was used in light traps to attract and catch a large number of different insects affecting cotton and stored grains. Entomologists found the new black light insect trap effective in determining populations of night-flying insects.

LIVESTOCK DISEASES

A vaccine was developed at the Angleton station in 1954 which proved effective in protecting cattle against pinkeye, a communicable disease of great economic significance. Several commercial concerns are licensed to produce the new vaccine.

Several strains of a new viral sheep disease called bluetongue were identified at the Sonora station. A small night-flying gnat was found to be the principal vector of the virus. Based partly on this work, several companies have developed and are marketing effective vaccines against bluetongue.

Studies at Angleton, Lufkin and College Station have answered many questions concerning the control of gastrointestinal parasites of cattle.

The symptoms, lesions and cause of hyperkeratosis of cattle were discovered largely through the efforts of the Texas Station.

Widespread occurrence of leptospirosis in cattle and swine in Texas is being proved. Heretofore-unknown features of the disease as it affects farm animals are being discovered and described.

A number of conspicuous accomplishments were made for veterinary research in poultry diseases.

Cooperative efforts of poultry researchers and the Texas Public Health group proved the existence of the ornithosis-psittacosis problem in turkeys in Texas and

the United States, and resulted in the development of a research effort on ornithosis which is now underway.

The development of the phenol red indicator carbohydrate PPLO liquid medium for the isolation and propagation of the causative organism of chronic respiratory disease and infectious sinusitis of turkeys has added greatly to the efficiency of diagnosis.

The pioneer work in the development of the water method of Newcastle disease vaccination on a mass basis was accomplished at the Texas Station and has come into wide use throughout the United States.

Discovery that furazolidone is highly effective in the prevention of fowl typhoid in turkeys has been valuable in the control of losses from this infection in chickens and turkeys.

The finding of an infective, non-bacterial agent in synovitis and arthritis in chickens has led to continued research on this subject at many other experiment stations.

LIVESTOCK NUTRITION

Work at the Spur station and at College Station showed the value of adding stilbestrol to cattle-fattening rations. Increased rate and economy of gain make this practice profitable to feeders and the practice is now widely used throughout the State.

Studies at College Station showed that aureomycin in the ration of fattening lambs increased the economy of gain slightly and eliminated feedlot losses due to overeating. This practice is being adopted by commercial feeders and gives promise of reducing or entirely eliminating one of the principal hazards of the commercial lamb feeder.

Further research on the use of cottonseed meal in swine rations shows that the tolerance level for free gossypol in pigs depends on the level and quality of protein in the ration. This development provides basic information concerning factors affecting the nutritional value of cottonseed meal, analytical procedure for evaluating samples of cottonseed meal and new processing methods and new markets for superior quality cottonseed meal. One estimate of the importance of this development is a quarter of a million tons per year, sold at a premium price—a benefit to both consumer and processor.

A milk replacer formula for raising young dairy calves has been developed that

permits a change-over from a fluid milk diet at the close of the colostrum period, and enables dairymen to produce calves by this method with very low mortality losses. The use of nonfat dried milk and dried whey as components of this ration improved its nutritive properties and appetite appeal to the calves. A source of fat from a byproduct of cottonseed oil refining has been shown to carry an unidentified substance which is effective in preventing or curing scours of nutritional origin. The use of this milk replacer and a standard calf starter ration, combined with good care and management, practically eliminated mortality in the calf crop of the College herd. Excellent results also are reported in the field by dairymen who have adopted the recommended feeding and management schedules.

A low fiber ration will support production for milking cows in hot weather better than a high fiber ration. Advantages of the low fiber ration are most apparent when day temperatures reach or exceed 100° F. and when the night temperatures fail to fall lower than 75°. Dependence on high forage rations under conditions where the producing animals will consume the full ration fed, and particularly at temperatures below 95° maximum in the daytime and 70° to 72° at nighttime, is considered economically sound and practical.

LIVESTOCK REPRODUCTION

Studies at College Station on the physiology of the gonadotropic hormone showed that sows, ewes and cows can be made to ovulate by injections of this hormone and the eggs thus produced will mature in the normal manner. The fertility of such eggs has been very low. This may be due to an unfavorable environment for sperm survival in the reproductive tracts of the female.

Other work at College Sation on the tissue culture of testicular material from bulls has demonstrated that such tissues will survive *in vitro* and maintain relatively normal activity. Samples of the gonadal material can be removed from the living animal by biopsy without affecting the reproductive capacity of the animal, and can be maintained in the laboratory by judicious use of culture techniques, nutrient fluids and incubation temperatures.

LOW-FAT FROZEN DESSERTS

One of the big factors in the quality of soft ice cream and other low-fat frozen desserts is the control of bacteria that grow at ordinary ice box temperatures. Such psychrophilic, "cold-loving" bacteria, when present in dairy and food products, multiply rapidly at ice box temperatures, and thereby contribute to spoilage and off-flavor products.

While such strains of bacteria are not harmful in themselves, they may contribute to spoilage and low-quality in food products. Proper sanitation and adequate control measures are needed to avoid such occurrences.

This research has exposed the cause of some heretofore puzzling occurrences in loss of quality in these food products and has pointed the way to the solution of the problem.

MARKETING

Tremendous losses occur in the marketing of Texas green-mature tomatoes. Approximately 42 percent of the tomatoes leaving the farm are culled before arriving at the retail store. This includes 25 percent turned back to the farmer at the packing shed, 3 percent lost in transportation and 14 percent discarded during the repack operation. Additional losses at the retail store vary from 3 percent for tomatoes in cartons to 9 percent on bulk-displayed fruit.

Research indicates that these losses can be reduced substantially by the farmer. This includes the selection of larger, more mature fruit, use of liners in field boxes, proper stacking of containers in trucks, protection from sun and careful handling at the packing shed.

A pricing schedule was developed for citrus showing prices for smaller containers based on the standard bruce box. This enables packers and others in the industry knowing bruce box prices to convert those prices quickly to any size or type of container preferred by individual buyers.

A controlled experiment in retail grocery stores showed that white and red grapefruit are largely non-competitive products. White grapefruit sales are not affected by selling red grapefruit at the same price. This provides an opportunity for a sequence of advertising and merchandising aimed specifically at the products in largest supply. This study indicated also the need for better iden-

tification of grapefruit by color and by state of origin at the retail level.

Analyses of shipments of vegetables in mixed cars from the Lower Rio Grande Valley provide information on vegetable volume not previously available. This facilitates buyer ordering of less than carload lots, thereby improving distribution and increasing the overall demand for Valley vegetables. Shipments included 34 different vegetables, with carrots and cabbage each found in over 50 percent of the mixed carloads shipped by rail or truck.

Availability and use of approved cotton planting seed were determined by a study of the major cotton areas. Approved seed are pure as to variety, well matured from mid-season ginnings, delinted, recleaned and graded, treated to prevent disease damage, and tested with a minimum germination of 80 percent. They are sacked and stored properly to prevent heat damage and to maintain and preserve the quality of the seed.

The Lower Rio Grande Valley gins distributed the greatest volume of registered and certified planting seed to growers and four-fifths of these seed were of Deltapine types. The same type is planted on a similar proportion of the acreage in the Upper Gulf Coast area. In the Rolling Plains area, the leading variety was Lankart, largely non-delinted certified.

Housewives in the Houston metropolitan area were interviewed on their knowledge, uses and preferences for beef cuts. They prefer steaks from carcasses graded U. S. Good over U. S. Choice or U. S. Prime, irrespective of price, because of dislike of added fat in the higher grades. These results were checked and confirmed by a retail store test in the same city. Apparently U. S. grades do not represent the order of consumers' preferences. This raises serious questions as to the desirable weight and finish to feed cattle and the grades of beef to sell in retail stores.

Costs of drying and storing rice and grain sorghum on farms have been determined. This information, used with seasonal price differences, permits a producer to decide on immediate sale at harvest, commercial drying and storage or on-farm drying and storage.

Livestock auctions have increased in importance in recent years and handle large

numbers of all species of livestock. Studies were made to develop the most efficient auction facility for Texas conditions. This includes the planning of physical facilities to permit rapid and economical performance of the functions of unloading, penning back, selling and loading out of livestock. Substantial savings in labor are possible with the model auction.

Criteria have been established for specific livestock auction expenses so as to provide managers with operational standards. This guide indicates desirable changes in operating methods to permit lower costs and possible decreases in sales commissions.

Wool has been graded at the shearing pens and marketed on the basis of grade and length. This graded wool brought 3 to 5 cents per pound net more than ungraded wool of similar type. This indicates the desirability of changing from the system of selling wool in the original bag.

NEW MARKETS FOR COTTONSEED MEAL

Processing variables in the mill during the production of cottonseed meal result in wide variations in the nutritional value of the protein. This is true of all of the important types of commercial processing, including the hydraulic, the screw press, the solvent and the prepress solvent methods.

One of the most significant accomplishments of the work to improve the quality of cottonseed meal was the development of chemical laboratory tests for the evaluation of protein quality in different samples of the meal. With the aid of these analytical procedures, manufacturing methods have been established for the production of superior quality meals for use in rations for swine and poultry. As a result, extensive new markets for premium quality cottonseed meal have been established.

NEW STRAIN OF DAIRY CATTLE

A strain of dairy cattle better adapted to the climatic conditions of the South is a goal of the Texas Station. Some three-fourths Jersey, one-fourth Brahman cattle, with a few seven-eighths Jersey, one-eighth Brahman females, have been produced.

In studies on factors affecting the heat tolerance of individual animals, the actual air temperature was found to be the most important single factor in the animal's physiological responses to hot environments.

Limited results indicate that only a part of the cross-bred females will carry the inheritance needed for production equal to control animals of the Jersey breed. This result was anticipated, and further work is needed to determine whether the higher producing cross-bred animals can be used successfully in developing a strain of superior merit.

OFF-CAMPUS SHORT COURSES

Since the idea for this particular kind of short course was crystallized about 1952, requests for them have taxed personnel limitations.

Under the off-campus short course plan, interested persons in a county or area apply for the course through their county or district agricultural agents, and a member of the regular teaching staff of the A&M College of Texas is assigned. Invariably the teacher is a joint employee of the A&M College and the Texas Station, one who has had a hand in the research phase of developing the material thus offered to the farmer or ranchman.

The professor assigned to teach the 5-day short course studies the area in question in view of the subject requested, and of any special problems the county agent might have mentioned.

Classes of this type are limited in enrollment so they come between 20 minimum and 30 maximum. This size enables the professor to give personal attention to each member of the class.

Through March 1956, a total of 38 off-campus short courses were held for 983 participants. Subjects have included beef cattle, wool marketing, dairy, pasture, irrigation, poultry, soils and fertilizers, vegetables and general crops.

ORNAMENTALS

An experiment conducted at College Station during the past 5 years on practical methods for cooling greenhouses shows a significant improvement in the production of most greenhouse crops during the summer. This procedure will increase income and reduce production costs for these crops.

A wide market potential was found for the mass marketing of ornamental crops through high human traffic outlets such as supermarkets and dime stores. Nurserymen can increase their sales in this manner

while continuing to market their produ through the present type of outlet.

PASTURE IMPROVEMENT

A study of dairy farms in East Texa shows the value of pasture improvemen practices. Unimproved pastures average only 50 days of grazing per acre. Over a 4 year period, with an average annual outla of $15.81 per acre, grazing was extended t 170 days on a group of farms where a num ber of recommended practices were follow ed. On another group of farms where les intensive work was done, 106 days of gra ing were provided at a cost of $8.44 per acr per year during the 4-year period. On sti another group, 70 days of grazing were ob tained at an annual cost of $4.09 per acre.

PECANS

Research by entomologists and patholo gists of the Texas Station, and an energeti follow-up by research and extension hort culturists, have resulted in the developmen of a sound and much-used spray progra for pecans in Texas.

Fruit quality analyses, including a hig percentage of pecans sampled from th many pecan areas of Texas, have been mad to determine a fair means of buying and sel ing pecans, and to establish a suitable set o standard grades for Texas pecans. Severa years more work will be required.

The pecan commonly bears a light cro or no crop following a heavy crop year. Ba sic studies with leaf analyses for the min eral elements have pointed out the relation ship between mineral elements and bearin on which orchard management practice tending to alleviate the alternate bearin can be based.

A mechanical huller and separator ha been developed for harvesting pecans.

PHOSPHATE-DEFICIENT RANGES

Animal production data show that it i necessary to supply supplemental phosph rus to grazing animals in phosphorus-defi cient areas to prolong the life of the cows an obtain satisfactory calf crops.

Supplying phosphorus through the drin ing water gave a higher net return tha other methods studied. Application of pho phate fertilizers to stands of native rang grasses resulted in a loss of better grass and less total forage production over a peri

of years. As the abundance of the better grasses decreases, both under fertilized and non-fertilized conditions, production also decreases.

Preliminary results from small plots show that a combination of phosphorus and potassium fertilizer tends to maintain and increase the stands of better forage plants.

Present research in this area is being directed toward a more complete explanation of these results.

PLANT INSECTS

A well-equipped entomology research laboratory is operated at College Station for screening new insecticides for use in controlling insects attacking field crops. Hundreds of new compounds have been tested and those which were found effective in both laboratory and field tests have been recommended for general use.

Experiments have been conducted on the timeliness of applications for seasonal control of the major insect pests of cotton. Early-season control of such insects as thrips, aphids and spider mites was found to be profitable.

Two systemic insecticides, among many tested, have proved effective and profitable for use on cotton to control pests. Applied as a foliage spray, demeton protects cotton from damage by aphids and spider mites for several weeks. Thimet applied to the cottonseed at planting time will protect seedling cotton from thrips, aphids and spider mites for 4 to 6 weeks.

A new pest, known as the brown cotton leafworm, invaded cotton fields in some sections of Texas during 1954 and chemical controls were developed during the same growing season.

The pink bollworm has spread in recent years to all cotton-producing counties of Texas, creating a potential threat to the production of this crop. Research on the control of this pest has been greatly accelerated. A well-equipped laboratory is operated at Brownsville by the Entomology Research Branch of the USDA for basic studies on its control. Basic studies on certain phases of the problem also are conducted at College Station.

Results of many experiments in the Lubbock area show that it is profitable to use insecticides for the control of such cotton

insects as thrips, fleahoppers and bollworms on cotton.

Research has been expanded on the control of legume insects. Progress has been made in the development of economical controls for insects attacking various legume crops.

Definite progress also has been made in the evaluation of honeybees as pollinators of legume crops.

The passage of Public Law 518 has increased the demand for information on problems in the control of vegetable insects with chemicals. Experiments are being conducted at the Weslaco and the Crystal City stations to find effective controls for vegetable insects without creating a hazard from poisonous residues on the crops.

The biology and control of insects attacking fruit and nut crops are being studied. Some of the new chemicals show good promise in controlling these insects.

PLANT PHYSIOLOGY—DISEASE

Outstanding results obtained recently in plant physiology and pathology research include:

Development of a spray program for pecans by which trees may be sprayed economically with zineb, which results in high control of the major disease—pecan scab—without simultaneously building up insect infestations, as earlier fungicide programs had done.

Development of a bacterial blight-resistant Empire-type cotton variety to be released by the Texas Station as "Austin."

Discovery of the relationship between levels of nitrogen and carbohydrates in the cotton plant and susceptibility or resistance to bacterial blight.

Discovery of the tobacco ringspot virus as the cause of watermelon pimples, a major disease of watermelons in Texas. It was demonstrated that the virus is seed-transmitted in watermelons.

Studies on the physiology of the action of chemicals affecting the shedding or retention of cotton leaves, supporting the practical cotton defoliation research program.

Clarification of the essential nature of sulfur in the nutrition of cotton and establishment of the exact levels required.

Determination of the physiological effects of systemic insecticides—schradan,

demeton, thimet and 17078—on the cotton plant.

Cataloguing of plant parasitic nematodes in Texas, now underway.

Determination of the extent of mutual substitutability of potassium and sodium in the nutrition of cotton and the influence of these ions on the utilization of calcium.

Development of Texto 2, a commercially acceptable variety of tomato resistant to Fusarium wilt and gray leaf spot.

Discovery of tristeza in the Lower Rio Grande Valley and Winter Garden and the development of a precise procedure for eliminating this virus disease from Texas citrus.

Development of a procedure by which freshly harvested onions may be exposed 9 minutes to infrared heat to give practical control of Botrytis neck rot.

POISONOUS PLANTS

Control measures have been established for peavine, garbancillo, loco, senecio, bitterweed, buckeye and other hazardous plants growing on Texas pasture-lands.

A record has been made of the distribution, abundance, economic importance and suggested control measures for the 34 most hazardous plants; for 22 plants that are less hazardous because of low toxicity, their limited spread or their less frequent grazing by livestock; and of 13 plants recorded as toxic under certain circumstances but which usually are not considered hazardous.

Photosensitization of cattle in South, Central and East Texas has been under study by the Texas Station for 4 years. Outbreaks of the disease studied occurred on pastures under two conditions. The most prevalent were those with a high percentage of annual grasses and weeds and a low percentage of good perennial grasses. A number of records have been established for pastures on which molds were abundant on the old vegetation and were consumed with the new spring growth. The nature and causes of the disease have been established and recommendations have been issued for management practices to cope with it.

Most of the plants poisonous to livestock on Texas range lands are native plants. They are grazed most frequently when desirable forage and salting and watering facilities are scarce.

POPULATION STUDIES

The size of the farm population is estimated annually. Changes in the composition of the population are determined and their implications for agriculture are pointed up. Individual requests for information on population changes indicate its extensive use by businessmen, church and school administrators, and by leaders of farm and city organizations in planning their future operations.

POULTRY BREEDING AND INCUBATION

Significant contributions of the Texas Station in the blood antigen, breeding and poultry incubation fields include: the demonstration of the selective value of the blood antigens in breeding for economic characteristics such as hatchability, growth and egg production in chickens; demonstration of the necessity for maintaining a storage temperature of 55 to 60° F. for the maximum year-round hatchability of eggs going into Texas incubators; development of the first random sample turkey meat performance test in the United States; development of a replicated random sample egg production test for measuring the egg producing capacity of various strains and crosses of egg production stock in Texas; development of a dominant white broiler strain of birds showing fast growth and excellent market quality; development of three inbred lines of White Leghorns for use in hybridizations; and development of a line of White Leghorns showing a high rate of egg production and excellent feed efficiency.

POULTRY AND EGG MARKETING

Major contributions made recently by the Texas Station in poultry and egg marketing include: demonstration of the major factors associated with low market grades of Texas turkeys; demonstration of the necessity for large volume and use of modern machinery in processing plants for maximum efficiency and lowest cost; demonstration of the consumer acceptance of chicken parts with an associated increase in consumption; demonstration of the value of hormones in the improvement of market quality of chickens; and demonstration of the necessity for refrigerated storage of eggs from the time they are gathered until they reach the con-

sumer for maintenance of maximum egg quality.

POULTRY NUTRITION

Significant contributions by the Texas Station in poultry nutrition include: the discovery of the growth-promoting activity of antibiotics; demonstration of the presence of an inorganic growth stimulant in the ash from several feedstuffs; demonstration of the growth-promoting activity of several feedstuffs like fish meal, fish solubles, dried whey, distillers dried solubles, alfalfa leaf meal and molasses solubles, because of their content of unidentified factors; demonstration of the nutritive value of poultry offal meal and feather meal in poultry rations; and demonstration of the value and efficiency of high-energy-type laying rations.

SEED POLICY AND RELEASE COMMITTEE

Details of the increase and release in Texas of new strains of field and horticultural crops created by workers of the state agricultural experiment stations and the USDA are now handled by the Seed Policy and Release Committee of the Texas Station.

Personnel of the committee include the director, editor and representatives of the Departments of Agronomy, Genetics and Horticulture.

Among the varieties and hybrids released recently through this committee are: corn, Texas 32, 34, 36, 15W and 17W; wheat, Frisco, Concho, Crockett and Knox; oats, Alamo and Bronco; barley, Kearney and Cordova; cotton, Austin, Blightmaster and Mebane B-1; peas, Extra Early Blackeye, Cream 12, Cream 40 and Purple Hull; tomatoes, Texto 1, Texto 2 and Weshaven; cantaloupes, Rio Gold; clover, Floranna, Louisiana Synthetic No. 1 and Cogwheel; sesame, Rio and Blanco; flax, Newturk; sorghum varieties, Combine Hegari, Combine Bonita, Redbine-58 and Combine Shallu; sorghum hybrids, Texas 590, 601, 610, 611, 620, 650 and 660; onions, Granex, L-36, L-365, Eclipse, Early Crystal 281 and White Granex; spinach, Early Hybrid 7; rice, Century Patna, Bluebonnet 50 and Improved Bluebonnet.

SESAME

Considerable progress has been made in the breeding program with sesame. Rio, a non-shattering variety which is adapted to

mechanical harvest, was released to Texas seed growers in the spring of 1955.

Progress also is being made in breeding for disease resistance and in harvesting methods.

The acreage planted to non-shattering sesame in Texas probably could equal that of oats or barley if varieties are developed that can be harvested as easily as small grain or sorghum.

SHEEP

Performance testing of sheep in cooperation with Texas sheepmen has been underway at the Sonora station since 1948. Rate of gain, clean fleece weight and staple length have proved highly heritable. Increased interest in selecting for characteristics of economic importance is evident among both commercial and purebred sheep producers.

Studies with wool marketing warehouses in Texas show that wool graded according to staple length sells at a net advantage of about 5 cents per pound above comparable ungraded wools. Better preparation of wool, including grading at the shearing pens, also has increased the net return to growers.

The attention of growers has been focused on the advantages to be derived from the application of performance as a guide in selection and the use of better methods of shearing and preparation of wool. Growers are making application of these findings on a substantial scale.

SMALL GRAINS

Recent research in small grains has resulted in the distribution of Mustang and Alamo oats, Quanah and Frisco wheat, Cordova, Kearney and Goliad barley and Newturk flax.

Technical problems in progress include studies of the nature of resistance to rust in small grains, the causes and mode of inheritance of shattering in wheat, a search for favorable mutations in wheat and oat varieties treated with X-rays and a search for greenbug resistance in small grains.

Mustang oats, because of their outstanding winterhardiness and leaf rust resistance, have materially reduced losses from low temperatures and extended the use of oats for forage. Alamo oats are resistant to leaf and stem rust and permit the growing of oats for grain in South Texas where formerly

this was impossible. These two new varieties have influenced an expansion of oats in Texas to more than twice the 10-year average and the seeding of nearly a million acres for forage alone.

Cordova barley, because of its high yield, mildew resistance and smooth awns, has contributed to a marked expansion of barley acreage. Goliad provides farmers with a disease-resistant variety for South Texas capable of producing high forage yields early in the fall. Kearney is the first variety of small grain distributed which has resistance to greenbugs. It is adapted to the High Plains because of its cold resistance. Other greenbug-resistant lines are now being isolated from hybrid lines.

Quanah wheat is a high quality, hard red winter wheat with moderate resistance to the rusts and, together with Frisco, a soft red winter wheat, provides farmers of Central Texas with greater protection from these diseases.

Newturk flax will give farmers increased protection from losses often caused by low temperature.

Studies of the nature of rust resistance in wheat are helping to give basic information on why some varieties may be resistant or damaged only slightly by rust. Irradiated wheat and oats are being studied and screened in an attempt to find greater resistance to rust, Helminthosporium blight, short stature or other mutations of value for the breeding program.

SOIL FERTILITY

Research has shown that money can be saved by buying fertilizer on the basis of the cost per pound of plant food rather than on the total cost per ton.

Detailed experiments at most Texas field units have determined the grades and amounts of fertilizers best adapted to particular soil and crop conditions.

Moisture has been a limiting factor in the results obtained from many of the fertilizer experiments conducted by the Texas Station in recent years. A high loss of significant results has occurred because low rainfall limited production to a level no better than might have been expected without fertilization.

Both the yield and the protein content of irrigated Coastal Bermudagrass were in-

creased by nitrogen fertilization on Lufkin fine sandy loam soil. Hay production on this soil, when well supplied with other nutrients and water, was 2 tons of 8 percent protein hay with no nitrogen added. When 1,050 pounds of nitrogen were applied per acre in five applications, 14 tons of 14 percent protein hay were produced. The rate of nitrogen most profitable to a farmer will depend on the costs of water and fertilizer and the value of the forage. The most profitable rate of nitrogen in this experiment was 360 pounds per acre if nitrogen cost 2 cents per pound and hay was worth $15 per ton. If hay was worth $20 per ton and nitrogen cost 13 cents per pound, it would be profitable to use up to 700 pounds of nitrogen per acre.

Iron chlorosis of grain sorghum and oats is widespread on the Rio Grande Plain of Texas. Chlorosis can be controlled if a foliar application of a spray solution containing 2.5 to 5.0 percent copperas and 0.01 percent of a wetting agent is applied within 10 days after seedling emergence, and a second application is made within 14 days of the first. These sprayings should be applied over the entire field. Additional applications should be made in areas where chlorotic plants develop.

Fertility studies indicate that nitrogen and phosphorus are generally needed on all East Texas soils for good production of pasture and field crops, and the sandier soils also may require potash. In general, fertilized pastures will produce about 220 pounds per acre of good quality forage for every inch of rainfall from March to September, while non-fertilized pastures will produce about 110 pounds of low quality forage. The phosphorus requirement of pastures on acid soils may be supplied by superphosphate or rock phosphate. Rock phosphate tends to be slower in response and requires higher rates but may be effective for a longer time.

Good corn production will require a minimum of 8,000 plants per acre when properly fertilized. Lodging may occur if potash is not adequate.

A series of systematic experiments were conducted on the five principal soil types used in rice production. They dealt with amounts and proportions of nitrogen, phosphorus and potassium, time and method of

application, sources of nitrogen, condition of the soil at the time of application and other factors. Much of this work was done on farms of cooperating owners. These experiments resulted in a significant increase in yield and net profits. The yield increases for the best treatments averaged 4 to 6 barrels of rice per acre on different soil types.

SOIL RESEARCH

A new phase of soil research, with major emphasis on the mineralogy and chemistry of the soil, was initiated in September 1952. An X-ray diffraction unit was obtained at an installed cost of $14,000 to identify and characterize the mineral portion of the soil.

To date, 62 soil profiles have been collected for mineralogical and chemical characterization studies. They include some of the more agronomically important soils from the Rio Grande Plain, Gulf Coast Prairie, Forested Coastal Plain, Blackland Prairie and the High Plains.

Studies on those profile samples have resulted in a clearer understanding of soil development and formation, and have shed new light on some of the chemical and physical properties for which there had been considerable speculation, but very little concrete evidence.

SORGHUM HYBRIDS

The successful development of sorghum hybrids by the Texas Station, through the use of male-sterile and fertility-restoring seed stocks, is the most important advance in the crop improvement field in recent years.

The best of these hybrids outyield varieties now grown extensively over Texas by 20 to 30 percent.

Several thousand acres of seven adapted sorghum hybrids will be produced by commercial seed growers in 1956, and seed will be available for large-scale farm plantings in 1957.

SWINE

Swine growers are cooperating with the Texas Station in performance testing of swine in studies designed to produce the ideal meat type hog as determined by rate and economy of gain plus desirable carcass quality. This study got under way in 1955 and much interest is being shown in it by Texas swine breeders.

Breeding work at Crystal City has res ed in the introduction of Early Crystal 2 an early, white onion resistant to pink r White Granex, a first generation hybrid ion similar to Granex but white, and seve others of similar value.

Recent work at Prairie View with Gra onion showed a highly significant yield sponse to both sulphur and phosphoric a

Cold storage experiments at Dallas sh ed that onions of the Bermuda type can stored successfully at temperatures of 32 35° F. and relative humidity of 50 to 75 p cent, but unless the onions are stored v soon after harvest, sprouting occurs s after their removal from storage.

Spinach breeding work at Crystal C has resulted in the introduction of Early H brid 7, a semi-Savoy type, resistant disease, giving high yields and adapted machine harvesting.

Breeding work at Crystal City, Wes and College Station has resulted in the int duction of Texto 1, a very productive va ety; Texto 2, a good commercial variety w considerable disease resistance; and W haven, a highly productive variety with so disease resistance. Further work at Coll Station in breeding for yield and dise resistance has resulted in promising se tions that are now under test.

Tomato marketing studies in East Te have resulted in many suggestions for i provement in handling, and also much va able information on methods of ripening a repacking tomatoes in centers of distributi Problems of handling pink tomatoes (inste of green-mature) also are being investigat

Breeding work with Southern peas College Station has resulted in further i provements in Purple Hull 49, Cream 40 a Extra Early Blackeye, with selections fr these lines under trial in several locati over the State. In addition to yield, atten has been given to the development of pla producing peas in an upright position, hi on the plant, and plants non-vining and w minimum foliage so as to facilitate mecha cal harvesting. Several cream and three p purple hull peas are being tested for poss release.

Canning and freezing studies showed better adaptation of certain strains of Southern peas to processing.

Cantaloupe breeding work at Weslaco has resulted in the introduction of Rio Sweet and Rio Gold, melons of fine quality and with considerable disease resistance. Later work at Weslaco and College Station has developed other lines with resistance to disease and also with desirable horticultural characters.

Watermelon breeding work at College Station has resulted in the isolation and introduction of a Black Diamond type with non-lobed leaves, a character which is very useful as a genetic marker; and a bush-type, yellow-fleshed melon that gives promise in the development of commercial red-fleshed bush types. Breeding lines of the Black Diamond type possessing resistance to wilt and anthracnose are being tested.

Breeding work with cucumbers is under way at College Station. A trials program has resulted in the recommendation of several new lines for pickling. These lines possess disease resistance and are more productive than older varieties.

Considerable work has been done at Gilmer in indexing sweet potatoes for internal cork, and working out a program for disease-free stock of sweet potatoes for planting.

VALUE OF BRUSH CLEARANCE

By contracting for clearing brush land in the Corpus Christi area, farmers increased land values by $138 per acre at an average cost of $41. Within a few weeks, brush-covered pasture was converted to cropland on which cotton was generally planted as the first-year crop.

WEARABILITY OF A FABRIC

Studies conducted for several years by the Texas Station showed that the wearing quality of a fabric cannot always be predicted by the quality of the fiber and yarn. One or more factors other than those generally measured are evidently responsible for differences which sometimes occur among fabrics.

Shirts with the greatest visible signs of wear were not those that lost the most strength. Earlier and greater shrinkage, greater loss in strength and sometimes more yellowing occurred when shirts were launder-

ed in three commercial laundries than wh laundered by household methods. The nu ber of days a shirt remained soiled h slightly more effect on the loss of streng than the number of hours worn.

To obtain maximum use from shirts, th should be laundered as soon as possible aft wear.

WEED CONTROL

The use of chemicals to control weeds cultivated land has received major emphas from the Texas Station in recent years.

Research and farm applications of herb cides show that, when properly used to su plement other weed-control practices, gre savings usually are realized in man-hour Control practices include: cultural methods seedbed preparation, sweep cultivation, r tary hoe and cross-plowing or cross-cultiv tion; chemical methods — pre-emergen treatments and post-emergence treatment and combinations of these methods.

Research seeks to gain a better unde standing of the "how and why" of herbicid action, and the weed and crop reactions th occur under the varying influences of soil weather and other factors.

Spraying at the proper stage of we growth with proper chemical formulations highly important in weed control work.

Perennial weeds are easier and cheap to control when they are at the early bu stage. Annual weeds are easier to contr when they are young and actively growing

Outstanding work by the Texas Station the control of Johnsongrass is treat separately in this section.

Recent experiments developed formu tions that gave successful control of scatter stands of trumpet vines in cotton, corn an alfalfa as a supplement to cultural practice All phenoxy-type herbicides acceptable f use near growing cotton were tested duri 1956 for foliage and crown treatment trumpet vine, eardrop vine, tie vine and t vine milkweed.

Among the group of modern herbicides commercial use, more studies have been co ducted by the Texas and other state exper ment stations on hormone-type weed-killer such as 2, 4-D than on any other compound

Control practices in use throughou Northwest Texas for bindweed and blu

weed are based on results of research conducted by the Amarillo station since 1949. Surveys indicate that annual losses from these weeds are about $825,000.

WILDLIFE

The diet of cattle and deer is not identical in quality and quantity. Competition between deer and cattle is favorable to deer only during late fall when deer are consuming mainly browse; cattle are favored during the rest of the year. Consequently, heavy stocking with cattle has more harmful effects on deer than does heavy stocking of deer on cattle.

A method of determining the age of juvenile mourning doves by the molt pattern of the wing has been developed. This technique is useful when combined with a check of the hunter's kill in the fall to determine the degree of nesting success of doves the previous spring and summer.

Populations of cotton rats, a native rodent that is destructive of range grasses and eggs of ground-nesting birds, are correlated primarily with the amount and distribution of suitable cover (mainly bluestem grasses). If this cover is reduced, cotton rat populations are correspondingly reduced; if it is removed, cotton rats disappear from the area.

The mottled duck is a popular resident duck on the Gulf Coast Prairie. Its nesting success is correlated with burning practices on the prairie ranches. Spring burning of pastures destroys nesting habitat. Where the burning of dead grasses is a desirable range practice, patches of dead grass left in and near marshes would provide sufficient nesting cover to maintain good populations of this duck.

WHOLE-BODY RADIATION

The Texas Station demonstrated that domestic birds may be exposed to high levels of whole-body radiation with only a temporary drop in fertility. Fertility returns to normal about 10 weeks after radiation. The LD/50 dosage has been established at approximately 600-700 R units of whole-body radiation.

TOMORROW'S PROGRESS

Permanent advances in Texas agricultu are the result of scientific research of t past. Research now underway or in prospe gives high hopes of other great advances the future.

The experience of the past half centu has proved that scientific research in agr culture repays the original cost many tim It has led again and again to larger yields higher quality crops from the same acreag to more efficient animals, to control of i sects and of plant and animal diseases a parasites, and to great reductions in lab and time costs of farm and ranch operati and of the manufacturing and distributi processes which use the products of far and ranches.

Yet the more we learn, the better realize that present agricultural knowled still is inadequate to meet the future nee of our people.

During the past several decades, there h been a gradual shifting of emphasis of agr cultural research devoted largely to the we fare of the farmer, ranchman and hom maker to the present day concept of fo and fiber production, resource conservati and use, processing, marketing and consum tion for all the people. Today every pers has a stake in agricultural research sin the quality and quantity of food and fib available for his welfare are dependent the use of information developed throu organized research.

In planning for agricultural research the immediate future several consideratio are kept in mind. Some major ones are:

1. Protect the gains that have been a are being made.

2. The nation's population is increasi at the rate of 7,000-8,000 daily, and is cre ing a constantly greater demand for food a fiber to be produced by fewer and few farmers and ranchmen.

3. Continued improvement in the diet the average person is highly desirable. Pr sent trends are toward less high-calorie fo per person and toward more food high proteins, minerals and vitamins.

4. A broad increase is needed in fund mental research on the efficiency a

economics of transportation, processing, distribution and merchandising of food and fiber.

5. Increased productive capacity will have to be gained largely by more efficient use and conservation of soil, water, livestock and human resources.

6. Ways and means must be found to encourage our farmers shifting from the production of crops in long-time surplus. For some of these surplus crops we need to develop better storable forms for later use; for others we need to develop new uses to expand their market outlets.

7. We need to develop better methods of dealing with the severely recurring drouths.

8. Answers are needed to many questions arising from the increased use of supplemental irrigation water.

9. Bacteriology has many unsolved problems the answers to which will have direct application to present-day and future living.

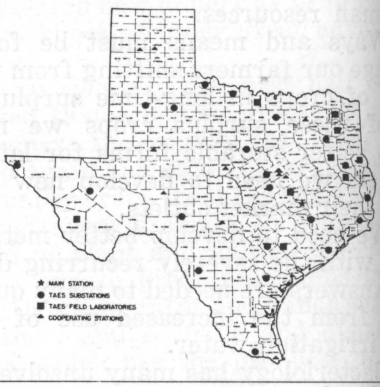
10. We need to intensify fundamental research studies and to attract to the agricultural sciences more of the brighter students graduating from our high schools.

11. Our best research results will come from a continuity of purpose and effort over a long period of time.

12. Agricultural leaders recognize that to maintain potentials of production greater than actual requirements, research in all phases of agriculture and its basic resources will have to be intensified.

Research Field Units

TEXAS AGRICULTURAL EXPERIMENT STATION AND COOPERATING AGENCIES



Name or number	Address	Location and main highw
SUBSTATIONS		
1	Beeville (Box 871)	5 mi. E., U.S.
2	Tyler (Route 5)	10 mi. NW.,
3	Angleton	3 mi. NE., S.
4	Beaumont (Rt. 5, Box 366)	10 mi. W., U
5	Temple (Box 414)	2 mi. S., F.M.
6	Denton (Route 1, Box 547)	4 mi. W., S.H.
7	Spur	1 mi. W., F.M.
8	Lubock (Route 1)	3 mi. E., U.S.
9	Balmorhea	4 mi. E., U.S.
11	Nacogdoches	2 mi. N., U.S.
12	Chillicothe	5 mi. SW., F.M.
14	Sonora	28 mi. S., S.H.
15	Weslaco	2 mi. E., U.S.
16	Iowa Park	2 mi. S., F.M.
17	Ysleta (Route 1, Box 454)	5 mi. E., F.M.
18	Prairie View	1½ mi. N., U
19	Crystal City	5 mi. S., U.S.
20	Stephenville	3 mi. N., U.S.
21	Gonzales	7 mi. SW., F.M.
22[1]	Kirbyville	5 mi. E., U.S.
23	McGregor (Box 567)	1 mi. W., U.S.
FIELD LABORATORIES		
Animal Disease	María	3 mi. NE., F.M.
Brazos River Valley	College Station	10 mi. SW., F.M.
Dairy	Mt. Pleasant	U.S. 67
East Texas Pasture	Lufkin (Route 5, Box 181)	6 mi. SW., S.H.
Fruit	Montague	2 mi. SW., S.H.
Horticultural	College Station (Hqts.)	U.S. 190
Plant Disease	Yoakum (Route 3)	2 mi. E., S.H.
Poultry Disease	Center (Box 724)	1 mi. N., U.S.
Sweet Potato	Gilmer	2 mi. S., U.S.
Tomato Disease	Jacksonville (Route 4)	2 mi. N., U.S.
COOPERATING STATIONS		
Amarillo Exp. Station[2]	Bushland	1 mi. W., U.S.
Big Spring Field Station[2]	Big Spring (Box 909)	1 mi. N., U.S.
Blacklands Exp. Watershed[2]	Riesel (Route 2)	2 mi. E., S.H.
Cotton Field Station[2]	Greenville	3 mi. SW., U.S.
Cotton Insect Inv.[2]	Brownsville (Box 1033)	Fort Brown,
Cotton Insects Section[2]	Waco (Box 1218)	215 Federal B
Cotton Spinning Lab.[2]	College Station (Box 297)	ASC Bldg., S.
Grasshopper Control Project[2]	Waco (231 Federal Bldg.)	Federal Bldg.
Livestock Insect Invs.[3]	Kerrville (Box 232)	6 mi. N., S.H.
Livestock & Range Investigations[3]	Encino (Box 116)	U.S. 281
PanTech Field Lab.[4,2]	Panhandle (Route 2)	U.S. 60
Pecan Field Station[2]	Brownwood (Box 589)	1 mi. E., U.S.
Stored-Product Insect Laboratory[2]	Houston (1110 McKee St.)	U.S. 90
Texas Range Station[5]	Barnhart	8 mi. S., S.H.

[1] Cooperative with Texas Forest Service
[2] U.S. Department of Agriculture
[3] King Ranch
[4] Texas Technological Coll
[5] University of Texas