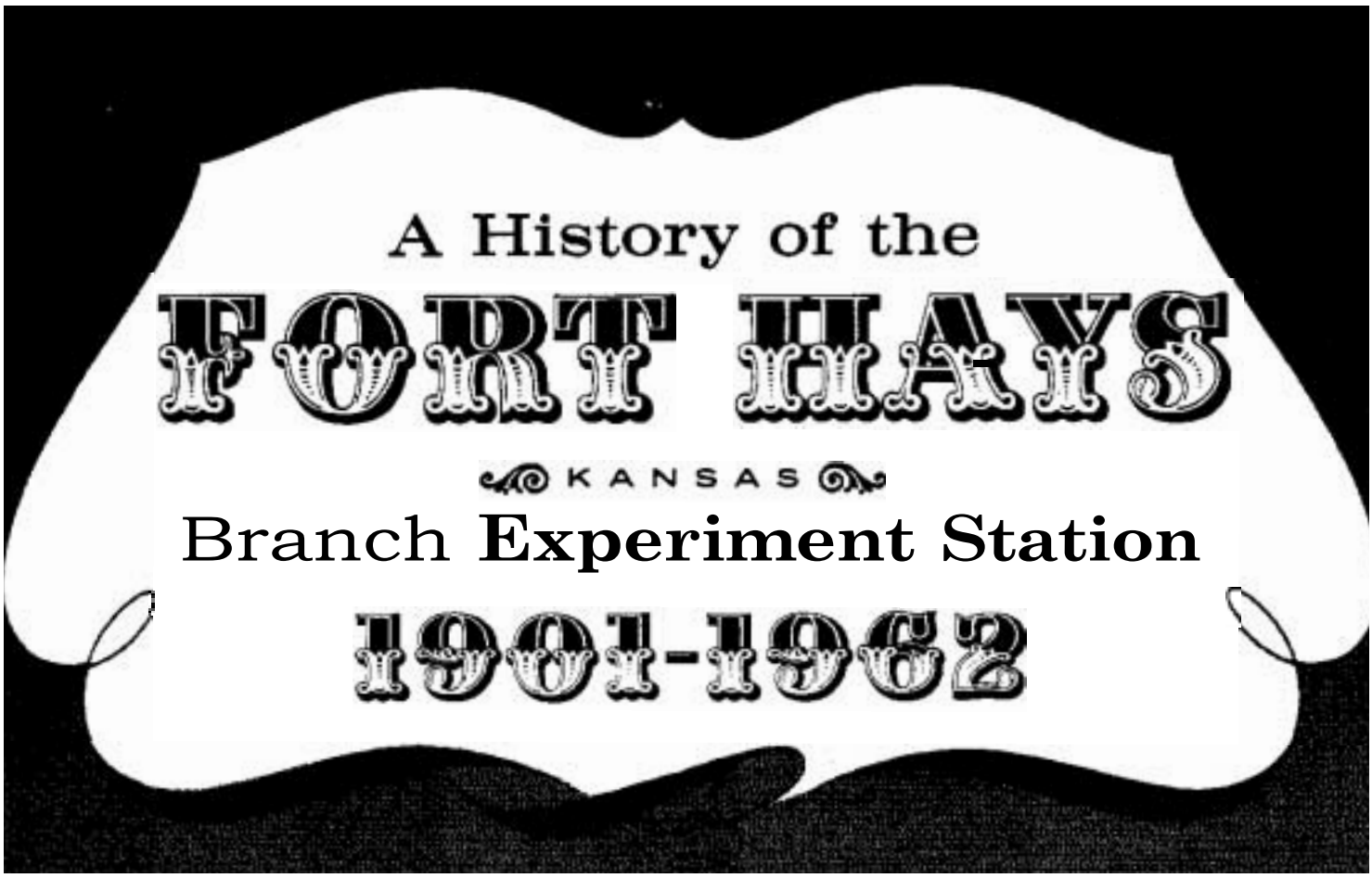
Bulletin 453, May 1963



Agricultural Experiment Station

Kansas State University of Agriculture and Applied Science, Manhattan

C. Peairs Wilson, Director

ACKNOWLEDGMENTS

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CONTENTS

A History of the Fort Hays (Kansas) Branch Experiment Station 1901-1962[1]

by

Leland E. Call[2] and Louis C. Aicher[3]

The Fort Hays Branch of the Kansas Agricultural Experiment Station was established in 1901. It was made possible by a gift of land from the United States Government to the State of Kansas. The land was a part of the Fort Hays Military Reservation. The reservation, no longer needed for military purposes, was turned over by the Army to the United States Department of the Interior, October 22, 1889, for disposal under the Act of July 5, 1884.

LEGISLATIVE AUTHORIZATION

In 1889 the Secretary of the Interior directed the suspension of action on this reservation to await the action of Congress in regard to it. In February, 1895, Representative Jno. Schlyer of Ellis county introduced a resolution in the House of Representatives of the Kansas Legislature which was adopted and concurred in by the Senate, February 8, 1895, as follows:

"WHEREAS, The experience of the settlers upon the plains of western Kansas, covering a period of more than twenty years, has demonstrated conclusively that agriculture cannot be pursued with profit under existing natural conditions, and that artificial means and methods must be substituted therefor; and

WHEREAS, The tests and experiments required to determine the fitness of new methods applicable to these higher altitudes and limited rainfall cannot be made at the Agricultural College of the state; and

WHEREAS, The Fort Hays military reservation, at an altitude of 2000 feet above sea-level, contains a valuable body of native timber that should be preserved to posterity, and the land of said reservation is admirably adapted for such experiments in agriculture as are required in the premises; and

WHEREAS, The buildings upon said military reservation, formerly used as residences for officers and their families, barracks for troops, storehouses, etc., are large and commodious, but cannot be moved without destruction of their value, but in their position are of great value, and could be used, with little additional repairs, for the purposes of a branch of the State Normal School; and

WHEREAS, The location of a branch of the State Normal School at this place would be central and convenient for the whole of the north half of the state; and

WHEREAS, The said military reservation has long since been abandoned by the United States government as a military post; now, therefore, be it

Resolved, by the house of representatives of the state of Kansas, the senate concurring therein, That our senators and representatives in Congress are hereby requested to secure the passage of an act of

1. Contribution No. 108, Office of the Dean, Agricultural Research, Teaching, and Extension, and Director, Agricultural Experiment Station, Manhattan.

2. Dean of the School of Agriculture Emeritus and Director of the Agricultural Experiment Station Emeritus.

3. Superintendent of Fort Hays (Kansas) Branch Experiment Station Emeritus.

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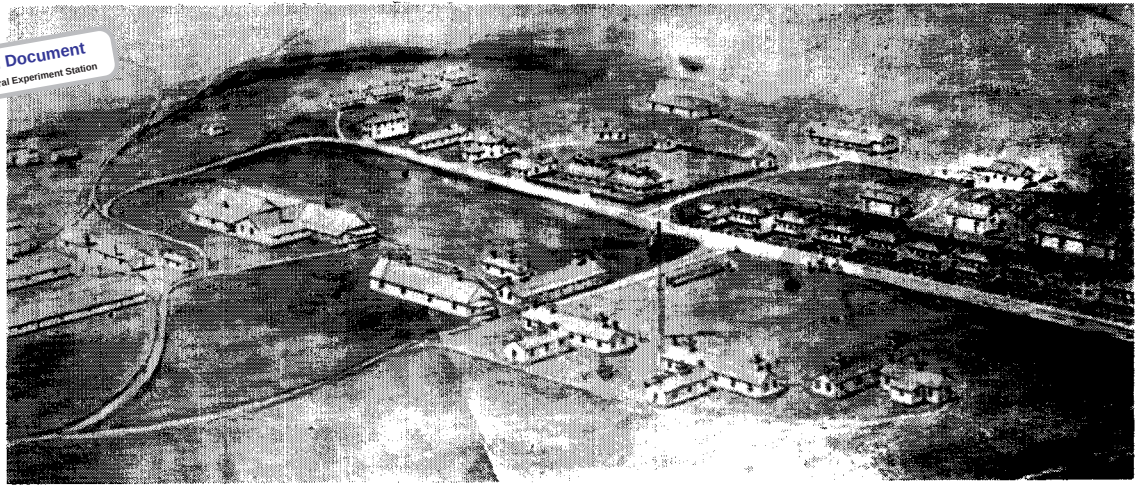

Fig. 1.—General view of Old Fort Hays.

Congress donating the said Fort Hays military reservation to the state of Kansas for the following public purposes: (1) For a western branch of the Kansas Agricultural College; (2) for a western branch of the Kansas State Normal Institute; (3) for a public park.

Resolved, further, That the secretary of state is hereby instructed to transmit a copy of these resolutions to the president of the United States senate, the speaker of the house of representatives, and to each senator and representative in Congress from the state of Kansas." (1)

On Saturday, February 23, 1895, a copy of said concurrent resolution was laid before the Senate of the United States by the Vice-president. It was referred to the Committee on Public Lands and accepted by Senate Bill 2799 introduced by Senator Martin; it reads as follows:

"Be it enacted, etc.: That the abandoned Fort Hays military reservation and all the improvements thereon, situated in the state of Kansas, be and the same is hereby granted to said state, upon the conditions that said state shall establish and maintain perpetually thereon, first, a western branch of the Kansas Agricultural College; second, a western branch of the Kansas State Normal Institute, and that in connection therewith the said reservation shall be used and maintained as a public park; provided, that said state shall, within five years from and after the passage of this act, accept this grant and shall by proper legislative action establish on said reservation western branches of the Kansas Agricultural College and the Kansas State Normal Institute; and whenever the lands shall cease to be used by said state for the purposes herein mentioned the same shall revert to the United States." (2)

This bill passed the Senate February 26 and the House March 2, 1895. Congress adjourned March 4 and the bill failed to receive the President's signature.

In view of the passage of Senate Bill 2799, the district land officers were advised by telegram dated March 22,1895, that said lands were withdrawn from settlement and entry to give opportunity for further legislation.

A bill similar to No. 2799 was introduced in the 54th Congress and reported favorably to the House of Representatives by Mr. Charles Curtis from the Committee on Public Lands.

This bill did not become a law, although again reported favorably by the second ses-

Fig. 2.—Officers Quarters at Old Fort Hays, parade grounds in foreground.

sion of the 54th Congress. A similar bill was introduced in the 55th Congress and passed the Senate but did not come up in the House. It was again introduced in the 56th Congress, in the Senate by Senator Harris, and in the House by Congressman Reeder, and became a law March 28, 1900. As finally passed it reads as follows:

"A BILL granting to the state of Kansas the abandoned Fort Hays military reservation in said state, for the purpose of establishing an experimental station of the Kansas Agricultural College and a western branch of the Kansas State Normal School thereon, and a public park.

Be it enacted, That the abandoned Fort Hays reservation, and all improvements thereon, situated in the state of Kansas, be and the same is hereby granted to said state upon the conditions that said state shall establish and maintain perpetually thereon, (1) an experimental station of the Kansas Agricultural College, and (2) a western branch of the Kansas State Normal School, and that, in connection therewith, the said reservation shall be used and maintained as a public park; provided, that said state shall, within five years from and after passage of this act, accept this grant, and shall, by proper legislative action, establish on said reservation an experiment station of the Kansas Agricultural College, and a western branch of the Kansas State Normal School; and whenever the lands shall cease to be used by said state for the purposes herein mentioned, the same shall revert to the United States; provided further, that the provisions of this act shall not apply to any tract or tracts within the limits of said reservation to which valid claims have attached by settlement or otherwise under any public-land laws of the United States." (3)

Acting under this law the 1901 session of the Kansas Legislature passed the following joint resolution:

"SECTION 1. That the state of Kansas hereby accepts from the United States the abandoned Fort Hays military reservation, as provided in an act of Congress relating thereto, approved March 27, 1900.

SECTION 2. That the provisions of the act of Congress, 'An act granting to the state of Kansas

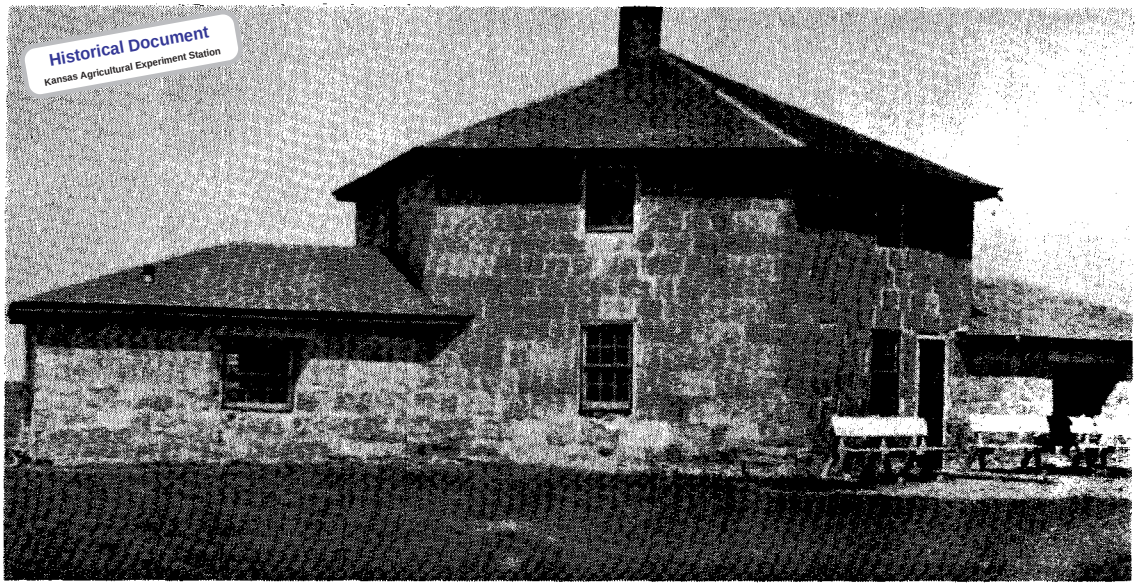

Fig. 3.—The Blockhouse, Old Fort Hays.

the abandoned Fort Hays military reservation, in said state, for the purpose of establishing an experimental station of the Kansas Agricultural College and a western branch of the Kansas State Normal School thereon and a public park,' approved March 27, 1900, are hereby accepted by the state of Kansas.

SECTION 3. That upon the approval of this act by the governor, he is requested to transmit a certified copy of the same to the secretary of the interior of the United States.

Approved February 7, 1901.

Copy transmitted to secretary of interior February 7, 1901." (4)

The Legislature of 1901 passed an act in respect to the division of the reservation, making appropriations for the branch station and the branch normal school. This act reads as follows:

"Be it enacted by the Legislature of the State of Kansas:

SECTION 1. The board of regents of the State Agricultural College and of the State Normal School, respectively, are hereby authorized to locate and establish an experimental station of the State Agricultural College and a branch or auxiliary of the State Normal School on the Fort Hays military reservation.

SECTION 2. The following-described tracts of land lying within the limits of the reservation aforesaid, to wit: Section 36, township 13 south, range 19 west; section 31, township 13 south, range 18 west: section 1, township 14 south, range 19 west; sections 6 and 8, the east half of section 7, the north half of section 17, and the northeast quarter of section 18, all in township 14 south, range 18 west, are hereby placed under the direction of the regents of the State Normal School. It shall be their duty to lease or rent the said lands to the best advantage, and all moneys derived from rents for such lands shall be collected by the regents aforesaid, who shall deposit the same with the treasurer of the board, to be expended by the said board of regents for the equipment and maintenance of said auxiliary of the State Normal School.

SECTION 3. All the remaining lands of the reservation aforesaid are hereby placed under the direction of the board of regents of the State Agricultural College, except the north hall of section 5, township 14 south, range 18 west, which with the buildings thereon, shall be used jointly as may be determined by the boards of regents of the institutions aforesaid,

SECTION 4. The said board of regents of the State Normal School shall employ a principal and such assistant teachers and janitors as

the needs of the school may demand; shall prescribe the course of study, not extending over more than two years, conditions of admission, and such other regulations as may be required for its successful conduct; provided, that such course of study shall embrace only such branches as may prepare pupils for the advanced academic and professional work provided at the State Normal School at Emporia.

SECTION 5. All persons meeting the requirements for admission prescribed by the board of regents shall be admitted to said school; and on declaring their intention to fit themselves to teach in the schools of Kansas shall be exempt from all fees, save a small matriculation fee, which the board of regents may require. Students not intending to teach may be charged a reasonable fee, at the discretion of the board.

SECTION 6. Any person of good moral character over sixteen years of age, having been in actual attendance at least twenty weeks at the above-named school, and having completed the course of study prescribed by the said board of regents, shall be awarded a certificate which shall be a legal certificate to teach in any of the public schools of the state except high schools, and good for one year. Said certificate shall also admit the holder to the third year's work at the State Normal School at Emporia without examination.

SECTION 7. The president of the State Normal School shall be president of said auxiliary normal school, with such duties and responsibilities as the board of regents may determine.

SECTION 8. The sum of $7,000 is hereby appropriated for the fiscal year ending June 30, 1902, and the sum of $5,000 for the fiscal year ending June 30, 1903, is hereby appropriated, for the current expenses and improvements of said auxiliary normal school, the said amounts to be expended under the direction of the board of regents of the State Normal School.

SECTION 9. The board of regents of the State Agricultural College is hereby authorized to locate and establish on the reservation aforesaid an experimental station of the Agricultural College, and shall adopt such measures as may be necessary to place the same in successful operation and to preserve the land upon which the native timber is now growing as a public park.

SECTION 10. To carry out the provisions of section 9 of this act, the sum of $3,000 is hereby appropriated for the fiscal year ending June 30, 1902, and $3,000 for the fiscal year ending June 30, 1903.

SECTION 11. All sums of money payable out of the appropriations specified in section 8 of this act shall be upon vouchers approved by the board of regents of the State Normal School; and all sums payable out of the appropriations specified in Section 10 shall be upon vouchers approved by the board of regents of the State Agricultural College.

SECTION 12. The auditor of state is hereby authorized to draw his warrants on the treasurer of state for the several sums and purposes specified in this act upon verified vouchers approved by the board of regents of the State Normal School or the State Agricultural College; provided, that no portion of the money appropriated in this act shall be expended by the board of regents until the attorney general of the state of Kansas shall first notify the governor and the board of regents that the title to the land in said reservation is unimpaired, and the land is available under the terms of the act of Congress ceding said reservation to the state.

SECTION 13. This act shall take effect and be in force from and after its publication in the official state paper.

Approved February 26, 1901
Published in official State paper, March 1, 1901." (5)

During the time the reservation was supposed to be open for settlement, some of the land was filed upon and occupied by settlers. When

the state accepted the reservation these claims constituted a flaw in the title, although deeds to the land had not been granted.

The regents taking cognizance of this situation on April 4, 1901, passed the following resolution:

"Moved by Regent Stewart to adopt the following resolution: Whereas the Legislature at its recent session passed an act accepting from the United States the tract of land known as the Fort Hays Military Reservation and whereas the grant of said land to the state of Kansas provides that it should be utilized by the State Normal School and the Agricultural College and whereas the act of acceptance provides that no money shall be expended on said land until the attorney general shall find that the state can have a good title to all of said land and whereas it has come to be knowledge of this board that a considerable portion of said land is held and claimed by private parties and that the citizens of Hays in connection with the attorney general are now endeavoring to secure the relinquishment of the present claimants on said land, therefore be it resolved that a committee of four be appointed from the board with direction to call upon the attorney general and if after consultation with him it shall be deemed best shall meet with the regents of the State Normal School at Hays next week and act in concert with them and assist the citizens there in securing the release of the claims on said reservation lands, but under no circumstances shall any arrangements be made whereby funds of this college or the state of Kansas shall be used for securing said releases or for making any improvements on said land until such time as the title of all such land shall be vested in the state. Moved by Regent Satterthwaite that the committee consist of Regents McDowell, Coburn, Stewart and Fairchild. Amendment carried. Resolution as amended carried." (6)

The matter was finally settled by the Board of Regents executing leases to the claimants to permit them to remain on the land from three to five years in consideration of which all future claim was relinquished.

DIVISION OF LAND

The military reservation as acquired by the state contained an area of about 7,200 acres. The area was divided by legislative act between the experiment station and the normal school as follows: five and three-fourths sections located principally on the north and west parts of the reservation to the normal school, one-half section on which the fort buildings were located to be used as determined by the Boards of Regents of the two institutions, and the rest of the reservation to the experiment station.

The area acquired by the Station has usually been reported as about 3,600 acres.[4] The station land was located on the east and south sides of the reservation. It embraces about 1,400 acres of bottomland along both sides of Big Creek plus gently rolling upland, nearly all tillable and highly productive.

One of the obligations placed on the Experiment Station by the Legislature when the Station was authorized was "to preserve the land upon which the native timber is now growing, as a public park." (7)

4. Since the original divisions, a part of the area has been used for roadways, for park purposes, and for a golf course. The Comptroller's Office at Kansas State University gives the area of the station at this time (1962) as 3,254 acres.

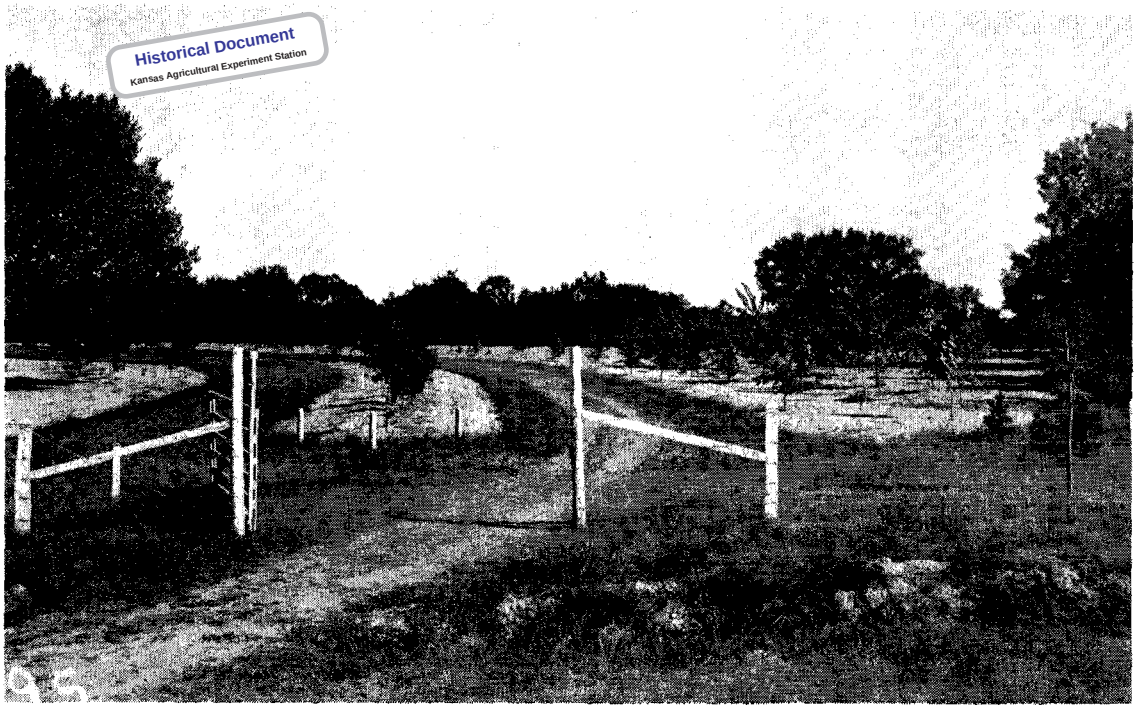

Fig. 4.—Frontier Historical Park as it appeared in 1906.

When the reservation was acquired by the state some excellent timber was growing along Big Creek. This timber was the more conspicuous because the creek banks outside the reservation had been denuded of all tree growth to provide fuel for the fort. Not only was the native timber protected, but forest trees were planted on additional creek bottomland, even during the first year of the operation of the station.

FRONTIER HISTORICAL PARK

The congressional act gave the abandoned Fort Hays Military Reservation to the state of Kansas for: first, an experiment station of the Kansas Agricultural College; second, a western branch of the Kansas State Normal School; and third, a public park. (8)

Responsibility for development and maintenance of the park fell to the experiment station. The first step was taken in 1905 when 43 acres of land along Big Creek, where the timber had been spared, was set apart for park purposes. The Station graded the drives, erected gates and fences, and set out about 2,500 additional trees. About 25 acres were planted to young trees as an addition to the park. The trees set out at this time grew well. In 1913 it was reported that the growth and vigor of deciduous trees planted in the state park in 1905 were good and ranked in this order: redbud, bur oak, black walnut, honey locust, coffee bean, white elm, hackberry, persimmon, green ash, Russian mulberry, Russian olive, red elm, poplar, cottonwood, and soft maple.

A grove of Chinese elm planted in 1925 west of the

highway leading to the city later became a part of the park. Most of these Chinese elm trees escaped serious damage from the Armistice Day freeze in 1940 and they now constitute an attractive area of the park.

About 1920 the citizens of Hays became interested in developing a golf course as a part of the state park. This resulted in the Station's leasing 40 acres of its grassland to local citizens for this purpose. This area adjoined the park on the southwest side. Later an additional area of about 20 acres was added. The Station did not assume the responsibility and expense of maintaining the golf course, this being done by an organization of local citizens.

In 1931 legislation was enacted creating the state park at Hays. The Legislature of 1931 passed House Bill No. 626 which reads in part:

"An act relating to and creating the Kansas Frontier Historical Park on the Fort Hays Military Reservation, to be designated and set aside by the State Board of Regents and making appropriation for the preservation and upkeep of same. Be it enacted by the Legislature of the State of Kansas.

SECTION 1. The State Board of Regents shall designate and set aside for park purposes that portion of the Fort Hays Military Reservation which was the site of the buildings of old Fort Hays, together with the remaining buildings of said fort and such other portions of said reservations as the Board may deem to be of particular historical interest of which, in the judgment of said Board, may be favorably situated and well adapted for park purposes, . . . and said Board shall within six months from the effective date of this resolution designate the boundaries of such portions of said reservation so set aside for park purposes.

SECTION 2. The portion of said reservation so set aside and designated by the Board of Regents for park purposes, together with a strip of ground along Big Creek in Sec. 4, T14, R18, which has been set aside for park purposes, shall be known as Kansas Frontier Historical Park in the Fort Hays Military Reservation, and said park shall at all times be subject to the State Board of Regents, but the general supervision and control of active custody and management thereof shall be vested in a Board of Managers, consisting of the chairman of the State Board of Regents, the secretary of the State Historical Society, the President of Kansas State Agricultural College, the Fort Hays Teachers College at Hays, Kansas, and a fifth member appointed by the governor. Said Board of Managers may, subject to revision by the State Board of Regents, make all proper and needful rules and regulations for the use, preservation, improvement, control and maintenance of said park and ground and buildings thereon, and or any portion thereof, a s is not may permit such use of the grounds inconsistent with this act or with the purpose for which said grounds have been set aside." (9)

The act also carried an appropriation of $500 for the fiscal year ending June 30, 1932. Over 120 acres were taken for the Frontier Historical Park in addition to the 43 acres previously designated for park purposes. A legal description of the park as established at this time is given in the 1931 report of the Hays Station. (10)

At the time of the establishment of the Park Board the care of the park was transferred to it from the Station.

THE GIFT TO THE STATE IS EVALUATED

The establishment of the Branch Station at Hays and its potential value to the state were reported upon editorially in THE INDUSTRIALIST in January, 1901, as follows: "About 4,000 acres is the best wheat land, it might be rented at one third to one half the crop, bringing $10,000 a year for the institution. Water can be had easily by boring 20 to 40 feet, and the best of water. There are fine white rock quarries within a mile of the buildings, easy to get at and enough for all time. . . . The gift to the state is worth $200,000." (11)

Two other editorials appeared in KANSAS FARMER within the next few months. The first, in December, 1901, said: "Two committees of the Kansas State Agricultural College Regents have visited Hays within the past week for the purpose of promoting arrangements whereby the College will acquire complete title to its portion of the abolished Fort Hays Military Reservation and beginning there an experiment station as contemplated by the acts of Congress and the State Legislature. . . . F. D. Coburn, Vice-president of the college regents, is very enthusiastic over the possibilities of having, on a large and decisive scale, an experiment station in the western half of the state, right at the navel of the continent as it were, and thinks a failure to make it in time the foremost example of its kind in existence an inexcusable and short-sighted folly. The body of land is ample, its quality entirely typical of both the high prairie and the creek 'bottom' and its situation every way superb." (12)

The second editorial, entitled "A Big Experimental Farm," appeared in May, 1902, and read as follows: "The Kansas State Agricultural College has just come into full possession of, and beginning work on, a part of the abandoned Fort Hays Military Reservation. The body of the land contains 4,000 acres, practically all of which is tillable land and representative of the vast area through western Kansas, Nebraska, Oklahoma, and Colorado. . . . The Fort Hays reservation is situated 290 miles west of Kansas City on the Union Pacific. The reservation embraces 7,500 acres lying along Big Creek in Ellis County. . , , The Boards of Regents of the two institutions made a division of the land, which gave to the agricultural college all the land along the creek which runs diagonally through the quarters for four miles. The land slopes gently back from the creek to an elevation of perhaps 200 feet, which gives a great variety of conditions.

"This location being typical of the Great Western Plains is expected to make a great experiment station. A thousand acres or so will be reserved for pasture and breaking at future times. A large area of alfalfa will be planted and other areas devoted to trials of various

forage plants that may be adapted to the west. Fifty acres of land is being prepared for planting forest trees next spring and undoubtedly a whole quarter section will later be developed to this. . . . The branch station will bear the same relationship to the agricultural college as any of its various departments. It is not expected that any money of the national appropriation for the Experiment Station can be used here, as it is already inadequate to the needs at Manhattan. The Fort Hays Branch will rely on its own resources and the generosity of the state. The appropriation for the years 1902 and 1903 is but $3,000 per annum, which is hardly sufficient to make even a semblance of beginning. This amount will be put into fencing, opening the land, buying implements and making as many other foundation improvements as possible. The next legislature will doubtless provide for buildings, necessary stock and equipments for carrying forward the work in a manner commensurate with the needs of such an institution." (13)

THE MANAGEMENT OF THE STATION

The plans for the management of the Branch Station were set forth in the following resolution adopted by the Board December 13, 1901:

"Resolved, That the president of the board of regents shall appoint a regent, who shall, under the direction of the board, have special charge of all matters pertaining to the Fort Hays reservation in behalf of the Agricultural College, the Experiment Station Council to direct all experiments, subject to the approval of the board.

Resolved, That the crop experiments and such other experiments as can be provided for, be begun in the year 1902 on as liberal a scale as circumstances and the funds at our command permit; and that all seeding, cultivation, harvesting, storing, sale and purchase of commodities, or of livestock and its feeding, pertaining to experimental work, and all records in reference thereto, be under the immediate supervision and direction of a competent man, who shall be stationed at Hays so much of the time as may be necessary for best doing the work contemplated,

Resolved, That such repairs be made upon the buildings on the Fort Hays reservation as shall make them available for use, and that a practical farmer be employed, who shall be known as foreman of the farm, and who shall see that all contracts pertaining thereto are fulfilled and all property belonging to the Experiment Station be properly cared for, and shall perform such other duties as shall be assigned to him.

Resolved, That the regent appointed to have charge of the interests of the Experiment Station at Hays shall be paid his per diem and actual and necessary expenses incurred in the performance of such duties, but shall not be allowed mileage." (14)

The Board appointed regent Fairchild as its representative to manage the affairs of the Station. The planning and direction of experiments was the responsibility of the Experiment Station Council. This plan of organization left much to be desired. No one individual was responsible. The plan of organization did not meet with the approval of the Office of Experiment Stations of the United States Department of Agriculture. This office was responsible from the

standpoint of the federal government for the administration of the Hatch Act. The criticism was set forth in a resolution of the Board of Regents July 7, 1905, as follows: "Moved by Regent Fairchild: whereas a letter from Director True,[5] under date of May 31, of which the following is a copy, "Examination of the work and expenditures of the Kansas Agricultural Experiment Station by different representatives of this office for a number of years has uniformly led to a criticism of the Station to the effect that it has a weak organization and is therefore unable to make the most effective use of the funds at its disposal. The divided responsibility existing in the Station Council has evidently not made it practicable to have a very definite plan of operation or to carry on the business of the Station in the most efficient manner. Our Mr. Beal, who recently visited the Station, states that this general weakness of management still exists and that it has been shown recently in a marked degree of the relations of the Council with the Substation at Fort Hays. In our judgment the Kansas Station needs a director with authority to plan and supervise the operations wherever they are conducted in the state, to represent the Station before the agricultural public and in general to perform the duties of an executive officer of the Station subject only to the general supervision of the President of the College and the governing board." (15)

The criticism led President Nichols and the Board of Regents to consider carefully the matter and to take steps to obtain a director for the Station. After several prospects were considered, some of whom failed to receive the approval of the Board and others offered the position failed to accept, Dr. C. W. Burkett was appointed Director of the Experiment Station September 26, 1906. (16)

STATION SUPERINTENDENTS

The first superintendent of the Hays Station, appointed March 29, 1902, was J. G. Haney. Mr. Haney was a graduate of the college who for some years was assistant in field and feeding experiments and later agricultural agent of the Chihuahua (Mexico) and Pacific Railway Company. He began his duties as soon as the title to the reservation was reported clear by the attorney general. The KANSAS FARMER reported editorially in July, 1902, as follows regarding Mr. Haney's appointment: "Kansas has been exceedingly fortunate in the selection of a manager for this station. Prof. Haney belongs to that class of young Kansans who are sought for positions of importance the world over. He is a Kansas farm product of the vigorous sort. He is well equipped by education and experience for the work. He inspires confidence in those around him and is in every

5. Dr. A. C. True, Chief of the Office of Experiment Stations, United States Department of Agriculture.

Fig. 5.—J. G. Haney, first superintendent (1903-1904).

Fig. 6.—O. H. Elling, 1905-1907.

way one of those men at whose hands great works are apt to be accomplished." (17) Mr. Haney served until December 31, 1904.

Upon the resignation of Mr. Haney, O. H. Elling, who had served as foreman of the farm under Mr. Haney, was appointed Acting Superintendent and served in this capacity until March, 1907. At that time the new Director of the Station, Dr. C. W. Burkett, secured as superintendent C. K. McClelland, who began his duties in May, 1907. Mr. McClelland came from the Office of Farm Management of the United States Department of Agriculture and had been associated with Dr. Burkett in agricultural education work in the East. In June, 1909, the resignation of Mr. McClelland was accepted, effective December 31, 1909. A successor was not appointed immediately, and during this period George K. Helder, assistant superintendent, was in charge of the Station. The position eventually was filled by Prof. A. M. TenEyck June 1, 1910. Professor TenEyck was head of the Department of Agronomy at the College. The subject of farm management was his specialty. Dr. H. J. Waters, who had just become President of the College, felt that the work of the institution as a whole might be strengthened by the transfer of Professor TenEyck to the superintendency of the Hays Station and the appointment of another agronomist at the

Fig. 7.— A. M. TenEyck, 1910-1912.

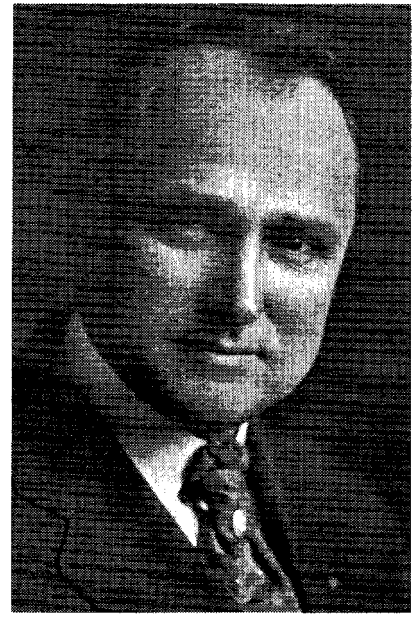

Fig. 9.— Charles R. Weeks, 1916-1920.

Fig. 8.— George K. Helder, 1913-1916.

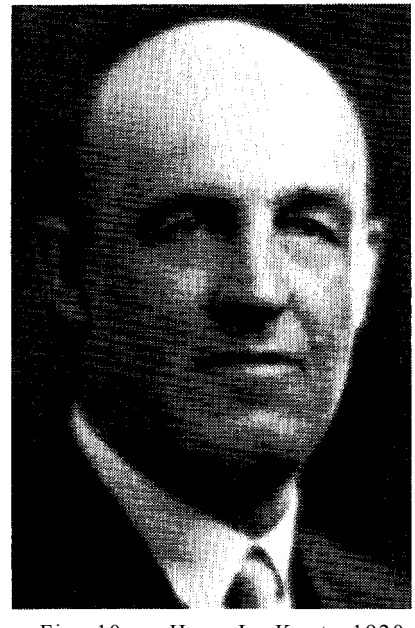

Fig. 10.— Harry L. Kent, 1920-1921.

College to head the Department of Agronomy. In addition to his appointment as superintendent of the Station, Professor TenEyck was made Professor of Farm Management in order that he might lecture on this subject at the College. He rendered but little service in the latter capacity. Dean Edwin H. Webster, who at this time was Director of the Station, did not work harmoniously with Professor TenEyck. This led to unsatisfactory working conditions. Professor TenEyck resigned December 31, 1912.

In anticipation of the resignation of Professor Ten-

Fig. 11.—L. C. Aicher, 1921-1952. "Mr. Aicher's appointment was a fortunate one. He was well prepared by training, experience, temperament, and personality for the position."

Eyck, H. M. Bainer was elected superintendent of the Station by the Board. He did not accept. George K. Helder became superintendent July 1, 1913. He had acted as superintendent in advance of Professor TenEyck's appointment and was assistant superintendent under Professor TenEyck. Mr. Helder served until March 15, 1916. He was succeeded by Charles R. Weeks who resigned May 1, 1920, to become secretary of the newly organized Kansas Farm Bureau. Mr. Weeks was succeeded by Prof. Harry L. Kent who had served as the first principal of the School of Agriculture at the College from September 1, 1913, until May 15, 1920,

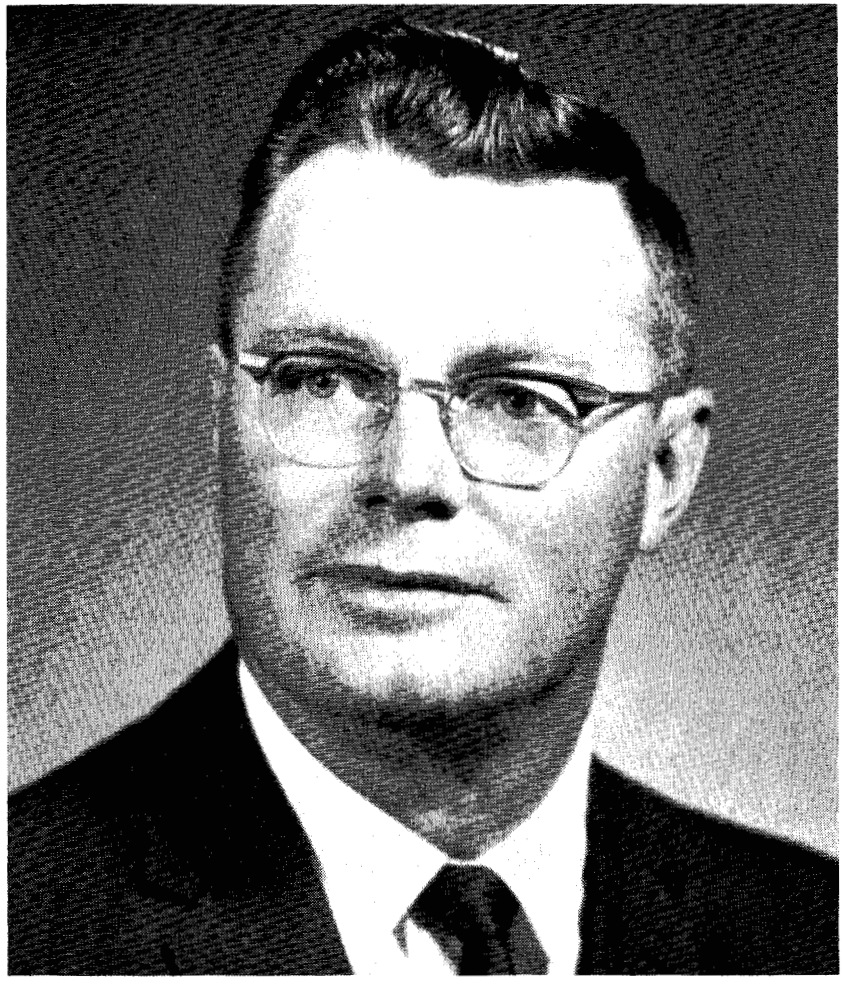

Fig. 12.—W. W. Duitsman, superintendent since 1952. "A worthy successor to Mr. Aicher."

when he became superintendent of the Station.

Professor Kent was a talented man and also an able administrator, but he was not prepared by temperament or experience for the superintendency of the Station. He rendered good service but was not happy in his work. He resigned September 15, 1921, to become President of New Mexico State Agricultural College where he served with signal success and longer than any other president of that institution. Professor Kent was succeeded by Louis C. Aicher September 26, 1921. Mr. Aicher's appointment was a fortunate one. He was a graduate of the College, class of 1910. He had served successfully 10 years as superintendent of the Aberdeen, Idaho, Experiment Station before coming to Hays. He was well prepared by training, experience, temperament, and personality for the position. Mr. Aicher came to the Station at the time when power on the farms of Kansas was changing from animal to mechanical. He had unusual vision as to farm mechanization, and ability to develop personally equipment adapted to the need. He replaced the mule and horsepower on the Station with mechanical power, thereby reducing the labor requirements of the Station and eliminating many of the most difficult labor problems. The change also improved the timeliness of farm operations, resulting in improved crop production. Mr. Aicher remained as superintendent of the Station until June 30, 1952, when he retired under the University's mandatory age retirement policy. During the 31 years that Mr. Aicher served as superintendent, the Station developed into one of the leading institutions of its kind in the country.

July 1, 1952, W. W. Duitsman became a successor to Mr. Aicher and has continued to the present time (1962). He was prepared for the position by serving for five years as a successful county agent and for two years as assistant superintendent of the Station under Mr. Aicher.

THE STATION A DEMONSTRATION FARM

The Board of Regents was concerned that the Station become a farm to demonstrate good farm management practices as well as an experiment station. The Station was so large that only a small portion was needed for intensive experimental work, leaving large areas available for commercial cropping and utilization. It was the desire of the Board that these areas be used for demonstrating the best husbandry practices and that the Station become a creditable demonstration farm. This desire was expressed in a minute of the Board: "Mr. McClelland and Mr. Colliver[6] are both informed that the Board regards it to be of vital moment that the station farming, outside the plot work, be

6. Mr. McClelland was superintendent and Mr. Colliver, assistant superintendent of the station.

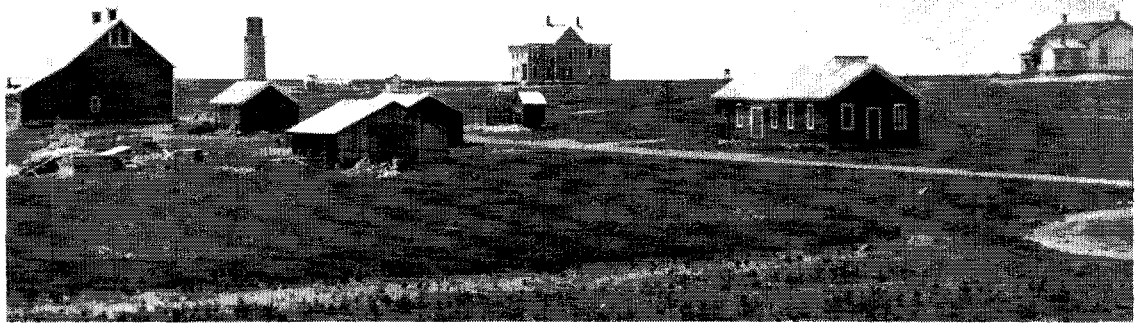

Fig. 13.—General view of the Station campus in 1904. Buildings from left: barn that burned in 1906; water tower (background); tool sheds and other miscellaneous buildings; boarding house (center background); granary (right foreground); superintendent's first residence, which included the first office. Most of these buildings were moved from the reservation or constructed from reservation material.

of such a nature as to produce maximum yields as nearly as possible and also to make the station farm a model farm in which 'model' feature the Board considers the prime factor is having the work done at a time when it ought to be done; and the management is accordingly instructed to pick up outside men and teams at piece-work prices, whenever practicable, otherwise at hour prices, to whatever extent is necessary to keep the farm work in line with the best farm management. Carried." (18)

Many factors stood in the way of the Station's becoming the model farm that the Board desired. In the first place, the Station was slow in acquiring the work stock that such a large commercial operation required, and satisfactory outside help was not easily obtained. In the second place, the requirements of good soil husbandry were not well understood. The Campbell system of soil management was the accepted practice of the time. The system required excessive tillage that under western Kansas conditions resulted in soil blowing. It was not until correct soil management practices were understood and mechanical power equipment become available that the Station became the type of farm that the Regents envisaged.

PHYSICAL PLANT

When the Experiment Station was established, the military compound proved unsatisfactory as its headquarters. A new campus to serve this purpose was established on the east side of the highway about one mile directly south of the city of Hays. It was located on bench land south of Big Creek at an elevation above the flood line. The location was about one half mile southeast of the old military compound.

The Legislature of 1903 ap-

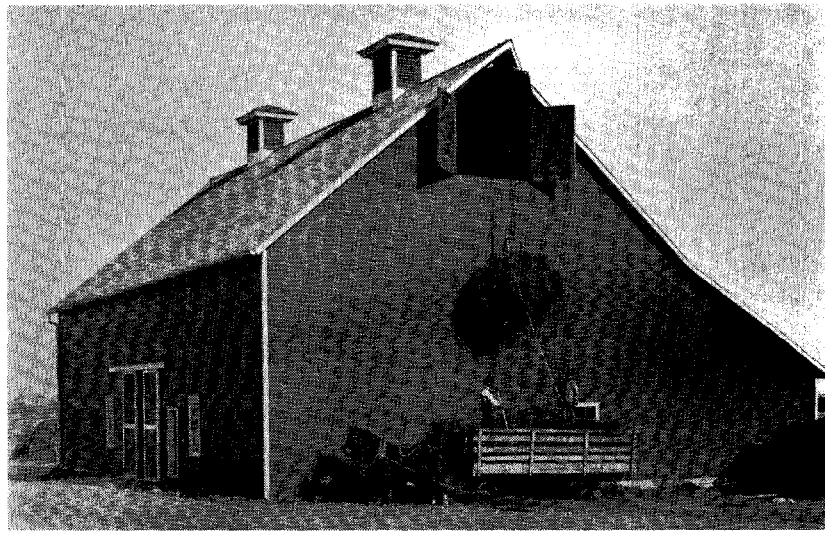

Fig. 14.—The Station barn in 1904. In 1906 it was struck by lightning and burned.

propriated $27,900 for the support of the Station. This money was used principally for the beginning of construction of the physical plant. One frame building was moved from the military compound to a more convenient location on the Station campus. It was repaired for the occupancy of the superintendent. Later, it was used as a residence for the dry land agriculturist and is still in use as a residence for the cerealist. Three other frame buildings were moved to the Station campus from the military compound, repaired, and used, one as a barn, one as a tool shed, and the other as a storehouse for sacked grain. Other frame buildings were dismantled and the old lumber used in supplying dimension material and sheeting for the horse barn, granary, house for workmen (14 rooms), and machinery and stock sheds. A water system was also installed. During 1904 and 1905 an elevator was built and the two stone buildings at the Fort repaired for use as dwellings.

In 1906 the large horse barn was struck by lightning and burned. The following spring a new barn with stone basement 40 x 60 feet, costing $4,400, was built to replace the building that burned. This building served only temporarily as a horse barn. A new barn less pretentious but more convenient was built on another site. The building erected as a horse barn was converted later into a large granary with bins on the ground floor and with sacked grain storage above. It served a most useful purpose to store the large quantities of seed grain produced on the Station.

In 1907 a residence for the superintendent was erected at a cost of $3,400. A cottage was built in 1908 on Section 10 for a station workman at a location where closer supervision could be given to farming operations on the east side of the farm. Another small cottage now used as a foreman's residence, and a small brick office building, costing $1,230 and $2,500, respectively, were constructed on the Station campus. The old stock sheds were enlarged and eight new ones added in 1908. All were enclosed with a woven wire fence constructed with round cedar posts. This improvement cost $5,000.

In 1910 two new cottages for the staff were erected at a cost of $4,200. These cottages are now used as residences for the assistant to the superintendent and a technical staff member of the Station. Also in 1910 in an exchange of property with the Normal School the Station secured the old dwelling of the commanding colonel formerly stationed at Fort Hays.

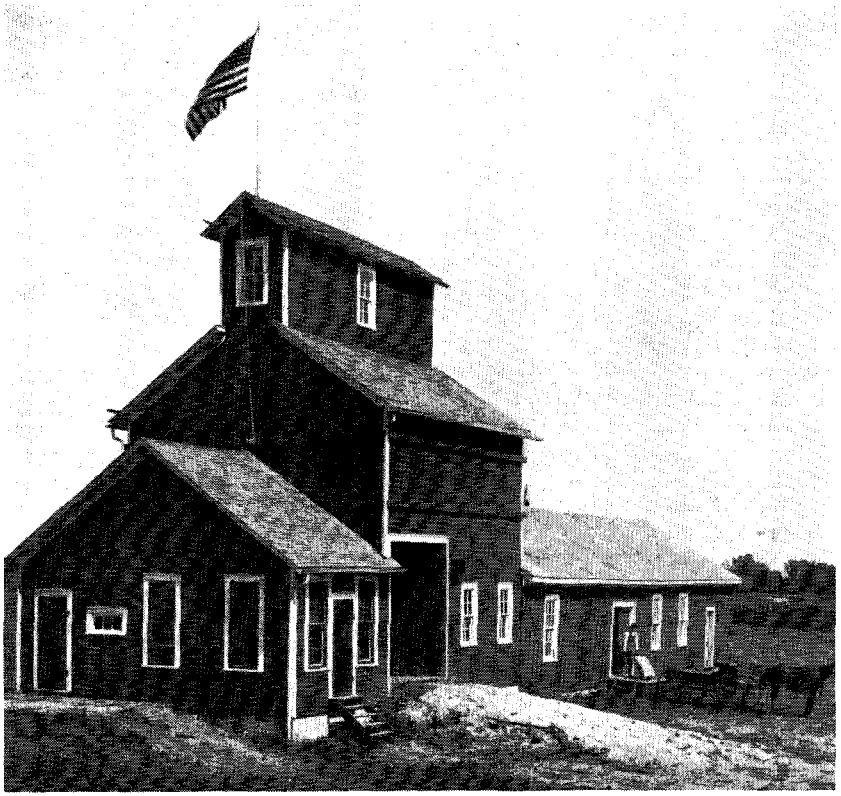

Fig. 15.—Elevator and seedhouse constructed in 1906. The superintendent's office was moved to the elevator building in 1907.

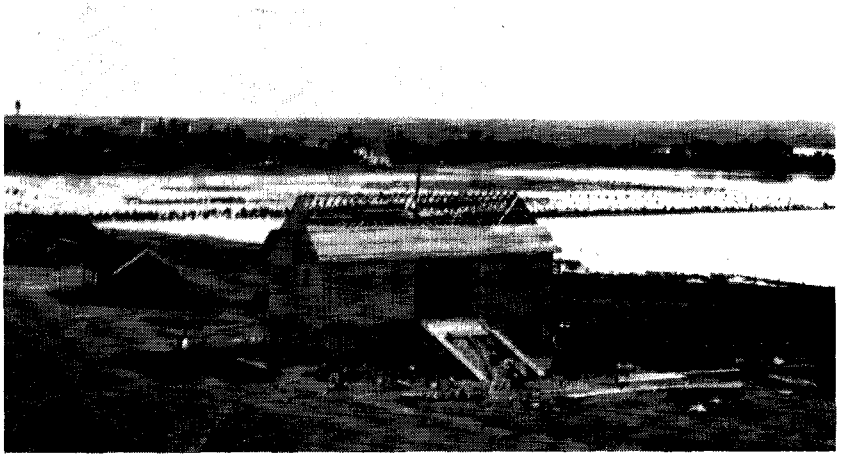

Fig. 16.—Barn under construction July 14, 1907, with Big Creek in flood. This building with stone basement cost $4,400 and was constructed to replace the barn that burned.

At the close of 1910 the physical plant of the Station consisted of the following: four old dwellings once a part of Fort Hays; six dwellings erected by the Station; two barns; elevator and granary: machine shed; field laboratory for dry land agriculture (erected by the United States Department of Agriculture); seed house; water system; 16 stock sheds each with its own fence enclosure; and various corrals and weighing pens.

The Station had also 25 miles of fencing including 7 miles of woven wire on cedar posts; 10 miles of graded roads and public driveways; and two bridges and a dam across Big Creek. The Station was also reasonably well equipped with horse-drawn machinery necessary to operate so large a farm.

Electrical Energy Supplied by Normal School. Arrangements were made in 1910 to secure electrical energy for the Station from the State Normal School. A minute of the Board of Regents relating to this matter passed July 15, 1910, reads as follows: "On motion of Regent Taylor the Board appreciates the courtesy of the offer of the Board of Regents of the State Normal School to furnish such electric current at approximate cost, as will be required for driving the machinery and lighting the buildings at the Hays Branch Experiment Station, and are pleased to accept the same. Director Webster and Professor TenEyck are hereby instructed to confer with Superintendent Picken[7] in regard to the amount of power required etc." (19) Subsequent arrangements were made to purchase electrical energy from the city of Hays. The Station

7. Mr. Picken was principal of the Normal School.

has always purchased its electrical energy. The Legislature of 1911 appropriated $2,000 for electrical wiring and power equipment.

Horse Barn Fire. A fire occurring the middle of September, 1912, resulted in the loss of one horse barn, 16 mares, and five geldings as well as harness, feed, and other equipment. The Station was reimbursed for the loss by a special appropriation of the 1913 Legislature which provided for the following: horse barn, $2,000; horses, $4,500; harness, $500; equipment, tools, etc., $500; total, $7,500. A new stable was built on the site of the original barn at a cost of $2,100.

The Dairy Farm Unit. A dairy farm unit located along the highway on the south side of the Station was started in 1913, with a dairy barn constructed at a cost of $3,800 and two 100-ton metal plaster lath silos built costing $500 each. In 1914 a cottage for the dairyman was built at a cost of $780. This unit was converted into a beef cattle wintering unit and the dairy project discontinued in 1928.

The dairy barn was moved to the headquarters to provide facilities for experimental beef cattle feeding. Other sheds were built on the site of the old dairy units for the care of the beef cattle herd. All of the buildings except the residence on the old dairy farm unit were destroyed by fire in 1959. The cattle sheds were replaced with a steel building in 1962.

Between 1922 and 1928 major construction projects consisted of the completion of the

Fig. 17.—Superintendent's residence, erected in 1927. It was described as "a modern two-story building with complete basement, constructed of brick and hollow tile at a cost of $15,245."

machine shed started in 1920, the erection of a new brick and hollow tile farrowing house, a seed house with work room and machine shed for the dry land agriculture project, a new greenhouse and service building for the forest nursery, and the rebuilding of the machine shed.

Superintendent's Residence. A new residence was built in 1927 for the superintendent. The old residence was poorly constructed, in need of repair, and inadequate. It was replaced by a modern two-story building with a complete basement, constructed of mingle shade rug brick and hollow tile with red tile roof at a cost of $15,245. It was paid for from Station fees.

Between 1928 and 1931 several of the older residences were rebuilt and modernized. A nursery irrigation plant was constructed, a tractor repair shop built, and an alfalfa hay shed constructed. Work was started on a new office building.

The Office Building. An office building 50 x 43 feet, completed March 17, 1931, was constructed to conform in style with the superintendent's residence. On the first floor were an office for the superintendent and three rooms for the clerical forces as well as a combined reading room and lobby; on the second floor, seven office rooms for the technical staff; and in the basement two laboratories, a photographic room, five storage rooms, and a room for the heating unit. Large fireproof vaults were located on each floor. The building was steam heated with natural gas. It was constructed at a cost of $20,477.

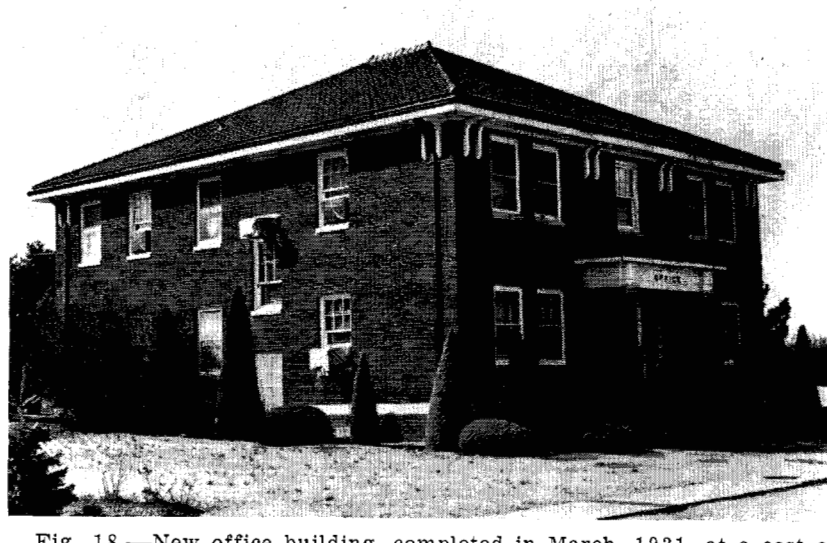

Fig. 18.—New office building, completed in March, 1931, at a cost of $20,477.

Construction with Relief Funds. During the depression of the 1930's the Station cooperated with the Works Progress Administration (WPA) and the Civilian Conservation Corps (CCC) and other relief agencies. It had much productive work to be done. One of the first projects undertaken in 1933 was road improvement. Thousands of loads of soil were hauled and a number of main roads on the campus, farm, and state park graveled. In 1934 road work was continued and a large drainage ditch constructed, changing the channel of the creek to protect valuable crop land from overflow and erosion.

The largest project undertaken was the construction of a battery of six pit silos 19 feet in diameter and 35 feet deep. Construction of these silos required much labor during 1935 and 1936. The silos also provided the Station with 1,200 tons additional silage storage capacity, thus enabling the Station to carry surplus feed from good to poor crop years. Labor provided by the CCC boys was used to develop an attractive picnic site on Big Creek. A dam was constructed, a swinging footbridge and shelterhouse built, and rustic tables and benches constructed from native timber secured on the site.

Crops and Soils Research Building. The Legislature of 1931 appropriated $12,000 for a crops and soils research laboratory. This appropriation was reduced by the governor to $10,500 due to the acute economic situation existing at the time that the money became available. A fireproof

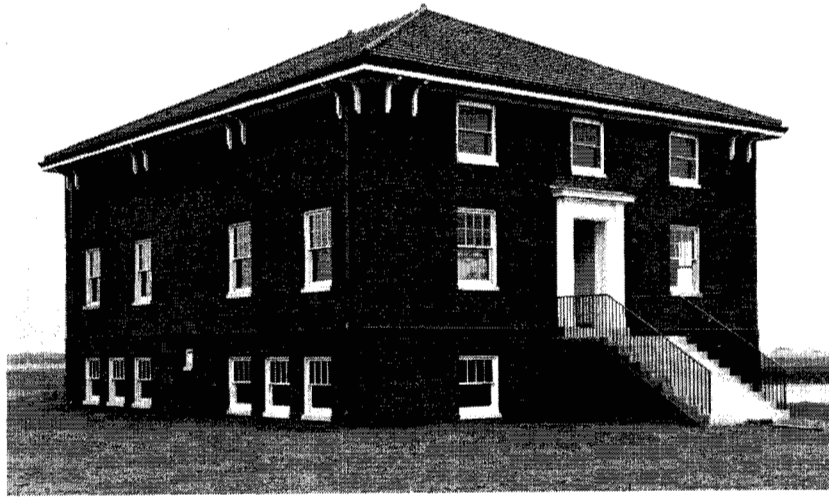

Fig. 19.—Soils and crops research laboratory, for which the Legislature of 1931 appropriated $12,000.

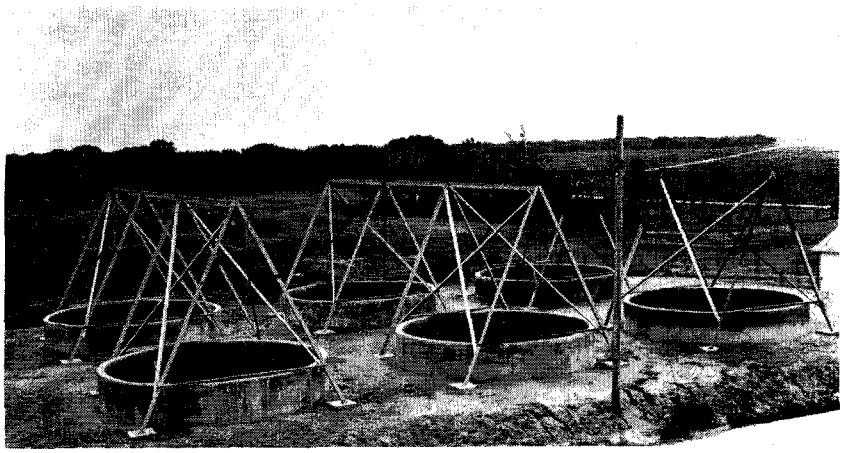

Fig. 20.—Battery of pit silos 19 feet in diameter and 35 feet deep built with the assistance of the Works Progress Administration. This construction "furnished much labor during 1935 and 1936."

building 42 x 54 feet was constructed in 1932 but the interior was not completed until 1936. The building was constructed of concrete, brick, and hollow tile to match the office building constructed in 1931. The building had four main laboratory rooms, a boiler room, and lavatory in the basement, five work rooms on the first floor, and a large storage room on the top floor, The building, when completed, was provided with hot and cold water, gas and electric heat, electricity for power and light, and exhaust fans to remove fumes. It cost $12,920.

Water System. The Legislature of 1937 appropriated $6,700 for a steel water tank, tower, and four-inch water line. The tank was to replace a concrete tank erected in 1920. The old concrete tank leaked and had been repaired unsuccessfully several times at considerable expense. A new 50,000-gallon steel tank manufactured by the Darby

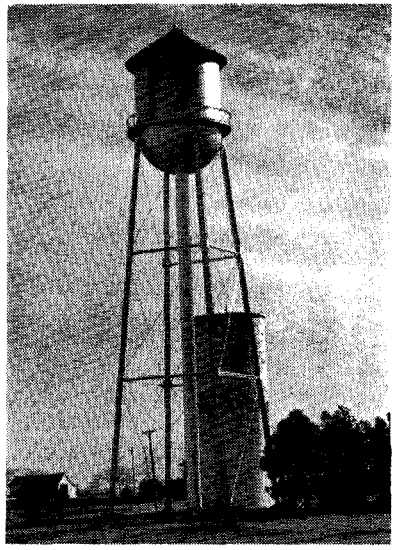

Fig. 21.—New water tank, with old concrete water tank in background. This 50,000-gallon tank was purchased in August, 1938, and erected during the winter months.

Corporation, Kansas City, Kansas, was purchased in August, 1938, and erected during the winter months. The total cost of the tank erected, including footings, was $5,970. The bottom of the tank was 75 feet above ground, which was 50 feet higher than the old tank. The added water pressure from the higher tank provided more satisfactory water service as well as better fire protection. To connect the new water system with the pump, 1,591 feet of four-inch transit pipe was purchased at a cost of $830. A trench 42 inches deep, for the water line, was dug by WPA labor at a cost of $364. The old well in the forest nursery, to which the water line was attached, proved inadequate. It was decided to prospect for water at a point near the new water tower. The first attempt produced a well 61 feet to shale, with 10 feet of water above the shale. This was an adequate supply of water, and a gravel-packed well was constructed. A four-inch water line connected the new well

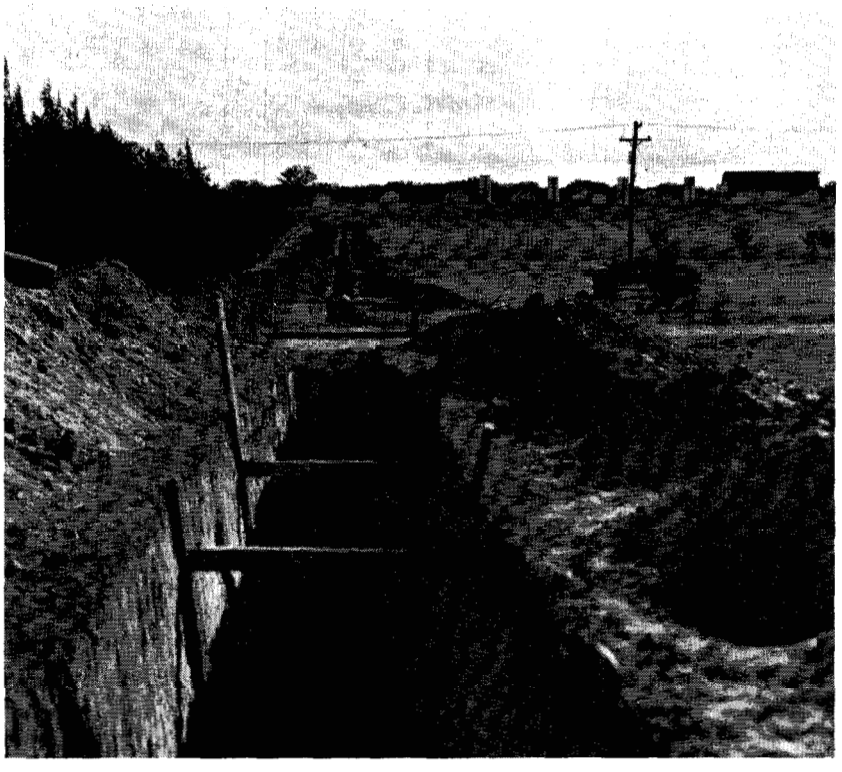

Fig. 22.—Sewer line east from flush tank. When the city of Hays installed a new sewage disposal plant in 1935 permission was granted for its installation on Station land, with the agreement that the Station could connect its sewer to the city's.

with the water tower. The well under test delivered 190 gallons per minute and enabled the new 50,000-gallon tank to be filled in approximately 3 hours.

Sewer System. In the early days of the Station a sewer line was constructed leading to a septic tank that emptied into what was later the golf course of the state park. This location was objectionable; furthermore, the sewer line was not deep enough to service the basements of some of the new buildings. When the city of Hays installed a new sewage disposal plant in 1935, permission was granted for it to be installed on Station land with the agreement that the Station could connect its sewer with the city plant, Work on the sewer line was delayed for lack of funds. However, a grant of WPA funds enabled the Station to make the connection in the fall of 1938. An eight-inch sewer line was run from the office building to near the forest nursery building, then east to Big Creek with a siphon under the Creek, then to the city sewer and disposal plant. The sewer tile and labor were supplied by WPA. The expenditure for the line was $3,673 by WPA and $860 by the Station.

Bridges. Two wooden bridges were constructed across Big Creek in the early years of the Station. These bridges were poorly con-

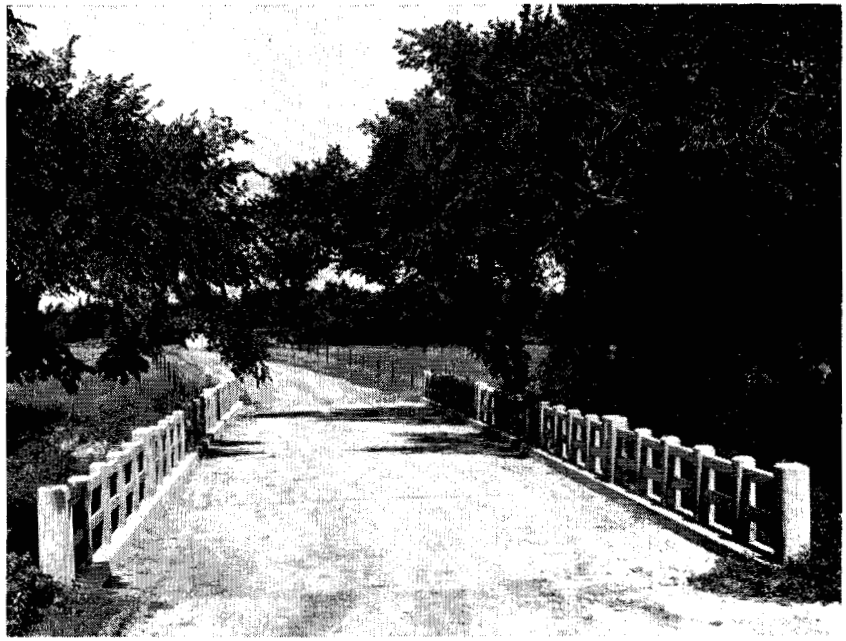

Fig. 23.—This high level reinforced concrete bridge was constructed in 1929 at a cost of $12,858.

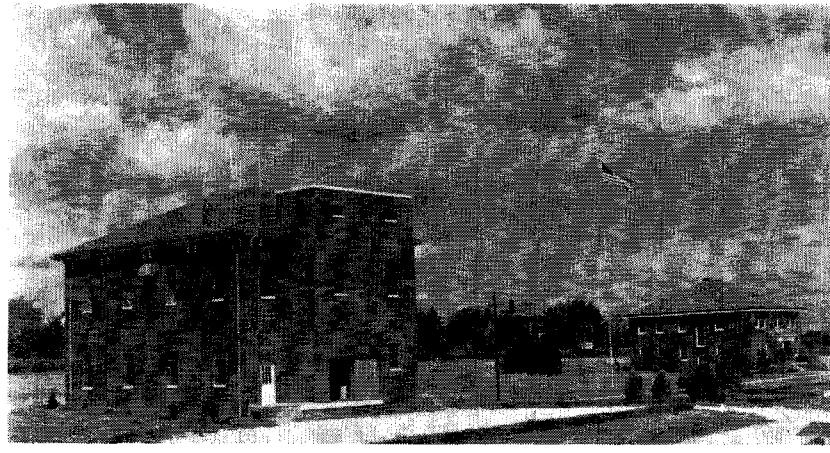

Fig. 24.—The new seedhouse with new office building to the right and the superintendent's residence in the background. Facilities for handling seed were inadequate until this seedhouse was built in 1941. The Legislature of 1939 appropriated $7,500 for the purpose. The building cost $13,455, with the balance being paid from fees.

structed and unsafe. The first bridge east of the stockyards collapsed in 1923, dropping a number of horses into the creek. The Legislature of 1923 appropriated $2,500 for the construction of a reinforced concrete wash bridge across Big Creek to replace the collapsed bridge. The new bridge was constructed in 1925 at a cost of $3,395 and is still in use but is not passable in times of high water.

The second bridge located on the east-end farm unit became unsafe. An appropriation of $12,500 was made by the Legislature to replace it. A new high-level reinforced concrete bridge was constructed in 1929 at a cost of $12,858. This bridge is still in use and should give many more years of satisfactory service.

Seed House. A service of the Station that increased greatly in importance between 1920 and 1940 was the production and distribution of improved and certified seed. Facilities for handling seed were inadequate until a new seed house was built in 1941, the Legislature of 1939 having appropriated $7,500 for this purpose. A large two-story reinforced brick structure was built. This building harmonized in general construction with the superintendent's residence, office building, and laboratory. It was completed at a cost of $13,455 in time to house the 1942 seed crop.

The seed house was built principally to clean and grade seed and handle sacked stocks. An elevator to handle large quantities of seed and feed grain in bulk was constructed in 1950. The modern elevator,

made of heavy metal, was installed on a concrete foundation and had a capacity of 24,000 bushels. It was constructed at a cost of $38,021.

Utility Building. The Station had been handicapped in not having a building in which public meetings could be held during inclement weather. This need was met in 1948 with the construction of a utility building at a cost of $43,500. It is reinforced concrete faced with brick, with a tile roof to correspond with other main buildings on the campus. First floor of the utility building is usable as an auditorium when needed, and seats 900 people. It has been used to store buffalograss seed at other times, and other seed stock. The basement was devoted entirely to buffalograss seed processing.

Shop Building. For the successful operation of the Station a modern shop building was needed. In the early days the Station shop occupied a part of a machine shed. In

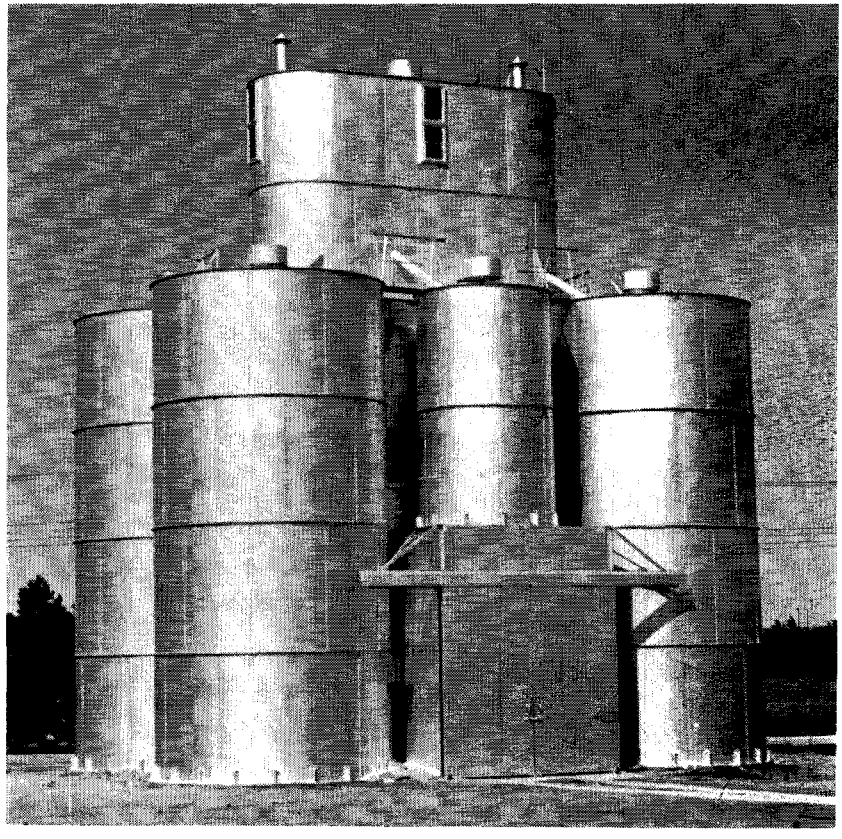

Fig. 25.—A seed elevator with a capacity of 24,000 bushels was constructed in 1950 at a cost of $38,000.

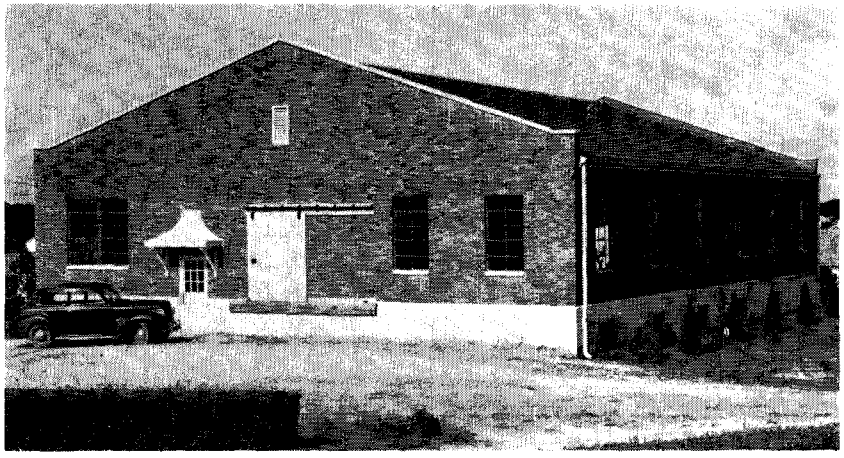

Fig. 26.—The utility building, which fulfilled the need for a place where public meetings might be held on the Station. It was built in 1948 at a cost of $32,000.

1926 when a new wing was added to the machine shed, a shop was constructed in its east end. In 1930 a tractor repair shop was provided by moving an old shed to the east of the machine shop. The south two-thirds of the building was used as a tractor shop and the rest of the building for storing oil and grease. A modern machine shop was built in 1951 at a cost of $17,900. This building was constructed of brick to conform in design and construction with the other major buildings on the campus.

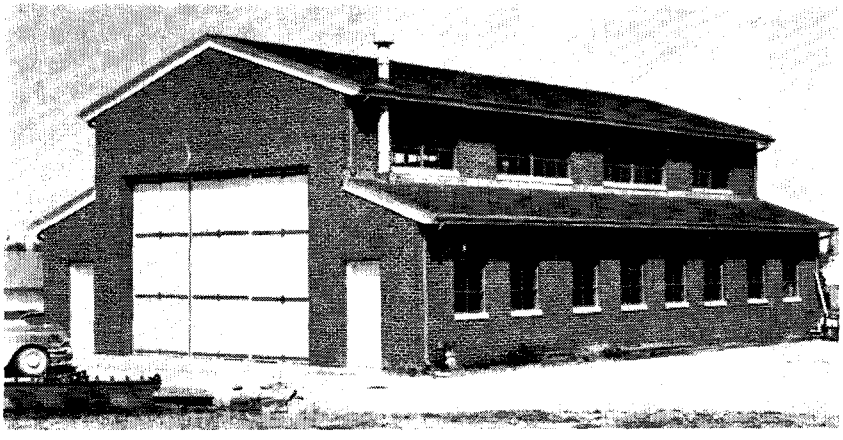

Fig. 27.—A modern machine shop was erected in 1951 at a cost of $16,772. It was built of brick and conformed in design and construction with other major buildings on the campus.

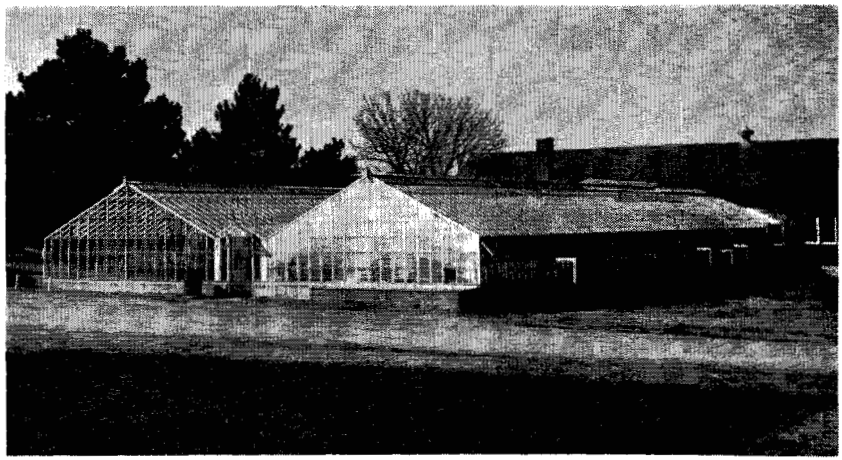

Fig. 28.—The new greenhouse completed in 1954 was 56 by 100 feet and included eight thermostatically-controlled rooms 25 by 25 feet with connecting corridor. This greenhouse is used by the cereal and forage crop geneticists and by the entomologists and horticulturists.

Experimental Greenhouse. An experimental greenhouse to provide facilities for plant geneticists, entomologists, and horticulturists was completed in 1953. The house was 100 x 56 feet. It consisted of eight thermostatically controlled rooms 25 x 25 feet with connecting corridor down the middle. This building provides facilities that enable the technical workers to grow plants under controlled conditions.

While the facilities discussed above constitute the major units of the physical plant, numerous other facilities have been provided: additional residences for the technical staff: experimental beef cattle barn; modernized stockyards; hay and storage sheds; additional experimental cattle sheds; packing sheds; hog houses: and additional pit, trench and upright silos. All service facilities such as telephone, electric power and lighting, and sewage disposal have been modernized. The total cost of the physical plant exceeds $325,000, of which less than $100,000 was provided by direct appropriation of the Legislature. Most of the money came from fees obtained by the Station from the sale of livestock and agricultural products, the residue of experimental work. A small amount came from WPA and other relief grants made to the Station during the 1930's.

EARLY WORK AT THE STATION

Directions for the experimental work that should be undertaken at the Station were given in a resolution of the Board of Regents March 6, 1902: "Moved by Regent Fairchild that the superintendent at Hays be authorized to carry on such experiments

as the Station Council may direct, namely alfalfa, Macaroni wheat, emmer, barley, etc. Carried." (20) At the same time the Board of Regents authorized a survey of the lands of the Station.

The work undertaken the first year at Hays was more extensive than that indicated by the resolution of the Board. During the season the following crops were planted: five varieties of macaroni wheat on 15 acres; three varieties of sorghum in rows, 6 acres; sorghum sown thickly, 5 acres; mixed sorghum and kafir sown thickly, 5 acres; kafir sown thickly, 11 acres; barley, 25 acres; soybeans, 15 acres; cowpeas in rows, 6 acres; cowpeas for hay, 7 1/2 acres; alfalfa, 22 acres; bromegrass, 4 1/2 acres; Kansas stock and other melons, 10 acres; peanuts and garvanzos, 1/2 acre. A grass garden containing 31 varieties of grass was laid out, and 3/4 acre set to trees and shrubs. All planting was made on sod ground. A portion of the area formerly used by the garrison as a garden was planted to potatoes, half of which was mulched. Smaller areas were planted to Jerusalem artichokes, three varieties of cowpeas, three of soybeans, and four each of corn, sorghum, kafir, rape, and penicillaria.

STATION WEATHER RECORDS

Precipitation, temperature, wind velocity, and evaporation records have been kept at the Hays Station since 1907. Records of precipitation were taken first at the military reservation. They were started in 1868 and for 94 years (1863 to 1961) averaged 22.95 inches annually. Average precipitation through the growing season, April through September, is over 77 percent of the average annual precipitation. Average monthly precipitation increases in the spring until a maximum is reached in May or June. This is followed by gradual decrease to a low winter level.

Annual precipitation since Station records have been taken has ranged from 43.34 inches in 1951 to 9.21 inches in 1956. The total amount, the amount from each storm, and the distribution, especially during the growing season, are important. The unpredictable and extremely variable weather, especially rainfall, is the largest contributing factor in crop production.

Average annual snowfall over 62 years has been 19.5 inches. The most snow is received in February and March, averaging 5.0 and 4.5 inches, respectively.

Average annual mean temperature for 64 years, 1897 to 1961, is 54° F., with a mean maximum of 68° F. and a mean minimum of 40° F. Except for three years, daily maximum temperatures of over 100° F. were recorded each summer. Except for 1941, subzero temperatures were recorded each winter. The extremes were 117° F. July 13, 1934, and —24° F. February 7, 1895. The average date of the

last killing frost in the spring is April 29 and of the first killing frost in the fall, October 15. Through 59 years the frost-free period varied from 114 to 199 days.

IRRIGATION

Irrigation investigations at the Hays Station were started in 1903. The first work was in cooperation with the United States Department of Agriculture, covered by a memorandum of understanding dated February 22, 1904 (21). This memorandum described the work to be undertaken cooperatively both at the Hays Station and in the Arkansas River Valley near Garden City. Work at the Hays Station was done to determine:

(a) Cost of pumping water from a well and of its application to the land.

(b) Maximum amount of water that a well will furnish, by lowering the water level by pumping at different rates.

(c) Amount of water applied and yield of crops.

(d) Effect of irrigating in winter only.

Garden vegetables, potatoes, sugar beets, alfalfa and other field crops were irrigated when there was sufficient water.

A well was dug near Big Creek to a depth of 40 feet, and the water level rose to 24 feet. A Knowles pump was installed and operated with a J. I. Case traction engine and the regular thresher belt used. It was estimated that the pump had a capacity of 22,000 gallons per hour. Cost of the well with pump installed was $865.65. A complete description of the project is given in Bulletin 128, Kansas Agricultural Experiment Station (22).

It was found that irrigation by centrifugal pump and traction engine was too costly to be practical for field crops under conditions that existed at that time. The cooperative irrigation experimental work was discontinued in 1909. However, the pump equipment was used later to irrigate the

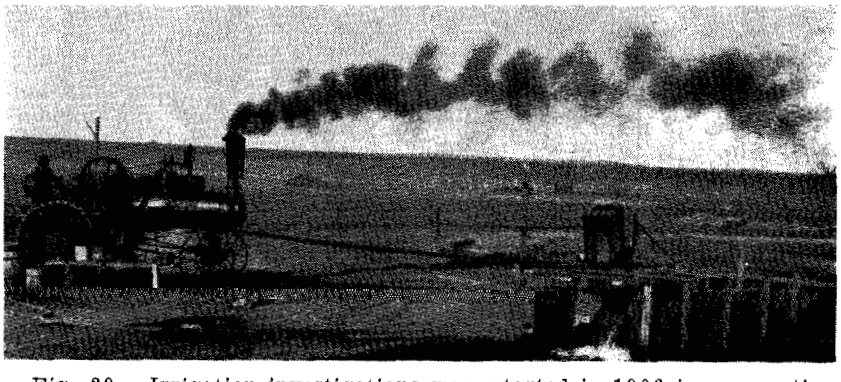

Fig. 29.—Irrigation investigations were started in 1903 in cooperation with the U.S.D.A. A Knowles centrifugal pump was operated with a J. I. Case steam engine.

forest nursery and the vegetable garden.

A demonstration of the use of vitrified tile for supplying water underneath the surface to irrigate garden crops was undertaken in 1913 with little success.

Subirrigation. It was thought that deep-rooted crops such as alfalfa could be assisted materially in growth by raising the level of underground water by means of dams in streams. The alfalfa growing on the bottomland along Big Creek provided an opportunity to study this problem. A dam had been built in the early days of the Station to attempt to raise the water level in the valley. The dam held a maximum of five feet of water and backed water up the creek for nearly a mile. When the dam was washed out in 1924 a question arose as to whether it should be rebuilt. Ten test wells dug to shale across the valley in 1926 showed that little water-bearing gravel existed in any well; consequently there could be little movement of water from the creek to surrounding bottomland. Water measurements in the wells over a period of five years showed little relationship between the position of the well in the valley and the height of the water in the well. The dam was not rebuilt,

A well that supplied the garden and nursery after the irrigation project of 1909 was discontinued provided a limited quantity of water. A more liberal supply was obtained by pumping the water from Big Creek. A dam was constructed across Big Creek in 1933 by the C i v i l i a n Conservation Corps, and a pump to irrigate the nursery installed above the dam. Some defects developed in the pumping outfit, which were corrected in 1935 when construction of a new bridge

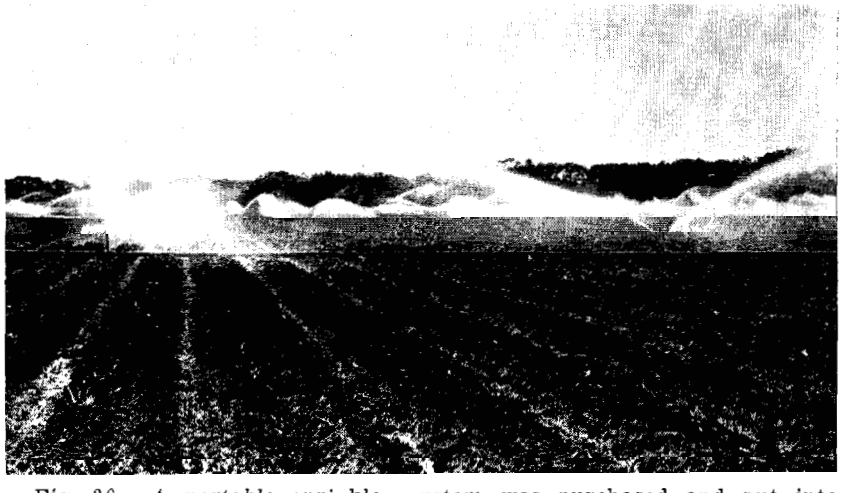

Fig. 30.—A portable sprinkler system was purchased and put into operation in 1950.

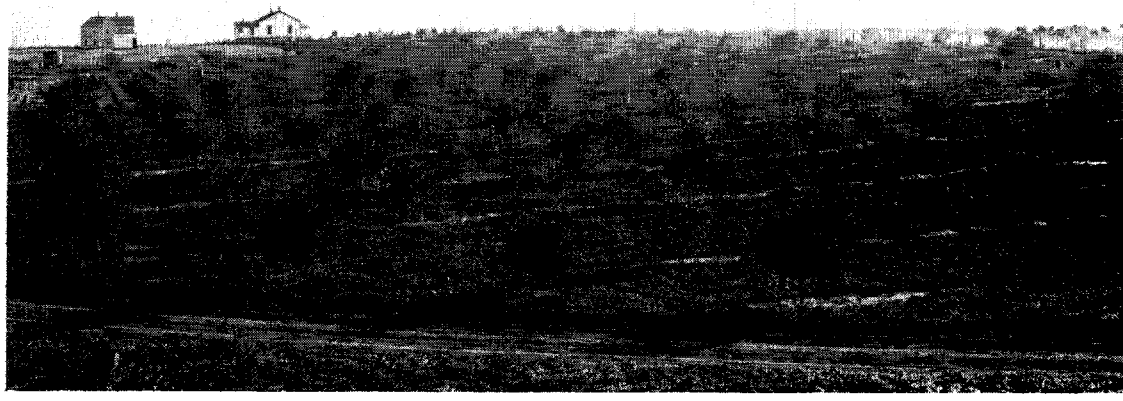

Fig. 31.—The first Station orchard as it appeared in 1906. It was planted in 1903.

across the creek on Highway U.S. 181 required the lowering of the water in the creek. A new suction line with a larger intake was also installed.

Irrigation water to save valuable forage plants under investigation in the forage crop nursery was provided in 1938 by a well completed in February of that year. A Fairbanks - Morse electric pump with a capacity of 125 gallons per minute was installed.

The drouth of the 1930's forcefully demonstrated the need for irrigation water to insure production of seed of improved varieties and to protect important types of investigational work, especially grasses and alfalfa, as well as to safeguard feed supplies. In 1942 a small dam of loose rocks was placed in the creek to create a pool from which water was pumped. Capacity of the pump was 900 gallons a minute and it irrigated about 50 acres. Until 1950 all irrigation was by flooding. In 1950 a sprinkler system was purchased and operated with a Caterpillar tractor. This portable outfit supplied water to any part of the valley land adjacent to the creek. Irrigation water has been used principally to irrigate such crops as grass and certified sorghum for seed production. Since 1950 the system has been enlarged and it is used extensively for winter as well as summer irrigation.

FOREST PLANTINGS AND NURSERY

A forest nursery was one of of the first projects started at the Station. In the spring of 1903, 1,000 deciduous forest trees, 4,000 cedar and pine trees, 300 fruit trees, and 500 vines were planted. It was recorded in 1904 that 32 percent of the evergreens grew and that some Austrian pines made a first-year growth of 12 to 15 inches without irrigation. Additional plantings made in 1905 consisted of 8,000 forest trees, 1,400 of which were black walnut and oak. About 2,500 were planted in the State Park.

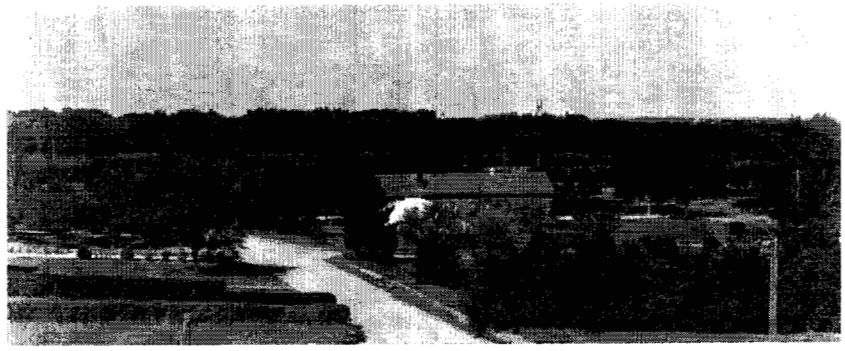

Fig. 32.—General view of the forest nursery in 1933. In January, 1912, the Regents had directed that nursery stock be grown at the Station and made available to the residents of the state at cost.

Early Shelterbelt. In 1907 60 acres a half mile south of the Station campus were set aside as a demonstration of the value of windbreaks under western Kansas conditions for the protection of orchard plantings. About 30 acres in the center of the tract were planted to some 1,000 fruit trees. A windbreak 10 rods wide occupying about 30 acres was planted around the orchard. At the start about 17,000 forest trees were planted, consisting of catalpa, honey locust, and Osage orange. A severe drouth in 1907 made it necessary to replant most of the trees, both fruit and forest. In the spring of 1909 2,200 more trees were planted, but a destructive hail that summer killed 97 percent of the fruit trees and severely damaged the forest trees in the surrounding shelterbelt. The orchard was not replaced. Replantings were made in the shelterbelt, but after the hail the area did not receive the care required to maintain trees in good growing condition. Superintendent Helder in his report for 1914 stated, "The forest plantation on upland . . . 10 rods wide, surrounding a field of 30 acres of upland prairie land had no pruning and very little cultivation because of insufficient help during the rush season of harvest and threshing." (23)

The shelterbelt gradually deteriorated and was disposed of completely in 1925 by pulling up the old stumps and cleaning the field. At that time most of the trees were dead and served only to catch blowing Russian thistle and trash carried into the area by the high winds of western Kansas.

Nursery Established. June 1, 1910, a state forester was appointed. He was stationed at Kansas State Agricultural College but worked with the Hays Station. It was his recommendation that a forest nursery be established. An assistant state forester, Christian Jensen, was appointed and placed in charge of the forestry work. A nursery was

established to produce forest, shade, and ornamental trees, and shrubs and vines of species and varieties found adaptable and desirable.

In January, 1912, the Regents directed that nursery stock be grown at the Station and made available to Kansas residents at cost. J. W. Preston, a graduate of the College, was appointed nursery foreman March 15, 1912.

The propagation and commercial distribution of nursery stock were continued without much emphasis on experimental work until 1923. In April, 1927, E. W. Johnson, a graduate in horticulture and forestry at Colorado Agricultural College, was appointed forester. He immediately began testing new trees and shrubs for adaptation to western Kansas conditions. The Chinese elm was proving a rapid-growing, hardy tree, apparently well adapted to western Kansas. A scarcity of seed existed, so a grove of Chinese elm was planted in 1925 and enlarged in 1930, for propagation purposes. A new greenhouse completed in 1925 provided facilities to propagate Chinese elms with root cuttings. Several thousand root cuttings were made and planted in the greenhouse in December, 1925. These cuttings grew well, with 85 percent surviving.

Distribution of forest tree seedlings in cooperation with the U.S. Forest Service, as authorized by the Clarke-McNary Act, was started in 1928. Under this act the Forest Service was authorized to provide funds equal to those expended by the state to distribute forest tree seedlings at low cost to farmers; 10,000 seedlings were distributed in 1928. Maximum distribution was 868,000 in 1948. From 1941 to 1951, 5,154,642 trees were distributed. Orders were received from nearly every county in the state, especially those in western and central Kansas. Seedlings were purchased also by Colorado farmers for shelterbelt plantings. The program was discontinued in 1952.

Chinese Elm.[8] Mention has been made of the Chinese elm tree first planted at the Station in 1913. This tree was one of two obtained from China and was the first Chinese elm planted in Kansas. The tree grew rapidly and gained great popularity. Thousands of trees propagated from this mother tree were planted throughout the state upon the recommendation of the Station. The March 26, 1931, blizzard, most severe to hit western Kansas in 68 years, killed thousands of Chinese elms and severely injured more by rupturing their cambium layers. Two-thirds of the trees in the planting of 1925 were killed. Many trees not killed outright recovered satisfactorily, demonstrating remarkable power of recuperation.

The next severe damage to Chinese elm from cold occurred with the "Armistice Day Freeze" in 1940. The tem-

8. The "Chinese elm" discussed in this manuscript is **Ulmus pumila.** It is usually referred to in horticultural publications as Siberian elm.

Fig. 33.—A 15-year-old Chinese elm tree, planted as a seedling in 1913. This tree was one of two obtained from China and was the first Chinese elm planted in Kansas. Thousands of trees propagated from this mother tree were planted throughout the state.

perature at Hays dropped to 0° and to —1° F. November 13 and 14, respectively. No cold weather to harden off vegetation had occurred prior to the freeze. The freeze destroyed all tender types of vegetation. Chinese elm particularly suffered severely. Practically all Station Chinese elm over 16 inches in diameter were killed, and most of the other young trees were damaged. The old tree that was planted in 1913 was killed, except for one branch on the north side. It was felled the next fall. At 3 feet above the ground the tree had an aver age diameter of 24 1/2 inches inside the bark, with the greatest diameter being 26 inches. The circumference at this height was almost 7 feet. The tree was 52 feet tall. The loss of Chinese elm from the

freezes of 1931 and 1940 lessened the enthusiasm of western Kansas people for this species. Prior to this time many had planted Chinese elm to the exclusion of all other kinds. The freezes may have been useful in demonstrating that the Chinese elm was not the only kind of tree to plant in western Kansas.

Chinese elm and cherry trees were the only deciduous trees on the Station that suffered severely from the freeze, although several other species in the nursery were affected. Most of the Chinese arborvitae were killed. No pines were killed outright. The red cedar and Pfitzer juniper were damaged. Among seedlings in the nursery, black locust and Osage orange were a total loss, as were most of the catalpa. Hackberry, Russian olive, American elm, black walnut, and honey locust were damaged little. Most of those species were sufficiently dormant before the cold weather struck.

Since the state forest nursery closed in 1952, the Station has devoted little attention to tree propagation or distribution. Commercial nurseries, the Extension Service, and the Soil Conservation Service now perform those services.

ORCHARDS AND GARDENS

An orchard and vineyard of 300 fruit trees and 500 vines was planted in 1903 and made a "splendid start." This orchard was planted on the north side of what is now the Station campus and nursery. It contained different varieties of apple, plum, and peach trees. In 1910 it was reported that there were a number of bearing trees in the orchard but that "The high winds of

PROJECT LEADERS IN FOREST INVESTIGATIONS

Name	Appointed	Termination
J. L. Pelham	July 1, 1905	March 15, 1906
R. Green	May 1, 1906	November 30, 1906
J. L. Pelham	April 1, 1907	February 28, 1908
C. F. Jackson	March 1, 1908	April 30, 1910
Christian Jensen	May 1, 1910	July 31, 1911
Charles Scott	Spring, 1912	
J. W. Preston	February 15, 1912	April 30, 1916
I. T. Bode	May 15, 1916	May 24, 1918
W. A. King	January 1, 1919	April 15, 1919
C. R. Jaccard	April 15, 1919	February 28, 1920
Tom Williams	March 21, 1920	July 15, 1920
Henry Nye	July 12, 1920	February 28, 1921
D. E. Wilson	March 1, 1921	November 30, 1926
Jake Schoenfeldt	December 1, 1926	March 1, 1927
E. W. Johnson	April 1, 1927	June 1, 1934
E. P. Eshbaugh	July 1, 1934	May 15, 1940
J. C. Crupper, Jr.	July 5, 1940	July 31, 1942
J. G. Harrison	August 16, 1942	Retired on leave January 1, 1962

western Kansas and the late spring frosts are the greatest detriment to rapid growth of fruit culture. The old orchard shows the effect of these high winds in the number of deformed trees growing in exposed locations." (24)

As the trees in the orchard died, they were replaced principally with cherry trees. A large number of apple trees were removed in the winter of 1927-28 and replaced with Early Richmond and Montmorency cherries. This orchard suffered in the Armistice Day freeze. Before that it had produced full crops. It continued to be maintained, principally as a cherry orchard.

Grape Variety Test. A variety test of 21 varieties of grapes was planted the spring of 1927. By 1931 only six of the varieties gave promise of being able to withstand western Kansas conditions. Of these, only three varieties have borne fruit in quantity. Commonest difficulty with grapes in western Kansas is winterkilling.

The Cherry Orchard. An experimental cherry orchard was planted in 1930 on terraced land that was too rough to be used for field crops. Earth terraces were constructed on the contour and the trees planted with 20-foot spacings in the row and the rows spaced 22 to 28 feet apart. In all, 1,040 trees were planted, consisting of 12 varieties of cherries and 10 varieties of plums; 400 of these trees were Early Richmond and 300, Montmorency cherry. The trees were hand watered

Fig. 34.—Water in cherry orchard terraces (1934) following heavy rain. The orchard was planted in 1930 and trees reached maximum production in 1938 and 1940. The orchard was killed by the "Armistice Day freeze" in 1940.

the first year but received no irrigation later. The orchard was top-dressed the first year with barnyard manure to supply nutrients and to retard erosion. Regardless of the dry conditions of the 1930's the trees produced well. By the summer of 1940 when measurements were made of the growth of the trees, the largest had reached a height of 12 feet and a diameter of 8 1/2 inches. The orchard was killed by the 1940 Armistice Day freeze and was not replanted.

Experimental Fruit Plantings. When commercial cherry and plum trees were planted on the contour (1930), experimental plantings of cherry, plum, and apricot were made in the nursery. They made good, upright growth in contrast to exposed trees in the terraced orchard on the upland that had a decided north "lean." Most of the varieties produced fruit in 1932. Fruit plantings are still being made as an important phase of experimental work at the Station.

Gardens. Garden crops were first grown at the Station in 1903 when 9 acres were planted in part to potatoes, cabbage, tomatoes, beans, and corn for irrigation studies in cooperation with the U.S.D.A. This experimental work was of short duration.

In 1928 five varieties of seedling potatoes descended from the South American yellow-fleshed potato were received from the Presque Isle Potato Station of the Bureau of Plant Industry, U.S.D.A. Results were disappointing and the experiment was discontinued in 1930.

Paper Mulches for Vegetables. An experiment to determine the value of paper mulches for vegetables was conducted for two years —1929 and 1930. Most promising results were obtained with beans, peas, carrots, and cantaloupe, with yields ranging from 114 percent to 190 percent of those from the plots without paper mulch. Negative results were obtained with lettuce, radishes, and one variety of watermelons. The paper mulch proved unsatisfactory under the windy conditions in western Kansas.

Tomatoes. Tomatoes in western Kansas produced vines but little fruit. The Horticultural Field Station of the U.S.D.A. at Cheyenne, Wyoming, had started to study this problem with the Hays Station cooperating. In 1937 seed of a number of varieties was secured from Cheyenne, and purchases were made of others. The results, while not conclusive, showed that some of the old standard varieties were not dependable. The variety Bison, despite numerous faults, gave an excellent yield and was recommended for western Kansas.

WORK ANIMALS

All tillage work on the Station farm the first year of its operation (1902) was done by hired and contract labor. The regents on March 4 passed the following resolution relating to the first tillage work:

Fig. 35.—Reeves steam plowing outfit, purchased under a legislative appropriation made in 1907.

"Moved by Regent Nichols to break at once at Hays about 340 acres at best terms available." (25)

The first authorization by the regents for the purchase of work animals was August 8, 1902, as stated in the following resolution offered by Regent Fairchild: "Whereas, the available funds for use at the Hays Branch Station for the current year are not more than $1,000, and believing that the importance of the work at Hays justifies the most liberal treatment, be it resolved that $350 or so much thereof as may be necessary be appropriated for the purpose of purchasing a team of young horses and harness for use at the Hays Experiment Station." (26)

The Legislatures of 1903 and 1905 appropriated for horses, mules, and equipment. The report of the Director of the Experiment Station for 1907 contains the following: "The Branch Experiment Station now has 15 horses and 12 mules. . . . This number is inadequate to properly carry on the farm work at the time such work should be done, so that at harvest and plowing time, additional teams have been rented." (27)

Mechanical power equipment was being tried in an experimental way for tillage. Steam plowing outfits were being manufactured. The Legislature of 1907 appropriated $3,500 to purchase a steam plowing outfit for the Hays Station. A minute of the Board July 31, 1907, was: "Moved by Regent Nichols that the act of the committee in purchasing steam plow outfit and Otto[9] engine be approved. Carried." (28)

That this purchase was entered into with some skepticism is indicated by another minute of the Board passed

9. The Otto engine referred to in this minute was a stationary gas engine. The engine secured with a plowing outfit was a 33-hp. Reeves steam engine.

at the same meeting: "Resolved that Mr. Colliver, in the absence of Mr. McClelland, be instructed to offer $1.50 per acre for plowing to the extent of 200 acres in case the steam plow does satisfactory work; and in case the plow fails to work satisfactorily, he will then hire done whatever portion of the remainder of the summer plowing may be necessary in his judgment to bring about the best results." (29)

That the steam plow outfit did not give satisfactory results is indicated by a minute of the Regents passed June 28, 1909: "Moved by Regent Capper that Director Webster be requested to investigate gas and tractor engines, also possibility of trading the old steam engine plowing outfit." (30)

This effort to dispose of the steam plowing outfit was unsuccessful, and Superintendent Helder, in his annual report for 1913, reported: "It is proposed that effort be made to dispose of the steam plowing outfit, either by direct sale or trade, and acquiring a tractor for farm use, perhaps as large as 35 hp. Or, procure a 20 hp. tractor and engine plow of not to exceed 5 gang size, so that demonstrations of the practicability of such equipment for farm needs may be made." (31)

The steam engine was not disposed of but remained on the Station as a source of power for threshing and other stationary engine jobs.

The Station depended chiefly on horses and mules as power for field work. A number of mares were purchased and an effort made to produce horse and mule colts as a source of supply of young work stock. During 1913 and 1914 one of the stallions from the Department of Animal Husbandry at the College was loaned to the Station. In 1914

Fig. 36.—Five 6-horse (and mule) teams pulling gang plows in 1914, when the Station depended chiefly on horses and mules as a source of power for field work.

a well bred, two-year-old jack was purchased by the Station for $800. The effort to produce colts was not overly successful and reliance was placed chiefly on the purchase of young work stock. In 1915, 34 young mules ranging up to two years old and 2 two-year-old colts were purchased for $3,321.50. The Station inventory at the close of 1915 showed 1 stallion, 1 jack, 11 geldings, 6 colts, 15 mares, 7 fillies, 26 mules, and 35 mule colts—for a total of 102, and the most work stock ever owned by the Station. Interest increased in tractors for power. In 1915 the J. I. Case Implement Company provided the Station a Case 40 tractor. A few years later a Rumley Oil Pull tractor was purchased. These tractors supplemented team work and reduced somewhat the animal power requirements.

In 1921, 96 head of horses and mules were in use on the Station farm, and as many as 66 head of work animals were put into the field at one time for tillage operations. The use of work animals presented many problems; keeping up equipment was a great expense, and runaways, many of which were permitted by incompetent teamsters, were common. Substituting tractors for horsepower began in earnest in 1924. An Allis-Chalmers, a Farmall, and two Caterpillar tractors were purchased within the next 10 years. A Caterpillar Diesel No. 35 tractor was secured on the college loan plan in 1934, and a Caterpillar Diesel 40 tractor purchased in 1936. The Station became completely mechanized in 1947. The last use made of work horses at the Station was in the winter of 1944 when a team was used in feeding cattle. Fourteen horses were still on the Station in 1947. Twelve of these were large black Percheron horses weighing about a ton each. They were beautiful teams but were sold for $45 a head to a packing house. The only horses remaining on the place were two saddle horses. Riding horses have always been and are still kept at the Station to handle cattle.

BEEF CATTLE

Management. The most extensive work with livestock at the Station has been with beef cattle. Management and feeding work started the second year of the operation of the Station and has continued without interruption to the present time. The first herd, acquired in 1903, consisted of 144 head of common cattle, mostly breeding stock. They were bred to good Shorthorn and Hereford bulls to demonstrate what could be done by using good sires to improve the quality of this kind of cattle.

The Legislature of 1907 appropriated $5,000 for livestock experimental work. In anticipation of starting new work the regents authorized the sale of all cattle on the Station. A minute pertaining to the matter reads: "Moved by Regent Griffith that ten (10) cows

Breed	Bulls	Cows	Yearlings	Calves	Total
Shorthorn	1	25	22	25	73
Aberdeen-Angus	1	25	21	22	72
Hereford	1	25	17	25	65
Galloway	1	25	23	25	74
Total	4	100	83	97	284

and their calves, ten (10) two-year-olds, and ten (10) yearlings be fattened and that the remainder of the herd be sold when in condition. Carried." (32)

An experiment started in the year 1907-08 compared the four common breeds of beef cattle — Shorthorn, Angus, Hereford, and Galloway. A new herd of each breed was obtained consisting of 25 head of high-grade yearlings. Each herd was headed by a pure-bred sire of the very best breeding. The animals were purchased with the aid of Professor Kinzer[10] of the College at different times during the fall, winter, and spring. All animals were TB free. They were reported to be splendid individuals, fairly representative of their respective breeds.

The plan was to raise three crops of calves, and at the end of four years fatten and sell the entire number: cows, three-year-olds, two-year-olds, and calves. Results would be compared by feeding out the different ages, including maintenance and selling value. Each herd was to be pastured and fed separately but given similar conditions and the same kind and quality of feed. In 1910 the herds consisted of the individuals shown above.

The experiment was never well understood by the superintendent of the Station. In 1913 Superintendent Helder reported regarding this work: "So far as the Hays Station office was informed, no definite plan was organized and put into execution concerning the lines of investigation to be studied. The consequences of it resulted in conflict of orders and method of maintenance for the greater period of four years. Hence, no valuable data is accumulated regarding features of beef cattle production, such as must have been the intent when the project was first undertaken." (33)

In 1915 the cow herd on the Station farm, including calves dropped that year, numbered 51 Galloways, 69 Angus, 31 Shorthorn, and 285 Hereford. One hundred of the Herefords that bore the XI brand were purchased as yearling heifers in 1914 from the Adams Ranch at Maple Hill. In the fall of 1915 an outbreak of blackleg resulted in a loss of 26 head, and considerable trouble had arisen from abortion.

Developing the Hereford Herd. In October 1915 the Station purchased 100 Hereford calves at $43 a head from Poole Bros. of Manhattan. These heifers were to be used

10. Professor Kinzer was head of the Department of Animal Husbandry at the College.

Fig. 37.—The Station feed yards in 1904. In 1903 the first herd, 144 head of common cattle, was acquired.

in a breeding experiment where one half were to be bred to calve at two years old and the other half at three years old. Paragon Rupert and Beau Parsifal, two well bred bulls, were purchased in the spring of 1919. In the fall of 1919, 30 Hereford heifer calves and 9 yearling bulls were purchased from Alex Philip at Hays. These heifers were also used in the breeding experiment. It was found that the two-year-old heifers had a hard time calving. Much assistance was required of the herdsman, and despite the assistance many calves and a few heifers died at calving time.

In the spring of 1922 abortion among the young cows again became a problem. Nineteen abortions were recorded at the close of the calving period that year. Changes were made in the methods of handling and feeding the cow herd during the fall and winter of 1923. Abortions were reduced to 11 for that year. In the fall of 1924, 75 off-type cows, including those that had lost their calves, or had not produced a calf, and all bulls, were shipped to market. This cut the cow herd to 98 head composed almost entirely of cows of Poole Bros. and Adams XI breeding. These were old cows remaining from the purchases made in 1914 and 1915. The Hereford heifers purchased in 1919 were the last to be introduced into the herd. Since that time all females used in the Station herd have been bred and raised on the Station.

In the fall of 1924 four bulls were purchased at the dispersal sale of the W. E. Dickey purebred Hereford herd at Kansas City, Missouri. Two of these bulls rendered outstanding service. They were deep-bodied, thick-fleshed, and heavy-quartered individuals with great scale. They passed on these qualities to their offspring.

In 1929 three purebred Hereford bulls were purchased

Fig. 38.—Yearlings sired by Matthews bulls. In 1931 four yearling bulls of Regulator breeding were purchased from E. L. Matthews of Kinsley. The service of these bulls proved "most outstanding."

from Robert H. Hazlett of El Dorado. Among these bulls was a son of Hazford Rupert 25th. He proved an outstanding sire. In the fall of 1931 four yearling bulls of Regulator breeding were purchased from the E. L. Mathews herd at Kinsley. The service of these bulls proved most outstanding. The bulls were all from the same sire. They passed on excellent qualities and uniformity to their calves. Many of the heifer calves were used as herd replacements. Another good sire of similar breeding was purchased of Mathews in 1934. Other bulls have been purchased as follows: in the fall of 1935 Carlos Domino III bull from the Wyoming Hereford Ranch at Cheyenne, Wyoming; in 1936 an Advance Mischief bull from John M. Lewis and Sons of Lamed; in 1937 a Regality Bred bull from the College; in 1940 a Domino Mixer bull from the Rothschild dispersal sale at Norton. Bulls purchased between 1940 and 1950 included Battle Mischief, Delson Rupert, Rollo Mischief 8th, Real Pioneer 23rd, Perfect Tredway, Prince Tredway, and J. O. Royal Lad.

Bulls obtained in the period 1951 to 1955 inclusive had similar breeding and included Dandy Tredway 4th, Duke R. Domino 2nd; P. Royal Duke 92nd; P. Royal Duke 33rd; J. O. Duke Pride 71st; and two Princeps Mixer bulls the 44th and 46th, respectively.

In 1955 a series of breeding investigations was begun that involved the relationship of the feedlot performance of a sire to that of his progeny.

Since the heritability of feedlot gain is relatively high, this project was initiated to study the feasibility of feeding a fattening ration to a group of bulls for 180 days after weaning, in order to determine their ability to gain when on full feed and to investigate further the importance

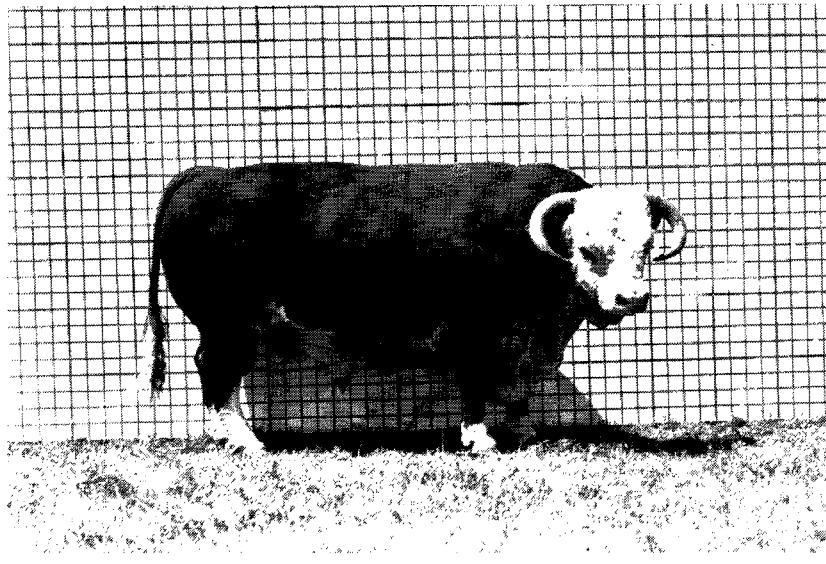

Fig. 39.—Perfect Tredway, "typical of the bulls that headed the Station herd, passing on excellent qualities and uniformity to their calves."

of considering this factor when selecting a herd sire.

Nine bull calves all sired by the same bull and from closely related dams were selected during the period 1955 to 1962, from the herds of the following purebred Hereford breeders: William F. Winzer, Reece; L. W. Henry, Leoti: Thad Douthit, St. Francis; and the Sun Ranch, Salina. Additional sires for use on the remainder of the cow herd not used in the progeny-testing investigations were obtained from the Forest J. Scrivner herd at Haigler, Nebraska.

In 1933 a policy was inaugurated of marking each calf with tattoo numbers. In one ear the tattoos recorded ownership and the number of the mother; in the other ear the tattoos recorded the year of birth and the calf number. In this way it was possible to determine the kind and quality of calves each bull was siring.

During the 1930's great difficulty was experienced in maintaining the herd. Following the exceedingly hot, dry season of 1934, poor pastures and depleted finances made it necessary to dispose of breeding cattle in 1935. All the yearlings were sold and the old cows culled, reducing the herd to 89 cows and 81 calves. The herd then was shipped to Manhattan and grazed on the Alvin Springer pastures north of town. In 1937 following the exceedingly dry year of 1936 the cow herd, including 2-year-old replacement heifers, totaling 123 head and 94 calves, was shipped to Niles for summer grazing. Forty-four yearling steers were grazed that sum-

mer on rented pasture 15 miles north of Hays, and a few yearling heifers were given the run of the entire pasture area of the Station. There were 185 females in the herd upon return from pasture in 1937. All were given the Bangs test and found negative, resulting in the Station's being awarded a Bangs-free certificate.

Feed shortage and insufficient funds made it necessary in December 1937 to sell 50 cows, heavy with calf. Because of continued dry weather it again became necessary in 1939 to rent pasture for the cows and calves. Good pasture was located in Mitchell County. Thirty-seven cows were sorted out and sold before the herd was moved to pasture, in order to provide funds for Station operation. The continued drouth situation and shortage of funds in 1940 again made it necessary to sell breeding cattle. Thirty-three 10- and 11-year-old cows and 12 two-year-old heifers were sold. The rest of the herd consisting of 76 cows and calves and 23 yearling heifers were moved by truck in June to pasture near White City. The average weight of calves off grass that fall was 520 pounds, showing the value of good grass and of selecting good cows and herd sires proved by the herd sire testing program.

The Hereford cow herd was developed at the Station to provide uniform stock for experimental work and a demonstration of good cow herd management.

The cattle inventory reached an all-time high of 774 head in the fall of 1961. All were used as experimental animals. There were 150 head in the cow herd, and 275 steer calves were purchased that fall. Half of the steer calves were wintered in the lots and used in the summer feeding programs. The others were held over for use for annual grazing trials followed by fattening tests the second winter. Calves from the cow herd were on creep-feeding tests.

Fig. 40.—Station yearling heifers on grass near White City, where the herd of 76 cows with calves and 23 yearling heifers were moved to pasture when the drouth persisted in 1940.

Fencing the cattle-feeding corrals with pipe and cables, arranging gates and pens, and building concrete fence-line bunks began in 1960. Feeding operations were mechanized by addition of a silo unloader, a mixer-auger-conveyor arrangement at the elevator, and a three-compartment feeding trailer. These changes improved the appearance of the cattle-feeding area, reduced costs, and reduced labor needed for winter operations.

Feeding. The first feeding experiment was started December 21, 1903, when 51 head of grade Hereford and Shorthorn calves 8 to 10 months old were put on feed in seven lots for 182 days. Best gains were obtained from the lot receiving corn and alfalfa, and the poorest from the lot receiving corn and sorghum hay, with corn and oat straw a close second. The same winter, 1903-04, a study was made of the comparison of penicillaria stover with kafir stover as roughage for cattle.

The feeding test authorized by the regents July 31, 1907 (32) with a herd of 40 cattle consisting of 10 head of calves, 10 one-year-olds, 10 two-year-olds, and 10 head of old cows was started on November 14, 1907, and continued until February 7, 1908, at which time all lots were shipped to market. Each group was fed in a separate lot on rations of corn and kafir meal in equal parts with alfalfa and kafir stover. The old cows and the two-year-olds were well finished by this time; the yearlings were in fair condition, but calves were not in shape to bring a good price as baby beef.

These examples of early experiments indicate some of the types of feeding investigations that were to be conducted during the next five decades. They stressed the feeding value of types of grain and forage which could be grown successfully in western Kansas. Emphasis was placed on determining the relative

Fig. 41.—Station cow herd grazing on native pasture. "The main object of developing a high class Hereford cow herd was to provide uniform calves and yearlings for experimental work and as a demonstration of good cow herd management."

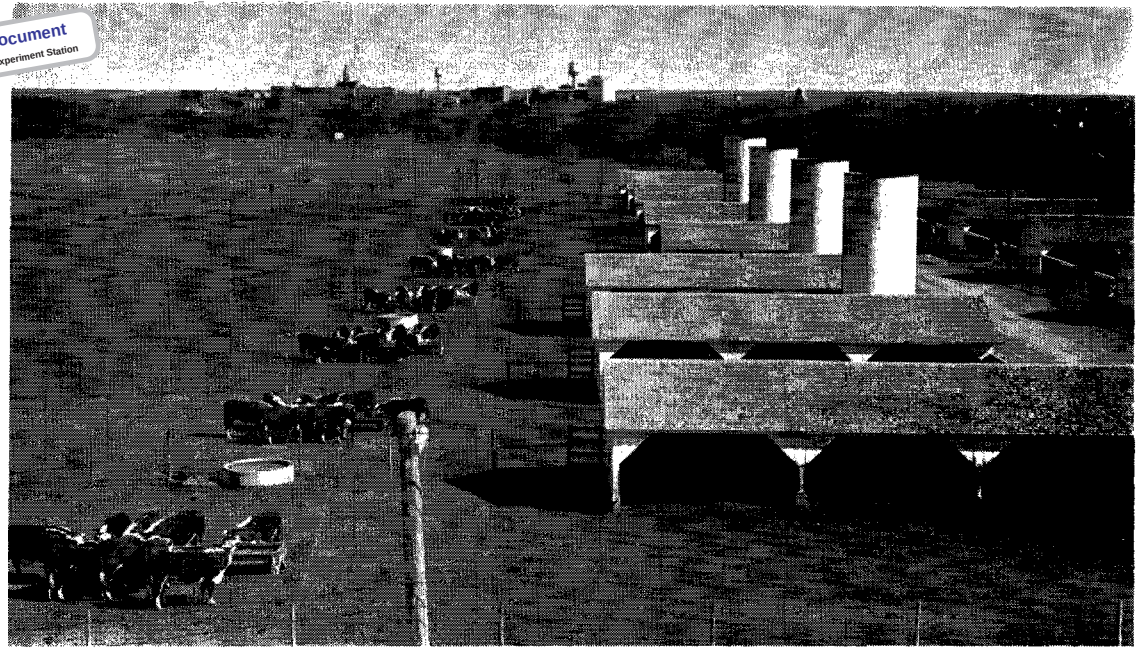

Fig. 42.—Experimental cattle in feedlots.

values of different roughages and on increasing the utilization of roughages. Important studies were conducted comparing dry feed and silage, fodder and stover, sweet sorghums and kafir, and grinding and chopping.

Little full feeding was undertaken until 1944, when the combine types of grain sorghum became popular in western Kansas and sorghum grains became available in quantity for feeding. Since 1944 fattening trials have become an important phase of the beef cattle feeding research, and most of the stock have been marketed as finished animals. The most important studies of this kind have related to different ratios of grain to silage and feed supplements. They have been repeated and refined over the years as management systems and carcass grade specifications have changed. Because of the tremendous production of sorghum grain during the late 1950's, experiments were conducted to determine the feasibility of ensiling sorghum heads, grain, and the forage at different stages of maturity. Concentrates that have been evaluated for fattening cattle include Midland milo, Westland milo, Martin milo, hybrid sorghum grains, corn, barley, wheat, and molasses. Interest-

PROJECT LEADERS IN LIVESTOCK INVESTIGATIONS

Name	Appointed	Termination
J. A. Wilham	April 13, 1908	August 31, 1911
A. M. Paterson	April 15, 1914	September 15, 1914
A. L. Burkholder	July 16, 1917	August 31, 1918
H. A. Chittenden	September 3, 1918	January 31, 1922
L. C. Aicher	September 20, 1921	June 30, 1952
Frank B. Kessler	March 6, 1946	March 11, 1957
John R. Brethour	July 8, 1957	To date

ing experiments have been conducted with the various minerals and antibiotics such as Purdue Supplement A, cobalt, calcium, phosphorus, and vitamin A. The use of stilbesterol and aureomycin in various beef cattle programs also was studied.

LIVESTOCK PUBLICATIONS

Results of the beef cattle work have been reported chiefly in Roundup Circulars, the first of which was prepared in 1913 as a mimeographed circular. These publications were numbered consecutively as Roundup Circulars until 1945. Since that time they have been published as Roundup Circulars and circulars or bulletins of the Kansas Agricultural Experiment Station, the first such circular being No. 271 for the year 1946-47. Other circulars published since that time carry the following Experiment Station numbers: 260, 261, 272, 278, 292, 295, 307, 322, 334, 348, 359, 363, 377, and 382.

A number of technical articles have been published in scientific journals.

DAIRY CATTLE

The first cow owned by the Station was purchased to supply milk to the station personnel. Authorization was given by the Board of Regents on March 28, 1903, in a resolution as follows: "Moved by Regent Tulloss that Superintendent Haney be authorized to buy one cow at a cost not to exceed $40. Carried." (34) Only a few milk cows were kept at the Station prior to the establishment of a dairy farm unit in 1913. The Legislature of 1911 appropriated $3,000 for the purpose of starting a dairy project. The intention was to operate the dairy farm as a separate and distinct unit in a practical businesslike manner to demonstrate the desirability of more dairying for western Kansas. A tract of 160 acres of upland on the south edge of the Station located on the main highway south of Hays was set aside for the purpose. During 1913 the fields of the dairy unit, were cropped in anticipation of the needs of the dairy herd during the coming winter. Two 100-ton silos were built and partly filled from the crop of 1912. In the summer the construction of a modern dairy barn was begun. It had a concrete floor and feedways, fixtures for stalling the cows, and feed and manure handling facilities. A wing separated by the two silos adjoined the barn and provided accommodations for the teams used in the farm work. Corral yards separated from each other were provided for the cows, calves, bull, and hogs.

About one-third of the $3,000 appropriation was expended in building the silos and in making other improvements. The Station secured permission from the Board of Regents to use station fees to complete the dairy unit and buy the dairy cattle. Eighteen well bred Holstein cows were purchased in Wisconsin by Prof. O. E. Reed, Head of the

Fig. 43.—South end dairy unit. In 1911 the Legislature appropriated $3,000 to start a dairy project "as a separate and distinct unit to demonstrate the desirability of dairying for western Kansas."

Department of Dairy Husbandry at the College. They were brought to the Station in September, 1913. The cost of the investment in the dairy unit at the end of 1913 was: dairy barn, $3,800; two silos, 100 tons each, $500; hog sheds, corrals, etc., $91; one-room house (for man), $46; well, equipment and well-house, $435; fixtures and equipment, $278; 18 Holstein cows, $1,950; total, $7,100.

The project was in charge of H. E. Dodge, a dairy husbandry graduate of the College. Mr. Dodge resigned September 1914 and was succeeded by R. E. Turner, an experienced dairyman from the College. In 1914 three rooms were added to the small cottage which provided living accommodations for a married man helper for the dairyman.

The dairy farm was operated as a unit until 1922. Competent help was scarce during and immediately following World War I. Operating the unit separated as it was from the headquarters unit also proved inefficient and unprofitable. It was decided, therefore, in 1922 to convert the dairy unit farm into facilities for wintering the beef herd and to move the dairy to the headquarters unit.

The severe drouth of 1934 resulting in poor pasture conditions and a limited feed supply forced the Station to reduce its livestock population. A large part of the dairy herd was leased to the State School for the Deaf at Olathe and the State Orphanage at Atchison until June 1, 1935. At the termination of the lease agreement the institutions bought the cows. Nine Holstein cows were sold to the State Orphanage at $80 a head. The cows at the State School for the Deaf at Olathe were sold to the institution for $70 a head.

Seven calves about six months of age were sold to the two institutions at $35 a head. Twenty-three 2-year-old heifers were sold locally at private sales at about $65 each. The remaining 16 head of heifers were sold at public sale at Hutchinson on October 28, 1935. A few heavy springers sold well, but the other bred heifers not so far along sold for $35 to $50 a head. Buyers were looking for cows in milk or heavy springers. All of these cattle were purebred, of excellent type. One herd bull was sold to the State School for the Deaf for $200 and the other to the Fort Hays Kansas State College.

The Station has not maintained a dairy herd since 1985.

SWINE

The first swine owned by the Station were purchased in 1904. Three breeds of hogs were obtained: Duroc Jersey, Poland China, and Berkshire. Feeding experiments with hogs were started in 1905 and continued through the early years of the Station. Comparisons were made of the gains by hogs following cattle fed different rations and of different types of hogs fed the common feeds of western Kansas.

By January 1913, swine on the Station had been reduced to one breed—Duroc Jersey. The herd numbered 386 head, 32 being bred sows. During the year 517 head were sold for $6,529.69. The plan of management at this time consisted of breeding 20 to 30 sows, these to bring two litters a year, bred to farrow in April and in September or October. One good purebred boar was purchased each year. No special hog yards were maintained, the stock being given liberty in cattle pens, on alfalfa range, or in feed lots for fattening. The sows were given such accommodations as the farrowing sheds afforded and were grazed on alfalfa during the summer months.

The Legislature of 1923 appropriated $1,000 for the construction of a hog house. In 1924 a new hog house was built, with feed lots adjoining, all of which were provided with running water. The equipment provided economical handling of several hundred pigs.

By 1928 the entire herd of swine was purebred Durocs, with some of the best breeding in the state. Many gilts and male hogs were sold to the farmers throughout western Kansas and eastern Colorado. In 1929, 42 sows were farrowed, producing 373 pigs, of which 299 were saved. Intestinal parasites necessitated worming the litters. The cost of worming and keeping the pens sanitary and free from worm infestation became almost prohibitive. Alternating the use of the yards for one year with fallow was started in 1930 in order to attempt to eliminate the worms. The change was successful and less trouble occurred. The exceedingly dry weather of the 1930's reduced grain production and the excessive heat was detri-

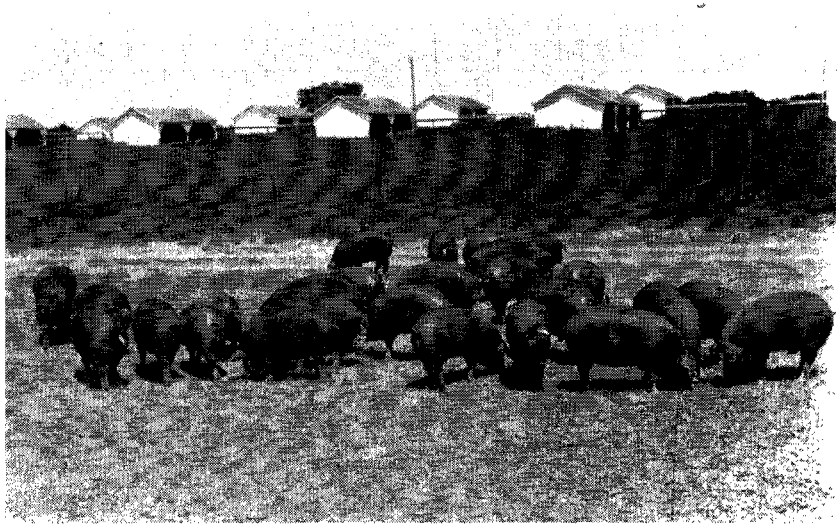

Fig. 44.—Fat hogs ready for market.

mental. A temperature of 106° on June 4, 1933, resulted in the death of two sows. In 1936 the Station decided to dispose of the Duroc Jersey breed and start a herd of Poland Chinas. Since no grain sorghums were produced on the Station that year and feed had to be purchased at a high price, it was decided to keep the hog population at a minimum. In 1937, 18 pigs were saved from the two gilts purchased the year before. They developed into an attractive lot of gilts and fat barrows. As weather for crops improved and feed grain production increased, conditions became more favorable for swine production. In 1940, 103 pigs were farrowed. A purebred Poland China boar was purchased. Between 1940 and 1950 only a sufficient number (10 to 20) sows were kept to produce the pigs needed to utilize waste grain. Since the project was not contributing to the experimental findings of the Station, it was decided to discontinue the production of swine in 1950. No pigs have been kept on the Station since that time.

SHEEP

The first and only sheep owned by the Station were purchased from the College in December, 1912. The flock of 57 grade ewes and two purebred Shropshire rams cost $550. The flock was purchased with two objectives: to demonstrate sheep production in western Kansas, and to determine the possibility of exterminating bindweed with sheep. It was hoped that a flock of 80 to 100 ewes might be kept and a carload of lambs marketed annually. In the fall of 1915 the flock consisted of 90 ewes bred for spring lambing.

During the summer of 1915

Fig. 45.—Sheep grazing bindweed. During the summer of 1915 a flock was grazed on a 12-acre field heavily infested with bindweed to determine the effectiveness of sheep in utilizing the weed and the possibility of the weed's extermination in this way.

the flock was grazed on a 12-acre field heavily infested with bindweed to determine the effectiveness of sheep in utilizing the weed and the possibility of exterminating the weed in this way. The field also contained a considerable growth of lamb's quarter, sunflowers, red root, and wild millet. The sheep fed upon these weeds first. After about two weeks the sheep were eating bindweed liberally and continued to graze it until the weed failed to supply forage, at which time it was eaten down to stubble and small stems. The sheep grazed satisfactorily upon bindweed, but did not exterminate it. A growth of bindweed sufficient to supply satisfactory grazing for sheep was also sufficient to maintain a continuing stand of the weed.

By 1916 the flock had increased to 98 ewes, 3 rams, 78 lambs, and 2 wethers valued at $1,374. By 1917 the inventory value was $1,635. Labor became hard to obtain during the World War I period. It was difficult also to protect the flock from dogs. It was considered advisable to discontinue the sheep project in 1922. No sheep have been kept on the Station since that time.

CEREAL INVESTIGATIONS

The earliest investigational work with crops at the Hays station was with cereals as stated under the section of this report entitled "Early Work at the Station" (p. 32). The work was cooperative with the United States Department of Agriculture almost from the beginning. The report of the Experiment Station of 1902 states that "The

fall wheat and rye seeding comprise 200 acres, a trial of 165 varieties and several methods of seeding. The variety trial is in cooperation with the United States Department of Agriculture. The varieties of wheat tried are those which have been selected as being adapted to this climate. Careful notes are being taken on each variety as to its vigor, manner of growth, yield, etc. A large number of varieties are direct importations while others are hybrids of the best wheats grown in the state. . . . Spring work comprised the planting of 18 varieties of spring wheat, mostly macaroni, 22 of barley, 16 of oats, and one of spelt. The area devoted to this is 140 acres." (35)

The work was financed jointly by the U.S.D.A. and the Station. In 1905 the U.S. Department of Agriculture furnished the seed and $200. The Station furnished the man in charge and all permanent equipment, fencing, land, labor, and supplies. Subsequently, a larger share of support came from the Department, with the Department paying the salary of the cerealist and the Station furnishing his living quarters, facilities for work, labor, and the major portion of all operating costs.

The cereal investigational work has been cooperative with the U.S.D.A. and with other experiment stations in the Great Plains. Consequently, many of the new and improved varieties developed during the past 60 years are not the work of a single agency. Co-ordination by the U.S.D.A. has made the work more productive.

Methods of Work. From 1903 to 1925 investigations with cereals consisted chiefly of varietal testing of wheat, oats, barley, sorghum, and corn. Improvement was carried out largely by establishing pure lines from foreign introductions. Wheat, the chief crop, prior to 1920 was confined largely to the variety Turkey and to Crimean introductions from Russia. Sorghum selections and pure lines were established from African and Asiatic introductions.

Experiments were conducted in cultural practices such as rates and dates of seeding wheat and sorghum, fertilizer top dressing, chemical seed treatment, and pasturing experiments with winter wheat. The growth response of wheat on cropped and fallowed land was studied.

From 1920 to 1950 improvement through hybridization followed by selection dominated the creation of the new crop varieties which were increased and released through certification. New strains were also created which were not of commercial importance but became useful for their germ plasm.

From 1950 to the present, breeding emphasis has been on the critical and highly specialized study of genetic and cytoplasmic inheritance. This led to the development and use of male sterility in hybridiza-

tion, which in sorghum has been of great economic value to the region.

More recently the Station has made use of backcrossing for the improvement of wheat and sorghums to improve existing good varieties and to eliminate weaknesses. In wheat, emphasis has been placed on quality as well as on yield.

The improvement of crops from pure line selections and hybridization to methods of genetic and cytoplasmic inheritance has progressed steadily at the Station for 60 years. Pure seed has been supplied in quantity to the farmers as a result of this breeding program. Most of the work has been in cooperation with the U.S.D.A. and in close collaboration with the central station at Manhattan.

Cereals Developed or Fostered. During the first 30 years the Station served principally to test the value of different varieties of cereals for western Kansas. The adaptability of Turkey and Kharkov wheat was shown. When Kanred wheat was developed at the College, the Station demonstrated its value for the region. Tenmarq and Comanche wheat, both developed at the College, were tested and demonstrated by the Station. Largely through the efforts of A. F. Swanson, cerealist from 1917 to 1951 who rendered signal service, Kiowa and Bison wheats were developed as replacements for Tenmarq and Comanche. Bison in 1961 was grown on 27 percent of the Kansas wheat acreage.

Bison is highly regarded for its strong gluten strength. It has high yield and has spread into Colorado and Nebraska. Apache was developed at the Station and was made ready for certification and distribution, but it lodged badly in a wet year and was never approved. The foundation seed

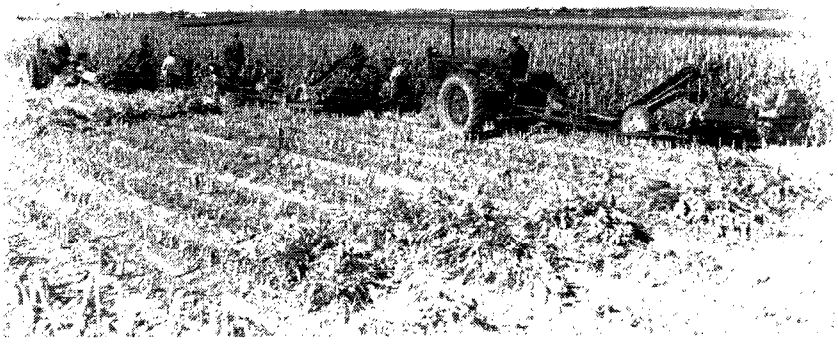

Fig. 46.—Cutting pink kafir for seed. Pink kafir isolated in 1910 "was highly regarded and had the longest period of distribution of any sorghum variety ever grown at the Station."

was sent to the Clayton Experiment Station in New Mexico and was distributed in New Mexico and in the Texas Panhandle. It came back into southwestern Kansas during the early 1950's, and in 1960 was grown on 1 percent of the wheat area of the state.

Hays Golden corn, acquired by A. F. Swanson on the Fleming Farm in Ness County in 1923, was further purified and was rather widely distributed. It is still being used by corn breeders as germ plasm for drouth resistance.

Pink kafir isolated in 1910 by the Station was highly regarded and had the longest period of distribution of any sorghum variety ever grown there. Early Sumac sorgo had wide distribution and is still grown. Dawn kafir, Dwarf yellow milo, and feterita, while not of Hays origin, were grown for seed production.

Wheatland was the first combine sorghum to become established firmly on the Great Plains. It was brought to the Station in 1929 from Woodward, Oklahoma, and was approved for distribution in 1931. It later was replaced by Westland from the Garden City station and by Midland from Hays.

From 1920 to 1950 the Station developed a number of sorghum varieties from plant breeding. Approved for certification but reaching only limited distribution were Kalo, Club Kafir, Norkan, and Cody. The latter was grown for a specialized starch during World War II to meet an emergency, but was later discontinued. Other minor varieties developed or fostered were Dwarf Freed, Modoc, Greeley, Weskan, Coes, and Gurno. Some of these have been used by plant breeders for new germ plasm. Gurno at one time was grown extensively in South Dakota, while Coes had a distribution in Colorado.

Of the more important varieties, Early Kalo, approved in 1940, came into competition with Westland but later was replaced by Midland which had much better standability. Early Kalo's distribution covered much of western Kansas and reached into Nebraska. All the varieties were replaced in the late 1950's with the new hybrids. By 1961 these predominated the grain sorghum production of the state.

In 1948 the white-seeded Ellis sorgo from the Station was approved for distribution and still is grown extensively in central Kansas. It is highly regarded for its quality, even though the tonnage is relatively low.

Since 1955 the hybrid sorghums KS601, KS602, KS651, and KS701, developed at the Station, have been released. Use of pure-line grain sorghums on the farms has declined rapidly since 1956 so that seed production now is almost zero. This older material has been replaced with hybrids produced by large commercial seed companies having skilled personnel using highly specialized methods and extensive equipment.

PROJECT LEADERS IN CEREAL INVESTIGATIONS

Name	Appointment	Termination
A. D. Colliver	April 1, 1905	December 31, 1908
C. C. Cunningham	January 21, 1909	July 31, 1911
B. E. Rothgeb	April 1, 1910	March 1, 1912
F. A. Kiene	March 1, 1910	April 30, 1919
A. F. Swanson	June 1, 1919	October 3, 1951
Lowell Penny	April 1947	June 1, 1949
A. J. Casady	June 1, 1949	June 30, 1951
Wayne L. Fowler	July 1, 1952	July 31, 1953
W. M. Ross	September 1, 1951	To date
John D. Miller	August 17, 1953	August 28, 1957
James A. Wilson	September 16, 1957	October 1, 1961
Ronald W. Livers	February 1, 1962	To date

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GRAIN STORAGE INVESTIGATIONS

Introduction of the combine resulted in much wheat being harvested while too moist for safe storage. It is estimated that high moisture content caused injury to 10 to 25 percent of the total Kansas wheat crop during the latter part of the 1920's and the early 1930's. Work was undertaken at the Hays Station in 1929 to study whether the type of bin in which the wheat was stored immediately after harvest might influence the extent of the damage. Eleven 500-bushel grain bins were erected on the Station grounds. The storage work was under the direction of Prof. F. C. Fenton of the Department of Agricultural Engineering and the milling and baking studies under the direction of Dr. C. O. Swanson of the Department of Milling Industry of the College.

The 1929 harvest began June 28 when windrowed wheat was picked up and threshed. The weather was hot, dry, and windy, drying the grain rapidly. Grain that contained 18 percent moisture in the morning was down to 14 percent in the afternoon. A second combine was started in another field of standing grain that was still green in low places. This wheat ranged in moisture content from 16.2 to 18.6 percent moisture.

Three bins of the mixture of the green and ripe wheat proved to be the most difficult to store without damage.

While the grain available was not sufficiently uniform in moisture to permit comparison for the different types of bins, it was possible to arrive at certain conclusions: 1. Any wheat stored with moisture content of 15 percent or higher is likely to be damaged because of heating. 2. Wheat stored in tight-walled bins seems more likely to heat than that stored in ventilated bins. 3. Severe damage in damp wheat may be prevented by moving it as soon as it starts heating; this moving will be effective to the extent that it cools the wheat and removes moisture. 4. Power cost of moving wheat is small, amounting to 8 to 15 cents for 500 bushels. 5. Hot weather influences heating of wheat in steel bins more than in better insulated bins. 6. When the outside temperature is low and the bin is filled with hot wheat, there is a decided condensation of moisture on the wheat near the outside walls, especially in the steel and concrete stave bins; this causes the outside 6 or 8 inches of wheat to mold more rapidly. 7. Ventilation appears to be an important factor in preventing heating of wheat in storage. This ventilation, however, must facilitate air movement sufficiently to cool the wheat and remove moisture. Ventilators which do not accomplish this do more harm than good. The work in 1929 indicated that the material of which a bin was constructed was probably of less importance than the type of ventilation.

In 1930 work was undertaken to determine the best methods of ventilation and the effect of ventilation upon cooling, the removal of moisture, and the prevention of damage. Wheat was stored in five 1,000-bushel bins, each representing a different type of ventilation. The wheat used in the study was combined before it was entirely ripe and contained enough moisture to create a difficult storage problem. Each load of wheat as it came from the field was divided equally among the five bins. No attempt was made to force air through the wheat artificially. This study led to the following conclusions: 1. Wheat with a moisture content of 17.5 percent is too damp for safe storage in any ordinary type of bin in hot weather. 2. Cooling wheat by transferring it from one bin to another is not very effective when the weather is extremely hot. 3. Ventilation is very valuable in lowering the temperature in damp wheat in storage. 4. Ventilated bottom bins proved to be the most effective in lowering the temperature during the summer of 1930. 5. A bin with ventilated side walls, a flue in the center, and suction cupola on top was also effective in cooling the wheat. 6. Ventilation flues of perforated metal were of little value in cooling the grain; in fact, they might have

promoted molding. 7. The blower type of elevator cracked much of the grain if the moisture content was below 15 percent. 8. The wheat in all the bins was damaged from the standpoint of milling.

The studies to this time had demonstrated the value of ventilation in preventing damage to damp wheat in storage. They had shown that when the moisture content was too high and the weather hot, no system of natural ventilation was effective. It was decided, therefore, to try methods of forced ventilation in 1931 and to compare them with those methods of natural ventilation that in previous studies had shown the greatest promise. Four 1,000-bushel steel bins were used having different types of forced and natural ventilation.

Harvest started June 29, 1931. The moisture content of the wheat when stored varied from 10.8 percent to 17.23 percent. The following conclusions were drawn: 1. Forced ventilation was more effective than natural ventilation in cooling the wheat. 2. The evidence comparing suction of air with forcing of air was limited, but indications were that forcing was more effective. 3. The temperature of wheat stored in the ventilated bins approximated outside air temperatures more closely than did that stored in unventilated bins.

Further experiments in the storage of damp wheat were undertaken in cooperation with the Bureau of Agricultural Chemistry and Engineering, United States Department of Agriculture, in 1936 and continued through 1937 and 1938. The experiments embraced work with both natural and forced ventilation and various types of bin construction. The following conclusions were drawn from these studies: "The results seem to indicate that in this area wheat can be stored safely for several years in tight unventilated bins if the moisture content is 13 percent or less. In order to store wheat safely that has a moisture content in the range of 13 to 14.5 percent, it appears necessary to provide ventilation. This may be accomplished in many ways, but the following types of wind-ventilated bins (in order of efficiency) have proved effective in field tests: (1) Bins having a system of horizontal flues with alternate layers connected to suction and pressure cowls and so spaced that the maximum air travel between the flues is 2 feet. (2) Bins having a suction or pressure cowl which is connected to a perforated chamber so proportioned and located in the center of the mass of grain that the maximum distance the air travels through the wheat is 3 1/2 feet. These bins must have perforated floors and, preferably, perforated walls. (3) Bins having a suction cowl connected to the space above the grain in such a fashion that the air is drawn through a perforated floor and

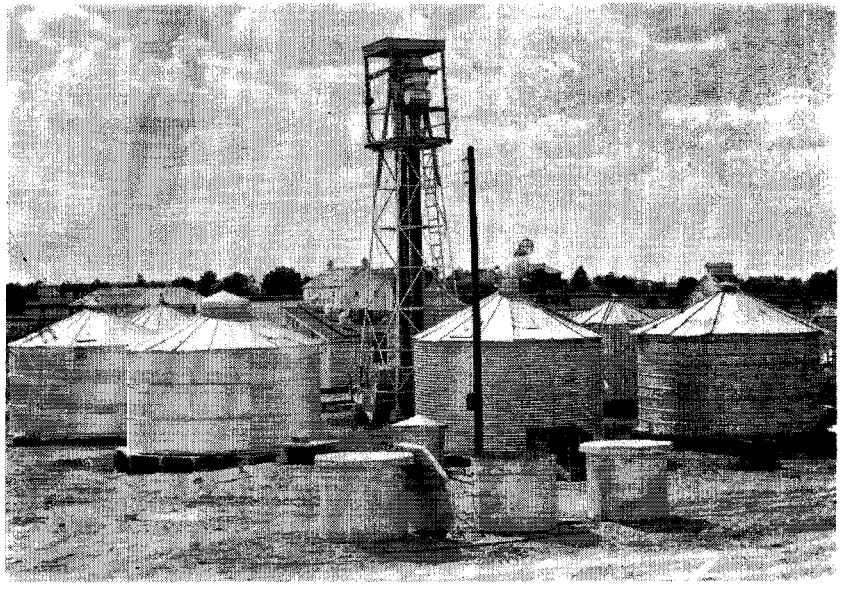

Fig. 47.—Grain storage bins were used to study the effect of ventilation upon the removal of moisture, cooling, and prevention of damage in stored wheat.

not more than 8 feet of grain. (4) Bins having a suction or pressure cowl connected to a perforated central chimney so the air enters through perforated walls and passes through not more than 6 feet of grain. Any of the naturally ventilated types enumerated above can be provided with power ventilation to prevent damage to grain having more than 14.5 percent of moisture. If the weather is favorable for drying, wheat at 18 percent moisture content can be stored in ventilated bins if the air travel is very short and the blowers have high capacity." (36)

A complete report of the grain storage investigations at Hays is contained in the following publications: 1. Kansas Agricultural Experiment Station Technical Bulletin No. 33, December, 1932. The Quality of Wheat as Affected by Farm Storage. 2. U.S.D.A. Circular 544, April, 1940. Methods of Ventilating Wheat in Farm Storages.

FORAGE INVESTIGATIONS

Experimental work with forage crops began with the establishment of the Station. Efforts to improve alfalfa, bromegrass, and big bluestem were attempted. Observational plantings of sweetclover and various large-seeded annual legumes such as soybeans were made. A selection of pink kafir, made in 1907, led to its subsequent widespread distribution. Not until 1913 when a cooperative agreement was

initiated with the Bureau of Plant Industry of the U.S.D.A. did the work become firmly established. Under this agreement the department paid the salary of a scientific worker stationed at Hays and the Station provided the physical facilities and most of the labor. From 1937 half of the scientific worker's salary was paid by the Station to conduct full-time research on alfalfa, grasses, and sweetclover. Federal support for the project terminated in 1950.

The most extensive work at the beginning was with forage sorghums, relating to the choice of varieties, their improvement, and development of the most effective methods of culture and utilization. Varieties of forage sorghum improved by selection and recommended for distribution were Early Sumac, Red Amber, Western Blackhull, and Atlas. Although major emphasis prior to 1930 was placed on experiments with sweet sorghums, many other forage crops were investigated. Studies with sudangrass involved rate and date of seeding, determination of optimum growth, and stage of harvesting for hay. With newer selections of sudangrass, tests were initiated on palatability and grazing. In 1951 a sudangrass breeding program was initiated, and with the advent of cytoplasmic male sterility in sorghums efforts were directed toward the development of male-sterile lines, useful in hybrid combinations.

The value of foxtail millets was explored. They were shown to be less valuable for forage than were sorghums or sudangrass. Varietal and cultural studies with various large-seeded annual legumes, root crops, and miscellaneous crops continued through the mid-1930's.

Drouth that prevailed from 1932 to 1936 permitted extensive studies on survival of native grasses. Studies were made of time, depth, rate of seeding, and methods of preparatory cropping for seeding native grasses. It was found that protective stubble such as sudangrass or close - drilled sorghums provided best conditions for spring seeding of warm-season grasses.

The breeding program for improvement of buffalograss was begun in 1936. A selection that was superior in seed production was increased vegetatively in 1942. Pollination of this plant with selected male plants resulted in a strain with superior seeding vigor. Seed produced from this planting was named Hays buffalograss. The use of Hays buffalograss and its importance in revegetating western Kansas is discussed fully in another section of this report (page 83).

With the establishment of the Station in 1902 alfalfa at once assumed an important role on the bottomland of the farm. Problems associated with establishment and production were studied. Lines developed by the breeding program at the College were evaluated, including the bac-

terial wilt-resistant variety Buffalo. Foundation plantings of Buffalo alfalfa were made. With the appearance of spotted alfalfa aphids in 1954, an alfalfa breeding project was initiated as a part of the U.S.D.A. interdepartmental cooperative breeding program. A spotted alfalfa aphid-resistant variety, Cody, was released in 1959. The program has increased in scope and is now centered on insect resistance and breeding of types of alfalfa better suited to upland conditions and capable of persisting under grazing in association with grasses.

No consistently satisfactory and reliable method has been found for establishment of sweetclover. Attention is being given to the possible exploitation of large - seeded types which appear to be more readily established. Madrid sweetclover, a selection from introductions of sweetclover seed from the Madrid Botanical Garden in Spain, was tested extensively both at the College and the Station and released for increase and distribution in 1937.

PROJECT LEADERS IN FORAGE CROPS

Name	Appointment	Termination
R. E. Getty	April 1, 1913	March 31, 1929
D. A. Savage	April 1, 1929	January 23, 1937
L. E. Wenger	March 1, 1937	August 6, 1943
R. E. Wagner	October 20, 1943	May 1, 1945
F. E. Meenen	March 5, 1945	June 16, 1951
A. J. Casady	July 1, 1951	August 28, 1954
H. L. Hackerott	November 1, 1954	To date

Fig. 48. — Planting grass seed in Sudan stubble with the new improved grass drill built in the Station shop. It was found that protective stubble such as Sudan grass or close-drilled sorghum provided best conditions for spring seeding of warm-season grasses.

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3. Vinall, H. N. and Getty, R. E. 1921. Sudan Grass and Related Plants. USDA Bul. 981. 66 pp.
4. Getty, R. E. 1921. Forage Crops in Western Kansas. Kans. Agr. Expt. Sta. Bul. 225. 54 pp.
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6. Savage, D. A. 1933. Buffalo Grass for Fairways in the Plains States. Bulletin U.S. Golf Assn. Grass Sec. 13:144-149.
7. Getty, R. E. 1934. Experiments with Forage Crops at the Fort Hays Branch Station, Hays, Kansas, 1913 to 1928. USDA Tech. Bul. 410. 92 pp.
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28. Anonymous. 1952, 1953, 1954, 1955, and 1956. Fall Field Day Reports of Fort Hays Branch Station. Circulars 289, 302, 315, 330, and 345. Part of these reports concerned with investigations on sudangrass, sweetclover, tepary beans, safflower, cool-season perennial grasses, foxtail millets, and spotted alfalfa aphids.

SEED PRODUCTION AND DISTRIBUTION

Distribution of seed of improved varieties has been an important service of the Hays station. In the beginning, emphasis was not placed on the production of crops primarily for the production of seed for distribution; but good seed of the best known varieties was used for all field work, and a demand of farmers for this seed soon developed. The Station sold for seed 4,500 pounds of miscellaneous sorghums in 1904 and 152,700 pounds of winter wheat in 1908, principally of the Turkey variety. The wheat seed was released in lots of 2 to 15 bushels per farm and reached nearly all western Kansas counties. A total of 10,400 pounds of seed corn was sold the same year. In the spring of 1909 large quantities of seed corn and some spring wheat, barley, and oats were distributed. Pink kafir seed was sold for the first time this year, as was seed of dwarf yellow milo.

On June 13, 1909, a hailstorm destroyed the entire wheat crop so that no seed was available for distribution that year. Prof. A. M. Ten-Eyck in the 17th Biennial Report of the Station (June 1910) reported regarding the production and distribution of seed, "In fact nearly all the grain planted on the station farm is improved or pedigreed and is grown primarily for seed production. The best of the crop is reserved for seed, which is graded, sold and distributed among the farmers of Kansas and bordering states. 4,000 bushels of well-bred seed wheat and several thousand bushels of improved corn, kafir corn and small grains have been distributed from the Hays Branch Station during the last four years (1907-1910). The crops now growing or being harvested are largely from purebred seed, included in which are 300 acres of pure Kharkov wheat, all of the surplus of which will be offered for sale for seed and distribution to Kansas farmers." (37)

As sorghums became more important to western Kansas the demand for sorghum seed from the Station increased. Superintendent Helder in his report for 1914 says "An extensive work in growing sor-

Fig. 49.—A field of certified Dawn kafir. "The amount of seed that can be produced on the Station is the only limit to the amount that can be sold."

ghum seed for distribution has always been performed at the Station. The demand is extensive this winter from all parts of Kansas and from adjoining states. The supply will not prove adequate for the demand, but will be distributed as its possibilities permit. Four varieties of grain sorghum, and five varieties of cane seed are available from the 1914 crop." (38)

The four grain sorghums mentioned by Superintendent Helder were Dwarf Blackhull Kafir, Whitehull Kafir, Feterita, and Dwarf Yellow Milo. The sweet sorghum varieties were Red Amber, Black Amber, Freeds Sorgo, Western Orange, and Black Dwarf. In 1914, increase plots were planted to the five varieties of sweet sorghum. This seed was available for distribution in 1915.

The sorghums as a crop, both grain and forage, increased gradually in importance, in part due to the availability of pure improved seed

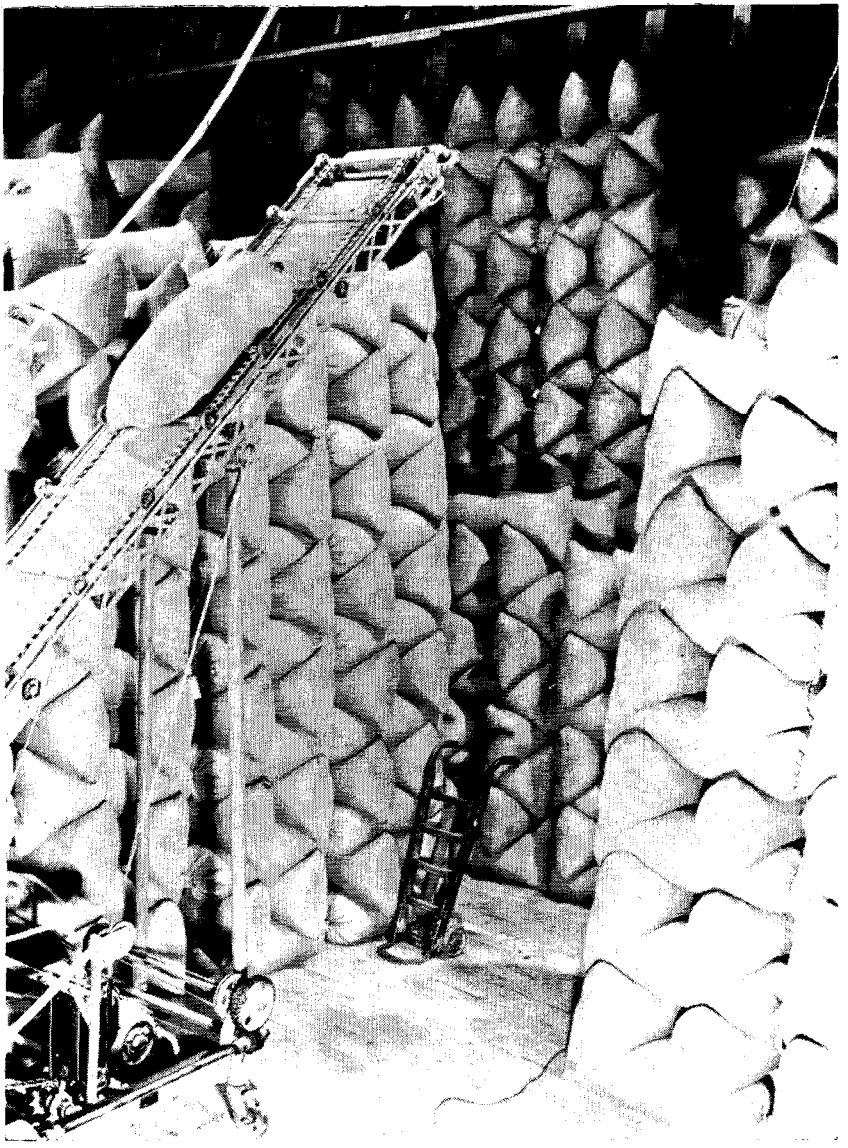

Fig. 50.—Certified seed stored over winter in the seedhouse. The seed was stored in bags piled to provide ventilation, which maintained high germination.

of the standard varieties from the Station. By 1925 the demand for pure certified sorghum seed became so great that the superintendent reported, "It seems as if the amount of seed that can be produced on the Station is the only limit to the amount that can be sold." (39)

Sorghum seed production at the Station reached a peak in 1925. The crop was produced under nearly ideal conditions. The seed produced was plump and bright, of high germination and excellent quality. Heads of seed had been hand selected the previous year and the fields had been carefully

rogued several times. The fields were widely separated from other sorghum varieties to prevent cross-pollination. Fields were at least 40 rods apart. Great care was exercised in harvesting, recleaning, grading, and storing the seed to maintain color, purity, and germination. Good cleaning facilities meticulously operated assisted in maintaining purity. Prompt harvesting and threshing with proper storage of seed in bags piled so as to provide ventilation insured high germination. The goal was 90 percent or higher germination. Pink Kafir, Dawn Kafir, Early Sumac, and Feterita were the principal varieties grown.

The sale of certified sorghum seed reached a maximum for the early years in the period 1925-1930. In 1925, 121,906 pounds were sold. The next year sales reached 244,659 pounds, and in 1930 they were 285,456 pounds. The sale of all kinds of certified seed of crop plants reached a maximum for the early years in 1930 with a total of 709,561 pounds. These sales consisted of 412,650 pounds of seed wheat and 285,456 pounds of sorghum seed. The seed went to 86 Kansas counties and 11 states.

Sudangrass was introduced from Africa by the U.S.D.A. in 1908. It was planted first at the Hays Station by R. E. Getty[11] in 1913, and recognized at once to be an excellent forage and pasture crop. In 1914, 23 acres were planted to sudangrass, which produced 100 tons of hay and 900 pounds of seed. The hay was used in a feeding experiment and proved highly palatable to livestock. The 900 pounds of seed were widely distributed in Kansas. The amount of seed was limited to four pounds to any one farmer. Instructions for growing the crop accompanied each shipment. The seed sold for $2 per pound. In 1915 larger lots of seed were sold to selected cooperators of the College and the Station, and seed produced by them was sold to other farmers.

Pink kafir, the first grain sorghum developed at the Station, was produced during the period 1907-1910. It proved to be an exceptionally good variety for central and western Kansas, in yield of both grain and forage. It had a wide distribution and was considered by growers as one of the most valuable sorghum crops. Some seed of the variety was sold to farmers in 1909. Two fields on the Station were planted to Pink kafir in 1915. They produced a good crop of forage as well as grain. Pink kafir was the most dependable grain sorghum for western Kansas before the combine types of grain sorghums were developed. Seed sales of the variety reached a maximum in 1926 when 122,056 pounds were sold. The sales during the eight-year period 1922-1929 were 359,061 pounds. As late as 1942, 81,172 pounds of Pink kafir seed were sold, but after that time Pink kafir for grain

11. Mr. Getty was a scientific employee of the U.S.D.A. stationed at the Hays Station.

was replaced rapidly by the combine sorghums.

Atlas Sorgo, a cross between sourless sorgo and Blackhull kafir made by I. N. Farr of Stockton and purified by the Kansas stations at Manhattan and Hays, became a popular variety because of its white seed, high yield, quality, and strength of stalk. It was grown first for seed distribution in 1927. Over 12,000 pounds of seed were produced in 1928 and 11,918 pounds were distributed in 1929.

Wheatland, the first combine-type grain sorghum, was distributed by the Station for seed in 1931. Since the crop was new and popular, it was considered advisable to obtain as wide a distribution as possible. Sales were limited to 120 pounds to a grower, the quantity needed to plant 40 acres. A total of 8,216 pounds was sold to 82 growers in 35 counties, principally in western Kansas.

Early Kalo and Pink Kafir were planted first at the Station in 1938, but the grain was not sufficiently pure to be distributed as seed. The first distribution of pure seed was in 1940 when 5,940 pounds of Early Kalo were sold.

Cody. During World War II when the country was cut off from supplies of glutinous starch made from cassava, a tropical plant, acute shortages of this type of starch developed. This type of starch was needed for adhesives and for the manufacture of tapioca. Cody sorghum, developed at the Hays station, contained a waxy endosperm from which this type of starch could be produced. From only a few seeds, Cody was increased by growing a second crop during the winter in the greenhouse and as a winter crop in southern California, Arizona, and Texas. Cody grain was produced for the General Foods Corporation both by the Station and by farmers to whom Cody seed had been supplied. In 1945 the Station sold 35,760 pounds of Cody seed. There was no demand for the crop after the close of the war, when supplies of glutinous starch from the tropics became available again.

Norkan, an early white-seeded sorghum produced at the Hays station from a cross made between Atlas and Early Sumac, was released first and sold for planting in 1941. A total of 12,010 pounds of seed was distributed, of which 9,892 went to Kansas farmers and 2,128 were sold outside the state.

Ellis, another variety produced at the Hays station, was first released for planting in 1948. The variety is a cross between Atlas and Leoti Red. It has white seed and a sweet stalk. It is valued for its palatability and earliness, maturing about the same time as Early Sumac. The first seed of the variety, 15,397 pounds, was sold in 1948.

FEDERAL SEED STOCKS COMMITTEE

The serious drouth in 1934 caused an acute shortage of sorghum seed for planting in

western Kansas in 1935. To aid farmers in securing seed, the U.S.D.A. set up in the Plains states Federal Seed Stocks Committees. One of these committees was at the Hays station. The superintendent and the cerealist were made collaborators of the department to purchase and distribute seed. High - quality Dawn Kafir seed was shipped from Texas. Some good Wheatland was obtained near Lakin and Sublette, and Dwarf Yellow Milo obtained near Elkhart. This seed, produced under irrigation, was distributed by the committee throughout the drylands of western Kansas. The drouth was severe again in 1936. This year was the first in over 15 that the Station sorghum crop failed completely to produce seed. A small quantity of Atlas seed, produced on bottomland that had been flooded, was sold at 15 cents a pound.

SEED WHEAT DISTRIBUTION

Seed wheat distribution by the Station was made extensively in 1910 when 6,400 bushels of Kharkov seed were sold. This variety had been introduced recently into the United States by the U.S.D.A. It went to all parts of Kansas and many other states.

Kanred wheat, released for distribution to farmers in 1918, was the only variety grown and distributed by the Hays station between 1919 and 1932. In 1925, 233,250 pounds of Kanred seed wheat were sold and in 1930 the sales increased to 412,650 pounds. In 1931, due to drouth, the wheat seed was shriveled and sales of

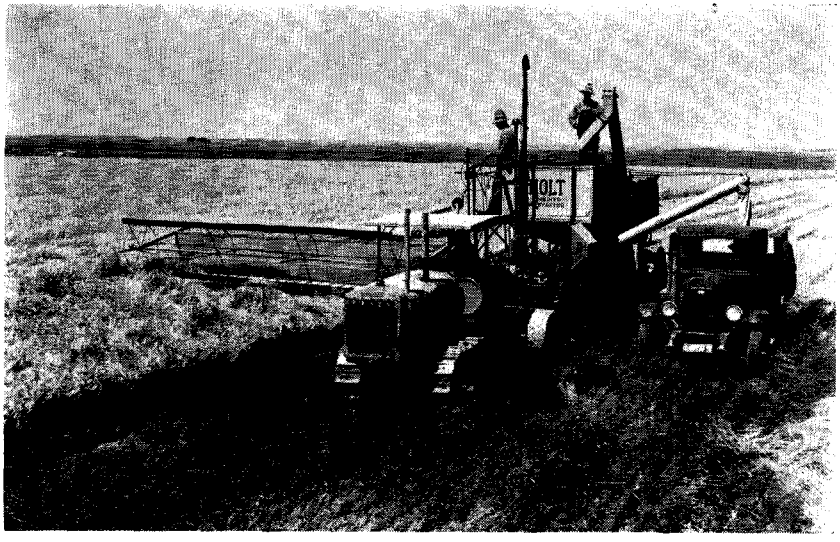

Fig. 51.—Combining Kanred wheat, which was the only variety grown and distributed by the Station between 1919 and 1932. Over 400,000 pounds of Kanred were sold in 1930.

Kanred dropped to 167,032 pounds. Most of the seed sold that year had been produced in 1930.

Tenmarq wheat, a new variety produced by the College, was planted first at the Station in the fall of 1932. The season of 1933 was very dry. The Tenmarq field produced only 15 bushels per acre of shriveled grain, with a total yield of 1,600 bushels. Only a small quantity of this grain was sufficiently plump to be suitable for seed. This seed was used to plant a 120-acre field in the fall of 1933. The rest of the good seed was sold to farmers, each sale being limited to 20 bushels. In 1939 a carload of Tenmarq seed was shipped for distribution to farmers in Texas. Tenmarq continued to be distributed until 1945.

Comanche, released by the College, had superior milling and baking quality and was planted first at the Station in 1943. The variety lodged badly at the Station in both 1944 and 1945. Due to this weakness, little Comanche seed was distributed.

Kiowa wheat, a cross between Chiefkan and Oro and Tenmarq, produced cooperatively by the Manhattan and Hays stations and the U.S.D.A., was released for distribution in 1950. A total of 1,700 bushels of Kiowa was sold for seed that year. Kiowa outyielded Comanche two to three bushels per acre and had a stiffer straw than Comanche or Tenmarq.

Bison, a bearded hard red winter wheat recommended for the western three-fifths of Kansas, was selected from a cross of Chiefkan x Oro x Tenmarq made at the College in 1938. The first generation was grown at the College in 1939. Later generations were grown at Hays where A. F. Swanson made the final selection resulting in Bison wheat in 1943. The variety is closely related to Kiowa. It possesses superior characteristics of high yield, good test weight, resistance to stinking smut (bunt), tolerance to wheat streak mosaic, stiff straw, and good milling and baking qualities. Bison was first released from the Station in 1956. Over 15,000 bushels of seed of the variety were distributed.

DISTRIBUTION OF SEED OF OTHER CROP PLANTS

Seed of crop plants other than wheat and sorghum has been grown and distributed by the Station. As has been stated, fairly large quantities of seed corn and some Stavropol and six-rowed barley were distributed in the early years. Burt, considered to be the best variety of oats in early years, was sold to farmers in small quantities. Barley was the best of the spring grains. Flynn barley, a smooth-awn variety, proved well adapted to western Kansas conditions. It was produced in limited quantities beginning in 1935. Only 2,018 pounds were released that year, but 10,444 pounds were sold in 1937. Osage oats, a variety produced

by the College, were grown first at the Station in 1946, with 28,126 pounds of seed being distributed that year.

Alfalfa. Alfalfa was one of the first crops planted on the Station. It was grown primarily for hay, but under favorable conditions seed crops were produced. A total of 35,172 pounds of seed of Kansas Common alfalfa was distributed in 1937. Buffalo alfalfa, a wilt-resistant strain selected from Kansas Common, was released first in 1944. The highest production and sale of this variety was in 1947 when 14,113 pounds were sold. This seed was in demand and had a wide distribution. A new strain of alfalfa resistant to both bacterial wilt and spotted alfalfa aphids was developed and released in 1959 under the name of Cody. Over 6,000 pounds of foundation Cody seed have been released during the last three years (1959-1961) and there are presently growing at the Station about 100 acres of Cody eligible for the production of foundation seed.

Buffalograss. The native grasses proved to be best for re-establishment of grass on the Great Plains following the dust storms of the 1930's. A high-yielding strain of buffalograss called Hays Buffalo was released in 1943. A large quantity of Hays Buffalo as well as Common Buffalograss seed was distributed. This seed contributed greatly to the re-establishment of grass on the Plains and resulted in the stabilization of much of the blow lands of western Kansas. In addition to buffalograss, the seed of sideoats grama, blue grama, and western wheatgrass was grown and distributed.

The most certified seed distributed in any one year by the Station was in 1951 when a total of 1,197,367 pounds of seed was sold, 783,940 pounds of sorghum, 340,310 pounds of wheat, 66,628 pounds of oats, 374 pounds of alfalfa, and 115 pounds of buffalograss.

DRYLAND AGRICULTURE

The Division of Dryland Agriculture of the U.S.D.A. in the early part of the twentieth century established in the Great Plains area a number of experimental stations to study crop adaptation, the effect of different cultural methods, cropping systems, and fertilizer practices upon crop production, and the adaptation of various practices to farming in this area. These stations provided reliable information about crops that could be grown and successful methods of farming in a new region. One of these stations was started cooperatively at the Hays Station, in 1906, with the arrival of L. E. Hazen, an employee of the Department of Agriculture. Mr. Hazen was followed in 1909 by A. L. Hallsted who served as project leader until 1945, a period of 36 years. Mr. Hallsted's long period of service and devotion to the work contributed greatly to the success of the project. The Office of Dryland Agriculture paid the salary of the project leader and the Sta-

tion furnished the land, equipment, and most of the labor.

The work as a cooperative project terminated in 1958.

The experimental work consisted of a study of cropping systems, tillage practices, and cultural methods for dryland farming. The first experimental plots were laid out for the 1906 crop year on what was essentially virgin land, the sod having been broken less than five years. Thirteen acres were devoted to experimental plots the first year, but the area in plots was later increased to about 60 acres. The plots were 2 x 8 rods, divided by 40-inch alleys, and the ends separated by 20-foot roadways. Standard recommended varieties of each crop were grown. The same variety was planted on all plots of a given crop in any one year. Improved varieties were substituted whenever seed became available.

Cropping Systems. The work embraced over 50 cropping systems with winter wheat, spring wheat, grain sorghums (kafir, milo, etc.), barley, oats, corn, sorgo, sudan, alfalfa, and bromegrass. Most of the systems were in use during most of the years of the dryland studies.

Summer fallowing, a common practice in the dry areas of the western states, was introduced into many cropping systems. Several crops were grown both continuously and in alternate fallow-crop systems over a long period. Moisture stored in the soil during the fallow period in addition to the rainfall during a cropping season usually insured increased crop yields.

Winter wheat, the major crop in central and western Kansas, was grown after fallow in 10 cropping systems, after wheat in 8 systems, after green manure in 4, after barley in 4, and after both sorghum and corn in 3. Kafir was included in 15 cropping systems, barley in 21, oats in

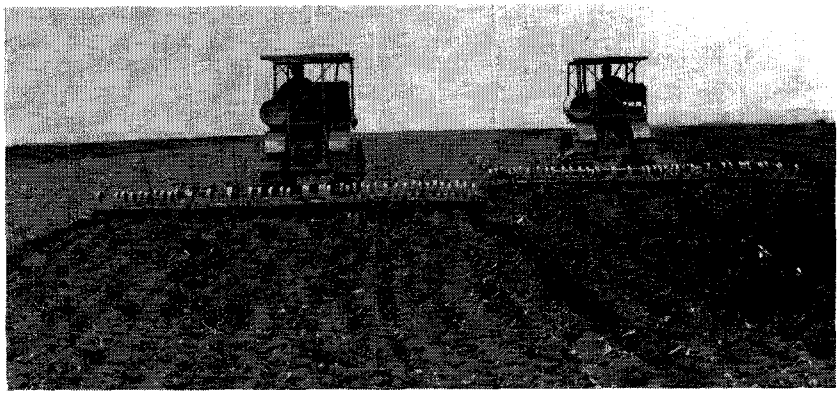

Fig. 52.—Summer fallowing with spring tooth harrow. Summer fallowing, a common practice in the dry areas of the western states, was introduced into many cropping systems.

Fig. 53.—Double disking wheat stubble immediately after harvest. Results at the Station showed that initial tillage should begin as soon after harvest as possible when the land was to be reseeded to winter wheat.

16, corn in 11, and spring wheat in 7.

Yield data from more than 30 cropping systems indicate that average wheat yields are not greatly different when the crop of the previous year or the land use has been the same. An exception shows a lower average yield from continuous wheat as compared to wheat after wheat in systems including fallow. Weed control has been a problem with continuous cropping with small grain. Green manuring crops in the rotation were of no benefit for winter wheat production. Any value they might have had was offset by their use of soil moisture which could have been utilized better by the main crop. As much wheat was produced by fallowing one year in four as with continuous cropping to to wheat. Fallowing lends stability to production because of higher yields and fewer crop failures.

Yields of milo after fallow were nearly twice those obtained with continuous cropping. The percentage increase was greater than for any other crop. Sorghum crops apparently make more effective use of stored soil moisture. Milo averaged about twice the production of corn.

Barley was the highest-yielding spring grain, exceeding oats or spring wheat. Spring wheat produced about half as much as winter wheat. Neither corn nor spring wheat compared favorably with sorghum or winter wheat.

Tillage Experiments. Tillage studies included time and method of preparing seedbeds for winter wheat, comparison of listing and plowing, frequency of plowing, and tillage methods for summer crops. Seedbed preparation studies for more than 50 years show that the initial tillage should begin as soon after harvest as possible when land is to be re-

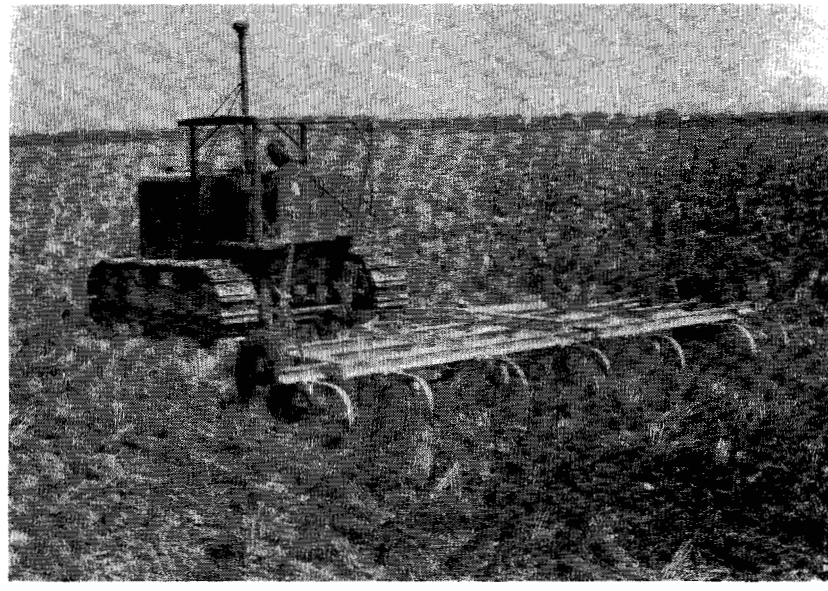

Fig. 54.—Preparing seedbed for wheat with duckfoot cultivator. Shallow cultivation such as could be done with subsurface equipment proved as satisfactory for wheat production as deeper tillage with a moldboard plow or lister.

seeded to winter wheat. Early plowing consistently gave higher yields than late plowing, by some 5 bushels per acre. Yield from early listing was 2 bushels greater than for early plowing for the 51 years. Increased moisture storage in listed plots apparently accounted for the higher yield. Shallow cultivation, such as can be done with a one-way disc plow and subsurface tillage equipment, was as satisfactory for wheat production as deeper tillage with a moldboard plow or lister. Subsurface tillage leaves the crop residues on the surface and provides protection against soil blowing. These residues also increase the infiltration rate of moisture. Fall tillage was superior to spring tillage for preparing the seedbed for spring crops.

Cultural Practices. Cultural practices studied included subsoiling in deep tillage, burning stubble, barnyard manure for winter wheat and for sorghum, crop response to commercial fertilizer, crop spacing, and contour tillage. Average yields of several crops grown continuously, or of those grown the second year after fallow, were increased substantially by subsoiling. The method is expensive and the need for frequent subsoiling is questionable. Plowing 14 inches deep had no effect on the yield of wheat after fallow.

A 10-year experiment to de-

termine the effect of stubble burning on subsequent wheat yields with different tillage methods was started in 1945. Winter wheat was grown continuously; stubble was burned in July after harvest. Burning did not affect average yields. However, burning is a poor practice because it increases the wind erosion hazard.

The effect of barnyard manure in a three-year rotation of fallow - wheat - kafir was studied from 1914 to 1957. Straw at the rate of 2 1/2 tons and manure at the rates of 3 and 6 tons per acre were applied in the spring on the growing wheat crop, and spring manure applications of 3, 6, 9, and 12 tons per acre made on plots planted to sorghum. All treated plots received manure and straw every third year. Yields obtained for 44 years indicated that manure and straw had little or no effect during this period on yield of either wheat or kafir. Straw and the heaviest manure applications tended to depress straw yields slightly. Kafir grain yields were not affected significantly but kafir forage yields were increased slightly by manuring.

An experiment with commercial fertilizer began in 1920 with continuous winter wheat. Fertilizers that were predominantly phosphatic showed no response for the 27-year period. Another experiment was initiated in 1950 to study the effect of both nitrogen and phosphorus on winter wheat grown continuously or grown the second year after fallow. Significant and profitable yields were obtained four of nine years with 30 pounds of nitrogen per acre, but there was no re-

Fig. 55.—Basin listing on contour for wheat. The effect of planting on contour was studied over a period of 10 years, and increases in yield of 10 to 20 percent were obtained.

sponse in yield for five years, 1953 to 1957. Dr. R. E. Luebs reported, "The data indicate three factors largely determine response to nitrogen. They are (1) surface soil moisture at planting, (2) subsoil moisture at planting, and (3) spring rainfall. All these were above average in the four years yield increases were obtained with nitrogen fertilizer. The opposite was generally true the five years when no response was obtained." (40)

Corn and kafir were planted in rows 40 inches and 80 inches apart to compare the yields of both the row crops and the wheat crops that followed in a 2-year rotation. In this 24-year study (1924-1948), corn yields were reduced 5.4 bushels and kafir yields 4.9 bushels per acre when planted in the wider rows, but the yield of wheat that followed was increased 1.5 bushels following corn and 2.9 bushels following kafir.

Planting on the contour of crops in a rotation of wheat-milo-barley, on land with a 2 to 3 percent slope, was studied for 10 years—1948 to 1957. The soil was moderate or low in permeability. A one-way disc plow or disc harrow was used for the initial seedbed tillage operations the first 6 years. The last 4 years subsurface tillage methods were used. The same tillage operations were performed on both the contour and noncontour plots. Average increases of 10 to 20 percent were obtained from contour tillage for first-year wheat, second-year wheat, milo, and barley respectively. Moisture stored in the contour plots averaged an additional 2.9 inches.

The half century of investigational work in dryland farming indicates that the successful dryland farmer in this area, insofar as possible, must follow a flexible system in his cropping sequences, tillage methods, and cultural practices and choose them to fit the weather and soil conditions, taking into consideration the preceding crops, surface residues, weed populations, soil moisture, and soil tilth.

PROJECT LEADERS IN DRYLAND AGRICULTURE

Name	Year appointed	Year terminated
Hazen, L. E.	1907	1908
Hallsted, A. L.	1909	1945
Erhart, Andrew B.	1946	1948
Brown, Paul L.	1949	1956
Luebs, R. E.	1956	1959

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9. Brown, Paul L. and Shrader, W. D. 1959. Grain Yields. Evapotranspiration and Water Use Efficiency of Grain Sorghums Under Different Cultural Practices. Agri. Jour 339-343.
10. Luebs, R. E. Investigations of Cropping Systems. Tillage Methods and Cultural Practices for Dryland Farming at the Fort Hays (Kansas) Branch Station. Kans. Agri. Expt. Sta. Bul. 449.

BUFFALOGRASS

The need of a grass to revegetate western Kansas and the importance of buffalograss for this purpose is set forth in the annual report of the superintendent of the Hays Station for 1940: "The need for revegetating vast areas of land in western Kansas has been apparent to many interested in the agricultural welfare of the state. The plowing up of thousands of acres of prairie land immediately following the first World War to grow more wheat, coupled with over-grazing, soil blowing and water erosion, have provided thousands upon thousands of acres where grass surface cover should be restored.

"Experimental work at the Fort Hays Experiment Station has determined after years of investigation that the native grasses, particularly buffalograss and blue grama, provide the most promising material from which to make selections for types suitable for this vast revegetative program.

"The inherent good qualities of buffalograss together with its valuable surface stoloniferous method of spreading, makes this a most useful species for western Kansas." (41)

Buffalograss, as found growing over the Great Plains, varied greatly and had tremendous possibilities for improvement. This was recognized by Leon Wenger, a grass specialist at the Station from 1937 to 1943. Upon his arrival at the Station he started to make field selections from buffalograss plants found growing in various parts of western Kansas, Texas, Nebraska, and South Dakota. At the height of this selection work more than 10,000 individual plants were growing in the Station breeding nursery. All of these plants had

Fig. 56.—Ten-acre field of buffalograss for seed production planted with cuttings from one high-yielding mother plant. Buffalograss has hardiness and the ability to persist in the face of drouth, heat, and other difficulties.

at least one generation of selection. Plants that had superior qualities were increased by growing them in larger blocks. Some of the superior selections when grown under irrigation produced as much as 2,400 pounds of seed and 3.69 tons of hay per acre.

A few of the superior selections were planted in 10-acre blocks. It was from one of these that the variety named "Hays Buffalo" was obtained. This variety was selected for adaptation to general use. Some of the selections had characteristics that adapted them to specialized uses. A type was selected and adapted to lawn purposes. This type had fine quality and a dense-leaved, short - growing turf characteristic of buffalograss found in northern Nebraska and the Dakotas. The southern types from Texas grew much taller, were more vegetative in character, and produced higher yields of forage. Since buffalograss is a dioecious plant, only female plants were started vegetatively for lawn purposes, thus eliminating the flaglike pollen stalks of the male plants.

Buffalograss produces its seed on stalks that grow close to the ground, making the seed difficult to harvest. Various methods of harvesting have been used at the Station, starting first by hand picking with forceps. The first method of collecting the seed mechanically was by using a pan attached to the cutter bar of a mowing machine. Much seed was lost with this method. Then a large home-made suc-

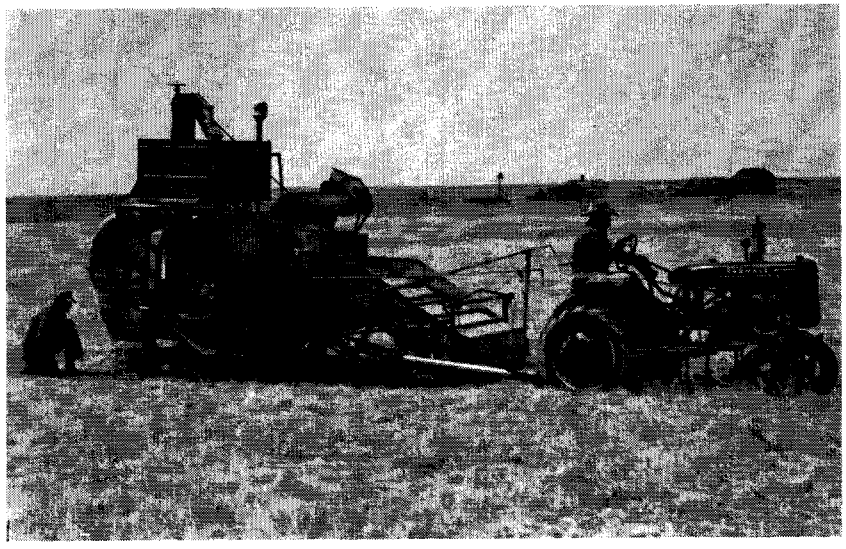

Fig. 57.—Harvesting buffalograss seed with combine developed at the Station. Buffalograss produces its seed on stalks that grow close to the ground, so is difficult to harvest.

tion sweeper having a 6-foot nozzle was mounted on an automobile chassis and propelled by a small truck. The sweeper and suction fan were operated by a gasoline motor. The outfit sucked up the seed satisfactorily but also gathered cow chips, gravel, cacti, etc. A rotating sweeper attached to the rear of a small combine was developed next. It proved too cumbersome and also collected trash.

A successful and satisfactory method of harvesting the seed finally was developed from a small combine harvester. This combine was rebuilt in the Station shops and was equipped with a remodeled cutter bar riding on the ground. A slatted canvas on the elevator platform elevated the cut material. This machine was used first August 15, 1941. It proved so successful that others interested in harvesting buffalograss seed adopted the plan and rebuilt their own combines. Much seed was harvested during the fall of 1941 and in other seasons whenever the weather favored the production of buffalograss seed.

Nature has endowed buffalograss seed with a natural dormancy that assures the perpetuation of the species under adverse conditions. The germination of newly harvested seed rarely exceeds 7 percent, making new seed unsatisfactory for planting. Under most conditions the seed increases germinability slowly, so it was necessary to develop some method to break the dormancy of the seed if buffalograss was to be reseeded successfully. Starting in 1938 Mr. Wenger

attacked the problem, and by 1941 had worked out a successful treating process. The seed was soaked in a 1/2 percent solution of saltpeter (potassium nitrate) for 24 hours, then chilled in a refrigerator at a temperature of 40° F. for six weeks. During this period the seed was resoaked twice at intervals of two weeks. The seed was dried immediately after being removed from the refrigerator. This treatment increased the germination from about 7 percent to some 80 or 85 percent, thus producing seed satisfactory for immediate planting.

After a successful experimental treating method had been developed, it became necessary to apply the results to commercial usage. This required large treating tanks, large refrigerators, and equipment for rapidly drying the seed after soaking and refrigeration. Through the assistance of the U.S. Army, with which the Station was cooperating in establishing grass on air fields, two 10,000-pound refrigerators were procured. Large vats of several thousand gallons capacity were built in the Station shops. A satisfactory drier was built after trial and error. When taken from the refrigerator the seed averaged 85 percent moisture. After drying, the moisture content was 14 to 16 percent.

World War II was under way and an acute need existed for buffalograss seed that would grow promptly. Air fields were being built throughout the Great Plains, one of the largest at Walker, about 30 miles from the Station. Great difficulty was being experienced with blowing soil damaging the propellers

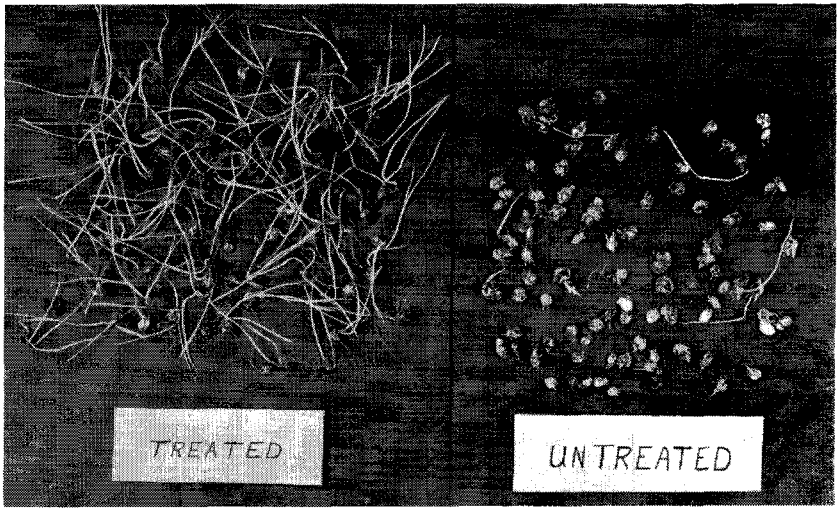

Fig. 58.—Comparison of germination of treated and untreated buffalograss seed. The natural dormancy of buffalograss insures the perpetuation of the species under adverse conditions.

Fig. 59.—Buffalograss seed under treatment in refrigerator to improve germination. This treatment increased the germination from an average of about 7 percent to 80 or 85 percent, producing seed satisfactory for immediate planting.

on the large B-17 bombers. Officers from the Walker Air Base came to the Station for assistance. It was recommended that the air field be sodded with buffalograss. The Army procured 60,000 pounds of seed, which was the first processed by the equipment at the Station. The seed for the Army was dried at the rate of 100 pounds of seed per hour, on a 24-hour basis. Later the equipment was used to process seed for the Station itself and for collectors, dealers, and processors. Seed for processing came not only from Kansas but from Colorado, Nebraska, and Texas. The first year 63,919 pounds were treated. By the end of 1950 a total of 534,763 pounds had been treated.

PASTURE MANAGEMENT STUDIES

An experiment was started in 1946 to study the effect of

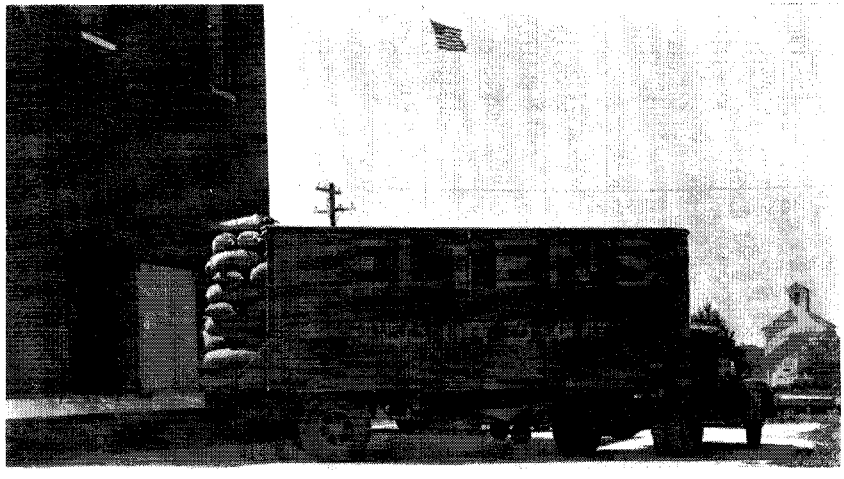

Fig. 60.—A transport load of treated buffalograss seed leaving the Station.

Fig. 61.—Station steers grazing on newly-seeded grass pasture. Intermediate wheatgrass proved the best in terms of livestock performance during years of good or above-average rainfall.

heavy, moderate, and light summer grazing on the native shortgrass range. It was enlarged in 1948 to compare late season protein supplementation with no supplementation on moderately grazed pastures, Plant cover and soil moisture determinations were made. Grazing investigations were expanded in 1948 when buffalograss, western wheatgrass, and intermediate wheatgrass were planted separately on three fields on a cultivated lowland site to compare the grasses as summer pasture for steers.

Grazing comparisons were made from 1949 to 1960. The intermediate wheatgrass pasture was abandoned in 1955 because of injury to the grass by drouth, and the buffalograss pasture was returned to cultivation in 1958 after heavy silting from a flood in June 1957. Intensity - of - grazing trials were conducted on the western wheatgrass until 1960. Intermediate wheatgrass proved the best in terms of livestock performance during years of good or above-average rainfall. Western wheatgrass appeared best as a long-term pasture, while buffalograss was the poorest on this lowland site.

Pasture and range research was expanded beginning in 1955. In addition to livestock performance, increased emphasis was placed on vegetation studies under the various systems of grazing. Studies initiated since 1955 include three intensities of winter grazing on native shortgrass range; summer grazing trials on four types of upland reseeded pasture; a comparison of cottonseed meal and sorghum grain as late season supplements on moderately grazed summer range; plot studies involving heights, date of mowing, date of burning, rates and dates of fertilization, and pasture weed control on both native and reseeded pastures; and range reseeding investigations that include date of planting, type of mulching materials for seedbed cover, and amount of mulching material needed for seedbed cover.

PROJECT LEADERS IN PASTURE MANAGEMENT

Name	Year appointed	Year termination
F. B. Kessler	March 6, 1946	March 11, 1957
F. E. Meenen	March 5, 1945	June 16, 1951
J. L. Launchbaugh	October, 1955	To date

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BINDWEED INVESTIGATIONS

Bindweed, Convolvulus arvensis, a deep-rooted perennial noxious weed introduced in Kansas from Europe, probably in Turkey seed wheat and in garden seed, became well established in many parts of central Kansas about the time the Station was started. It proved so destructive to wheat and many other crops that cognizance of the problem reached the Legislature. The Legislature of 1907 included in House Bill No. 877 Miscellaneous Appropriations, under item No. 7, an appropriation of $1,000 "to be expended under the direction of the Board of Regents for experiments to exterminate bindweed."

The money appropriated un-

Fig. 62.—Visitors inspecting the bindweed project. The work consisted of controlling field bindweed by intensive cultivation, competitive crops, and use of sodium chlorate.

der this act was placed with the Department of Agronomy at the College at Manhattan; but since the problem was most acute in central Kansas, the work undertaken was directed through the Hays station. Since bindweed on the Station land itself was not extensive, it was decided to rent heavily infested bindweed land from private owners. A satisfactory field was secured, rent free, on the farm of Andrew Sander near Victoria, about 7 miles east of the Hays station. Mr. Sander was employed to look after the work required in carrying out the experiments.

The experiments consisted of 16 treatments of cropping and cultivation, carried out on 16 one-acre plots. Two general plans of extermination of bindweed were tried: (1) different cultural methods, and (2) the use of smother crops. As to results, Professor Ten-Eyck of the Department of Agronomy at the College reported: "It appears from the work of a single season that ordinary methods of destroying the bindweed by thorough cultivation has only resulted in more favorable conditions for growth by storing and conserving soil moisture and by providing an abundant supply of readily available plant food. Although the plants may be cut off and apparently destroyed, many times during the season, the live roots remain in the soil and quickly start new shoots again after each cultivation. There is some promise, however, that by winter plowing and the proper use of smother crops such as sorghum and kafir corn, the bindweed may be destroyed or at least weakened in vitality and greatly reduced in numbers. With a year or

two of such treatment and preparation, it may be possible to check the weed so that profitable crops of wheat and other grain may be grown on bindweed-infested land. . . . Small patches of bindweed may be destroyed by very frequent hoeing. In order that hoeing may be successful, however, it will be necessary to prevent the weed from making any growth of foliage. Young plants must be cut off just as soon and as often as they appear above the ground. The patch should be hoed regularly, say once a week, during the growing season. Again, the weed may be destroyed by poisoning the ground with salt or brine, by applying such a quantity that the soil will be "killed" so that nothing will grow on it for several years." (42)

Appropriations were not continued for bindweed studies and the work was discontinued after the second year; not, however, until unsuccessful attempts were made to smother the weed with heavy applications of straw. After the termination of this work limited studies were continued on the Hays Station land. An unsuccessful attempt to eradicate bindweed by grazing with sheep was undertaken in 1915 as reported on page 57. Small areas of bindweed were salted and large areas were cultivated intensively and planted to smother crops. Every precaution was taken not to spread the weed by carrying live roots on tillage machines from infested land to uninfested land.

It was not until cooperative work with the U.S.D.A. in the study of noxious weeds was started in 1935 that successfully planned and executed experimental work again was undertaken. The Department established cooperative projects with a number of stations, including Kansas at the Hays Branch Station. The work at Hays was coordinated with work in Idaho, Nebraska, Minnesota, and Iowa. F. L. Timmons was appointed as project leader at Hays. His salary was paid by the U.S. D.A. and operating costs of the project were paid by the Station.

The first work consisted of methods of controlling field bindweed by intensive cultivation, competitive cropping, and use of sodium chlorate. Detailed studies were made of the root system and root food reserves of the bindweed plant as affected by various treatments. In 1945 a chemical, 2,4-D, became available for experimental use as a herbicide. A large number of experiments indicated that while the chemical was effective, it would not give complete control unless combined with intensive cultivation and competitive cropping. Practical methods were soon developed where 2,4-D could be substituted for some of the cultivation operations, combining cultivation and competitive cropping to control the weed at minimum expense. These methods were best for controlling extensive infestations. An equally important problem was how best to prevent small

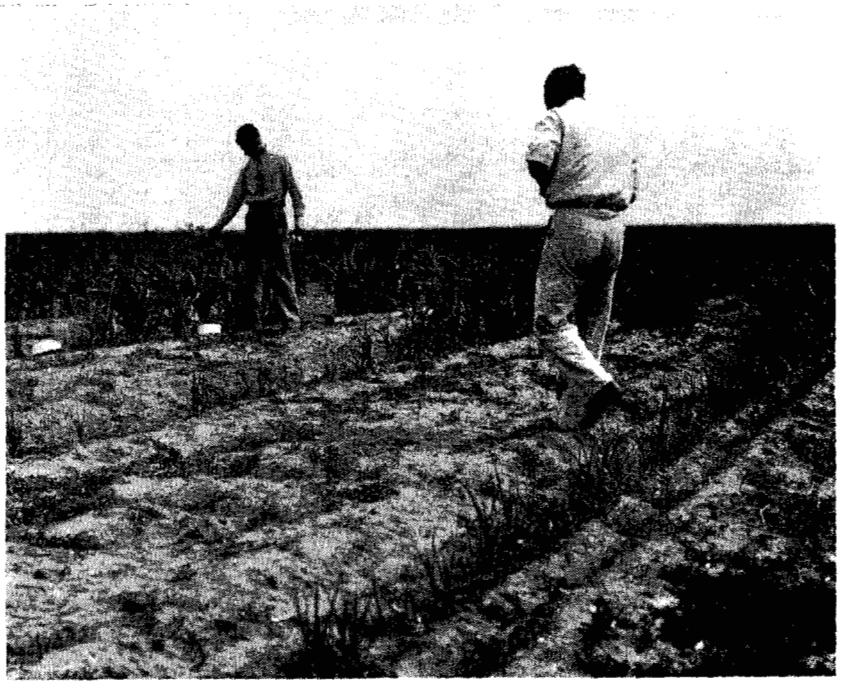

Fig. 63.—Sorghums unable to compete with bindweed.

patches of bindweed from spreading. A study was made of many sterilizing herbicides. Chlorinated benzoic acid compounds were found to be as effective for this purpose as sodium chlorate, and in many cases more effective.

Originally it was planned to study only the control of bindweed. Soon a study was undertaken of other serious weed species, Russian knapweed, hoary cress, and Johnsongrass. Studies were also undertaken for the control of weeds in growing crops, principally wheat and sorghum. A practical method of controlling broad-leaved weeds in growing wheat was developed. Also a pre-emergence chemical became available for weed control in sorghums. W. M. Phillips succeeded F. L. Timmons as project leader in 1948. He has directed the work since that time.

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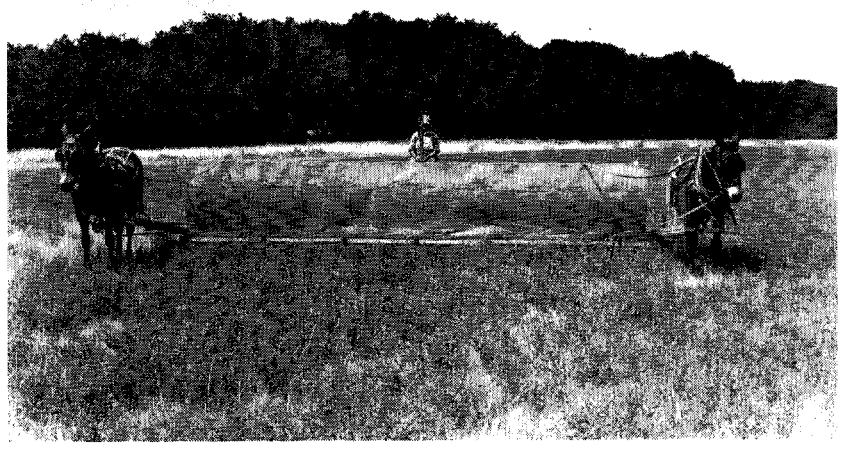

Fig. 64.—Hopper dozer collecting grasshoppers.

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ENTOMOLOGICAL STUDIES

Entomological studies were started at the Station in 1947. During the first three years studies were made of the pollinating activities of various bees on alfalfa flowers, and results published in Technical Bulletin No. 70 of the Kansas Agricultural Experiment Station. In 1950 through 1955 the pollination work was conducted, but emphasis was placed on chemical control and the project broadened to include insects attacking wheat. Since 1956 the work has consisted of host plant resistance to the spotted alfalfa aphid, pea aphid, and greenbug. This work contributed to the release in 1959 of Cody alfalfa, a variety resistant to the spotted alfalfa aphid. The development of Cody is described in Technical Bulletin No. 114 of the Kansas Agricultural Experiment Station. Studies to evaluate systemic insecticides for the control of insects affecting man and animals have been under way since 1956.

The work was under the direction of Dr. W. W. Franklin from May 15, 1948, to November 10, 1953, and of T. L. Harvey since March 15, 1954.

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MACHINERY AND EQUIPMENT

An outstanding contribution of the Station has been the improvement and adaptation of farm machinery to specialized uses on the farm. New pieces of equipment have been invented that saved labor or increased output, and improvements have been made that better adapt farm equipment to the function for which it was manufactured. Up to 1922, the Station had done its work principally with hand-operated or horse - drawn equipment. The change that took place about this time in adapting farm machinery to mechanical power presented an unusual opportunity. Two conditions at the Station contributed to this opportunity: first, the Station operations were sufficiently extensive to justify the use of mechanical power, and second, the volume of work required the service of a skilled mechanic and the operation of a well-equipped farm shop.

The first attempt to use mechanical power in tillage work was in 1907 when a steam plowing outfit was purchased. In 1914 a three-wheeled J. I. Case gasoline tractor was "made available." None of this power equipment proved satisfactory or was in use for field work by the fall of 1921. Immediately thereafter, purchases of power equipment increased rapidly. An Allis-Chalmers 30-hp gasoline tractor and a 30-60 Rumley oil pull tractor that burned kerosene were purchased in 1922 and 1924, respectively. They were put into use for listing, plowing, and belt work. The most important job for the Rumley tractor was to pull a 15-foot sidehill-type Holt combine acquired in 1924 to harvest a big wheat crop. Much other machinery and equip-

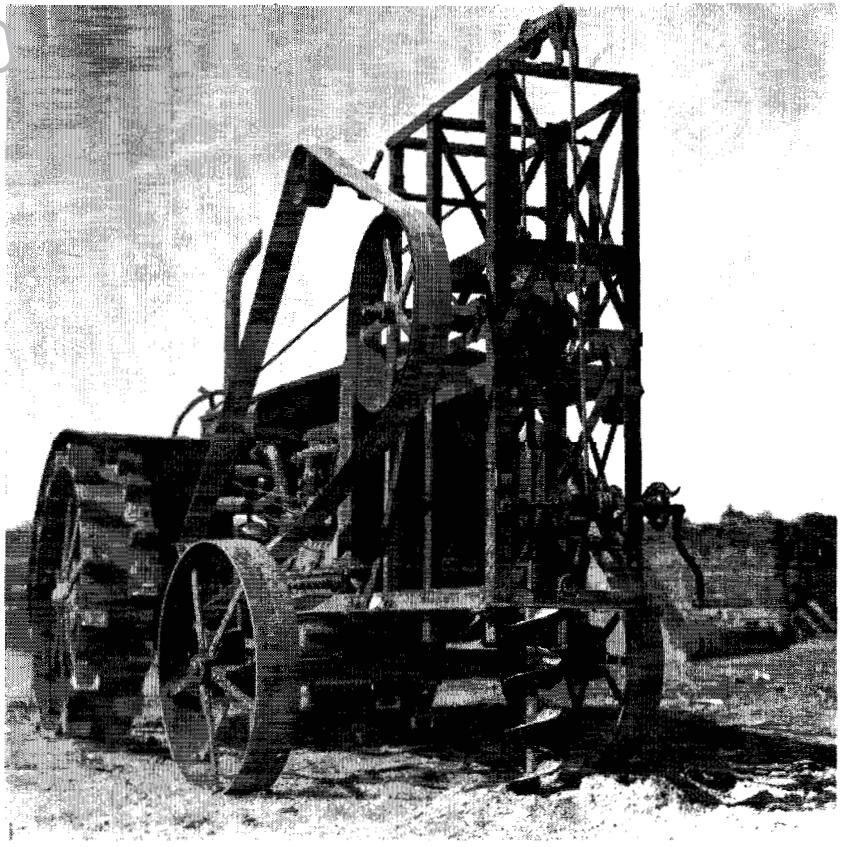

Fig. 65.—Mechanical posthole digger.

ment was purchased during the period 1921 to 1927. This equipment consisted of grain wagons, binders, headers, manure spreaders, plows, harrows, rakes, press grain drills, seed-cleaning machinery, cultivators, listers, ridge busters, corn binders, bundle toppers, pumps, hay loaders, feed grinders, concrete mixer, small gasoline engines, tree digger, electric motors, and a freight elevator for the seed-house. Much of this equipment needed to be modified to adapt it better to the purpose for which it was to be used. For other types of work no equipment was available that was well adapted for the purpose.

In 1924, a full-time shop mechanic was employed. A machine shop was built and equipped.

While the machine shop was used primarily to care for routine repair work of a 3600-acre experimental farm, much rebuilding and remodeling of machinery was undertaken and many new pieces of equipment were built. A few of the most outstanding accomplishments were the following:

Mechanical Posthole Digger, The need for a mechanical posthole digger became almost a necessity about 1925 when several miles of fence had to be rebuilt. The digger that was constructed consisted of an 8-inch auger rolled on special order by a machine shop in Chicago. It was made

of ¼-inch steel. The auger was welded to a 1½-inch shaft and fitted into the rear end of an auto differential to power the auger. This unit was fitted into a frame and mounted on the front end of an Allis-Chalmers tractor and was driven by a belt from the flywheel of the tractor. The equipment was used to dig thousands of postholes for fences on the Station, and many farmers used the plan to build similar equipment for their own farms.

Remodeling of J. I. Case Thresher. The J. I. Case separator in use at the Station did satisfactory work but was difficult to clean preparatory to threshing different varieties and kinds of pure seed stocks. Several changes were made to facilitate cleaning. The rear end of the separator that included the heavy straw blower was unbolted, and large hinges attached. This permitted the rear end to be swung out of the way so that the separator could be thoroughly cleaned quickly and with ease. This change not only facilitated cleaning but insured that mixtures would be avoided when pure seed stocks of different kinds were threshed.

Automatic Hay Baler. Making alfalfa hay was time consuming and laborious. Stacking the hay in the field with buck rakes and baling the hay

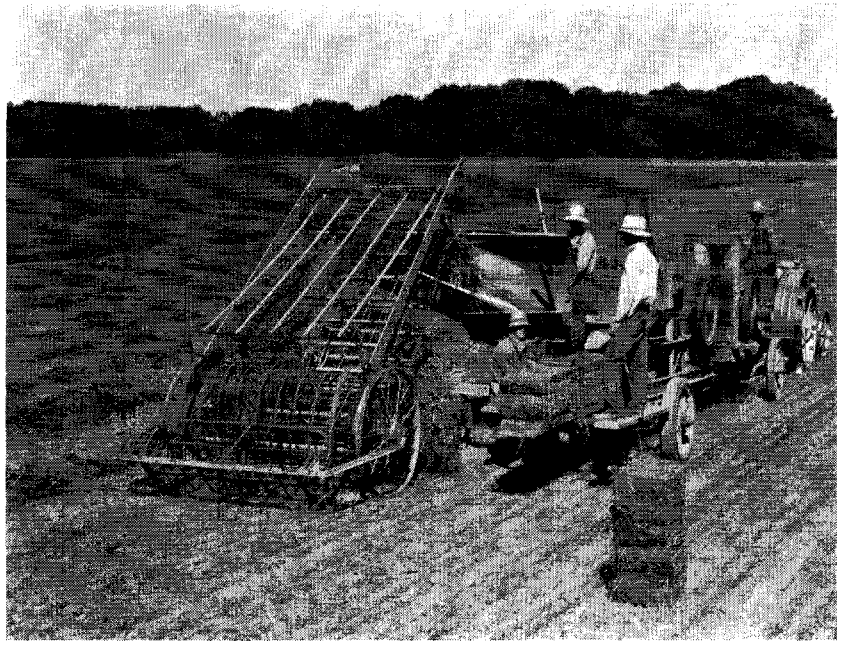

Fig. 66.—Automatic hay baler in operation in 1931. Because the making of alfalfa hay was a time-consuming and laborious operation, it was decided to build a portable hay baler.

out of the stacks was customary. Many leaves and much hay were lost due to weathering in the stack and excessive handling. It was decided to build a portable pick-up hay baler. A hay loader, used for loading loose hay on wagons from the windrow, was purchased. It was attached to the side of an old truck chassis on which a stationary hay baler had been mounted. A metal chute was added to guide the hay from the loader to the platform of the baler. Seats were provided for two men, one on each side of the baler, to push bale ties through the bale blocks and twist the bale ties. The 1922-1927 report says: "This outfit bales hay out of the windrow as it is pulled along with either a tractor or horses. This device works fine when competent help can be secured to tie the bales as fast as the machine is ready to make them. If automatic tying equipment can be successfully installed on balers, one of the greatest steps forward in automatic hay baling will have been taken. Automatic tying will eliminate two men, which should reduce the cost of baling hay in the field. The Station will make considerably more effort along the line of improving upon this hay baling equipment, as the quality of the hay is greatly improved by this method." (43)

Experimental Plot Combine. In 1928, a small self-propelled combine was constructed to harvest small experimental plots of 1/10 acre

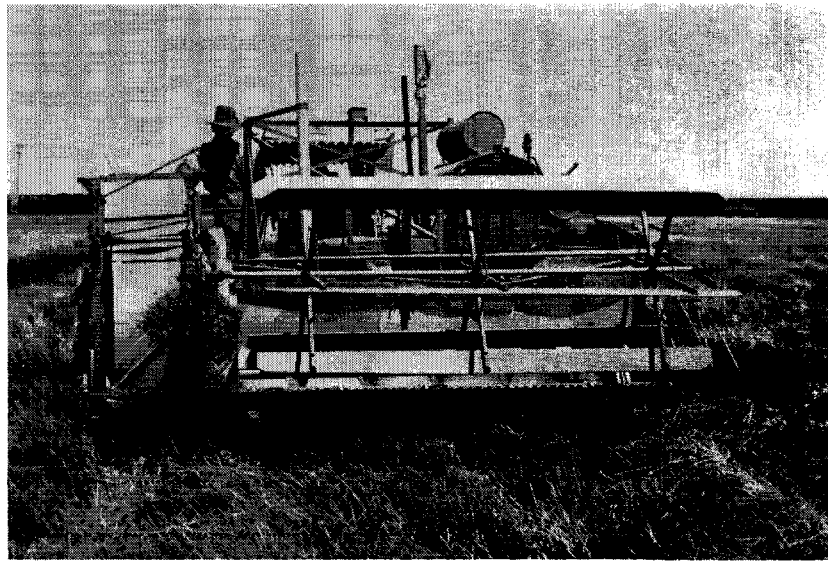

Fig. 67.—Experimental plot combine. In 1928 a small self-propelled combine was constructed to harvest experimental plots, which greatly reduced the cost of harvesting.

or less. A small rebuilt Gleaner combine was mounted on a small 2-ton Caterpillar tractor. The machine was especially valuable because of its mobility. It could be turned around in its own length. It could be manipulated to do work that was impossible with other equipment. It reduced greatly the cost of harvesting experimental plots. The combine worked so successfully that requests were received from other experiment stations for similar outfits. Four additional plot combines were built at cost, one for the Colby Branch Experiment Station delivered for the 1931 harvest, and others completed in the fall of 1931 for the Garden City Branch Experiment Station, the U.S.D.A. Field Station at Woodward, Oklahoma, and the U.S.D.A. Soil Erosion Project at Hays. The combine built for the Soil Erosion Project was mounted on a McCormick-Deering wheel tractor since a tractor of this make was available. It worked satisfactorily for harvesting irregular plots of wheat and sorghum but was not as mobile as the combines mounted on crawler-type tractors. Since that time a smaller self-propelled combine has been designed and is now in use.

Sweetclover Seed Scarifier.

Newly harvested sweetclover seed is low in germination because many of the seeds are so hard that they will not absorb moisture. This condition can be overcome by passing the seed through a scarifier that scratches or chips the surface of the seed. A satisfactory machine of this type with a large capacity was designed and constructed in the Station shops in 1935. The scarifying unit consisted of two metal perforated cones, one inside the other. The seed to be scarified was introduced between the cones, one stationary and the other rotating. The sharp edges of the perforated metal scratched the surface of the seed. The degree of scratching was determined by adjusting the space between the cones and by the speed of the rotating cone. The machine was powered with a small electric motor. A blower recleaned the seed as it came out of the scarifier.

Three scarifiers were built: one for the Station, one for U.S.D.A., and one for the Agronomy Department of the College. A fourth machine with capacity four times that of the original machine was made for the Russell County Farm Bureau.

Power Hitches. The Caterpillar tractor owned by the Station was used to propel a number of implements such as listers, plows, ridge busters, planters, weeders, etc. Different types of hitches were required to accommodate the length of tongue, turning radius, and lever control. Several hitches were designed and built at the Station shops in 1933 to accommodate the different implements. For example, the Station was the first to use 6-row listing, planting, and weeding equipment. Since special hitches for

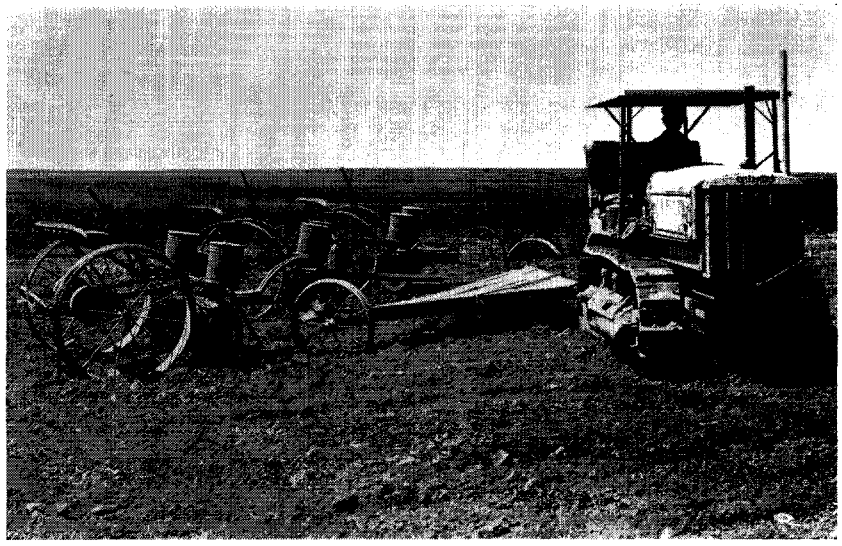

Fig. 68.—Hitch developed for attaching three 2-row lister planters. Such special hitches were developed to facilitate large tillage operations. The Caterpillar Tractor Company requested and was furnished with blueprints of all hitches designed at the Station.

such use were not being manufactured, 2-row, and in some cases 3-row equipment, was purchased and remodeled into 6-row equipment. The Caterpillar Tractor Company of Peoria, Illinois, requested and was furnished with blueprints of all the hitches designed at the Station. Working plan prints were supplied to many Caterpillar tractor owners over the United States and much favorable comment resulted.

Basin Lister. A successful basin lister to catch and retain moisture on listed land by mechanically placing small dams in the lister furrows was constructed at the Station in the fall of 1935 after a number of unsuccessful attempts. The machine was built by mounting the equipment that made the dam on a rebuilt Chase 2-row lister. New 38-inch wheels were substituted for the lower planter-type wheels. Auxiliary cam rollers were mounted in each wheel to lift the dammers at proper intervals to make the dams about 10 feet apart. The damming equipment was attached to the lister frame with angle irons mounted at the rear end of the lister beam. This provided a hinge so that the damming attachments could be raised and lowered. Mounted this way the dammer attachment became a part of the lister, and the entire machine became as portable as the lister itself.

The blade forming the dams was made to conform to the furrows made by the lister so that the blade moved only soil that had been loosened. The

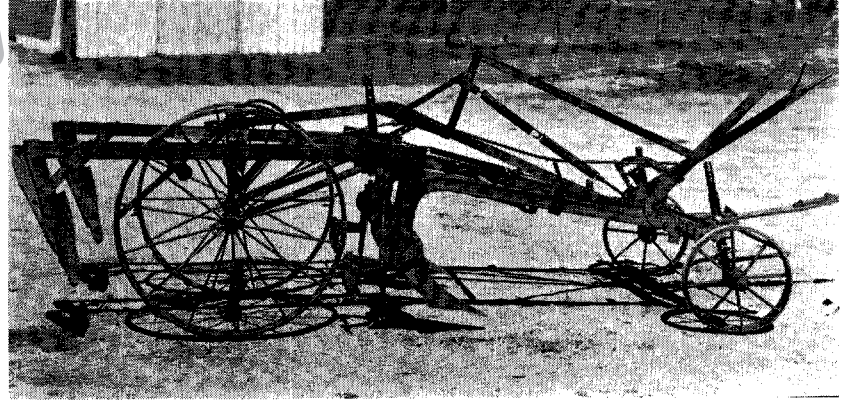

Fig. 69.—In the fall of 1935 a successful basin lister was constructed at the Station. It placed small dams in the lister furrows to catch and retain moisture on listed land.

height of the dam in the lister furrows could be varied by the depth at which the lister ran and speed at which it was pulled. A speed not exceeding 3 miles an hour proved best. In 1936 this machine was used to basin list a field with a 4 percent slope. A photograph taken 12 hours after a 2 1/2-inch rain, 1 inch of which fell in 30 minutes, showed that the basins held all of the water without run-off.

Following the successful operation and use of the basin lister on the Station, a small trailer was built on which the basin lister was mounted in order that it might be transported for demonstrations. Demonstrations were put on in 30 counties in western Kansas with an attendance of

Fig. 70.—Basin-listed land holding water 12 hours after a 2.57-inch rain which fell in one-half hour.

Fig. 71.—An elevating grader was used to construct some 10 miles of terraces to conserve water and to control soil erosion on the cultivated land of the Station.

over 3,000 farmers. The equipment was also demonstrated in Colorado and at the soil and water conservation conference at Stillwater, Oklahoma. Following these demonstrations the Station was deluged with inquiries. Blueprints of the machine were made and sold at cost to 500 individuals in 1936 and more in 1937. Machinery manufacturers recognized the value of this type of equipment and were quick to capitalize on the interest created by the work of the Station in water conservation. During the dry period of the 1930's many types of damming and basin-making attachments for listers were manufactured and sold by commercial interests.

Elevating Grader. To conserve water and control soil erosion on the cultivated land of the Station, it became necessary to construct at least 10 miles of terraces. Properly designed labor-saving equipment was needed urgently for this purpose. An old elevating road grader borrowed from Ellis county and remodeled was used first. When this machine was sold by the county and became unavailable for Station use, it was decided to build a grader designed especially for terrace construction. An old wheel-driven elevating grader was purchased from the Lincoln County Highway Department for $300 and remodeled in the Station shop. The terraces built with this machine had a 60-foot base and a height of 18 inches. These terraces could be crossed readily with all types of farm equipment, including a 20-foot combine harvester. In addition to constructing over 10 miles of terraces on the Station and on some of the Fort Hays State College land, the equipment was used to construct several miles of road on the Station, much of it to divert flood waters from crossing cropland.

Fig. 72.—A self-propelled field silage cutter designed and built at the Station was used first to harvest the 1947 silage crop.

Self-propelled Field Sllage Cutter. A self-propelled field silage cutter designed and built in the Station shop was first used to harvest the 1947 silage crop. This was conceived following the construction and successful operation of a 2-row tractor-pulled field silage cutter built in 1945. The first machine did a good job of cutting silage but knocked down considerable feed when opening up new lands. To avoid this loss and to economize on labor, the machine was converted into a self-propelled unit. The cutter assembly was mounted on a heavy frame carried by two homemade wheels fitted with 12" x 24" tractor tires. A 72-hp Continental motor to power the cutting and transport unit, with necessary forward and reverse driving mechanism, completed the outfit. A Thomas varidraulic drive was installed to permit speeds of from 1 to 14 miles per hour, Field cutting speed usually varied from 3 to 5 miles an hour, depending on tonnage of the crop. Hydraulic brakes operating independently on each wheel enabled the machine to turn in a small radius. The machine easily cut 30 tons of silage an hour.

Silage making was one of the most laborious jobs on the farm before field cutters were available. A 14-man crew was required by the old method. The new method used a crew of 6 and eliminated entirely the back-breaking labor of handling the heavy bundle feed. The introduction of the self-propelled unit reduced by 62 percent the cost of putting up silage. It also made it possible to secure farm labor for the work, since the job was now entirely mechanized and had become a simple tractor-and-truck operation. This ma-

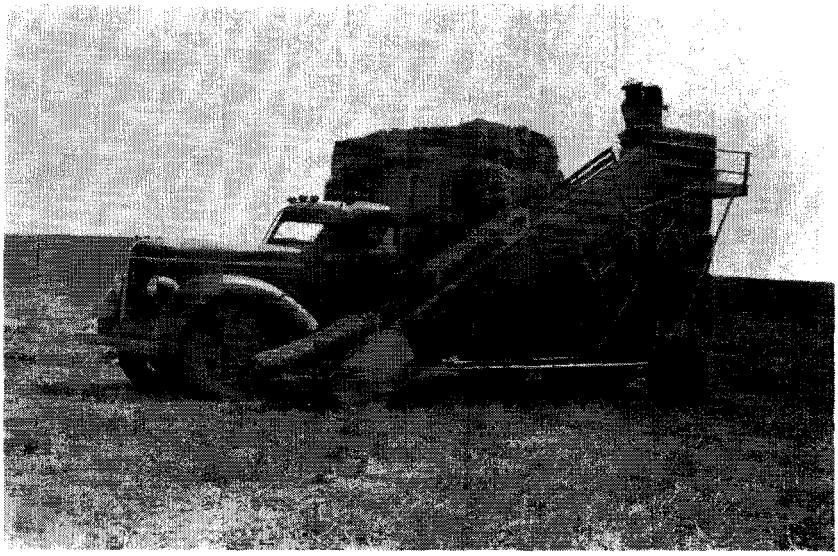

Fig. 73.—An automatic bale pickup and loader was designed and built at the Station in 1946.

chine is still (1962) in use on the Station. It has been demonstrated many times, twice at the Kansas State Fair at Hutchinson where it was closely observed by many farmers and machine manufacturers. The success with the machine immediately stimulated farmer interest, and the demand for it encouraged manufacturers to build self-propelled field silage cutters. They became available commercially in 1950 and 1951.

MACHINES AND EQUIPMENT DEVELOPED OR IMPROVED AT THE STATION

	Type of Equipment	Year Produced
1.	Power posthole digger	1927
2.	Automatic field hay baler	1927
3.	Tractor duckfoot with 28-inch sweeps for heavy tillage, especially for bindweed	1927
4.	Power metal saw for shop	1928
5.	Homemade triphammer for shop	1928
6.	Two-row corn binder bundle-loading attachment	1930
7.	Windrow header dump box	1931
8.	Buffalograss sod cutter	1934
9.	Road roller (made with tractor wheels filled with concrete)	1934
10.	Vacuum-type buffalograss seed harvester	1935
11.	Sweetclover seed scarifier	1935
12.	Power cross cut log saw	1935
13.	Basin lister	1935
14.	Dam-busting attachment for ridge buster	1937
15.	Nursery thresher	1937
16.	Motorized hopper dozer	1937
17.	Six-row flexible automatic lift tractor lister	1937

18. Rebuilt press grain drills 1937
19. Tractor hitches 1937
20. Elevating grader rebuilt for terracing machine 1938
21. Automatic grain seed-treating machine 1938
22. Duckfoot corn cultivator 1938
23. Calf dehorning chute 1938
24. Buffalograss seed-harvesting attachment 1938
25. Tree-digging attachment for tractor 1938
26. Blade weeder for terrace cultivation 1938
27. Grasshopper poison spreader 1939
28. Buffalograss seed combine 1941
29. Drill for sowing grass seed 1942
30. Improved buffalograss combine with pick-up attachment 1943
31. Buffalograss seed drier 1944
32. Motorized hay buck 1944
33. Two-row field silage cutter 1945
34. Pick-up bale loader 1946
35. Self-propelled field silage cutter 1947

GERMAN WAR PRISONERS

Labor for farm work became difficult to obtain during World War II, both at the Station and on other farms throughout the country. In August, 1943, it was learned that arrangements were being made by the Army to make available German prisoners of war for farm work. It also developed that German prisoners were available for such work at a war prison camp in Nebraska, providing the requirements of the Army for use of the prisoners could be met. Among the requirements were the following:

1. Satisfactory housing and mess facilities, the housing to be such as to make difficult the escape of the prisoners,

2. Facilities for housing and feeding the detail of soldiers who could guard the prisoners.

3. Work available either on the Station farm or on farms within a driving distance of 50 miles that would occupy the time of the prisoners.

4. Assurance that all precautions would be taken by those employing war prisoners to comply with the requirements of the Army for the use of such labor.

These conditions were met by establishing at the Station a prison war camp and arranging with farmers in Ellis and the four surrounding counties for the use of prison labor. The camp for the prisoners was built by utilizing the old feed barn and the utility building. The compound was surrounded by a barbed-wire barricade. The guard detail was housed in comfortable quarters in the new brick and concrete seed-house. The facilities provided passed the inspection of both the Medical Department of the Army and the commandant of the Prisoner of War Camp in Nebraska. The first contingent of 100 war prisoners was received early in September, 1943.

A maximum of 150 prisoners was available for work on the Station and on farms in the five counties. The farmers using the prisoners came to the Station, signed up for the number of workers desired, re-

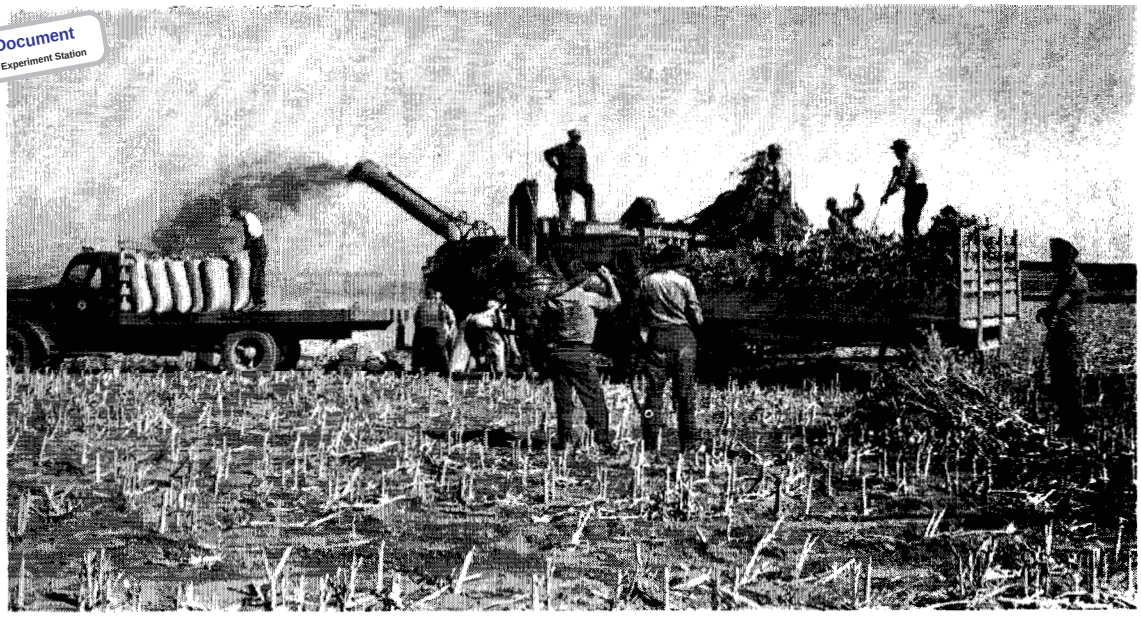

Fig. 74.—German prisoners of war were used in threshing certified seed sorghum in 1943. As many as 150 prisoners were available for work on the Station and surrounding farms, proving an invaluable source of labor in a time of manpower shortage.

turned with the prisoners to the farm, fed them at noon, and returned them at a specified time to the camp in the evening. One or more guards accompanied each contingent of prisoners.

The work performed varied. Many were used in construction work such as erecting a garage, laying a concrete floor in a large feedlot, constructing foundations for a farm building, and digging a well. The labor performed by the prisoners proved on the whole satisfactory. The labor permitted much Station work to be done that otherwise would have been impossible during the war years. Some technically trained prisoners were used in the Station laboratories. The service of the prisoners ended shortly after the close of the war with Germany. The first contingent left in November, 1945, and the other shortly thereafter.

OIL AND GAS LEASES

The oil and gas development which has been extensive in central Kansas had reached an area near the Station by 1942. Some very good wells had been obtained in Ellis county, though none was discovered close to the Station land. Geological formations appeared favorable, and great pressure was placed upon the Station administration to lease the land for oil and gas development. This pressure at first was resisted, but the Board of Regents decided that bids would be accepted with the stipulation that certain lands, the least valuable for experimental work, should be designated for development areas; other lands, the most valuable for experimental work, should be designated as non-development areas.

Bids were received June 22, 1942, and a lease awarded to the Darby Petroleum Corpora-

tion of Kansas City, Mo., for a bonus of $18,267.20 plus $1 an acre a year delayed rental. The lease covered the entire 3,260 acres of the Station, both the development and the non-development areas. The lease was renewed June 22, 1943, for one year upon the payment of $2,740. The lease was discontinued by the Darby Corporation on June 20, 1944, after a dry well had been drilled in the center of the southeast pasture area.

A second lease was awarded June 26, 1948, to the Union Oil Company of Wichita on a bonus of $1,428, covering 560 acres, of which 252 acres were designated as drilling area and 308 acres non-drilling area. Annual rental of $1 an acre per year was also stipulated.

From 1948 to the present, portions of the Station land have been under lease to various corporations and individuals more or less continuously, with total income from all rentals and leases amounting to about $31,000. No producing wells have been drilled under any of these leases.

MAKING THE RESULTS KNOWN

The Station has been active in bringing the results of its research to the attention of the public. This has been done through numerous publications, by inviting the public to visit the Station, and by the technical staff attending public gatherings where the work of the Station was explained and the results presented.

In the first 60 years about 170 formal publications were issued. These reports were in

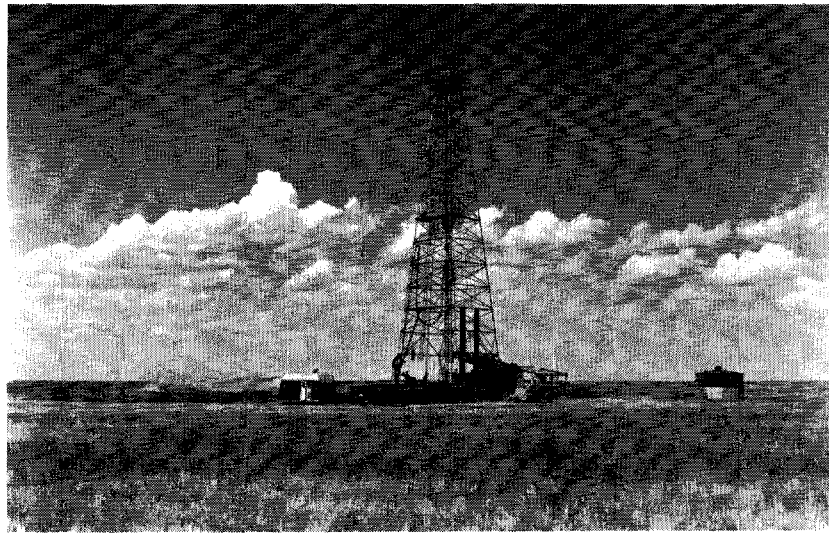

Fig. 75.—A well was drilled for oil under a lease by the Darby Corporation. The lease was discontinued on June 20, 1924, after a dry hole had been drilled in the center of the southeast pasture.

the form of popular bulletins and circulars as well as technical bulletins and journal articles. Fifty of these publications presented results of winter feeding experiments with cattle. The first reports on experimental feeding were mimeographed circulars, but starting with 1947 they have been issued as formal circulars and bulletins of the Kansas Agricultural Experiment Station. About 45 publications relate to cereal and forage crop work, while others relate to weed control, trees and shrubs, orchards and gardens, soil management, soil moisture, tillage operations, restoring native grasses, new farm implements, insect control, and other subjects relating to work of the Station.

These publications have been distributed both to individuals and to such agencies as newspapers, farm journals, agricultural extension workers, and vocational agriculture teachers. These agencies have made the information available to many thousands of citizens. Also, many popular news articles have been prepared each year by the technical staff and distributed to the press. A daily radio program has emanated from the Station since 1953.

A second method of acquainting the public with the work has been through public events at the Station, when the results of the work of the Station have been presented through demonstrations, exhibits, and oral reports. These have included annual roundups, field days, judging contests, and informal visits by groups and individual farmers.

Annual round-ups have been held each year since 1913, usually the last week in April. These events have placed special emphasis on work with cattle, especially the presentation of results with winter feeding, although on these occasions the results of other work have been presented. Attendance at the round-ups has varied with the condition of the weather, ranging from fewer than 100 when the weather was especially bad to more than 1,500 when conditions were favorable. Visitors came each year from many of the counties in the state and from a number of adjoining states.

Judging contests have been held as a feature of the round-ups. 4-H group boys and girls and vocational agriculture students have participated each year in the judging of livestock, crops, clothing, and foods.

Attendance at these contests has varied over the years, from 13 teams of four individuals each the first year, 1922 to 494 teams in 1956 with more than 1,500 individuals in competition. Of these teams 241 judged livestock, 66 judged grain, and 187 judged clothing and foods. While the students attending were concerned chiefly with judging, they also became acquainted with general work of the Station.

Field days have been another method of acquainting the public with the work of the Station. On such occasions

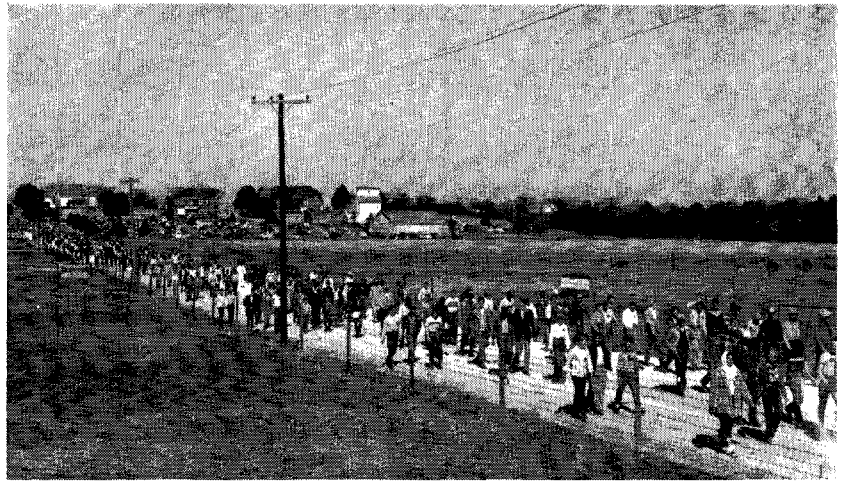

Fig. 76.—4-H and Vocational Agriculture contestants enroute to the stockyards for a livestock judging contest. Judging contests have been held each year since 1922 as a feature of the Annual Roundup.

visitors were invited to study some particular phase of work at a time when results were most evident. The first meeting of this kind was in June, 1910, when the annual assembly of the Kansas Dry Farm Association convened at the Station. A number of other meetings of this group were held in subsequent years, some in the spring and others in the fall. More typical field days came later. Since that time numerous wheat, sorghum, soil conservation, and other field days have been held. Schools have been held for weed supervisors, county agents, and grain graders, with attendance ranging from a few to several hundred. Many other visitors came to the Station individually or in small groups, usually led by county agricultural agents or vocational agriculture teachers. Recently numerous representatives of foreign countries have visited the Station.

Superintendents and other members of the technical staff have spoken at public gatherings and held demonstrations at agricultural fairs and other gatherings of farmers.

These methods of acquainting the public with the work of the Station have been effective. Farmers have accepted the findings of the Station to a gratifying extent, and reasonable financial support for the work of the Station has been provided by the State Legislature.

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