

Historical Document
Kansas Agricultural Experiment Station

SEVENTEENTH ANNUAL REPORT

OF THE

EXPERIMENT STATION

OF THE

Kansas State Agricultural College.

FOR FISCAL YEAR 1903-'04,

WITH AN

Index to Bulletins 119 to 123.

MANHATTAN, KANSAS,
1905.

KANSAS STATE AGRICULTURAL COLLEGE,
MANHATTAN, KAN., January 27, 1905.

To his Excellency E. W. Hoch, Governor of Kansas:

DEAR SIR—I herewith transmit, as required by act of Congress approved March 2, 1887, the Sixteenth Annual Report of the Experiment Station of the Kansas State Agricultural College, for the year ending June 30, 1904, including the financial statements for that period.

Respectfully,

E. R. NICHOLS,
Secretary Board of Regents.

KANSAS STATE AGRICULTURAL COLLEGE.

BOARD OF REGENTS.

Hon. J. S. McDOWELL (1905),* President,
Smith Center, Smith county.

Hon. C. E. FRIEND (1905), Vice-president,
Soldier, Jackson county.

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Ellsworth, Ellsworth county.

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Hon. J. O. TULLOSS (1907),
Sedan, Chautauqua county.

Hon. GEO. S. MURPHEY (1905),
Manhattan, Riley county.

Pres. E. R. NICHOLS (*ex officio*), Secretary,
Manhattan, Riley county.

Miss LORENA E. CLEMONS, Assistant Secretary.
Manhattan, Riley county.

STATION STAFF.

COUNCIL

E. R. NICHOLS, A. M.,
Chairman ex officio,

J. T. WILLARD, M. S.,
Chemist and Director.

E. A. POPENOE, A. M.,
Entomologist.

E. F. ROBERTS, M. S.,
Botanist.

N. S. MAYO, M. S., D.V.S.,
Veterinarian.

ALBERT DICKENS, M. S.,
Horticulturist.

A. M. TEN EYCK, B. AG R.,
Agriculturist.

OSCAR ERF, B. S.,
Dairy and Animal Husbandman.

LORENA E. CLEMONS, B. S.,
Secretary.

ASSISTANTS.

V. M. SHOESMITH, B. S. Assistant Agriculturist.

G. A. DEAN, B. S. Assistant Entomologist.

C. L. BARNES, D.V. M. Assistant Veterinarian.

ROSCOE H. SHAW, B. S. Assistant Chemist.

R. J. KINZER, B. S. Agr. Assistant Animal Husbandman.

GEO. C. WHEELER, B. S. Assistant in Feeding Experiments.

R. E. EASTMAN, M. S. Assistant Horticulturist.

. Assistant Botanist.

ALICE M. MELTON, B. S. Clerk in Director's office.

FORT HAYS BRANCH STATION.

J. G. HANEY, B. S.,
Superintendent.

O. H. ELLING, B. S.,
Foreman.

*Term expires.

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EXPERIMENT STATION
OF THE
KANSAS STATE AGRICULTURAL COLLEGE,
MANHATTAN.

SEVENTEENTH ANNUAL REPORT—FISCAL YEAR 1903-'04.

FINANCIAL STATEMENTS.

Report of the Custodian.

To the Board of Regents of the Kansas State Agricultural College:

GENTLEMEN— Herewith is submitted my report of receipts and expenditures on account of the Experiment Station for the period between July 1, 1903, and June 30, 1904:

Balance on hand July 1, 1903	\$1,164.84
Received from the treasurer of the United States	15,000.00
Received from cash sales of products.	4,184.55
Total	\$20,349.39
Approved vouchers Nos. 1 to 434, including credits,	19,502.09
Balance on hand June 30, 1904	\$847.30

LORENA E. CLEMONS, *Custodian.*

Report of the Secretary.

To the Board of Regents of the Kansas State Agricultural College:

GENTLEMEN — Herewith is submitted the following report of the financial affairs of the Experiment Station of the Kansas State Agricultural College for the year ending June 30, 1904, as prepared under directions from the United States Department of Agriculture. The several items of this account are covered by vouchers approved by

the disbursing officer, certified by the Secretary, and allowed by the President of the Board of Regents:

Experiment Station, Kansas State Agricultural College, in account with the United States appropriation, 1903- '04.

DR.

To receipts from the treasurer of the United States as per appropriation for fiscal year ending June 30, 1904, as per act of Congress approved March 2, 1887 \$15,000.00

CR.

By salaries	\$7,953.46
Labor	3,418.08
Publications	769.84
Postage and stationery	142.96
Freight and express	238.04
Heat, light, water, and power	29.95
Chemical supplies.	344.58
Seeds, plants, and sundry supplies...	337.20
Feeding stuffs.. . . .	58.54
Library	32.27
Tools, implements, and machinery.. . . .	476.44
Furniture and fixtures	105.35
Scientific apparatus	462.78
Live stock	65.70
Traveling expenses	261.23
Contingent expenses	18.00
Building and repairs	285.58
Total	<u>\$15,000.00</u>

We, the undersigned, duly appointed auditors of the corporation, do hereby certify that we have examined the books and accounts of the Experiment Station, Kansas State Agricultural College, for the fiscal year ending June 30, 1904; that we have found the same well kept, and classified as above; and that the receipts for the year from the treasurer of the United States are shown to have been \$15,000, and the corresponding disbursements \$15,000; for all of which proper vouchers are on file, and have been by us examined and found correct, thus leaving no balance.

And we further certify, that the expenditures have been solely for the purposes set forth in the act of Congress approved March 2, 1887.

(Signed)

C. E. FRIEND.

[SEAL.]

J. O. TULLOSS.

GEO. S. MURPHEY.

ATTEST: LORENA E. CLEMONS, *Custodian.*

Supplementary Statement.

D R.

To receipts from other sources than the United States for the year
ending June 30, 1904:

Balance on hand July 1, 1903	\$1,164.84
Farm and garden products	4,184.55
Total	<u>\$5,349.39</u>

C R.

By salaries	\$698.34
Labor	434.41
Publications	27.22
Postage and stationery	18.87
Freight and express	79.56
Heat, light, water, and power	39.60
Chemical supplies	89.66
Seeds, plants, and sundry supplies.	71.12
Feeding stuffs	1,010.40
Library	133.85
Tools, implements, and machinery.	10.00
Furniture and fixtures	307.49
Scientific apparatus.	143.75
Live stock	976.24
Traveling expenses.	34.20
Contingent expenses	326.14
Building and repairs.	101.24
Total	<u>\$4,502.09</u>
Balance	<u>847.30</u>
Grand total	<u><u>\$5,349.39</u></u>

Respectfully submitted.

LORENA E. CLEMONS.

Expenditures by Departments, 1903-'04.

Items.	General.	Farm.	Botan- ical.	Chemical.	Dairy and animal hus- bandry.	Entomo- logical.	Horti- cultural.	Veteri- nary.	Total.
By salaries	\$1,188 30	\$1,141 70	\$1,079 20	\$1,408 30	\$1,304 20	\$1,111 70	\$1,101 70	\$316 70	\$8,651 80
Labor.....	64 44	1,396 65	420 73	46 82	584 66	34 70	1,210 28	94 21	3,852 49
Publications	107 53	262 23	13 94	3 30	185 13	71 69	100 34	52 85	797 06
Postage and stationery.	66 98	.....	13 72	42 08	.....	17 00	1 00	21 05	161 83
Freight and express.....	100 64	31 32	11 95	12 08	20 20	37 76	29 78	73 89	317 60
Heat, light, water, and power.....	.....	12 60	.....	42 17	.....	.....	.....	14 78	69 55
Chemical supplies.. ....	.....	.....	.....	22 84	.....	40 84	72 07	298 49	434 24
Seeds, plants, and sundry supplies....	5 30	96 12	51 97	3 53	.....	13 57	219 29	18 54	408 32
Feeding stuffs .....	.....	.....	.....	.....	1,012 87	.....	.....	56 07	1,068 94
Library .....	.....	.....	145 89	20 23	.....	.....	.....	.....	166 12
Tools, implements, and machinery..	221 78	.....	63 02	6 08	.....	31 00	93 80	70 76	486 44
Furniture and fixtures	90 44	.....	.....	44 90	.....	277 50	.....	.....	412 84
Scientific apparatus .....	.....	12 00	.....	381 14	.....	198 72	.....	14 67	606 53
Live stock .....	.....	.....	.....	2 20	974 49	11 00	.....	54 25	1,041 94
Traveling expenses.....	13 95	2 50	10 00	2 25	9 28	37 02	105 80	114 63	295 43
Contingent expenses	81 00	.....	55 60	.....	.....	.....	207 54	.....	344 14
Building and repairs .....	.....	4 52	42 81	169 90	.....	21 60	3 00	144 99	386 82
Totals.....	\$1,940 41	\$2,939 61	\$1,908 83	\$2,207 80	\$4,090 83	\$1,904 10	\$3,144 60	\$1,345 88	\$19,502 09

REPORT OF THE COUNCIL.

To the Board of Regents of the Kansas State Agricultural College:

GENTLEMEN—We present, to accompany the financial statements, the following account of the Station work for the fiscal year ending June 30, 1904, as a part of the annual report of the Station to the governor required by law.

The Staff.

There have been but few changes in the staff the past year. Professor Otis resigned his position as dairy husbandman August 1, 1903, to accept the superintendency of the Deming farms, in Labette county, Kansas. Since Professor Webster's resignation he had also been in charge of the Dairy Department. September 1, Professor Oscar Erf, B. S. Agr., instructor in dairy husbandry in the University of Illinois, and a graduate of the Ohio State University, assumed the duties of dairy and animal husbandman. Mr. Geo. O. Greene resigned the assistantship in horticulture October 1, in order to take a similar position at the Massachusetts Agricultural College. He was succeeded at once by Mr. R. E. Eastman, B. S., professor of agriculture in Hampton Institute. Mr. Eastman is a graduate of this college and a graduate student of Cornell University. Mr. Leslie F. Paull resigned his position as assistant botanist May 16, 1904, to take a position in the Bureau of Plant Industry.

Publications.

Within the fiscal year, the Station has issued the Sixteenth Annual Report, Bulletins Nos. 119 to 123, and Press Bulletins Nos. 125 to 131. The number of bulletins issued is the smallest since 1894. However, the bulletins were large, so that the total number of pages is about as usual. There are ready for printing seven more bulletins, on the following subjects:

- Experiments in Steer-feeding.
- Breeding and Feeding Pigs.
- Experiments with Dairy Cows.
- Observations on the Test of Milk.
- Hand-fed Calves.
- Root Development of Crops.
- Experiments at the Fort Hays Branch Station.

These have not been issued because of lack of available funds for state printing. With the beginning of the next fiscal year, some of

these will be consolidated and issued, and it is hoped that they, with others in preparation, may appear soon.

Following is a summary of the annual report and bulletins issued, and a list of the press bulletins, with certain other data concerning them:

Annual Report.

SIXTEENTH ANNUAL REPORT, 1902-'03, November 1903. 3000 copies. This contains the financial statement of the Treasurer and Secretary, a report by the Council upon the work of the several departments, some account of progress at the Fort Hays Branch Station, and in the work in destruction of prairie-dogs and gophers, and a brief statement concerning cooperative experiments with the United States Department of Agriculture. It also contains a list of the Station publications to date and an index to those for the year.

Bulletins.

BULLETIN No. 119, PRESS BULLETINS Nos. 71 TO 124. (*Pages 1-86.*) September 1903. All departments. 30,000 copies.

This reprint of press bulletins puts in permanent form a large number of valuable articles, most of which embody original observations or experiments made at this Station. The titles of those in this collection may be found in the complete list published elsewhere.

BULLETIN No. 120. TESTS OF FOREST-TREES. (*Pages 85-132.*) January 1904. Horticultural Department. 25,000 copies.

This amply illustrated bulletin summarizes the results of many years of observation upon a large number of species of forest-trees at the College. Numerous data on the rate of growth, hardiness and general adaptability are given.

BULLETIN No. 121. TREATMENT AND UTILIZATION OF FLOOD-DAMAGED LANDS. (*Pages 133-162.*) January 1904. Agricultural, Botanical and Horticultural Departments. 25,000 copies.

This bulletin, prompted by the conditions following the great flood of the Kansas river, May 1903, contains advice applicable to like conditions at other times and places. It contains sixteen plates, showing the flood and its effects, and crop possibilities of flooded land.

BULLETIN No. 122. BLACKLEG AND VACCINATION. (*Pages 163-178.*) February 1904. Veterinary Department. 15,600 copies.

This contains a description of blackleg, its cause, symptoms, and treatment, a discussion of its prevention by vaccination, directions for vaccinating, and statistics concerning the efficacy of this operation.

BULLETIN No. 123. CROP EXPERIMENTS IN 1903. (*Pages 181-250.*) March 1904; issued May 1904. Farm Department. 25,000 copies.

This extensive bulletin gives the results at the Station of experiments with alfalfa, barley, broom corn, corn, cow-peas, emmer, flax, grasses, Kafir-corn, millet, oats, pencillaria, silage, sorghum, soy-beans, teosinte, and wheat. The season was a favorable one, and 240 acres were devoted to the 360 plats included in the tests.

Press Bulletins.

No. 125. MEADOW FESCUE, July 7, 1903. Agricultural Department. 4000 copies.

No. 126. CORN ENSILAGE FOR STEERS. July 21, 1903. Animal Husbandry Department. 3700 copies.

No. 127. RABIES OR HYDROPHOBIA. July 28, 1903. Veterinary Department. 2700 copies.

No. 128. PREVENTIVE WORK AGAINST THE HESSIAN FLY. August 4, 1903, Entomological Department. 3500 copies.

No. 129. BROMIS INERMIS. September 1, 1903, Agricultural Department. 4000 copies.

No. 130. POISON FOR PRAIRIE-DOGS AND OTHER RODENTS. January 26, 1904. General Department. 5000 copies.

No. 131. WARBLER OR GRUBS IN CATTLE. February 9, 1904. Veterinary Department. 4000 copies.

The Work of the Departments.

FARM DEPARTMENT. The experiments with farm crops outlined in the report of the Farm Department a year ago were mostly successfully carried out and the results were published in Bulletin No. 123, which contains fifty-eight pages of printed matter and ten pages of cuts, illustrations of the crops. A large part of this work is being repeated in 1904. Besides the testing of varieties of the various crops, some work has been undertaken in crop breeding and seed selection, looking toward the establishment of pure and improved strains of corn, wheat, oats, barley, etc. These seeds, if they prove better than the original, will be distributed among the farmers of the state. The work is being carried on in part in cooperation with the Botanical and the Chemical Departments of this Station. The Farm Department has charge of the general seed selection and field testing, the purpose being mainly to purify and improve by careful selection the best standard varieties of various crops now being grown.

A new series of experiments has been begun with flax, including tests of varieties, date and thickness of seeding, effect of the crop on the land, rotation with other crops, and careful selection of seed. Flax is not grown so successfully in Kansas as in the states further north, and these experiments have been undertaken for the purpose of learning which are the best varieties to grow and what are the best methods to employ in growing the crop, that it may perhaps be more extensively and profitably grown in this state.

A large amount of work has been done in studying the roots of various plants grown as farm crops. Some twenty-five samples of the roots of the several crops have been washed out at different stages of

growth, or the plants were grown under different systems of culture. A study was made of these samples and they were photographed. A fifty-page bulletin has been prepared and is now awaiting publication, showing cuts of the root samples and describing the root development of several crops. Many of the original root samples are being exhibited at the St. Louis Exposition, in the Kansas state exhibit and in the exhibit of the experiment stations.

The soil-moisture studies in 1903 gave some interesting results, some of which were published in a paper by Mr. H. C. Kyle in the *Industrialist*, July 9, 1894. This work is being continued.

Early in the summer of 1903, in cooperation with the Horticultural and Botanical Departments, the Farm Department made some investigations of the damage to farming lands resulting from the "great flood." The results of this study were published in Bulletin No. 121, containing thirteen pages of printed matter and sixteen pages of cuts, illustrating the flood-damaged lands.

By reason of the good crops in 1903, the department was able to pay out on a large part of the crop experiments, and concluded the year with \$159.60 in the treasury. This season the crops are fair and will return a considerable income. In an unfavorable year, however, it will be impossible to conduct the experiments with the funds available.

BOTANICAL DEPARTMENT. The Botanical Department of the Station is continuing a series of acclimation tests with cereals, from which as a basis breeding plants are taken. A very extensive series grown during the past two years has furnished a number of promising wheats and oats, which in many cases have been utilized in the very numerous hybridization experiments. Crosses have been effected between wheat and rye; wheat on the one hand, and spelt, emmer, einkorn and Polish wheat on the other. Extensive crossing has been practiced, especially between the hard Red winter strains and other promising varieties. A series of Australian hybrid wheats, obtained by exchange from the prominent wheat-breeder, Mr. William Farrer, have been added to the list under experiment. The nursery-plat system as a basis for selection work with the cereals has been extended, and a nursery planting-machine has been purchased. The better and more promising hybrids and pure-breds among the cereals have been placed in increase plats, with a view to obtaining a sufficient quantity on which to base comparative-yield tests. Oats and barley in a very large number of varieties have been added to the breeding experiments. Soy beans are in the third year of experiment. A race of non-shattering beans has been secured, the first step in the advance of this plant as a grain crop. The study of heredity and varia-

tion in hybrids and the distribution of parental characters in the crossed offspring being indispensable as a scientific basis for breeding, considerable material of hybrids grown by the department has been preserved in Flemming's solution, and will be studied in stained microtome sections. Experiments in fixation of the nitrogen content of corn are being continued on a larger scale with two of the more promising of the serial lots of corn.

CHEMICAL DEPARTMENT. In addition to a considerable number of miscellaneous analyses, the following work has been done: In connection with Prof. E. H. Webster, of the dairy division of the Bureau of Animal Industry, a series of experiments was conducted to determine the conditions necessary for accurate testing of cream by the Babcock method. The results of this investigation have been published as Bulletin No. 58 of the Bureau of Animal Industry. In cooperation with the Veterinary Department, considerable work has been done with cattle dips, especially the sulphur dip. This is still in progress. The analyses of corn in connection with corn breeding have been continued. As heretofore, when requested, we have determined the sugar content of sugar-beets for individuals, making no charge. Considerable work has been done in studying the cause of the poisonous effects observed in the use of cottonseed-meal. At the request of Secretary F. D. Coburn, of the State Board of Agriculture, this department has analyzed nineteen commercial fertilizers offered for sale in this state. This is in pursuance of the provisions of the fertilizer law enacted in 1903, the enforcement of which is in charge of the secretary of the State Board of Agriculture. The increasing demand for analyses of feeds, soils, waters, ores, clays, etc., has been met as far as possible, a charge being made usually for quantitative work. A definite provision by the state for such analyses should be made, as for the most part they are not properly a part of either the College or Station work, though the policy of the Chemical Department has been to accommodate the public whenever a real service would be rendered.

DAIRY AND ANIMAL HUSBANDRY DEPARTMENT. During the past year the department has made a study of the different kinds of ferments in curds for cheese-making. Experiments have been conducted to determine how dense cream may be separated for practical butter-making. Studies in the pasteurization of cream for butter-making have also been made. In the economical production of milk, experiments have been conducted comparing rations of alfalfa hay and corn silage without concentrates, with rations of alfalfa hay, corn silage and some concentrates in addition. An extended study has been made of the variations of butter-fat production as affected by the weather and other temporary and changeable conditions. The effects

of udder manipulation upon milk production have been studied, and some investigations made on the physiology of milk secretion. Two lots of steers were fed to determine the relative advantage in feeding a ration of corn and alfalfa hay and a ration of corn and alfalfa with additional roughages, as Kafir-corn stover, sorghum hay, corn-stover, and prairie hay, supplied *ad libitum*. The tests of the feeding qualities of different breeds and crosses of swine, which had been planned for the previous year, were carried to completion. An experiment was carried on to test the probability of successfully feeding swine a moderate quantity of cottonseed-meal in their rations. Cottonseed-meal was also fed to brood-sows previous to parturition, the effect upon the offspring being observed. The cottonseed-meal ration was also continued with the pigs farrowed by these sows. A test was made to show the comparative values of the following feeds for pork-production : Kafir-corn, sorghum seed, corn, soy beans, and tankage. Experiments were made to determine the best crops and mixtures of crops for ensilage. The observations to determine the best varieties of grasses for permanent pastures, begun the previous year in cooperation with the Farm Department, have been continued.

ENTOMOLOGICAL DEPARTMENT. In the Entomological Department the control of orchard pests has continued to demand attention, tests of certain advertised spraying materials and limited experiments in modified spraying methods having been made. A somewhat extended investigation of the habits of the prairie ant has necessitated several trips to western localities, and has been productive of the desired practical information looking to the control of the species where injuriously abundant. In the same field, the attacks of locusts upon farm crops have been studied and satisfactory methods of protection tested.

HORTICULTURAL DEPARTMENT. In addition to the work begun in previous years, the Horticultural Department has added new varieties to the lists of fruits under observation. A careful record of the characters and qualities of seedling fruits now coming into bearing is being made. A large number of varieties of Sand plums (*Prunus watsoni*) have been fruited in the Station orchard. The comparison of individuals of the same lots upon the sand-dune land was seriously impaired by the flood of 1903. A number of varieties of the native persimmon (*Diospyros virginiana*), now coming into bearing, are very promising, and means of propagation are being tested. The control of some native shrubs and vines, valuable as ornamental, is receiving attention. A test of varieties of vegetables suitable for canning factories is receiving considerable attention. The improvement of the quality of fruit by thinning and spraying is under investiga-

tion, both small and orchard fruits being treated. The work with forest-trees is being continued and improvement by selection of seed is being undertaken.

VETERINARY DEPARTMENT. During the past year experiments have been carried on with blackleg vaccine, methods of attenuating, and results obtained. Experiments have also been made regarding scab or itch in cattle, the life-history of the parasite, and various remedies for treatment of this disease, with methods of application. Evidence regarding the accidental poisoning of stock by plants and weeds has been collected. Experiments are also being carried on regarding the effects of loco plants on horses and cattle, and treatment for this condition.

GENERAL DEPARTMENT. The general work of administration in the Station has been much as heretofore. The President of the College certifies vouchers, the accounts are in charge of the Secretary, and the Director attends to all correspondence, printing and mailing bulletins, and other general business of the Station. The cooperative work with the United States Department of Agriculture at McPherson and Hays adds materially to the duties of the Director. The mailing list having exceeded 25,000 in number, and the limited appropriation for state printing necessitating cutting down our requisitions for printing, a revision of our mailing list was made by enclosing private mailing cards with the copies of Bulletin No. 119 sent to persons enrolled previous to January 1, 1900. Subsequent bulletins are sent to these only on return of the card or other application for continuance of the bulletins. About 5000 names were dropped in this way. Requests for reinstatement are constantly received, however, and these, with new names added daily, will doubtless bring the list to its former figures before many months. June 30, 1904, it numbered 21,165. It is the policy of the Station to enroll names only upon the direct request of the person interested, though at the suggestion of another sample bulletins with a return application card are sent to farmers likely to wish them. Neither does the Station send bulletins in bulk to others for distribution. By these precautions it is believed that the bulletins printed get into the hands of almost none who have not asked for them. It would seem the part of wisdom for the state to allow a sufficient fund for printing to enable our bulletins to be issued in sufficient numbers to meet all demands.

As heretofore, the transient requests for bulletins are attended to in the Director's office, and the regular mailing from the linotyped list is done by machine in the College printing-office. This arrangement affords instructive and remunerative work to a number of stu-

dents in that department, and, under the systematic watchfulness of Superintendent Rickman, it is done with such care and economy as to be very advantageous to the Station.

Fort Hays Branch Station.

The past year has shown marked progress in the development of the Branch at Hays. For convenience of reference, the act making appropriations for this Station passed at the last session of the legislature is given, as follows:

AN ACT making appropriation for the Experiment Station of the State Agricultural College, on the Fort Hays military reservation.

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

SECTION 1. That the following sums, or so much thereof as may be necessary, are hereby appropriated out of any moneys in the state treasury not otherwise appropriated, for current expenses, improvements and equipment of the Experimental Station of the State Agricultural College, on the Fort Hays military reservation:

	1903.	1904.	1905.
Current expenses, including salary of superintendent, 2,000	\$5,200	\$5,200	
Dwelling houses	2,000	.....	.....
Live-stock experiments	1,000	2,000	.....
Horse barns . . . . .	.....	1,000	.....
Cattle sheds and yards. . . . .	.....	750	750
Fencing . . . . .	.....	700	700
Teams and equipment	2,500	.....	.....
Implements . . . . .	.....	1,000	1,000
Water plant and skimming station	1,500	2,000	.....
Creek crossings and bridges . . . . .	.....	500	.....
To cooperate with the United States Department of Ir-			
rigation	1,000	.....	.....
Thrashing machine and equipment. . . . .	.....	1,750	.....
	\$10,000	\$14,900	\$7,650

SEC. 2. The auditor of state is hereby authorized to draw his warrants upon the state treasurer for the several sums and purposes specified in this act upon verified vouchers approved by the board of regents of the State Agricultural College; provided, that all moneys derived from the sale of produce, commodities, or from any sources whatsoever, shall be paid to the state treasurer, and the same is hereby reappropriated to the current-expense fund of the Experimental Station of the State Agricultural College, on the Fort Hays military reservation, to be paid out by the state treasurer on warrants issued by the auditor of state on vouchers properly approved, as aforesaid.

SEC. 3. This act shall take effect and be in force from and after its publication in the official state paper.

Approved March 6, 1903.

Published March 18, 1903.

The items as given in the act show the nature and amounts of the

expenditures made at the Station. Superintendent Haney furnishes the following statement concerning the work of the year:

The harvesting of the 1903 crop was very gratifying, owing to the good yields secured. The Branch Station now owns its own harvesting and thrashing machinery. Of the 165 varieties of winter wheat sown, only 22 failed to make a yield. Theiss and Kharkov, two new varieties of direct importation, made the best yield —40.9 and 40.97 bushels per acre, respectively. They are both hard wheats of the bearded or Turkey type. The variety test has been continued, and further selections have resulted from the hybrids, which greatly increase the number of stocks being handled. In the preparation of land for fall wheat, the better and earlier prepared gave best results. The season was too wet for the macaroni or durum wheats, but barley and oats did splendidly. Telli, a new variety of barley, and the Texas red oats gave the best yields.

The season of 1903 was too wet to admit of very satisfactory irrigation experiments. However, as the planting was late, the irrigating done gave good results. One irrigation of potatoes made a gain of ninety-five per cent. in yield. Large yellow corn, irrigated once, yielded forty-five bushels per acre, and, not irrigated, yielded thirty-seven bushels. Other crops also showed increased yields from irrigation. The season of 1904 has had less rainfall than the previous year, though the moisture has come very regularly and has made irrigation again almost unnecessary. The work in irrigation was extended to include both summer and winter irrigation, and the list of crops changed to include sugar-beets and alfalfa.

A number of varieties of millets are being grown, some of which are promising. Grains and hays sufficient for a feeding experiment with calves were grown. The test of grasses has not revealed anything very promising so far, as the seasons have been favorable to all. A number of new varieties have been planted.

December 21, 1903, 56 head of grade Hereford and Short horn calves were put on feed, in seven lots of eight calves each, and fed 182 days, with good results. The Station herd of cattle has increased, by purchase and otherwise, to 126 head. The native pasture has been excellent and all are doing well. Three breeds of hogs have also been purchased, as a beginning in this line.

The orchard of fruit trees has done remarkably well. Only a few will have to be replaced, and a splendid growth has been made. Thirty-two per cent. of the evergreens, cedars and pines grew. The Austrian prime is making a very rapid growth. Specimens made a growth of twelve inches the first year, and this, the second season, some have grown fifteen inches without irrigation.

The entire amount of land now being used for farming operations, including alfalfa, grasses, orchard, nursery, etc., is approximately 625 acres. No little of the work of the past year has been in making permanent improvements, including buildings, water system, fences, roads, and bridges.

Destruction of Prairie-dogs and Other Noxious Mammals.

The legislature of 1903 made provision for continuing the experiments in destroying noxious animals and the preparation of poisons, to be sold to citizens of Kansas at the actual cost of the materials used. The work was broadened so as to include studies in the food habits of birds and mammals, with reports thereon. The Board of Regents continued Mr. D. E. Lantz as the special agent in charge of the investigations. A new law makes it the duty of the township trustees to

supervise the field-work of killing prairie-dogs, and a much higher percentage of effective work was obtained under the plan than when the distribution of the poison was left to the individual owners of the land. During the past year it is estimated that these animals were destroyed on about 700,000 acres. In all, about three-fifths of the two and one-half millions of acres of land in the state formerly infested with prairie-dogs have been entirely reclaimed.

Besides being adapted for killing prairie-dogs, the poison manufactured at state expense has been used quite successfully in destroying pocket-gophers, field-mice, ground-squirrels, and rabbits, and with a less degree of success in destroying rats and garden-moles. Experiments along these lines have continued. The agent has done much by correspondence and by private instruction to encourage land-owners to make intelligent efforts to rid their lands of the animals that prey so largely on the growing and stored crops.

Two press bulletins were published during the year, and a larger bulletin on the mammals of the state considered in their economic relations is nearly ready for publication. Much material for a bulletin on the food habits of our birds has also been collected and the bulletin will be prepared during the coming fall and winter.

Of the \$7000 appropriated and available for the three years ending June 30, 1904, about \$6200 was drawn from the state treasury on approved vouchers. The balance, about \$800, reverted to the state. The actual cost to the state of the three years' work has, however, been much less, for there are on hand, in cash and in items easily convertible into cash, the sum of \$3200, which belongs to the state and which is being held temporarily as a revolving fund to enable the agent to continue the operations of the poison department. Deducting this from the sum expended will leave the net cost of the work accomplished in the three years as about \$3000, or \$1000 per year.

Cooperative Experiments with the United States Department of Agriculture.

The Station has continued its cooperation with the Bureau of Plant Industry of the Department of Agriculture in experiments in testing and improving cereals. This work has been conducted at Halstead, Harvey county, for a number of years, but for various reasons was transferred last fall to McPherson, McPherson county. Nineteen acres of land were leased by the Station for this purpose. Mr. Leslie A. Fitz, special agent in charge of the work, has kindly prepared the following brief summary of the experiments now being carried on at McPherson.

The object of the work is to secure hardy, good yielding varieties of cereals especially adapted to the arid and semiarid portions of Kansas. It includes improvement of the cereals by selection and hybridization and the making of variety tests. Some cooperative experiments have been started with farmers in this vicinity, and more will be instituted this fall when seed is obtained in sufficient quantity from our better varieties. Some rotation experiments have been planned for this coming fall. No cross-pollination work has been attempted this season, the time being taken up by selection of plants from crosses made the two previous years. Although the Hessian fly was very numerous in volunteer wheat in the fall, almost no damage has been done by it this summer.

The following is a list of varieties sown the fall of 1903:

- 16 tenth-acre plats of hard winter wheats, consisting of introduced varieties from Russia and Hungary.
- 6 tenth-acre plats of durum wheat.
- 1 acre Tennessee winter barley.
- 1/2 acre Belgian winter oats.
- 2 acres Culbertson winter oats.

Smaller plats sown by hand:

- 153 standard varieties common bread wheats, including introduced and native sorts.
- 156 hybrid varieties originated by the Kansas State Agricultural College Experiment Station.
- 750 hybrids originated by the Department of Agriculture at the Halstead Station.
- 2 varieties einkorn,
- 4 varieties rye.
- 1 variety winter spelt.

The list of grains sown the spring of 1904 is as follows:

- 12 tenth-acre plats standard durum varieties.
- 4 acre plats of oats.
- 6 tenth-acre plats of oats.
- 3 tenth-acre and one fifth acre plats of introduced barleys.
- 4 tenth-acre plats of proso.
- 5 acres of corn, including tests of twenty-three varieties.

Smaller plats sown by hand:

- 60 standard varieties of wheat, mostly durums.
- 95 standard varieties of oats, introduced and native.
- 180 standard varieties of barley.
- 2 standard varieties of emmer.
- 4 standard varieties of spring rye.

The large plats of winter grain were sown October 8, and came up well. Although all varieties made a good, vigorous start, the drought during the winter months retarded their growth and all were very small on the 1st of March. The durum wheats and winter oats all winter killed. Tennessee winter barley nearly all survived the winter, though it made but small amount of growth. It ripened June 19, the yield from one acre being sixty-two and one-fourth bushels. The germination of spring grains was quite uneven, owing to lack of moisture, but most of them made a very good growth later. All grains were damaged to a greater or less extent by rust, black stem rust appearing on the soft wheats about June 12. Tennessee winter barley and the einkorns escaped with the least rust.

Concluding Statement.

The work of the Experiment Station is not and cannot be nearly what is desirable until its resources are increased. Most of the work in connection with farmers' institutes falls upon members of the Experiment Station force, most of whom also have more or less teaching. The need of additional force to perform these manifold duties is imperative. There is also much need of additional funds to provide for the material equipment required for experimentation and to pay for labor employed. The scope of the experiments could be very materially increased, and we believe to the great advantage of the state in particular and agricultural science in general, in the testing of varieties of farm crops and for carrying on in an extended way efforts to improve existing varieties and originate new ones. More labor could be profitably employed and commodious seed-houses and work-rooms are absolutely necessary. The advantage that would accrue to the state from such improvement of varieties of staple crops cannot be estimated.

In a similar way, there is an enormous amount of experimentation that could be advantageously made with reference to the problems of animal production. These are of the most varied character. It is safe to say that the so-called feeding standards established by German investigators are of but limited applicability to our conditions, and no more far-reaching or serviceable work could be done than to establish, by long-continued and oft-repeated experiments, the most suitable proportions of the several nutritive constituents for rations adapted to maintenance, milk production, labor, etc., of our domestic animals when fed upon Kansas products. This involves expensive experiments in digestion, accompanied by accurate observations of the gains made or work accomplished. Comparatively little investigation of this kind has been made in the West.

Experiments are much needed establishing the value of alfalfa, ensilage of various kinds, Kafir-corn, prairie hay, corn stover and other standard Kansas feeds when applied to the nurture of the various species of domestic animals, whether for the production of beef, pork, mutton, milk, wool, or other products.

Experiments testing the various breeds of cattle and swine, also of cross-breds and scrubs for beef, pork or milk production, would be very valuable, but require for their execution abundant resources for the purchase of herds and for buildings to house them and store fodders and other feeds. The Station is in special need of barn room for the storage of hay and fodder.

Investigations should be undertaken with sheep. These should bear on the most advantageous methods of handling them, and determine the adaptability of various breeds to Kansas conditions.

Thus far no experimental work has been conducted with horses. This large field is one in which many valuable experiments might be undertaken, bearing upon the question of rations, breeds, the relative adaptability of mules and horses, etc. A horse barn is much needed.

Experiments with poultry have thus far been undertaken to but a very limited extent. These should be continued and enlarged, with a view to carefully testing the egg-laying and meat-producing capacity of the several breeds, the feed best adapted to obtaining profitable results, etc.

In the dairy industry there are still many unsolved problems, such as the use of ferments in cheese-making, study of the details of handling cream and milk, the most economical ration for the dairy cow, with a view to ascertaining by what means the ration may be most economically produced on the average Kansas farm, and especially avoiding the purchase of expensive concentrates. The conditions determining temporary variations in the percentage of butter-fat and the influence of bacteriological conditions upon the quality of cream should be investigated.

The field of animal diseases affords almost unlimited scope for investigation, covering as it does so many species of domestic animals, maintained under such a variety of conditions.

Extended and important investigation might be undertaken in co-operation with farmers in various parts of the state with a view to ascertaining the local adaptability of the various varieties of farm crops and to the production of improved strains suitable to the several localities. It seems almost indubitable that varieties must be developed suitable to the locality where they are to be grown. This work, to be effective, must be performed under the close supervision of competent Experiment Station officers, assisted by progressive interested farmers in the several parts of the state.

At the Station, an important element in the financial possibility of conducting experiments with farm crops is the uncertainty of the season. When this is favorable the product will to a considerable extent pay the expenses of the experiments, but in unfavorable seasons the expense of the numerous observations and special care required in planting are no less, but the income arising therefrom is much decreased. To enable such experiments to be conducted upon a proper scale, larger amounts of money must be available for use if necessary.

Investigations should be undertaken to ascertain the causes of the

unfruitfulness of Kansas orchards and the effects of fertilizers on blossom buds and fruit. Crown gall, stem rot of sweet potatoes and other important plant diseases should be more exhaustively studied.

While the above outline of directions in which the Experiment Station work might be advantageously extended if sufficient financial support were available is by no means complete, it may be taken as an index of the large work possible, and is earnestly commended to your careful consideration. Respectfully submitted.

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