

Historical Document
Kansas Agricultural Experiment Station

NINETEENTH ANNUAL REPORT

OF THE

Experiment Station

OF THE

Kansas State Agricultural College,

MANHATTAN.

For the Fiscal Year 1905-'06, with an
Index to Bulletins 130 to 139.

STATE PRINTING OFFICE,
TOPEKA, 1907.

3070



Kansas State Agricultural College.

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- 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 <i>ex officio</i> . | A. M. TEN EYCK, B. AGR.,
Agronomist. |
| J. T. WILLARD, M. S.,
Chemist and Director. | OSCAR ERF, B. S.,
Dairy Husbandman. |
| E. A. POPENOE, A. M.,
Entomologist. | F. S. SCHOENLEBER, D. V. S.,
Veterinarian. |
| H. F. ROBERTS, M. S.,
Botanist | R. J. KINZER, B. S. AGR.,
Animal Husbandman. |
| ALBERT DICKENS, M. S.,
Horticulturist. | LORENA E. CLEMONS, B. S.,
Secretary. |

ASSISTANTS.

- | | |
|------------------------|------------------------------|
| V. M. SHOESMITH, B. S. | Assistant Agronomist. |
| G. A. DEAN, M. S. | Assistant Entomologist. |
| C. L. BARNES, D. V. M. | Assistant Veterinarian. |
| R. E. EASTMAN, M. S. | Assistant Horticulturist. |
| G. F. FREEMAN, B. S. | Assistant Botanist. |
| GEO. C. WEBBLER, B. S. | Assistant Animal Husbandman. |
| C. W. MELICK, B. S. | Assistant Dairy Husbandman. |
| W. E. MATHEWSON, M. S. | Assistant Chemist. |
| ALICE M. MELTON, B. S. | Clerk In Director's office. |

Fort Hays Branch Station.

- | | |
|-------------------------------|-----------------------------------------------------|
|
Superintendent. | A. D. COLLIVER, B. S.,
Assistant in Agriculture. |
| H. ELLING, B. S.,
Foreman. | LORENZ GREENE, B. S.,
Assistant in Horticulture. |
| | GEO. K. HELDER,
Bookkeeper. |

* Term expires.

KANSAS STATE AGRICULTURAL COLLEGE,
MANHATTAN, KAN., November 25, 1906.

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 Nineteenth Annual Report of the Experiment Station of the Kansas State Agricultural College, for the year ending June 30, 1906, including financial statements for that period. It does not contain much of the results of experimentation in the different departments and at the Fort Hays Branch. These are printed in bulletins, paged consecutively throughout the year, and an index to those issued within the year is included with this report. The cooperative work with the United States Department of Agriculture is presented at some length, in so far as it has not been published already.

R e s p e c t f u l l y ,
E. R. NICHOLS,
Secretary Board of Regents.



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EXPERIMENT STATION
OF THE
Kansas State Agricultural College,
MANHATTAN.

NINETEENTH ANNUAL REPORT—
FISCAL YEAR 1905-'06.

FINANCIAL STATEMENTS.

Report of 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, 1905, and June 30, 1906:

Balance on hand July 1, 1905..	\$679 19
Received from the treasurer of the United States..	20,000 00
Received from cash sales of products..	2,081 16
Total	<u>\$22,760 35</u>
Approved vouchers Nos. 1 to 390, including credits..	21,535 09
Balance on hand June 30, 1906.....	<u>\$1,225 26</u>

Expenditures by departments are exhibited on the following page.

Expenditures by Departments, 1905-'06.

Items.	General.	Farm.	Animal husbandry.	Botanical.	Chemical.	Dairy.	Entomological.	Horticultural.	Veterinary.	Total.
By salaries	\$1,088 70	\$950 00	\$806 69	\$950 00	\$1,108 42	\$900 00	\$950 00	\$950 00	\$950 04	\$8,661 85
Labor	25 84	2,073 74	499 87	317 05	625 76	783 43	33 04	973 98	75 23	5,317 94
Publications	82 73	46 00	38 94	215 10	.....	94 67	31 87	18 16	10 03	536 60
Postage and stationery	59 15	3 70	20	45 27	85	.....	14 50	.....	.....	123 67
Freight and express	19 44	139 14	54	54 40	11 53	25	24 24	33 63	2 60	285 82
Chemical supplies .....	.....	.....	.....	9 22	49 39	.....	28 20	151 69	.....	238 50
Seeds, plants, and sundry supplies,	22 50	174 21	.....	108 39	16 41	1 10	1 38	172 78	.....	496 77
Fertilizers .....	.....	.....	.....	.....	.....	.....	.....	17 25	.....	17 25
Feeding-stuffs .....	.....	.....	602 75	.....	.....	.....	.....	.....	13 28	616 03
Library	2 00	.....	.....	205 55	8 74	.....	.....	.....	.....	216 29
Tools, implements, and machinery,	132 45	251 06	.....	16 50	133 94	.....	.....	18 10	.....	557 05
Furniture and fixtures	3 60	.....	.....	33 50	1 30	.....	20 25	.....	21 38	80 03
Scientific apparatus .....	.....	147 86	.....	238 74	55 31	.....	59 70	10 38	16 00	527 99
Live stock .....	.....	.....	3,030 00	.....	.....	.....	.....	.....	13 50	3,043 50
Traveling expenses	11 90	7 80	15 00	.....	.....	.....	52 75	29 05	50	117 00
Contingent expenses	142 50	.....	.....	99 97	.....	.....	.....	.....	.....	242 47
Building and repairs	412 32	.....	.....	85 21	8 30	.....	.....	.....	50	456 33
Totals	\$2,011 13	\$3,793 51	\$4,993 39	\$2,328 90	\$1,924 95	\$1,789 45	\$1,215 63	\$2,375 07	\$1,103 06	\$21,535 09

The following statements of the financial affairs of the Experiment Station are as reported to 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 United States appropriation, 1905-'06.

DR.

To receipts from the treasurer of the United States, appropriation for fiscal year ending June 30, 1906, as per act of Congress approved March 2, 1887..... \$15,000 00

CR.

By salaries	\$7,963 49
Labor.. ..	4,038 37
Publications	458 91
Postage and stationery.....	114 67
Freight and express.....	276 79
Chemical supplies	130 32
Seeds, plants, and sundry supplies.....	456 62
Feeding-stuffs	13 28
Library	88 27
Tools, implements, and machinery.....	452 60
Furniture and fixtures.....	56 18
Scientific apparatus	436 52
Live stock.. ..	13 50
Traveling expenses	87 00
Contingent expenses	39 97
Building and repairs.....	373 51
Total	<u>\$15,000 00</u>

DR.

To receipts from the treasurer of the United States. appropriation for fiscal year ending June 30, 1906, as per act of Congress approved March 16, 1906..... \$5,000 00

CR.

By salaries	\$608 36
Labor	611 05
Seeds, plants, and sundry supplies.. ..	1 27
Feeding-stuffs	602 75
Library	4 35
Tools, implements, and machinery.....	98 25
Scientific apparatus	56 57
Live stock	3,005 00
Traveling expenses	12 40
Total	<u>\$5,000 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, 1906; 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 \$20,000, and the corresponding disbursements \$20,000; 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 acts of Congress approved March 2, 1887, and March 16, 1906.

[SEAL] A. M. STORY
 GEO. P. GRIFFITH,
 J. W. BERRY, *Auditors.*

ATTEST: LORENA E. CLEMONS, *Custodian.*

Supplementary Statement.

The following account shows the receipts of the Station from other sources than the United States, expenditures, and balance on hand:

DR.	
To receipts from other sources than the United States for the year ending June 30, 1906:	
Balance on hand July 1, 1905.....	\$679 19
Farm and garden products.....	2,081 16
Total	<u>\$2,760 35</u>
CR.	
By salaries	\$90 00
Labor	668 52
Publications	77 69
Postage and stationery.....	9 00
Freight and express.....	9 03
Chemical supplies	108 18
Seeds, plants, and sundry supplies.....	38 88
Fertilizers	17 25
Library	123 67
Tools, implements, and machinery.....	6 20
Furniture and fixtures.....	23 85
Scientific apparatus	34 90
Live stock	25 00
Traveling expenses	17 60
Contingent expenses	202 50
Building and repairs.....	82 82
Total	\$1,535 09
Balance	1,225 26
Grand total	<u>\$2,760 35</u>

Respectfully submitted.
 LORENA E. CLEMONS, *Custodian.*

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, 1906, as a part of the annual report of the Station to the governor required by law:

THE STAFF.

Very few changes in the staff have taken place. By the division of the department of dairy and animal husbandry, Mr. R. J. Kinzer, assistant animal husbandman, became animal husbandman. Mr. C. W. Melick, assistant in dairying, was made assistant in dairy husbandry. Mr. Geo. C. Wheeler was again employed as assistant animal husbandman. Mr. R. H. Shaw, after over three years of efficient service as assistant chemist, resigned January 1, 1906, to become assistant professor of chemistry in the University of Nebraska, and associate chemist of the experiment station there. Mr. W. E. Mathewson, assistant professor of chemistry in the College, was appointed to succeed him, giving, however, but one-half his time to the Station. Mr. Lorenz Greene, a graduate of the College in the class of 1906, was made assistant in horticulture at the Fort Hays Branch Station.

CHANGE IN ORGANIZATION.

At the meeting of the Board of Regents held in September, 1905, the following resolution was adopted :

Resolved, That in order to coordinate and strengthen the work of the Experiment Station of this College, the following regulations be adopted:

(1) That the Experiment Station Council shall consist of a director, to be elected by the Board of Regents to serve during good behavior and efficiency, the president of this College, *ex officio*, who shall be chairman, the heads of the following departments: Agriculture, botany, horticulture, animal husbandry, dairying, chemistry, entomology, and veterinary science.

(2) It shall be the duty of the Council to meet annually, and to decide as definitely as possible the lines of experimental work to be carried out the ensuing year. It is intended at this meeting that a full and free discussion of proposed measures be had, and that the work finally determined upon shall be by a majority vote.

(a) It is recommended by the Board of Regents that one or two major lines of work representing typical interests of the state of Kansas, and in which all members of the staff, if possible, should cooperate, be selected. Other lines of work of an individual or restricted character-

may, of course, be outlined and prosecuted, but it is hoped that the work of this Station will have a special and definite direction along the lines of the state's most dominant interests.

(3) The director shall be responsible for the carrying out of the work of the Station, and it shall be his duty to see that all records are properly kept, and that the data relating to experiments be preserved and coordinated as fully as possible. He shall be responsible for the expenditures of the Station, and publications and management of all business details, and shall have full charge of the correspondence and the issuance of bulletins. It shall be his duty to render annually to the Board of Regents, on the first day of June, a full statement of work done by the Experiment Station. Expenditures shall be made on requisition drawn by different members of the Council and approved by the director, and all bills shall be approved before payment.

(4) Members of the Council shall be individually responsible to the director as regards Station work, and shall be held to the performance of work agreed upon by the Council in its annual or special sessions.

(5) All the work of the Station, wherever conducted, whether at Manhattan, Hays, McPherson, or elsewhere, shall be under the immediate charge of the director, and the director shall be held responsible for the management of all work without regard to locality.

(6) Excepting for the year 1905, the director shall prepare and submit to the Board of Regents, at its April meeting, plans for the Station work, and estimates of expenditures for the following year, the said plans being the action of the Council at a meeting to be held in March of each year. After approval by the Board of such plans and expenditures, it shall be the duty of the director to see that such plans are duly carried out, and thereafter such work, wherever carried on, shall be under his general supervision or of such member of the Council as he may assign to it.

(7) The regular meetings of the Council shall be held monthly, and as much oftener as the interests of the Station may demand, and a meeting may be called at any time by the director or the president of the College.

(8) That any lands now held by the State Agricultural College or the Experiment Station at Hays, and that are not needed for scientific experimentation, may be leased only on condition that the lessees thereof shall keep and report to the director a complete record of the sowing, irrigation, cultivation and yield of the crops grown on such lands, and that this clause be made a part of any lease.

PUBLICATIONS.

As usual, the publications for the year include the annual report for the preceding year, bulletins, and press bulletins. A brief summary of these follow :

Annual Report.

EIGHTEENTH ANNUAL REPORT, 1904-'05. (*Pages 1-54.*)
January, 1906. 25,000 copies.

This report contains the required financial statements of the custodian, the report of the Council, and a list of the Station publications to June 30, 1905. With the growth of the cooperative work with the United States Department of Agriculture the amount of material of general interest in the annual reports has increased, and of this one enough were printed to supply all on our mailing-list. The reports upon irrigation meet considerable demand from correspondents.

Bulletins.

BULLETIN No. 130.—“Steer-feeding Experiment, VII, 1903-'04.” (*Pages 1-8.*) April, 1905. Dairy and Animal Husbandry Department. 25,000 copies.

The experiment described in this bulletin was designed to ascertain whether, with corn-and-cob, meal as the grain ration, cattle would gain as well on a mixture of roughages as on alfalfa as the only roughage. The results indicated that alfalfa alone was preferable. The steers made more rapid gains at less cost.

BULLETIN No. 131.—“Care of Dairy Utensils.” (*Pages 9-20*) April, 1905. Dairy and Animal Husbandry Department. 25,000 copies.

In addition to general directions for the care of dairy utensils, this bulletin contains an account of some trials of different methods of cleansing separators. Observations by the eye were confirmed by bacteriological cultures made from the milk run through separators receiving the different kinds of treatment.

BULLETIN No. 132.—“Western Feeds for Beef Production.” (*Pages 21-52.*) January, 1905. Fort Hays Branch. 25,000 copies.

This bulletin describes experiments with eight lots of steers so planned as to test as grain rations corn-and-cob meal, Kafir-corn meal, ground wheat, alfalfa hay, Kafir-corn hay, sorghum hay, and a mixture of these. The value of alfalfa was again strikingly demonstrated. Using it, there was little difference between the results given by corn-and-cob meal, and by Kafir-corn meal.

BULLETIN No. 133.—“Alfalfa Seed: its Adulterations, Substitutes and Impurities and their Detection.” (*Pages 53-112.*) February, 1906. Botanical Department. 25,000 copies.

This elaborately illustrated bulletin contains a detailed discussion of the matters indicated by the title. Yellow trefoil is found to be the chief adulterant at present, Bur clover and Sweet clover being occasionally met with. Dead alfalfa seed is the chief impurity in the alfalfa seed of the Western market.

BULLETIN No. 134.—“The Alfalfa Seed Crop, and Seeding Alfalfa.” (*Pages 113-132.*) March, 1906. Agricultural Department. 25,000 copies.

The importance of the seed crop of alfalfa, and of getting a stand when this crop is seeded, led to inquiries the results of which are summarized in this bulletin. The successful farm practice of the state is here clearly set forth. The conditions essential to getting a stand of alfalfa are stated in detail.

BULLETIN No. 135.—“Grading Cream.” (*Pages 133-144.*) May, 1906. Dairy Husbandry Department. 29,000 copies.

This bulletin discusses the conditions affecting the quality of butter, and points out the fundamental effect of the quality of the cream used. A system of grading cream that the Station dairy has been testing for

nearly two years is recommended. The payment of higher prices for the higher grades has given universal satisfaction to the patrons and produced a marked improvement in the quality of the cream.

BULLETIN No. 136.—Press Bulletins Nos. 125-151. (*Pages 145-204.*) June, 1906. All departments. 29,000 copies.

This is a reprint in bulletin form of the press bulletins issued from July, 1903, to June, 1906. The subjects cover a wide range, but topics relating to the feeding and care of animals are most prominent in numbers.

BULLETIN No. 137. —“Variations in the Test of Separator Cream.” (*Pages 205-212.*) June, 1906. Dairy Husbandry Department. 29,000 copies.

The causes of variation in the test of separator cream when the cream screw remains unchanged are here discussed from the standpoint of experimental results. The chief causes are stated as difference of temperature, amount of flush water, variation in speed of bowl, difference in rate of flow of milk through the separator, and variation of acidity of the milk.

BULLETIN No. 138.—“Effect of Bacteria in Wash Water of Butter.” (*Pages 213-222.*) June, 1906. Dairy Husbandry Department. 29,000 copies.

A series of experiments is described which brought out the importance of pure water for washing butter. Sterilized water was shown to be practical, cheap, and profitable.

BULLETIN No. 139.—“The Study of Corn.” (*Pages 223 250.*) June, 1906. Agronomy Department. 36,000 copies.

This bulletin gives data that enable farmers to select seed-corn to the best advantage. Rules for judging corn, score-card, cuts illustrating types, directions for testing germination, etc., are included.

Press Bulletins.

No. 143.—“Preparing Fruits for Exhibition.” July 4, 1905. Horticultural Department. 3000 copies.

No. 144.—“The Garden Web-worm.” July 4, 1905. Entomological Department. 3000 copies.

No. 145.—“A Shade-tree Pest: the Fall Web-worm.” July 18, 1905. Entomological Department. 3000 copies.

No. 146.—“Testing Winter Wheat Varieties for Western Kansas.” August 15, 1905. Fort Hays Branch Experiment Station. 3000 copies.

No. 147.—“Kansas Experiment Station Egg-laying Contest.” November 1, 1905. Dairy and Animal Husbandry Department. 4000 copies.

No. 148.—“A Troublesome Parasite of the Horse.” December 19, 1905. Veterinary Department. 3000 copies.

No. 149.—“Swine-feeding Tests.” March 27, 1906. Animal Husbandry Department. 4000 copies.

No. 150.—“The San Jose Scale in Kansas.” April 24, 1906. Entomological Department. 3500 copies.

No. 151.—“Baby Beef Production with Western Feeds.” May 29, 1906. Fort Hays Branch Experiment Station. 3500 copies.

WORK OF THE DEPARTMENTS.

The following brief summaries are presented concerning the work of the several departments that is now in progress, or has not been previously reported, or published in bulletin form.

AGRONOMY DEPARTMENT.—The Board of Regents June, 1906, changed the name of the “Agricultural Department” to Agronomy Department. Agriculture in its broadest sense means not only the cultivation of land and the production of crops, but also includes stock raising and dairying, which industries are represented by the Animal Husbandry and Dairy Husbandry Departments. Agronomy is limited to crop production. The Agronomy Department is continuing all of the lines of work described in the annual report of this department for 1904-'05, and several new experiments were begun this year, including a test of various chemical fertilizers in comparison with barn-yard manure for wheat, corn, oats, and barley; experiments in thickness and depth of planting winter wheat and winter barley; experiments in cutting alfalfa, cowpeas and soy beans for hay at different stages of maturity, and a large amount of new work in seed breeding and selection with small grains, corn, Kafir-corn, sorghum, cowpeas, soy beans, flax, millet, alfalfa, and grasses. The plan is not only to test varieties of all the common crops, but when certain varieties prove more hardy and more productive, than others, the best producing sorts are grown in larger plats for seed production, and this seed grain is sold and distributed among the more progressive farmers throughout the state. Thus the department is not only determining which varieties are best, and by selection purifying and improving these varieties, but as rapidly as the limited means and land will permit, seed of the best producing varieties is being distributed, thus improving the quality and productiveness of the standard crops all over the state. Some 600 bushels of winter wheat

and winter barley of the best producing sorts were distributed in this way in the fall of 1905, and several hundred bushels of seed oats, barley and corn were distributed from the Station in the spring of 1906. The yield and culture of wheat and corn has already been improved by the introduction of better seed through this department, but the work has only just begun and there is still room for great improvement along this line. Large yields are secured not only by planting good seed of the best producing varieties, but also by practicing the best methods of soil management and crop culture. The tillage, fertilizer and rotation experiments which are being carried on by the Agronomy Department, and the general instruction along this line which has proceeded from this department in the form of bulletins, farmers' institute lectures, and published replies to inquiries, is doing much toward introducing and establishing better methods of farming throughout the state.

ANIMAL HUSBANDRY DEPARTMENT.—During the past year this department has conducted two feeding tests with hogs. The first test was with thirty head of hogs divided into three lots, one lot being fed corn, the second corn and meat meal, and the third corn and alfalfa. In the second test 100 head of hogs were used, divided into five lots. The first three lots were fed the same as the lots in the previous test, lot 4 on corn and tankage; and lot 5 on corn and cottonseed meal. The hogs used in this test were from fall litters. The first three lots gave a check on the previous test, and it also gave possible comparison between fall- and spring-farrowed pigs, and summer and winter feeding. A slaughter test was made in connection with the first experiment. At present an experiment is in progress with cross-bred hogs, in which Tamworth-Poland-China, Tamworth-Yorkshire, Tamworth-Berkshire and Tamworth-Duroc-Jersey crosses are being used. During the winter a sheep-feeding test was conducted with 100 lambs, divided into ten lots, and fed as follows: Kafir-corn and alfalfa, corn and alfalfa, emmer and alfalfa, barley and alfalfa, corn and wild hay, corn and brome hay, cottonseed-meal and alfalfa, Kafir-corn, cottonseed-meal and alfalfa, dried blood and alfalfa, and Kafir-corn and soy-beans. Owing to lack of room the department was unable to do any cattle feeding except with show steers, and this experiment

is still in progress, and comparisons are being made regarding the cost of gain of two-year-olds, yearlings, and calves.

BOTANICAL DEPARTMENT.—During the past fiscal year an entirely new line of work for this Station has been introduced in the Botanical Department, viz., the work of seed control. The wide-spread use of adulterants and substitutes for seed of alfalfa and several principal forage grasses, evidence of which was forthcoming last spring and summer, led to the inauguration of a systematic inquiry into the conditions referred to. The results so far as alfalfa was concerned were published in Bulletin No. 132. A system of records and analysis sheets for purity and germination tests was devised, new in arrangement and design, and which has proved exceedingly satisfactory. In all, 274 samples of seed were subjected to an analysis for purity and 267 samples were given a germination test. In cereal breeding the most marked feature of the year's work has been the extension of the wheat-breeding experiments, and the introduction of a new principle in connection therewith, viz., that of the pedigree method of selective breeding. Over 1500 distinct heads from as many wheat plants were selected this spring for special reasons in each case, and the vegetative characters are to be tabulated in detail from the mature spikes after harvest. The progeny from these will represent pure races. For the further execution of the cereal-breeding experiments new laboratory apparatus of original design is being constructed. The experiments with hybrid wheats continue, and this season a variety of types appearing in the third generation of wheat-spelt and wheat-emmer hybrids offer promising material for the selection of dry-region wheat varieties. This present spring a large tract of alfalfa was planted to alfalfa on the hill plan for selective breeding, and a large number of selections of distinctive and promising types have been made. After selection the rejected plants will be removed and the ground replanted on the same plan, while the selected plants will be left to continue their growth and to form seed. A large number of wire cages for close pollination of alfalfa have been constructed for use the coming season. Corn-breeding experiments continue this season. A large number of hybrids between field and sweet corn were secured last season, and these are to be grown this year. The purpose of the experiment is to secure stronger and more pro-

lific races of sweet-corn. Experiments to test the inheritance of characters are commencing this season, color characters being those selected for preliminary work. The work on protein content has been discontinued for the present by this department, on account of the inconclusive and unsatisfactory character of the data thus far secured through four years of selective breeding to this end. In corn a series of experiments on the physical results of close as compared with cross-fertilization have been started. In soy beans the experiments on the inheritance of high and low bearing capacities in the plants have been continued. In plant pathology less has been done than usual, on account of the absorption of the time of the head of the department and the assistant in breeding investigations. A much-needed experiment on the strength of formaldehyde solutions and the length of time of application required in the case of grain smut of the sorghums was commenced this spring, the results of which will become available by the end of the ensuing summer. This smut is exceedingly destructive in the case of Kafir-corn, sorghum, and allied forms, and its control by a more satisfactory method than that of the hot-water treatment is needed.

CHEMICAL DEPARTMENT. —The work of the Chemical Department has been confined almost entirely to analyses and other tests in connection with the egg-laying experiments carried on by the Department of Dairy Husbandry. These were very numerous and laborious. Nearly 600 eggs were separately analyzed, as well as a considerable number of composite samples. Mr. Shaw's resignation, January 1, might have made an awkward break in this study but for the fact that he took much of the material with him and had it analyzed at the Nebraska Experiment Station under his supervision. The latter part of the year some preliminary work was done upon flour, and considerable time spent in an attempt to obtain further knowledge upon the subject of bleached flour and the bleaching gases used in its production. For courtesies in this connection we are indebted to the Manhattan Milling Company. The resignation of Assistant Mathewson makes a break in this work which it is hoped will not be permanent.

DAIRY HUSBANDRY DEPARTMENT.—This department during the past year has completed a series of experiments, some of

the results of which have been published and some of which are ready for publication. Those that have been published are "Care of Dairy Utensils," "Cream Grading," "Variations in the Test of Separator Cream," "Effect of Bacteria in Water for Washing Butter." Experiments are still being conducted in regard to feeding alfalfa ensilage, and also in regard to the feeding of cows in yards as compared with feeding them in stalls. Since the introduction of milking machines, new experiments have been inaugurated to test the efficiency of those that are at present on the market and the effects they have upon the animal. In the poultry work a series of experiments has been completed indicating the profitableness of the special breeding of hens that are good layers. Feeding experiments are also being conducted, but are not yet completed. An egg-laying contest is being carried on between the individual hens of the White Leghorns. The experiment touching the accuracy of Mendel's law is still being continued, and a new breed test is being planned to be inaugurated November 1, to continue for one year.

ENTOMOLOGICAL DEPARTMENT.—The Entomological Department has been engaged in the systematic study of the scale insects of the state as a group. Collections of the species have been made from as many localities as possible, and from their different host-plants. The repressive treatment of the more injurious species has been made the subject of more or less successful trial. The discovery of the San Jose scale in two localities called for a thorough inspection of the more important fruit-growing regions, which has been well begun and will be prosecuted as rapidly as consistent with other work to which the force is assigned. In October, 1904, upon the resignation of D. E. Lantz, the former agent of the Station in charge of the work of prairie-dog and gopher extermination, the duties of such agent became a part of the work of the entomologist of the Station. The distribution of the poisons used in this work has gone on with little change from that noted in previous reports, excepting that the great reduction in the numbers of these pests has been evident in the lessened amount of poison demanded, especially for the prairie-dogs, which in many localities are completely exterminated.

GENERAL DEPARTMENT.—The executive work of the Station has been much as in previous years, and calls for little special

comment. The prompt and careful attention to some 6000 letters and postal cards received; the constant care of the mailing-list, now including 21,450 addresses; business in connection with the Station at McPherson conducted in cooperation with the United States Department of Agriculture; oversight of the printing and binding of Station publications, and many other items of a general character, have been part of the work of the director's office. The president has certified to all vouchers and the secretary has kept the accounts as heretofore. The mailing of publications has been supervised by Superintendent Rickman, which is an assurance that it was well done. The mailing sheets are furnished him by the director. These are galley proofs from linotype lists kept for us in Topeka. This method of handling the mailing is very convenient and the cheapest yet devised, and has been retained in spite of earnest solicitations to change on the part of interested representatives of other modern systems of mailing. Current requests for publications are attended to by the director's clerk.

HORTICULTURAL DEPARTMENT.—This department has continued the work of observing the growth and success of varieties of small and orchard fruits, garden vegetables, forest trees and ornamental trees and shrubs. Careful descriptions of varieties under varying conditions are recorded, and the habits in blossom and fruit are studied. The work begun in pruning is being continued and extended. Tests of commercial fertilizers alone and in connection with barn-yard manures are in progress. The value of cow-peas and alfalfa as crops in rotation with potatoes is being ascertained. The intensive culture of a small plat of ground planted to strawberries and garden vegetables, with a view to ascertaining the best plan of rotation and the possibilities of a small area in producing food for home use, is giving interesting results. The observations on the efficiency of spray mixtures and machinery and the cost of the work are being continued. In the forestry work the observations concerning the rate of growth and the behavior of species are being continued. The value of the coppice growth of post timber is being investigated. The propagation of forest-trees, particularly the species of conifers found best adapted to Kansas conditions, is being continued. The results from stratifying Red cedar seed over two winters, planting in the seed-beds early in the second spring and

transplanting at one year old have been very gratifying. The work done with Jack pine (*Pinus divaricata*), Western Yellow pine (*Pinus ponderosa*), Scotch pine (*Pinus sylvestris*) and Austrian pine (*Pinus Austrica*) has been fairly satisfactory, and will be continued. As other species reach a seed-bearing age they will be added to the list. In the matter of cooperative work tests of fertilizers for sweet potatoes have been undertaken in the vicinity of Manhattan, and work in testing methods of mixing and applying spray mixtures in large quantities has been undertaken at Hutchinson.

VETERINARY DEPARTMENT.—A comparative study is being made of the various coal-tar products in use as disinfectants. Among these in use in this department were Cresco, Chloronaphtholeum, Zenoleum, and Cremoline. The preparation and use of the lime-and-sulfur dip is also under experiment. A series of experiments for the purpose of ascertaining the cause of cerebritis in horses has been undertaken.

Fort Hays Branch Station.

Mr. O. H. Elling, of the Fort Hays Branch Station, furnishes the following summary of the work and improvements at the Station; the experiments there in cooperation with the Department of Agriculture are reported upon under another head :

The accompanying general statement gives a list of the legislative appropriations, the supplemental income derived from disposition of stock and produce, and the expenditures for the year in the operation of the Branch Station at Hays.

State appropriations:	<i>Revenue.</i>	
Current expense		\$6,000 00
Machinery		500 00
Teams and equipment.....		1,000 00
Elevator and granary.....		1,500 00
Horticulture and forestry.....		500 00
Building repairs		500 00
Dams and water service.....		800 00
Fencing		500 00
Cash:		
Cattle		3,245 73
Hogs		987 85
Seed		437 37
Produce		419 57
Old wood		72 50
Miscellaneous		59 04

Department of Agriculture cooperative fund:	
Cereal investigations	\$200 00
Cultivation trials	150 00
Balance from 1904-'05.....	2,922 69
Total	<u>\$19,794 75</u>

Expenditures.

Machinery	\$500 00
Teams, harness, etc.....	1,175 00
Elevator and granary.....	1,498 00
Sheds and building repairs.....	500 00
Horticultural department	500 00
Cement dam	800 00
Fences and materials.....	500 00
Cattle	885 00
Hogs	15 00
Office safe	150 00
Maintenance:	
Supervision and labor.....	\$6,608 37
Merchandise supplies.....	799 35
Feed	2,115 77
Coal	297 92
Miscellaneous repairs	120 41
Miscellaneous expense	245 25
Seed stocks	210 40
Total expenditure	<u>\$16,920 72</u>
Balance June 30, 1906.....	2,874 03
Total	<u>\$19,794 75</u>

In a brief statement it will be impossible to touch upon all experiments or give any in detail. Within the fiscal year just closed some results have been published in Press Bulletins Nos. 146 and 151 and in Bulletin No. 132, consisting of twenty-six pages of printed matter and nine illustrations. The experiments to be continued for a series of years were carried out and some new work begun. Considerable experimenting in seed-bed preparation tests, cultivation trials, variety tests and trials in thickness and time of sowing and planting with the various farm crops has been done.

The winter-wheat harvest consisted of 300 acres, with yields ranging from 2 bushels to 22.7 bushels per acre. This acreage included rotation, time of plowing, seed-bed preparation, and cultivation experiments, and the plats for seed increase. These plats range in size from a few hills of newly selected types in the variety garden to forty-acre plats on the rotation field. The acreage sown in the fall was considerably increased. A fertilizing experiment, comprising ten eight-acre plats, to

test the time and rate of application of barn-yard manure on wheat ground was begun.

Alfalfa yielded three good crops of hay, which was baled directly from the field and used in the experimental feeding tests with cattle and hogs. Four lots of calves, three lots of two-year-old steers and heifers and six lots of hogs were fed experimentally. Corn yielded well, and was fed in the experiments with cattle and hogs to determine the relative feed value of barley, emmer, and Kafir-corn, using corn and alfalfa as standard.

Irrigation gave increased yields in all crops treated, though alfalfa and potatoes responded most satisfactorily. The sugar-beet crop was destroyed by web-worms, so no results were obtained this year with beets. In connection with the irrigation experiments, subsoiling, ten- and five-inch plowing and subsurface packing were tested on both the irrigated and non-irrigated plats growing corn, potatoes, and sugar-beets.

The spring planting of small grain, outside of the rotation experiments, consisted of rate and time of seeding tests with emmer, durum wheat, and flax, and field variety tests of oats, durum wheat, barley, and flax. The acreage of alfalfa has been increased and eight new strains of alfalfa have been sown on one-acre plats on the upland, for the purpose of making comparative tests and possibly doing some work in selecting. More work with corn, Kafir-corn and broom-corn was taken up, especially as to the improvement of these by selection.

The appropriations would permit of only a few improvements at the Branch Station. The east half of section 8 was enclosed with a three-wire fence. One hundred rods of substantial woven-wire fence were erected on the west line of section 4, and minor repairs to fences made. A 6000-bushel elevator, including wagon dump, cleaner, and a well-equipped seed room for handling small quantities of varieties of seeds, was built. A concrete dam was erected across Big creek, for the purpose of subirrigating the alfalfa fields in the vicinity of its location. A commodious wagon shed and several small hog-houses are additional minor improvements. Two teams of mules and a team of horses were added to the equipment. One gang plow, one spraying outfit, a truck wagon, a potato-planter, five tank heaters, a three-horse-power gasoline-engine, and five cultivators, two Acme harrows, together with nu-

merous smaller implements, were likewise added to the machinery of the Station.

The work in horticulture and forestry has been continued and increased. Over 1000 fruit-trees, including ninety varieties of apple, pear, plum, peach, cherry, and apricot, were set out and are making a good growth. The first orchard, planted in 1903, is making a vigorous growth of wood this season. A few good peaches of the early maturing varieties have been picked and more late ones will ripen. Some of the cherry trees bore a small amount of fruit. Seventeen thousand forest-trees, of twelve different species, were set out in the spring of 1906. Small nurseries of forest-trees are begun and are thriving well. The trees set out in 1905 have done remarkably well, considering the unfavorable conditions existing in the early part of the present season.

***Cooperative Experiments with the United States
Department of Agriculture.***

The cooperative experiments with the Department of Agriculture have been limited to those conducted with the bureau of plant industry, and most of these have been in continuation of tests of grains. This spring another important series has been undertaken which has special reference to ascertaining the best means of conserving moisture and humus in regions of deficient rainfall. This includes trials of several systems of rotation as well as various methods of treatment in respect to tillage. These experiments have been started at the Fort Hays Branch Station, where also the tests of certain forage plants and extensive trials of cereals have been continued. Mr. O. H. Elling has furnished a brief account of the work at Hays, and Mr. V. L. Cory a more detailed one concerning that at McPherson. These reports follow.

At the Fort Hays Branch Station.

These experiments were continued in the investigation of cereals, and cooperative work in cultivation methods has been inaugurated. The department supplied the seed and \$200 toward paying the expense of the cereal investigation work, and \$150 for expenses of the work in cultivation methods.

Most of the work with cereals consisted of variety tests and making selections from both hybrids and the purer strains for

the purpose of improving the quality of grain and increasing the yield per acre. Of the winter wheat varieties 350 were grown on plats sufficiently large so that yield records were secured, and some thirty varieties on small plats. Nearly all the varieties of barley, oats and durum wheat were harvested, though the yield was low.

Over 200 of the inferior winter wheat varieties were discarded in the fall. Thirty-three were sown on one-acre, eight on one-half acre, seventeen on one-tenth acre, and eighty on one-hundredth acre plats. In the spring fifty new varieties of oats from Italy were planted. Twenty-three varieties of durum wheat and thirty-one of barley were also planted.

The cooperative work in cultivation methods includes experiments in different systems of farming, continuous cropping under ordinary methods and under moisture-conservation methods, alternate cropping and summer fallowing, and sub-soiling and lister method. The work also includes a series of plats devoted to various rotations—first, to determine the most desirable sequence of the various farm crops; and second, to store, or at least conserve, the organic matter in the soil. From the nature of the work it is apparent that it should be continued for a series of years.

At McPherson.

The cooperative experiment station at McPherson is located one mile west of town on First street. The farm of thirty acres lies in the southwest corner of the section and runs north and south. It is not fenced, but the roads on each side are graded, while the farmers on the east and north have their farms fenced. Last summer two buildings were erected, one a seed house and the other a thrashing shed. In the latter building the small thrasher, gasoline-engine and tools are kept, and also, before thrashing, bundles harvested from the row-work plats. In the seed house is kept the grain and the grain cleaner. Lately both of these buildings have been painted, and a large sign has been placed on the front end of the seed house which reads: "Cooperative Grain Investigations, Kansas Agricultural Experiment Station in Cooperation with the United States Department of Agriculture." While all operations are on a comparatively small scale, nevertheless they are under conditions made as nearly like those on the Kansas farm as possible, in order that the results of experi-

ments may be gained under circumstances the same as would be met by the ordinary farmer. The varieties of grain best adapted to the Central West are being determined. Breeding and selection work are employed to originate better types of grain and to improve the strain of the standard varieties. Thorough preparation of the seed-bed is given to demonstrate the importance of this point as connected with the yield and behavior of the crop. The rotation experiments are to exhibit the value of crop rotation, and especially in regard to the use of legumes on ground devoted to small grains. The soil is a rich black loam. The land lies comparatively level, but about half way between the north and south ends there is an acre or two rather lower. Thus a large spot on the east and a smaller one on the west furnish the required habitat of that troublesome weed, *Franseria tomentosa*. Generally associated with *Franseria* is *Coreopsis tinctoria*, which the farmers in this vicinity call "wild flax." Such places in the field vitiate results in yields, for part of the plats are affected, and these unequally. This year the barleys and durum (macaroni) wheats were grown in this section of the farm, leaving the bread wheats and the oat varieties to the land furnishing more uniform conditions. A heavy growth of wild buckwheat (*Polygonum convolvulus*) occurred in all the spring seeding. This weed also gave much annoyance in the fall row-work plats wherever the seed was planted very thinly. It is said that these weeds are more numerous this season than last. Other weeds are present on the farm, but they need not be mentioned. Good cultivation will assist in keeping these weeds down, and with their extermination in view it is intended to keep up the fight against them. As the wild buckwheat is especially troublesome only in the spring seeding, by alternating spring and fall sowing on the same pieces of land and then sowing clean seed a check is to be given to this weed. Another object gained by the simple rotation just mentioned is the comparative ease of controlling the volunteer grain.

Although the fall brood of the Hessian fly was present on the volunteer grain, no apparent damage was done. Only a very few survived the winter. In the later ripening grains, especially oats, the grasshoppers have done some damage. The chinch-bugs put in a belated appearance during the harvesting of the latest barleys and oats. Nearly all grain this

season has been characterized by the presence of an exceptionally large amount of loose smut, which, in the case of winter barley, affected thirty-five per cent. of the grain. One or two of the barleys in the row-work planting even exceeded this amount. Some varieties of both oats and barley were entirely free from the loose smut. The orange leaf-rust was not very bad this year, but owing to the backwardness of the season the black stem-rust has done more than the usual amount of damage. At the beginning of harvest a week of dry, windy weather occurred, which caused some little shattering of grain in the wheats and in the beardless barley.

This year the division into plats is as follows: Seven acre plats, one three-fourths-acre plat, three one-half-acre plats, two one-fourth-acre plats, and 137 tenth-acre plats. Of the tenth-acre plats fifteen were used for the various row-work plantings. There are four acre plats of winter wheat, one each of Crimean No. 1559, Turkey No. 1558, Kharkov No. 1442, and Crimean No. 1437, and forty-two tenth-acre plats. In the row work (there are generally two rows of each variety) there are 240 kinds of winter wheat, "standards," including 137 Kansas hybrids, so called on account of originating at the Experiment Station at Manhattan, thirteen selections of standard winter wheat varieties, and 379 department hybrids, which have their origin in the work of men of the Department of Agriculture. The department hybrids and the selections were planted in rows twelve inches apart, one grain in a place, and spaced four inches apart, for the purpose of allowing study of the individual plant. There are three tenth-acre plats of rye and twenty-four varieties in the row work. There are three tenth-acre plats of winter einkorn, three of winter barley, one of emmer, and one of spelt. There are also two larger plats of the Tennessee winter barley of medium late and late sowing. Of the spring grains there are thirty-one tenth-acre plats of oats, twenty-six tenth-acre plats of barley, five tenth-acre plats of durum (macaroni) wheat, one of spring einkorn, and there are two twentieth-acre plats of spring emmer. There are six larger plats of oats, consisting of two plats each of Sixty Day No. 165, Red Algerian No. 286, and Burt No. 293. At the north end of the field the oats are growing on fall-plowed land, while at the south end they are growing on corn land. Something of a difference in favor of the fall-plowed land is noticeable. A

larger plat of beardless barley is near the north end of the field. The seed is from grain grown in Idaho at an elevation of 8000 feet. It ripened fairly uniformly and filled well. In the spring row work are forty kinds of spring wheat (mostly durum varieties), eighty-seven kinds of oats, 184 of barley, two of spring emmer, two of spring rye, one of spring einkorn, five of proso (broom-corn millet), and eight kinds of buckwheat. Some buckwheat was planted April 17. It came up nicely, but was entirely destroyed by the frost on the night of May 8. Of a later planting the buckwheat began to blossom June 8 and to set seed June 22. The work with both buckwheat and proso is experimental, chiefly in respect to time of planting, some being planted every week or so, beginning with May 9.

Twenty plats are devoted to the rotation scheme printed on opposite page.

As is noted, this work began last year. The alfalfa and brome grass in plats 5, 6, 11 and 14 were sown late. With the dry fall they did not come up until the middle of November and the tender young plants were winter-killed. This spring the plats, excepting No. 5, were reseeded, with the result of securing a good stand in each case; still the loss of practically one year is involved. It is believed that late summer is the best time for sowing these crops.

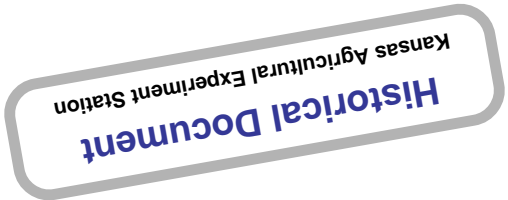
The alfalfa in plat No. 20 was sown in the spring of 1905, so no cuttings were secured last year. This year two cuttings have been made already, the first yielding 187 pounds of green hay, while the second yielded 321 pounds of green hay. After the first cutting the plat was disked and harrowed. That the plat responded to the disking was quite evident. At the second cutting so much room for improvement in the condition of the plat was noted that another thorough disking was given it. Other than clipping the weeds on the spring seeding of alfalfa and brome-grass, no treatment was given these plats.

The winter barley used is the variety known as the Tennessee winter. In 1904 this variety yielded at the rate of 62.5 bushels per acre. Kharkov wheat No. 1583, Ivanov rye No. 34, Sixty Day oats No. 165 and Texas Red oats No. 451 are the other grains used. These varieties are of the best of each grain.

Last year the corn used in the rotation plats was a native

	1905.	1906.	1907.	1908.	1909.
Plat 1	Winter barley.	Winter barley.	Winter barley.	Winter barley.	Winter barley.
Plat 2	Winter barley.	Corn.	Winter barley.	Corn	Winter barley.
Plat 3	Wheat.	Wheat.	Wheat.	Wheat.	Wheat.
Plat 4	Wheat.	Corn.	Wheat.	Corn.	Wheat.
Plat 5	Wheat (alfalfa).*	Oats.	.....	.....	.....
Plat 6	Wheat (brome-grass).*	Brome-grass.	Brome-grass.	Brome-grass.	Oats.
Plat 7	Rye.	Rye.	Rye.	Rye.	Rye.
Plat 8	Rye.	Corn.	Rye.	Corn.	Rye.
Plat 9	Oats, 165.	Oats, 165.	Oats, 165.	Oats, 165.	Oats, 165.
Plat 10	Oats.	Corn.	Oats.	Corn.	Oats.
Plat 11	Oats (alfalfa).*	Alfalfa.	Alfalfa.	Alfalfa.	Alfalfa.
Plat 12	Oats, 451.	Oats, 451.	Oats, 451.	Oats, 451.	Oats, 451.
Plat 13	Oats (cow peas).	Corn.	Oats (cowpeas).	Corn.	Oats (cowpeas).
Plat 14	Oats (brome-grass).*	Brome-grass.	Brome-grass.	Brome-grass.	Corn.
Plat 15	Corn.	Corn.	Corn.	Corn.	Corn.
Plat 16	Corn.	Oats, 451 (cowpeas).	Corn.	Oats, 451 (cowpeas).	Corn.
Plat 17	Corn.	Oats, 165.	Corn.	Oats, 165.	Corn.
Plat 18	Corn.	Winter barley.	Corn.	Winter barley.	Corn.
Plat 19	Corn.	Winter barley.	Corn.	Wheat.	Corn.
Plat 20	Alfalfa.	Alfalfa.	Alfalfa.	Wheat.	Wheat.

* Fall sowings of alfalfa and brome-grass were winter-killed.



white dent corn, the seed of which was obtained from a farmer near the Station. It yielded at the rate of 43 2/3 bushels per acre. This year and hereafter a selection from the United States plant-breeding laboratory of the Boone County White will be used. This corn, being newly introduced and hence unaccustomed to conditions here, may not at first prove to be as productive as the native white dent, but it is known to be a superior corn. As will be noted, for this year there are six tenth-acre plats of corn. There are nine rows of corn in each plat, thus making a total of fifty-four rows. In the planting use was made of twenty-seven ears which had been specially selected, graded, and tested for germinability. Each ear furnished seed for two rows. These rows were put in separate-plats and in reverse order, with the object in view of beginning at one end of the series and detasseling alternate rows. This gives one detasseled row for each ear. The corn was planted in drills, with the aim to secure 100 plants in each row. The seed is to be field selected from the detasseled rows of the ears which prove most highly productive. By supplying near-by farmers with seed of the same selection the seed will be kept free from contamination.

Five additional rotation plats were added this spring. These are for a wheat-alfalfa rotation, two years of wheat and three of alfalfa. One plat is to be sown in alfalfa each year. This experiment really commences next year, for no wheat or alfalfa has been obtained from these plats this year.

On account of the favorable season, all grains will make a splendid showing. The Station is now equipped with grain testers and will soon be supplied with platform scales. This means that the yield and quality of the grain may be accurately determined. This season it is the intention to treat all seed used for planting at the Station or for distribution to farmers with formalin treatment for smut. This is deemed advisable on account of the large amount of smut in nearly all grain this year. There will be seed from the larger plats for sale, chiefly of winter wheat, winter barley, and oats.

The rainfall for the last twelve months was as follows :

July 4.37 inches.	January 0.64 inches.
August 1.10 "	February 0.28 "
September 6.33 "	March 2.60 "
October 1.57 "	April 2.96 "
November 2.92 "	May 1.64 "
December 0.12 "	June 6.0 "
Total, 30.53 inches.	

Concluding Statement.

In this, the last report of the Council, we wish once more to urge upon the Board the desirability of securing appropriations from the state to supplement those made by the United States for this Experiment Station. The Experiment Stations in other states of which we hear most receive such additional appropriations on a liberal scale. It is especially desirable that such funds be available for carrying out experiments with freedom from supervision and control of the United States Department of Agriculture. We also wish to urge once more that if the work of farmers' institutes is to be increased or maintained some means should be found by which that can be done without breaking in to so great an extent upon the time of men supposed to be conducting experimental research.

Respectfully submitted.

E. R. NICHOLS.

J. T. WILLARD.

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OSCAR ERF.

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R. J. KINZER.