



TWENTIETH ANNUAL REPORT
OF THE
AGRICULTURAL EXPERIMENT
STATION

C. W. Burkett

OF THE

Kansas State Agricultural College,
MANHATTAN.

For the Fiscal year 1906-'07.

STATE PRINTING OFFICE,
TOPEKA, 1908.



ORGANIZATION OF THE
Kansas State Agricultural College
Agricultural Experiment Station.

BOARD OF REGENTS.

- HON. A. M. STORY (1909), President Manhattan, Riley county.
- HON. J. O. TULLOSS (1911), Vice-president. Sedan, Chautauqua county.
- HON. J. S. McDOWELL (1909) Smith Center, Smith county.
- HON. GEO. P. GRIFFITH (1909) Hays, Ellis county.
- HON. EDWIN TAYLOR (1911) Edwardsville, Wyandotte county.
- HON. W. E. BLACKBURN (1911) Anthony, Harper county.
- E. R. NICHOLS, President of College, (ex officio) Secretary. Manhattan.

MISS LORENA E. CLEMONS, Assistant Secretary.

EXPERIMENTING STAFF.

- ERNEST R. NICHOLS, President of the College.
- CHARLES WM. BURKETT. Director.
- JULIUS T. WILLARD Vice Director; Chemist.
- EDWIN A. POPNOE Entomologist.
- HERBERT F. ROBERTS Botanist.
- ALBERT DICKENS Horticulturist.
- ALBERT M. TEN EYCK Agronomist.
- OSCAR ERF Dairy Husbandman.
- FRANCIS S. SCHOENLEBER Veterinarian.
- ROLAND J. KINZER Animal Husbandman.
- LELAND E. CALL Assistant Agronomist.
- GEORGE A. DEAN Assistant Entomologist.
- CLARENCE L. BARNES Assistant Veterinarian.
- ROBERT E. EASTMAN Assistant Horticulturist.
- GEORGE F. FREEMAN Assistant Botanist.
- GEORGE C. WHEELER Assistant Animal Husbandman.
- DAVID M. WILSON Assistant Dairy Husbandman.
- CHARLES O. SWANSON Assistant Chemist.
- HERBERT F. BERGMAN Assistant Botanist.
- ETHEL W. EDWARDS Executive Clerk.

FORT HAYS BRANCH STATION.

- CHALMERS K. MCCLELLAND Superintendent.
- ANDREW D. COLLNER Assistant in Agriculture.
- JESSE L. PELHAM Assistant in Horticulture.
- GEORGE K. HELDER Secretary.

The regular bulletins of the Station are sent free to persons residing in the state who request them.
Address, Director of Experiment Station, Manhattan, Kan.

Historical Document
Kansas Agricultural Experiment Station

KANSAS STATE AGRICULTURAL COLLEGE,
MANHATTAN, KAN., December 20, 1907.

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 Twentieth Annual Report of the Agricultural Experiment Station of the Kansas State Agricultural College, for the year ending June 30, 1907, 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.

Respectfully,

E. R. NICHOLS.



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AGRICULTURAL EXPERIMENT STATION
OF THE
Kansas State Agricultural College,
MANHATTAN.

REPORT OF THE DIRECTOR OF THE AGRICULTURAL
EXPERIMENT STATION.

To Ernest R. Nichols, President of the Kansas State Agricultural College:

SIR-The experiment work in agriculture in the Kansas Agricultural Experiment Station is of two kinds, and is supported by two classes of funds: First, the research work at Manhattan, supported by federal funds; second, research and demonstrative work at Fort Hays, supported by state funds.

During the year eight departments of the Kansas State Agricultural College have been included in these Experiment Station enterprises: Agronomy, Dairy Husbandry, Horticulture, Animal Husbandry, Veterinary, Entomology, Chemistry, and Botany. A statement of the work in each of these departments is included as a part of this report and appears elsewhere.

CHANGES IN THE STAFF.

Few changes in the staff appeared last year. C. W. Burkett, of the Ohio State University, began his duties as director September 1. On December 1, Mr. V. M. Shoesmith, assistant agronomist, resigned to accept a similar position in the Maryland Experiment Station. This position was filled by the appointment of Mr. L. E. Call, a graduate of the Ohio State University, Columbus, Ohio.

Mr. C. W. Melick, assistant dairy husbandman, resigned also to accept a similar position with the Maryland Experiment Station, and was succeeded by Mr. D. M. Wilson, of the Governmental Inspection Service, Ontario.

Mr. Chas. O. Swanson, of the Indiana Experiment Station, was made assistant chemist, succeeding Mr. W. E. Mathewson, who resigned early in the year for study in Europe.

PUBLICATIONS.

Included in the publications of the year are the bulletins, the press bulletins, and the annual report. The list of these various publications is as follows :

Nineteenth Annual Report by the director and chemist.

BULLETIN No. 140.—“Milking Machines,” by Oscar Erf. October, 1906.

BULLETIN No. 141.—“Commercial Seeds of Brome-grass and of English and Kentucky Blue-grass; Adulterants and Substitutes and their Detection,” by H. F. Roberts and Geo. F. Freeman. January, 1907.

BULLETIN No. 142.—“Value of Oil Roads,” by Albert Dickens. January, 1907.

BULLETIN No. 143.—“Disposal of Dairy and Farm Sewage and Water-supply,” by Oscar Erf. February, 1907.

BULLETIN No. 144.—“Small-grain Crops,” by A. M. Ten Eyck and V. M. Shoesmith. March, 1907.

BULLETIN No. 145.—“Spraying,” by Albert Dickens and R. E. Eastman. April, 1907.

BULLETIN No. 146.—“Kansas Law Regulating Sale of Concentrated Feeding-stuffs,” by C. W. Burkett and J. T. Willard. May, 1907.

BULLETIN No. 147.—“Indian Corn,” by A. M. Ten Eyck and V. M. Shoesmith. June, 1907.

PRESS BULLETIN No. 152.—“Picking and Packing Apples,” by Albert Dickens. August, 1906.

PRESS BULLETIN No. 153.—“Poisons for Prairie-dogs and Gophers,” by E. A. Popenoe. September, 1906.

PRESS BULLETIN No. 154.—“Dipping Live Stock,” by C. L. Barnes. February, 1907.

PRESS BULLETIN No. 155.—“Prevention of Sorghum and Kafir-corn Smut,” by H. F. Roberts. April, 1907.

COOPERATION WITH THE UNITED STATES DEPARTMENT OF AGRICULTURE.

The investigation of the varieties of grain best adapted to the Central West is being continued in accordance with the plans that were set in motion some years ago. 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 exhibit the value of crop rotation, especially in regard to the use of legumes on ground devoted to small grains.

At the Fort Hays Branch Experiment Station cooperative work in cultivation methods has been undertaken which includes experiments in different systems of farming, continuous cropping under ordinary methods and under moisture-conservation methods, alternate cropping and summer fallowing, a subsoiling 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; second, to store, or at least conserve, the organic matter in the soil. From the nature of the work these lines of investigation will be continued for a series of years.

During the past year the work as outlined above was undertaken at Garden City, a farm having been provided for this purpose by Finney county, which farm is leased to the Agricultural Experiment Station for a long time for the purpose of carrying on investigation work that shall help to solve the problems of that section of the state. The work there has been barely organized, due to lack of funds, but a start has been made. It is believed by the Station authorities that this work will be very helpful and will bring just the sort of help that is needed for the entire southwestern region of the state.

Appropriations from the state, however, will be required for the promotion and development of this work.

LIVE STOCK EXPERIMENTS.

A special appropriation of \$5000 was made by the last legislature for each of the next two years, to be used for breeding and feeding experiments at the Fort Hays Branch Experiment Station. The experiment, as planned, calls for a breeding herd of 100 head of cattle—25 from each of the beef breeds—Angus, Short-horn, Hereford, and Galloway. Each of these herds will be headed by a typical sire of each respective breed.

The progeny will be raised, and every four years this progeny will be fed, thus giving a direct comparison between the four breeds—a comparison between three-year, two-year and yearling animals, and for the four beef breeds; and will provide a study of the cost of production of beef for the four beef breeds. This experiment allows a careful study of parentage in connection with the feeding operations.

Feeding experiments as ordinarily made do not consider the problem of the parentage—a factor of very great importance in comparative tests. In these experiments parentage will be an all-important factor, and some of the important questions underlying the question of feeding will be brought out. The entire life of these animals will be devoted to these experiments.

LECTURERS AT FARMERS' INSTITUTES AND OTHER MEETINGS.

A demand upon various members of the Station staff for addresses at farmers' institutes, and for various meetings throughout this and other states, has become so great as at times to seriously interfere with Station duties. A certain amount of this work is valuable, as it keeps the man in touch with farm interests of the state; yet when this demand goes beyond a reasonable limit, the matter becomes serious, and should receive careful attention. To carry on farmers' institute work is one of the functions of an agricultural college; and to do this work sufficient funds ought to be provided by the state in just the same way as is done for other phases of education as furnished by an agricultural college. The farmers' institute pays a big interest on the investment, just as the College or the Experiment Station pay big interest, and all three lines ought to be fostered and developed.

THE FORT HAYS BRANCH STATION.

From the view-point of finances, the Branch Experiment Station at Hays had considerably less money for carrying on its growing work than was available for the fiscal year closing June 30, 1906. The legislative appropriations for general maintenance about equaled those of the preceding year, but no funds were allowed for improvements of permanent nature, such as buildings, fences, or the larger needs in equipment, such as engines, water-works, and other utilities.

The last annual report showed the Hays Branch Station to possess a cash balance of \$2614.63. The appropriations passed by the legislature at its 1904-'05 session provided for the following:

Current expenses	\$6,000 00	
Machinery	500 00	
Teams and equipment.....	1,000 00	
Horticulture and forestry.....	500 00	
Building repairs	500 00	
Emergency (barn)	4,000 00	
Total from state.....	\$12,500 00	

Balance from fiscal year 1905-'06.....		\$2,614 63
Cash receipts, 1906-'07: Cattle sold	\$2,456 68	
Hogs sold	1,063 99	
Produce and miscellaneous	632 16	
Total	4,152 83	
Received from United States Department of Agriculture, account of cooperative work.....	617 42	
Total receipts for year.....	\$19,884 88	

The following is a statement of the disposition of these funds:

Supervision and labor.....		\$7,930 79
Merchandise supplies	581 70	
Seed stocks	572 88	
Feed	1,006 65	
Coal	280 53	
Sundry expense and repairs.....	366 61	
Buildings and repairs.....	1,293 05	
Cattle (for feeding).....	603 10	
Farm machinery	500 00	
Harness, etc.	250 00	
Horse barn	4,000 00	
Horticulture	500 00	
Mules and horses.....	750 00	
Total expenditures	\$18,635 31	
Balance on hand June 30, 1907.....	1,249 57	
Total	\$19,884 88	

The climatic conditions affecting the crops of the year were even more irregular than the ordinary irregularities possessed by the weather of this section. The first three months—or July, August and September—gave a precipitation of 12.05 inches, or one-half of the total recorded for the twelve-month period. From October 1, 1906, to June 1, 1907, there were 7.45 inches of moisture recorded. June closed the year with a rainfall of 4.97 inches, which moisture “made” what wheat crop there was.

Owing to the failure of the small-grain crop of 1906, the Station was required to purchase the greater part of the wheat seeded in the fall. This seeding was interrupted by occasional rains, but with the abundance of moisture in the soil germination followed rapidly and an excessive fall growth resulted. Winter brought but traces of snow and a light precipitation generally, together with moderate temperatures. The drouth of February, March and April, with subsequent freezing spells and late frosts of May, indicated disaster for the winter wheat and spring small grains. However, June brought the desired favorable weather, which gave to the sec-

tion a better average wheat crop than any season since the large yields of 1903's crop.

While the small-grain crop of 1906 was almost a complete failure, corn, Kafir-corn, alfalfa and summer crops in general gave a munificent return; in fact, much better than any preceding season at the Station. The experiments carried on with these products were successfully terminated in the fall of 1906. A large quantity of grain and roughage, including corn, Kafir-corn, sugar-beets, alfalfa and other forage, was harvested. The quantities secured permitted the Station to undertake some investigations in stock feeding for the production of beef and pork, which work was consummated in a feeding experiment with sixty calves and forty pigs, supplemented by a number of scrub cattle and hogs fed for local marketing and shipment to Kansas City markets. In these feeding tests only such feeds as were produced by the Station were used, in order to demonstrate to the Western farmer what could be accomplished in this work by the use of home-grown feeds. The fat hogs were sold in March and the cattle shipped to Kansas City in May, both bringing good prices.

The size of the Station's herd of cattle has been reduced, preparatory to the introduction of new lines of investigation in animal husbandry concerning which a statement appears elsewhere in this report.

Hogs.

The Station is breeding Duroc-Jerseys and Poland-Chinas, both pure and cross-bred. A number of the pure-bred males and females have been purchased by farmers in the vicinity, and the demand for this better class of stock is increasing. In hog-feeding, experiments various rations, from feeds grown at the Station, are utilized, and comparisons made of the value of each as pork producers. The number of hogs has increased, necessitating larger yards, which, with farrowing houses, have been built during the year.

Agronomy.

The prominence given wheat production in the great plains region of the West makes the Station work with that cereal the foremost of its investigations. Aside from the number of different varieties being tested for adaptability and improvement, experiments in soil preparation, time and manner of

seeding, cultivation and crop rotation are in progress each season. The year 1906-'07 had 500 acres planted to wheat. The best returns were secured where land had early preparation and seeding, and better yields occurred in rotation with legumes than where wheat followed the small grains, such as Kafir-corn, oats and barley. The Kharkoff and Turkey varieties have, for the fourth season, demonstrated their excellent productiveness as compared with the other varieties tested. A yield of 33 $\frac{1}{3}$ bushels per acre was secured on land plowed early, then packed and harrowed before drilling the wheat.

With corn, the trial of varieties, manners of seed-bed preparation, planting and cultivation are continued. The crop of 1906 yielded 1750 bushels. Corn under irrigation returned 105 bushels per acre as compared with 50 bushels per acre where not irrigated; the variety being the same in each case. Again did the Pride of Saline variety excel all others tried. This section had a larger acreage in corn in 1906 than any preceding year, and the general results were better than for any previous season.

Spring small-grain crops, with the exception of oats, did not survive the spring drought and late frosts of May. Oats produced well, considering the trials the crop experienced, although the grain was not thoroughly matured at harvest. Other small grains grown are flax, emmer, rye, millet, barley, and durum wheat.

One hundred acres of Kafir-corn matured some very fine grain which, with the corn and alfalfa harvested, provided rations for the cattle and hogs that were experimentally fed during the winter.

The sixty-five acres of growing alfalfa produced good crops in late summer, but the spring crops of 1907 suffered from late frosts, so that two frozen crops were mowed off in May and early June. The alfalfa was baled in the field, which process was found to be both practical and saving in the labor of future handling. Likewise, the hay was preserved in a better condition by baling. More land was prepared in the spring for seeding alfalfa and about 100 acres were planted. A fair stand resulted, although unfavorable conditions made necessary the reseeding of perhaps seventy-five per cent. of the original area.

Cereal Variety Work.

In 1902 the Fort Hays Branch Station began testing-work with some 180 varieties of winter wheat for trial. These were both pure- and cross-bred types. By selection and additions the Station, in the season of 1905-'06, was growing 361 winter wheats in the variety garden. These varieties were obtained from local wheat growers, from the Manhattan Station, many from Oklahoma and Nebraska, and a great many from the United States Department of Agriculture.

In 1905 the Hays Station had, by selecting the various types from the crosses, increased their number to 181. And this year the work of discarding the inferior varieties began, and all those yielding under ten bushels per acre were discarded as well as any which had shown a weakness not to withstand smut or rust, and any marked weakness not to withstand drought.

SEASON.	Total variety in garden.	Grains.						
		Hard.	Soft.	Bearded.	Awnless.	Large.	Medium.	Small.
1904-'05...	361	302	59	265	96	36	272	53
1905-'06...	170	158	12	142	28	12	137	21
1906-'07...	84	78	6	74	10	8	62	14
1907-'08...	44	41	3	41	3	3	37	4

The above table shows how the soft, awnless, large- or small-grain varieties have been discarded, and those which remain stand at the foot of the list, which leaves the hard red bearded varieties with a medium size grain the better wheat for western Kansas.

Other than four varieties of corn tested at the Station since 1903, no great varietal trials were undertaken until 1906, when twenty-eight varieties were planted, thirteen of them being standard varieties from the older corn-growing sections of the state. Six were secured from corn growers of this section, all of them having a limited local reputation; the remainder were flint corns and early maturing varieties from other states.

Much variation is shown in the yields of a two-year trial. The local varieties are, without an exception, the better yielders, and, with some variation, the most early maturing corns, with several of the flint varieties, come next; while the large-

growing varieties, requiring a long season to mature, are inferior to a marked extent. The average yield of local varieties has been 36.8 bushels per acre; of early and flint varieties, 23.1 bushels per acre; and of the large-growing varieties, 17.2 bushels per acre.

Irrigation Investigations.

This work, begun in 1903 in cooperation with the Office of Experiment Stations at Washington, has been continued each season; however, without the cooperative feature since 1905.

In lieu of "winter" irrigation, heretofore conducted in early spring before time for soil preparation, divisions of the several plats of the irrigation field were given special soil treatment at plowing-time, so that comparisons of subsoiling *versus* not subsoiling, packing *versus* not packing, and packing and harrowing *versus* not packing and harrowing entered into the comparisons with both irrigated and not irrigated crops. The crops grown the past year were sugar-beets, potatoes, corn and alfalfa. Some yields obtained were:

	Irrigated.	Not irrigated.
Sugar-beets	12 tons per acre.	5½ tons per acre.
Potatoes	126 bu. per acre.	45 bu. per acre.
Corn	105 bu. per acre.	50 bu. per acre.
Alfalfa	5.4 tons per acre.	3.9 tons per acre.

The Station has demonstrated that irrigation by use of a centrifugal pump and traction-engine is too costly an operation to be practical for the Western farmer. Also, that the area to be irrigated in that manner must necessarily be too small to include general farm crops; the work demanding undivided attention just at the busy harvest season, and when labor is most expensive. However, for small fields of alfalfa, potatoes, fruit and garden, irrigation by the aid of pump or well, with windmill or gasoline-engine power, can be conducted with very good results. And it is reasonable to suppose that the pumping of water onto the land in late winter, when the soil is dry and opened by numerous cracks, and when labor is plentiful and correspondingly cheap, will accomplish no little benefit to subsequent summer crops that could thrive on the stored-up moisture. The summer irrigating, demanded when both time and labor is most valuable, might be dispensed with. In the primary tests of this plan all crops responded favorably—alfalfa particularly so.

Horticulture and Forestry.

During the spring of 1906, 2625 fruit- and forest-trees were planted in favorable locations. A number of varieties of each of the more common fruits and no less than eight species of forest-trees were set out. As a whole, these plantings have had good attention from the time of planting and show a good average growth for each season.

The planting for the spring of 1907 was centered largely in an upland orchard and forest plantation to eventually include a sixty-acre tract; the work this year being the commencement of a four-year test to demonstrate the need of proper preparation of the soil, and what that preparation should be, before planting. When the planting of this sixty acres is accomplished, there will be a thirty-acre orchard of apple, peach, pear, plum and cherry trees entirely surrounded by a belt of forest-trees comprised of catalpa, honey-locust and Osage orange.

Treatment and Planting.

- Block A: Orchard and forest-trees planted 1907.
- Block B:
 - Plot 1. Corn, 1907. Orchard and forest-trees, 1908.
 - Plot 2. Cow-peas, 1907. Orchard and forest-trees, 1908.
 - Plot 3. Fallowed, 1907. Orchard and forest-trees, 1908.
- Block C:
 - Plot 1. Corn, 1907; wheat, 1908. Orchard and forest-trees, 1909.
 - Plot 2. Cow-peas, 1907; cow-peas, 1908. Orchard, 1909.
 - Plot 3. Sorghum, 1907; fallow, 1908. Orchard and forest-trees, 1909.
- Block D:
 - Plot 1. Corn, 1907, wheat, 1908; corn, 1909. Orchard and forest-trees, 1910.
 - Plot 2. Cow-peas, 1907, 1908 and 1909. Orchard and forest-trees, 1910.
 - Plot 3. Sorghum, 1907; barley, 1908; fallow, 1909. Orchard and forest-trees, 1910.

The total number of trees, both fruit and forest varieties, planted at the Hays Branch Station up to the present time is: 1903, 4000; 1905-'06, 9400; 1906-'07, 17,000, and 1100 bush fruits.

New Equipment.

The Station's complement of buildings has been enlarged by the completion of a \$4500 horse barn, replacing the barn destroyed by lightning in June, 1906. This structure was built of stone and wood, the ground floor of the former and hay-loft of the latter. A driveway from the ground up to the mow facilitates the hauling of loads of hay directly into the barn loft. The appropriation was insufficient to provide a barn

large enough to stall all the teams owned by the Station, so the small stock barn is still utilized for stabling some of the work horses.

Other Station buildings were given such repairs as were needful and that available funds warranted. The workmen's boarding-house received new paint, the stone guard-house was partially partitioned as a dwelling for the accommodation of the family of one of the married workmen. The old fort, or blockhouse, was reroofed and the interior woodwork partly renewed and decorated, so that it now makes an acceptable abode for one of the Station staff.

In machinery some needful grain-drills, sugar-beet and potato tools and cultivators were purchased.

Three mules and one horse were bought during the year. The Branch Station now has fifteen horses and twelve mules. With the additional cultivated land to farm, that land reverting to the state by expiration of leases in 1906, this number is inadequate to properly carry on the farm work at the times such work should be executed, so that at harvest- and plowing-time additional teams have been rented.

Labor and Supervision.

The force of workmen required to perform the multitudinous duties of the large farm has likewise been insufficient at critical times. The number employed varies from ten to thirty, depending on what work the seasons demand. With small-grain harvest, cultivating, haying, irrigating and stock-feeding in progress on a scale commensurate with the large tract of land controlled by the Experiment Station, the need of a large force of men and equipment of teams and machinery is quite patent.

Some changes in the Station staff have occurred within the recent six months. Mr. O. H. Elling resigned his position as foreman and left the Station in March. In May, Prof. C. K. McClelland, from the office of farm management, United States Department of Agriculture, arrived and assumed the duties of superintendent. Mr. J. L. Pelham, a graduate of the State Agricultural College, was employed as assistant in horticulture, and reached Hays in April to take up his duties. Mr. Geo. K. Helder, as secretary of the Station, and Mr. A. D. Colliver, assistant in agriculture, retain their positions on the staff.



LEGISLATION IN REFERENCE TO THE STATION.

Aside from increased appropriations for the Fort Hays Branch Experiment Station, the last legislature placed the control of concentrated feeding-stuffs and commercial fertilizers with the Agricultural Experiment Station.

These acts of legislation are in accord with similar movements in other states, the aim being to prevent fraud, adulteration, short weight, and at the same time providing the consumer with a guaranty and simple labeling that enables him to know just what is purchased, and the grade. It is believed that the manufacturers, farmers and other consumers will give every form of necessary help for making this service of the Station as efficient as possible. These two laws require every brand of concentrated feeding-stuffs and every brand of commercial fertilizers used in the state to be registered in the office of the director of the Agricultural Experiment Station. All feeding-stuffs and fertilizers are to be inspected, and two bulletins are to be published annually: one dealing with feeding-stuffs, and one with commercial fertilizers. These two bulletins are to give a list of the brands registered, with their guaranteed composition, and such other information as may be deemed valuable to the public concerning them and their use.

REPORT OF CUSTODIAN.

STATEMENT OF RECEIPTS AND EXPENDITURES OF KANSAS AGRICULTURAL COLLEGE EXPERIMENT STATION FOR THE FISCAL YEAR ENDING JUNE 30, 1907.

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, 1906, and June 30, 1907:

Balance on hand July 1, 1906.....	\$1,225 26
Received from the treasurer of the United States.....	22,000 00
Received from cash sales.....	11,195 32
Total	\$34,420 58
Approved vouchers Nos. 1 to 523, including credits.....	28,542 27
Balance on hand June 30, 1907.....	\$5,878 31

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 director, and allowed by the president of the Board of Regents :

Experiment Station, Kansas State Agricultural College, in account with United States, appropriation, 1906-'07.

DR.

To receipts from the treasurer of the United States, appropriation for fiscal year ending June 30, 1907, under acts of Congress approved March 2, 1887 (Hatch fund), and March 16, 1906 (Adams fund)..... \$15,000 00 \$7,000 00

CR.

By salaries	\$7,203 50	\$3,649 88
Labor	4,441 68	1,224 18
Publications	507 43
Postage and stationery.....	288 00	46 03
Freight and express.....	273 62	75 68
Heat, light, water, and power.....	28 60
Chemical supplies	28 00	395 90
Seeds, plants, and sundry supplies.....	1,063 89	257 36
Feeding-stuffs	8 00	24 56
Library	33 23	4 10
Tools, implements, and machinery.....	161 03	365 25
Furniture and fixtures.....	23 21	125 72
Scientific apparatus	42 87	369 63
Live stock	503 80	2 25
Traveling expenses	312 60
Contingent expenses	15 00
Building and repairs.....	94 14	430 86
Total	<u>\$15,000 00</u>	<u>\$7,000 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, 1907; 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 \$22,000; and the corresponding disbursements \$22,000; 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.]

(Signed)

J. S. MCDOWELL,
 EDWIN TAYLOR,
 A. M. STORY,
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, 1907:
 Balance on hand July 1, 1906..... \$1,225 26
 Sales and fees..... 11,195 32
Total \$12,420 58



	Cr.	
By salaries		\$705 00
Labor		2,110 00
Publications		63 97
Postage and stationery.....		192 62
Freight and express.....		137 63
Chemical supplies		271 59
Seeds, plants, and sundry supplies.....		676 31
Feeding-stuffs		316 57
Library		21 96
Tools, implements, and machinery.....		156 78
Furniture and fixtures.....		329 11
Scientific apparatus		8 00
Live stock		496 25
Traveling expenses		689 46
Building and land.....		367 02
Total		<u>\$6,542 27</u>
Balance		<u>5,878 31</u>
Grand total		<u>\$12,420 58</u>

Respectfully submitted.

LORENA E. CLEMONS, *Custodian.*

REPORT OF THE AGRONOMIST.

Prof. C. W. Burkett, Director: The experimental work of this department may be classified under two heads: Crop Production, and Soil Studies. The first includes the testing of different varieties of grain, grasses, forage crops, etc.; the rotation of crops; manuring and fertilizing; culture methods; breeding and selection, and other miscellaneous work, such as the rate of seeding, date of seeding, depth of seeding, corn-shrinkage tests, etc. Soil-moisture studies are being carried on in connection with the rotation and cultivation experiments. Studies are also being made with reference to the movement of soil moisture as affected by time and depth of cultivation, etc. Soil studies are also being conducted to learn the effect on the soil temperature of mulches, different methods of seed-bed preparation for corn, and different depths and dates of cultivation for corn.

VARIETY TESTS.

The variety trials include the testing of winter grains: wheat, rye, emmer, oats, and barley; spring grains: wheat, oats, barley, and emmer; and other crops: Kafir-corn, sorghum, broom-corn, millet, flax, soy-beans, cow-peas, navy beans, grasses, and perennial legumes; these experiments requiring in all about 350 plots. The purpose of the variety test

is to determine which are the hardier and better producing varieties of the different standard crops, and when this has been determined the better producing varieties are improved by breeding and selection and grown in large areas for the purpose of securing pure seed for distribution among the farmers of the state. During the past year this department sold and distributed more than 1000 bushels of well-bred winter wheat; several hundred bushels of spring grain—oats, barley, emmer, flax; 300 or 400 bushels of well-bred seed-corn, and smaller quantities of seed of the best-producing varieties of cow-peas, soy-beans, Kafir-corn, and sorghum. The work along this line has been well appreciated by the farmers. The seeds offered for sale by this department have been in great demand and much larger quantities could have been sold. There is little question but that the sale and distribution of well-bred seed of these best-producing varieties has had a marked influence on increasing the yields per acre and total yield of several standard crops in the state, especially wheat and corn.

ROTATION EXPERIMENTS

Two series of experiments are being carried on in rotation of crops, corn being the main crop in one series, and winter wheat in the other. This is the fifth season for these experiments.

MANURING AND FERTILIZING.

Fertilizer experiments are being continued with wheat; barley, oats, and corn, and include the use of barn-yard manure as compared with different chemical and commercial fertilizers applied alone or in combinations. Fertilizer experiments are also being made with cow-peas and rape and used as catch-crops in wheat stubble and corn. Soil-moisture studies are being made in connection with these experiments, and the plan is to study the formation of nitrates in the soil in connection with the use of different fertilizers.

CULTURE METHODS.

The culture experiments include the preparation of seed-bed for corn by plowing, listing, disking, and harrowing; a comparison of methods of planting (listing *versus* planting with disk, furrow-opener *versus* ordinary surface-planting), and the cultivation of corn, including deep and shallow cultivation

and combinations of deep and shallow cultivation. This is the fifth season for these experiments.

A series of experiments has been begun in harrowing wheat, oats, and barley. This may be considered a new experiment. Another new experiment has been undertaken to learn the effect of the continuous practice of burning or plowing under corn-stalks in preparing the ground for corn.

IMPROVEMENT OF PLANTS BY BREEDING AND SELECTION.

The department is breeding this season eight different varieties of corn by the "ear-row" method. By careful breeding, considerable improvement has been made with several varieties of corn, not only with regard to securing higher yields, but the corn has been made much purer in type, and the quality and feeding value has also been improved. The department is breeding by the "head-row" method several varieties of small grains, including eight varieties of winter wheat, two of winter barley, three of spring barley, three of oats, two of emmer, four of sorghum, and two of Kafir-corn. Several of these "bred" varieties have been, or will be, planted in larger areas for the production of seed for distribution. We are growing for seed production this season on the Experiment Station farm, or under contract, 100 acres of winter wheat, 15 acres of winter barley, 30 acres of spring barley and oats, 140 acres of our purest-bred corn, 10 acres of sorghum, and 10 acres of well-bred Kafir-corn. In connection with the growing of these crops for seed production, experiments are also being conducted as outlined above.

Mention, in detail, cannot here be made of the several miscellaneous experiments. A report of the work in progress on date of seeding, rate of seeding and depth of seeding winter wheat and other small grains will be found in Bulletin No. 144 and similar work with corn in Bulletin No. 147 of this Station. The results of the corn-shrinkage tests for three years are also published in the last-named bulletin.

COOPERATIVE EXPERIMENTS.

For the past two years the department has been carrying on cooperative experiments with a number of farmers located in different sections of the state. These experiments have consisted largely in the testing of different varieties of standard crops with reference to their adaptation and productiveness

when grown under different conditions of soil and climate. This is a very interesting and important line of work. The same variety is not equally valuable everywhere and under all conditions, and local tests should be made in order to determine which varieties are best adapted to certain conditions. The enlargement of this work would include the breeding and selection of the varieties which prove to be the better producers in order to adapt them still further and also secure purer types for propagation, with the ultimate object of distributing the seed throughout the local section where the varieties succeed best.

Respectfully submitted.

A. M. TEN EYCK.

REPORT OF THE ANIMAL HUSBANDMAN.

Prof. C. W. Burkett, Director: The work of the Animal Husbandry Department the past year has been principally in the lines of feeding experiments, and these have been considerably hampered, owing to the lack of proper accommodations for carrying on such work.

CATTLE.

Two car-loads of two-year-old steers were fed. These were high-grade Herefords, and of very uniform quality. One lot was fed on white corn; another on yellow corn; the third lot on corn-fodder, green and cured; and the fourth lot on old corn. The object of this experiment was to compare the value of old and new corn, and also the feeding value of white and yellow corn. During the entire year a record has been kept of the feed consumed, and the gains made on the herd of show steers, the object here being to compare the relative gains of two-year-olds with those of yearlings and calves.

HOGS.

Two feeding experiments with hogs have been conducted with five lots of hogs. We used twenty head in each lot. No. 1 was fed on corn alone; No. 2, on corn and cottonseed-meal; No. 3, corn and alfalfa; No. 4, corn and tankage; and No. 5, corn and meat-meal. All this feeding was done in dry lots.

In the second experiment three lots were fed: one on corn, the second lot with corn and tankage, and the third with corn and alfalfa.

During the winter, observations were made of the value of alfalfa hay for brood-sows. The work in the cross-breeding of hogs was conducted through this year also, the principle cross being the bacon hog upon the lard type.

SHEEP.

One hundred head of Mexican lambs were fed, in which the value of Kafir-corn was compared with corn, emmer and barley, alfalfa being the roughage for all lots. Prairie hay, *Bromus inermis* and cottonseed-meal were also compared with blood-meal as a supplementary feed, and one lot was fed on cut Kafir-corn and cut soy-beans, fodder and green feed being run through a cutting-machine.

Five breeds of pure-bred sheep have been maintained also through the year, in order to determine which are the most hardy and best adapted to our conditions.

Respectfully submitted.

R. J. KINZER.

REPORT OF THE BOTANIST.

Prof. C. W. Burkett, Director:

DEAR SIR-I beg to report on the work of my department in the Experiment Station for the year ending June 30, 1907, as follows:

WHEAT.

In July, 1906, the process of wheat-breeding by the pedigree method was substituted for previous methods, and 536 heads of wheat were selected in the field out of some 600 mass variety cultures. These heads represented every species and race, and almost every so-called variety-form in general cultivation, and furnished a very wide range for future study of pure races of wheat. Each of these heads was subjected to scrutiny and examination in the plant-breeding laboratory by a corps of trained operators, and the morphological characters of the head and of the seed were recorded on special blanks. In this analysis no detail of structure capable of description or measurement was omitted. All of the seeds thus obtained were planted, with the exception of a reserved one-third retained to be tested for color, hardness, volume and specific gravity. In addition, another series of "pedigree grains" was prepared out of the wheat samples of various "varieties" re-

ceived from a wide range of sources. Grains were selected representing almost every discernible type of wheat grain, as to color, form, volume and hardness. The selection covered 16 sorts, of which 100 each were taken. Measurements of the length and breadth of the kernels were accurately made by means of a micrometer scale. For a small number of the series, 50 in all, the volume was determined, and in the case of a few, in addition to these data, a photographic record was made of the grain itself in three positions. In this way a very complete record of form has been perfected, to which reference can be made in the study of the progeny seeds. In the fall the 2000 pedigree cultures were planted. In addition there had been obtained from every wheat-growing experiment station in the United States, from seedsmen in every state, and from the two most prominent seedsmen in France and Germany, samples of each so-called variety of wheat in their possession. These were sown in rows, all the varieties bearing the same name being planted side by side, with conspicuously labeled stakes indicating the source of each. These variety plots were planted to compare the difference in type among lots bearing the same variety name, and filled two blocks of the wheat-breeding field. Another series of blocks was planted to a very extensive series of wheats arranged according to botanical relationships, for study and observation, and which included a complete series of all the various bread wheats, arranged according to color and hardness of the grain.

Still another block or section was occupied by the wheat hybrids originated in the department. In all, the wheat planting of 1906-'07 comprises a most comprehensive scheme for the study of character in wheat, and for the examination of variety types, and in the pedigree cultures offers the most extensive mass of material for plant breeding that is believed to be available anywhere, and insures the development in large numbers of pure strains of wheat.

ALFALFA.

In the spring of 1906 a considerable tract was planted to alfalfa in hills standing 1 x 2 feet apart, and the plants thinned to one in a hill. At once, and in the seedlings, although the seed was uniform and from a single source, the greatest differences appeared in form and color of leaves, in

texture of stem, density of foliage, and in the general habit of the plants. About 140 selections were made in this field of plants to be studied. During the spring a late frost brought out marked individual differences in the resistance of the various plants to the same degree of low temperature, and such exceptional plants were marked. Pollinating cages were constructed during the previous summer for use during the coming season in close-pollinating the selected plants. From these it is expected to obtain pure strains of close-bred plants, in which the favorable differences in habit with respect to forage value, frost, and drought resistance may be retained, and new alfalfa-fields originated which shall consist solely of these superior plants.

CORN.

The work with corn in the botanical department occupies a narrower scope, and deals with the following problems:

1. The relative effects of close and out pollination in the progeny.
2. The distribution of characters in corn hybrids.
3. The sporadic appearance of alien types of ear in apparently pure races of corn; as that of the appearance of the red ear in white corn fields.

Of these problems only the second has been continued far enough to admit of report, and the details are too numerous and technical for this report, but will be embodied in a bulletin.

OATS.

The department's experiments with oats cover solely the problem of the spontaneous appearance of black oats in fields of the red oats and the replacement of the red by the black, so commonly reported as occurring in the state. From plots grown during the past season, from selected red and black grains, it appears that there are marked differences in the habits of the plants coming from the two sorts of seed. These differences extend to the ripening period, and are sufficiently pronounced to constitute the two as distinct varieties. The black oats was found to be the earlier in ripening, and by actual count of the grains to produce more, but, on the other hand, was found to shatter badly, which may account for its reported lesser yield under field conditions. A considerable number of the plants of both types were sacked at blossoming time to secure close pollination, and the progeny

of these close-pollinated plants will be followed through several successive years of close pollination to determine what inheres in the reported phenomenon of white oats "turning" to the black variety.

SEED ANALYSIS.

The analysis of agricultural seeds for farmers, seedsmen, and others has proceeded as usual. The following table gives in tabular form the distribution of the analyses among the different species of plants. The value of this work to the farming community cannot be overestimated:

Tests of Seed Samples from June 30, 1906, to June 30, 1907.

SEEDS.	Purity tests.	Germination tests.
Alfalfa	74	69
<i>Bromus inermis</i>	11	11
Clover (red)	3	3
Kentucky blue-grass	5	4
Meadow fescue	31	50
Orchard-grass	6	3
Timothy	2	2
Miscellaneous and foreign seeds.....	3	...
Miscellaneous and garden seeds.....	...	51
Totals	135	193

NEW APPARATUS.

It may be proper to add that the work in plant-breeding has demanded the invention of a number of pieces of special apparatus to fill various needs. A crushing-machine for the determination of the hardness of wheat grains, an apparatus wholly new of its kind, has been devised and constructed by Gaertner & Co., of Chicago, on the basis of suggestions furnished by the Station botanist. This apparatus works to perfect satisfaction and brings the matter of hardness of wheat within the range of scientific inquiry. A modification of the Lovibond tintometer has also been devised by the botanist for determining color values in wheat quantitatively. For the seed-analysis work a special seed-mixing machine has been designed, which now awaits funds for construction. A fund is further needed for the purchase of meteorological instruments to be set up in the wheat-breeding field, in order that the changes in character and composition of the grain, which apparently take place under diverse climatic conditions, may be definitely correlated with these latter—a field of investigation hitherto untouched.

Respectfully submitted.

H. F. ROBERTS.

REPORT OF THE CHEMIST.

Prof. C. W. Burkett, Director: During the early part of the fiscal year considerable time was given to some investigation of the process of artificial bleaching of flour. Our experiments were made possible by the courtesy of the Manhattan Milling Company. A test of the bleaching gases was made with reference to the detection of ozone and no evidence of its presence was obtained. The active agent in the mixture of gases seemed to be nitrogen peroxide only. The amount of this present in the air-mixture used was found to be very small. These experiments were broken off before reaching entirely satisfactory results by the resignation and departure of Assistant W. E. Mathewson.

The time of Assistant Swanson, who began the performance of his duties September 1, has been occupied almost exclusively in conducting milling tests of wheat, and baking and other tests of the flours produced. In milling the wheat the experimental reduction-mill manufactured by the Allis-Chalmers Company was found not to produce as satisfactory results as had been hoped for, and, assisted by the advice of Mr. Schreiber, head miller of the Manhattan Milling Company, a small middlings-purifier was designed and constructed. A dust-collector was attached to the middlings-purifier, and a scourer was also designed and built to prepare the grain better for the mill. With these additions and some more sieves very satisfactory quantitative milling tests have been made, the success of which has been due as much to the skill and intelligence of the miller, Assistant Swanson, as to the machinery employed. Nineteen samples of the wheat grown at the McPherson cooperative station and twelve of those grown at Manhattan have been analyzed and milled. In the milling the products obtained are patent flour, bakers' flour, low-grade flour, bran, shorts, and dust. Determinations of total protein and gliadin have been made with each of the flours, to study the connection, if any, existing between baking qualities and gliadin content of gliadin ratio.

The baking tests of the flour have been made by baking loaves under as nearly uniform conditions as could be attained. For the most part the apparatus furnished by John Koelner was used. The flour was also submitted to gluten expansion

tests. The work on these wheats and flours is still in progress and other points in connection with them are under investigation. Enough has been done to show the excellent milling and baking qualities of all of the varieties of wheat tested and to confirm our previous observations that the ratio of gliadin to total protein has no close connection with the baking qualities of the flour.

Assistant Mathewson has been again employed and is taking up a further investigation of the properties of gliadin.

Another principal line of investigation planned for the department is the study of the digestibility and nutritive value of Western feeds and their most economical employment in rations for the various purposes for which animals are kept. Because of the lack of sufficient assistance and the difficulty of getting quarters constructed and equipment provided, no experiments have thus far been made in this line. A portion of the stone barn has been set aside for this work, and reroofed and remodeled. A suitable cement floor has been laid and five stalls for cattle or horses and five for smaller animals provided. An outside exercising yard has also been enclosed and cemented.

The plan is for this department to conduct digestion and nutrition experiments in these quarters which shall to a certain extent be parallel to feeding experiments conducted simultaneously by the Animal Husbandry Department in the ordinary way, though the work is not to be limited to such parallel experiments. These experiments will be prosecuted to as full an extent as means and other limitations will permit. The digestibility and nutritive value of the prairie hay of the West has never been studied to any extent, and it is planned to cover this field by experiments with the various kinds of animals. Special experiments touching the utilization of alfalfa have also been planned.

The legislature, at the session of 1907, passed a law designed to regulate the sale of concentrated feeding-stuffs in this state. This law applies to all ground, milled or mixed feeds and to all condimental or medicinal stock foods, and requires that all who sell or offer for sale such products within the state of Kansas shall register them with the director of the Experiment Station, and may send a sample of the feed registered to the Chemical Department for analysis, in order that the manufacturer may be able to make a guaranty as to the protein and

fat of the feed. The law goes into effect July 1, 1907, but the analyses required by those who have already registered their feeds have been more than sufficient to employ fully several men from the middle of May to the present time, and hundreds of samples are still awaiting analysis, and hundreds of others will be registered and require analysis in the immediate future. The research work of the department suffers, therefore, at present, and will until suitable additional assistance has been secured to take care of these routine duties. The feeding-stuffs law makes it the duty of the chemist of the Station, personally or by deputies, to inspect the feeding-stuffs on sale in the state, and to do this properly will require still more assistance. The need of additional floor space in the department is already more keenly felt.

Respectfully submitted.

J. T. WILLARD.

REPORT OF DAIRY HUSBANDMAN.

Prof. C. W. Burkett, Director: I herewith submit report of work done by this department during the past year.

EXPERIMENTS WITH MILKING-MACHINES.

We continued the experiments started two years ago with reference to the effect the milking-machine has upon the cow.

We have just completed the experiments between hand milking and machine milking, which showed an increase of six per cent. in the maintenance-flow of the machine-milking.

The question as to stripping the cow after machine or allowing the machine to do all the milking is another experiment which was started, but no definite results have been obtained. The results, so far, indicate that cows stripped after the milking by machine do not give as good results as where milking is done entirely by the machine.

The question as to the economy of producing vacuum for the milking-machine has been under investigation. A steam-jet was loaned by the D. H. Burrell Company and attached to a ten-horsepower boiler, and the steam utilized for producing the vacuum was condensed and the hot water used for washing purposes. Therefore no extra amount of power was required for producing this vacuum.

SEWAGE DISPOSAL.

We also carried on more experiments in connection with the sewage-disposal plant, which has been changed and has become an experiment of labor saving and also an economic problem, as far as fertilization and irrigation of land are concerned. It was our intention to carry this on still further, with the hope that we could liquefy all the solid manures in the cow-stable.

CREAMERY DEPARTMENT.

In the creamery department we have introduced new types of machines for preparing samples of butter for determination of moisture.

We have been working on a more rapid method of determining butter-fat in moisture than that used at the present time.

Experiments were also carried on with reference to the various methods of condensing milk in order to determine which will produce the best material at the least cost.

Investigations were carried on to construct a floor for a creamery that will be sanitary and at the same time will be comfortable and healthful to the operators. Up to the present time this has been a serious problem. Cement has been the best material to be used for creamery and cheese-factory floors, but they have always been cold and unhealthful to the operator. We have, therefore, devised a floor by which the heating is done through the cement, warming the cement and making it comfortable for the operator, at the same time raising the temperature in the room. This has been one of the most successful experiments of the past year, and the plan has proved to be very successful.

In connection with this we have made also some tests in regard to cement partitions as they should be used in creameries. We have experimented on making sinks for creameries and cheese-factories out of cement. The results of these experiments will be observed later.

The question of securing an insulator for creamery refrigerators has been taken up and some good results have been obtained. The first experiment in this line was to use baled straw as the insulating material, cementing the bale with Portland cement on both sides. This has proven to be a very successful way of insulating ice houses and refriger-

ators. Cement was also used in connection with asbestos fiber and sawdust, which proved to be successful for creamery floors by mixing cement with asbestos fiber and sawdust.

A line of investigation with reference to recovering the buttermilk that has been lost in the large creamery was undertaken and some very valuable results have been obtained. Buttermilk, to the extent of several million dollars, has been dumped into the streams of the state of Kansas every year. By drying this buttermilk and turning it into a food product the feeding value of the buttermilk can be fully recovered. Feeding experiments were begun along poultry lines, and later with cows. In both cases the casein has proved to be a very profitable feed. It has been estimated that it is worth approximately seven cents per pound as feed for chickens, and about five cents per pound as feed for cows. This casein can be produced for the creameryman as well as the feeder, and by this means buttermilk is recovered and not lost, as now is the case.

POULTRY EXPERIMENTS.

Besides taking up the state poultry contest problem, which has been a great stimulator and a great help to the public in general who are interested in poultry, we have carried on investigations in the rearing and hatching of chickens.

We experimented on new constructions for poultryhouses, and have invented a coop and trap-nest, both proving very satisfactory for our work.

The experiment which was started four years ago—feeding casein with corn in comparison with blood-meal and corn, alfalfa and corn, bran and corn, linseed-meal and corn—is still being continued. A slight change was made in the alfalfa and corn, owing to the fact that the alfalfa pen stopped laying and the hens did not seem to be nourished well enough to do work, which suggests that alfalfa and corn may not be a good ration for chickens as an egg-laying feed.

The casein pen is still in the lead as far as economic production is concerned.

An experiment with reference to the breeding of poultry has been in progress. In order to test the correctness of Mendel's law, this experiment has been carried on for four years, and in nearly every case it has been shown to follow the law. Some valuable suggestions have been obtained,

which can be applied to breeding other lines of stock in connection with this experiment, such as to determine the per cent. of fowls which breed toward egg laying and meat production in each generation.

Respectfully submitted,

OSCAR ERF.

REPORT OF THE ENTOMOLOGIST.

Prof. C. W. Burkett, Director: During the period covered by this report, investigations have been made especially on the spring grain aphid, or so-called "green bug" of wheat, and the San Jose scale. The work with the spring grain aphid was chiefly to discover its distribution in the state at the time of its greatest abundance, and the relation of its most important parasite, *Lysiphlebus*, at that time. The conclusion reached is that the aphid was present practically throughout the wheat area, though only locally in serious abundance, and that everywhere its parasite was naturally present with it in sufficient numbers to prove its final check.

Several new and important areas were discovered infected with San Jose scale in addition to that of Dodge City, previously reported, including the north half of the city of Wichita; five orchards, covering about eighty acres, seven miles southwest of Wichita on the seventh meridian road; one house lot in Alden, Rice county, and a peach orchard of 400 trees, with numerous fruit-trees in adjacent plantations, two miles north of Kansas City, Kan.

Preliminary trials of several sprays against the San Jose scale were made at Dodge City. Investigations covering the entire territory were made to determine the localities and economic importance of various species of scale insects as horticultural pests.

Respectfully submitted.

E. A. POPENOE.

REPORT OF THE HORTICULTURIST.

Prof. C. W. Burkett, Director: I herewith submit my report for the fiscal year ending June 30, 1907:

APPLES.

The work with fruits has been largely comparisons of varieties, of spraying materials and spraying machinery, and the effects of summer and winter pruning. The crop of 1906, for the most part, has verified the estimate published in previous reports. The younger trees coming into bearing seem to warrant the placing of Yellow Transparent and Duchess of Oldenburg near the head of the list of early varieties. The list of earlies fully recommended is Early Harvest, Benoni, Yellow Transparent, Duchess of Oldenburg, Cooper, Maiden's Blush, Second Early, Grimes's Golden, and Jonathan. The varieties York Imperial and Mammoth Black Twig are proving of greater value as trees age. Of winter apples, the Winesap perhaps has first place in regularity of bearing, productiveness and quality in the experimental orchards. It is only surpassed in quantity produced by the Missouri Pippin and Ben Davis. Varieties not previously recommended are Stuart's Golden and Kinnard's Choice. Loy has produced abundantly and of good quality.

Following the experience of previous years in the matter of spraying, reported in Bulletin No. 145, the combined spray of arsenic of lead and Bordeaux mixture maintains its record of efficiency.

PEACHES.

Continued observation of block of trees pruned in early summer of 1901-'02-'03, compared with pruning done in preceding winter, confirms the opinion that the summer pruning was most productive of good results on unfruitful trees.

The cutting back occasioned by the failure of 1905 gave further opportunity in the summer of 1906 to observe the effect of this treatment. In practically every case trees cut back produced more fruit, which was more easily handled and of better quality. Young trees were cut back severely, leaving only stubs of main branches, while more wood was left on older trees. Trees ten or eleven years old cut back as severely as were those of four or five years of age failed to produce good heads, and a considerable proportion were killed outright.

The crop of 1906 was a very satisfactory one, and the yield of the different varieties fully up to previous record. Triumph, Champion, Carmen, Family Favorite, Mountain Rose, Elberta, Crawford and Salva, and of the newer varieties Waddell and Belle of Georgia proved productive and very desirable.

Nearly all varieties of plums set fair crops of fruit. Varieties of Japanese and European origin were more severely affected by the brown rot than were varieties of native groups. In case of Burbank and Abundance the loss by rot was very considerably reduced by picking fruit as soon as it began to color, and ripening it in a cool, dry room. The fruit thus treated did not reach as high quality as that left on the trees, but was very good for canning and preserving. Among the cultivated natives Wayland excelled in productiveness and quality, followed closely by Forest Garden, Robinson, and Pottawatomie. Of the later American varieties Wolf excelled, followed closely by Quaker and Weaver. The previous good record of the Wyant has not been sustained as trees age.

Of the new fruits, quite a number of varieties of persimmons have given very satisfactory results. The varieties Early Bearing, Golden Gem, Daniel Boone, and Hicks, secured from Indiana, and American Honey, secured from Texas, set in 1900, produced much larger crops in 1906 than the previous year. The largest yield, slightly more than a bushel, was produced by the American Honey variety. The yield of Daniel Boone was somewhat less than one-half bushel. It is interesting to note that in the spring of 1907, when the flower-buds of all other fruits froze, the persimmons set a fair crop of fruit, owing, doubtless, to the fact that persimmon fruit-buds are borne on shoots of the current season's growth.

A good crop of grapes was produced in 1906, and it is gratifying to note that in spite of the untimely freeze of 1907, a light crop of fruit was set from buds which were late in starting. The Munson system of trellis maintained its superiority over the overhead system of training, the crops being practically equal to those borne on the fan system. The standard varieties, Moore's Early, Green Mountain, Concord, Elvira and Catawba, maintain their position at the head of the list of productive varieties, with Woodruff and Grein's Golden increasing in productiveness as vines age. The value of winter protection for half-hardy varieties, and the bag as

protection from the birds, has continued to be very much ahead of the cost of these operations.

In the fertilizing tests for strawberries the yield was much lighter than that for 1906. The complete fertilizer, consisting of bone-meal, dissolved bone and potassium chlorid, at the rate of 150 pounds to the acre each, with 100 pounds sodium nitrate per acre, gave the heaviest yield. But in nearly every case the increase in yield was barely sufficient to cover the cost of the fertilizer. The check plot, which had no commercial fertilizer, compared very favorably with the other four blocks. The entire plantation was on very good land, on which garden crops had been grown several years previous, and which had been given fairly heavy applications of barn-yard manure until two years previous to setting of strawberries. The varieties producing heaviest yields were in the following order: Warfield, Senator Dunlap, Parker Earle, Sample, Excelsior, Gandy, and Aroma. In the average of the crop of the two years previous Parker Earle leads, followed by Dunlap, Warfield, Sample, Aroma, Excelsior, and Gandy, in the order named.

Of the black raspberries, Kansas has maintained its position as first in productiveness, followed by Cumberland, somewhat superior in size and quality. Progress and Namaha proved worthy of planting.

Of the early varieties of blackberries, Early Harvest maintains its position at the head of the list by reason of its greater hardiness and regularity of bearing. The Kenoyer was larger in size last year and excelled the Early Harvest in productiveness, but was much more injured by the freezes of 1907. Of the later varieties, Snyder ranks first in productiveness and hardiness and resistance to disease. Taylor, second in productiveness, has been rather more subject to the ravages of rust than those previously mentioned. Erie has followed Mercereau closely in yield and quality.

Tests with vegetables on continuation of yields and varieties and influence of fertilizers, show lettuce, celery and cabbage to give increased yields and better quality for application of nitrate of soda. This is especially true of forcing-house lettuce. The most desirable tomatoes, from the standpoint of yield and quality combined, are as follows: Earlianna, Early Jewell, Greater Baltimore, Paragon, Acme, Matchless, and Trucker's Favorite.

Root crops have been uniformly successful. Tests of fertilizers with sweet potatoes, carried on in cooperation with local growers, seem to indicate that ten large two-horse loads of barn-yard manure were more valuable than the commercial fertilizer used in the tests. Of Irish potatoes, the Early Ohio continues first for yield and quality, equaled only by Early Six Weeks, Rural New Yorker, and Irish Cobbler.

The model garden has continued to produce very large quantities of vegetables suitable for home use, showing the possibility of double-cropping where only a limited area of land is available.

The observation of the rate of growth of forest-trees has been continued, and that of the rate of renewal of coppice growth has been begun. The plantation grown from seed, planted where trees are to remain permanently, has made very satisfactory growth, and will furnish some posts and fuel the coming season. The plantation of conifers continues to give satisfactory results, and the propagation of these trees from seed has been under observation. The most gratifying success has been in the case of the red cedar, which has been the most difficult of the evergreens to propagate from seed. The method which has given the best success was to stratify new seed in moist sand over winter, keeping exposed to frost, burying the following summer at sufficient depth to insure moisture, exposing to frost the following winter, and planting the succeeding spring. The best germination has been sixty per cent., the highest secured by any method.

Respectfully submitted.

ALBERT DICKENS.

REPORT OF THE VETERINARIAN.

Prof. C. W. Burkett, Director: I herewith submit report of work done by this department during the fiscal year ending June 30, 1907.

The efforts of the department for the last twelve months have been confined in the experiment line to the study of the cause of so-called "blind staggers" (*cerebritis*) in horses.

Some of the molds affecting the corn ear, husk and stalk have been investigated—first, their laboratory characteristic; second, their actions upon guinea-pigs, rabbits, and the horse.

Respectfully submitted.

F. S. SCHOENLEBER.