FIFTH ANNUAL REPORT

OF THE

AGRICULTURAL

EXPERIMENT STATION

FOR SOUTH DAKOTA.

FOR THE

FISCAL YEAR ENDING JUNE 30, 1892.

SOUTH DAKOTA AGRICULTURAL COLLEGE.

BROOKINGS, S. D.
To Honorable

C. H. SHELDON,
Governor of the State of South Dakota.

Sir:—I have the honor to transmit herewith the Fifth Annual Report of the Agricultural Experiment Station of South Dakota, in accordance with the requirements of law.

Yours Respectfully,

EDWARD T. SHELDON,
President Board of Trustees.
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STATION STAFF.

Lewis McLouth, A. M., Ph. D., Pres., Ex-Officio.
Luther Foster, M. S. A., Director, .................... Agriculturist
John C. Whitten, B. S., .............................. Assistant Horticulturist
I. H. Orcutt, M. D., Ph. D., ......................... Entomologist
Jas. H. Shepard, B. S. ................................ Analytical Chemist
A. H. Wheaton, ........................................ Dairy Science
T. A. Williams, A. M., ............................... Botanist
W. S. Frost, ........................................... Accountant
John M. Aldrich, M. S., .............................. Assistant Entomologist
Cyril G. Hopkins, B. S., ............................. Assistant Chemist
Robert F. Kerr, A. M., ............................... Librarian
FINANCIAL REPORT.

THE AGRICULTURAL EXPERIMENT STATION OF SOUTH DAKOTA
IN ACCOUNT WITH
THE UNITED STATES APPROPRIATION.

1892.

To receipts from the treasurer of the United States for the year ending June 30, 1892, as appropriated by act of Congress approved March 2, 1887 . . . . . $15,000.00

June 30.
By Salaries ........................................... $7,303.76
" Labor .............................................. 4,026.69
" Printing ............................................. 1,028.78
" Irrigation .......................................... 428.00
" Buildings .......................................... 745.67
" Equipment and supplies—
   Department of Agriculture .................... $ 241.58
   Department of Chemistry ....................... 420.09
   Department of Horticulture .................... 103.29
   Departments of Veterinary Science
      and Dairying .................................. 65.79
   Department of Entomology ...................... 70.17
" Incidental expenses—
   Postage, freight, express and drayage ........ 239.08
   Stationery ....................................... 74.30
   Office supplies ................................... 28.75
   Traveling expenses ............................... 201.05
   Association fee .................................. 10.00
   Periodicals ...................................... 13.00

$15,000.00 $15,000.00

We, the undersigned, committee of the Board of Trustees, appointed for that purpose, have examined the vouchers covering the expenditures of the Agricultural Experiment Station of South Dakota for the fiscal year ending June 30, 1892, and we have compared them with the books of the Station Accountant, and we hereby certify that the books and vouchers agree, and that the expenditures have been made in accordance with the rules and orders of the Board of Trustees.

Signed,

E. T. SHELDON, C. H. COLLINS,
Committee
REPORT OF THE PRESIDENT OF THE STATION COUNCIL.

There has been little of a general nature during the past year requiring mention.

In January the Regents somewhat modified the organization of the Experiment Station so as to constitute it a co-ordinate part of the Agricultural College, and one of its departments of work. A Station Council was established, to consist of the president of the college, the professor of Agriculture, the professor of Entomology, the professor of Chemistry, the professor of Dairy Science, the professor of Botany, the professor of Horticulture, the professor of Veterinary Science and such other officers as may from time to time be designated by the Board of Regents. The president of the college is made ex-officio the president of the Station Council and its executive officer, and bears the same relation to the Station as to any other department of the College.

This Council has control of the Experiment Station, subject to the official governing board, takes the initiative in all lines or methods of work, recommends to the action of the board all purchases and expenditures, makes annual reports to the board through the officers of the Council, holds regular semi-monthly meetings and at the meetings of the governing board makes recommendations of any action deemed necessary.

The personnel of the Station Staff has changed somewhat during the year covered by this report. In November, 1891, Dr. Cary retired from the department of Veterinary Science, and the place has continued vacant since. In January, 1892, Prof. Chas. A. Keffer retired from the department of Horticulture, Botany and Forestry to accept the professorship of Horticulture in the University of Missouri. Mr. T. A. Williams was then advanced to the professorship of Botany, and Mr. J. C. Whitten was put in charge of the work in Horticulture.

During the year the following bulletins were issued: No. 26 in July, '91, on the Strawberry, Sand Cherry and The Orch-
ard; No. 27 in November, '91, from the department of Chemistry on Sugar Beet in South Dakota; No. 28 in December, '91, from the department of Agriculture on Irrigation; No. 29 in December, '91, from the department of Forestry, Horticulture and Botany on Forestry and Fungi; No. 30 in March, '92, from the department of Entomology; No. 31 in March, '92, from the department of Meteorology, giving the weather data of the Station from May 17, '88, to Dec. 31, '91.

A financial report of receipts and expenditures for the fiscal year ending June 30, 1892, precedes. For details of the work of the Station reference must be had to the annexed reports of the heads of the several departments.

Lewis McLouth,
Pres. Station Council.
FOR SOUTH DAKOTA.

DEPARTMENT OF AGRICULTURE.

During the past year the work of this department of the Experiment Station was carried forward in all of the principal lines begun in previous seasons. The following may be mentioned as prominent among the new investigations undertaken:

Root Development of economic plants under different conditions. The work has thus far been directed to wheat, oats, barley, corn, rye, millet, field peas, Alfalfa and sugar beets.

Pig Feeding. Cost of production from different rations and comparative quality of pork being the objects aimed at.

Lamb Feeding, to compare English rape with tame grasses for fattening and fall feeding.

Breeding Problems. With hogs, to compare the results from fully developed, well matured animals with those from young, immature stock; with sheep, to give the Merino and common sheep increased fecundity and better mutton quality.

Facilities are now provided to enable the department to begin some experiments in poultry raising. The breeding and feeding of poultry is a very important branch of farm economy at present and well worthy the attention of experimenters.

During the year a bulletin was published on "Irrigation by Artesian Wells," giving the results of one season's work at different places in the James river valley. Numerous "press bulletins" were also sent out discussing the following and other similar subjects: "Press Drill vs. Broadcast Seeder," "How Much Seed Wheat and Oats per Acre," "Field Peas for South Dakota," "Potato Planting" "Potato Culture" and "Methods of Treating Wheat and Oats for Smut."

The season's field experiments are briefly summarized below:

Wheat. The variety test included eleven kinds of winter wheat and twenty-six of spring wheat. In this work special attention was given to previous crop, preparation of soil, time of sowing, quantity of seed, time of coming up, amount of stooling, time of ripening, damage from rust, smut, etc., condition of straw, time of harvesting and threshing, yield, weight of measured bushel, together with a review of the weather during the season as it affected plant growth, and other observa-
tions necessary to a careful comparison of the several varieties.

In addition to the variety work in wheat, there was a series of experiments in methods of seeding, in which a standard variety was sown broadcast in duplicate plats, at the rate, severally, of two, three, four, five and six pecks per acre. Other plats were press drilled, in duplicate, with the same amounts of seed. The observations of the plats covered the same grounds as did those of the variety test with about the same general comparative summary. Duplicate plats were also planted with the press drill and treated respectively with salt, manure and straw, and still other plats were drilled north and south for a comparison with those drilled east and west.

Oats. Thirty-seven varieties were grown, with observations similar to those made with the wheat. In addition, the relative weight of each variety before and after hulling was ascertained, the weight of hulls giving a very good test of quality. Experiments were made, similar to those with wheat, in methods of seeding, quantity of seed and treatment with salt, manure and straw as protection against drought.

Corn. The sixteen varieties of corn grown comprised the best dents and flints for this climate as selected from our sixty kinds heretofore tested.

Besides the comparison of varieties there was an extensive line of experiments relating to methods. In “time of planting,” six experiments ranging from April to June inclusive; in “preparing ground,” four experiments in which the plowing varied from three to ten inches deep with four inches subsoiling; in “cultivation,” three experiments, deep, shallow and frequent; in “methods of planting,” twenty-six different experiments, including listing, thick and thin planting in hills and drills and depth of planting.

Potatoes. In addition to the variety work which included over one hundred and fifty kinds, new and old, experiments were conducted in thick and thin seeding in both hills and drills; in “methods of preparing seed,” using one and two-eye cuttings, halves, quarters, seed ends, stem ends and whole potatoes, large, small and medium sized; in “time of planting” extending over a period of eight weeks; and in “depth of plant-
“ing,” the cover ranging from two to seven inches. Experiments in culture were confined to a comparison of level cultivation with hilling, applying the methods to potatoes planted in both hills and drills.

**Grasses and Other Forage Plants.** In the long list of varieties grown, a few were found that promise to stand our peculiar climatic conditions remarkably well and hold the same position in South Dakota that clover and timothy do in other states. Other experiments were made with grasses and clovers in time and method of seeding and the manner of preparing the seed bed.

In addition to the work outlined above the field tests included barley, winter and spring rye, millet, field peas, sorghum, sugar beets, carrots, mangels, rutabagas and turnips.

From the forage plant and potato experiments, especially, a large amount of valuable data has accumulated which will be published in bulletins as early as possible.
DEPARTMENT OF CHEMISTRY.

The work in this department is now approaching definite and settled lines of investigation. While perhaps, about one hundred miscellaneous analyses have been made, this class of work is very properly growing less and will practically soon be abolished.

The experiments with sugar beets were continued throughout the current year. Of the one thousand packages of sugar beet seed distributed to farmers throughout the state about three hundred were reported upon. Also two hundred and sixty-five samples of beets were returned and analyzed. While the character of the cultivation and the selection of samples left much to be desired, the general tenor of the results obtained show that the sugar beet may find a congenial home in South Dakota. The results of this investigation were given in a bulletin.

Experimentation with pedigreed sugar beet seed was continued. The mother beets grown and analyzed the previous year were planted and seed was obtained from three of the five samples experimented upon. This seed was planted last spring and at the close of this fiscal year the plats were in fine condition.

Last winter two sacks of sugar beet seed were imported direct from Germany and this was parcelled out among four hundred farmers. Also two plats of one acre each were installed for the purpose of ascertaining the cost per acre of raising sugar beets in this state. One plat is at Milbank under the supervision of Hon. D. W. Diggs and the other is on the college farm. The spring opened discouraging but later prospects are brightening.

Mechanical soil analyses were continued with some few interruptions throughout the year. The work will probably close with this season. Chemical investigations in this line will be next in order.

The analysis of native and introduced grasses was pushed ahead vigorously in the hope of bringing that work to a close the coming year. Owing to the incomplete state of the last two lines of investigation no bulletins on these subjects were issued.
HORTICULTURAL DEPARTMENT.

In the department of Horticulture, experiments during the fall of 1891 were conducted by Professor Keffer and published in bulletin No. 20. This spring the aim has been to continue experiments already begun by Professor Keffer, and to prepare for new work, to be done the coming season.

The orchards have claimed a good share of attention. The trees in the old orchard came through the winter in prime condition, and with the exception of the cherries, never looked better. Many promising varieties are just coming into bearing and records are being taken of their habits of growth, healthfulness, time of blossoming, tendency to set fruit, etc., as it is of the greatest importance to farmers and fruit growers, that a correct knowledge of the adaptability to our climate be obtained, as an index to the selection of the most reliable sorts. In a new orchard, set a year ago, a small section of the trees failed. This space has been filled with apple trees from the college nursery.

Among the forest trees, cultivation is going on in all plats that have not reached that stage of growth which will not admit of it. In the other plats attention is being given to the development of the different varieties, noting tendency to endure close planting, susceptibility to self-pruning, influence upon the hard woods of their different soft wood neighbors, influence of different arrangements in platting upon weed growth, etc.

A new strawberry plantation has been set this season, the following varieties of which are making excellent growth: Cumberland, Crescent, Captain Jack, Charles Downing, Windsor Chief, Dandy, Haverland and West Lawn. Some of these have been tested here before but it was thought best to test them still further.

A large vegetable garden is being grown with a view to determining the comparative merits and cost of production of different varieties. An especial experiment with tomatoes has been begun, one object being to select seeds from best specimens and ascertain the value of acclimating them.

Some of the hardy small fruits and ornamental shrubs are being propagated to test their value, as well as to extend their use among those who are building homes within our state.
During the present year this department has been separated from Horticulture and Forestry, with which it has been hitherto connected. This has necessitated a thorough overhauling of old lines of work and considerable labor has been expended in getting the department in good working order.

The lines of work begun last year has been followed up and considerably expanded, and new experiments outlined and begun. The work on native and introduced forage plants has been continued. Over one hundred species have been studied, and most of them are already in the hands of the chemist for analysis. A large number of these have been cultivated in plats on the Station grounds the past season, and several varieties give promise of fulfilling the requirements for good forage plants for our state. We have been able to make a thorough study of the native forage plants, in the field, throughout the greater part of the state east of the Missouri river, and in some parts of the country west of it. Correspondents in various parts of the state are aiding us materially in getting hold of many facts not otherwise obtainable. A study of the fungous diseases of forage plants is also being made.

A study of the weeds of our state has been begun with special reference to the "Russian Thistle." Collections of our weedy plants are being made. The plants themselves are being studied in the field. Special attention is being paid to the "root system" of each and its bearing on the successful eradication of the plant; the value of each for the forage or fertilizing plants. The vitality of the seeds; and the influence of certain weeds, as squirrel-tail grass, upon the distribution, prevalence and "wintering over" of the grain rusts. The farmers of the state are taking a hand in this work and the outlook is promising.

In the matter of plant diseases, we have studied the rusts, smuts, blights, scabs, etc., found in the state. The "plum pocket" has been very bad this year and we hope, by another season, to be able to recommend an effectual remedy for this disease. The "beet scab" and its relation to the "potato scab" has received considerable attention.
Various fungicides have been tried for our common plant diseases. In some cases good results have been obtained, in others the experiments have been attended with no results or with but indifferent success. This work will receive more attention next season.

The making of a collection of all the plants growing in the state has been well advanced this season; over a thousand species and upwards of ten thousand specimens have been collected. A collection of native woods, fruits, and articles manufactured from plants has also been begun.
DEPARTMENT OF ENTOMOLOGY.

From the beginning of the fiscal year until the close of school in November, the time of the assistant was considerably occupied with laboratory and museum work for the college department; the principal station work was in the care of the bees and in the line of collecting insects. At the opening of the entomological season for 1892 the college and station work of the department was so arranged as to leave the assistant free to devote his whole time to the latter. Early in May an opportunity arose to try the merits of kerosene emulsion on sheep scab. The assistant was accordingly sent to Beadle county, where the disease existed, and spent a week in experimenting. A little later, at the request of the South Dakota Sheep Breeders' and Wool Growers' Association, and at their expense, he attended their annual meeting in Aberdeen, for the purpose of exhibiting the scab mites under a microscope to the members of the association. On both of these trips be examined several flocks of sheep suspected of having scab.

The principal achievement of the latter part of the year was the successful tracing out of the life history of the cottonwood leaf-miner, this insect has been an enigma for several seasons, owing to our inability to rear it to the mature form.

One bulletin, No. 30, was issued by the department this year. It treated of the parasites of the large willow saw-fly; food habits of the striped gopher; a new potato-sprinkler, and some other topics.
DEPARTMENT OF DAIRY SCIENCE.

This department was established by an act of the last state legislature during its session of 1891 by a special appropriation for the erection of a dairy building on the South Dakota Agricultural College and Experiment Station farm, to be designated as the South Dakota Dairy School; to be used for the purpose of instruction in the agricultural and mechanic arts as designated in the Morrill act, for the more complete endowment and support of agricultural colleges; and by the Hatch act, establishing experiment stations for conducting experiments pertaining to agriculture and its pursuits.

At a subsequent meeting of the Boards of Control, plans were submitted for a dairy school building which were accepted and the building ordered built. The building is twenty-four feet by fifty feet east and west and north and south, built in the form of a cross, one and one-half stories high. The arrangement of rooms inside provides for an office, hall and wardrobe or cloak room, in the front wing; a large general work room, student's laboratory, cold storage room for butter, and ice house in main part, with cheese curing room, engine and boiler room, feed grinding room and coal house in rear end of building. This building is equipped with a twin cheese vat, capacity 200 gallons, for cheese making; a large, upright cheese press, hoops, curd knives, etc. For butter making Boyd's cream ripening vat, Babcock's milk tester, Adam's acid test, Boyd's fermenting can, De Laval's power and hand seperator, Whipple's rectangular and Blanchard's barrel churns, a lever butter worker and many fixtures and appurtenances such as are usually found in a modern creamery and cheese factory combined. The power to drive the machinery and to supply steam for heating is furnished by a Watertown, N. Y., steam boiler of ten horse power and steam engine of same make of eight horse power, making in all a very complete outfit for the purpose of teaching, by practical application, lectures and study, the science of dairy practice to students, and for conducting experiments with milk and the products of milk in all its forms with a view to the advancement of the dairy interest throughout the state and for demonstrating
the practical adaptability of dairying to successful agricultural pursuits.

Within the past year there has been added to the dairy plant a large dairy barn, forty by sixty feet in size with sixteen foot posts and basement, full size of barn, eight feet deep, for the accommodation of cows; the upper part to be used for storage of fodder and ground feed. There is also provided in basement of barn a very convenient root cellar for storage of roots for winter use. The cost of buildings, appurtenances, machinery, etc, including barn is about $4,500.

During the year twenty-eight students have had one term each of instruction in butter and cheese making, care of cows, milk, cream, cheese and butter, and have been taught the practical use of all the different apparatus and appliances in use in the department, as applied in the factory, creamery or upon the farm. Some experiments have been commenced in the line of deep and shallow setting of milk for separation of cream, and comparative tests made with centrifugal separation, also ripened cream vs. sweet cream for butter, its keeping quality, etc., together with tests for yield of butter fats with common cows fed on wild prairie pasture with a view to showing the profitableness of the dairy in the extreme west. Owing to the small amount of milk obtainable from the college farm with which to make comparative tests some of these experiments have been unsatisfactory and will be continued and completed when more cows are furnished this department.

Considering that the work undertaken here is new to most of the farmers of this state, who have applied their faculties mostly heretofore to wheat-raising exclusively, this department has received very good support from the people and is fairly launched on the road to the successful accomplishment of its mission, viz: The promotion of the dairy interests of a prairie state.