SEVENTH ANNUAL REPORT

OF THE

AGRICULTURAL

Experiment Station

FOR SOUTH DAKOTA,

FOR THE

FISCAL YEAR ENDING JUNE 30, 1894.

AGRICULTURAL COLLEGE, BROOKINGS, S. D.

1895.

HURON, S. D.
To the Honorable CHARLES H. SHELDON,
Governor of the State of South Dakota.

Sir:—I have the honor to transmit herewith the Seventh Annual Report of the Agricultural Experiment Station of South Dakota, covering the period of the fiscal year ended June 30, 1894, in accordance with the requirements of law.

Yours respectfully,

Lewis McLouth,
Director of the Station.

Brookings, S. Dak., Dec. 1, 1894.
GOVERNING BOARDS.

REGENTS OF EDUCATION.

Hon. Junius W. Shannon, President ................. Huron
Hon. Florenzo G. Hale, Sec'y and Treasurer .... Scotland
Hon. Abel B. Smedley ................................ Milbank
Rev. Walter S. Peterson ............................ Lead
Hon. Martin R. Heninger ............................ Westport
Hon. Lyman T. Boucher ............................. Eureka
Hon. N. W. Egleston ............................... Chamberlain
Dr. H. M. Finnerud ................................. Watertown
Rev. W. H. Jordan ................................. Sioux Falls

AGRICULTURAL COLLEGE COMMITTEE.

Egleston, Chairman; Smedley and Finnerud.

BOARD OF TRUSTEES.

Hon. E. T. Sheldon, President ....................... St. Lawrence
Hon. John Giese .................................. Watertown
Hon. J. G. Carter ................................. Aberdeen
Hon. Lars K. Larson ............................... Dell Rapids
Hon. O. T. Grattan ............................... Elkton
Lewis McLouth, President of the College, Secretary.

STATION COUNCIL.

Lewis McLouth, President of the Council and Director of the Station.

James H. Shepard ................................. Chemist
A. H. Wheaton .................................. Dairyman
D. A. Cormack ................................. Veterinarian
E. C. Chilcott ................................ Agriculturist
L. C. Corbett ................................ Horticulturist
Thos. A. Williams ......................... Botanist and Entomologist
Harvey N. Ott ................................ Animal Pathology

Ed. F. Hewitt, Secretary of the Council and Accountant for the Station.

ASSISTANTS.

John M. Parkinson ................................. Librarian
Cyril G. Hopkins ............................... Assistant Chemist
Hubert B. Mathews ............................... Meteorologist
Edmund T. Bates ............................... Assistant Dairyman
Fred K. Luke ................................ Assistant Horticulturist
A. W. Williams ................................. Farm Foreman
# FINANCIAL REPORT.

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

1894.

To receipts from the Treasurer of the United States for the year ending June 30, 1894, as appropriated by act of Congress approved March 2, 1887...$15,000 00

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<td>&quot; Equipment and Supplies—</td>
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<td>Department of Botany and Entomology</td>
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<td>Association fees</td>
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<td>Periodicals</td>
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$15,000 00 $15,000 00

We, the undersigned, officers of the Board of Regents of Education, have examined the vouchers covering the expenditures of the Agricultural Experiment Station of South Dakota for the fiscal year ending June 30, 1894, 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 Governing Boards. Signed,

J. W. SHANNON, President.

F. G. HALE, Secretary.

Dated December 6th, 1894.
DIRECTOR'S REPORT.

Lewis McLouth.

STATION STAFF.

Nothing of moment occurred during the year to interfere with, nor especially to forward the work of the station. The added experience of the station workers enables them, with each added year of service, to do their work more wisely and with more certain results. The men who were new to the work last year have been diligent, studious and progressive and are showing themselves successful in their departments.

Mr. Edmund T. Bates, a graduate of the college in August, 1893, was at once added to the Station Staff as assistant dairyman, and has rendered efficient service.

It is noticeable, I think, that the older students in the college classes who are employed to work, or to superintend work for the station, are becoming year by year more interested in the scientific problems which the station is engaged with, and more and more of them each year seem to have their thoughts turned toward fitting themselves for service in the field of industrial experimentation. It is certainly a favorable sign, and proves the wisdom of the policy of keeping the agricultural experiment stations in close contact with the colleges. The student is thus enabled to see all about him the immediate application of scientific principle in the business of life.

ADDITIONS TO THE EQUIPMENT.

During the year additions of no inconsiderable importance have been made to the working facilities and apparatus of the station. By the means of a state appropriation for that purpose waterworks, costing $1,500, have been put in that furnish the barns, dairy building, green-
house and laboratories with an abundance of excellent water. The water is furnished by a well near the seed house, and the plant consists of a 16-ft. aermotor, two large tanks, double acting pumps, and about 2,000 feet of iron piping. It is believed that the expenditure of an additional thousand dollars would so far increase the water supply that it might be used for experimental irrigation in the gardens and tree plantations.

Several of the buildings have been materially improved by repair and additions. By the transformation of the men’s dormitory the library of the college and of the station is wonderfully better housed, and the department of botany has been provided with new and capacious quarters. By this change, too, the department of horticulture was greatly benefitted by being left in individual possession of the horticultural building.

Many hundred dollars worth of apparatus and machinery for investigational uses have been added to the equipment of the station.

BULLETINS.

During the year four bulletins were published, as follows: In December, 1893, bulletin No. 37 by the departments of Horticulture and Forestry on Tomatoes; in January, 1894, bulletin No. 38 by the department of Agriculture on Feeding Wheat to Hogs; in February, 1894, bulletin No. 39 by the department of Dairy Science on Milk Tests and Comparison Tables; and in May, 1894, by the departments of Chemistry and Botany conjointly, bulletin No. 40 on Native and Introduced Forage Plants. Fuller mention of these bulletins will be found in department reports subjoined; but it may not be out of place to say here that bulletin No. 40 is by far the largest and most pretentious publication the station has ever issued. It is a 210-page volume, profusely illustrated, and describing botanically and chemically 125 different native or intro-
duced forage plants. Bulletin No. 38 on Feeding Wheat to Hogs, attracted special attention on account of the unprecedented low price of wheat. A summary of the conclusions reached by this bulletin will be found in the subjoined report of the agriculturist.

Considerable progress has been made during the year in the work of indexing and cataloguing the library collection of the bulletins of this station and of other stations; and an attempt is being made through the efforts of the National Station at Washington to complete the files of all the bulletins of the stations by means of a general exchange.

This opportunity is taken to ask all the Experiment Stations and individuals who have received our bulletins to return to us any spare copies of bulletins of this station of the following Nos. 5, 6, 7, 8, 12, 13, 15, 17, 22 and 23, as these are now out of print.

THE PAST WORK OF THE STATION.

The station was organized for work in the spring of 1888, and during the six years and three months of its existence, it has published forty bulletins, six annual reports and a great number of "press" bulletins, or articles prepared for the press by members of the station staff. The bulletins at the present time are mailed to nearly seven thousand five hundred subscribers, mostly in South Dakota. During the six years more than two hundred thousand copies have gone into the hands of the people. These bulletins have treated of nearly every branch of farm industry. They have given the results of numerous experiments in a great variety of farm operations. They must have had their influence in favor of better methods. They have pointed out new lines of industry for the farmers of our state, notably in sugar beet raising, dairying, and the growing of better kinds of live stock.

Still it takes a long time and repeated trials to deter-
mine absolutely many questions. For example, more than one hundred thousand trees have been planted; and after a time the station will be able to give complete and more trustworthy utterances upon the subject of fruit and forest tree growing.

**METEOROLOGY.**

It has been deemed best to give in this report a brief summary of the climatic conditions at the station since May 17, 1888, when meteorological observation began. This covers the time to December 31, 1894.

A table is also added showing the percentage of atmospheric moisture for the six growing months of the year 1890, a year chosen because it was thought to be a fair average year.

**TABLE I.**


<table>
<thead>
<tr>
<th>Month</th>
<th>TEMPERATURE</th>
<th>BAROMETER</th>
<th>RAINFALL</th>
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<td>October</td>
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<td>November</td>
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<td>December</td>
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Actual rainfall for the period, estimated for the first four months of the first year 109.97 inches.

Average rainfall per year, 15.71 inches.
TABLE II.

Average Per Cent. of Humidity for each Day for the Period, April to September, 1893.

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Summary: 2684 | 2756 | 2579 | 2854 | 2360 | 3337
Average: 87.80 | 90.19 | 88.95 | 75.94 | 76.13 | 77.90

Average for the six months is 82.8 per cent.
Department Reports.

AGRICULTURAL DEPARTMENT.

E. C. CHILCOTT.

The following is a summary of the various lines of work conducted in this department with the results so far obtained. It should be borne in mind that unless otherwise stated these results are from a single year's experiments and are not to be taken as conclusive, but simply as the evidence so far obtained, and subject to modification, as the experiments are continued from year to year.

WHEAT—VARIETY TESTS.—Thirty-seven varieties of wheat were sown. The seed was obtained from the North Dakota Station, sown May 3rd., with drill. The following is a list of varieties with estimated yield per acre, character of grain, straw, etc.:

Wellmans Fife, yield 16 bu., grain soft, shrunken, beardless.

Colorado, yield 5 bu., grain soft, shrunken, bearded.

French Imperial, yield 4 bu., grain very soft and much shrunken, bearded.

Wild Goose, yield 24 bu., grain hard and plump.

White Russian, yield 14½ bu., grain large, plump, soft.

Haynes Blue Stem, yield 20 bu., grain large, plump, hard.

Colorado, yield 8 bu., grain soft and very much shrunken, bearded.

Powers Fife, yield 16 bu., grain plump and hard, beardless.

Holbens Imported, yield 19 bu., grain plump and hard.
McKessics Fife, yield 10 bu., grain soft and shrunken.
White Fife, yield 19\(\frac{1}{2}\) bu., grain hard and but little shrunken.
Old Red River, yield 15 bu., grain hard and shrunken.
Assiniboine Fife, yield 19\(\frac{1}{2}\) bu., grain soft but plump.
Red Fife, yield 17\(\frac{1}{2}\) bu., plump and hard.
Summer Cob, yield 12 bu., plump and hard.
White Fife, yield 19\(\frac{1}{2}\) bu., grain hard and but little shrunken.
Okagagon Valley Velvet Chaff, yield 19\(\frac{1}{2}\) bu., grain hard and but little shrunken.
Blonts Hybrid, yield 10 bu., grain soft and much shrunken.

Glyndon (774); yield (?) grain plump and hard.
Glyndon (856), yield 13\(\frac{1}{2}\) bu., grain shrunken but hard.
Glyndon (711), yield 14\(\frac{1}{2}\) bu., grain plump and hard.
Glyndon (696), yield 19 bu., grain hard but shrunken.
Glyndon (664), yield 18\(\frac{1}{2}\) bu., grain hard and plump.
Glyndon (669), yield 20 bu., grain large, plump and hard.

Glyndon (754), yield 20 bu., grain large, soft and plump.
Glyndon (629), yield 18 bu., grain large, hard and plump.
Glyndon (694), yield 18 bu., grain shrunken and soft.
Glyndon (636), yield 16 bu., grain plump but soft.
Glyndon (671), yield (?) hard and not much shrunken.
Glyndon (655), yield 8\(\frac{1}{2}\) bu., grain long, soft and much shrunken.
Glyndon (639), yield 8 bu., grain soft and much shrunken.
Glyndon (673), yield 11\(\frac{1}{2}\) bu., grain shrunken and worthless.
Glyndon (815), yield 16\(\frac{1}{2}\) bu., grain hard and plump.
Glyndon (852), yield 18\(\frac{1}{2}\) bu., grain hard and plump.
Glyndon (816), yield 21 bu., grain hard and plump.
Glyndon (773), yield 22 bu., grain hard and plump.
Glyndon (670), yield 25½ bu., grain hard and plump.

All varieties were badly rusted, and were cut August 10th, several days of hot winds having "dried up" those that were not already ripe.

**Barley—Variety Tests.**—Fourteen varieties of barley were sown May 3rd., with press drill and gave the following results:

- **Empress**, yield 24 bu., grain a little shrunk, weight per bu. 50 lbs.
- **Ontario Six Rowed**, yield 23.16 bu., grain plump, weight per bu. 51 lbs.
- **Oderbucher**, yield 32 bu., grain a little shrunk, weight per bu. 52 lbs.
- **Kalina**, yield 21.83 bu., grain a little shrunk, weight per bu. 50 lbs.
- **Scotch Imported**, yield 28.50 bu., grain plump, weight per bu. 53 lbs.
- **Prize Prolific**, yield 30.67 bu., grain a little shrunk, weight per bu. 51 lbs.
- **Hallet’s Pedigree**, yield 31.66 bu., grain a little shrunk, weight per bu. 52 lbs.
- **Duck Bill**, yield 14 bu., grain badly shrunk, weight per bu. 47 lbs.
- **Imperial**, yield 22.33 bu., grain badly shrunk, weight per bu. 48 lbs.
- **Mansbury**, yield 33 bu., grain plump, weight per bu. 51 lbs.
- **Improved Golden**, yield 28 bu., grain shrunk, weight per bu. 49 lbs.
- **Danish**, yield 33 bu., grain a little shrunk, weight per bu. 49 lbs.
- **Chevelier**, yield 31 bu., grain a little shrunk, weight per bu. 50 lbs.
Improved Cheyenne, yield 28 bu., grain a little shrunken, weight per bu. 50 lbs.

Ontario Six Rowed, Kalina, Scotch Imported, Munsbury, Danish were ripe and cut July 24th; Chevelier and Improved Cheyenne, August 4th, and all other varieties on July 31st. Hot winds did great damage.

Oats—Variety Tests.—Eleven varieties were sown May 6th, with press drill and gave the following results:

- Lincoln, yield 48.87 bu., grain large and well filled, white, weight per bu. 34 lbs.
- White Canadian, 47.25 bu., grain much shrunken, white, weight per bu. 30 lbs.
- Dakota Gray, yield 43.31 bu., grain much shrunken, white, weight per bu. 29 lbs.
- Chanilles Canadian, yield 49 bu., grain plump and fair size, black, weight per bu. 34 lbs.
- Joanitte, yield 53 bu., grain small, black, weight per bu. 34 lbs.
- Black Empress, yield 51.75 bu., grain a little shrunken, black, weight per bu. 33 lbs.
- Poland White, yield 49.50 bu., grain plump, white, weight per bu. 34 lbs.
- Egyptian, yield 36.75 bu., grain large but not well filled, white, weight per bu. 27 lbs.
- Improved American, yield 45.25 bu., grain large but not well filled, white, weight per bu. 27 lbs.
- White Wonder, yield 44.25 bu., fair size, white, weight per bu., 33 lbs.
- White Bonanza, yield 52.18 bu., small but plump, white, weight per bu. 36 lbs.

White Wonder and White Bonanza were cut July 28th; all others July 31st; all were more or less rusted but not as badly as wheat; hot winds seriously affected yield.

Renovating Pastures.—Considerable work has been done in this line but as yet little has been accomplished of
a satisfactory nature. The seasons of 1893-'94 having been very dry it has been impossible to get any kind of grass to "catch."

**Potatoes—Variety Tests.**—One hundred and twenty varieties were grown. They were planted on the 20th day of May, with an Aspinwall planter in rows three feet apart. Below is given a list of the varieties divided into six classes according to yield for the year 1893:

**CLASS I.—YIELD FROM 93 TO 139 BU. PER ACRE.**

- Beauty of Hebron, E,
- Vaughn,
- Early Wisconsin, E,
- Burpee's Surprise,
- Early Puritan,
- Clark No. 1,
- Dakota Red, E,
- Keith Collection,
- Champion of America,
- Polaris,
- Eureka,
- Round Rose, E,
- Vanguard,
- Early Ohio, E,
- Gov. Rusk,
- Thorburn,
- Late Puritan,
- Empire State,
- Charles Downing,
- Bill Nye,
- Arizona,
- New Rose.

**CLASS II.—YIELD FROM 80 TO 92 BU. PER ACRE.**

- St. Patrick,
- South Bend,
- Early Maine, E,
- Allen's Beauty,
- Halo of Dakota, E,
- Kansas,
- Burbank Seedling,
- Gilman,
- Bellair.

**CLASS III.—YIELD 75 TO 80 BU. PER ACRE.**

- Early Telephone,
- Early June, E,
- Early Show,
- Wilson,
- Michigan Rose,
- Bliss Triumph, E,
- New Brunswick,
- Extra Early Vermont, E,
- Pearl of Savoy,
- Vicks Extra Early, E,
- Star White,
- Early Six Weeks, E,
Columbus, Red Peach Blow, White Lily, No Blow, Dr. White.

CLASS IV.—YIELD 58 TO 70 BU. PER ACRE.

Berkshire, Essex, Porter’s Excelsior, Topeka, Dakota Mammoth Pearl, Early Oxford, Early Albion, Rural Blush, Pierce’s Seedling, Rocky Mountain Rose, E, Rural New Yorker, Findley, Snowflake, Iron Clad, Connecticut Blue, White Star, Early Scotch Cottage, Patterson’s Albert, College Seedling, Triumph, Grand Mogul.

CLASS V.—YIELD FROM 52 TO 58 BU. PER ACRE.

Minnesota Pinkeye, Extra Early Seedling, Late Iron Clad, Agowan, Hoffman, Gem, Baldwin, Badger State, Paragon, Minnesota Seedling, Pride of the West, Wall’s Orange, Hotel Favorite, Manly, Lee’s Favorite, Badger, Sunrise.

CLASS VI.—YIELD FROM 17 TO 52 BU. PER ACRE.

Jumbo, Hamsom, Early Minnesota, Canova, Cusco Seedling, White Apple, Early Mayflower, Golden Beauty, West Winsor, Mayflower, London White, Belle, Black Prince, Chicago Market,
Angola, O. K. Prolific,
White Elephant, Colorado No. 2,
White Rose, Tynas Purple,
Early Blue, Ohio Pinkeye,
Brown's Best, Hall's Early Peachblow.

Those marked E were among the best early ones. The season was a very poor one for potatoes, and the yields are much below the average yields of these varieties.

FIELD CORN—VARIETY TESTS—CULTURE.—Although a considerable number of varieties of corn were planted but little data of value was obtained, as the season was a very unfavorable one, especially for crops on low bottom land, having been cold, wet and backward in the spring and very hot and dry in the summer.

FORAGE CROPS.—The following named forage plants were raised experimentally: Jerusalem Corn, Kaffir Corn, Brown Dhuroh Corn, Milo Maize, and Dwarf Essex Rape. None of the above mentioned non-saccharine sorghums have as yet proved to be equal to Indian corn, although they have been tried for several years at this station. The principal objection to them is that on account of their slow growth and lack of vigor when first coming up weeds are apt to get the start of them before they are large enough to cultivate.

Dwarf Essex Rape has proved to be a valuable forage plant when cut green and fed to sheep, lambs and pigs. Rape intended for cutting should be sown at intervals of about two weeks, beginning in May and continuing until August. Some difficulty has been experienced in getting it to germinate when sown during very dry weather, but if it once gets started it stands drought well, but will not afford as many cuttings as during wet weather.

GRASSES.—A large number of grasses and clovers have been grown for a number of years on the farm. A full
description of all of them, together with an analysis of the chemical composition of each variety is contained in Bulletin No. 40, Department of Chemistry and Botany.

Several acres of Smooth Brome grass are now growing on the farm, and it was hoped that we would be able to distribute some seed this year, but the unprecedented drought of the past summer made it impossible to save any seed. About twenty acres were sown last spring but it all blew out when about 2 ins. high. This is unquestionably the most promising meadow grass yet tried, and it is confidently hoped that enough seed can be saved next year to enable us to get it well introduced among the farmers of the state.

Breeding Experiments.—Experiments have been under way for two years to test the value of the Horned Dorset as a cross upon grade Shropshire and grade Merino ewes. Prior to this time, some Merino ewes had been bred to Shropshire rams. Besides our pure bred sheep, we now have the following described cross bred sheep and lambs:

**SHEEP.**

Three Ewes, $\frac{1}{2}$ Shropshire and $\frac{1}{2}$ Merino.
Two Ewes, $\frac{3}{4}$ Shropshire, $\frac{1}{4}$ Merino.
One Ewe, $\frac{1}{3}$ Shropshire, $\frac{1}{3}$ Merino, $\frac{1}{3}$ Horned Dorset.
Two Wethers, $\frac{1}{4}$ Shropshire, $\frac{1}{4}$ Merino, $\frac{1}{4}$ Horned Dorset.
Three Wethers, $\frac{3}{4}$ Shropshire, $\frac{1}{4}$ Merino.

**LAMBS.**

Four Ewes, $\frac{1}{4}$ Shropshire, $\frac{1}{4}$ Merino, $\frac{1}{4}$ Horned Dorset.
One Ewe, $\frac{1}{2}$ Merino, $\frac{1}{2}$ Horned Dorset.
Two Wethers, $\frac{1}{4}$ Shropshire, $\frac{1}{4}$ Merino, $\frac{1}{4}$ Horned Dorset.

A record is being kept of the results of the various crosses to ascertain the effect upon both the weight of fleece and size, and time required for maturity of carcass. While nothing conclusive has as yet been proved, all indi-
cations tend to show that the Horned Dorset will prove a valuable breed to use as a cross upon grade sheep when early maturity, hardiness, fecundity, and good mutton producing qualities are desired.

**SWINE.**

Duroc Jersey sows have been bred to Poland China boars with very good success. The offspring being fully equal, if not superior, to pure bred animals for pork. Some of these cross bred sows have been sold for breeders and when bred back to Poland China boars have given good results.

We now have two of these sows which will be bred to a Poland China boar.

**Feeding Experiments.**—**Feeding Wheat to Hogs.**—An experiment to ascertain if possible the relative value of wheat, ground and unground, corn and peas, as well as the price per bushel which could be realized for the same when fed to hogs and the pork sold at a given price (5½ cents dressed) was begun on Sept. 5th, and closed on Dec. 5th. Full details of this experiment can be found in Bulletin No. 38.

The following is a summary of some of the results obtained from this one experiment:

**Questions Asked.**

This experiment was undertaken to answer the following questions:

1. Can the farmers of this state realize more from their wheat by feeding it to hogs, than by selling at present prices for wheat and hogs?
2. Can wheat be profitably fed without some other food to form a balanced ration?
3. Will it pay to grind wheat as food for hogs?
4. How does wheat compare with corn and peas as food for hogs?
5. How does the quality of pork made from wheat compare with that made from corn, peas, and mixed food?

6. How does the average daily gain of hogs fed on an exclusive diet of wheat, corn or peas, compare with that of hogs fed on mixed foods?

7. When should fattening begin and how long should it continue?

**Answers Obtained.**

The answers obtained from this experiment are as follows:

1. Hogs, averaging about 100 lbs in weight can be purchased near September 1st. at $4.50 per hundred live weight, fed three months on nothing but wheat, water, ashes and salt, and an occasional handful of hay or corn fodder, butchered and sold December 1st, for $5.50 per hundred dressed; and will return from 56 to 58 cents per bushel for wheat consumed, without allowing anything for manure, or labor in caring for hogs.

2. At present prices wheat can be profitably fed as an entire ration, but it would undoubtedly pay better to mix it with some other food, particularly during the earlier stages of fattening.

3. Hogs fed on ground wheat made a more rapid and uniform gain, and produced pork of rather nicer quality; but they also consumed more food than those fed upon whole wheat. Those fed ground wheat required 4.81 pounds of wheat to produce one pound of gain, while those fed whole wheat required 4.91 pounds to make the same gain. Ground wheat brought 58.39 cents per bushel, while that fed whole brought 55.83 cents per bushel, a difference of only 2.56 cents per bushel. This would hardly pay for grinding, but considering the better quality of the pork and greater weight, it would probably pay to grind, if it could be done without much extra cost.

4. Ground wheat brought 58.39 cents, whole wheat
55.83 cents, peas 65.36 cents, and corn 60 cents per bushel, on an average, for all the grain consumed during the entire experiment, continuing for 90 days. Hogs fed on peas did much better, in proportion, during the first part of the experiment than they did during the latter part, which would indicate that peas are not as good for a complete ration for a long period as either wheat or corn.

5. The quality of the pork made from corn and ground wheat was about equal, and was superior to that made from whole wheat, peas or mixed food. That made from mixed food was the fattest. (See cuts in Bulletin 38).

6. The average daily gain of hogs fed on peas was 1.21 pounds, on whole wheat 1.12 pounds, on ground corn 1.40 pounds, on ground wheat 1.32 pounds; and on mixed foods 1.61 pounds.

7. This question was not settled, but it was very plainly demonstrated that a considerably larger return per bushel for food consumed would have been realized if the hogs had been sold at the end of the second period (October 28th.) This was particularly true of Lot I, fed on peas. The decrease in rate of gain in proportion to food consumption for those fed cornmeal and wheat was no greater than could be accounted for by the natural result of increased weight and age.

Better results would undoubtedly have been obtained if the change from mixed food and plenty of exercise to close confinement and a single article of food, to which they were not accustomed, had been made gradually; as the number of pounds of food required for a pound of gain was greater during the first period than during the second, whereas, it should have been less.

Silos and Ensilage.—Early in the spring of 1894, it was decided to make the subject of silo and ensilage, in connection with stock feeding—especially dairying—a leading feature in the work of this department for the
ensuing year, and as much longer as might be necessary to make a thorough study of this important subject in all its details—from the sowing of the corn to the marketing of the product in the form of butter, cheese, mutton or beef. This proposition received the hearty approval of the Station Council and Board of Trustees. An elaborate experiment was accordingly begun with a number of varieties of corn, sown in various ways, in order to ascertain if possible the best variety and also the best way of sowing corn for ensilage. Material was purchased for a silo and the foundation was built. When the experiment was well under way and everything looked favorable for successful work in this line, circumstances, over which this department had no control and for which it was in no wise responsible, made it necessary to indefinitely postpone all work in this line.

Sundry Investigations.—Various lines of work have been undertaken which will necessarily take several years to complete, or in fact, to obtain any results that will be of value. The following are some of them: Effect of continuous cropping to flax, millet, oats, and barley; subsoil plowing, spring and fall; deep vs. shallow plowing; spring vs. fall plowing; drill vs. broad cast seeding; experiments with manures.
At the opening of the fruit show at the World’s Columbian Exposition in September, 1893, this department was represented by the largest collection of native plums then on exhibition, also several varieties of tomatoes, apples, jellies and canned fruits added to the display.

During the year the nucleus of a garden and forestry herbarium has been formed. Plants representing all the cultivated varieties grown upon grounds during the year were collected and pressed, as well as specimens of many of the wild and cultivated trees and shrubs. One object of the collection at this time is to have material for comparing, from time to time, the modifications undergone by the native plants that are at present attracting the attention of cultivators.

Beside the more important lines of work pursued during the year and reported in special bulletins, and answers to questions requiring the experience of more than a single season to settle, the following brief statement of some of the problems under consideration is deemed advisable.

Snow Catch.—In the spring of 1892, one plat of elms was added to the forest plantations, and, as is well known, trees suffer most from lack of moisture during the first years of their growth, it was thought worthy of attention to provide some means of preventing the rapid evaporation characteristic of cultivated grounds in this country. The trees themselves although planted only four feet apart each way, were too small to afford any covering to the exposed earth, and as a partial soil cover and a protection to the trees at the same time a hill of corn was planted to the south and a little to the west of each tree. This was given clean culture during the season and at maturity it was
topped, thus leaving the stiffer portion of the stalks standing. The average height of these remaining stalks was about two feet. During the winter there was perhaps a little more than the usual snowfall with less than the usual accompaniment of wind, but at few periods during the winter was there a complete snow cover on fall plowing or even stubble fields, while in the tree plat there was a constant snow cover varying in depth but averaging thirteen inches. In many places, particularly in those quarters facing the prevailing winds, the snow collected in the first five or six rows of stalks until the tops only projected above the snow bank. This heavy cover remained a number of days after the neighboring unprotected ground was bare, and as snow melted gradually most of the water found its way into the soil, and in this way materially advanced the growth of the trees in the plat.

The beneficial action of the cornstalks, then, was two fold, first, making a windbreak and giving the needed shade to the young trees; and second, as a means of giving them a winter protection and an added water supply for the following season.

Wind-Breaks.—The importance of wind breaks can not be over estimated in this country. It is well known to planters that corn and small grains grow best and suffer least from winds and drouth when planted to the leeward of a belt of trees, even so small a protection as a row of currant bushes may be the means of protecting the young and tender plants. This was noted this season on a new strawberry plantation. The first five rows of the patch were unprotected by the currant plantation, which was south of the remainder of the patch. On the 12th of May, the day following the first heavy sand storm, the young plants of these rows, which were previously well established and in full leaf, presented the appearance often seen in old patches that have been neglected and have
“hove out” during the spring frosts and lay lifeless, withered and drying in the sun. The remainder of the patch which was in the lee of the currant bushes suffered much less. This experience adds strength to the argument in favor of a wind-break for the protection of young and tender crops.

**Bedding Plants.**—The Coluns, the plant used to make up a large portion of the so called “carpet bedding” in the parks of our large cities, does not stand the test of our intense Dakota sun; for even when growing well it changes color so markedly after planting in the open, that combinations at first pleasing become ugly because of the change in color of the foliage. Only two forms of this plant are worthy of attention here, one having a yellow leaf with green veins and fluted edges, the other a dark red leaf similar in form to the preceding. Pansies stand well at the north of a building or under the protection of a hedge, but nothing has given better satisfaction than the purple and white Ageratum and the yellow variegated Althernanthera.

**Greenhouse.**—One of the marked successes of the year was the construction of an inexpensive greenhouse built on the plan of a hot-bed and using hot-bed sash, the whole structure, except the roof, being below the surface of the ground yet arranged in the form of a greenhouse.

During the winter of 1893-94 a successful crop of tomatoes was grown in the greenhouse, but owing to the light demand of the local markets this branch of gardening is not encouraged; and further experiments have been abandoned.

In the spring of 1894 the fruit plantation was increased by eighteen varieties of strawberries, one of cherries, and several of plums. The results of grafting European varieties of plums upon native stocks has been more than satisfactory, and if the grafts survive the
winter, further experiments will be undertaken with both plum and sand cherry stocks.

The results of the experiments of the year with tomatoes were published in Bulletin No. 37, from which the following summary of conclusions is quoted:

1. "There is not enough gain to warrant the additional trouble and expense of sowing tomato seeds before March 1, and for the ordinary field crop they should not be planted later than the middle of March."

2. "Single stem training makes the crop earlier but reduces the quantity materially."

3. "Seeds from green fruits gave larger fruits and a greater weight of fruit per plant than sun-ripened or normal."

4. "Cutting plants are decidedly earlier and more productive during the early part of the season than normal or parent plants."

5. "Pruning plants before setting in the fields retards maturity of the fruit."

6. "The three best varieties tested were Dwarf Champion, Early Ruby, and Early Advance."

A press bulletin on "Strawberries" was issued in the March 3rd number of the Industrial Collegian for the current year. In this was given a brief outline of the best methods of planting and culture together with a list of varieties worthy of cultivation.

Acknowledgements.—I take pleasure in acknowledging the hearty co-operation of the fruit growers of Brookings county in preparing an exhibit for the World's Fair, as well as in acknowledging the following donations:

Prof. L. H. Bailey, Ithaca, N. Y., cuttings of currants.

Prof. W. M. Munson, Orono, Me., cions of Moor's Arctic plum.

Mr. J. W. Corbett, Watkins, N. Y., cuttings of Con-
cord grape, Buck Thorne, and cions of German prune, and Lombard plums.

Hon. H. C. Warner, Forestburg, S. D., eight varieties of Dakota grown tomato seed.

T. L. McCrea, Tyndall, S. D., cions of apples, seeds of tomatoes and two trees of Red Beitigheimer apples.

A. Norby, Madison, S. D., one Dwarf Rocky Mountain cherry and plum cions.

H. Biggar, Aurora, S. D., one-half dozen plants of Staghorn Sumac, Rhus typhany.

W. Atlee Burpee, Philadelphia, Pa., vegetable seeds.

J. C. Vaughn, Chicago, vegetables seeds.

Northup Braslan, & Co., Minneapolis, Minnesota, vegetable seeds.

Secretary Japanese World's Fair Commission, collection of beans.

A. Carpenter & Sons, Vermillion, S. D., collection of native woods.
During this fiscal year, the work of this department has been along two lines. The analysis of feeding stuffs and forage plants was completed during the fall months of 1893. In all, 143 analyses in duplicate were made. This work was begun in the years 1889-90.

A complete report of this work may be found in Bulletin No. 40, which was issued in May by this department acting conjointly with the department of botany.

In the spring of 1894 it was decided by the authorities of the college that an investigation of the artesian waters of the state should be made by this department. In accordance with this decision twenty wells were selected which were geographically distributed as uniformly as possible over the artesian basin of the state. From these wells authenticated samples were taken by the assistant chemist and the work of analysis is well under way. It is expected that this work will be completed this fall.

As in years past some miscellaneous work has been done which is of little or no value to the state at large. While it is to be regretted that such work seems unavoidable, it may be urged that local benefits do accrue. In all perhaps one hundred analyses of waters, minerals, etc., have been made. Of such work no records can be made in the form of bulletins or otherwise.
The work of this department has been mainly along the lines planned a year ago.

Bulletin 40 on “Native and Introdced Forage Plants” has been published in conjunction with the Department of Chemistry. In addition to this, press bulletins have been issued on “Russian Thistle,” “Rust of Small Grains” and “Spraying.”

The correspondence of the department, within the state, has been more than double that of any previous year. It has been chiefly in relation to forage plants, weeds and injurious insects.

The study of our weedy plants has been continued and the first bulletin may be expected in the near future.

In connection with the department of agriculture a series of experiments on potato scab was begun this spring. Various fungicides are being used and certain varieties of potatoes are being studied with reference to their power of resisting disease. The results of these experiments will be published later. Enough has been learned already to prove that potatoes should not be planted in soil which has produced a crop of scabby potatoes the previous year, and that it pays to treat seed potatoes for scab even in such a dry season as this has been.

The study of other plant diseases has been continued, particularly the diseases of the fruit and forest trees, and small grains.

The season has been a very abnormal one and its effect upon the development of insects and fungous diseases has been very marked. The boxelders have been almost free from cecropias and the willow sawfly has been very rare, having been seen by myself, in injurious
quantities, in but two localities, and these in the north-
eastern part of the state. The cottonwood leaf-beetle has
also been exceedingly scarce. On the other hand, grass-
hoppers have been much more plentiful than usual, and
the various species of borers have done more apparent
damage than in ordinary years.

The collection of biologic series of our injurious insects
has been continued.

Despite the unfavorable year some good results have
been obtained in the breeding experiments. Very interest-
ing facts have been learned concerning the life history of
a small moth causing gall-like swellings in the twigs of
boxelder. The plum sawfly has been traced through
nearly all the stages of its yearly cycle.

Much time has been spent in the study of certain
plant lice (belonging chiefly to the genus *Pemphigus*) which
have been very plentiful on the underground portions of
certain of our root crops. Garden beets have been partic-
ularly liable to their attacks.

The small grains have suffered very little from insect
depredations. Grasshoppers did some injury in occasional
instances. The grain louse (*Siphonophora avenae*) appeared
in oat fields but only in small quantities. An undeter-
dined species of fly did more or less injury to wheat.

On the whole very little damage has been done by
insects as compared with previous years.

Several insects have been found feeding on the Rus-
sian thistle, the most important of which is the caterpillar
of a small moth, probably *Mamestra trifolii*. It has been
found occasionally before, feeding upon lamb's quarters,
various species of *Atriplex*, clover and other plants.

These insects will be studied further during the com-
ing season.

The working facilities of the department have been
very materially strengthened by the addition of some
much needed apparatus for the study of certain questions in vegetable pathology and physiology.

The herbarium has been increased by valuable collections of fungi, grasses, and weedy plants as well as by a large number of plants of our own collecting. Through the kindness of Mr. F. V. Coville, botanist to the Department of Agriculture at Washington, an almost complete set of Mr. Rydberg's collection of Black Hills plants has been added to the herbarium, so that we now have a fairly representative collection of the plants of the state.

We are making a collection of the seeds of all the native and introduced plants found within the state, giving especial attention to weeds, forage plants and native flowers and fruits worthy of cultivation.

During the coming year the study of fungous and insect enemies of our fruit and forest trees, forage plants and grains will be continued, as also the work on the weeds of the state. New lines of work will be mainly on questions pertaining to plant physiology, namely the water supply of growing crops and the physiological effects of certain conditions existing in our state.
The work of this department during the past year has been of a varied character.

In addition to our regular station and college duties, we have responded to calls from stock owners and local boards of health, in the following counties, viz: Brookings, Codington, Clark, Faulk, Hamlin, Kingsbury and Spink, for the purpose of investigating supposed outbreaks of contagious and infectious diseases among domestic animals.

During the past few years, special attention has been called to the prevalence of tuberculosis among domestic animals, more particularly among cattle throughout the United States; and in many states the dairy herds at the experiment stations have been either partially or completely destroyed by this dangerous disease.

This department is making preparations for testing the dairy herd of this station with the "tuberculine test."

During the year we have received several bottles of mallein from the United States Bureau of Animal Industry at Washington, D. C., with which we have tested a large number of horses in different parts of the state. With this mallein test, glanders is very readily detected in horses, especially when the disease exists in the sub-acute form so common in this state.

There is more danger to the farmers of South Dakota from this disease than from all others put together. The disease is found to exist all over the state, and in such a hidden form that the affected animals are in good flesh, and apparently in a healthy condition; yet at the same time they not only have the disease, but they transfer it to other horses and also to man.

During the year we have travelled upwards of 1,800
miles while engaged in this work, and have answered upwards of 400 communications relating to the diseases of domestic animals.

This department is now engaged in an investigation as to the cause of the "bottom disease" (so called) among horses on the Missouri river, and also regarding the extent of tuberculosis in South Dakota.
During the year this department has been consolidated with that of agriculture, and hereafter it is to be conducted as a part of the agricultural department, under the management of the professor of agriculture. Some of the work indicated as begun, in last report, has been carried out and published in Bulletin No. 39 of this station.

The work incident to ascertaining the relative value of the several dairy breeds of cows for this climate is being carried on, and the results carefully noted.

Some experiments are in progress in which the variation of butter fats and other solids of the milk of individual cows is being investigated, together with a practical and speedy method of keeping accounts, and testing composite samples in creameries and cheese factories.

During the winter and college vacation the head of this department was called out to participate in a number of farmers' institutes held in different parts of the state, all of which were well attended by farmers and their families. At these meetings lectures were given on the practicability of more diversified methods of farming, with special reference to the advantages to be derived from dairying and the saving of time and increased value of products by the use of modern appliances. Practical demonstrations were given in separating milk and cream with a hand separator and in testing the quality of milk of different cows by the use of Dr. Babcock's Milk Tester.

The good results of this work were demonstrated by an increased interest in dairy husbandry as shown by the erection during the early summer of numerous creameries and cheese factories, and by the establishing of private dairies throughout the state.
Since it is the purpose to confine the work of this department for the present chiefly to bacteriological research, the main effort of the year in which the department has been under the present head, has been directed toward the preparation and equipment of a suitable bacteriological laboratory. Unavoidable delays in the importation of apparatus have prolonged this work of preparation; but now that a reasonably fair equipment is secured the department will, during the coming year, take up as its chief work, a study of the bacteria of milk, butter and cheese, their economic and health relations.