REPORT OF THE PRESIDENT

OF THE

SOUTH DAKOTA AGRICULTURAL COLLEGE

AND THE

DIRECTOR

OF THE

Agricultural Experiment Station

FOR THE YEAR ENDING JUNE 30, 1903

As Required by Act of Congress, August 30, 1890

1903
DUTCHER & BREED, PRINTERS
Brookings, S. D.

REPORT

To the Honorable Secretary of the Interior and the Secretary of Agriculture:

GENTLEMEN: As required by Act of Congress, August 30th, 1890, I have the honor to submit to you the annual report of the South Dakota Agricultural College for the year ended June 30th, 1903.

STUDENTS DURING YEAR ENDED JUNE 30, 1903.

	Male.	Female.
Preparatory classes	117	37
Collegiate classes	107	32
Post Graduate courses	2	1
Short or Special courses	137	54
Number that pursued courses in Agriculture		15
Number that pursued courses in Mechanical Engineering		25
Number that pursued courses in Electrical Engineering		25
Number that pursued courses in Architecture		0
Household Economy		10
Veterinary Science		3
Dairying		11
Military Tactics		160

	Men.	Women.
Students graduated during year	24	7
Average age of graduates		22

DEGREES CONFERRED.

	Men.	Women.
Master of Science	2	
Bachelor of Science	10	7
Pharmacy Graduates	12	0

CERTIFICATES ISSUED ON COMPLETION OF SHORT COURSES.

Agriculture	0

Amanuensis	14
Art	1
Commercial	5
Dairy	5
Domestic Science	2
Music	1
Steam Engineers	23
Total certificates issued	51

PROFESSORS AND INSTRUCTORS DURING YEAR ENDED JUNE 30, 1903.

	Male.	Female.
Preparatory classes	3	
Collegiate and Special classes	23	4
Total, counting none twice	26	4
Number in Experiment Station Staff	6	

VALUE OF ADDITIONS TO EQUIPMENT DURING YEAR ENDED JUNE 30, 1903.

Buildings	$1,175.00
Library	125.00
Apparatus	1,000.00
Machinery	800.00
Total	$3,100.00

STUDENT LABOR DURING YEAR ENDED JUNE 30, 1903.

Number of students employed	122
Average amount earned by each student	$ 42.46
Total amount expended for student labor	5,180.76

RECEIPTS FOR AND DURING YEAR ENDED JUNE 30, 1903.

1.	State Aid—	
	Appropriation for current expenses	$26,500.00
2.	Federal Aid—	
	Morrill Fund (Act of August 30, 1890)	25,000.00
	Hatch Fund (Act of March 2, 1887)	15,000.00
3.	Fees and all other Sources—	
	Tuition fees	2,282.00
	Incidental fees	3,033.50

Miscellaneous receipts	17,921.89
Total	$89,737.39

EXPENDITURES FOR AND DURING YEAR ENDED JUNE 30, 1903.

Instruction (as required by Morrill Act)	$25,000.00
Instruction in other subjects	7,500.00
Administrative expenses, fuel, etc.	20,662.75
For building and repairs	3,085.85
For Experiment Station	15,223.70
Total	$71,472.30

PROPERTY, YEAR ENDED JUNE 30, 1903.

Value of all buildings	$170,000.00
Value of apparatus	12,000.00
Value of machinery	3,700.00
Value of library	5,300.00
Value of farm and grounds	40,000.00
Value of unsold land	800,000.00
Total number of acres in farm and ground	400
Total number of acres under cultivation	200
Acres used for experiments	80
Number of acres allotted to the College when state was admitted	160,000
Number of bound volumes in library	7,126
Number of pamphlets in library	10,600

I also submit herewith the report of work done in our Agricultural Experiment Station during the year ending June 30, 1903, as required by the rules of the Department of the Interior.

Respectfully submitted,

JAMES CHALMERS,
President.

ANNUAL REPORT
OF
THE DIRECTOR OF THE EXPERIMENT STATION
FOR THE FISCAL YEAR ENDING
JUNE 30TH, 1903.

Mr. James Chalmers, President:

SIR: I have the honor to transmit herewith the annual report of the Experiment Station for the fiscal year ending June 30th, 1903.

Very respectfully,

JAMES W. WILSON,
Director.

The work of the past year includes a larger field of investigation than ever before. Special effort was made to conduct such investigations as were most applicable to the needs of the farmers in this rapidly developing agricultural state, and along as many different lines as the limited funds of the Station would permit.

The personnel of the working force is the same as last year, except the addition of one assistant in Animal Husbandry, and one assistant in Chemistry.

The Station staff consists of six members, who are also at the head of their respective departments in the College. These departments are as follows: Agronomy, Chemistry, Horticulture, Botany and Entomology, Animal Husbandry and Veterinary Science. To a considerable extent their work is inter-dependent. Considerable work in co-operation with the United States Department of Agriculture, in the introduction of new fruits, grains, grasses and their improvement, has been done which will prove of value not only to this state but to the entire Northwest.

The Department details two men to assist in these investigations. One is located at Brookings and the other at the state farm near Highmore, South Dakota. By growing the same crops in these two sections of the state it affords a better field for the adaptation of new varieties of grains and grasses than would be possible with the one station, because the soil and climatic conditions of the two localities are quite different.

Five different bulletins, Nos. 77 to 81, inclusive, were pub-

lished during the year on eleven different subjects, viz: Macaroni Wheat, Fringed Tapeworm in Sheep, Crop Rotation, Lamb Feeding, Fattening Sheep on Grass, Pasture and Forage Plants in South Dakota, Feeding Dairy Cows, Flies, The Artesian Waters of South Dakota, Some Destructive Insects and The Elements of Prairie Horticulture.

Bulletin 77 on Macaroni Wheat concludes that this wheat can be raised in all parts of South Dakota, that it will yield from twenty-five to one hundred per cent more than the best Bluestem and Fife wheats under ordinary conditions; that the difference in yield in favor of the Macaroni wheats increases as the conditions for the production of bread wheat decrease; that Macaroni wheats can be raised in dry sections where the bread wheats fail. It can be ground in the flouring mills of the state without extensive modifications of the apparatus used for milling the bread wheats and that the Macaroni flour contained a higher per cent of nitrogen than that made from the bread wheats, and is, consequently, a richer food. In this bulletin the results of experiments conducted by the Professor of Domestic Economy in the College in the making of bread, breadsticks, rusks, rolls, and other forms of eatables are reported.

A short article by the Chemist treats of the milling properties of this wheat. A bulletin giving the analysis of all the varieties of Macaroni Wheat tested at this station will be published during the next fiscal year. Great progress has beeen made in this state, through the efforts of the Station, in producing Macaroni wheat. The local millers pay within two cents as much for it as for the bread wheats and intend to add the coming winter the additional machinery necessary for the manufacture of flour. Steps are now being taken by the Department of Commerce, through its agents abroad, to establish a better market for the wheat than we now have.

In Bulletin No. 78 the life history of the Fringed Tapeworm affecting sheep, its distribution in the United States, and the diagnosis, prevention and cure, are given in detail.

The results of crop rotation experiments since 1897 are reported in Bulletin No. 79. There are several illustrations, as object lessons, of one kind of grain following another in rotation and a report of the advantages and disadvantages of the same. It

not only includes the carefully prepared crop records of the grains and grasses but also a record of the temperature and precipitation for the past six years. It states in detail the results of one crop following another of the same kind and of different crops under the same or different conditions. The conclusions are, in every respect, practical, and very beneficial to the farmers of the state.

Bulletin No. 80 includes two experiments, one on Lamb Feeding and the other on Fattening Sheep on Grass. In the former experiment a carload of lambs were fed different feeds in nine different lots, but otherwise under the same conditions. An attempt to feed two of the lots ground grain proved unprofitable on account of the non-palatability of the feeds. The lambs made a better gain after the wool was removed than they did before shearing. It also appeared advantageous to dip the sheep in the fall before putting them in the feed lot. The individual gains of these lambs were published separately in order to give the reader an idea of the variations in the fattening of sheep on the same kind and different grain rations. In the second experiment the daily record of the feeds were published for the purpose of showing the gradual bringing to full feed, or all they would eat, with the five different lots receiving grain on grass. As the season advanced the food value of the native grasses decreased, from the fact that the sheep receiving grass alone lost in weight. This loss was undoubtedly occasioned by the frequent rains in the fall, partially washing out the soluble ingredients after the grass was cured.

Bulletin No. 81 treats in detail of five experiments on the last five enumerated subjects above mentioned. It sets forth the advantages of keeping sheep for renovating pastures, the results of extended tests of different grasses and forage plants for the past ten years, results of feeding ensilage, Bromus inermis and alfalfa hay to dairy cows and the comparative value of speltz, corn and barley when fed to different cows under the same conditions. The results are given of trials with various spraying mixtures for the prevention of flies on stock and the mode of application. Analyses are given of the medicinal properties of the artesian waters of the state, the form of the occurrence of minerals in these waters, their effect upon soils and vegetable life, a complete analysis from

the deep artesian wells throughout the state in general, and the effect of using these waters for irrigation purposes. It also contains a short article on the Hessian fly, Wheat Aphis and other injurious insects to farm crops. Forty-one pages are devoted to a resume of the experiences and the results of experiments at this station along horticultural lines, intended more especially for new settlers in this state.

These bulletins are in demand not only by residents of this state but by non-residents who have interests here. New names are placed on our regular mailing list every day and the bulletins seem to be appreciated by the farmers in general.

DEPARTMENT OF ANIMAL HUSBANDRY.

Quite extensive preparations are being made on the Farm in order to provide facilities for experiments along the lines of breeding and feeding animals. While the farm is supported by funds directly from the state it is a valuable adjunct to the Experiment Station along live-stock lines, the aim being to raise such crops and animals as can be utilized in experiments.

There are at the presnt time seventeen breeds of pure-bred domestic animals on the farm besides a herd of twenty-four head of common dairy cows. During the winter of 1902 and 1903 an experiment was conducted with these cows to determine the relative feeding value of ensilage, Bromus inermis and alfalfa hay, when they were receiving the same grain ration, and of speltz, corn and barley when they were receiving the same roughage ration.

Two other experiments were conducted with feeding sheep on different kinds of grain and the same kind of roughages.

An experiment has been inaugurated in breeding these common dairy cows to representatives of the leading breeds of beef cattle in this state, viz: Shorthorn, Aberdeen Angus and Hereford, in order to ascertain which is the best breed for the farmer to keep. This experiment is to cover a period of three years, breeding the same cow once to each of the beef-bred bulls, feeding their progeny exactly the same, and marketing the same time each year. It is proposed in this experiment to market the progeny at from eighteen to twenty months old. An experiment is now under way, in feeding calves skim milk in supplying the fat extracted by the separator.

An experiment is to be undertaken this winter with feeding steers on millet, speltz, barley and corn for the purpose of ascertaining the comparative value to corn of the three first mentioned grains for the production of beef.

I have one assistant in this department and he was very successful last winter in topping the Chicago market with both lots of sheep used in experiments aforementioned.

Outside the farm and its equipment the state does not provide any funds to do experimental work in this department, notwithstanding the fact that the live-stock industry ranks as the most important one in the state.

The state appropriates $1,000.00 annually for the maintenance of a station at Highmore and it is supervised by the members of this Station. The various forage plants, grasses and legumes are being tried there in order to get some that are suitable for this comparatively dry section and also to develop new grains and grasses suitable for these conditions.

The following is a statement showing how the $15,000.00 received annually from the federal government is expended:

Salaries	$9435.00
Agriculture	1048.40
Botany	389.97
Chemistry	500.19
Horticulture	1234.90
Printing	1196.38
Animal Husbandry	698.58
Executive	443.01
Zoology	53.57
Total	$1500.00

For a more detailed statement of the work I refer you to the reports from the different departments hereto attached.

Very respectfully,

JAMES W. WILSON,
Director.

DEPARTMENT OF AGRICULTURE.

J. W. Wilson, Director.

SIR: Complying with your request for a report on the work of the Agricultural Department of the Experiment Station for the

fiscal year ending June 30th, 1903, I submit the following: The work for the past year has been the continuation of the work of former years and has consisted mainly of the following lines of work: Co-operative work with the United States Department of Agriculture in the testing of new varieties of grain and forage plants: Testing of winter wheat and rye, spring grains, forage plants, grasses and field crops, independent of the United States Department of Agriculture. A continuation of the work in Crop Rotation which was begun in the spring of 1897 and has been carried on continuously and systematically since that time. Experiments in Soil Physics involving the movement of soil water and the available plant food in the soil. In connection with the above named lines of work a careful record has been kept of the meteorological conditions. A special feature of this meteorological work and one of great importance on account of its not having been carried on to any considerable extent at other points is the work in the evaporation of water from an exposed surface.

Three bulletins were issued during the fiscal year. Bulletin No. 77 upon Macaroni wheat contains the results of our co-operative work with the United States Department of Agriculture and some of the experiments conducted by James H. Shepard, the chemist of the Station, and Alice Dynes Feuling, the professor of Domestic Economy in the College. It is believed that this bulletin contains much valuable information that the farmers were urgently in need of. The importance of the subject of Macaroni wheat growing in this state can hardly be over estimated. It would seem that the work has been carried to a point by this station where it needs the assistance of the United States Department of Agriculture in establishing a foreign as well as a home market. We understand that this is being done not only by the Department of Agriculture but by the United States Department of Commerce. As soon as they succeed in bringing about the desired results in the way of markets it is believed that the value of the work of this Station in the introduction of Macaroni wheat will be appreciated by everyone interested in the industrial development of this state.

Bulletin No. 79 upon Crop Rotation is a preliminary report giving a detailed description of the work in Crop Rotation, which has been in progress since 1897, and an attempt to point out some

of the probable results of this work. While it is too early to draw any very definite conclusion as to the best rotation for this state it has already been clearly demonstrated that this work, if continued under the present plan, will be of great value to the farmers of the state. The scope of the work has been somewhat enlarged during the past season, but the general plan has not been and will not be changed materially so long as it is under the present management. Many letters of commendation and of encouragement have been received from the farmers of the state, who have furnished many valuable suggestions for this work. It is hoped that the farmers will continue to respond in this manner, as they can greatly assist us thereby.

Bulletin No. 81 contains an article upon Pasture and Forage Plants for South Dakota, issued by this Department. While this article is largely a re-issue of an earlier bulletin, much new matter has been added, based on more recent experiments, and the work along the lines indicated in the title has been brought down to the present date and the results given in a concise form. The rapid growth of the live-stock interests of the state makes the matter of pasture and forage plants one of great interest to the farmers at this time and it is believed that the work of the Station in this line is being appreciated by them.

The work of the current fiscal year will be carried under the same general plan as that of the preceding year. No entirely new lines of work have yet been planned, but we hope to extend and broaden the lines of investigation along which we have been working. We will probably take up the subject of Available Plant Food as determined by laboratory analysis in connection with our work in Crop Rotation. A large mass of data has accumulated concerning soil moisture. The experiments which have been conducted in the laboratory throw much light upon some of the results we have obtained in our field work in Crop Rotation and we hope to publish some of these results in connection with that work, in our next bulletin upon that subject.

The destructive hailstorm which completely destroyed all of the crops upon our experimental plats will make it impossible to publish some bulletins that we expected to issue during the current fiscal year.

The testing, breeding and selection of corn will receive more

attention than it has in the past. Some of the varieties of corn introduced by this Station during the past years have proved of great value to the farmers of the state, particularly Minnesota No. 13, which was obtained from the Minnesota Experiment Station and sent out to the farmers from this Station.

Respectfully submitted,

E. C. CHILCOTT.

DEPARTMENT OF HORTICULTURE.

James W. Wilson, Director.

SIR: I have the honor to make the following report of work in the Department of Horticulture for the fiscal year ending June 30th, 1903. The experiments have been along the lines noted in my earlier reports. In brief, it is realized that South Dakota is a new state, with many unsolved problems in horticulture. An abundance of certain kind of orchard and small fruits can be raised, providing proper care be given and suitable varieties selected. In the hope of increasing the list all old and new varieties of fruits, trees, shrubs, vegetables and flowers deemed of any promise for this region are tested as far as facilities permit. However, it has already been demonstrated at this Station that certain classes of plants are a commercial success in all the grain raising sections of the state, and the question of varieties is now largely a local one.

"NEW CREATIONS" IN FRUITS.

Over a large area of the prairie Northwest it is agreed by fruit-growers that the main need is the origination of new varieties of orchard and small fruits better adapted to prairie conditions than any now known. We must create a new pomology. It is only in recent years that the immense importance of plant-breeding has become generally recognized. Plant-breeding means the originating of improved varieties by selection, crossing, and hybridizing. These are often termed "new creations," and the work corresponds to that of invention in the domain of the mechanical industries. A strictly hardy winter apple, a hardy cherry, or a hardy grape of large size and good quality would be worth millions of dollars to the prairie Northwest The work of this Station is mainly with the native fruits of this vast region. The exact number of seedlings will not be

known until digging time this fall, but a careful estimate places it at fully one quarter of a million. The new plant-breeding building and greenhouse authorized by the Legislature in 1901 has aided greatly in this work and we hope the facilities will still further be improved in the near future.

One of the main fruits under amelioration is the native sand cherry. From among many thousands of seedlings over one hundred varieties have been selected and are now under propagation. A few were sent out last fall and this spring to many Experiment Stations and private experimenters for trial in other parts of the Union. Some plants of the third generation began to bear this season. The sand cherry appears to hybridize readliy with other species of the genus and the fruiting of our many hybrids of this character is awaited with interest. Last summer a two hundred and fifty mile trip was taken northwest and west of Pierre, especially among the Sioux Indians along the Cheyenne River, hunting for sand cherries and other native fruits, and much valuable material was secured. This spring over 14,000 strawberry plants of some 225 varieties, selected from the seedling patch, were transplanted to the field for further trial and the selection of the best few for distribution elsewhere. These plants are hybrids of the wild northwestern strawberries with choice tame varieties. Some promising raspberries of similar half wild and half tame ancestry are also under propagation. Seeds of many hybrids and crosses of various fruits were obtained this year and are now in sand for spring planting.

VEGETABLES.

The present season some 850 varieties of vegetables were on trial with the co-operation and under the direction of the United States Department of Agriculture, but the severe hailstorm of July 15th ruined nearly all the plants. Seeds of two new varieties of very early vegetables have been raised. One, a watermelon, was distributed last year; the other, a sweet corn, is ready for next spring. These were both obtained in Russia by the writer for the United States Department of Agriculture in 1897-98.

ORNAMENTALS.

Several varieties of hardy imported shrubs are under

propagation for trial elsewhere. The department does not run a commercial nursery but it is realized that the true value of any new plant can only be determined by trial in the various parts of the state, and it is deemed advisable to do this before the nurserymen propagate them on a commercial scale. Last year a hardy Siberian rose *(Rosa rugosa)* and the native South Dakota rose were hybridized with choice cultivated roses and promising seedlings obtained this year. The present season about 3,000 blossoms of these two roses were crossed with pollen of choice double roses and considerable seed is now in sand for spring planting. Those who have planted tame roses in several of our northwestern states and lost them from winter-killing, realize the need of this line of effort.

TREE CULTURE.

The Black Hills of South Dakota and other parts of the western mountain region contain evergreens of far greater value to prairie planters than any of the common species from the moist coast climate of western Europe. Certain problems arise concerning their ready propagation. One great problem in raising evergreens is preventing the "damping off" or rotting before the true leaves have developed. Experiments in this line of work were started last year.

IMPORTATIONS.

Early in the winter two large importations of choice fruit trees were received from Europe by courtesy of Secretary James Wilson of the United States Department of Agriculture. A variety of the Vladimir race of cherry secured by the writer in Russia in 1897, under commission from the United States Department of Agriculture, proved hardy during the severe winter of 1898-99. The past two years show the fruit to be desirable in size and quality, and propagation was begun last year for introduction under the name "Moscow." From the same source a choice, large, black currant was received, which is now under propagation; also a large, red currant, with leaves apparently proof against the fungus causing the early loss of foliage during the summer. As the Rusian name appears too unwieldy for American tongues the name "Czar" is suggested. From the same source two new willows were received and cuttings from them

were sent out in quantity this spring. One appears excellent for tying purposes and basketry, the other of promise for windbreaks. A considerable quantity of Crab Apple seed from the heart of Siberia was received, and many thousand seedlings are now growing this season as the result.

BULLETINS AND MISCELLANEOUS.

The preparation of Bulletin 76, A Study of Northwestern Apples, was delayed until certain notes could be verified at the fruit displays at the State Fairs of Minnesota, Iowa and South Dakota. In 143 pages, with 81 cuts, a summary is given of my study of Northwestern apples during the past eleven years. In Bulletin 81 the 44 pages devoted to "Elements of Prairie Horticulture" contain a review of former bulletins and some new points of interest to beginners. Considerable material has accumulated which will be published at the earlest possible date.

The tree cellar for which the Regents appropriated $300.00 last summer was constructed last fall. It is 50x16 feet, and last winter proved excellently adapted for storing trees.

Much new light in plant-breeding was received at the International Conference of Plant Breeders and Hybridization in New York City, which I attended last fall, under commission from the Regents of Education.

The correspondence of this department is steadily increasing and indicates that South Dakota is taking greater interest in matters horticultural. Part of the inquiries are answered at length in the agricultural press of the state to afford greater publicity to the information given.

Respectfully submitted,

N. E. HANSEN,

Horticulturist.

DEPARTMENT OF CHEMISTRY.

Director James W. Wilson.

DEAR SIR: I take pleasure in submitting herewith a report of the work done by the Chemical Department of this Station during the fiscal year ending June 30th, 1903.

The entire time of this Department has been devoted to work upon different varieites of wheats now under investigation by the South Dakota Station. The object of this work has been,

in the first place, to make nitrogen control tests of the new wheats being propagated under cultural tests. In the second place, it is desirable to ascertain which of the new wheats now under propagation are best for general introduction.

In the third place, a series of milling tests have been made, in order to determine which of these new varieties will be best from the miller's standpoint. In this work the yields of bran, shorts and flour have been determined quantitatively. Also the nitrogen content of these different products has been determined in order to ascertain their food value. Also this work will throw light on the protein distribution among the different mill products. Again, the wet and dry gluten in the flour has been determined for each variety.

In order to give some idea of the work involved, the following statement is given. This includes analyses to close of fiscal year:

No. samples analyzed for Nitrogen control	256
No. samples wet and dry gluten	184
No. samples milled	92
No. Nitrogen determinations for same	736
No. moisture determinations	736
Total	2004

In addition to work just enumerated considerable quantities of flour have been milled for baking tests with the new Macaroni wheats. Also much more has been employed in experiments in the manufacture of macaroni and vermicelli.

The results of the year's work are now nearly ready for publication in bulletin form.

Very respectfully,

JAS. H. SHEPARD,

Department of Chemistry.

DEPARTMENT OF BOTANY AND ENTOMOLOGY.

The work of the Botanist and Entomologist the past year has been along lines laid down in last year's report, i. e.: Plant Breeding, The Study of Rusts and Insect Pests, the testing of Drought Resisting Plants at the Highmore Station. In Plant Breeding, the amount of ground allotted to the work has been largely increased and the number of new varieties has been

doubled. Many very promising forms of wheat have been produced and at least two new varieties of Cow Peas have been made which should be of value to the state. Many inquiries have been answered with reference to insect pests. Considerable advice as to the destruction of grasshoppers and a press bulletin on Hessian-flies and other destructive insects issued.

At the Highmore Station Mr. Sylvester Balz, a well trained and careful agriculturist, has been appointed as superintendent. Millets, corns, alfalfa and several varieties of saccharine and non-saccharine sorghums, besides a large number of perennial grasses, are being thoroughly tested. Considerable success has also been attained in seeding Brome grass into the native prairie. A bulletin on the results of the work of the Highmore Station will soon be issued.

Respectfully submitted,

D. A. SAUNDERS.

DEPARTMENT OF VETERINARY SCIENCE.

Director James W. Wilson.

SIR: I have the honor of submitting the following report for the fiscal year ending June 30th, 1903. The work of the department has been confined to investigations of those diseases appearing almost exclusively in the vicinity of the Experiment Station. This has been rendered obligatory on account of the impossibility of obtaining any extended leave of absence from college duties for field work. The diseases most prevalent and demanding especial attention are blackleg, hog cholera, haemorrhagic septicaemia, parasitic diseases of sheep, and a peculiar disease of horses in which the most prominent feature are a progressive anaemia and a marked polyuria. The latter disease so far has been confined to particular localities and a further investigation may show it to be due to dietory or hygienic errors. In addition, the department has published a preliminary report on the fringed tapeworm of sheep (Thysanosoma fimbriata).

Very respectfully,

E. L. MOORE.