

Compliments of

Wm. M. Liggett,

Chairman

**ANNUAL REPORT**

OF THE

**AGRICULTURAL EXPERIMENT STATION**

OF THE

**UNIVERSITY OF MINNESOTA.**

1896.



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# University of Minnesota.

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## OFFICERS OF THE STATION:

WM. M. LIGGETT	- - - - -	Director.
WILLET M. HAYS, M. Agr.,	- - - - -	Agriculturist.
SAMUEL B. GREEN, B. S.	- - - - -	Horticulturist.
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THOS. SHAW,	- - - - -	Animal Husbandry.
T. A. HOVERSTAD, B. Agr.,	- - - - -	Asst. in Agr., Crookston.
WARREN W. PENDERGAST, B. Agr.,	- - - - -	Asst. in Agr., Grand Rapids.
ANDREW BOSS,	- - - - -	-Asst. in Agr., Univ. Farm.
R. S. MACKINTOSH,	- - - - -	Asst. in Hort., Univ. Farm.
J. A. VYE,	- - - - -	Secretary.

The Bulletins of this Station are mailed free to all residents of the State who make application for them.

MINNEAPOLIS, MINN., July. 1, 1897.

*To His Excellency David M. Clough, Governor of Minnesota:*

I have the honor to transmit to you herewith the annual report of the Agricultural Experiment Station of the University of Minnesota, for 1896.

J. S. PILLSBURY,  
*President Board of Regents.*

## List of Bulletins Published during the Year 1896.

	Page.
PRESS BULLETIN No. 6, Feb. 10, 1896.—Smut in Wheat .....	
PRESS BULLETIN No. 7, April 22, 1896.—Azoturia.	
BULLETIN No. 47.—Flax.—The Draft of Flax on the Soil, and the Composition of Flax Soils. The Feeding Value of Flax Products.....	3
BULLETIN No. 48.—Insects Injurious in 1896.....	31
BULLETIN No. 49.—Rate of Increase on the Cut-over Timber Lands of Minnesota.....	259
BULLETIN No. 50.—Progress at the Several Experiment Farms in 1896. Beans, Variety Tests.—Barley, Variety Tests.—Corn, Variety Tests.—Oats, Variety Tests.—Wheat, Variety Tests.—Wheat, Smallest vs. Largest, vs. Hardest Kernels for Seed.—Rotation of Crops; Cross Rotation Experiments.—Sugar Beets, Cost per Acre and per Ton.—Root Crops, Variety Tests.	305
BULLETIN No. 51.—Bovine Tuberculosis.....	343
BULLETIN No. 52.—Potatoes.—Variety Tests in 1896. Potato Implements.....	419

**REPORT**  
OF THE  
**DIRECTOR OF THE EXPERIMENT  
STATION CORPS.**

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This report of the Minnesota Experiment Station gives a summarized statement of disbursements and receipts first, for twelve months beginning January 1, 1896, and ending Dec. 31, 1896 inclusive; second, for six months beginning January 1, 1897 and ending June 30, 1897 inclusive; and third, a statement of expenditures from the Hatch fund for the United States fiscal year ending June 30, 1897. This change has been made that our annual reports may hereafter cover the period embraced by the United States fiscal year which ends June 30th. This statement shows that the University of Minnesota expended in 1896 \$10,419.63 more in carrying on the experiment work than the Hatch fund (\$15,000 annually), received from the United States government. Following the statement is the financial report of the two sub-stations provided for by the legislature of 1895, and the one previously established on the farm of O. C. Gregg in Lyon county, Minnesota. Location of the Crookston and Coteau Sub-stations and the purpose of their establishment were given in previous annual report.

VI.

THE UNITED STATES APPROPRIATION, 1896-7.

DR.		
To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1897, as per Act of Congress approved March 2, 1887.....		\$15,000.00
CR.		
By Salaries.....	\$4,635.65	
Labor.....	5,987.38	
Publications.....	677.59	
Postage and Stationery.....	441.18	
Freight and Express.....	244.00	
Heat, light and water.....	314.55	
Chemical supplies.....	110.11	
Seeds, plants and sundry supplies.....	418.94	
Feeding stuffs.....	512.14	
Library.....	36.10	
Tools, implements and machinery.....	273.20	
Furniture and fixtures.....	90.05	
Scientific apparatus.....	20.54	
Live stock.....	673.18	
Traveling expenses.....	143.09	
Contingent expenses.....	218.10	
Building and repairs.....	204.20	
Total.....	\$15,000.00	15,000.00

D. W. SPRAGUE, *Accountant.*

FINANCIAL STATEMENT.

Statement of disbursements and receipts of the Minnesota Agricultural Experiment Station for the twelve months beginning Jan. 1, 1896, and ending Dec. 31, 1896, inclusive.

	Disbursements.	Receipts.	Cash Outlay.
Station.....	\$8,464.29	\$ 432.85	\$8,031.44
Agriculture.....	4,665.84	228.09	4,437.75
Horticulture.....	3,804.86	372.35	3,432.51
Chemistry.....	1,753.48	100.00	1,653.48
Entomology.....	1,088.81	.....	1,088.81
Veterinary.....	1,243.21	197.73	1,045.48
Dairy.....	1,357.44	.....	1,357.44
Animal Husbandry.....	6,342.69	1,969.97	4,372.72
	<u>\$28,720.62</u>	<u>\$3,300.99</u>	<u>\$25,419.63</u>
Coteau.....	548.07	326.27	221.80
Crookston.....	9,475.52	440.81	9,034.71
Grand Rapids.....	13,318.43	75.22	13,243.21
	<u>\$52,062.64</u>	<u>\$4,143.29</u>	<u>\$47,919.35</u>

J. A. VYE, *Secretary.*

VII.

Statement of disbursements and receipts of the Minnesota Agricultural Experiment Station for the six months beginning Jan. 1, 1897, and ending June 30, 1897, inclusive.

	Disbursements.	Receipts.	Cash Outlay.
Station.....	\$6,795.61	\$ 231.30	\$6,564.31
Agriculture.....	2,037.18	316.08	1,721.10
Horticulture.....	2,098.68	163.80	1,934.88
Chemistry.....	934.94	3.20	931.74
Entomology.....	552.81		552.81
Veterinary.....	654.55	173.40	481.15
Dairy.....	719.90		719.90
Animal Husbandry.....	1,933.16	1,388.08	545.08
	<u>\$15,726.83</u>	<u>\$2,275.86</u>	<u>\$13,450.97</u>
Coteau.....	*258.70		258.70
Crookston.....	1,770.44	261.17	1,509.27
Grand Rapids.....	2,244.84	234.32	2,010.52
	<u>\$20,000.81</u>	<u>\$2,771.35</u>	<u>\$17,229.46</u>

\*\$233.93 paid by current expense.

J. A. VYE, *Secretary.*

In June, 1896, the second sub-station was located at Grand Rapids, Itasca county donating about 370 acres, Messrs. Morrison & Brown, 80 acres, and the University paying to Itasca county \$3,500 for the buildings and improvements made upon the land. This sum was paid on July 2, the deed received and title approved by the Attorney General. The object of this Station is to benefit north-eastern Minnesota, where the farmers recognize their need of special information on how to cheaply clear the land, how to produce permanent pastures or pasturage of summer crops on the sandy lands, how to clear swamp lands of stumps and subdue the surface so as to make a soil suitable for meadow, kind of grass to sow and what variety of grains, fruits and vegetables are best to plant on the sandy, the clayey and the immense areas of peaty soils. These are all questions of wide interest affecting large amounts of investments of money and labor. Especial emphasis will be placed upon the experiments looking to the keeping up of the fertility of the large amount of light soil in this part of the state, and the importance in this connection of experiments



and demonstrations in live stock and dairy husbandry. This sub-station is in charge of Warren W. Pendergast, assistant in agriculture, a graduate of the College of Agriculture of the University of Minnesota. Additional buildings have been erected and the farm is fairly equipped. Farmers in the vicinity of the sub-stations are taking interest in the work and will be enthusiastic supporters if a sufficient annual appropriation is made to carry them on in a practical manner.

The work in the division of Agriculture along the lines of farm, field, and crop improvement, cultivation and management has been extended, systematized and made more practical, both from the stand-point of demonstrating what good farming is and in experimenting to find better things. Experiments in the study of field management have progressed most satisfactorily. The central feature of these experiments is the system of 44 plots, each to run a number of years in a distinct rotation of crops or method of farming. During 1896 the crops on these plots were good and the figures and notes gathered regarding yields, etc., are valuable. These experiments promise important results. Another line of work to discover better methods of experimenting with pastures and meadows in their rotations has also given useful facts. The testing of new varieties of grain and forage crops, the production of new varieties by breeding, and the study of the principles of breeding as applied to field crops promise substantial results in the way of better seeds for our farmers and a better knowledge of the principles of breeding. A variety of corn, called "University No. 13," was the first sent out as a practical result of these experiments. This corn is the Yellow Dent suited to about one-third of the state. Several hundred bushels have been sold in small lots and in nearly all instances excellent results have been reported. The study of methods of breeding has been extended to all our important grain forage and root crops and new varieties of most of them are being produced by selection or by crossing followed by rigid selection.

Prof. Hays is giving much attention to the best methods of planting, cultivating and harvesting all the improved

crops of the farm and especial attention is being given to the best methods of handling the field to conserve soil moisture in seasons lacking ample rain fall. Not only are those crops sought which will best resist drought, but an effort is made to find the best combination on succession of crops which will be most profitable under droughty conditions, as by trying to grow them on clay or light soil, and studies are made of how best to get the rain-fall into the soil for each crop, and then how best to conserve it there by proper methods of tillage. Bulletin No. 50 has been published by Prof. Hays of this department, with Messrs. Hoverstad, Pendergast and Boss assistants in agriculture.

In the division of Horticulture the crops were good with the exception of strawberries and grapes. The apple orchard produced well and several varieties fruited for the first time. A new seedling orchard of about 600 trees was set out last spring and has done well.

Important changes and additions have been made in the forestry plantation. The forestry and the fruit plantation at Coteau farm have done well and are of much interest.

Two bulletins have been published by this division, one on "The Rate of Increase on Cut-Over Timber Lands of Minnesota," and one on "Potatoes and Potato Machinery." Prof. Green has prepared a book of 224 pages, entitled "Vegetable Gardening," which gives the results of the latest experiment work in the line of vegetable growing, besides furnishing a text book for our school of agriculture. The collection of photographs for record has been increased. Two hundred and thirty negatives and over 200 stereopticon slides have been made for illustrating the different phases of progress in horticulture and for use in lectures.

In the division of Entomology, bulletin No. 48 was issued, which contains a full description of insects injurious in 1896. During the year 1,233 farmers received diseased spores to enable them to combat the chinch bug, and according to their reports applied them with results more or less beneficial. The frit fly, wheat-stem maggot and the Hessian fly, insects which are destructive to our small grains, have been studied and the remedies and results are given. It is shown that the

latter insect, which at one time was very threatening to our crops, even more so than the chinch bug, has been more than decimated by parasites, and if the remedy proposed in the bulletin is carried out there is no danger for the future. The common army worm, erratic army worm, white grubs, hairy rose-beetles, domestic cricket, leaf hoppers and other injurious insects are fully described and illustrated, and the proper remedies are given to destroy them.

The history of two injurious plum insects is also given and especial attention has been given to the "Parasites of Man and Domesticated Animals," and all species found in Minnesota have been described and illustrated. This part of the bulletin will be used as a text-book in the School and College of Agriculture.

Two species of migratory locusts, or grasshoppers, were exceedingly numerous near Taylors Falls and threatened the whole state. Dr. Luggar and his assistant devoted considerable time in inaugurating a war against them. The work done by 230 hopper-dozers shows that local invasions by such dangerous locusts can be overcome with concerted action and crops can be saved in this manner, and what is found more important, locusts can be prevented from spreading all over the state by timely and well directed action.

In this division, as well as in all the divisions, the correspondence has grown to such an extent that much time is required to answer letters. The museum, which contains besides botanical and entomological specimens a fair collection of the animals and birds of Minnesota, is growing rapidly.

In the chemical division the work has been along the line of soil and food investigations. Bulletin No. 47, relating to flax, has been published, and material has been prepared for another bulletin relating to the action of manures upon soils, and the production of humus.

The human food investigations, during the past year, have been confined mainly to the subjects of bread and flour. The topics considered being: (1) The food value of different kinds of bread; (2), the digestibility of different kinds of bread; (3), the losses of nitrogen during bread making and

the factors which cause the greatest losses; (4), the gluten of wheat, and what makes a good gluten for bread-making purposes and what causes a poor gluten; (5), and the composition of the gluten from northern grown wheats, and the gluten from foreign competitive wheats, as Russian wheat, Indian wheat, South American wheat, etc. The work relating to the food value of bread and flour has been carried on in co-operation with the United States Department of Agriculture.

The soil work has been continued along the lines as stated in Bulletin No. 41. About 100 soils have been analyzed since the last report, making in all about 300 analyses of Minnesota soils. Particular attention has been given to soil faults, as alkali soils, peat soils, "gumbo" soils, etc. The chemical and physical analysis of the soil type has been very beneficial in determining the adaptability of new crops to the various parts of the state.

In addition to the soil and food investigations, many miscellaneous analyses have been made for other divisions of the Station and for the farmers of the state.

Prof. Snyder has prepared for the U. S. Department of Agriculture an article on Humus in Relation to Soil Fertility; and a work entitled "The Chemistry of Dairying," of 162 pages, has been published during the year and adopted as a text book in our School of Agriculture.

The line of work in the dairy division as published in Bulletin No. 35 has been continued during 1896. The accumulated data are being compiled for publication. The work thus far has accomplished much in determining the type of cow that gives the best returns in the dairy.

Prof. Haecker is giving close attention to many of the minor details that need further investigation before fixed and verified laws can be formulated governing animal nutrition. To complete this work so that it will be accepted as authority it must be supplemented by more work in the line of food of support and the raising of young animals of the various types and working them in the dairy a number of years, carefully weighing all food consumed, recording all growth made and dairy products yielded and preserving

photographs taken each year from calthood. By this method can be demonstrated the type of calf that should be bred for the special dairy cow. Results obtained with the combined milk and meat producing cows are not satisfactory as they show a greater discrepancy in the cost of butter between this type and the special dairy type than seems possible. Prof. Haecker believes that further experiments should be made with cows combining milk and flesh producing qualities.

During the past year there has been an unusual demand for dairy meetings, and in response to these requests there have been some sixty held in various portions of the state.

The Veterinary division has completed the work with tuberculin as originally planned and results have been published in Bulletin No. 51, "Bovine Tuberculosis." The people of Minnesota have been somewhat aroused to the importance of this matter, and there has been quite a general call for tuberculin from various parts of the state. The early opposition which the tuberculin test met is rapidly disappearing.

It is demonstrated in this bulletin that the effect of this test on non-tuberculous cows is practically negative as to general health and milk flow; that the effect on tuberculous cows is rather favorable than otherwise, and the effect on fattening steers negative. Tuberculin has also been proven curative in certain cases. Radical or extreme measures of extermination to cover the entire state are not deemed practical at present.

As a result of these investigations it is evident that the city dairies should be more vigorously and promptly dealt with for the reason that there is a large percentage of tuberculosis among these cattle, and they are kept where they may do the most harm.

The Veterinary division has been urging the tuberculin test because it is believed that this is a serious matter and one worthy of considerable work and expense. Interesting data have been collected concerning the wisdom of raising calves from tuberculous cows by removing the calves from the cows and rearing them on wholesome milk. Results show that this may be entirely practical under certain easily defined conditions.

Experiments with cathartics have been continued since our last report. The experiments with barium, both by intravenous injection and per mouth, have been completed, as also those with hypodermic cathartics in which eserine was used as a basis. A great amount of important and valuable statistics have been collected in this work. A third series of experiments is now under way, which includes the use of the old cathartics given by mouth, such as aloes and various oils. When this work has been finally completed a bulletin will be issued on the subject. The breeding experiments will be continued at least another year. Clinical work at the hospital is constantly growing and is resulting in a large collection of valuable records.

The Animal Husbandry division has continued the work of growing and fattening beef animals, sheep and swine. Experiments have been conducted in fattening steers to ascertain the merits of moderate and heavy grain rations in making beef. Range steers have been fattened to determine the practicability of this work on the ordinary farm and the profit arising therefrom under existing conditions. Animals have also been grown for meat making on the early maturing plan and by feeding them on cheap foods to ascertain the benefit that may accrue to the farmers by growing beef in the same way.

Sheep and lambs have been fattened on various kinds of food to determine the comparative values of these for making mutton. Wethers and lambs have been brought in from the range and fattened to demonstrate the advantages that may be reaped by the farmers from doing likewise and also to determine the profit from feeding these respective classes of sheep. Extensive experiments have also been carried on in growing summer forage for sheep. In these experiments the most surprising results have been realized. Much has been discovered in this line that should prove of great practical value to the farmer. The experiment has also been continued in changing the breeding habit in sheep with encouraging results.

Experiments have been carried on with swine, more especially with certain crossbreds with the object of ascer-

taining how they compare for the production of meat and for breeding. These, however, were rendered of but little use for the time being through a visitation of hog cholera, the infection of which was brought to the station by persons visiting the same from infected districts.

Prof. Shaw wrote an article on "The Canada Field Pea," which was published in the Year Book of the department of agriculture at Washington for 1895. Ample material has been compiled for three bulletins, which will soon be ready for the printer.

The farmers of Minnesota have shown much interest and appreciation of our work during the past year. Through the invitation of J. J. Hill, president of the Great Northern Railway Co., and the liberality of the officials of the St. Paul & Duluth, of the Minneapolis & St. Louis and of the Soo Line, delegations of farmers from various counties and districts of the state have been enabled to spend a day visiting University Farm and the School of Agriculture. Carleton county upon invitation of the St. Paul & Duluth Railway Co., sent the first delegation of representative agriculturists, seventy-five in number. Otter Tail county sent the second by the invitation of J. J. Hill, ninety in number. Then followed Kittson, Marshall, Douglas, Swift, Stevens, Stearns, Kandiyohi, Wilkins, Morrison, Polk and others with like representative delegations of farmers who came as guests of the Great Northern; also delegations of one hundred each from Traill county, North Dakota and Watertown, South Dakota. This company requires some one to head a delegation from a county and to select two or three representative farmers from each town in the county and about ten at large, making the delegation from sixty-five to a hundred. An extra car is attached to the regular train and for transportation each delegate is required to wear a badge bearing the name of his county. The Minneapolis & St. Louis road has usually brought in large delegations representing the counties along its line. Delegations are received here and at the noon hour lunch is served; after this the principal of the school and each member of the experiment corps, and frequently some of the teachers are

presented to the delegates and in a few minutes talk, present their part of the work of the farm and in the school. Four thousand persons have visited us during the past year and each delegation has given expression by resolution or otherwise of a hearty approval of the work being done both at the station and school.

This station has published in all 52 general and 8 press bulletins, which embrace a wide range of agricultural subjects included under the following heads: Animal husbandry, entomology, botany, horticulture, forestry, chemistry, veterinary medicine, and general agriculture. These bulletins are issued for gratuitous distribution to the citizens of this state who apply for them. Of each general bulletin 20,000 copies are printed.

WM. M. LIGGETT,

*Director.*



