

THIRTEENTH ANNUAL REPORT

OF THE

Agricultural Experiment Station

OF THE

UNIVERSITY OF MINNESOTA.

Fiscal Year July 1, 1904 to June 30, 1905.



AUSTIN, MINN.
The Basford Co., Printers.
1906.

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

Minneapolis, Minn., July 1, 1905.

To His Excellency, John A. Johnson,

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 the fiscal year ending June 30, 1905.

JAMES T. WYMAN,
President Board of Regents.

**LIST OF BULLETINS PUBLISHED DURING THE FISCAL
YEAR, ENDING JUNE 30, 1905.**

	Pages.
Press Bulletin No. 21, Seed Wheat Famine.....	
Press Bulletin No. 22, Insects and Insect-like Animals attacking Live Stock in Minnesota.....	
Press Bulletin No. 23, Dipping Live Stock.....	
Press Bulletin No. 24, Seed Grain.....	
Bulletin 87—Horticultural Division—Potatoes at Uni- versity Farm	1-12
Bulletin 88—Entomological Division—Injurious In- sects in 1904	13-190
Bulletin 89—Division of Agricultural Chemistry—Soil Investigations	191-212
Bulletin 90—Division of Agricultural Chemistry—1. Heavy and Light Weight Grains. 2. Starchy and Glutenous Grains. 3. Light and Dark Colored Flax Seed. 4. Rusted Wheat. 5. Milling Tests of Wheat	213-238
Bulletin 91—Northwest Experiment Farm, Crookston, Minn.—Poultry Culture in Minnesota.....	239-258
Bulletin 92—Division of Agricultural Chemistry—The Digestibility and Nutritive Value of Cottage Cheese, Rice, Peas and Bacon	259-275

REPORT OF THE DIRECTOR OF THE EXPERIMENT STATION.

To the President of the Board of Regents:

I have the honor to transmit herewith the thirteenth annual report of the Agricultural Experiment Station of the University of Minnesota, covering the work done at the Station at St. Anthony Park, and the two sub-stations established by an act of the legislature in 1895, the one at Crookston and the other at Grand Rapids, Minnesota.

The report includes Bulletins 87 to 92 inclusive, published during the fiscal year, and a full account of the expenditure of the annual appropriation from the United States Government, as well as that received from the current expense fund of the University.

The Minnesota Agricultural Experiment Station, in account with the United States Appropriation, 1904-1905.

Dr.

To receipts from the treasurer of the United States, as per appropriation for fiscal year ending June 30, 1905, as per act of congress approved March 2, 1887.....	\$15,000.00
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By salaries		\$10,129.03
By labor	2,284.62	
By publications	75.28	
By postage and stationery	317.21	
By freight and express	27.63	
By heat, light, water, and power	777.25	
By chemical supplies		
By seeds, plants and sundry supplies	254.91	
By fertilizers	40.00	
By feeding stuffs	703.78	
By library		
By tools, implements, and machinery	54.25	
By furniture and fixtures	5.75	
By scientific apparatus		
By live stock	185.00	
By traveling expenses	12.15	
By contingent expenses		
By buildings and repairs	133.04	
Balance	\$15,000.00	\$15,000.00

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FINANCIAL STATEMENT.

Statement of disbursements and receipts of the Minnesota Experiment Station for the twelve months beginning July 1st, 1904, and ending June 30, 1905, inclusive:

	Disbursements.	Receipts.	Cash Outlay.
Station	\$16,441.89	\$651.25	\$15,790.64
Agriculture	11,274.78	1,482.26	9,792.52
Horticulture	4,511.83	713.73	3,798.10
Chemistry	3,153.51	16.57	3,136.94
Entomology	1,205.30	1,205.30
Veterinary	2,160.41	156.90	2,003.51
Dairy	1,200.00	1,200.00
Animal Husbandry	9,990.04	3,167.15	6,822.89
	<hr/>	<hr/>	<hr/>
	\$49,937.76	\$6,187.86	\$43,749.90
Crookston	\$6,900.87	\$900.87	\$6,000.00
Grand Rapids	5,049.77	1,049.77	4,000.00
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	\$11,950.64	\$1,950.64	\$10,000.00

VII

DIVISION OF AGRICULTURE.

The work for the year in the Division of Agriculture has been a continuation of tests of varieties of grain which have been a prominent feature of the work since 1890; methods of cultivation have been studied and a great deal of work has been done in rotation of crops; the work with tame grasses and alfalfa has been especially encouraging. The experience of recent years goes to show that it requires only proper tillage and preparation of land, combined with the selection of good seed, to insure growing alfalfa in most parts of Minnesota.

The plant breeding work carried on in co-operation with the United States Department of Agriculture is on a sound basis and results are rapidly being obtained. We now have in the field tests, several promising varieties of grain that have been originated through cross breeding or straight selections from the crop nursery.

The bulletin on farm statistics which was mentioned in the report of a year ago as being ready for publication was held to get further data on subjects where averages were desirable. It was thought advisable to retard publication a year rather than to publish results which were not absolutely reliable. The farm management bulletin has been held for similar reasons though both are now practically ready for publication. Material has been gathered also for a bulletin on *Bromus Inermis* and will be published as soon as is deemed advisable.

During the fall of 1904 the Division made quite a comprehensive exhibit of methods of field crop breeding at the St. Louis Exposition. This work was, likewise, in co-operation with the United States Department of Agriculture and resulted in a wide dissemination of knowledge of the methods employed in Minnesota for developing new varieties of grain. It is a matter of pride to the division that one of the new varieties of wheat developed in the crop nursery (Minnesota No. 169) was given a grand championship prize at this exposition.

A reorganization of this division was made necessary in January, 1905, by the appointment of Prof W. M. Hays to the position of Assistant Secretary of Agriculture. His associate, Prof. A. Boss, has been placed in charge of the work and Mr. A. D. Wilson and Mr. E. C. Parker have been made assistants in Agriculture.

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REPORT OF THE DIVISION OF HORTICULTURE.

The work in the division of Horticulture and Forestry for the past year has included the following lines of experimentation, which are largely a continuation of work which has occupied our attention for a number of years past.

The work of originating hardy varieties of apple is still carried on, both at this station and at Owatonna, the object being to find varieties that are better fitted to our conditions than those we now have. Our seedling orchard has been increased by the addition of several hundred permanently set seedling trees, and about 10,000 seedlings have been raised from seed of our hardiest kinds. Some of the seedlings that have fruited for the first time in our seedling orchard are of good size and quality, and are of much promise. The seedling apples competing for the prize of \$1,000 offered by the Minnesota Horticultural Society, are on trial in our orchard. The result of this work being carried on here is to bring together perhaps the best collection of hardy seedlings to be found in America.

The work of improving our hardy plums has occupied much of our attention and 400 plum seedlings have been set out in orchard rows for fruiting. Most of these are seedlings of the Surprise, which we regard as of much promise. We are also growing several hundred seedling strawberries, obtained from seed of the best kinds. In addition to the above lines of seeding work we are testing a large number of varieties of the various fruits.

In the case of vegetables our attention has been confined largely to experiments with potatoes for the purpose of determining the best way of overcoming the great injuries from rot and blight which have so lessened our potato crop during recent years. This has followed two lines: One is the trial of new varieties of potatoes and the other is the raising of seedling varieties of potatoes, the object in both cases being to get varieties that are immune to potato diseases.

Experiments have also been made in the spraying of potatoes to determine the best way of protecting them from disease. The data in regard to our experiments with potatoes were published in bulletin No. 87, which is made a part of this report.

In the line of forestry and ornamental planting, we have raised a large number of seedlings of hardy plants that seemed especially desirable for introduction into this section. These in due time will be distributed by the nurserymen of this section.

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‡ DIVISION OF CHEMISTRY.

The division of Agricultural Chemistry has issued three bulletins during the year: No. 89, soil investigations, treating of the influence of crop rotations and farm manures upon the humus content and fertility of soils; the water soluble plant food of soils, and the production of humus in soils; No. 90, Wheat and Flour investigations, giving the differences in composition between light and heavy weight grains, the detection of starchy and glutinous kernels, the characteristics of rusted wheat and milling and baking tests; No. 92, treating of the digestibility and nutritive value of cottage cheese, rice, peas and bacon. Professor Snyder has also published through the Chemical Publishing Co., Easton, Pa., his revised work on soils and fertilizers which has been adopted as a text in a number of agricultural colleges and schools. In co-operation with the office of experiment stations of the United States Department of Agriculture a bulletin on the nutritive value of bread has also been issued, and also an article in the Year Book of the department on the same subject. The work of the division of agricultural chemistry is largely centered on soil investigations, human foods and wheat and cereal problems. The division makes a large number of free analyses for the farmers of the state of materials used in agricultural practice.

DAIRY DIVISION.

The work in this division has been continued along the plan outlined in the last report. The complete and careful records that have been kept since the organization of the division in feed consumed and dairy products yielded by each member of the dairy herd furnishes valuable data on cost of milk production, the rearing of young stock and the determination of the nutrients required in economical milk production and the growing of dairy animals. From its inception there has been constantly kept in view the needs of data for both popular and scientific information, the former dealing more especially with the herd as a business proposition, while the latter has to do with the methods of breeding, rearing and feeding for large productive powers and economy of production. The progress made in this work has far exceeded expectations.

Since the publication of bulletin 79, treating on the Food of Maintenance, Nutrient Requirements in Milk Production, two winters' work have been added and publication of the results postponed by suggestion of most eminent authorities, with a view of accumulating more data. The advanced

and improved method in which this subject was presented in bulletin 79 has been adopted by some of the other experiment stations with very satisfactory results. The basic principle, that a feeding standard for milch cows must be adjusted to quantity and quality of milk yielded is now generally recognized, and the one tentatively formulated in bulletin 79 will ultimately form the basis for one that will be both practical and scientific.

The experiments that are being conducted in this division are beginning to show that experiments as ordinarily conducted are of too short duration; that the residual effect of feeding will have a bearing upon milk production for one or more years; that it requires several years of systematic feeding along one line to secure definite results. They are also bringing to light the fact that the feed stuffs grown upon our western fertile farms come nearer providing the constituents actually needed in milk production than had been generally supposed; that the amount of protein prescribed in the feeding standards heretofore in general use is in excess of the amount actually needed and that a marked saving may be made in preparing feed for dairy cows.

VETERINARY DIVISION.

There has been the usual run of correspondence and office work during the past year, but with a constant tendency to reduce the amount of general hospital clinic and utilizing this time and the stable room for station work.

An important work in stable ventilation was taken up during this period, the endeavor being first to secure a physiological basis for defining and estimating the effect upon confined animals of naturally contaminated stable air, and second, to determine the least amount of ventilation compatible with health, and the most economic feeding of confined stock, and finally to be worked out later, to compare the relative efficiency of different systems and methods of stable ventilation. Our work during this period has been continued in two series and we have made studies of the blood and urine in various details from animals in free air and in confined stable air. The periods of confinement have varied from six to 42 hours during the work reported here; careful records have been kept of stall conditions, weights of confined animals, etc. A very large amount of material has already been tabulated and we now have on hand sufficient matter for two and perhaps three bulletins, which will be issued as soon as results can be verified and the manuscript gotten ready.

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A considerable amount of work has also been done with the blood and urine of milk fever patients. This latter work can only be done as opportunity offers, and the cases within reach have not been so numerous as during past years.

DIVISION OF ANIMAL HUSBANDRY.

In 1902 definite plans were formed in the Division of Animal Husbandry for studying the cost of production of meat producing animals. Methods were formulated which would give data in regard to the cost of growth and nutrients required by the different classes of animals. Work has been continued along this line, during three years and many facts have been accumulated that make possible a compilation of valuable information in animal production. Up to the present time very little has been placed in shape for publication, it being considered advisable to duplicate and triplicate any experiments before publishing results. Some features of the work are finished and results will soon be published.

The herds and flocks have been kept at about the normal number, the effort being to build up in quality rather than in quantity. The number of animals on hand at the close of the year is perhaps a little less than a year ago on account of selling a number of steers that were finished for market. The funds accruing from the sales were turned in to the University and the money was not available to repurchase until August, 1905. Records of feed required and gains made have been kept with all classes of animals and the cost of growing sheep and swine on different kinds of forage, and on forage in connection with grain foods, has been given a great deal of attention. This work will be duplicated during the ensuing year and extended with a view to publishing a bulletin on forage and pasture crops.

During the year only one bulletin—Press Bulletin No. 23, on Dipping Live Stock has been published by the division.

Mr. D. A. Gaumnitz has been made assistant in the Division of Animal Husbandry, and the work is well organized for definite results in the future.

DIVISION OF ENTOMOLOGY.

Experiments have been conducted against the leaf hopper in nurseries, and the cabbage maggot, the latter insect being a serious pest in our market gardens. The nurserymen have been notified of the appearance of the imported willow and alder insect, known as the European Willow and Alder Borer.

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Eleven lectures were delivered to farmers in various places throughout the state, and in almost every case the lecture was illustrated with lantern views. A large number of letters were written in answer to inquiries regarding insect pests, and communications sent to the papers of the state regarding especially injurious insects. Bulletin 88 was issued in December, 1904, which contained a key to insects affecting small fruits, with remedies for these insects. The same bulletin also contained directions for combating the insects of the vegetable garden, and some of the common insects of the flower garden.

The entomologist was allowed about a quarter of an acre on the Experiment Station grounds for experimental purposes along the line of entomology, and found it very useful. It was planted with nursery trees and small fruits, and experiments against the cabbage maggot, and also with honey plants were carried on.

The Cottony Maple Scale has been extremely abundant and destructive in the Twin Cities and various towns of the state and neighboring states, and definite directions have been given citizens for the control of this pest.

In October, 1904, a leaflet was issued, containing an account of some special experiments performed against the flour moth, which leaflet was sent to the millers in Minnesota.

In April, 1905, Press Bulletin, No. 22, was issued, entitled "Insects and Insect-like Animals Attacking Live Stock in Minnesota." In this bulletin were discussed the external and internal parasites of horses, cattle, sheep, hogs, dogs, cats and poultry.

Work against the cabbage maggot has been continued in co-operation with a number of market gardeners.

POULTRY DIVISION.

The work in this division has been confined to a study of the best conditions for farm flocks. The problem of ventilation of poultry houses in winter has been studied and an experiment with cloth frames in place of half the windows on the south side of the house has proved very satisfactory as a means of ventilating and keeping the air of the house dry. Trials with incubators and brooders and experiments with different methods of preserving eggs for winter use have been continued. The feeding and management of fowls for winter egg production has received special attention.

This division is in great need of material to replace the old fences which are so badly rusted as to be useless. More house room for laying hens and material with which to build colony houses for the young fowls are also urgently needed.

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NORTHWEST EXPERIMENT FARM.

The work with poultry has been very successful. The farm now has White Wyandottes, White Leghorns and Barred Plymouth Rock, from which eggs have been distributed to many farmers throughout the Red River Valley. Bulletin No. 91 on Poultry culture was issued during the year and the 15,000 edition is now entirely exhausted. Considerable work has been done in preparation for a complete system of drainage which is hoped may be put in operation the coming year. Some pure bred cattle from among the Herefords, Galloways, and Shorthorns have been purchased as foundation stock from which to build up a herd.

THE NORTHEAST EXPERIMENT FARM.

During the past year the field experiment work has been practically the same as the three years previous—testing of different varieties of plants and crops for this section of the state, crop rotation, and different methods of tillage.

In the variety tests there were grown 25 different varieties of wheat, 32 of oats, 22 of barley, 11 of corn, and 51 of potatoes. The years' work will about conclude this experiment of testing varieties, it having been conducted for five years. The varieties found best adapted to this northern section will be retained for continued use and improvement.

An apple orchard of 150 trees has been set out and also considerable small fruit, including the highbush cranberry.

Dairying, stock raising, and poultry are being given particular attention. Dairying is being made a special feature and in connection with it the production of bacon pork. The profit from this combination for this section of the state is very promising. A silo of 100 tons capacity has been built and a farm creamery is now under construction. The work of the experiment farm and results obtained during the past year have been published in press bulletin form and circulated thru the local papers of northeastern Minnesota.

Respectfully submitted,

W. M. LIGGETT.