

TWELFTH ANNUAL REPORT

OF THE

AGRICULTURAL EXPERIMENT  
STATION

OF THE

UNIVERSITY OF MINNESOTA.

Fiscal Year July 1, 1903, to June 30, 1904.



ST. PAUL, MINN.  
MCGILL-WARNER CO., PRINTERS.  
1904.

# UNIVERSITY OF MINNESOTA.

## BOARD OF REGENTS:

|  | Term Expires      |
|--|-------------------|
| The HON. SAMUEL R. VAN SANT, WINONA,<br>The Governor of the State.                     | <i>Ex-Officio</i> |
| CYRUS NORTHROP, LL. D., MINNEAPOLIS,<br>The President of the University.               | <i>Ex-Officio</i> |
| The HON. JOHN W. OLSON, ALBERT LEA,<br>The State Superintendent of Public Instruction. | <i>Ex-Officio</i> |
| The HON. ELMER E. ADAMS, FERGUS FALLS,   | 1908              |
| The HON. THOMAS WILSON, ST. PAUL,  | 1909              |
| The HON. WILLIAM M. LIGGETT, ST. ANTHONY PARK,   | 1909              |
| The HON. A. E. RICE, WILLMAR,  | 1909              |
| The HON. GREENLEAF CLARK, M. A., ST. PAUL,   | 1910              |
| The HON. E. W. RANDALL, MORRIS,  | 1910              |
| The HON. STEPHEN MAHONEY, B. A., MINNEAPOLIS,  | 1907              |
| The HON. O. C. STRICKLER, M. D., NEW ULM,  | 1907              |
| The HON. JAMES T. WYMAN, MINNEAPOLIS,  | 1907              |

## THE AGRICULTURAL COMMITTEE.

The HON. WILLIAM M. LIGGETT, Chairman.  
 The HON. J. T. WYMAN,  
 The HON. A. E. RICE,  
 The HON. E. W. RANDALL.

## STATION OFFICERS.

WM. M. LIGGETT, - - - - - Director.  
 J. A. VYE, - - - - - Secretary.

## EXPERIMENT CORPS.

SAMUEL B. GREEN, B. S., - - - - - Horticulturist.  
 HARRY SNYDER, B. S., - - - - - Chemist.  
 T. L. HÆCKER, - - - - - Dairy Husbandry.  
 M. H. REYNOLDS, M. D., V. M., - - - - - Veterinarian.  
 ANDREW BOSS, - Associate Agriculturist, in Charge of Live Stock.  
 FREDERICK L. WASHBURN, M. A., - - - - - Entomologist.  
 T. A. HOVERSTAD, B. Agr., - - - - - Superintendent, Crookston.  
 H. H. CHAPMAN, B. S., B. Agr., - Superintendent, Grand Rapids.  
 J. A. HUMMEL, B. Agr., - - - - - Assistant Chemist.  
 COATES P. BULL, B. Agr., - - - - - Asst. in Agriculture.  
 A. G. RUGGLES, M. A., - - - - - Assistant Entomologist.

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

MINNEAPOLIS, MINN., July 1, 1904.

*To His Excellency, Samuel R. Van Sant,*

*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, 1904.

GREENLEAF CLARK,  
*President Board of Regents.*

## LIST OF BULLETINS PUBLISHED DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

---

|   | Pages.  |
|---|---------|
| Class Bulletin No. 14, Two New Varieties of Wheat.....  |         |
| Class Bulletin No. 15, Breeding Corn .....  |         |
| Press Bulletin No. 17, Winter Wheat in Minnesota.....   |         |
| Press Bulletin No. 18, Seed Corn Famine.....  |         |
| Press Bulletin No. 19, A Plea for Some of our Common Birds  |         |
| Press Bulletin No. 20, Hardy Alfalfa in Minnesota.....  |         |
| Bulletin 83—Division of Horticulture—Apples and Apple<br>Growing in Minnesota.....                    | 1-80    |
| Bulletin 84—Division of Entomology—Insects, Injurious, in<br>1903 .....                               | *1-178  |
| Bulletin 85—Division of Chemistry—Wheat and Flour Inves-<br>tigations .....                           | 179-224 |
| Bulletin 86—Division of Chemistry—1, The Food Value of<br>Sugar; 2, The Digestive Action of Milk..... | 225-237 |

---

\*Owing to an error, this paging is incorrect, making it necessary to divide the index into Parts 1 and 2.

# REPORT

OF THE

## Director of the Experiment Station.

*To the President of the Board of Regents:*

I have the honor to transmit herewith the twelfth 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 83 to 86, 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, 1903-1904.

Dr.

To receipts from the treasurer of the United States, as per appropriation for fiscal year ending June 30, 1904, as per act of congress, approved March 2, 1887 \$15,000.00

Cr.

|   |             |             |
|---|-------------|-------------|
| By salaries .....                         | \$10,499.88 |             |
| By labor .....                            | 2,350.00    |             |
| By publications .....                     |             |             |
| By postage and stationery.....            | 175.00      |             |
| By freight and express.....               |             |             |
| By heat, light, water and power.....      | 697.54      |             |
| By chemical supplies .....                |             |             |
| By seeds, plants and sundry supplies..... | 22.08       |             |
| By fertilizers .....                      |             |             |
| By feeding stuffs .....                   | 932.47      |             |
| By library .....                          |             |             |
| By tools, implements and machinery.....   | 14.03       |             |
| By furniture and fixtures.....            | 59.00       |             |
| By scientific apparatus .....             |             |             |
| By live stock .....                       | 250.00      |             |
| By traveling expenses .....               |             |             |
| By contingent expenses .....              |             |             |
| By buildings and repairs.....             |             |             |
| Balance .....                             | \$15,000.00 | \$15,000.00 |

## FINANCIAL STATEMENT.

Statement of disbursements and receipts of the Minnesota Experiment Station for the twelve months beginning July 1, 1903, and ending June 30, 1904, inclusive:

|                       | Disbursements. | Receipts.  | Cash Outlay. |
|-----------------------|----------------|------------|--------------|
| Station .....         | \$16,496.22    | \$584.45   | \$15,911.77  |
| Agriculture .....     | 9,294.57       | 2,057.52   | 7,237.05     |
| Horticulture .....    | 4,492.27       | 1,562.04   | 2,930.23     |
| Chemistry .....       | 3,123.25       | 30         | 3,122.95     |
| Entomology .....      | 1,215.69       | .....      | 1,215.69     |
| Veterinary .....      | 1,727.96       | 77.12      | 1,650.84     |
| Dairy .....           | 1,200.00       | .....      | 1,200.00     |
| Animal Husbandry..... | 10,381.66      | 3,496.24   | 6,885.42     |
| Coteau .....          | 208.93         | .....      | 208.93       |
|                       | <hr/>          | <hr/>      | <hr/>        |
|                       | \$48,140.55    | \$7,777.67 | \$40,362.88  |
| <br>                  |                |            |              |
| Crookston .....       | \$7,837.64     | \$1,837.64 | \$6,000.00   |
| Grand Rapids.....     | 4,590.43       | 590.43     | 4,000.00     |
|                       | <hr/>          | <hr/>      | <hr/>        |
|                       | \$12,428.07    | \$2,428.07 | \$10,000.00  |

## DIVISION OF AGRICULTURE.

In 1903 the season was unusually cold and wet, and there was considerable injury to crops at University Farm from storms. The experiments in crop rotations, cultural methods, and breeding field crops were quite as successful as usual. Progress in the statistical investigations and in the work of devising methods of farm management was on the whole very satisfactory. The work of investigating the rural school problem has also progressed and a bulletin relating to the better organization of education for country life is in preparation. The bulletin of exercises in agriculture and home economics published in 1903 has been widely and successfully used in this State and has had a good reception in other states. Bulletins are also being prepared on farm statistics, farm management and breeding field crops. The co-operative relations with the United States Department of Agriculture in plant breeding have been not only very satisfactory but productive of good results in improved varieties of field crops and in the development of better methods of breeding and distributing the new varieties to the farmers throughout the State.

The proposed bulletin giving the results of investigations in farm statistics will contain the methods developed and the data secured by the three men working in three corners of the state, thus inaugurating a very successful plan of securing the cost of growing field crops, of producing live stock products, etc. These investigations are giving much information which will aid in devising a more rational system of farm accounts, and will be a great help in reorganizing farms so they may be managed more intelligently. This work has been made possible only by the liberal co-operation of the Department of Agriculture at Washington.

The bulletin on farm management will contain the results of experiments in the rotation of crops, which have been carried on for eleven years, and will outline methods of organizing farms and of teaching farm management. It has been amply demonstrated that very many farms are not well planned, but that they may be reorganized at small expense so as to increase the yield of fields and the profits from the crops and from the live stock products.

A well appointed building for the storage of farm machinery was erected during the year and is most admirably serving its purpose.

## VIII

### DIVISION OF HORTICULTURE.

The work in the Division of Horticulture has been along much the same lines as heretofore. Bulletin No. 83 has been published by this division during the past year, and relates especially to the study of varieties of apples and their adaptation to Minnesota conditions. The call for this bulletin has been such that the edition is practically exhausted. The work with seedling varieties of fruits and potatoes which has been carried on for many years is in good condition and seems to meet the general approval of those who are concerned with the horticultural interests of the state. The orchards, campus and forest garden are all in good condition and afford many useful object lessons which are receiving increased appreciation.

### DIVISION OF CHEMISTRY.

In the Division of Agricultural Chemistry the nutrition and soil investigations have been continued and have formed a prominent feature of the year's work. The following bulletins have been prepared and published by this division:

No. 85, Wheat and Flour Investigations, (45 pages, 11 illustrations) treating of the characteristics of glutenous and starchy wheats, and showing how the two types can be distinguished; the relative protein content of wheat and flour; the influence of storage and bleaching upon the composition and bread-making value of flour; and the comparative nutritive value of graham, entire wheat and straight flours.

No. 86, Human Food Investigations, treating of the nutritive value of sugar and the digestive action of the enzymes of milk.

In addition to the published articles of the Division of Agricultural Chemistry there have been a number of pieces of work completed and prepared for publication. A number of digestion experiments with both men and domestic animals have been made. During the year an experimental flour mill, capable of making milling tests of wheat, has been added to the equipments, thus enabling such subjects as comparative milling, bread-making, and nutritive value of different grades and types of wheat to be determined in an experimental way.

Numerous free analyses of farm products and feeds have been made for the farmers of the state, and also for other divisions of the experiment station. While soil and nutrition investigations have formed a prominent part of the work, other lines of investigation have also been undertaken, such as



the composition of rusted wheat, the comparative amounts of reserve plant food in heavy and light weight seeds, the oil content of various types of flaxseed, and the distinguishing characteristics of starchy and glutenous grains.

There has been no increase in the number of assistants employed during the year, although there has been a material increase in the amount of work accomplished, due in part to better facilities afforded by the new chemical laboratory. Miss I. D. Parker who has been an efficient assistant in the laboratory for the past four years has resigned and the position filled by the promotion of Mr. Ralph Hoagland.

This division has also assisted in a number of agricultural meetings in the state, and has answered a large number of letters received from farmers and others requesting information upon a wide range of topics.

#### 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, of feed consumed and dairy products yielded by each member of the dairy herd, furnish 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 need 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 Bullétin 79, treating on the food of maintenance, and nutrient requirements in milk production, a year's work has been added and publication of the results postponed 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 milk 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 a standard 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 effect of feeding will have a bearing upon milk production for one or more years, and that it requires several years of systematic feeding along one line to secure definite results.

### VETERINARY DIVISION.

This division has been actively engaged during the year in studying certain problems connected with the ventilation of stables, lumpy jaw in cattle, azoturia in horses, and milk fever.

In the study of stable ventilation the object has been to determine by careful experiments the effect of good and poor ventilation upon the health of animals, in order to settle upon some definite standard of requirements for ventilating stables in this climate. In the course of these experiments some very interesting and unexpected results have developed, but the work is not sufficiently advanced as yet to justify publication.

Experiments have been carried on with cases of lumpy jaw in cattle, the idea being to determine, if possible, to what extent the disease is infectious. This part of the history of the disease has never been worked out and is of very great practical importance in connection with the problem of preventing the spread of this disease on the farm.

A large amount of work has been done in studying the blood of the horse with a view to establishing normal standards upon which a future study of azoturia can be based. One case of this disease among our own horses furnished interesting material for the study. A number of cases of milk fever have been given careful laboratory study and the records preserved for future investigation of this very serious disease.

### DIVISION OF ANIMAL HUSBANDRY.

Very little new work has been undertaken during the fiscal year. Work already inaugurated has demanded the full attention of the force employed, and the aim has been to perfect the system of records established rather than to enlarge upon it.

The breeding herd of cattle has been maintained at about the standard of a year ago. The principal records of the year relate to the cost of growth of grade and pure bred beef calves, though accurate records are kept of all of the cattle fed. Several steers kept for class room instruction are being

highly finished for the International Exposition; and a careful study is being made of feed consumed and gains made by them. No commercial feeding tests have been made during the year owing to the high prices of feeds and of feeding cattle.

The flock of sheep at University Farm has been built up by careful selection and breeding from the best individuals. As with cattle, the study has been along the line of economic production of meat. The breeds are being compared as to prolificacy and yield of wool. The daily feed records give us the opportunity of learning the comparative cost of maintaining the different breeds. These figures are believed to be of more value to the farmers of Minnesota than figures on purely commercial feeding.

The experiments in swine breeding have been confined to cross breeding. The cross bred pigs are to be compared to pure bred pigs as to cost of production, yield of carcass and value of product. The experiment contemplates carrying them through the slaughter test and through the mechanical analysis of the carcass.

The forage work carried on by this division for some years has been continued though a portion of the land has been required for permanent swine yards. Rotation pasture crops are now provided for the swine and experiments are in progress showing the value of some of these crops for hog pasture. Tame grass plots have been added to the sheep forage crops, and give opportunity for reliable and useful comparisons.

A bulletin on Farm Meats prepared for the United States Department of Agriculture is the only publication of the year by this division. Material is at hand, however, for a bulletin on forage for sheep.

It was suggested last year in the annual report that work should be started with the stock feeders of the state. It is still believed that this method is a most satisfactory way of securing results in stock feeding. Funds are not available for the purpose, however, and the work has been deferred. Just as soon as funds can be secured the work will be started.

#### DIVISION OF ENTOMOLOGY.

During the fiscal year this division issued Bulletin No. 84 and press bulletin No. 19. Bulletin 84 treats of grasshoppers, chinch bugs, injurious caterpillars, the leaf hopper, the strawberry weevil, clothes moths and other insects; and contains directions for preparing and using the most common and effec-

tive insecticides and fungicides. Press bulletin No. 19 treats of the food habits of some of our common birds.

The entomologist has made a special study of the Hessian fly which has caused considerable damage in the wheat-raising areas of the state, and has tried to acquaint the farmers in these regions with the life history of the insect, and the best means of reducing its ravages to the minimum. Some alarm has been caused by the introduction into Minnesota of the European willow and alder borer, which appeared in New York State several years ago, and is gradually working its way westward. This pest is now on the list of proscribed insects and no nursery is given a certificate of inspection if this insect is found on its grounds.

The cottony maple scale has been somewhat injurious, and, through the press and in other ways the public has been informed of how to combat it.

One feature of the year's work was that of determining the nature of the Paris green on the Minnesota market. There was reason for believing that a poor quality of Paris green was being sold in some localities, and by buying samples in different parts of the state, and examining them under the microscope, and through the co-operation of the Division of Chemistry obtaining chemical analyses of the same, undoubted evidence of adulteration was found. This is fully explained in Bulletin 84.

Thirty-eight nurseries were inspected in accordance with the law, and fees for inspection turned into the state treasury.

## POULTRY DIVISION.

The year's work in this division has been mainly a continuation of that mentioned in the last report. The fowls have been kept as nearly as possible under conditions which may be duplicated on the ordinary farm, and the problems of the farmers' flocks rather than those of the fancier have been studied.

Experiments in winter feeding for eggs, in preserving eggs, and in incubation and brooding are being continued. Owing to lack of room for laying hens the west wing of the poultry house, which was intended for a brooder house, has been rearranged and used for some of the flocks of layers.

Three breeds are being kept at the present time, Plymouth Rocks, Silver Wyandottes and White Leghorns.

## NORTHWEST EXPERIMENT FARM.

The work on this farm has been continued on much the same lines as formerly. The barn and silo mentioned in the last report have been finished and are now in use. Several additions have been made to the herds of pure bred cattle on the farm. The rotation experiments and work with grasses and hardy fruits have been continued.

Considerable of the time of the superintendent has been devoted to work in farmers' institutes and farmers' club meetings.

## NORTHEAST EXPERIMENT FARM.

During the year Mr. Herman H. Chapman, who had been superintendent of the farm for six years, resigned to accept a position in the Bureau of Forestry in the Agricultural Department at Washington, and Mr. A. J. McGuire, a graduate of the school and college of agriculture was appointed to fill the vacancy. Mr. McGuire took charge of the work the first of March. Besides continuing the experiments already inaugurated, he expects to give considerable attention to work in the dairy line.

## REPORTS AND BULLETINS.

We have many calls from agricultural colleges and experiment stations, also from public libraries, for copies of former reports and bulletins. We have about 15,000 names on our mailing list, besides many bulletins are sent out on special request. Those who are not keeping files of our publications are urgently requested to return to us any copies they may have of our old reports and bulletins.

Four bulletins comprising 317 pages, with illustrations, have been issued during the year; also two class and four press bulletins. These are free to all citizens of Minnesota who apply for them.

Respectfully submitted,

W. M. LIGGETT.