

TENTH ANNUAL REPORT

OF THE

AGRICULTURAL EXPERIMENT STATION

OF THE

UNIVERSITY OF MINNESOTA.

Fiscal Year July 1, 1901, to June 30, 1902.



DELANO, MINN.
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1902.

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COATS P. BULL, B. Agr.,	Asst. in Agriculture.
JOHN THOMPSON, B. Agr.,	Asst. in Agriculture.

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

MINNEAPOLIS, MINN., July 1, 1902.

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, 1902.

GREENLEAF CLARK,
President Board of Regents.

**List of Bulletins Published during the fiscal year ending
June 30, 1902.**

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REPORT

OF THE

Director of the Experiment Station Corps.

To the President of the Board of Regents:

I have the honor to transmit herewith the tenth annual report of the Agricultural Experiment Station of the University of Minnesota, including the station established on the farm of Mr. O. C. Gregg, Superintendent of Farmers' Institutes of Minnesota, located near Lynd, Lyon county, also the station located near Crookston and the one near Grand Rapids, established by act of the legislature in 1895.

This year, as last, has been one marked by success and progress. This report gives an outline of the work done here and at the sub-stations; and contains copies of Class Bulletin 12 and Bulletins 73, 74, 75 and 76 published during the government fiscal year, July 1st, 1901 to June 30th, 1902; and a detailed statement of the receipts and expenditures of the annual appropriation from the United States Government. Following this is a summarized statement of the receipts and disbursements during the same period, including the Coteau Station which is maintained out of the current fund. In carrying on the experiment work the Hatch Fund of \$15,000 received from the United States Government has been supplemented by \$32,130.01 from the current fund of the University. Following this report is a financial statement of the two stations located at Crookston and Grand Rapids, respectively. These stations are maintained by special appropriations made by the legislature.

THE MINNESOTA AGRICULTURAL EXPERIMENT STATION
IN ACCOUNT WITH

THE UNITED STATES APPROPRIATION, 1901-1902.

Dr.

To receipts from the Treasurer of the United States
as per appropriation for fiscal year ending
June 30, 1902, as per act of Congress approved
March 2, 1887..... \$15,000.00

Cr.

By Salaries.....	\$10,306.55	
Labor.....	1,350.00	
Publications.....	382.10	
Postage and stationery.....		
Freight and express.....		
Heat, light, water and power.....	650.00	
Chemical supplies.....	19.15	
Seeds, plants and sundry supplies.....	48.70	
Fertilizers.....		
Feeding stuffs.....	1 456.70	
Library.....		
Tools, Implements, and machinery.....	3.25	
Furniture and fixtures.....		
Scientific apparatus.....		
Live stock.....	776.00	
Traveling expenses.....		
Contingent expenses.....		
Buildings and repairs.....	7.15	
Balance.....		
Total.....	\$15,000.00	\$15,000.00

FINANCIAL STATEMENT.

Statement of disbursements and receipts of the Minnesota Experiment Station for the twelve months beginning July 1st, 1901, and ending June 30th, 1902, inclusive.

	Disbursements.	Receipts.	Cash Outlay.
Station.....	\$16,539.67	\$ 508.10	\$16,031.57
Agriculture.....	15,307.61	2,772.76	12,534.85
Horticulture.....	3,900.07	1,046.89	2,853.18
Chemistry.....	2,934.52	109.00	2,825.52
Entomology.....	153.77		153.77
Veterinary.....	1,855.74	190.15	1,665.59
Dairy.....	1,175.00		1,175.00
Animal Husbandry.....	15,555.73	6,220.11	9,335.62
Coteau.....	554.91		554.91
	<u>\$57,977.02</u>	<u>\$10,847.01</u>	<u>\$47,130.01</u>
Crookston.....	5,145.56	1,160.52	3,985.04
Grand Rapids.....	4,893.54	1,571.58	3,321.96
	<u>\$10,039.10</u>	<u>\$2,732.10</u>	<u>\$7,307.00</u>

DIVISION OF AGRICULTURE.

The season of 1902 was fairly favorable to the lines of experimental work which have been under way for some years in the Division of Agriculture. Results of importance are accumulating and many useful data have been compiled from the experiments with farm management, rotation of crops, production of pastures, meadows, cereals, and annual forage crops. Bulletins along these lines will be published as rapidly as the respective experiments are brought to a conclusion.

On January 1st, 1902, this division and the Division of Statistics of the U. S. Department of Agriculture began a co-operative effort to secure data on the cost of growing field crops. Three statisticians were employed for the entire calendar year of 1902: One in southeastern Minnesota, near Northfield; one in southwestern Minnesota, near Marshall; and one in northwestern Minnesota, near Halstad, each with a route about fifteen miles long reaching twelve to fifteen farmers. The statistician visited each farmer daily, and recorded where each portion of labor was used. The man hour was taken as the unit and the horse hour as half a unit. Young men suitable for this work were found in the college of agriculture, and very good results have so far been secured. These data will make it possible to make much better application of the results of the field experiments in farm management at the several experiment farms. The data thus gathered, together with the results of experiments in crop rotation by means of field plots added to the pedagogical methods worked out in teaching field management, are demonstrating the value of a union between the experiment station and the college of agriculture. The fact that the farming business can be reduced to a system which may be brought under pedagogical forms and taught in schools of agriculture, is a point well worth the expense of demonstration. Many of the young men in the School of Agriculture make farm plans as a part of their class work, often remodeling the arrangement of their home farms, which they afterward report as having been adopted and put into operation at home. The experimental work of the station and the

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wrok of the class-room have developed the fact that orderly arrangement may be easily introduced on farms where a wrong system prevails.

The plant improvement work has continued to develop. The work has been considerably increased by assistance from the Bureau of Plant Industry of the U. S. Department of Agriculture. The efficiency of the investigations in plant breeding is being increased under the auspices of the U. S. Department of Agriculture by a co-operative union of this station with the experiment stations of North Dakota, South Dakota, Iowa and Wisconsin. The work with wheat and other cereals has been increased, and with clover and especially with hardy forms of alfalfa the work of breeding has been much increased. The season of 1902 was not altogether favorable. Chinch bugs, an unusual amount of cold weather and early autumnal frosts did much injury and some good. Minnesota No. 163 wheat, distributed in 1899, has continued popular, and careful estimates place the acreage of this variety in 1902 at 60,000 acres in Minnesota, and at 20,000 acres in North Dakota. This variety was bred in co-operation with the North Dakota Experiment Station, and was distributed simultaneously in the two states. Our reports from farmers indicate that this wheat yields one and one-half bushels more per acre than the wheats it is displacing. At 67 cents per bushel, this makes the estimated increased value of this wheat to Minnesota farmers at \$60,000.00 for 1902, the third year after its introduction. In the spring of 1902, a second newly-bred wheat, Minnesota No. 169, was distributed. This gives evidence of a still better yield than Minnesota No. 163. This wheat was sold to several farmers in each county, selected as suitable to induce to grow for sale to their neighbors' good, clean seed; and limited quantities were sold to seed firms within the the state. Numerous other newly-bred varieties of field crops are coming forward for distribution at an early date.

For some years this division has been carrying on experiments with gardens for rural schools, and on methods of introducing agricultural instruction into rural schools. Very encouraging progress is being made in this much needed

work and some publications are in prospect. Bulletin No. 1, "Practical Exercises Relating to Agriculture and House-keeping," is now being prepared for publication.

Experiments at Coteau Farm.—Mr. D. A. Gaumnitz is superintending the experiment work at Coteau Farm. The experiments on field management, rotation of crops, pasturage of annual and of perennial crops, and in forestry are progressing. An experiment in corn breeding is also under way and satisfactory progress is reported. This work goes forward in a very satisfactory manner. Southwestern Minnesota has agricultural problems peculiar to that section. These experiments have already demonstrated many facts as how to best to rotate crops, produce forage, grow shelter belts, etc.

DIVISION OF HORTICULTURE.

The experiment work in this division has been conducted along much the same lines as in several previous years.

The work with seedling fruits is of special interest to the horticulturists of the state. The seedling apple orchard of nine hundred trees has produced some fruit for several years. These trees are seedlings from the largest and best varieties of apples grown in the state, and many of them are the result of work which was done about twelve years ago in hand-crossing between the hardiest sorts.

The nurserymen and horticulturists of the state are especially interested in the work being done at the station in the introduction of *Pyrus baccata* stocks to prevent root killing of the apple. Over twenty-five thousand of these stocks have been raised the past season for sale to nurserymen. Seedlings of other plants that are desirable for introduction have also been raised in considerable quantities. These are now offered to the nurserymen of the state, and are being rapidly taken. This is regarded as one of the best ways of introducing desirable novelties.

As a result of raising many thousand seedling potatoes, two varieties, known as University Numbers 32 and 33, promise to be of value and will be sent out for trial.

The forest garden of the Experiment Station and the campus with its plantings of trees and shrubs furnish inter-

esting object lessons to our students and visitors on the possibilities of tree growth and landscape gardening.

One bulletin of for forty pages has been published, giving the results of six years experience with fruits and ornamental and timber trees at Coteau Farm.

A new and revised edition of "Forestry in Minnesota," containing over four hundred pages, has been issued during the past year. It is a report on the value of native and introduced trees. There is now on hand, ready for publication, a bulletin on the apples which are of promising value. It will be illustrated with over sixty full size plates of varieties of apples, and will contain about one hundred pages.

CHEMICAL DIVISION.

The three bulletins published by the Division of Agricultural Chemistry during the year give, in part, the work accomplished by this department. Bulletin No. 74, "Human Food Investigations," treats of the composition and nutritive value of a number of foods as determined by feeding and digestion experiments with men. Beans, cheese, butter, bread made from different kinds of flour, as graham, entire wheat and patent, all milled from the same lot of wheat; toast and oatmeal, are some of the foods considered. Results are also given as to the comparative values of butter and oleomargarine. A special feature of this bulletin is the report on the effect of the chemical ferments or enzymes in milk upon the digestibility of other foods. The influence which these bodies have in the curing of cheese and the handling of dairy products had previously been demonstrated by other investigators, but their effect upon the digestion of food had not been considered. The work reported in this bulletin shows that pure fresh milk may act as a digestive fluid, rendering other foods more digestible.

Press Bulletin No. 14, published by the Chemical Division, treats of the feeding value of wheat and appeared at a time when wheat was selling at a comparatively low price. The report gave information in regard to the feeding value of wheat compared with other grains and milled products, and suggestions as to obtaining the best results in the feeding of wheat. It is believed that this bulletin proved to be of much

value, enabling many farmers to secure better returns from their lower and poorer grades of wheat.

Bulletin No. 101, U. S. Dept., Office of Experiment Stations, gives the results of studies on bread and bread making made by this division. The results show that when graham, entire wheat and straight grade flour are milled from the same kind of wheat, a larger amount of available nutrients is obtained from the straight, due to its digestibility, than from other grades of flour. The bulletin also shows the effect which the addition or removal of gluten, the addition of starch, and the blending of flours have upon bread making. This bulletin has created a great deal of interest in regard to the nutritive values of different kinds of flour.

An extensive investigation has been made by the Chemical Division, during the summer, in regard to the value of alfalfa as a farm crop. Work has also been carried on in relation to the testing of wheat and flour for commercial purposes.

A large number of analyses have been made for farmers and others who have sent samples to the station asking for information. Such analyses have always been made free of cost whenever the results have been considered of public value.

DAIRY DIVISION.

In addition to the record of the work done by the dairy herd, which has been kept for a period of eleven years, special experiments have been carried on in this division on protein and other nutrient requirements in milk production. These experiments are conducted by methods differing from those generally employed. Bulletin 71, treating of protein required by dairy cows in milk production, was the first of a series of bulletins to be issued under the new method with a view of testing the various feeding standards and the nutrient requirement in food of maintenance. Bulletin 71 gave evidence that cows really need only 60 per cent. of the protein prescribed by the feeding standards. The experiment was repeated during the winter of 1901-2 with less protein and yet normal yields of milk and butter fat were secured. The results of this trial are now ready for publication, and give

more definite information in regard to the actual needs of dairy cows than has been shown heretofore. It is the aim to continue the work along this particular line until the question of nutrient requirements for the various grades of milk are more definitely settled and practical standards are evolved—based upon the actual performance of the cows.

It is a question of great economic value to every one engaged in milk production. Food stuffs containing a high per cent. of protein are very expensive, and if it is found that for ordinary work in the dairy our farm grains contain an ample supply of protein, it will prove a great economy to our dairy men.

The experiment mentioned in the last report, of feeding dairy bred and cross bred steers for beef, has been continued. The object of this experiment is to determine so far as possible the advisability of dairymen or creamery patrons breeding their dairy cows to beef breeds in order to raise steers for beef. This is a matter which can only be decided by a series of experiments extending over a considerable period of time. As heretofore, there is much demand made upon the dairy division for addresses at creamery meetings and assisting in the monthly educational butter and cheese contest.

VETERINARY DIVISION.

Work in the Veterinary Division during the past year has been interfered with by the erection and equipping of the new veterinary building mentioned in our last report. The amount of time required in getting such a building fully equipped and in good running order has been unexpectedly large, and Dr. Reynolds has not been able to do all the work outlined in our last report. Correspondence, general office and hospital work, in addition to the professional cares of our farm stock, have taken considerable time so that it has been difficult to accomplish very much in the way of research work.

The health of our farm stock has been as good as usual during past years. One valuable foal has been lost from what is commonly known as "joint disease." There have been several cases of rheumatism among our swine in the old building, which is very deficient from a sanitary stand-

point. There has been some loss from tuberculosis in both the dairy and beef herds and a serious loss from an infectious meningitis in the dairy herd. At one time we were threatened with an outbreak of infectious cellulitis of the foot structures among young stock in the beef department; but by prompt treatment of the affected animals, disinfecting the feet and limbs of every animal in the department, and by disinfection of the stable the disease was soon checked, and no further trouble is anticipated. We have also had an outbreak of hog cholera to deal with; but with the aid of the contagious ward in the new hospital and by other isolation and disinfection this was also checked, and the loss was comparatively light.

Considerable research field work has been done with hæmorrhagica septicæmia, Dr. Reynolds having had opportunity to carefully study several outbreaks in various portions of the state. Individual cases have been kept under close observation from the earliest symptoms of the disease until the fatal terminations. The symptoms, histories of the cases, etc. were carefully recorded and may be used in a future bulletin.

This is a comparatively new disease in the state, and seems to have developed in serious proportions.

ANIMAL HUSBANDRY DIVISION.

Prof. Thomas Shaw resigned from his position as Professor of Animal Husbandry in April 1, 1902, on account of his connection with *The Farmer*, and Mr. Andrew Boss was appointed Associate Professor of Agriculture and given charge of the Animal Husbandry Division.

The work in Animal Husbandry during the year has consisted in preparing a foundation for reliable records in all lines of stock raising and feeding, and in some preliminary experiments in swine and sheep feeding.

It is the policy of the division to maintain good representatives of each of the breeds of animals adapted to Minnesota. With this object in view several animals have been purchased; carefully selected individuals from the breeding stock have been reserved and all surplus stock sold to farmers at fair prices, or when not considered good enough

to sell for breeding purposes they have been sent to the block.

Daily report sheets have been adopted to bring the detail work clearly under the observation of those in charge, and to insure painstaking care on the part of the herdsmen. Weekly feed records are being kept in cattle and swine feeding, and the sheep feeding is to be brought under the same system. This enables us to calculate the cost of growth of any animal and also to ascertain whether each animal pays the cost of maintenance. These records will be invaluable in determining proper methods of feeding and if persisted in for some years will also be useful in studying breeds and types of animals.

Records were kept of the food eaten by each litter of pigs from farrowing time until weaned, and so far as possible the pigs have been divided since weaning by breeds and sexes, and the records continued during the growing period. Five years of such work will throw much light on the relative value of each breed as pork producers.

Experiments in finishing pigs of the bacon type have been conducted through a portion of the summer. Four lots were made up from the culls of the breeding pens and finished on peas, corn, ground hog millet and green corn respectively. Three pigs from each lot were exhibited in the carcass demonstration at the International Exposition at Chicago and the balance slaughtered at home, and the product cured at the school meat market, in order to study the quality of the bacon from such feeding. The work on bacon production will be continued during the coming year and as soon as conclusions can be reached they will be put into bulletin form.

Several individuals of the breeds of lard hogs have been added to the swine herd, and work will be conducted along the line of their economical production as soon as a sufficient number may be obtained to make the results reliable. Some experiments in growing swine on pasture crops are planned for the coming year, with a view of studying their influence on pork production and the relative yields of the crops commonly used for such purposes.

The forage experiments with sheep have been continued

as in years past with good results in pasturage yields though more land and larger plots would greatly reduce the cost of making such tests and would also eliminate some possible sources of error in securing data from the small plots now in use. Besides furnishing pasturage for 120 head of sheep and lambs during the summer, 25 tons of cured fodder have been secured from the 16 acres given over to the division. The work in annual crop forage for sheep, is to have added to it some of the pasture and meadow grasses as a basis of comparison. While much larger crops of forage may be produced from the annual crops, the large amount of labor necessary to secure a succession of crops in season makes doubtful their economical superiority. It is believed that full grown wethers should be purchased for this work, as it is difficult to estimate the amount of food used by ewes and lambs while the lambs are sucking.

Lambs have been finished for the market on speltz, macaroni wheat, corn and barley in comparison, and further comparisons of speltz with other grains as sheep food are to be made.

Steers have been purchased for securing data on the value of the pasture grasses for cattle and these, with others purchased since from the range, will be fed on sound corn and soft corn in different form to compare with wheat as a food for finishing cattle. The pasturage work taken up in co-operation with the division of agriculture has furnished valuable data and it is expected to continue these studies in connection with the experiments on farm management. As soon as the opportunity may be obtained, steers will be finished on grass pasture during the summer months.

The appropriation made in 1901 for a new swine building has been used in the erection of a brick building with accommodations for 15 brood sows with litters, or for 60 full grown hogs.

A cattle barn for steer feeding has been erected from the material obtained from the old veterinary hospital, and various minor improvements have been made in the stock buildings and paddocks.

An outlying farm, where summer pasture and winter fodder might be grown would reduce materially the ex-

penses of the division and aid in the maintenance of sufficient stock to supply the need of animals suitable for experiment work.

ENTOMOLOGICAL DIVISION.

The position of entomologist left vacant by the late Dr. Otto Lugger has been filled by the appointment of Frederick L. Washburn, A. B. and A. M., a former resident of Minnesota. He has been for the last twelve years entomologist of the experiment station and in connection with the University of Oregon. He began work here in May, 1902.

The entomologist was engaged during the summer in answering calls from different parts of the state where chinch bugs, grasshoppers or the Hessian fly were damaging the crops, and where it seemed practical to demonstrate methods of combating these insects.

Numerous circulars have been sent to the papers of the state giving information regarding the above pests and the best means to combat them.

In May, in response to an apparent need, a press bulletin on "A Remedy for the Mosquito Evil" was issued.

Experiments have been conducted to determine the best methods of combating the mosquito, the horn fly, the white grub, the stalk borer, cockroaches and the chinch bug; the last named pest being studied in co-operation with the agricultural division of the station.

Studies are in progress in the life histories of the mosquito, Hessian fly, chinch bug, codling moth and white grub with a view of determining the best methods of economical treatment.

Fourteen nurseries have been inspected and certificates granted to the proprietors.

During the past season 980 gallons of kerosene oil have been issued free of charge to farmers in the grasshopper infested districts for use in hopper-dozers.

Extreme conditions in Ottertail county in May appearing to demand it, the State had plowed, under direction of the entomologist, 200 acres of land to avoid the spread of grasshoppers. This pest has been injurious in the vicinity of Crookston and also in the Hill River district. The lack

of a more general visitation was undoubtedly due to the extreme moisture last spring which destroyed the eggs.

The Rocky Mountain locust has not been discovered this summer in Minnesota. The form which has appeared, as above mentioned, is what is known as the lesser migratory or White Mountain locust, a species not much less injurious than the dreaded Rocky Mountain variety.

POULTRY DIVISION.

The work in this division has been largely a continuation of the experiments mentioned in the last annual report. In addition a series of experiments to determine the best ration for laying hens has been carried through the year, the results of which will be published later. The keeping of records by means of trap nests has been continued, and a complete record of the work done by individual hens as well as the food consumed, is kept.

Experiments with artificial incubators confirm our former belief that while for large poultry plants they are a necessity, for the average farmer they are no improvement over the natural incubator, properly managed.

Owing to lack of room only one breed is being kept.

It is believed that a number of small poultry houses, each one being built so as to illustrate a different method of building a poultry house for the average farm, would be a good way to relieve the present crowded condition of this division.

Letters from farmers seem to indicate that a bulletin on the subject of farm poultry houses would be welcomed.

NORTHWEST EXPERIMENT FARM.

The work on this farm has not been wholly successful this year on account of the excess of moisture. There is great need of drainage to take the surplus water off which would remove from the soil much of the alkali salts.

Good work has been done in grasses, substituting for native grass something more productive and having more nutritive qualities. In 1896 forty plots were sown to test the different species and mixtures of grasses. These plots have not been plowed since. Timothy, bromus, red-top and

slender wheat grass have given the best results. While the bromus has improved each year it has not been entirely satisfactory for a hay crop. In quality it is excellent both for hay and pasturage. Clover has been successfully grown. For three years the average yield was 3714 lbs. per acre.

We had a failure in 1900 due to drouth and a partial failure in 1901 due to excessive rains. Clover has never been winter killed on this farm. The growing of crops for forage has been quite easy, and this is growing in popularity in the Northwest every year. Corn is the leading forage plant and has never failed for fodder. Peas and rape have been tried with good results.

Roots have been tried only in a garden way and give promise of becoming a prominent crop.

The soil and climate is adapted to the highest production of celery. It is being given a field trial this year for the first time.

Plums have succeeded well where planted among other trees.

A good start has been made in poultry. A foundation stock has been built up. Flocks of barred and white Plymouth Rocks, White Leghorns, Light Bramas and Cornish Indian Games are kept on the farm. Flocks of Pekin ducks, gray African geese and Bronze turkeys are also kept. A poultry house large enough for 150 birds was built during last year, which has proved in every way satisfactory.

The legislature made an appropriation in 1901 for a cattle barn. On account of advance in prices of building material we have not been able to let the contract as yet.

NORTHEAST EXPERIMENT FARM.

During the fall of 1901 the appropriation of \$1,200.00, made by the legislature the preceding winter, was expended in the erection of a cattle barn. This structure is 30x58 feet long, and has a hay loft with 16 ft. studding. It is built on the hillside, giving the whole basement for stock, with floor for grinding and cutting feed above. The barn is well constructed and well arranged, and should fulfill the purpose for which it was built.

One system of sheep pastures has been completed by the

construction of the remaining fences, and the sheep can now be turned upon any one of the five fields upon which is grown a five year rotation of crops, thus giving them abundant pasture at all seasons. Four and one half acres of land were stumped and broken and planted to corn and potatoes, and the stumps were pulled from five acres more. About three acres additional was logged and brushed. This clearing was done upon land intended for hog pastures, and in the sheep pastures, upon which the sheep had run for three years. A corn binder was obtained to replace the method of cutting fodder by hand.

The field experiments consisted of testing new varieties of oats, wheat, barley and winter wheat; fall vs. spring plowing for grain; effect of changing seed oats and wheat; varieties of corn; breeding corn; testing varieties of fodder corn, distance and method of planting; tests of clovers and grasses, amount of seed; millet varieties, root crops and potatoes. Some sixty varieties of potatoes were compared for yield and quality in cooking tests. A large number of kinds of vegetables were raised. Additions were made to the apple and plum orchard and to the raspberries and strawberries. In the spring of 1902 considerable ornamental planting was done about the buildings and grounds, consisting in establishing an arboretum and groups of trees, shrubs and perennial flowers.

Our stock, consisting of a herd of dairy cows, grade Oxford sheep and large Yorkshire swine, was maintained in good condition.

The results of the work have been brought before the public in the form of press bulletins, which, to the number of thirty, have been sent to about fifty newspapers in the northern part of the state, nearly all of which published them in full. In this way, it is hoped to fulfill to the fullest extent possible the objects of the station's establishment.

17,000 copies of each bulletin are issued to supply our mailing list. By reason of many calls from out of the state for bulletins on special subjects, in addition to our regular bulletin list, we publish several thousand extra copies.

Two press bulletins have been published during the year, No. 14, entitled "The Feeding Value of Wheat," and No. 15, "A Remedy for the Mosquito Evil."

Bulletins are issued for gratuitous distribution to the citizens of Minnesota who apply for them.

Respectfully submitted,

WM. M. LIGGETT, Director.

