ANNUAL REPORT

OF THE

AGRICULTURAL EXPERIMENT STATION

OF THE

UNIVERSITY OF MINNESOTA.

1895.

ST. PAUL, MINN.:
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STATE PRINTERS.
1896.

UNIVERSITY OF MINNESOTA.

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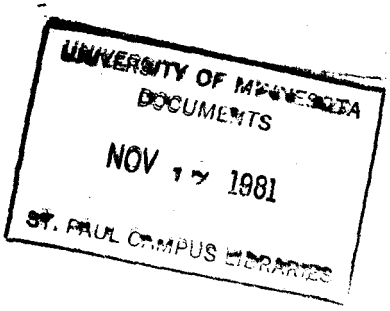
☞The Bulletins of this Station are mailed free to all residents of the state who make application for them.

MINNEAPOLIS, MINN., Jan. 1, 1896.

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 1895.

J. S. PILLSBURY,
President Board of Regents.



LIST OF BULLETINS PUBLISHED DURING THE YEAR 1895.

PRESS BULLETIN, No. 3, March 5, 1895.—Smut in Wheat.

PRESS BULLETIN, No. 4, July 9, 1895.—The Russian Thistle Law.

PRESS BULLETIN, No. 5, Dec. 15, 1895.—Hog Cholera and Swine Plague.

BULLETIN No. 41.—Soils: The Essential Elements of Soil Fertility; Humus as a Factor of Soil Fertility; The Chemical and Mechanical Analyses of Soils; The Action of Organic and Mineral Acids Upon Soils; Comparison of Different Methods of Farming Upon the Conservation of Soil Fertility.

BULLETIN No. 42.—Composition, Digestibility and Food Value of Potatoes.

BULLETIN No. 43.—Insects Injurious in 1895.

BULLETIN No. 44.—Fattening Steers in Winter; Fattening Lambs in Winter.

BULLETIN No. 45.—Potatoes: Variety Tests; Treatment for Potato Scab and Blight, Internal Brown Rot. Tomatoes: Variety Tests; Treatment for Rot. Small Fruits: Variety Tests; Spray Pumps, A New Form of and a Strainer for.

BULLETIN No. 46.—Forage and Grain Crops. Cross Rotation Experiments. Smut in Wheat. Three Annual Weeds. Tillage Experiments. Meteorological Records.

NAMES OF EXPERIMENT FARMS.

The Minnesota Experiment Station is the legal and general name of that part of the University of Minnesota which is organized for conducting agricultural experiments, the official organization of which is shown on page ii. The main office is at University Farm, St. Anthony Park, on which farm are located also the College of Agriculture, the School of Agriculture, the Dairy School, and the Woman's Agricultural School. The Experiment Station has two other farms; the office of one is addressed as the Northwest Experiment Farm, or "Northwest Farm," Crookston, and the office of the other is addressed as the Northeast Experiment Farm, or "Northeast Farm," Grand Rapids. The experiment station has a fourth office in the southwestern part of the state, and this office is addressed as "Coteau Experiment Farm," Lynd, Minn.

The State Horticultural Society employs a number of its members to conduct trials of horticultural plants, on their own grounds, under the joint auspices of the State Horticultural Society and State Experiment Station, and these farms have been called horticultural experiment stations. In conference with the executive committee of the State Horticultural Society, to avoid confusion of names, it has been decided hereafter to designate these "horticultural trial stations," and to call those farms belonging to the University, other than University Farm at St. Anthony Park, "sub-experiment farms," and to leave the name "experiment station" to designate the general experiment station organization.

"Experiment" station is the way all United States experiment stations spell the first part of the name; the suffix "al" is the form used in Britain.

REPORT

OF THE

CHAIRMAN OF THE EXPERIMENT STATION CORPS.

Progress in the University Experiment Station for 1895 has been marked. The farmers of Minnesota, and of other states, have shown such appreciation of the work that it seems safe to say that the station is very rapidly becoming of great value to the people of the state. Harmony prevails and each department is making rapid progress, far greater than is indicated by any increase of expenditure. The University Farm, besides being a scientific center, is now a good example of the best methods of handling meat, dairy and work stock. Every farmer or other person interested in public affairs who visits University Farm and thoroughly inspects it and talks with the several officials leaves it with the feeling that the station and school work are being done in a manner to be of great use to our most important industry. The station officials, though burdened with many duties, continue much popular teaching through the press and through the annual publications of the farmers' institutes and the several state societies relating to agriculture. It is gratifying to those in charge that the members of the experiment station corps are much in demand for public addresses, and so long as this work does not seriously interfere with the work of the station this demand will be met. The time will come, however, if these de-

mands increase, when only a part of the calls can possibly be met without great addition to the working force of the station. The board of regents have dealt wth the experiment station with a liberal hand, and our farmers should know and appreciate this fact.

The last legislature also showed a most liberal spirit toward the experiment station, reflecting the general good will of the state to the work being done, by giving more means for the erection of buildings on University Farm and by appropriating $30,000 with which to procure, equip, and for the two following years conduct two sub-experiment farms. The Northwest Sub-Experiment Farm was located at Crookston, Polk county, on lands donated by the Great Northern Railway through the generous liberal-mindedness of President J. J. Hill and Samuel Hill. Besides this, the city of Crookston and the county of Polk each gave $1,000, which is being utilized in draining and making roads around and through the Northwest Farm. Another farm will soon be located in the forested two-fifths, or northeastern, part of the state. The sub-experiment farm work, begun in 1894 in Lyon county on Coteau Farm (Supt. O. C. Gregg's homestead), has been continued, the expense having in part been paid from the sub-experiment station fund, part from the general university fund, while the rental of lands, teams, and machinery were provided by the board of farmers' institutes and by Mr. Gregg.

In the agricultural division the last was the most satisfactory year since the station was organized. Not only were good yields secured of nearly all crops, as was the case generally throughout the state, but the experiment comparisons were in most cases very satisfactory, both at University Farm and at Coteau Farm. At University Farm the work in this division covers numerous lines, prominent among which may be mentioned field management, including rotation of crops, meadows and pastures; pastures of annual crops, testing varieties, breeding and propagating for distribution new kinds of grain and forage crops, tillage of crops, studying flax for fiber as well as for seed, irrigation, drainage, road-making, and the erection of buildings and fences.

The agriculturist, Prof. W. M. Hays, who assisted the agricultural committee in locating the new sub-experiment farms, has charge of the equipment and plans for experiment work on the sub-experiment farms. Mr. T. A. Hoverstad was chosen assistant agriculturist, and was given the local management of the Northwest Farm, work having been begun there late in 1895. Mr. Wm. G. Smith, a junior in the College of Agriculture course,

was placed in charge of experiments at Coteau Farm. Hereafter Mr. Gregg will retain the management of those parts of his farm not used for experiments, providing the station with such lands, teams, etc., as are yearly needed for the experiments in hand, thus making it possible for the station to do experimenting without the trouble of managing so large general farming operations. The work of this farm is settling down to several main lines, chief among which are tillage experiments, especially the question of conserving soil moisture; pastures and meadows, including annual crops for hay and pasture; and prairie forestry, and field management, especially studying the questions of the cost of crop production on a large farm as conducted by the owner for profit.

The work to be taken up at the Northwest Farm is not fully decided upon as yet, but the choice will from year to year be among the following: The production for dissemination of the best grains produced by the station; the testing of varieties; field management; tillage; weeds; pastures and meadows; forage and pastures from annual crops; prairie forestry, vegetables, and fruit production; drainage; irrigation; road making; feeding work horses and other stock; breeding animals and dairying. While there is much work which can best be done at University Farm, there are very many questions which can be properly studied only in this peculiar part of the state.

Part of the work done in 1895 is shown by the report of the agriculturist, included in pages 331 to 389 of this volume.

In the horticultural division crops in 1895 were generally very good. The stock of nursery crops are in good condition. The plantation of forest trees at University Farm showed considerable injury from the drouth of the previous year, which helped to show which trees are best able to survive severe drouth. A four-acre tract has been planted to forty species of forestry trees at Coteau Farm; in the main, so planted in plots that long-lived hardwood trees are grown among softer nurse trees. Seven hundred seedling apple trees, three years old, originating from the hardiest sorts, have been dug, and will be used in a new orchard at University Farm. Some of our promising seedling raspberries are being propagated for distribution. A small plant for experiments in irrigating garden crops has been constructed. Much grading, changing drives, cutting trees from native woods on campus, building 900 yards of cement and brick walks, and other work to improve the grounds has been done. Professor Green made an investigation into the condition of the orchards of the

state, making a report thereon to the State Horticultural Society. He has collected, mainly by gift, over $700 worth of potato machinery. Nearly 300 photographs of horticultural subjects have been taken, and outline drawings have been made of over 200 varieties of apples which have fruited in Minnesota.

Pages 299 to 328 of this report give results of experiments with potatoes, tomatoes, and small fruits.

The division of entomology has found much work to do. Chinch bugs were very numerous in the southern half of the state. Early in the season chinch bug disease was bred in large quantities, and nearly 50,000 boxes were sent by mail to the farmers of the state who applied for them. In many neighborhoods Dr. Lugger's poison is believed very efficacious, while in some localities, where the weather was too dry for the disease to spread, little good effect was observed. Grasshoppers in several counties received careful attention, and some facts were developed regarding them. Numerous injurious insects were studied, and in pages 99 to 244 of this report is given a report of much of the work in progress. In 1896 a study and report will be made upon the parasites infesting all kinds of stock, including poultry. Any insects proving especially injurious during the year will be studied, and if possible, the farmers will be taught the remedies. Additions are constantly being made to the collection of insects, and Dr. Lugger is rapidly collecting into the agricultural museum mounted specimens of the economic animals and plants of the state.

The chemical division published considerable bulletin material during the year. (See pages 3 to 96, inclusive, in this report.) Very worthy of note are the discussions under the humus in soil fertility; the chemical and mechanical analyses of soils: the action of organic and mineral acids upon soils; a comparison of different methods of farming upon the conservation of soil fertility; and the composition, digestibility, and food value of potatoes. Other lines of work well started are studies of flax; its effect upon the soil; chemical composition of seed, straw, and oil cake, and the digestibility of oil meal. Work is planned on the ventilation of barns, and the work with the chemistry and the minute physics of soils is being continued. Coöperative experiments have been undertaken with the Department of Agriculture at Washington on a study of human foods, paying especial attention to the cooking of vegetables, balanced rations for people, and the value of the different kinds of fuel. Professor Snyder coöperates in experiments on rotation of crops with the agriculturist, and

receives from farmers many samples for analyses, and has in hand other uncompleted work, heretofore partially reported upon,—as digestion experiments, and the influence of one food upon the digestibility of another. Some work is done each year on methods in the analysis of agricultural substances.

The dairy division has wisely followed up the lines of work under consideration since its separate organization some years ago. During the years 1894 and 1895 each milking of every cow in the dairy herd was weighed and tested for butter fat by means of the Babcock test, and much data have been gathered on various questions. Abortion appeared in the herd in 1894, so much affecting the value of the results in the study of cost of production that the data were not published separate for that year, but will be included in a future bulletin. The data obtained will serve as a basis for determining the effect of abortion on the annual yield and cost of dairy products. The herd record for 1895 is complete, and the work is being continued through 1896, with a view of issuing a bulletin at the close of 1896, giving the results for the three years. The main line of work in comparing the different types of cows, in relation to cost of dairy products, has been deemed of such prime importance that other lines of feeding experiments have been taken up, as comparing grains, only where they would not interfere with this work. Experiments have been carried on in feeding wheat to dairy cows, feeding timothy hay in comparison with different grades of wild hay, feeding grain separately and mixed with roughage, and in rearing dairy calves on separator skim milk and flax meal. Experiments in cheese making have been carried on during the past year with very satisfactory results. The influence of climatic conditions have been carefully studied, and a method of manufacturing sweet curd cheese especially adapted for the farm has been practically solved, and Minnesota Gouda is now made on many farms in the state. The process is simple, and requires only such appliances as are found in every well-regulated farmer's kitchen. The unusual development and interest in dairying in the state has resulted in Professor Haecker being very much in demand for public addresses.

The veterinary division has continued work with tuberculin as a diagnostic and curative agent in bovine tuberculosis. The proof is most conclusive, that, by this means, tuberculous animals may be identified, and the evidence tends to prove that tuberculin has a marked curative effect, and not, as too often alleged, a bad effect. Experiments on larger or smaller doses of tuberculin; *post mortems* to decide whether tuberculous animals ever fail to

react; also, a study as to whether the manner of the reaction will indicate the extent or location of the lesions; all have been made, and an investigation has been attempted to determine any effects the hypodermic injection may have on the organs and tissues of diseased animals. Dr. Reynolds has brought this subject home to physicians, veterinarians, and cattle owners in such a way that opposition and fear of these experiments have been allayed. Interesting data are being collected regarding the wisdom of raising calves from tuberculous cows by removing the calves from their dams and giving them sterilized milk. A dozen cows and calves in this experiment have resulted in finding eleven calves healthy and one tuberculous at the first test after birth. A bulletin on "Tuberculin and Bovine Tuberculosis" will be issued during the year 1896. Many experiments have been made with hypodermic cathartics for horses, and careful records made of the number and amount of bowel discharges; also, the effect on the pulse, respiration, and temperature. Eserine has been used for a cathartic alone and in combination with various other drugs, and much data valuable to veterinarians and horse owners are in hand, which, together with the results of experiments with other cathartics, will be published in due time. The free hospital clinics for the School of Agriculture give much data on methods of treating diseases and wounds.

The division of animal husbandry has continued with beef stock in the study of breeds in fattening, and to determine the relative economy of full feeding and less than full feeding steers on corn meal and oil meal, and to determine the cost of feeding. In feeding lambs for the market several coarse foods have been compared, and the profits of fattening this class of sheep have been found very satisfactory. In finishing lambs for market, comparisons have been made between wheat and wheat screenings; outdoor and indoor, and liberty to be outdoor or indoor, have been compared, as also the advisability of giving the lambs a somewhat restricted ration of grain as compared with grain fed *ad libitum*. Sorghum, corn, rape, etc., and other annual crops, have been grown for pasture, and it has been shown that these crops will yield heavily in mutton per acre, and that by their use far less land is needed for sheep pasture and that the sheep have better pasturage for the entire season than when the perennial grass pastures alone are depended upon. An experiment is under way in crossing Dorset rams with grade ewes, to determine if the breeding habit cannot be so changed that the lambs will be dropped in the fall rather than in spring. Beef bred calves are

fed on skim milk, and such adjuncts as flax meal, to determine what gains and profits can be made. Feeding experiments with pigs are being carried on to compare the cost of different rations. Many of these experiments and others will be continued in 1896.

DONATIONS TO THE EXPERIMENT STATION WORK.

Below is a list of donations to the experiment station. We extend the thanks of the station corps to these gentlemen and firms:

West Virginia Experiment Station—One packet seedling tomatoes.

Hoover & Moore, Antlers, Col.—Three packets of seedling tomatoes.

George Hallberg, Brooklyn, N. Y.—One packet cauliflower seed.

C. W. H. Heiderman, New Ulm—Scions of hybrid plum and sand cherry.

Martin Penning, Sleepy Eye—Scions of unnamed plum.

Jewell Nursery Co., Lake City—Scions of new plum.

Martin Bovee, Northville, Mich.—Two pounds of seedling potatoes.

Storrs & Harrison, Painesville, Ohio—One variety of raspberry and gooseberry.

S. Norby, Madison, S. D.—One variety of plum.

Greening Bros., Monroe, Mich.—One variety of pear.

Thayer Fruit Farm, Sparta, Wis.—One variety of strawberry.

E. J. Hull, Olyphant, Pa.—One variety of strawberry.

Otto Wasserzicher, Bay Lake—Scions of two varieties of apples.

Andrew Peterson, Waconia—One variety of grapes and one variety of apples.

J. R. Johnson, Dallas, Tex.—One Columbian grape vine.

Department of Agriculture, Washington, D. C.—Several scions of apples and plums.

F. B. Van Ornan., Lewis, Iowa—Sample of new potato.

H. W. Buckbee, Rockford, Ill.—A large number of flower and vegetable seeds.

Delano & Moore, Presque Isle, Me.—One packet tomato and cucumber.

John Prescott, Princeton, Minn.—One packet muskmelon.

Gardner & Sons, Osage, Iowa—Two varieties of new strawberries.

Arnold Arboretum, Jamaica Plains, Mass.—A long list of valuable trees and shrubs, etc.

John S. Harris, La Crescent, Minn.—A collection of eighty-six specimens of native and foreign woods.

John R. Cummings, Washburn, Minn.—One specimen of native black walnut.

J. Colgrove, Clearwater, Minn.—One Colgrove Hand Potato Planter, $2; one Colgrove Potato Cutter, $8.

Hoover, Prout & Co., Avery, Ohio—One Hoover Potato Digger, $125; one Hoover Potato Sorter, $15.

F. Splittstoser, North Branch, Minn.—One Splittstoser Potato Sprayer (power), $55.

Scofield & Co., Freeport, Ill.—One Scofield Potato Planter, $35.

C. J. Cummings, Tully, N. Y.—One Cummings Potato Digger, $75.

Bateman Manufacturing Co., Greenlock, N. J.—One Improved Robbins Potato Planter, $65.

W. A. Lake Manufacturing Co.—One Peerless Plant Setter, $10.

Dowden Manufacturing Co., Prairie City, Iowa—One Dowden Potato Digger, $120; one Dowden Potato Sorter, $15; one Dowden Potato Cutter, $2.50.

Aspinwall Manufacturing Co., Jackson, Mich.—One Aspinwall Potato Planter, $65; one Aspinwall Potato Cutter, $10.

Davenport & Prince, Downer's Grove, Ill.—One Davenport Automatic Potato Cutter and Planter, $80.

Potato Implement Co., Travers City, Mich.—One Acme Hand Potato Planter, $2; one Hill's Improved Knapsack Sprayer, $3.

Rickenbacher & Baldridge, Columbus, Ohio—One transplanter, $1.50.

Deere & Mansur, Moline, Ill.—Potato planter, $52.50.

NEWSPAPERS DONATED TO THE EXPERIMENT STATION LIBRARY.

Acker und Gartenbau Zeitung, Milwaukee, Wis.
Agricultural Epitomist, Indianapolis, Ind.
American Agriculturist, 52 Lafayette place, New York.
American Dairyman, 61 Beekman street, New York.
American Horticulturalist, Wichita, Kan.
American Sheep Breeder, Chicago, Ill.
American Swineherd, Chicago, Ill.
Baltimore Weekly Sun, Baltimore, Md.
California Cultivator, Los Angeles, Cal.
Church and Farm, Salt Lake City, Utah.
Creamery Journal, Waterloo, Iowa.
Dairy World, Chicago, Ill.
Dakota Farmer, Aberdeen, S. D.
Dakota Ruralist, Aberdeen, S. D.
Elgin Dairy Report, Elgin, Ill.
Farm and Home, Springfield, Mass.
Farm Implement News, Chicago, Ill.
Farmer and Breeder, Cedar Rapids, Iowa.
Farmers' Advocate and Home Magazine, London, Ont.
Farmers' Guide, Huntington, Ind.
Farmers' Home, Dayton, Ohio.
Farmers' Magazine, Springfield, Ill.
Farmers' Review, Chicago, Ill.
Farming, Toronto, Ont.
Farm, Stock and Home, Minneapolis, Minn.
Garden and Forest, Tribune building, New York.
Hoard's Dairyman, Fort Atkinson, Wis.
Homestead, Des Moines, Iowa.
Indiana Farmer, Indianapolis, Ind.
Industrial American, Lexington, Ky.
Irrigation Age, 34 Clark street, Chicago, Ill.
Jersey Bulletin, Indianapolis, Ind.
Lever, Rockford, Ill.
Maryland Farmer, Baltimore, Md.

Mirror and Farmer, Manchester, N. H.
Montana Fruit Grower, Missoula, Mont.
Nebraska Bee Keeper, York, Neb.
Northwestern Agriculturist, Minneapolis, Minn.
Northwest Farmer, St. Paul, Minn.
Nor'-West Farmer, Winnipeg, Can.
Pacific Coast Dairyman, Tacoma, Wash.
Pacific Tree and Vine, San Jose, Cal.
Practical Farmer, Philadelphia, Pa.
Public Ledger, Philadelphia, Pa.
Rural Northwest, Portland, Ore.
Southern Cultivator, Atlanta, Ga.
Southern Farmer, New Orleans, La.
Southern States, Baltimore, Md.
Texas Stock and Farm Journal, Fort Worth, Tex.
The Sugar Beet, Philadelphia, Pa.
The Breeders' Journal, Indianapolis, Ind.
The Weekly Call, San Francisco, Cal.
Turf, Farm and Home, Waterville, Me.
Vick's Magazine, Rochester, N. Y.
Wool and Sheep Markets, 507 Rookery building, Chicago, Ill.
Wallace's Farmer, Ames, Iowa.
Watertown Journal, Watertown, S. D.

FINANCIAL STATEMENT.

Statement of disbursements and receipts of the Minnesota Agricultural Experiment Station for the twelve months beginning Jan. 1, 1895, and ending Dec. 31, 1895, inclusive.

	Disbursements.	Receipts.	Cash Outlay.
Station	$10,271.98	$632.93	$9,639.05
Agriculture	4,429.81	150.65	4,279.16
Horticulture	3,445.24	538.57	2,906.67
Chemistry	2,284.55	.....	2,284.55
Entomology	988.92	.....	988.92
Veterinary	1,606.36	287.97	1,318.39
Dairy	952.66	.....	952.66
Animal Husbandry	4,571.80	1,507.70	3,064.10
	$28,551.32	$3,111.82	$25,433.50
Coteau	*1,815.49	212.55	1,602.94
Crookston	7,872.65	1,000.00	6,872.65
Grand Rapids	112.10	.....	112.10
	$38,351.56	$4,330.37	$34,021.19

*$1,625.45 paid by current expense.

J. A. VYE, *Secretary.*

As will be seen by the foregoing financial statement, the University is adding to the expenditures of the experiment station above the amount provided by the federal government ($15,000), and in addition the state is now investing money in two sub-experiment farms in northern Minnesota. That this money is being expended in a way that is of value to the state is shown by the great interest with which the experiment work as well as the agricultural school work is being received by the farmers. The farmers have come, as they should, to regard this as their one special interest among the state institutions.

WM. M. LIGGETT,
Chairman.