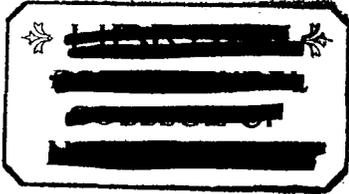


BIENNIAL REPORT



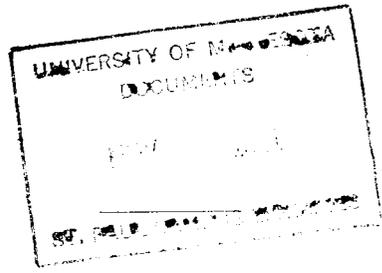
OF THE

MINNESOTA

State Agricultural Experiment Station

FOR THE

Biennial Period Ending December, 1892.



MINNEAPOLIS:
HARRISON & SMITH, STATE PRINTERS

1893

To the Board of Regents of the University of Minnesota:

I have the honor to transmit herewith the biennial report of the Experiment Station for the period beginning December 1st 1890, and ending November 30th, 1892. This report includes the report of the director and the reports of the heads of the different divisions of the station, a tabulated statement of the transactions in live stock and grain raising, with a financial statement showing the receipts and all the expenditures, except the salaries of the members of the staff; all of which are respectfully submitted.

CLINTON D. SMITH, Director
St. Anthony Park, Minn., Dec. 1, 1892.

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REPORT OF
EXPERIMENT STATION,
ST. ANTHONY PARK.

ADDITIONS TO EQUIPMENT.

The State of Minnesota with its seven million acres of improved land
r cultivation, embracing the wheat fields of the Red River valley on
orth, the fruit farms of the Park region and the farms of the
sified crops of the central and southwestern part, and the dairy farms
the southeastern section of the State, presents to the Experiment Sta-
on that attempts to aid her in developing her still new industries, a set
uestions of so great importance and of such widely varying character
, to answer them at all helpfully, the station must be most thoroughly
anned and equipped. The growth of the State the past two years has
en marvelous. Agricultural industries that were, at the beginning of
is period, still in their infancy, have grown to importance and now de-
and the attention of all interested in the welfare of the farmer and his
rosperity. Prior to the year 1891 the demand for experiments along
airy lines had not made itself manifest; but the high price of dairy goods
nce then and that increase in the density of population in the southern
art of the State which made the starting of creameries over a consider-
le extent of territory both possible and profitable, gave a strong im-
tus to the dairy business that has placed it next in rank to wheat rais-
g in value of products exported. Taking into account the home con-
mption, this industry has risen almost to a level with wheat raising in
lue of total products. Recognizing the importance of accurate knowl-

edge to the dairy industry at this growing and formative period of its history, the Regents wisely and generously provided for the carrying on of experiments in dairy lines by erecting on the site of the former station building a commodious dairy hall with an equipment including apparatus, for experiments in the handling of milk both for cheese and butter making, as well as the machinery and outfit necessary for giving thorough and complete instruction to the students in agriculture at the school and college, in the latest and best methods of dairy work. The total cost of building and equipment is not far from \$17,000. In the second story of this building are located four offices and a mailing room for the use of the station corps. On the main floor besides the entrance hall, dressing room, wash room and cold storage rooms, there are two rooms 42x30 feet, both abundantly lighted and well ventilated. One of these rooms is used in butter making, the other is equipped for cheese making. The building is heated by steam supplied by a 40-horse power boiler in the basement, which also furnishes power for a 26 H. P. engine used in driving the steam separators, churns and butter workers. All of the shafting in the building is kept below the main floor and the machinery is driven by belts going up through the floor. The light and view of the butter room is thus left unobstructed by shafting or belting, and the danger from loose belts hanging on a revolving shaft is thus entirely obviated. The plumbing of the rooms is so arranged that while the cheese and butter rooms are provided with cold and hot water and with steam at convenient points, the pipes obstruct neither the light nor free passage in any direction across either room. In the basement, besides the engine and fuel rooms and experimental curing rooms, there is a large lecture room into which animals are led for illustration in the breeding classes.

The equipment of the dairy hall for purposes of experiment in dairy work is very complete. The thanks of the station authorities are due the DeLaval Separator Company, of 74 Cortlandt street, New York; P. M. Sharples, of West Chester, Penn.; Davis & Rankin, of Chicago, Ill.; Vermont Farm Machine Company, of Bellows Falls, Vt., and Cornish, Curtis & Greene Company, of St. Paul, Minn., for their generosity in loaning the station the use of the separators which they respectively make or handle, for testing and for use in the factorymen's course at the dairy school.

A herd of cows comprising the best obtainable specimens of Guernseys, Jerseys, Holsteins, Shorthorn and Polled Angus breeds and grades, has been purchased as types for study by the scholars of the agricultural school, and for use in the various experiments heretofore reported and in progress. The milk of these cows is used in instructing the students in butter and cheese making as well as for experimental purposes. A full report of the amount eaten by each individual of this herd, and the amount of milk and butter fat yielded will be reported in a future bulletin. These additions to the equipment of the station make possible experimentation that can not fail to be one of great advantage to the farmers of the State.

At the date of the last biennial report a chemical laboratory was in process of erection. This building has been completed. The chemist reports that the equipment of the laboratory is unusually full and complete

in lines relating to higher organic work, and the sugar producing plants, and for soil work. The chemical laboratory is also used by the School of Agriculture for instruction in agricultural chemistry.

The insufficiency of the water supply has heretofore been a constant source of annoyance to the school and station. At the first session of the dairy school in January, 1892, the well was pumped dry and it became necessary to haul water from the St. Paul city water supply at Merriam Park. At various other times during the winter serious inconvenience was caused by the supply becoming exhausted at critical periods. To remedy this chronic difficulty the well has been deepened during the summer of 1892 from 187 to 226 feet, and the water is now derived from a stratum of St. Peter sandstone lying immediately below a layer of limestone forty feet in thickness. This source seems to be inexhaustible. A tank holding over 1,800 barrels and elevated sixty feet above the ground has been erected at a cost of \$2,000 on the hill west of the dwelling house. The height of this tank is sufficient to throw water to the topmost story of any building on the grounds. A sewer, built to give suitable drainage to the school buildings, serves also as a drain for the chemical laboratory, obviating the necessity of cesspools heretofore used.

CHANGES IN STATION STAFF.

This biennial period has been characterized by a number of changes in the working force of the station. In February, 1891, the resignation of Prof. N. W. McLain, the former director, was accepted, and on the first of the following May the appointment of the present director went into effect. Dr. Olaf Schwartzkopff, veterinarian, on account of the pressing duties occasioned by the inauguration of the college of veterinary medicine of the university, was obliged to withdraw from the station staff early in the summer of 1891. His successor, Dr. Christopher Graham, B. S., M. V. D., was appointed in August, 1892, and began his connection with the station the first day of September, 1892. The connection of Mr. E. F. Batten, the accountant of the station ceased on the first day of June 1891, and his successor, the present secretary of the station staff, Mr. J. A. Vye, whose appointment dates from that time, began his work with the station. On the first day of December, 1891, Prof. D. N. Harper, the chemist, resigned his position here to take up another line of work. He was succeeded by Prof. Harry Snyder, the former assistant in chemistry in the experiment station of the Cornell University at Ithaca, New York. Prof. W. M. Hays, the efficient agriculturist, severed his connection with the station on the first of January, 1892, to accept a position with the North Dakota Agricultural College.

In June of the present year, Prof. T. L. Haecker was appointed assistant in agriculture and placed in charge of the dairy experiments relating to butter making.

The time of the station workers has been divided between experimental work and teaching. The sessions of the farm school begin in October and end in April. During that period a large share of the instruction in all of the branches of practical agriculture, horticulture, veterinary and entomology, is given by the members of the staff. This involves, for some members of the staff, three exercises a day. The preparation for the kind of teaching given in the school is a matter of no small importance. The students are bright, anxious to learn, and thoroughly progressive, and to

give them helpful instruction in the various lines in which they are interested requires careful and accurate preparation of both material for illustration and lectures. On the part, therefore, of the whole station staff but little time can be given during the winter to experimental work. A considerable share of the time of each member of the staff is rightfully taken up in answering questions, either for publication in the great agricultural weeklies or directly to the farmers interested.

To bring the station into more intimate relation with the farmers of the State and to draw the attention and interest of the agricultural communities to our work, the members of the staff have improved their opportunities to address meetings of the farmers whenever invited so to do. Many of the county fairs were visited and practical addresses given. During the summer of 1892 the time of Professor Haecker was occupied in visiting the creameries to give instruction where needed and to call the attention of the people employed in dairy work to the advantages offered by the school, and to the work done at the station. In this connection I must not fail to record the gratitude of the station staff to the railroads who have shown their kindness to the station and their appreciation of our work by granting free transportation to the director and other members of the staff when called to distant parts of the State on experimental work. This aid has been of invaluable service to the station. Our thanks are especially due to the officers of the Great Northern, the Chicago, Milwaukee & St. Paul, the Chicago, Minneapolis, St. Paul & Omaha, the Chicago & Great Western, St. Paul & Duluth, Minneapolis, St. Paul & Sault Ste. Marie, Northern Pacific and the Eastern Minnesota railroads. These railroads have also extended their courtesy to the station by transporting, free of charge, in many cases both to and from the station, the material used in our co-operative experiments when conducted by farmers along their respective lines.

In the spring of 1891, Mr. Chas. A. Pillsbury donated to the station 500 bushels of thoroughly cleaned, well selected superior Scotch fife wheat grading No. 1 hard, for the purpose of undertaking in a broad and comprehensive way an experiment to test the influences of variations of soil and climate on the yield and character of wheat. This wheat was scattered over typical areas in all the different sections of the State. From most of the farmers receiving the seed, reports were returned. The results were published in bulletin No. 23, and go to show that great care in selecting and cleaning seed wheat is rewarded by a larger crop, and that the grade of the wheat is largely determined by the character of the soil and climate of the place where the crop was raised. The thanks of the station are due Mr. Pillsbury for his philanthropy in donating this large amount of wheat.

The station farm comprises about 150 acres of land under cultivation, exclusive of pasture. This entire area is used annually in plot experiments, and in the production of the fodder and grain for the stock. To cultivate this thoroughly and keep it in proper shape for the inspection of visitors requires the employment of a large force of men, the management of which is no small task.

In field experiments during the year 1891, 155 plots have been used; during 1892, 181.

The management of the farm help, the care of these plots and the general execution of the experiments in the agricultural division of the station have been entrusted to Mr. Andrew Boss, the foreman of the farm. Besides skillfully managing the farm hands and the farm work generally, Mr. Boss has observed the progress of the experiments and kept notes concerning the plots and animals in detail, with painstaking fidelity. The director has thus been relieved entirely of the necessity of observing the details of the experiments.

The amount of property belonging to the university placed in the hands of the director has grown to be very large, and to manage it economically and skillfully a large amount of routine business is involved and absorbs a large share of the director's time. The office work, keeping accounts, the stenographic work and duties of secretary to the staff have been most efficiently performed by Mr. J. A. Vye, whose accurate business judgment and good sense have made his services invaluable.

The following bulletins have been issued during the biennial period :

Bulletin No. 13—A treatise on flax culture.

Bulletin No. 14—Swine, feeding for profit. Swine breeding. Sugar beets, their cultivation, the process of manufacture.

Bulletin No. 15—Wheat, a comparison of foreign and native varieties the selection and changing of seed.

Bulletin No. 16—Sheep scab, and how to cure it.

Bulletin No. 17—Migratory locusts in Minnesota in 1891.

Bulletin No. 18—Notes on strawberries and raspberries, 1891. Notes on sand cherries, buffalo berry and Russian mulberry. Evergreens from seed. Summer propagation of hardy plants.

Bulletin No. 19—Dehorning experiment. Cream raising by cold, deep setting. Experiments in cheese making—Incorporating cream into cheese. The Babcock test and churn.

Bulletin No. 20—Fertilizers. Improvement of timothy. Rape in Minnesota. Peas and oats. Field peas.

Bulletin No. 21—I. Sugar beets. II. Sorghum.

Bulletin No. 22—I. Comparison of corn, barley, corn and shorts, barley and shorts, corn, shorts and oil meal, and barley, shorts and oil meal in the ration of growing pigs. II. Corn vs. barley for fattening hogs. III. Corn meal, barley meal and a mixture of barley meal and oil meal compared. IV. Wet vs. dry food.

Bulletin No. 23.—WHEAT. I. Milling and baking tests. II. Co-operative tests with selected seed wheat. III. The frit fly. Preliminary report upon an insect injurious to wheat.

Bulletin No. 24.—Ornamental and timber trees, shrubs and herbaceous plants in Minnesota. Notes on their hardness and desirability.

Bulletin No. 25.—Notes on small fruit in 1892.

The best evidence of the value of the experiments is found in the fact that although the bulletins are issued in editions of 15,000, this number is inadequate to supply our present mailing list and at the same time furnish copies to be sent to new names which are constantly coming in.

The full reports of the heads of the different divisions which are appended and form a part of this report, need but little comment from me. It is the aim of the director and staff to make the station useful to as many of the important industries of the State as our means and equipment will warrant. The wheat raiser receives valuable information in the bulletins

of the entomologist on the means of fighting the locusts and the frit fly, and of the chemist in his work on fertilizers, milling and baking tests and co-operative tests with selected seed wheat. The fruit culturist has in bulletin number 24 a compendium of all the trees which he can with safety plant in his wind break or forestry plantation; and in bulletin 25 and 18 the reports on small fruits, grapes and apples as to their behavior on the station farm, with suggestions as to the best varieties for planting and as to methods of cultivation. The stock raiser is interested in the bulletins on swine feeding for profit; sheep scab, and how to cure it; in the dehorning experiments, and in the comparison of corn and barley alone or combined with other foods in the ration of growing pigs. The dairy division has offered to the farmers but one bulletin, largely treating of the effects of dehorning on quality and quantity of milk, and reporting experiments in butter and cheese making. The general farmer, in addition, will be interested in the treatise on flax culture, and on sugar beets and sorghum. Also in bulletin No. 20, on fertilizers, improvement in timothy and field crops, including rape in Minnesota, peas and oats and field peas.

The reorganization of the veterinary division of the station opens another wide field for profitable investigation. In New York, it is said, that every eighth death in the human family results from tuberculosis, and that this dread disease is taken into the system very often in the milk and flesh of affected animals. It is not believed that tuberculosis is proportionately as frequent in Minnesota, owing to climatic differences, but it still exists, and cases occur with alarming frequency. The communicability of the germs from cows to man through the medium of the milk, is well established, and it therefore becomes of vital importance to investigate the new means of diagnosis, like tuberculine, and then, if that is found satisfactory, test the question of the frequency of the disease among cattle in the State. Among horses there also exists a disease communicable to man, yet very difficult to diagnose, viz: glanders. Lately a new diagnostic agent has been suggested. The disease is supposed to be common among our horses, but the characteristic lesions are so obscure that certainty of diagnosis is well-nigh impossible.

These are given as but two instances of the kind of work that the veterinarian finds ready at hand as he begins his work. Fortunately, the general health of the animals of the State is most excellent, still occasional unusual outbreaks of contagious or epidemic disease call for the exercise of his skill in combatting them, and offer fields of useful research.

CLINTON D. SMITH, Director.

REPORT OF THE AGRICULTURAL DIVISION.

I. Animal Industry. No apology is needed for the fact that a large share of the time and means of the agricultural division has been expended in experimenting in lines of animal industry. As the State grows older and the adaptability of the land to wheat growing decreases, every farmer will become from necessity more or less a breeder of farm stock. He will find a great variety of foods produced in his own state and will not have to go out of its boundaries to import any by-products wherewith

to supplement his home grown fodder to form a perfect ration. Our experiments in live stock have therefore been directed to obtaining a better knowledge of the feeding stuffs of the State and to encourage their utilization at home and to prevent their exportation in the crude form.

The large number of cross bred pigs on the farm in the spring of 1891 offered the material for somewhat extended experiments in swine feeding. The report of the results of part of these experiments is found in bulletin No. 22. These tests were directed towards finding the value of barley as compared to that of corn in the ration of growing pigs and of fattening hogs. Thirty-four hogs were used in one experiment which led to the conclusion that when both grains were fed to pigs weighing 50 pounds, 100 pounds barley meal was found to produce as much gain as 119.5 pounds corn meal, and that even when mixed with shorts, barley meal was slightly superior to corn, but when the pigs had attained a weight of 125 pounds or more the relative value of the two grains for feeding purposes was reversed and 100 pounds of corn meal and shorts produced as great a gain as 119 pounds of barley meal and shorts mixed in equal proportions. Another experiment on two groups of hogs demonstrated that pigs could distinguish between good and poor barley and that they gained very much faster on the former than on the latter, but that in no case did these fattening hogs make as great gain from a given amount of barley as from a given amount of corn. It was also demonstrated that with young pigs the same feed when fed wet produced a greater gain than when fed dry because the animals would eat more of it, but that the gain per hundred pounds consumed was almost identical in the pens fed wet and those fed dry. Other experiments in pig feeding have been conducted the results of which are not yet reported.

A large amount of digestion work has been performed, the results of which are reported by the chemist.

With sheep, an experiment was conducted in the winter of 1891-2, to test the value of feeding pigeon grass seed, wild buckwheat, various grades of screenings, shrunken wheat, corn and barley, as food for fattening lambs. The results, while not conclusive, tend to show that pigeon grass seed has an appreciable value as a sheep food, though not so great as the poorest wheat screenings. The results of this experiment will be reported in connection with an experiment now under way, partly to test the same question.

A variety of experiments have been performed and are now in progress on the feeding of dairy cattle, the results of which will be reported in a future bulletin. A comparison of the feeding value of a quantity of corn put in the silo and an equal quantity field cured showed that the advantages of the silo in this dry climate where usually the fodder can be cured in the field with but very little rain, are not so great as in moister climates. The whole question of whether silos are to be recommended to the farmers or not has been taken out of the field of chemistry and experiment, and now rests for its decision on another question—Which of the two methods involves the less expense in handling the corn? Other comparisons of grain foods for dairy cattle have been conducted, the results of which go to show that barley compares very favorably with corn in a ration, that bran and oil meal are very profitable, if not indispensable factors in the ration where ensilage is used.

A very careful and complete record of the feed and yield of the dairy herd for the year has been kept, in order that we might study the individuality of the cows and the effect of the lapse of the period of lactation and the proximity to calving, not only upon the total yield of milk and butter fat, but upon the richness of the milk. This account with the cows necessarily cannot be closed until the date of this report. It is being worked up as rapidly as possible and will be ready for publication soon. It cannot fail to be a vast treasure house of information for the dairymen and will give them the ground work for a host of valuable lessons.

Experiments now in progress in animal industry are the comparison of cut and uncut clover in the ration of all kinds of farm stock, to test the question whether it will pay the farmer to cut his hay and mix his grain feed with it; a study with sheep as to the increased expense of fattening the animals out of doors as compared with the same animals in a barn, and whether it is possible in this climate to successfully fatten sheep without barn protection; and finally a comparison of the value of screenings and corn and barley in the ration of fattening lambs and a repetition of the former experiment, comparing the same field area of ensilage and field cured corn.

II. Plot experiments in 1891. Raising field peas for forage and for threshed grain has justly attracted the attention of the progressive stock raisers of the State. Peas offer another source of the protein in the supplementary foods. To test questions relating to quantity of seed per acre, methods of sowing, alone or mixed with oats, shallow or deep, 38 plots were sown to peas in 1891. The results are reported in bulletin 20, and how that although no great advantage seems to lie with either one of the four classes of field peas, improvement ought to be made by selection of plants of more erect habits. The seed may be sown with a shoe drill or plowed under to a depth of three or four inches, using from two to three bushels per acre.

A trial was made of rape as a forage for sheep. The result went to show that it is a valuable fodder for carrying the flock through the fall when the pastures are dried up and feed is short. Care should be exercised in obtaining the seed to get the kind that grows a succulent fodder and not bird seed rape. Experiments were also conducted to test the relative merit of sowing grains alone or mixed, which showed that where wheat and oats were sown together a marked improvement was noted in the quality of both grains though the quantity was not perceptibly increased.

Different methods of sowing oats were tried; sowing broadcast on stubble and working in with cultivators; sowing broadcast and plowing under, and broadcasting on spring plowed ground. Nine plots were used in this experiment, the results of which will appear in connection with similar work of this year in a subsequent bulletin.

Of the experiments of rolling oats after they had attained considerable height, the results seem to show that on over-rich fields, if they be rolled when twelve inches high, the luxuriance of the plant may be somewhat checked, and the oats will stand up better at harvest, and may yield a somewhat larger amount.

Eighteen varieties of corn were tested and various cultural experiments carried on, the results of which await publication.

The results of the experiments in sugar beet raising are reported in bulletin 21. It is shown that beets with a high per cent. of sugar and a high degree of purity can be raised in profitable quantities with reasonable care. The advisability of establishing beet sugar factories does not rest, however, upon this fact, but upon other considerations not within the scope of our experiments.

At Glyndon, Minn., a test of 75 varieties of imported Russian seed wheat was conducted.

III. Plot experiments in 1892. PROF. CLINTON D. SMITH. *Dear Sir:* In accordance with your request I submit the report of plot work done at the Station since December 1, 1891. ANDREW BOSS, Foreman.

Owing to the unusually wet and stormy season, the results of the field experiments are inconclusive and misleading, and at least a part of them should have another trial before being published.

WHEAT. Three experiments were started with wheat in the spring, as follows: I. Early and late seeding. II. A comparison of the broadcast seeder, the hoe and press drills. III. A variety test of sixty-six varieties of Russian wheat.

In the case of early vs. late seeding, four plots six rods long and one rod wide were used, containing in all nine-tenths of one acre. The results of this experiment were unfitted for publication by a severe rain and wind storm at the time of ripening, but are strongly in favor of early seeding.

The comparison of the seeder, hoe drill and press drill is in favor of the press drill. The plot sown with that implement ripening a week earlier than the one sown with the seeder and three days earlier than the one sown with the hoe drill.

The variety test is unfinished but bids fair to be complete, and will doubtless develop some good varieties of wheat. In addition to the above experiments there were eight acres of wheat raised on the farm which yielded 184 bushels, or twenty-three bushels to the acre.

OATS. The experiments with oats were as follows: Early vs. late seeding; light vs. heavy seed; fall vs. spring plowing.

Early vs. late seeding of oats is parallel with experiment No. 1 of wheat with the same general results.

The comparison of the broadcast seeder, the hoe and press drills in oats was performed on a much larger scale than the one in wheat, each plot containing one and one-third acres. The results are again in favor of the press drill as the straw stood up better, filled better and yielded more for the same amount of seed.

The variety tests, light vs. heavy seed, thick vs. thin seeding, and fall vs. spring plowing are not yet finished, but the results will not be very satisfactory owing to the conditions previously mentioned.

There was raised on the farm this season 24 acres of oats which yielded 1,287 bushels, or 53 5-8 bushels per acre.

BARLEY—The experiments with barley were confined to a test of four varieties which with the varieties of oats remain to be threshed when a full report of the results will be made. There was also raised a field of 15 acres of barley yielding 575 bushels, or 38 1-3 bushels per acre.

PEAS AND PEAS AND OATS—Two acres of peas were sown in order to obtain the grain for feeding experiments during the winter, and two more sown broadcast and plowed under three inches deep, divided into equal plots,

and oats drilled in two inches deep in different proportions, the object being to ascertain the most profitable proportion for a feeding ration. The results show that when over one-half bushel of oats per acre was sown with two bushels of peas, the peas were smothered out.

VETCHES—An acre of vetches was sown and cut and cured for hay for the purposes of testing it as a fodder for sheep. One-half acre was sown at the rate of three bushels per acre and the other half acre at the rate of two bushels of seed per acre. The results show that in a wet season at least, two bushels is better than three.

MILLET—Two acres of millet yielding 7,560 pounds were raised and stored in the barn to be used in a feeding experiment against oat hay during the coming winter.

POTATOES—One and one-half acres of potatoes were planted in furrows forty-two inches apart and plowed under fifteen inches apart in the furrow. One-fourth of an acre was drowned out by June frost and the balance of the field yielded 190 bushels.

RAPE—As there has been considerable controversy over rape as a cheap food for fattening lambs, one-half acre was drilled with a Mathew's seed drill in drills 18 inches apart at the rate of two pounds per acre, and one-half acre broadcast and covered with a Breed's Weeder, at the rate of five pounds per acre. The half acre that was drilled was hoed once and was far ahead of that sown broadcast, growing five or six inches higher and so thick that one could hardly walk through it. To test its efficiency for fattening sheep, twenty lambs were purchased and turned into the field of rape, Sept. 21st. The weight of the lambs at the time was 1,170 pounds. They were left in the field till Oct. 27, when they weighed 1,285 pounds. While one test is not enough to determine the value of rape, the result of this one goes to show that its chief value is in producing a cheap-growing ration when pasture is short.

FLAX—Experiments are now under way to aid in determining the quantity of seed that should be sown per acre to produce the best fibre; and also some variety tests. One acre of land has been devoted to this purpose during the past year.

SUGAR BEETS—Two acres of land have been devoted to raising sugar beets, on which was raised 36,910 pounds of beets, 10,570 pounds of which are to be used for feed and 26,340 pounds have been shipped to Norfolk, Neb., to be worked into sugar. There was also raised 14,880 pounds of mangel wurzels to be used as feed.

CORN—A field of thirty-eight acres of corn was planted, five acres of which were cut up into ensilage and three acres drowned out. The corn on the remaining thirty acres has been husked and cribbed and amounts to 1,200 bushels by weight with thirty tons of fodder, all of which is still on hand.

A part of the field was used to test the value of ensilage as compared with dry fodder and the feeding experiment in furtherance of this test will besoon put under way. A test of the merits of corn drilled in very thick, over check rowed corn, both for ensilage and dry fodder is also to be finished as soon as the animals can be had to perform the feeding experiment. Eighteen varieties of corn have also been tried and the report will be ready in a few days.

The above report covers all crops raised on the farm except hay, of which there was raised thirty and three-fourths tons of timothy and thirty-eight and one-fourth tons of clover; and all experiments undertaken since Dec. 1st, 1891, excepting the ones with live stock, of which there has been one with sheep, seven with hogs and three with cattle, the reports of which are already in your possession.

CLINTON D. SMITH,
Agriculturist.

DAIRY DIVISION.

ST. ANTHONY PARK, Minn., Dec. 1, 1892.

CLINTON D. SMITH, *Director Minnesota Experiment Station*: In compliance with your directions I submit an outline of work done since the first day of October, 1891. The first half of the month was spent in selecting and shipping to the station a number of dairy cows to be used in connection with the experiment station and dairy school. As these cows were to represent distinctive types and be used for specific purposes, great care was taken in their selection. The cows purchased by me were Tricksey and Champion Sweetbrier 3rd, two registered Guernseys; Pride of Evergreen, a registered Jersey, and Marie, Pottie, Gertie and Beckley, four high grade Jerseys, also Houston a cross-bred Jersey-Guernsey; Rossie, a half-blood Jersey, and the yearling bull, Silver Pogis, registered Jersey. These with others bought within the State constitute the station dairy herd.

For purposes of experimentation and for use as object lessons in the class room, it is desirable to have the animals models of their kind; these must be of a type that will not lay on flesh under high feeding, but respond freely in milk and butter fat. The typical dairy cow is a machine for converting feed stuffs into dairy products, and one that will fail to do this or does not convert all food over and above that needed for the support of the body, into milk, is not the kind of beast needed for our purpose. The degree of success which has attended our efforts in making our selections will appear in the tables of live weights, yield of milk and per cent. of fat. Much of the work done has necessarily been of a preliminary character. On the first of December, 1891, a regular daily record of the herd was begun, each cow's milk is weighed and tested by the Babcock test for per cent. of fat thus affording an opportunity to note the variations in quantity and quality of milk of every cow and to study into the causes which produced them, and also to observe the conformation of the cows, to ascertain which is best suited for dairy purposes.

This line of work has been pursued during the year with great care and with gratifying results. As it would take too much labor to churn the cream of each cow separately to find her butter product, an experiment was made to ascertain the accuracy of the Babcock test in measuring the butter value of milk. For this purpose eight cows were selected, representing four different breeds, each cow's milk was weighed and tested morning and evening for one week and from this test the butter value was computed. The cream of each cow for the week was churned separately and by adding the total amount of butter fat lost in the skim and

butter milk it was found that the amount recovered by the churn was within 2.3 ounces of the total amount indicated by the test; this small difference could easily be accounted for by the mechanical loss in the making, so that, for all practical purposes, the Babcock test is a correct measure of the butter value of milk. In this experiment it was incidentally shown that the time required to do the several churnings and the churnability of the cream from cows of different breeds, as shown by the per cent of fat left in the butter milk, does not depend upon the breed, but that exhaustive churning is dependent upon the proper ripening and temperature of the cream.

During the winter several problems presented themselves for solution, and after the close of the school year general routine work was resumed in the dairy hall and at the same time some experiments were made in creaming and churning to solve, as far as possible, some of these problems. Numerous complaints were made in the agricultural press of cream not churning, and inquiries made as to the cause and remedy, the answer uniformly being "too many strippers in the herd." The term "strippers" has reference to cows well advanced in the period of lactation. To test the correctness of this theory, the cream from cows in the herd that had been in milk from nine to twelve months, and the cream from comparatively fresh cows was similarly treated. It was found that when the proper acidity was developed in the cream there was no material difference in the time required to do the churning.

There were also numerous complaints that by the gravity process there was great loss of fat in the skim milk; several trials were made with the Cooley process, and it was found that often as high as 25 per cent. of the fat was left in the skim milk, and upon further investigation it was ascertained that the milk from strippers was the cause of the heavy loss. Several methods were tried, and it was found that by churning this milk at a high temperature—70 degrees—satisfactory results were obtained.

There are so many conditions which prevent exhaustive churning that at times it is very difficult to discover the cause in cases reported, and in order to study this question more carefully numerous churnings were made with cream under varying conditions, the range of loss being from one-tenth of one per cent. to two and eight-tenths per cent., and in every instance of heavy loss it could have been prevented by observing a few simple rules which will be formulated in a forthcoming bulletin on this subject.

The station herd of dairy cows which is kept for purposes of experimentation in milk and feed stuffs numbered twenty-nine head; of these four have been sold and two have died, leaving twenty-three now in the herd. Three are full registered Guernseys; two are cross-bred Jersey-Guernseys; three are registered Jerseys; one registered Holstein; two grade Holsteins; eight grade Jerseys; two grade Shorthorns and two grade Guernseys. The four sold were Frank, Gran, Lucy and Ray; their performance as dairy cows was not such as would warrant their being retained in the herd, as will appear in the tabulated statement of yield of milk and per cent. of fat. The two that died, Marie and Pottie, were high grade Jerseys of great merit. Nearly all of the cows remaining in the dairy herd are of approved type and do excellent service as dairy animals, yet of these, two or three could be dispensed with, and would leave a herd which would do credit to the school and station.

As the record of the station dairy herd for the year did not close until the first of December, and since it will require about fifteen thousand computations to ascertain the total yield of milk and fat during the year, it will be impossible to furnish the tables in time for this report. They will be the subject of a bulletin to be published at an early day.

All of which is respectfully submitted.

T. L. HAECKER.

HORTICULTURAL DIVISION OF THE EXPERIMENT STATION.

ST. ANTHONY PARK, Minn., Nov. 30, 1892.

PROF. CLINTON D. SMITH, *Director Experiment Station*. Sir: I have the honor to herewith submit the report of the work in the horticultural division, for the biennial period ending Dec. 1st, 1892.

Yours respectfully,

SAMUEL B. GREEN,

Horticulturist.

HORTICULTURAL DIVISION.

Since taking charge of the work of this division it has been my object to keep the work in touch with the thought and work of the most progressive horticulturists, and so far as possible to aid in advancing a helpful, general knowledge of horticulture among the citizens of the State. The one fact that impressed itself most clearly on my mind while attending to my duties is that there are far greater possibilities for horticulture in this State than are generally supposed, and that many of the failures which have attended horticultural efforts heretofore, are due to the blindly following out of methods that, however well they may make for success elsewhere, can not obtain in successful horticulture here. In a report of this nature I can no more than outline in the briefest possible way the most important work undertaken by this division. An important part of my work has been the attention given to the answering of questions on various matters connected with horticulture and forestry, which I have received directly or through the agricultural publications of the State. This work has largely increased since my last report and now requires a considerable part of my time.

PUBLICATIONS.

The publications of this division of the time covered by this report are as follows: Bulletin No. 18, issued in September, 1891, consists of twenty-four pages devoted to a report on small fruits; the raising of coniferous evergreens, seedlings and on the summer propagation of plants. Bulletin No. 24, issued in October, 1892, consists of sixty-four pages and is a report on the behavior of the ornamental and timber trees, shrubs and herbaceous plants offered by the most progressive nurserymen, that have been tried in this State. This bulletin contains a table of hardiness, in which the different plants mentioned are, so far as possible, criticised by reliable observers in various parts of the State. It is designed especially as a guide to planters in this State, and furnishes a satisfactory answer to

the many requests this division has received for information of this character. Bulletin No. 25, issued in December, 1892, consists of a report on varieties of strawberries, raspberries, blackberries, dewberries and grapes, fruited at the station the past year; a report on the preliminary experiment in shading strawberry plants to increase their fruitfulness; on renewing old strawberry beds and on the details of a very successful experiment in spraying of grape vines to prevent downy mildew.

SCHOOL GROUNDS.

The laying out and planting of the grounds about the Farm School has required considerable attention. Since my last report the ground about the laboratory building has been graded and several new drives put in where needed. The main entrance to the Station has been improved by seeding down the boulevards and the appearance of the whole of the grounds greatly improved by the planting out of trees and shrubs along the borders of the drives and about the buildings in accordance with the plan suggested in my last annual report. There have been planted on the school grounds in the past two years 109 deciduous trees, mostly white elm and white maple; 360 coniferous evergreens, embracing seventeen species and varieties; and 170 shrubs and vines, embracing forty-six species and varieties. The typical specimens of these species should be plainly marked with their botanical, scientific and common names, and so treated will add much to the value of the grounds for purposes of instruction and pleasure.

APPLES.

Much interest is manifest throughout the State in the growing of apples. This is largely due to the very general planting of the hardiest, and exercising better care than formerly in their culture, which has resulted in the very heavy crops the past few years. The crop in 1892 was so large that many car loads were shipped out of the State and some growers sold as many as one thousand barrels of number one apples. There can be no doubt in the minds of careful observers but that there is a large amount of land in this State that can be far more profitably devoted to the growing of this fruit than to any other crop.

The experiment orchards at the station are in excellent condition and produced a small amount of very excellent fruit the past season for the first time, but they are not yet old enough to warrant me in drawing conclusions from the results. The number of varieties on trial has been increased by the addition of promising seedlings and Russian, Swedish and North German apples, until now we have about 300 varieties. It is my object to thin out this large list and reduce it to reasonable proportions as soon as may be. As fast as a variety exhibits any serious weakness it is discarded.

The varieties that are doing best aside from the Duchess, which is well and favorably known, are: Lieby, Anissein, Buskovka, Borovinka, Charlomoff and Red Wine.

NEW ORCHARD.

In the fall of 1890 about one acre of woodland on the north slope of the hill at the experiment station was grubbed out and planted to a variety of fruit trees as follows: 16 varieties of Russian cherries; 2 varieties of peaches; 4 varieties of plums; 1 variety of Russian apricot and 139 varie-

ties of apples, in all 360 trees. The advantages of this orchard lie in the northern slope and high altitude. It supplies us with what has been long needed by furnishing us with a favorable trial ground for varieties that only do their best on elevated land.

TOP WORKING APPLES.

The subject of top working somewhat tender varieties of apples on hardy stocks is one that is exciting among orchardists, in this State, much interest, and some results already achieved in this line seem to indicate that by this plan varieties of no greater hardiness than the Wealthy may be grown much farther north than at present seems practicable. One of the best stocks for top working is the Virginia crab, and last spring I planted fifty of them for this purpose. In my report last year I referred to the importance of experimenting with seedlings from one of the best varieties of apples. I have grown the season just past 900 plants from seed of the most hardy desirable known varieties of apples. While this is a promising field for experiment yet with these seedlings we know only the maternal parent and of course the work is made more a matter of chance than it would be did we know both parents. With the object of doing better work, I last spring made hand crosses of the following hardy kinds of apples with the Lieby, using the latter as the mother plant; Duchess of Oldenburgh, Christmas, Good Peasant, Borovinka and Charlamoff. This work may be compared to the systematic, intelligent breeding of domestic animals, and from these crossed seeds I expect much better results than from ordinary seedlings.

SMALL FRUIT.

In bulletins numbered 18 and 24 I have made an extended report of the behavior of the small fruits, so that any farther mention of them would be unnecessary and out of place here, except to add in a general way that among the newer strawberries and grapes especially, there are several varieties that are undoubtedly an improvement on the old kinds. There is much interest taken in this subject by our fruit growers, and the reports bearing on it are widely sought after.

PLUMS.

The outlook for improvement in this fruit is very encouraging. We have now forty-seven named varieties on trial, and are making a specialty of raising seedlings from the best kinds and have now over four thousand plums from which we expect to select at least two hundred promising plants for fruiting. We have fruited seven varieties. The large trees in the orchard have borne regularly very heavy crops of fruit, until this year when they blossomed profusely, but the pollen was washed away by heavy rains and the crop was a total failure.

FORESTRY.

In my last biennial report I referred to the planting out of two and one-half acres to forest trees. This plantation has been extended and now embraces about three acres. It is laid out in rows eight rods long and set with the following economic plants: European larch, white ash, black ash, green ash, box elder, wild black cherry, yellow birch, European white birch, canoe birch, American bass wood, European bass wood, five kinds

of timber willow, six kinds of timber poplar, catalpa, butternut, black walnut, soft maple, hard maple, hemlock, red cedar, red pine, Norway spruce, black spruce, Douglas spruce and white cedar. The special value of this plantation is for an object lesson to our students and others in forestry, for which its value is an increasing one. It will also furnish valuable data as to the comparative hardiness, rapidity and habits of growth, and the value for different purposes of newly introduced forest trees.

CONIFEROUS EVERGREENS FROM SEED.

The introduction of coniferous evergreens on our wind-swept prairies is a matter of much interest and importance. I have carried on experiments the past three years in raising seedlings of these trees, and some of the results obtained are of much interest and are reported on at length in bulletin No. 18. These results seem to show the great value of a few simple precautions which, if followed, will enable any careful man to raise these plants successfully.

ROCKY MOUNTAIN EVERGREENS.

After a careful study of these very beautiful and useful evergreens I have commenced raising the following kinds from seed obtained from high altitudes on the eastern slopes of the Rocky Mountains:

Heavy wooded or bull pine (*Pinus ponderosa*); Colorado blue spruce, (*Picea pungens*); Engleman's spruce (*Picea Englemanni*); (*Abies concolor*); Douglas spruce (*Pseudotsuga taxifolia*) and mountain balsam (*Abies sub-Alpina*).

Experiments of minor importance which have been completed or in progress are:

Variety tests with 21 kinds of tomatoes; variety tests with 50 kinds of potatoes; variety tests with 26 kinds of sweet corn; variety tests with 20 kinds of garden peas; experiments in grafting grapes; experiments to demonstrate the effect, if any, of electricity on plant growth when applied to the soil; experiments in shading of strawberry beds to increase the certainty and amount of the crop; experiments with raising sand cherries from seed with the object of producing improved fruit; (In conducting this work over 4,000 seedlings have been raised and I consider the work of great promise), experiments with raspberry, strawberry, grape and gooseberry seedlings, the object being to produce kinds of these fruits that are better adapted to our condition than any we now have. (In conducting this work over 500 seedlings have been raised.)

I have been called upon during the past year to investigate the work of the downy mildew in vineyards around lake Minnetonka, where the treatment I have recommended has given nearly entire immunity from the disease and this at a cost sufficiently small to permit of its being used on a large scale. By request an investigation has also been made into the adaptability for cranberry raising of some large marshes in Otter Tail county.

SAMUEL B. GREEN,
Horticulturist.

EXPERIMENT STATION.

CHEMICAL DIVISION.

ST. ANTHONY PARK, MINN., DEC. 1, 1892.

CLINTON D. SMITH, *Director Experiment Station, University of Minnesota:*
The work of the chemical division for the period, December 1, 1890, to
December 1, 1892, has been of the following nature:

I. WHEAT.

1. A test of varieties, both foreign and native. 2. Co-operative test with selected seed wheat. 3. Comparative milling and baking tests. 4. The composition of different grades of wheat and the milled products. 5. The composition of the wheat plant in the different stages of its growth. Topics one, two and three have been published in bulletins number 15 and 23 and are the result of the wheat work conducted by Professor Harper. Topics three and four are at present under investigation. The testing of the varieties of wheat has been carried on by the agricultural division during the past year, inasmuch as this work is more agricultural in nature than chemical. The analyses of the milled products (unpublished) show that the wheat germ is a very valuable food product and is richer in nitrogenous compounds than the wheat itself or any of the other products. The good results from selected seed wheat are clearly shown in bulletin No. 23.

II. SUGAR BEETS AND SORGHUM.

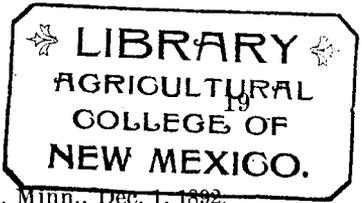
During the year 1891 extensive investigations were carried on with sugar beets and the results are published in bulletin No. 21. In all about 400 analyses were made of sugar beets grown in different parts of the State. The analyses were made by Mr. Thompson, assistant in the laboratory. The results show that sugar beets of a high per cent. of sugar and purity can be raised in nearly every part of the State.

In the spring of 1892 about one hundred samples of seed were sent out in order to continue the work of the previous year, and obtain results from another season. For the past three years these investigations have been carried on and the sugar beet has been subjected to the most extreme tests as to climate, section and season. The question is now a financial one. The station has shown that beets with as high a percentage of sugar and purity can be raised in this State as in any State in the Union. Chemical analyses and a laboratory experiment can do nothing further to decide this question. Over two hundred analyses of sugar beets have been made during the present year.

SORGHUM. In bulletin 21 the work that has been done by the station with sorghum is recorded. During the past year this work has been continued, particular attention being paid to the selection of seed from early ripening and thrifty heads. The results of this year's work with beets and sorghum have been completed and await publication.

III. DIGESTION EXPERIMENTS.

A bulletin on the digestibility of some of the typical grains of the State has been submitted. The results show in general what becomes of the food that is fed to pigs and milch cows and the amount required to supply the body with fuel for heat and other general mechanical purposes. In the case of milch cows the amount of food that is returned in the milk is determined. In all of these experiments analyses are made of the food



consumed by the animal as well as the dung, urine and milk. The results also show what becomes of the valuable fertilizer materials that are in the food eaten. A series of digestion experiments is the most laborious work that can be carried on in the laboratory.

In the case of pigs the results show that all of the gains in flesh come from the small amount of food eaten that is in excess of what is required for the mechanical purposes of running the machinery of the body and hence it is economical to feed well.

IV. MILK.

MILK—Complete analyses have been made of individual cow's milks. From January 8th, to November 15th, of the present year, Mr. John Thompson, assistant in the laboratory, determined the per cent. of fat in both the morning's and evening's milk from each individual cow of the whole herd; quite frequently this work involved more than fifty determinations of fat in one day.

BUTTER—The composition of butter made from individual cow's milk, from sweet cream, sour cream, and the cream from various centrifugal machines, including the extractor product, has been studied mainly during the session of the dairy school in the winter of 1892.

CHEESE—The losses of fat in cheese making were reported in bulletin No. 19 and the results show that milks rich in fat can be made into cheese with no greater loss of fat in the whey than with poorer milks. Analyses have been made of cheese at different stages of their ripening. The relation between the composition of milk and the cheese produced, the development of acid in cheese making, and the digestibility of skim cheese, full cream and cream cheese determined. This work has been done during the present year and awaits publication.

MISCELLANEOUS WORK.

In addition to the work already reported various other lines of work have been carried on. A collection has been made of some of the typical soils of the State, analyses made of the soils of the farm, of fodders used in various feeding experiments, and of samples of milk and of water sent by the farmers of the State to us.

The generous policy of the Board of Regents in the equipment of the new station laboratory with modern and improved apparatus, including power and special rooms for various investigations, has made it possible to accomplish much more than otherwise could have been done. For the special lines of the agricultural work of the State, the chemical laboratory of the Station is well provided.

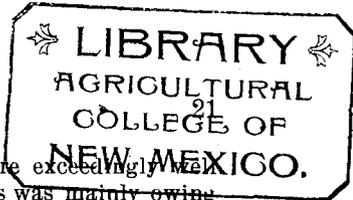
Very respectfully submitted,

HARRY SNYDER, Chemist.

DIVISION OF ENTOMOLOGY.

At the request of many farmers interested in sheep husbandry, bulletin No. 16 was prepared and issued in April, 1891. It contains an illustrated description of the common scab of sheep. The publication of this bulletin became necessary because sheep husbandry was at that time, and is even now, a new enterprise to most of our farmers, and notwith-

EXPERIMENT STATION.



standing the fact that large portions of our State are exceedingly well adapted to it, but little real progress was made. This was mainly owing to the fact that too many animals were kept by individuals who were unable to give them the care so important to success, and also because animals infested with the scab were introduced from other States. No great pains were taken to prevent, by a very careful investigation of the animals, the introduction of this disease. As the scab is easily communicated from animal to animal, the disease once introduced spreads rapidly; moreover, not having a clear understanding of the case, some farmers permitted their healthy sheep to graze with infested ones, and great losses had to follow.

Though the cause of this disease is not a true insect, a mite, in a practical sense the difference is but slight, the bulletin was prepared by the entomologist and not by the veterinarian. The bulletin gives an illustrated description of the scab mites, describes their life history, their method of attacking animals, and gives the different methods employed to destroy them. A large number of remedies were given which had proven successful and that are more or less inexpensive. Kerosene emulsion was only mentioned as a very promising and cheap remedy. Since that time many experiments have been made, both in Minnesota and elsewhere, and it is now a prominent fact that kerosene emulsion is by far the best, safest, cheapest and quickest remedy known against skin insects and scab mites. It has none of the disadvantages of other dips, does not discolor the wool, and presents, moreover, a humane way of treating a diseased domesticated animal. Other skin diseases caused by parasitic insects are equally well and quickly cured by an application of this cheap insecticide. One application to the skin of cattle belonging to the experiment station, which were infested with such external parasites, proved enough to rid the animals from such vermin.

In bulletin No. 17, issued August, 1891, a full account was given of a new invasion of migratory locusts in the Red River valley and adjoining regions. Swarms of these insects were seen on August 4, 1890, passing over Crookston, flying in a southeasterly direction. The gravid females dropped to the ground wherever conditions were favorable and deposited large numbers of eggs. Later inquiries proved that these insects had migrated from the mountainous parts of Manitoba; they had been seen by many eye witnesses crossing the boundary line near Pembina, N. D., and elsewhere. In the last biennial report, page 17, attention was directed to the danger of another locust trouble. The deductions from the observed facts proved only too true, as early in June, 1891, a number of newspapers published complaints that locusts were doing considerable damage in many fields. The infested region included many parts of Polk, Marshall, Kittson and Hubbard counties. At the request of His Excellency, Governor Merriam, and with the permission of the Board of Regents, the entomologist made a number of trips to the infested region, and advised the county commissioners in regard to remedies. These officers were also instructed by the governor to exert all possible energy to fight and reduce the common enemy, and to spend all the necessary funds for this purpose. In the worst infested regions in Polk county, Mr. Kirsh, of Crookston, waged war in a very telling way. But generally speaking less work was done in most parts of the infested region than ought to have been done.

1786

As shown in bulletin No. 17, three distinct species of migratory locusts invaded the Red River valley. Besides the "larger and lesser migratory locusts" farmers had to deal with the "pellucid locust," an insect not observed before in Minnesota.

The bulletin gave in a condensed form descriptions and illustrations of the three species; described the manner in which eggs are deposited; the best method to destroy the enemy, and expressed the fear that the year 1892 would see an alarming increase in the number of locusts, provided natural remedies did not come to our assistance. Owing to the very wet autumn of 1891 and the still wetter spring of 1892, the bulk of the locusts in the Red River valley have been destroyed.

The entomologist would like to be permitted to again call attention to the fact that the State of Minnesota needs some laws to protect the educated farmers against injurious insects raised by the uneducated ones. Locusts and some other injurious insects should be classed with certain contagious diseases, like the small-pox for instance, and similar laws ought to be framed to suppress these insects as such diseases.

While investigating locusts in the suspected localities the attention of the entomologist was directed to the study of a very destructive insect that had found a home in some portions the Red River valley and had caused considerable injury to the crop of wheat, already badly damaged by unfavorable weather and rust. This insect is called the frit fly, from the fact that Swedish farmers call the worthless grain resulting from such injury "frits."

To give timely warning to farmers troubled by this insect a "preliminary report upon an insect injurious to wheat" was published in bulletin No. 23. In this bulletin a partial life history of this insect is given, and a simple method to combat the same. As the insect has to be bred to maturity, it is at present impossible to give the scientific name to this fly. Similar flies have spread destruction near and far, both in Europe and North America, and it is wise to prepare in time to meet this foe.

Considerable attention has been paid to the study of insects injurious to trees planted for wind-breaks, to insects injurious to shade trees, the small fruit, vegetables and other plants, the results of which will be published in a future bulletin. It was intended to pay special attention to cut worms, but the copious rains of spring made any effort in this direction useless, as the cut-worms had been so decimated that but very little injury was caused by them. Yet in some places especially favorable to cut-worms considerable injury was caused. A number of experiments were carried out in these localities, mainly against a cut-worm, very destructive to onions.

Considerable attention was paid to the forest tent-caterpillar which again denuded many fine trees in the vicinity of our lakes. Besides forest trees and shade trees some of the small fruit suffered greatly. At the time of their appearance a number of illustrated articles were prepared by the entomologist. They were published in a number of daily, weekly and agricultural papers.

The last autumn was a very peculiar one on account of the long continued wet weather. This condition caused a number of insects to attempt to produce an additional brood. In most cases this attempt was a failure, but of considerable interest and, moreover, of some value to us. For instance, the last brood of Colorado potato beetles instead of

remaining as usual in the ground were misled by the warm weather and left their wintering quarters. They fled about in vain to find food ; only in cases where the potato tubers were left above the ground they succeeded in causing some injury by disfiguring them. But the great majority have perished on account of their mistake in the seasons, and thus potato growers start next spring with only a few of these enemies instead of a large number of them.

During the last two years some time was devoted to bring together a collection of Minnesota insects, both of the injurious and of the beneficial kinds. A collection accessible to all those suffering from losses by the multitude of insects found in our State is a necessity, as remedies can only be recommended with any degree of certainty if the depredators are known and identified. Of course it will take many years to make such collection fairly complete.

The entomologist was invited to prepare for the Columbian Exhibition as complete a collection of Minnesota insects as it was possible to make. Two large cabinets each with twenty-six drawers have been partly filled and when finished will be exhibited with the state collection in Chicago.

The correspondence with farmers in regard to injurious insects is gradually increasing, and requires a great amount of time, as it is not always best to advise without studying the question most thoroughly. The local newspapers have been of great assistance in securing information about any insect and the proper remedies against it.

The Great Northern, Northern Pacific and the St. Paul, Minneapolis & Omaha railroads have always gladly furnished free transportation to the Entomologist, and deserve thanks, as without their liberality it would have been impossible to visit infested regions as soon as an occasion arose.

Respectfully yours,

OTTO LUGGER, Entomologist.

BOTANY.

During the past two summers the formation of an herbarium, chiefly composed of such plants, as are either beneficial or injurious to the farmer, was the principal work of the botanist. A very good collection of the wild and cultivated grasses and forage plants of Minnesota has been brought together. The most common and injurious weeds are also well represented. Both groups of plants have been collected and preserved in sufficiently large numbers to furnish students of the Agricultural School material for study and dissection. To familiarize the students with the appearance of our native grasses, a majority of them (about 120 species) have been framed and are arranged in the general assembly room where they can always be studied. The remaining species of grasses not yet represented in this collection will be added to it during this winter. Each specimen is labelled both with its common English names and its scientific one. Early in the spring of 1892 the work of growing different species of grasses and forage plants in plots was put in charge of the botanist. The most suitable space for this purpose and the one most accessible to students and visitors seemed to be the little valley beyond the chemical laboratory and consequently one half of it was devoted to this purpose. Owing to the very backward season, and to the large amount of rain, operations could not be commenced as early as would have been best.

About 200 species of grasses and fifty species of other forage plants such as clover, vetches, spurry and others were added, and the majority grew well. It would have been impossible to obtain so many different kinds of seed in time, if Professor T. M. Tracy, of the Mississippi Experiment Station had not kindly donated to the botanist a large amount of valuable seed. Many grasses were from foreign countries, and proved so very promising that, after another season, they may be found of sufficient value to warrant a trial upon a larger scale. These plots are chiefly intended for instruction, not alone to the students of the Agricultural School and College, but also to the numerous visitors that come to the station. Arrangements have been made so that in another year the number of these plots will be largely increased. Of primary importance is a growing collection of all our native grasses, and of a barely secondary one is the trial with foreign species. For this purpose large numbers of seed of our native grasses were collected by the botanist during the past summer. Other plants of the native species have been marked in their native homes and will be transplanted at the proper time.

Considerable correspondence has been had with the botanists in foreign countries, and some of them have promised to aid by sending seeds. Thus many grasses from Norway, Sweden, Germany, Russia, France, South America, Australia and other countries will be received and propagated. If of no value to Minnesota they will be discarded. If promising they will be handed over to the agriculturist for future trial upon a larger scale. At the same time the chemist of the station will ascertain the food value of all the species, so that promising grasses without real value for fodder, can be discarded.

Of all the species of grasses and of other forage plants a large set of specimens has been pressed, so as to be of use in the class room. There can be no doubt that these plot experiments will be of great value, not simply for scientific purposes, but for practical ones as well.

Experience gained last summer has shown that the space selected for this purpose is not the best that might have been chosen, and it will, perhaps, be best to utilize another part of the farm for this purpose. Considerable trouble was caused by different kinds of rusts, mainly due to the poor ventilation in the valley, but as similar diseases were prevailing elsewhere, the choice of locality alone was not wholly to blame.

As the State will have at the Columbian Exhibition a display of its agricultural resources, the authorities in charge of these matters requested the botanist to prepare for this purpose as full a collection as possible. With the permission of the Board of Regents this work has been performed. As a result over 200 species of grasses and forage plants, nicely framed, have been prepared. Also over 300 large bundles of grasses, showing the average size and the appearance of these important plants as found in Minnesota.

Besides the above collection another one was prepared on behalf of the exhibit, showing the work of the station botanists at the Columbian Exhibition. This collection consists of 150 species of native and cultivated grasses. It will be exhibited with others in a special building devoted to agricultural experiment stations.

Yours very respectfully,
OTTO LUGGER.

ST. ANTHONY PARK, Minn., Dec. 1, 1892.

DIRECTOR CLINTON D. SMITH, *Experiment Station*. DEAR SIR:—Below I submit to you a statement of the receipts and expenditures at the Experiment Station, exclusive of salaries paid to officers, as shown on my books for the year beginning December 1st, 1891, and ending November 30th, 1892, inclusive:

	Receipts.	Expenditures.
Agriculture.....	\$1,521.76	\$4,623.44
Horticulture.....	572.48	2,102.48
Chemistry.....	28.84	1,390.77
Entomology.....		404.59
Station.....	62.00	4,784.71
Dairy.....	2,552.74	3,655.64
	<u>\$4,737.82</u>	<u>\$16,961.63</u>

There is in addition to the above a charge of \$10,495.32 against the dairy department, which was expended for building and apparatus.

Respectfully yours,
J. A. VYE, Accountant.

GENERAL INVENTORY, DEC. 1, 1892.

LIVE STOCK.			
1 Span gray mares.....	\$400.00	3 Mowing machines.....	60.00
1 Brown horse, Tom.....	50.00	1 Hay rake.....	3.00
1 Bay horse, Bill.....	75.00	1 Hay tedder.....	10.00
1 Set double harness.....	30.00	2 Drills.....	60.00
1 Set double harness.....	15.00	1 Seeder.....	10.00
1 Pair horse blankets.....	8.00	1 Iron gate.....	5.00
1 Pair horse blankets.....	5.00	2 Corn shellers.....	35.00
1 Shorthorn cow, Princess of Springwood 8th.....	75.00	1 Tank now stored in dairy hall..	2.00
1 Shorthorn cow, University Prin- cess, 2nd.....	75.00	1 Corn marker.....	2.00
1 Shorthorn calf, University Queen	25.00	Old gas and water pipe.....	2.00
1 Shorthorn cow, Dido.....	50.00	12 Sacks fertilizer (Phosphates)...	35.00
2 Bull calves.....	35.00	1,500 lbs. tankage.....	10.00
1 Polled Angus cow, Fancy of North Oaks, 3d.....	200.00	1 Level, 2 braces, 3 jack planes, 7 bits, 2 chisels, 1 saw set, 4 augers, 3 draw shaves, 2 meat saws, 1 hack saw, 2 hammers, 1 hatchet, 1 Bemis & McCall wrench, 1 Stettson wrench, 2 monkey wrenches, ½ doz. cast wrenches, 4 pipe tongs, 1 chain tongs, 1 anvil, 1 iron vise, 1 cross-cut hand saw, 1 rip saw.....	15.00
1 Polled heifer calf.....	75.00	2 Cross-cut saws, 1 spoke shave, 1 nail puller.....	6.50
1 Holstein cow, Bess.....	75.00	Bolts and screws.....	.50
1 Holstein grade cow, Jenny.....	35.00	Pipe fittings and valves.....	5.00
1 Holstein grade cow, Topsy.....	35.00	1 Buck saw, 20 ft. 4 in. leather belt.....	6.75
1 Guernsey cow, Tricksey.....	200.00	1 Grindstone, 1 sand pump.....	5.00
1 Guernsey cow, Betty.....	35.00	1 Bell City ensilage cutter.....	50.00
1 Guernsey cow, Sweet Briar.....	175.00	1 Small Ross ensilage cutter, (hand power).....	20.00
1 Guernsey and Jersey cow, H'ston	50.00	1 Diamond feed mill.....	40.00
1 Guernsey and Jersey cow, Nora	35.00	1 Howe platform scales.....	4.00
1 Guernsey heifer yearling, Nora	50.00	1 Fairbanks wagon scales.....	50.00
2 Guernsey bull calves.....	60.00	1 Tower's cultivator.....	20.00
1 Guernsey heifer calf.....	100.00	1 Caulkin cultivator.....	20.00
1 Jersey cow, Pride.....	75.00	1 Albion cultivator.....	25.00
1 Jersey cow, Doretia.....	35.00	1 Triumph steamer.....	40.00
1 Jersey bull, Silver Pogis.....	50.00	1 Flying Dutchman sulky plow..	10.00
1 Jersey heifer yearling.....	50.00	1 Oliver Chilled plow.....	12.00
1 Jersey grade cow, Rossie.....	35.00	1 Scandia walking plow.....	12.00
1 Jersey grade cow, Gertie.....	35.00	1 St. Paul steel beam plow.....	10.00
20 Grade Shropshire lambs.....	25.00	1 St. Paul steel beam plow.....	8.00
5 Southdown ewes.....	200.00	2 Steel beam plows.....	5.00
1 Southdown buck.....	40.00	1 Lever harrow.....	12.00
5 Duroc Jersey sow pigs.....	40.00	1 Disc harrow.....	12.00
1 Duroc Jersey sow pig.....	10.00	1 Outaway harrow.....	12.00
1 Duroc Jersey sow.....	25.00	1 Spading harrow.....	12.00
1 Essex sow.....	25.00	5 Harrows, (old).....	5.00
1 Small Yorkshire sow.....	25.00	1 Corn planter.....	25.00
1 Poland China sow.....	25.00	1 Pair light bobs.....	20.00
1 Essex boar.....	15.00	1 Swell body cutter.....	15.00
1 Cheshire boar.....	15.00	1 Breed's weeder.....	10.00
4 Poland China pigs, 2 boars and 2 sows.....	20.00	1 Plano binder.....	50.00
1 Shorthorn cow, Athol.....	100.00	1 Butter worker.....	20.00
	\$2,743.00	50 Grain sacks.....	7.50
		2 Bunches shingles.....	.75
		11 Chicken coops.....	6.00
		47 Hot bed sash.....	15.00
		2 Tower's pulverizer.....	12.00
		2 Wheel barrows.....	3.00
		4 Measures, 1 bu., ½ bu.....	10.00
		1 Pipe vise and set of dies.....	2.25
		75 Pounds nails.....	.50
		2 Pulley blocks.....	1.20
		6 Pulleys.....	1.75
		6 Hoes.....	1.50
		5 Warren hoes.....	1.00
		2 Garden rakes.....	1.00
		1 Ditching spade.....	.50
MISCELLANEOUS.			
Odd pieces harness.....	2.00		
1 Saddle.....	3.00		
1 Hose.....	5.00		
3 Strings of bells.....	5.00		
Neckyokes.....	1.00		
2 Forks.....	.30		
1 Rake.....	.10		
1 Shovel.....	.15		
1 Lap robe.....	2.50		
1 Horse (Old Harry).....	25.00		
3 Wagons with neckyokes and whiffletrees.....	60.00		
3 Bob sleighs.....	45.00		
1 Cart and harness.....	30.00		
2 Hay racks.....	20.00		
2 Long racks and sides.....	8.00		
2 Scrapers.....	6.00		
1 Iron kettle, large.....	3.00		

Forks—4 2-tined pitch forks, \$1.00;	
5 3-tined pitch forks, \$1.25;	
3 4-tined pitch forks, 75c.; 1 5-	
tined dung fork, 50c.; 2 4-tined	
ding forks, 50c.; 5 3-tined pitch	
forks, \$1.25 2 6-tined dung forks,	
\$1.00.	6 25
5 Barn shovels.....	2.00
Scoop shovels.....	2.00
3 Garden spades.....	1.80
3 Garden spades (poor).....	1.50
3 Potato forks.....	1.50
6 Grub hoes.....	3.00
4 Mattocks.....	1.00
6 Pick axes.....	1.50
3 Axes.....	1.00
2 Crow and 2 pinch bars.....	2.00
Harness and whiffletrees.....	4.00
2 Ice tongs.....	1 75
1 Single and 1 double harpoon fork	5.00
2 hand corn planters.....	1.00
2 Canvasses.....	7.00
1 Oil barrel and faucet.....	.80
6 Corn knives and 2 sickles.....	4.00
120 Feet 1½-inch rope.....	12.00
1 Wire tightener.....	.50
2 Scythes.....	.50
1 Cradle.....	1.50
3 Pair sheep shears.....	2.00
1 Log chain.....	2.50
1100 Bushels oats @ 32c.....	352.00
570 Bushels barley @ 40c.....	228.00
40 Bushels peas @ 50c.....	20.00
219 Bushels wheat @ 65c.....	142.35
1200 Bushels corn @ 45c.....	540.00
50 Bushels barley @ 30c.....	15.00
5 Tons pea straw.....	2.00
5 Tons oat straw.....	12.00
40 Tons timothy hay @ \$10.....	400.00
23 Tons clover hay @ \$7.....	161.00
2 Tons millet hay @ \$5.....	10.00
2 Tons oat hay @ \$5.....	10.00
30 Tons corn fodder.....	60.00
2 Acres of oats unthreshed.....	30.00
1 Acre of flax unthreshed.....	15.00
125 Feet hay fork rope.....	20.00
1 Boiler, engine and shafting.....	500 00
1 Thrashing machine.....	150.00
2 Fanning mills.....	20.00
12 Tons soft coal.....	54.00
1 Beet pulper.....	3.00
50 Tons ensilage.....	200.00
5 Tons sugar beets.....	15.00
7 Tons mangel wurzels.....	21.00
1 Mathew's seed drill.....	2.00
1 Daisy wheel hoe.....	2.00
1 Gem wheel hoe.....	2.00
2 Fairbanks platform scales.....	25.00
1 Small platform scale.....	5.00
1 Spring platform scale.....	5.00
1 Spring balance.....	1.00
1 Ross ensilage cutter.....	10 00

\$4,176.70

FARM HOUSE.

1 Washbasin.....	.10
1 Clock.....	.25
6 Looking glasses.....	3 50
4 Flat irons.....	.80
10 Lamps complete.....	5.00
10 Lanterns.....	5.00
2 Pot covers.....	.10
2 Spiders.....	.30
2 Iron kettles.....	.50
1 Broiler.....	.25
1 Griddle iron.....	.25
4 Sheets.....	1 20
10 Pillow cases.....	1.50
1 Rat trap.....	.10
13 Pair blankets.....	18.00
7 Commodes.....	7.00
1 Office chair.....	3.00
7 Pine tables.....	7.00
1 Reflector lantern.....	.50
1 Bracket lamp.....	.50

1 Centre table.....	1.00
2 Dish pans.....	.50
1 Bread pan.....	.25
4 Bread tins.....	.25
1 Clothes basket.....	.16
1 Ironing board.....	.25
1 Steamer.....	.50
1 Tray.....	.10
2 Coffee mills.....	.20
1 Flour sieve.....	.30
8 Pans (poor).....	.25
1 Colander.....	.10
37 Common chairs.....	12.00
1 Rocking chair.....	1.00
2 Table cloths (poor).....	.25
1 Dining room table.....	6.00
2 Bells.....	1.00
40 Plates, including one-half dozen	
soup plates.....	2.15
6 Saucers.....	.12
6 Tea cups.....	.12
8 Sauce plates.....	.25
2 Small pitchers.....	.20
1 Large pitcher.....	.20
4 Sugar bowls.....	.80
2 Spoon holders.....	.30
8 Soup bowls.....	.75
3 Platters.....	1.00
3 Vegetable dishes.....	.50
3 Syrup dishes.....	.60
1 Mustard dish.....	.05
2 Gravy bowls.....	.40
5 Salt dishes.....	.20
13 Large table spoons.....	.52
3 Butter knives.....	.30
23 Table forks.....	.50
10 Steel forks.....	.45
11 Knives.....	.75
2 Knife boxes.....	.40
1 Eight-day clock.....	2.00
2 Hanging lamps.....	2.50
1 Coffee pot.....	.15
1 Stove.....	10.00
2 Walnut cupboards.....	7.50
1 Wash bench and wringer com-	
bined.....	2.00
1 Washtub.....	.25
1 Clothes bars.....	.50
1 Washboiler.....	.50
1 Bread box.....	2.00
1 Combination table.....	8.00
1 Mixing board.....	.25
3 Single iron bedsteads.....	12.00
2 Double iron bedsteads.....	13.50
4 Bureaus.....	15.00
1 Office table.....	10.00
2 Writing desks.....	2.00
1 Tea kettle.....	.25
1 Coal scuttle.....	.50
1 Comfortable.....	1.00
10 Fine halters.....	10.00
1 3-Story box stove.....	6.00
1 Parlor stove, sheet iron.....	3.00
1 Refrigerator.....	15.00
1 Scoop shovel.....	.50
1 10-Gallon can.....	1.00
2 5-Gallon cans.....	1.00
6 Wooden bedsteads and springs	12.00
2 Mattress.....	.75
18 Pillows.....	9.00
2 Wooden pails.....	.50
7 Screen doors.....	7.00
5 Screen windows.....	2.50
20 Drawer pulls.....	1.00
6 8-In. door bolts.....	1.20
14 Hinges.....	1.40
2 Double spring hinges.....	2.50
4 Bolt fasteners.....	.80
14 Door knobs.....	2.80
1 Platform wagon.....	50.00
1 Carriage.....	75.00
2 Sets single harness.....	30.00
1 Set double harness.....	25.00
1 Set double heavy harness.....	15.00

\$452.37

DAIRY HALL.

40 Ft. $\frac{3}{4}$ -ply water hose.....	8.00
50 Ft. $\frac{3}{4}$ -ply steam hose.....	11.75
2 15-Gallon Hodo milk cans	4.00
2 10-Gallon Gem milk cans.....	4.50
2 Lactometers.....	.80
1 Lever worker.....	4.25
1 Favorite churn.....	4.32
5 Favorite churns, No. 1.....	15.30
6 Lever workers, No. 0.....	16.25
1 12-Bot. Beimling tester.....	19.20
1 6-Bot. Beimling tester.....	15.00
4 2-Bot. Beimling tester.....	20.00
$\frac{1}{2}$ Doz. 4-gallon cream cans.....	6.60
9 2-Gallon cream cans.....	5.85
1 Combination Frazer gang cheese press.....	48.00
12 Frazer gang hoops.....	39.78
6 7 and 8 $\frac{1}{2}$ Y. A. Frazer gang hoops.....	10.20
1 100-Gallon Reid churn.....	20.00
10 Horizontal curd knives.....	20.00
10 Vertical curd knives.....	31.00
5 4-oz. Graduates, ozs.....	2.40
4 4-oz. graduates, cc.....	1.60
8 Acorn wooden ladles.....	2.00
12 Spoon wooden ladles.....	2.00
1 Alphabet and figures; $\frac{3}{4}$ inch.....	1.25
10 Tin curd scoops.....	5.00
2 Curd pails.....	1.50
1 Standard thermometer.....	.40
1 Doz. floating thermometers.....	1.75
13 Yards 7 $\frac{1}{2}$ -inch strainer cloth.....	4.94
16 Yards 48-inch press.....	2.08
60 Yards seamless bandage.....	3.60
50 Y. A. seamless bandage.....	.40
10 Six-inch Tampica brushes.....	1.50
11 Twelve-inch Tampica brushes.....	2.00
6 Iron head rubber mops.....	3.50
10 Eight-inch hair sieves.....	4.00
10 Gallon dippers.....	4.00
5 Pint dippers.....	.40
40 Yards cloth, 40-inch.....	1.80
4 Gallons Hanson's butter color.....	8.40
1 Gallon Hanson's rennet extract.....	1.00
1 Gallon Hanson's cheese color.....	1.45
8 B. & H. lamps.....	30.00
1 B. & H. lamp, small.....	2.25
9 Bracket lamps.....	6.75
1 Hoop, 14 $\frac{1}{2}$ by 8.....	3.50
6 20-inch ash tubs.....	1.20
10 followers for 14 $\frac{1}{2}$ hoop gang press.....	5.00
1 50-bottle Babcock test.....	45.00
1 Howe counter scales, dec. beam.....	15.28
1 Spring balance scales dec. beam.....	100.00
1 Whirler for Babcock test.....	2.00
8 Dozen Greiner Babcock test bottles.....	25.60
2 Dozen Greiner Short test bottles.....	4.00
1 100-gallon Boyd vat.....	37.80
1 50-gallon Boyd vat.....	27.00
1 30-gallon Boyd vat.....	25.00
1 4-gallon Boyd ferment can.....	5.00
2 1-gallon Boyd ferment can.....	8.00
1 Mason power butter worker.....	45.00
1 Dozen $\frac{3}{4}$ special hose couplings.....	1.50
1 Dozen $\frac{1}{2}$ special hose clamps.....	.99
1 Stencil brush and paste.....	.30
2 8-gallon gem cans.....	5.00
7 Followers.....	4.75
5 No. 1, rectangular churns.....	21.25
5 No. 0, lever butter workers.....	17.50
2 15-gallon Hodo cans.....	6.00
1 I. T. L. printer.....	10.80
1 Hand printer.....	3.00
200 Lbs. Genesee dairy salt.....	2.00
10 Pipettes.....	4.00
17 Acid measures.....	6.80
3 Dozen numbers for test bottles.....	.25
3 Dozen numbers for test bottles.....	.25
1 Special vat 3,500 gallons.....	33.00
10 50-gallon cheese vats and racks.....	210.00
10 Whey strainers.....	6.00
1 Upright cheese-press & 3 hoops.....	10.00
1 Sharpless turbine separator.....	3.00
1 Heating vat, 150 gallons.....	25.00
1 16-bottle Babcock test.....	5.00

1 Testing table.....	10.00
1 8-bottle Babcock test.....	6.00
1 Cooley creamer.....	30.00
12 Cooley cans bottom faucet.....	18.60
6 Cooley cans (shot gun).....	4.50
4 Cooley cans $\frac{1}{2}$ size.....	2.40
1 Pohl curd mill.....	16.00
5 Tin sieves.....	1.00
2 Dozen tin pans.....	3.00
1 Milk strainer.....	.40
1 Level.....	1.45
1 Hammer.....	.50
30 Lbs. sal soda.....	.75
20 Bars soap.....	1.56
5 Lb. bars sapolio.....	.40
4 Lbs gold dust.....	1.00
36 Cheese boxes.....	3.60
1 Brush handle.....	.15
1 Mop handle.....	.15
1 Mop pail.....	.20
5 Milk pails.....	1.00
4 Flour barrels.....	1.00

\$1,225.01

HORTICULTURAL DEPARTMENT.

1 Hose.....	\$75.00
1 Single wheel cultivator.....	2.75
1 Seed drill.....	4.00
2 Garden wheelbarrows.....	3.00
1 Horse wagon.....	25.00
1 Spring wagon.....	20.00
1 Pung.....	6.00
5 Digging forks.....	1.25
2 Manure forks.....	1.25
4 Field hoes.....	1.00
4 Spades.....	2.50
3 Onion hoes.....	.60
5 Small draw hoes.....	1.00
4 Shovels.....	3.00
4 Garden rakes.....	1.20
1 Scoop shovel.....	.25
2 Picks.....	.50
2 Mattocks.....	.50
2 Scythes.....	2.00
2 Hay forks.....	.60
1 Lawn mower.....	5.00
1 Planet Jun. horse hoe.....	5.00
1 Plow.....	.75
1 Jack plane.....	.25
1 Smooth plane.....	.35
1 Hatchet.....	.80
1 Bench vise.....	1.50
1 Axe.....	.20
1 Ratchet bit.....	.50
1 Screw driver.....	.10
5 Bits.....	.50
1 Saw, 26 inches.....	.50
1 Back saw.....	1.00
1 Draw knife.....	.40
2 Monkey wrenches.....	.50
1 Pair dividers.....	.10
1 Oil can.....	.10
1 Oil stone.....	.25
1 Mounted grind stone.....	2.00
1 12-inch chisel.....	.30
1 1-inch chisel.....	.20
1 Cold chisel.....	.20
1 Saw set.....	.50
12-foot square.....	.40
1 Brass syringe.....	2.50
2 Watering pots.....	1.50
2 Lamps.....	.30
1 Lantern.....	.30
1 Garden trowel.....	.25
16 Callas.....	4.00
100 Carnations.....	5.00
12 Easter lilies.....	2.40
50 Pelorgums.....	5.00
25 Oxalis.....	2.50
30 Primulas.....	3.00
24 Heliotropes.....	2.40
4 Aspidistra.....	1.00
8 Palms.....	4.00
50 Geraniums.....	2.50
1,400 Roses.....	42.00

4 Agaves.....	2 00	1 Platinum crucible, 48.9 gm.....	43.87
14 Fuchsias.....	2.80	1/2 Doz. platinum milk dishes, 72.5 gm. @ 65.....	47.13
50 Cacti.....	4.00	2 Platinum spatulas 4 in. long 13.0 gms.....	9.04
25 Begonias.....	2.50	2 Platinum Δ 25.8 gms.....	16.25
75 Coleus.....	3.75	2 Ft. platinum wire gauge (4) 25 gm	15.00
70 Miscellaneous plants.....	2.50	2 Ft. plat'um wire gauge (29) 1 1/2 gm	.72
Bulbs.....	10.00	2 Ft. plat'um wire gauge (32) f	
400 Miscellaneous flower pots.....	8.00	1 Sq. ft. platinum foil, 91.6 gm.....	54.96
1,200 2-inch pots.....	6.42	1 Wire platinum, 358.45 gauge.....	.70
600 3-inch pots.....	4.80	1 Platinum boat, 1 in. 3.0 gm.....	1.94
700 3 1/2-inch pots.....	5.95	1 Platinum boat, 3 in. 9.7 gm.....	6.31
600 Apple grafts two years old.....	30.00	4 Platinum gooch crucibles, 30 cc, 14.2 gms each.....	96.56
600 Apple grafts one year old.....	18.00	2 Plain crucibles, 15cc, 34.4 gms...	22.30
20 Russian plums.....	5.00	1 Platinum dish, 400 cc, 149.5 gms....	97.17
250 Plum grafts three years old.....	37.50	1 Platinum dish, 200 cc, 64.4 gms....	41.86
4,000 Plum stocks.....	16.00	1 Platinum dish, 125 cc, 46.4 gms....	31.46
100 Pear trees three years old.....	10.00	2 Platinum dish, 45 cc, 48.5 gms....	27.63
100 Currants.....	5.00	2 Platinum dish, 30 cc, 30.5 gms....	19.82
150 Raspberries.....	15.00	2 Platinum dish, 20 cc, 17.6 gms....	11.44
150 Blackberries.....	15.00	1 Platinum hydrofluoric acid bottle, 106.9 gms.....	74.83
30 Cherries.....	3.00	1 Platinum still for do 337.2 gms....	236.04
450 Scotch pine.....	36.00	1 Platinum muffle with tripod, 59.7 gms.....	43.29
100 Hemlock.....	15.00	1 Piece platinum wire gauge, coarse 10.8 gms.....	7.02
170 White spruce.....	25.50	1 Piece platinum wire gauge, fine 1.1 gms.....	.83
14 Picea pungens.....	14.00	6 Dishes platinum (milk) 80.4 gms....	52.26
6 Abies concolor.....	6.00	4 Crucibles platinum, 15 cc, plain, 11.15 gms.....	44.60
150 Arborvitae.....	16.00	2 Crucibles platinum, 15 cc, gooch, 13.80 gms.....	27.60
30 Eurorean larch.....	1.80	1 Crucible platinum, 80 gms, old crucible about.....	40.00
30 Dwarf pine.....	9.00	1 Crucible platinum, 20 gms, old crucible about.....	10.00
15 Douglas spruce.....	4.00	1 Crucible platinum, 50 gms, old crucible about.....	25.00
120 White pine, 60 white spruce, 60 balsam fir, 60 Norway spruce	40.00	2 Small cones platinum, each 1.50.....	3.00
45 Red cedar.....	3.00	1 Platinum evaporator 30 gms.....	15.00
50 Red pine, small.....	1.50	1 Platinum evaporator, 21 gms.....	12.80
100 White pine.....	10.00	1 Platinum evaporator, 14 gms.....	10.40
100 Russian pine.....	3.00	41 Platinum scrap, 41 gms. @ .50.....	20.50
500 Elm seedlings.....	3.00	9 Troilus bulbs, @ .30.....	2.70
100 Red elm.....	3.00	8 Oz. magnesium ribbon.....	2.80
200 Wisconsin weeping willow, small	6.00	5 Sheets glazed paper.....	.25
360 Golden willow.....	14.40	2 2-10-Gallon copper gasometers.....	30.00
150 Mixed poplar cuttings.....	3.00	1 Kipp's apparatus improved.....	4.90
70 Cornus sanguinea.....	1.50	1 U. S. standard barometer.....	26.50
250 Grape vines.....	12.50	1 Set Cork borers.....	.25
120 Yellow birch.....	2.50	11 Graduated milk flasks.....	5.66
150 European birch.....	7.50	1 Zeiss microscope.....	57.00
120 White birch.....	3.60	1 Blending for microscope, Tris.....	4.28
760 Black cherries.....	22.80	4 Objectives, a2, a, d, f.....	42.93
600 American basswood.....	18.00	3 Oculars, 2 and 4.....	3.98
80 European basswood.....	2.40	1 Revolver, 24a.....	7.15
950 Black ash.....	19.00	1 Polarizer, 48b.....	8.21
500 Box elder.....	15.00	1 Diffraction apparatus.....	3.18
1,000 Mixed willows.....	30.00	1 Spectroscope, direct vision.....	67.50
800 Mixed poplar.....	20.00	1 Platform scales.....	13.50
175 Black walnut.....	5.25	1 Double acting bulb, large.....	1.80
900 White ash.....	18.00	1 Double acting bulb, small.....	1.15
900 Butternut.....	27.00	1 5-Inch agate mortar, perfect.....	9.35
300 Soft maple.....	15.00	8 2-oz. Indicator bottles.....	2.48
300 Catalpa.....	6.00	12 Rose crucibles, 1 oz.....	3.00
60 Deciduous ornamental trees.....	30.00	12 Graduated flasks, 200-210 cc.....	4.20
40 Ornamental shrubs, (large).....	10.00	2 Mercury troughs, 16 in.....	1.40
50 Ornamental shrubs, (small).....	5.00	2 Picnometers, 25 cc.....	2.80
300 Hydrangeas, (large).....	18.00	3 Picnometers, 10 cc.....	4.20
850 Hydrangeas, (small).....	25.50	3 Picnometers, 50 cc.....	4.20
1,000 Hackberry seedlings.....	4.00	12 Cu baths, constant level and porcelain rings.....	54.00
500 Buckl.orn.....	10.00	2 Cu evap.-burners.....	4.00
265 Pears, grafts of 1892.....	5.00	2 Fletcher's hot water heaters.....	20.00
800 Apples.....	12.00	1/2 Acid pump.....	1.75
250 Plums.....	10.00	1 Oxygen generator.....	2.25
500 Scotch pine, 2 years old.....	5.00	1 Soft Cu gauze for comb.....	1.00
500 White pine, 2 years old.....	5.00	1 lb. Cu wire, fine and coarse.....	.85
250 White spruce.....	2.50	1/2 Gross velvet corks, 1-16.....	9.00
300 Norway spruce.....	3.00	1/2 Gross flat corks, 1-24.....	9.25
2,500 White pine, one year old.....	8.00	1/2 Gross flat corks, 2 1/2-24.....	1.50
250 Austrian pine.....	5.00	1 Set cork borers, 15 in.....	2.00
	1,056.52		

IN THE LABORATORY.

Including the outfit of the School of Agriculture.	
2 Nickel crucible tongs, plat shoes	\$11.50
1/2 Quire litmus paper.....	.28
1/2 Doz. platinum Gooch crucibles.....	55.22
1 Each agate mortar and pestle 3 in.....	2.90
1 Platinum crucible, 63.7 gm.....	46.22

8 Cork presses, 42	3.36	1 Each thief glasses	45
1/2 Set label books	.15	4 Wash bottles, 8 oz.	1.68
1 Iron mortar and pestle	.45	5 Ether flasks	2.50
8 lb Rubber cloth	2.00	6 Weighing tubes, 2 in. long	.60
8 Wooden funnel supports	6.64	6 Copper Oxid bottles	1.92
1 Sq. foot each cu gauze, 20-100 mesh	4.55	10 Extra weighing bottles	2.37
1 Fletcher's blast lamp	9.00	12 Calcium chloride, 1 bulb, 6 in.	.28
36 Measuring glasses, C. O. & Ozs.	18.00	3 Liebig condensers, all glass	5.60
11 Bunsen batteries and jars, \$1.05	11.55	11 Nessler cylinders, 50 and 100 cc.	2.64
5 Balances, grain weights	15.00	6 Sepr. funnels, 1 oz.	2.77
20 Clamps, 9 cents.	1.80	12 Sepr. funnels, 4 oz.	6.72
1 Weisnegg blast lamp	2.90	4 Sepr. funnels, 16 oz.	3.15
5 Bunsen clamps, single	2.75	12 Safety tubes, 2 bulbs.	1.68
3 Test tube stands, 70 cents.	2.10	1 Geissler's siphon, 18 bulbs	.5
4 Test tube stands, 60 cents.	2.40	1 Thermometer, 0-109°, c.	2.70
10 Yards 3-16 in. rubber tubing; 10 yards 1/4 in. rubber tubing	4.00	1 Thermometer, 0-369°, c.	1.32
8 Supports of iron and brass rods	4.96	3 T. & H. dist. bulbs, 4	2.53
1 Large balance	8.20	12 Each T. and Y. tubes	6.95
40 Retorts, 8 oz. with stoppers	5.18	5 3-way enameled buretts, 25 and 50 cc	12.90
27 Receivers, 1 pt.	2.43	1 Johnson's nitrometer	7.00
40 Lbs. assorted hard glass tubing	12.00	1 Balance	9.45
64 Wolf bottles at 30c.	19.20	1 Kilo asbestos, long fibre.	2.00
1 Gasoline burner	1.00	1/2 Kilo asbestos, short fibre	.35
1 Gasoline burner	1.00	1 Lb. pure iron wire	.40
2 1/2 Ft. each rubber tubing	1.15	6 Watch glass springs	.90
1/4 Ream bibulous paper	.44	1 Colors on porcelain slab	.50
6 Brass filter pumps	6.60	1/8 Roll steel wire	.15
1 Glass callipers, 6 in.	.80	1/2 Quire glaze paper	.15
1 One burner gas pipe	4.17	4 Glasses graduated in cc and ozs.	1.00
1 Chlorine apparatus	11.35	25c	4.50
1 Each 1 pt. and 4 pt. acid pitchers	.40	2 Reichardt's thermometer	4.50
1 Two gal. acid pitcher	.90	2 Rubber funnels	1.45
1 Hinks petroleum lamp	8.50	5 Straight forceps	3.35
1 Normal sugar weight, 16.3	.60	1 Set file handles	1.30
2 Normal sugar weights, 26, 048 gm; 2 1/2 normal sugar weights, 13.024 gm.	2.10	2 Sets each flat files and O files	4.50
2 Thermometers for invert. sugar detrm	5.40	2 Cork knives	.40
20 Pks. 32 cm No. 588 S. & S. folded filters	18.00	4 Compressors, @ 20c.	.80
1 Set brix spindles, 2	2.00	2 Brousen filters	5.00
1 Set brix spindles, 9	27.00	3 1/2 inch acid dishes	1.83
1 Polariscopes, Schmidt & Haench	182.00	1/2 Pk. Adam's paper milk analysis.	65
1 220 escha tube	2.40	3 Co. 2 apparatus, Selwottler's	2.16
1 Mitcherlich's polariscopes and accessories	95.00	1 Quevenner's lactometer	.55
5 Lbs. glass tubing in 24 in. length	2.00	6 Calcium chloride tubes, Merchand	.77
30 16-oz. tincture bottles	19.02	6 Calcium chloride tubes, Mixer's	.39
50 8-oz. tincture bottles	24.09	6 Calcium chloride tubes, Volhard's	.57
16 6-oz salt mos bottles	7.44	12 Glass connectors, assorted	.60
2 Doz. glass T tubes assorted	4.50	1 Graduated cylinder, each 25 and 50 cc	.38
10 Ft. rubber tubing, 1/2 in	2.25	1 Graduated cylinder, 100 cc	.50
1 Steele mortar	4.00	1 Each graduated cylinder, stop'd, 50 cc, 250 cc, 100 cc.	1.40
5 Lbs. glass beads	3.50	1 Graduated cylinder, stop'd, 10 and 25	.38
1 Combustion furnace	40.00	1 Dessicating apparatus 6-in	3.00
1 No. 2 Romer mill	28.00	6 Dessicators	8.60
20 Green packers bottles	2.75	2 Sebuster's Dropping tubes	.18
1 Mill	53.75	6 Each fract. dist. flasks, 2, 3, 32 ozs.	2.55
1 Extra grinding plate	4.25	3 Lbs. pumice stone	.24
6 lbs. Asbestos board	.90	5 Lb. sea salt	.15
2 12 burners on gas pipe	27.00	2 Lbs. sealing wax	.50
2 8 burners on gas pipe	18.00	Silver nitrate solution	3.00
1 Cu. exhaaction tank, kjd	21.00	5 Sodium bibarate	.35
1 Ether exhaaction tank	20.00	5 Lbs. sodium bicarbonate	.35
2 12-hole iron stand	4.00	5 Lbs. sodium carbon	.30
2 8-hole iron stand	3.00	3 Lbs. sodium hyposulphite	.24
3 Copper tanks	34.73	10 Lbs. sodium nitrate, pure	.80
1 Flat burner	2.00	5 Lbs. sodium sulphate, common.	.25
3 Flat burners	12.00	3 Lbs. sulphur roll	.15
4 Gremont batteries, 1/2 gal	11.00	3 Lbs. sulphur flower	.18
25 lbs. glass tubing, assorted	4.50	5 Lbs. tin, feathered	3.75
25 lbs. glass rods, assorted	4.50	15 Lbs. tin, granulated	1.95
76 Geisslers' stop cocks	25.39	2 Lbs. Strontium nitrate	.35
12 Sepy funnels, 4 oz	5.76	2 Lbs. litmus	.50
1 1/2 Gross test tubes	1.62	1 Lb. calcium floride	.09
61 Glass shop bottles	27.45	2 Ozs. sodium metallic, 40	.80
50 Mohr's burettes	24.00	2 Ozs. Potassium metallic, 2.50	5.00
80 Condensers, 45 cm. long	90.00	1 Oz. Sodium bicarbonate anhydrous.	.55
60 U tubes at 11 cents	6.60	20 Lbs. zinc spelter	5.00
12 Graduated flasks	1.73	1/2 Carb. (about) H 2 SO 4	3.00
4 Reichardt's thermostadts	3.80	1 Wanklyn's milk analysis	1.50
4 Geisslers' potash bulbs	1.54	1 Konig's	
		1 Konig's chemic. de metr.	10.78

1	Hegner's butter analysis.....	1 00	27	Cylinders, 8x4.....	7.83
1	Duclux milk analysis.....	90	10	Cylinders, 10x4.....	4.00
2	Volumes Roscoe & Schorlemmer	6 00	14	Cylinders, 6x2.....	1.54
1	Crook's Art. Manures.....	6 00	20	Bunsen funnels, No. 2, at 5c.....	1.00
1	Krocker's let for agr. chem. an-		30	Bunsen funnels, No. 3½, at 6c.....	1.80
	alysis.....	1 50	8	Tubes for extraction apparatus.	2.12
1	Sachse farb. substances.....	3 50	1	Dozen fittings for Gooch cru-	
1	Laubheimer grauzoy des arg.			cibles.....	3.60
	chem.....	5 90	40	Bulb tubes, made to order, 1 and 2	10.00
1	Lebig chem. in relation to agr.		23	Glass-stop bottles, made to order	27.50
	and phys.....	6 00		One set agate measures.....	3.70
1	Sachse leobuch of agr. chem.....	2 50	32	Bohemian flasks, 12-oz.....	3.20
1	Helbreigel beitrage.....	2 00	30	Bohemian flasks, 6-oz.....	3.00
3	Alien's com. org. chem.....	10.25		Four nests beakers, extra tall.....	2.70
1	Battershall's foods, etc.....	2.75	30	Johnson flasks.....	3.00
1	German Fres. quan. anal.....	8.25	5	Automatic pipetts.....	12.50
1	Maerker hand b'k for alch'l dist	3.00	2	Small Liebig's condensers.....	1.75
1	Orth die. geog. agr. kart.....	2.00	6	Sp. gr. bottles.....	3.00
1	Ebermayer, Waldes, etc.....	2.00	16	Assorted funnels, 1 to 10.....	9.33
7	Vol. Boussingaults on chem.....	25.00	11	Evaporat. funnels, 10½.....	10.00
2	Mayer's lehrbuch agr. chem.....	5.00	25	Nests beakers, -1.6.....	18.00
3	Beilstein handbuch agr. chem.....	15.40	2-1	Nests beakers, 60-12.....	4.00
2	Risler geologie agricole.....	6.00	2	Each stopd. receivers, 1-oz, 4-oz.	
2	Titwald general chemistry.....	7.00		1-pt, 1-qt, 2-qt.....	1.60
9	Vois. Dr. Ladenberg chan. dict.....	25.00	25	Lbs. combustines tubing.....	8.28
1	Wolff's ashen analysen.....	3.30	10	Wolf's bottles, 2-gal.....	9.90
1	Ebermayer's phys. et.....	2.00	5	Wolf's bottles, ½-gal.....	3.00
1	Kohlmann & Freick's table.....	2.00	1	lb. acid arsenious, c p.....	.32
1	Rocks and Soils - Stockbridge...	2.50	1	lb. acid boracic, c p., cryst.....	.35
1	Dulzch.....	2.00	1	lb. acid citric, c p.....	.90
	Biedermas's Central Blatt. Agr.		2½	lbs. acid molybdic, c p.....	2.25
	Chem.....	5.00	8	lbs. acid oxalic.....	1.50
	Ruben Zucker Industrie.....	11.00	2	lbs. acid P2O5, anhydrous.....	2.50
	Annals of Agriculture.....	6.50	2	oz. acid tartnic, c p.....	.40
	Liebig's Analen.....	6.50	2	lbs. acid tartaric.....	1.44
	Zeitschrift fur Analytische		5	lbs. alum potassic.....	.90
	Chemie.....	2.90	2	lbs. Am. acetate, c p.....	1.50
	American Chem. Journal.....	4.00	5	lbs. Am. carbonate, c p.....	1.15
	Journal of the Chem. Society...	3.50	5	lbs. Am. chloride, c p.....	.95
	American Journal of Science.....	6.00	5	lbs. Am. nitrate, c p.....	1.50
	Monats heft fur Chemie.....	3.00	4	lbs. Am. oxalate, c p.....	1.40
	Sucree Indicine.....	4.75	5	lbs. Am. phos. and soda, c p.....	3.20
	Versuch's Stationen.....	8.00	1	lb. Am. sulphocyanate, c p.....	.50
	Journal for Practische Chemie...	5.50	1	lb. barium carbonate, c p.....	.60
	Neries' Jaberbuch fur Geology,		5	lbs. barium hydrate, c p., cryst.	1.60
	etc.....	5.00	1	lb. barium chloride, c p., cryst.	.75
	Chemie der Nahrungs Genuss-		5	lbs. barium peroxide, c p., cryst	1.60
	mettler.....	4.00	4	lbs. calcium carbonate.....	1.40
2	Vois. Bockman's Chemische and		1	lb. calcium chloride, cryst.....	.17
	Technische, Untersuchungs		2	ozs. casein, cryst.....	.40
	Methoden.....	6.50	½	lb. cobalt nitrate, cryst.....	.90
1	Pair scales, 1 to 10 gms.....	2 00	5	lbs. copper oxide, wire form.....	5.50
66	Chairs.....	50.00	10	lbs. copper sulphate, c p., free	
	Two dozen book supports.....	.50		from Fe.....	2.20
1	Ink well.....	1.00	1	lb. tin foil.....	1.15
3	Hooks.....	.25	½	lb grape sugar anhydrous, c p.....	.80
1	Door mat.....	1.50	4	ozs. gallic acid.....	.40
3	Cu. air and water baths and		20	lbs. iron sulphide, in cubes.....	1.25
	block tin.....	123.75	1	lb. iron chloride, acid.....	.25
1	Screw driver.....	.25	5	lbs. lead chromate, fused.....	2.80
1	Record book.....	1.00	2	lbs. lead chromate, powder.....	1.12
1	Gimlet.....	.25	1	lb. lead nitrate.....	.27
1	Balance.....	122.98	1	lb. lead oxide.....	.55
1	Balauce.....	45.00	1	oz. lithium oxide.....	.18
4	Chairs, at \$1.50.....	6.00	5	lbs. magnesium chloride.....	.70
1	Letter press.....	3.00	7½	lbs. manganese dioxide, lumps	.75
	Fruit jars, 26 pt, 30 qt, 13 2-qt.....	7.60	1	oz, mannite.....	.75
	Sample bottles.....	35.00	9	lbs. mercuric oxide, free from	
	Gas generator.....	410.00		N2O5.....	10.00
	Gas engine.....	452.00	2	ozs. red phosphorus.....	2.20
	Shafting.....	20.00	2	ozs. phenothaline.....	1.10
1	Table.....	3.00	2	lbs. Na2SO4, c p.....	.32
	Gasoline, about.....	40.00	1	lb. Sn. sticks, c p.....	1.00
	Tin shears.....	1.50	½	lb. Sncl.....	.20
	Bags, wheat.....	3.00	½	lb. Sncl.....	.20
6	Large brushes.....	1.00	½	lb. Uranium nitrate.....	2.80
36	Iron clamps and attachments...	14.15	2	lbs. Sn. powder.....	.38
9	Bottles Squibbs' neut. test paper	.54	2	lbs. Sn. sticks free from as.....	3.60
1	Set sieves, complete.....	6.70	1	lb. SnCl2.....	.43
2	Spatulas.....	.16	1	lb. SuO.....	.40
2	Horn spoons.....	.30	1	lb. FeSO4.....	.17
6	Supports for 2 burettes.....	15.00	1	lb. SbOCl.....	1.08
36	Bunsen burners.....	45.00	1	lb. F14SI.....	.35
2	Gasoline burners.....	1 00	½	lb. Furnice acid.....	.35
70	Funnel tubes, with bulbs.....	7.50	1	lb. Cr2O3, free from SO3.....	1.26

1 lb. Cr ₂ O ₃ , c. p. cryst.....	.90	8 Ozs. potassium iodide c. p.....	1.95
1 lb. Sb. c. p.....	1.70	1 Lb. potassium nitrate.....	.22
5 lbs. PbO ₂	2.40	1 Lb. potassium nitrite.....	.42
5 lbs. CS ₂	1.75	2 Lbs. potassium permanganate cp	.90
1 lb. Amyl. alcohol.....	.30	2 Lbs. potassium permanganate	1.80
18 lbs. acids acetic.....	7.20	sub.....	
1 lb. acid carbolic.....	.50	2 Lbs. potassium sulphate c. p.	.40
1 lb. P ₂ O ₅ , c. p. 1.12 sp. gr.....	.60	cryst.....	
1 lb. Balsam fir.....	.50	8 Ozs. potassium sulphocyanide.....	.35
2 lbs. Bromine.....	1.60	2 Lbs. sodium acetate.....	.40
1 lb. chloroform.....	1.15	1 Lb. sodium bichromate.....	.35
6 lbs. acid HCl.....	1.41	2 Lbs. sodium bicarb. cryst.....	.30
2 lbs. acid hydrofluoric.....	3.00	5 Lbs. sodium bicarb. amorph.....	1.40
5 lbs. sulphurous.....	.95	1 Lb. sodium chloride fused.....	.30
10 lbs. HNO ₃	2.00	3 Lbs. sodium hyposulphite.....	.48
1 lb. nitrous fuming.....	.90	5 Lbs. sodium nitrate c. p.....	.75
2 lbs. sulphuric Nordhouse.....	2.50	1 Lb. sodium nitrate c. p.....	.75
5 lbs. benzol.....	2.60	2 Lbs. sodium phosphate cryst.....	.50
2 ozs. sodium metallic.....	.60	5 Lbs. sodium and pot tartrate.....	2.10
2 ozs. potassium metallic.....	3.75	2 Ozs. brucine.....	2.50
1 lb. acid pyrogalic.....	3.70	5 Lbs. calcium chloride fused lump	1.10
2 lbs. acid salicylic, cryst.....	2.70	10 Lbs. calcium chloride granules.....	2.25
5 lbs. crude potash alum.....	.50	5 Lbs. calcium oxide.....	.35
10 lbs. ammonium chloride.....	1.40	3 Lbs. calcium hypochlorite.....	.25
1 Knorr's siphon apparatus for fats.	2.00	5 Lbs. calcium sulphate.....	.75
1 Blowpipe.....	1.80	1 Lb. animal charcoal cp.....	1.45
6 Dozen bottles like bologna flasks	6.00	5 Lbs. animal charcoal powder.....	.30
1 Gross 6 oz. W. M. bottles.....	4.80	5 Lbs. cuso ₄ cryst. common.....	.45
4 Scale pan brushes.....	.80	1 Lb. infusorial earth.....	.15
2 Blowpipe tips.....	.30	½ Lb. iodine cp.....	2.07
1 pressure apparatus, Reichart's.....	6.00	5 Lbs. iron filings.....	.40
½ Blower, No. 9.....	2.75	5 Lbs. iron sulphate.....	.60
½ Gross assorted gum labels.....	4.50	2 Lbs. lead nitrate.....	.15
4 square feet rubber sheet.....	9.75	5 Lbs. lead oxide.....	.45
10 lbs. assorted rubber corks.....	3.60	1 Lb. log wood.....	.10
20 feet rubber sheating, ½.....	1.35	5 Lbs. manganese ox. c. p.....	4.00
20 feet rubber tubing, 3-8.....	2.40	5 Lbs. manganese sulph.....	1.60
6 feet rubber tubing, ½.....	.90	2 Lbs. Hg. c. p.....	2.05
10 feet assorted tubing.....	1.75	25 Lbs. Hg. best.....	21.50
6 Mohr's clamps.....	2.15	½ Oz. Pt. cl. 2.....	4.00
2 cobalt glasses.....	.12	1 Lb. starch.....	.15
6 Iron retort stands.....	3.84	1 Lb. wax, white.....	.52
2 and 3 doz. each assorted watch		5 Lbs. zinc sulphate.....	.60
glasses.....	49.00	1 Lb. bismuth.....	2.40
2 and 3 pack each assorted filters.....	24.00	5 Lbs. vaseline.....	1.30
6 Graduated flasks, 25 and 50cc.....	.40	1 Lb. ant. and pot. tartrate.....	.35
2 graduated flasks, 100, 200, 250, 500		½ Lb. Brazil wood.....	.10
1,000, 2,000.....	2.75	1 Lb. litmus.....	.25
12 Pipettes not graduated, 5, 10, 25		½ Lb. sea sand.....	.07
and 50.....	1.40	1 Lb. cochineal.....	.40
6 Pipettes not graduated, 100 and		1 Lb. gum arabic, white, best.....	.95
300.....	.75	1 Lb. nut galls, powdered.....	1.30
1 Pipette, 200.....	1.58	10 Lbs. K. 2 Cr ₂ O ₇.....	.80
1 Mohr's, 25cc 1-10cc.....	.25	2 Lbs. K. Br.....	.80
½ Gross (seven sizes each) test		2 Lbs. K. Cl _o . 3.....	.50
tubes.....	6.00	2 Lbs. K. Cn.....	1.02
3 Porcelain rings.....	2.00	2 Lbs. K. I.....	5.80
1 Copper water bath.....	4.50	5 Lbs. K ₂ Cr ₂ O ₇.....	.70
4 Measuring glasses, 2s and cc.....	2.00	5 Lbs. K. 2 So. 4.....	.90
1 Balance grain weight.....	3.00		
60 Nests Hessian crucibles.....	6.00		
8 Jewelers' blow pipes.....	.80		
1 Gross glass plates 105 mm.....	15.10		
104 Glass plates 180 mm.....	9.30		
1 Lb. potassium bicarbonate.....	.27		
2 Lbs. potassium bisulphate fused			
2 Lbs. potassium bisulphate c. p.....	1.65		
2 Lbs. potassium bromide.....	.62		
5 Lbs. potassium carbonate.....	1.65		
1 Lb. potassium hydrate in sticks	2.70		
2 Lbs. potassium chlorate.....	.58		
1 Lb. potassium chromate.....	.90		
1 Lb. potassium cyanide.....	.60		
1 Lb. potassium ferrocyanide.....	.60		
1 Lb. sodium sulphide cryst.....	1.26		
½ Lb. cu foil.....	.55		
½ Lb. glass wool.....	1.20		
1 Lb. soda lime, coarse.....	.78		
1 Lb. soda lime, fine.....	.78		
1 Lb. soda lime, medium.....	.78		
½ Lb. diamond ink.....	.75		
1 Oz. fruit sugar.....	.80		
2 Lbs. glycerine, best.....	.60		
1 Lb. nickel.....	8.60		
8 Ozs. potassium ferrocyanide.....	.55		
4½ Lb. potassium hyposulphite.....	2.80		
			\$5,156.86.
		IN THE STUDENTS' LABORATORY.	
		6 Test tubes.....	.10
		1 Test tube stand.....	.60
		2 U tubes, 6c each.....	.12
		1 Lead dish.....	.13
		1 Magnet.....	.09
		2 Triangle and O files, each 18c.....	.36
		1 Cr. tongs.....	.60
		1 Pair forceps.....	.35
		1 Blow pipe.....	.09
		1 Sand bath.....	.11
		2 Small bottles.....	.10
		1 Funnel.....	.07
		1 Mortar and pestle.....	.30
		2 Cruc. and lids.....	.10
		2 Packages filter paper.....	.19
		1 Wooden stand.....	.63
		1 Glass plate.....	.09
		2 2-neck wolf bottles, each 30c.....	.60
		2 Glass stop wash bottles, each \$1.	2.00
		2 Belg sponges, each 14c.....	.28
		3 Flasks, 500cc, 15c; 300cc, 10c; 200cc,	
		10c.....	.35
		1 Tripod.....	.20

1 Burner and 2 tips.....	1.30
1 Iron rod stand.....	.62
1 Clasp.....	.55
1 Muffa.....	.55
1 Double clasp.....	.45
3 Bottles, each 7c.....	.21
3 Cylinders, med., each 11c.....	.33
1 Cylinder, large.....	.20
1 Pinch cock.....	.09
1 Evaporator.....	.30
1 Nest 5 beakers.....	.50
2 Feet rubber tubing.....	.15
40 Complete sets 40 bottles each, property of School of Agr., reagent and salt M. bottles..	350.00
1 Muffe.....	15.30
1 Fletcher burner.....	1.80
1 Soled burner.....	1.80
4 doz kjd. flasks.....	10.80
25 T T brushes.....	.75
1 doz. Erlenmeyer flasks, 8 oz.....	2.25
1 doz. Erlenmeyer flasks, 16 oz.....	3.15
2 doz. Naphthalamine chloride.....	.80
2 doz. Acid sulphanic.....	.80
2 Hydrometers.....	5.40
1 Thermometer, each 100, 2,250, 1,300	3.20
2 Thermometers.....	2.40
10 ft. 1/2 in. rubber tubing.....	.54
10 ft. 3-16 in. rubber tubing.....	.86
1 Water still and fixtures.....	40.00
1 Cane mill.....	24.00
1 Desk.....	35.00
1 Copy Analyst, 1892.....	1.80

\$513.45

ENTOMOLOGY.

2 Cabinets for herbarium.....	\$90.00
Herbarium paper.....	34.60
500 Specimens of mounted plants.....	50.00
3,000 Specimens of unmounted plants for dissection.....	50.00
Seed from grass plats for plats..	5.00
1 Heavy plant press.....	5.00
1 Old cabinet for insects, (cork lined).....	40.00
24 Frames for insects, (cork lined). 1 Drying case for insects.....	20.00 4.00
24 Glass jars for breeding insects..	2.40
20 Cheese covers for do.....	1.00
1 Large and 1 small butterfly net. 4 Single breeding cages.....	2.00 4.00
4 Double breeding cages (each with six apartments).....	24.00
1 Table for breeding jars.....	5.00
1 Insecticide blower.....	3.00
1 Old fashioned knapsack spray- ing machine.....	6.00
1 Spraying machine upon wheels.....	15.00
2 Spraying machines (in parts), 4 lbs. naphthaline, 6 lbs. whale- oil soap, 6 lbs. paris green, 8 lbs. London purple, 4 lbs acetic ether, 5 lbs. pyrethrum..	8.00
2 Magnifying lenses.....	8.00
2 Pair tweezers, 2 pair scissors, 2 pair scalpels.....	1.60
Dissecting microscope.....	10.00
1 Desk with chair.....	20.00
4 Pine tables, 1 oak table, 6 com- mon chairs, 1 large shelf, 1 shelf with drawers, 1 step lad- der, 1 coal stove, 1 waste bas- ket.....	
1 Broom, 1 duster, 1 dusting pan, 1 coal bucket.....	
1 Patterson's check list of N. A. plants.....	1.50
1 Patterson's genus cover labels..	1.50
Vials for alcoholic material....	2.50
Pinned insects.....	100.00

\$508.50

VETERINARY.

6 Feet 1/2 inch rubber tubing, 12c..	.72
6 Feet 3/8 inch rubber tubing, 8c..	.48
6 Feet 1/4 inch rubber tubing, 6c..	.36
2 6 oz. Rectal syringes, \$1 10.....	2.20
2 3 oz. Rectal syringes, 75c.....	1.50
2 2 oz. Rectal syringes, 65c.....	1.30
1 1 oz. Rectal syringe, uterine....	.75
2 1 oz. Rectal syringes, 55c.....	1.10
4 Langenbec's artery forceps, 40c.	1.60
1 Slide catch Bull Dog forceps....	1.75
1 Slide catch forceps.....	1.75
1 Bottle carbolized catgut.....	.50
1 Arkansas stone, 2x7.....	3.00
3 Belfast linen catheters.....	1.20
1 Rubber drenching tube.....	1.00
1 Three-bladed flea.....	1.50
1 Obstet. forcep.....	2.25
1 10-inch silver probe.....	1.00
1 Hard rubber probe.....	1.35
1 No. 27 tooth forcep.....	1.50
12 Needles.....	1.05
3 Horse catheters.....	4.50
1 Spool silver suture wire.....	.55
7 Scalpels.....	10.00
1 18-inch seton needle.....	2.25
6 Hoof knives.....	7.50
2 Sage knives.....	2.50
1 Adjusting float.....	2.00
1 Float for front molars.....	2.00
12 Files and rasps for floats.....	2.50
1 Bone forcep.....	3.00
2 Retractors.....	2.50
2 Tenaculi.....	2.00
1 Frog seton needle.....	1.50
1 Soud.....	2.00
1 Cuncan elevator.....	1.50
2 Flexor tenotomy knives.....	3.00
4 Hypdermic needles.....	1.40
3 Butcher knives and steel.....	1.50
Table and teaspoons.....	.40
2 Sidelines.....	8.00
3 Thermometers, (clinical).....	3.50
1 Foal hook.....	2.00
2 Metal trachea tubes.....	10.00
1 Rubber trachea tube.....	2.50
1 Mare catheter.....	1.20
1 Firing iron.....	1.00
1 Eccrasseur.....	10.00
1 Nasal speculum.....	8.00
1 Wolf tooth forceps.....	3.00
1 Dressing forceps.....	1.00
1 Incisor cutter.....	3.00
1 Reversible rasp.....	1.25
1 Eye speculum.....	4.00
1 Post mortem set.....	8.00
1 Thumb lancet.....	.75
1 Miles' castrating knife.....	1.00
3 Closed bistouries.....	3.00
1 Seton needle.....	.50
1 Bone chisel and hammer.....	2.00
2 Neurotomy forceps.....	3.50
1 Rat-tooth forceps.....	1.25
1 Hernia tenatome.....	1.50
Ovariotomy scissors.....	3.00
1 Set trocars.....	3.75
1 Simple trocar.....	1.00
2 Trocars (cow).....	2.00
1 Needle forceps.....	1.50
1 Probang.....	2.00
1 Saw (amputating).....	2.50
1 Hoof tester.....	1.25
1 Intestinal scissors.....	2.00
2 Molar cutters (open and closed)	12.00
3 Curved scissors.....	4.50
1 Percussion hammer and plex- imeter.....	3.50
Silk suture.....	1.00
1 Clamp.....	.50
1 Case of patent trephines.....	6.00
1 Trephine.....	1.50
1 Case drainage tubes.....	.50
1 Dissecting case.....	2.00
Clippers.....	2.00
2 Allen pumps and stomach pump	35.00

3 Rubber syringes.....	2.35	Iron.....	1.00
1 Vaporizer.....	1.00	4 1-gallon jugs.....	.60
1 Pocket case.....	1.00	2 Be-l jars.....	.50
1 Cradle.....	2.00	1 Gross test tubes.....	3.00
1 Roll surgeon's plaster.....	1.00	4 Test tube racks.....	1.00
1 Cork presser.....	1.00	1 Gross filter papers.....	1.50
3 Balances.....	25.00	1 1/2 Gross paper bags.....	1.50
6 Assorted spatulae.....	1.50	2 Tunnel stands.....	1.00
2 Screwdrivers.....	1.00	2 Irrigating jars (glass).....	3.00
3 Heller's rasps.....	1.50	Gummed labels.....	1.50
1 Pincer.....	.25	1 Lb. creoline.....	.50
2 Balling irons.....	2.00	1 Lb. oxide zinc c. p.....	.50
1 Stationary iron tackle.....	100.00	2 Gross assorted corks, at 75c.....	1.50
24 Medicine bottles with painted		1 Lb. green soap.....	.23
labels.....	9.45	10 Lbs. chlorinated lime.....	1.00
24 Ointment jars.....	3.25	1 Glass slab, 18x18.....	.68
6 Mortars and pestles.....	2.75	1 Lb. ammon. chlor. pure.....	.28
8 Graduate glasses (assorted).....	6.00	1 Oz. areca unt (pow'd).....	.05
24 bottles, (liquor).....	2.00	1 Lb. comp. tinc. iodine.....	1.33
1/2 Gross empty bottles.....	2.00	1 Lb. tinc. Buchu.....	.57
3 5 gal. cans.....	3.00	4 Oz. butter of antimony.....	.11
1 Demijohn.....	1.00	4 Oz. oil of rosemary.....	.75
5 funnels, assorted.....	1.75	1 Dram cocaine.....	.85
3 doz. tin boxes.....	.69	1 Pint acetic acid and bottle.....	.17
14 Sponges.....	3.50	1/2 Lb. arsenious acid.....	.13
Brushes, currycomb, etc.....	2.50	1 Lb. boric acid.....	.12
5 Halters.....	3.00	1 Lb. carbolic acid.....	.85
1 Horse sling with pulley.....	40.00	1 Lb. pyrolig. acid and bottle.....	.25
1 Horse sling with pulley.....	20.00	1 Lb. ammonium acetate crystals.....	1.25
1 Operating table.....	100.00	2 Oz. antifebrine.....	.50
1 Mo'ar extractor.....	5.00	1 Lb. camphor.....	.52
1 Mouth sp-culum.....	6.00	1 Lb. oxide lead.....	.10
1 Bullet forceps.....	1.50	1/2 Lb. biniodide mercury and bot'l.....	1.95
1 Truax urine test case.....	2.40	5 Oz. sulphate quinine.....	1.35
1 Leitz microscope.....	150.00	1 Lb. acetic acid.....	.47
1 Clinical microscope.....	47.00	2 Oz. resorcine.....	.56
Microscopical accessories and		2 Lb. bicarb. soda.....	.12
staining fluids.....	15.00	3 Lbs. sulph. soda.....	.09
Glass ware for microscopical		1 Lb. carb. ammonium.....	.13
work.....	10.00	1 Lb. carb. calcium.....	.17
2 Tables for microscopy.....	3.00	1 Pint F. E. juniper berries.....	.68
1 Instrument case.....	35.00	1 Oz. F. E. belladonnae.....	.37
1 Table.....	4.00	2 oz opium.....	.45
4 Surcingle.....	.75	1/2 lb. extract licorice.....	.15
1 Hobble.....	15.00	2 lbs. powdered licorice root.....	.30
ropes.....	2.00	1/2 lb. F. E. squills.....	.45
4 Boots.....	1.00	4 oz. iodide sulphur.....	1.88
2 Lanterns.....	4.00	1 lb. Donovan's sol.....	.35
2 Medicine cases.....	5.00	1 lb. Fowler's sol.....	.17
1 Writing desk.....	28.00	1 pint olive oil.....	.40
1 Writing desk.....	19.00	1 pint castor oil.....	.32
24 Arm chairs.....	34.00	1 gal. linseed oil.....	.61
50 Chairs.....	50.00	1 qt. cottonseed oil.....	.30
Bedstead and fixtures.....	12.25	2 lbs. sweet spirits nitre.....	.80
3 Counters in pharmacy.....	10.00	4 oz. compound syr. squills.....	.30
1 Blackboard.....	7.00	2 lbs. benzoated lard.....	.78
1 Chart, (physiology).....	25.00	1/2 lb. F. E. buchu.....	.64
5 charts, (anatomical).....	15.00	2 lbs. mustard.....	2.13
2 Manikins.....	525.00	4 oz. oil of mustard.....	.90
1 Skeleton horse.....	100.00	2 oz. oil of bitter almond.....	.40
12 Museum jars.....	10.00	2 oz. yellow oxide mercury.....	.35
3 Iron stands.....	3.75	1 lb. wax.....	.20
3 Saws.....	3.00	2 qts. liquid tar.....	.27
1 Whetstone.....	1.50	1 pint glycerine.....	.50
3 Cork serews.....	.75	1 pint syr. pruni. vir.....	.13
1 Sprinkler.....	3.00	1/2 lb. powdered nux vomica.....	.29
3 Shovels.....	1.80	4 oz. Monse's solution.....	.20
3 Forks.....	.75	1 lb. pot. chlorate.....	.82
1 Broom, (wire).....	1.25	1 lb. compound tinc. benzoin.....	.30
2 Rakes, (iron).....	4.00	1 oz. extract aloes.....	.38
1 Stove.....	1.50	1/2 lb. powdered rheu. radix.....	.40
3 Basins, (galvanized).....	15.00	2 oz. ethereal oil.....	.22
3 Dissecting tables.....	4.00	1/2 lb. asafoetida.....	.28
1 Brace and bits.....	3.50	2 lbs. powdered gentian root.....	.57
1 Tooth plane.....	1.25	1 lb. compound tinc. gentian.....	1.00
1 Powder blower.....	1.50	1/2 lb. subnitrate bismuth.....	.20
1 Lead mallet.....	6.00	1/2 lb. bromide pot.....	.20
1 Anvil.....	3.50	3/4 lbs. oil juniper wood.....	.50
6 Hammers.....	8.00	2 oz. citrate, iron and quinine.....	1.00
2 Vices.....	7.00	4 lbs. cape aloes.....	2.27
2 Kegs horse shoes.....	3.00	50 lbs. vaseline.....	3.50
6 Tongs.....	25.00	1/2 oz. oil eucalypt.....	.10
1 Bellows.....	.50	1 oz. oil juniper wood.....	.10
2 Nail boxes.....	.75	1 oz oil cajeput.....	.05
1 Pincer.....			

½ oz. oil sassafras.....	.05	4 oz. caustic pot.....	.40
8 oz. paregoric.....	.05	1 pt. carbolic acid.....	.12
1 oz. f. e. belladonna.....	.11	1 pt. muriatic acid.....	.10
3 oz. f. e. ergot.....	.37	2 lbs. copper sulphate.....	.18
2 oz. f. e. ipecac.....	.50	8 lbs. pot. permang.....	3.25
2 oz. tinc. gentian.....	.10	2 lbs. sulphur.....	.20
1 pint tinc. aconite.....	1.25	4 lbs. ginger.....	.80
6 oz. croton oil.....	.40	1 lb. mustard.....	.40
4 oz. tinc. quassia.....	.25	4 lbs. carbo-lig.....	.10
4 oz. tinc. nux vom.....	.35	4 lbs. magnesium sul.....	.18
½ lb. sulph. zinc.....	.10	4 lbs. alum.....	.20
4 oz. f. e. buchu.....	.40	4 oz. ipecac.....	.40
3 oz. f. e. digitalis.....	.30	4 oz. storax.....	.25
4 oz. f. e. Indian hemp.....	.55	4 oz. bichloride mercury.....	.40
2 oz. f. e. jaborandi.....	.14	8 oz. iodoform.....	3.50
1 oz. f. e. veratrum vir.....	.10	2 lbs. lead acetate.....	.50
2 oz. tinc. ginger.....	.10	1 lb. cantharides powder.....	1.00
6 oz. tinc. ferric chlor.....	.50	½ lb. aloes.....	.50
8 oz. tinc. iodine.....	.75	½ gallon ether.....	4.00
1 qt. alcohol.....	.25	½ lb. tannic acid.....	.75
6 oz. powdered belladonna root.....	.60	8 oz. Salicyl. acid.....	1.60
6 oz. powdered spigella root.....	.80	8 oz. Chloral hydrate.....	2.00
4 oz. creosote.....	.50	4 gallons benzine.....	1.00
4 oz. tinc. capsicum.....	.25	1 oz. nitrate silver.....	.75
1 oz. tinc. aloes and myrrh.....	.10	1 lb. sulph. iron.....	.09
1 oz. tripoli.....	.15	4 gallons turpentine.....	2.80
1 oz. sodium salicylate.....	.20	1 quart chloroform.....	1.00
1 oz. citrate iron and ammonium.....	.25	8 oz. F. E. jaborandi.....	.85
1 oz. santonine.....	.45	8 oz. balsam of Peru.....	1.25
½ oz. amyl nitrite.....	.15	2 gallons aq. ammonia.....	1.60
1 oz. calabar bean.....	.20	Eserine salicylate (hypod. tablets).....	10.80
2 lbs. nitre.....	.70	Pilocarpine muriate (hyp. tablets).....	4.80
2 oz. tartar emetic.....	.24	Morphine muriate (hyp. tablets).....	2.50
½ oz. pot. iodide.....	.20	Apomorphine (hyp. tablets).....	2.00
6 oz. calomel.....	1.20	Atropine sulph (hyp. tablets).....	2.00
1 oz. iodine.....	.40	Cocaine muriate.....	.50
1 oz. strychnine.....	1.35		
1 oz. pot. nitrite.....	.12		

\$1,060.06

FARM PRODUCTS.

	On hand Dec. 1, 1891.		PRODUCTION.							DISTRIBUTION.						On hand Dec. 1, 1892.		Acres grown 1892.
			Seed.		Labor.		Total yield.			Bought.		Sold.		Fed.				
	Bu.	Value.	Bu.	Value.	Hrs.	Value.	Cost.	Bu.	Value.	Bu.	Value.	Bu.	Value.	Bu.	Value.	Bu.	Value.	
Barley.....	537	\$268.50	30	\$15.00	420	\$67.20	\$82.20	575	\$287.50	59 5-6	\$36.45	.....	.....	546 5-6	\$273.40	595	\$243.00	15
Wheat.....	42	33.60	12	9.60	300	48.00	57.60	184	147.20	.....	.....	.....	.....	.....	.....	214	142.35	8
Oats.....	1,113	334.37	60	18.00	734	117.44	135.44	1,287	411.84	331	130.77	.....	.....	1,632	532.24	1,039	352.00	24
Peas.....	40	20.00	8	4.00	134	21.44	25.44	b7,560	22.68	.....	.....	.....	.....	.....	.....	40	20.00	4
Vetches.....	.....	.....	2½	7.50	27	4.32	11.82	a1½	7.50	.....	.....	.....	.....	.....	.....	a1½	7.50	4
Millet.....	.....	.....	¾	1.50	56	8.96	10.46	a3¾	22.50	.....	.....	.....	.....	.....	.....	a2	12.00	1
Potatoes.....	.....	.....	12	4.80	248	39.68	44.48	190	76.00	.....	.....	180	\$76.00	.....	.....	.....	.....	1½
Rape.....	.....	.....	b5	.75	5	.80	1.55	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
Flax.....	90	60.00	1½	.75	10	1.60	2.35	.....	.....	.....	.....	56	53.31	.....	.....	30	15.00	1
Sugar beets..	a50	150.00	b40	6.00	676	108.16	114.16	a18½	55.50	.....	.....	.....	a150	150.00	a18½	55.50	2	
Mangels.....	.....	.....	b15	2.25	110	17.60	19.85	7½	22.50	.....	.....	.....	.....	.....	a7½	22.50	3	
Corn.....	300	150.00	4	2.00	2,630	416.55	418.55	1,200	600.00	76	35.85	.....	.....	372	186.00	1,200	600.00	38
Timothy.....	a56	400.00	.....	.....	200	32.00	32.00	a33¾	273.00	.....	.....	a3	24.00	a40¾	326.00	a46	.....	15
Clover.....	a1	8.00	.....	.....	294	47.07	47.07	a38¾	306.00	.....	.....	a4½	36.00	10¾	86.00	a24	168.00	9
Ensilage.....	a90	360.00	.....	.....	.....	.....	.....	a50	.....	.....	.....	.....	a90	330.00	a50	200.00	.....

a—Tons. b—Lbs.

STOCK PRODUCTS.

	On hand Dec. 1, 1891.		Bred.		Purchased.		Feed.	Labor.	Animals Sold.		On hand Dec. 1, 1892.		Animals Died.	
	No.	Value.	No.	Value.	No.	Value.			Value.	Value.	No.	Value.	No.	Value.
Horses.....	6	\$750.00	.....	.....	.....	.....	\$446.78	.....	.....	5	\$550.00	1	\$75.00	
Sheep.....	96	550.00	7	.....	62	\$184.77	195.01	\$60.25	90	\$512.59	68	408.00	7	.....
Fat cattle.....	8	110.00	.....	.....	.....	.....	108.19	48.08	8	267.90	.....	.....	.....	.....
Shaw cattle.....	6	840.00	4	\$60.00	.....	.....	.....	.....	2	45.00	8	620.00	.....	.....
Dairy.....	32	1,745.00	22	247.00	4	240.00	891.50	1,278.65	11	240.25	35	1,517.00	a12	85.00
Swine.....	49	332.00	24	24.00	2	65.00	172.88	157.38	52	571.48	16	200.00	7	40.00

aTen calves killed.

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