# Public Documents of Maine:

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## ANNUAL REPORTS

OF THE VARIOUS

## PUBLIC OFFICERS AND INSTITUTIONS

FOR THE YEAR

## 1879.

VOLUME II.

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SPRAGUE & SON, PRINTERS TO THE STATE.
1880.

# ANNUAL REPORTS

OF THE

# TRUSTEES, PRESIDENT,

## Farm Superintendent and Treasurer,

OF THE

# STATE COLLEGE OF AGRICULTURE

AND THE

# MECHANIC ARTS.

## 1878.

Published agreeably to a Resolve approved February 25, 1871.

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SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1878.

# TRUSTEES.

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# TRUSTEES' REPORT.

*To the Honorable Senate and House of Representatives, in Legislature assembled:*

The act of Congress, providing for the establishment of colleges in the several States, "for the benefit of Agriculture and the Mechanic Arts," requires that "an annual report shall be made regarding the progress of each college, recording the improvements and experiments made, with their cost and results." In obedience to this requirement, the Trustees of the Maine State College of Agriculture and the Mechanic Arts respectfully submit their twelfth annual report, which together with the reports of the several professors herewith presented, will afford the information called for by this act.

The severe financial pressure of the times, affecting all classes of people in all educational and business pursuits, and particularly the industrial classes, for whose benefit the institution was especially designed, has had the effect to diminish the number of students. Still, the catalogue shows an attendance of 101 students who have entered the college for the full course of four years, and of several who are pursuing special studies. The institution draws students from all parts of the State, thus demonstrating that it is *not*, as has often been affirmed, an institution of merely local interest and importance.

It has sent out one hundred graduates, most of whom have entered upon active and useful pursuits. Its professors are intelligently and resolutely working to reach the highest point of usefulness and efficiency in their several departments, attainable with the means at their command.

For a knowledge of the quality and scope of the instruction given, the methods employed and the results attained, you are respectfully referred to the subjoined reports.

## Agricultural Department.

Mr. J. R. Farrington, the former Farm Superintendent, having been appointed instructor in the department of agriculture, relinquished the care of the farm early in the season. Mr. T. G. Rich, an experienced and successful farmer, was appointed to succeed Mr. Farrington. He entered upon his duties on the first of April, and has devoted his time to practical farming. During the summer the area of pasturage has been considerably enlarged, and the grounds around the farm buildings have been improved. Although the season has been unfavorable to the production of some of the most important crops, Mr. Rich has nearly succeeded in making the farm pay expenses.

Freed from the care of the farm, Mr. Farrington has devoted his time to giving instruction on various subjects pertaining to theoretical and practical farming, and has carried on a variety of important experiments, in which he has been aided by the class in agriculture. The character and results of these experiments are given at length in his report.

## Instruction in Shop Work.

Through the resolute purpose of Prof. Pike, of the department of engineering, a small beginning in shop work instruction, on the Russian plan, has been made with the most gratifying results. Much disappointed at the refusal of the Legislature of last year to provide shops properly equipped for instruction in practical work, the larger part of the class in mechanical engineering determined to seek elsewhere the instruction refused them at their own college, and, at the commencement of the summer term, so informed the Faculty. Loth to lose a promising class from his department and the college, Prof. Pike set himself immediately to the task of devising and carrying into execution a plan whereby the desired instruction could be furnished and the students retained. He was cheerfully aided by the other members of the Faculty. The students volunteered to supply their own

tools and material to work on. A sum sufficient to make necessary preparations and to pay for a term's instruction was provided by interested friends. A poorly adapted room in the attic of the chemical building was made to answer the purpose of a shop. Lumber being provided, the students made their own benches.

An excellent instructor was obtained from the Boston School of Technology. Several weeks of the term had passed before the preparations were completed, and the term of instruction was short.

The work done by the students under these unfavorable circumstances, has been pronounced by competent judges creditable in the highest degree. It was placed on exhibition at the State Fair in Portland, and the editor of one of the leading papers in that city, said of it—"the vise work showed the skill of trained artisans in the direction of the manufacture of complicated machinery."

A more signal achievement, in some respects, was reserved for the fall term. It having been determined to provide for a course of instruction in forge work, (the necessary funds having been pledged) the students, on their return at the end of the summer term, found ready for use a pile of lumber, a few pieces of damaged steam pipe and a plat of ground on which to place a building. Being furnished with nails, glass and other materials, they framed, raised and covered a building 41x21 feet, shingled the roof and battened the walls. Failing to receive some forges and patent blowers in season, that had been promised them by a friend of the college in Massachusetts, they extemporized forges by making rough boxes and filling them with sand. Pipes were run through the forges to carry the blast. A small engine belonging to the college was placed in position, and run by members of the Senior class in turn.

The preparations having been completed and a competent instructor secured, the course of instruction was begun early in October. So much of the term had been consumed in preparations that the time remaining was sufficient for only a

part of the intended instruction. The results, like those previously noted, were most encouraging. It is designed to have the work placed on exhibition during the coming winter at the State House in Augusta, where members of the Legislature and others interested can examine it. A more particular account of the experiment in shop work instruction and its results may be found in the report of Prof. Pike, who is entitled to much credit for initiating and conducting the experiment to so successful an issue in the face of so many difficulties.

The Trustees, on the occasion of their annual meeting, held at Orono in November, had the satisfaction of visiting the shop, where they found as many of the class as could be accommodated at one time busy at the forges, not simply as interested, but apparently as enthusiastic workers.

This system of instruction is simple but wonderfully effective. The old apprenticeship system has come into almost complete disuse. It was adapted to an earlier age, but its processes of attainment are too slow for the present times. Requiring several years to reach what can now be attained in a single year, its continuance would be absurd. Skilled workmen will always be wanted. The Russian system, which, after Massachusetts, Maine is the first to adopt, promises to come into use at a most opportune time. Its entire practicability and eminent capacity for usefulness have been demonstrated both in Massachusetts and Maine. An expenditure of a few thousand dollars judiciously applied to the construction and equipment of the necessary shop would be of great advantage to the young men of the State. The pertinent question is, not whether the State can afford the expenditure, but whether it can afford to withhold it. The Trustees and officers of the college are desirous of providing for a course of instruction in wood work as early as practicable next season. This course would be of great value, not only to the mechanics and machinists, but to the farmers who will graduate from the college.

## The Relation of Education to Labor.

A widely read and influential journal of the State, alluding, in a recent issue, to the large number of liberally educated young men who are vainly seeking employment, asks, "What, then, is to become of our educated young men? Is there no room for them? Would it have been better for them had they remained in ignorance? Not at all. They are needed, *but in new walks in life.* The better educated the worker in any department the better the work. What our college education *does not do is this, it does not sufficiently exalt the nobility of work.* * * Our learning needs to be energized and made to feel the dignity of work and the shame of idleness. We would advise the liberally educated young man, who finds no room in the editor's chair, in the forum, in the pulpit, to go into the shoe factory, the mill, the carpenter's shop, to the machine shop. Go to the land if nowhere else. In any or all these places, education and character, trained heads and hands, are what is required. You will rise, no matter where you start, just in proportion as you apply skilled brains and willing hands."

The above extract forcibly presents the defects in our prevailing methods of college training so far as the wants of the average student are regarded.

To divorce work from study through the formative and protracted period required to obtain a liberal education, has the effect, in a large majority of cases, to create an aversion to work that amounts to a complete disqualification for its performance. The methods employed by the State College are of a different character, and lead to different results. The several courses of study have been arranged to meet the requirements of those who expect to enter upon the active pursuits of life. The instruction of the class-room is supplemented, so far as practicable, with labor, investing it with an interest that relieves it of all the features of mere drudgery. Labor, in its turn, adds fresh interest to study and

instruction. Thus "study and labor go hand in hand," and habits of industry are formed that are always available capital to the person seeking to establish himself in business, and that constitute a passport to positions of usefulness and independence.

The laborers of Maine have a vital interest in the success of the State College. It was established "to promote the liberal and practical education of the industrial classes." It is often and justly asserted that these classes do not exercise the influence in the affairs of society and government commensurate with their relative numbers and usefulness. If there is to be a change in this direction it must come, not by indulgence in useless complaint or violent denunciation, but by compliance with the conditions necessary to secure the change. Social and political influence comes of knowledge. Trained intellect *has* governed, and *does* and *will* govern in the affairs of the community, State and nation.

Labor constitutes the basis of wealth and prosperity. It is due to the working men of Maine that there shall be one institution within the limits of the State to which their own children may resort, and at a moderate expense secure to themselves the advantages of a thoroughly liberal and practical education.

The Treasurer's Report shows a balance in favor of the college of $675.18. There are unpaid bills amounting to about the same sum. The institution is, therefore, nearly or quite free from debt.

With the application of the most rigorous economy in every department, an appropriation of $6,000 will be needed to meet the necessities of the institution the coming year. There is urgent need of more apparatus in the chemical laboratory, for the want of which the usefulness of that department is seriously abridged. Additions to the apparatus of other departments are also much needed.

To pay for instruction, in addition to the revenue derived from the Endowment Fund, there will be needed.... $4,000
For apparatus..... 1,000
For current expenses..... 1,000

Total ..... $6,000

Respectfully submitted,

ABNER COBURN, *President.*

# PRESIDENT'S REPORT.

*To the Trustees of the Maine State College of Agriculture and the Mechanic Arts:*

GENTLEMEN,—I herewith present to you in behalf of the Faculty, the annual report of the condition of the college. The continued attendance of large classes of students who come from all parts of our State to seek admission, demonstrates the deep seated feeling on the part of the people, that there is need of a college where young men who wish to become intelligent farmers and mechanics can obtain a liberal and practical education especially adapted to their wants. The increasing number of graduates who are taking honorable positions in productive employments, carries conviction to all unprejudiced minds, that the Maine State College supplies facilities for obtaining the required education.

The excellent system of instruction and the courses of study adopted by the Trustees, require a suitable teaching force to carry them into successful operation. With any essential diminution in the number or in the qualification of the teachers, one of two things must inevitably result—either some of the studies must be eliminated from the college curriculum, which would seriously detract from the advantages now offered to the student for obtaining the harmonious development of mental power and for securing desirable scholarly attainment; or a partial, hurried and superficial instruction must be given by over-worked teachers in a multiplicity of studies, which would be alike unsatisfactory to the teachers and the pupils.

Some change in the courses of study may wisely be made. As it is found by experience that the students who design to become farmers require most of the lessons embraced in the

chemical course, and that the studies in agricultural chemistry are of equal interest and profit to the chemical students and the agriculturists, the two courses hitherto kept distinct may most profitably be merged into one.

In the admission of students to the college, it is still to be regretted that a higher standard of scholarship is not attained by those who have graduated from our high schools. Among those seeking for admission to the State College are many fully prepared to enter successfully on our course of study, others whose deficiencies have been such as could possibly be removed by diligent study in connection with their class-work have been admitted on this condition. While some improvement is shown in the thoroughness of preparation of those last admitted over candidates of previous years, there is still margin for further advancement in the thorough acquaintance with the preparatory studies required of candidates.

At the commencement of the spring term eleven joined the present Sophomore class. This autumn thirty-five presented themselves for examination, of whom thirty have been admitted to the Freshman class and one to the Sophomore. The pressure of the hard times has effected the attendance of our students; several of those admitted the last term and others from the different classes were compelled to absent themselves from college when they found favorable opportunities of profitable employment, by which they might procure the means of prosecuting their course of study hereafter at the college. It is the especial merit of this institution that those unable to procure a liberal education elsewhere by their own exertions can here obtain that inestimable boon, and graduate with honor.

The general attention to study and the proficiency made by the several classes have been gratifying to all. The efforts made to maintain discipline and good order have not been without good results, and we trust they will be of lasting benefit.

The exercises of commencement were held on the last week of June. The first exercise was the Sophomore declamation

on Saturday evening, June 22d, which was well attended. The prize for excellence in speaking was awarded to C. M. Allen. Honorable mention was made of the declamations of Miss Marcia Davis and W. F. Cleveland. The baccalaureate was delivered on Sunday evening. On Monday evening an interesting and highly instructive address on the peculiarities of oriental education, was delivered by Rev. Cyrus Hamlin, D. D., of the Bangor Theological Seminary, in place of the usual exhibition by the Junior class.

On Tuesday afternoon the exhibition drill of the Coburn Cadets, and their target practice, were witnessed by a large crowd of interested spectators. The president's reception in the evening was a pleasant gathering of visitors and friends of the graduating class. On Wednesday the regular exercises of the graduating class were performed before the large audience that assembled to listen to the themes. The degree of Bachelor of Science was conferred on Miss Emma Brown, John Locke, Jr., and Edward C. Walker, who had completed the course in Science and Literature; and on C. C. Chamberlain, James Heald and O. C. Webster, who had completed the course in Chemistry. The degree of Bachelor of Civil Engineering was conferred on G. E. Fernald, F. J. Oakes, J. C. Patterson and W. E. Tripp; and the degree of Bachelor of Mechanical Engineering on A. J. Caldwell. A military diploma was granted to A. J. Caldwell, C. C. Chamberlain, C. C. Elwell, G. E. Fernald, J. Heald, J. Locke, Jr., J. C. Patterson, F. J. Oakes and O. C. Webster, who had completed a special course of study in military science.

The committees on Sophomore declamations and Junior essays having made their reports, the prizes were publicly awarded—the Coburn prize for excellence in declamation to C. M. Allen, the Coburn prize for best essay to S. P. Crosby.

On Thursday the class-day exercises by the graduates were of more than ordinary interest.

We have to regret that the students had not the privilege of attending the last session of the Board of Agriculture, which was held at Presque Isle. The remote locality of the

meeting made it impossible to make any arrangements with the railroads for free transportation. The Board will hold their next meeting in Orono, or in this vicinity, so as to accommodate the students. The mutual benefit of the attendance of the students in the meetings, to the Board and to the college, is fully appreciated.

The earnest zeal of the students in mechanical engineering to secure a thorough course of practice in mechanical arts was not quenched by the refusal of the legislature to make any appropriation to provide for the necessary accommodations. As most of the students in that department were about to leave the college and the State, to prosecute their studies where suitable facilities are furnished, efforts were made to retain them. By the generous donation of two hundred and fifty dollars by Ex-Gov. Coburn, and by the contributions of the students from their scanty means, the professor of engineering was enabled to make provision for the commencement of this important department of education. The room in the attic, originally designed for photography, was fitted up, by the labor of the students, for a vise shop, and the necessary apparatus was procured. Mr. Wallburgh, a successful teacher in the Massachusetts School of Technology, was employed; and the course of practical mechanics was commenced. The full success that has crowned the efforts made under the most unfavorable circumstances is certainly highly creditable to those engaged, and demonstrates the practicability, value and importance of this department. Work that was performed by the students under the pressure of literary preparation for the exercises of commencement, and in the exhausting efforts required to pass a creditable examination in their regular studies, has elicited the most enthusiastic commendation from skilled mechanics, and has received a medal from the State Fair at Portland.

This autumn term the students have gladly given their labor, and availing themselves of the donation of lumber given by citizens of Orono, have erected by their own work

a convenient forge shop. Their own contributions have aided another donation of two hundred and fifty dollars from Ex-Governor Coburn, in furnishing the necessary apparatus. The class of sixteen have finished very creditably to themselves and to their instructor, Mr. Webber of Bangor, the prescribed course in iron work. For lack of time the work upon steel must be deferred till next term.

The donations made to this department will surely be regarded as a most judicious investment. They have brought the department of the Mechanic Arts into special prominence. The inquiry naturally arises what can be done to make the practical work in the Agricultural department equally popular and efficient.

The next want in practical mechanics is a carpenter's shop, properly supplied with tools, where the students may be taught to work upon wood.

While the practical work is rendered more efficient, some expenditures in the scientific courses are of pressing importance. I would direct your attention to the need of another balance, and other requirements in the departments of Chemistry and Natural History.

## Department of English Literature, Mental and Moral Science.

As in former years, I have had charge of this important department of instruction. In the autumn term the Freshmen study rhetoric. The regular text-book recitations are accompanied with copious explanations and illustrations by the teacher; and written exercises are required of each of the students. In this way the science is practically applied. The great deficiency in the knowledge of grammar on the part of those entering college, makes it extremely difficult to teach the art of English composition in the brief time allowed from the pressure of scientific studies. Exercises in composition are continued through the whole college course. In elocution, after a short preliminary drill in the elements of vocal culture, all the students have regular exercises in

declamation, which alternate with their exercises in composition. Declamations and essays are too important exercises to be passed over without much time and care on the part of the teacher. The especial drill for public occasions is no inconsiderable item in the outlay of time and labor.

All the Sophomores have recitations in English Literature during the spring term, and the study of American Authors is pursued by part of the Juniors in the succeeding term. The intention in this study is to develop a correct literary taste, to direct the attention to the best authors, and to lay the foundation for subsequent profitable reading.

The Seniors not in the Engineering courses study the History of Civilization in the autumn term. The neglect of historical reading so common among students before they enter college, makes it necessary to supplement the lessons with such lectures on general history as are requisite for the full comprehension of this important study. The same students attend to Mental and Moral Science during the spring term. To all the Seniors I have given instruction in Political Economy, with lectures on Rural Law. During the last part of the autumn term I heard the review of the Seniors in Logic. The brief and comprehensive treatise used as a text-book is of little use without copious illustrations, and the efficient aid of a teacher well versed in the science, and interested in imparting knowledge.

In addition to the work of a presiding officer and of an instructor in the college, addresses and lectures have been given at agricultural meetings and at other public assemblies, by which a more general knowledge of the value of industrial education, and of the aims and methods of this institution, has been extended among the people of the State.

Respectfully submitted.

C. F. ALLEN.

## DEPARTMENT OF MATHEMATICS AND PHYSICS.

*President Allen:*

The classes under my instruction during the year now closing, have made satisfactory progress in the several branches to which they have attended. These branches are algebra, geometry, trigonometry, analytical gemoetry, calculus, physics and astronomy.

The study of physics, transferred from the Freshman year to the Junior year, and hence omitted for two years, has been resumed under favorable circumstances. The knowledge of mathematics possessed by students in the Junior year serves very fairly for dealing with most physical formulas, and renders possible a higher order of instruction and of acquirement than is possible at any earlier period of the course. The change of time was an important one. Ganot's Physics has been used for text-book, but the subjects of sound and electricity have been presented wholly by lectures illustrated by numerous experiments. Of these lectures the members of the class have been required to take notes, and have been examined upon these notes as upon lessons learned from the text-book. In like manner have been presented the laws of falling bodies, the laws of central forces and such topics as interference and polarization of light.

The small addition recently made to the apparatus for illustrating more fully the principles of light and electricity has been found highly serviceable. Especially valuable have been found the pieces for projection by solar light. The means at my command have not justified the purchase of apparatus for projection by the oxyhydrogen or by the electric light, and hence such apparatus still remains one of the needs of this department.

It gives me pleasure to acknowledge the gift within the year, by E. A. Ashcroft, Esq., of Boston, of a beautiful and

highly accurate steam-gauge—a very acceptable and useful addition to the physical apparatus of the Institution. It is doing service at present in connection with the engine of the forge-shop.

In practical astronomy, the class in the spring term was unusually large, numbering twenty-two, and hence requiring in the field-work a large amount of personal attention. Two sextants, a transit, a chronometer, and the Repsold Vertical Circle, were kept in almost constant daily use during the latter part of the term. In addition to the drill in taking observations for latitude and time, the work of reduction of the observations was carried on daily in class room exercises, thus affording the members of the class practice in spherical astronomy of the highest value.

Occasion has been taken within the year to make a determination of the geographical position of the college, by means of the Repsold Verticle Circle. Its latitude and longitude, as heretofore reported, were based upon sextant observations made on December 2d and 9th, 1869. A slight change in the figures indicating its position was to be expected when a determination could be made with the larger instrument now brought to the service.

As indicative of the quality of work which can be done with this instrument, I submit a brief summary of the results upon which the longitude of the college is based. On December 4, 1877, and on May 29, 1878, the local time was carefully determined by means of equal altitude observations of the sun, and comparisons were made with corresponding Greenwich time, furnished by telegraph by Messrs. S. M. Ingalls & Son of Bangor. The summary is given below.

| | | | | | | | *h.* | *m.* | *s.* |
|---|---|---|---|---|---|---|---|---|---|
| 1877. | Dec. | 4th, | 10 | observations | reduced | give longitude in time | 4 | 34 | 40.72 |
| 1878. | May | 29th, | 10 | " | " | " | 4 | 34 | 40.75 |
| " | " | | 11 | " | " | " | 4 | 34 | 40.78 |
| " | " | | 4 | " | " | " | 4 | 34 | 40.68 |
| " | " | | 9 | " | " | " | 4 | 34 | 40.71 |

The mean of the above result gives 4 h. 34 m. 40.74 s., or 68° 40′ 11″.1 W., as the longitude of the observing station

from Greenwich. The latitude of the station is 44° 54′ 2″ N. This value is based upon a number of observations upon stars in the meridian. These observations were taken with the horizontal axis of the instrument in both positions. The observing station is situated in front of the northwest corner of the Laboratory 145 feet, and north 18½ feet. The longitude of this station from Washington is 33 m. 31.35 s., or 8° 22′ 50″.25 E.

Regarding the latitude and longitude given as the latitude and longitude of the college, I submit a few time intervals, some of which have been employed in the foregoing longitude determination, and all of which are so frequently serviceable to students in Practical Astronomy in this Institution that I desire to have them printed in convenient form for their use.

| | | | | | | *h.* | *m.* | *s.* |
|---|---|---|---|---|---|---|---|---|
| Time from | Greenwich | Observatory | to | Washington | Observatory. | 5 | 8 | 12.09 |
| " | " | " | | College at Orono. | | 4 | 34 | 40.74 |
| " | Washington | " | | " | " | | 33 | 31.35 |
| " | " | " | | Cambridge | Observatory. | | 23 | 41.11 |
| " | Cambridge | " | | College at Orono. | | | 9 | 50.24 |
| " | " | " | | State House, | Boston. | | | 15.50 |
| " | Boston State House | | to | College at Orono. | | | 9 | 34.74 |
| " | " | " | | Bangor (near Custom | House,) | | 9 | 12.00 |
| " | Bangor | to | College | at | Orono. | | | 22.74 |

It is proper to add that the somewhat careful determination of the geographical position of the college enabled me to bring the vertical circle into successful service on the occasion of the solar eclipse July 29th, 1878. A report of the work done at that time has been made to the Naval Observatory, Washington, D. C., and has been "placed on file with its other contributions on the subject of the eclipse."

Respectfully submitted,

M. C. FERNALD.

# DEPARTMENT OF ENGINEERING.

*President Allen:*

The class-room instruction in this department has not varied essentially from that of last year. In the limited time given to the course in the college, it is impossible to exhaustively take up all, or perhaps any, of the various sub-divisions of engineering science. Our object has therefore been to establish a firm foundation of principles, rather than empirical rules, in the minds of the students. With this for our purpose, we endeavor to show the student *why* such and such things are done as well as simply how to do them. With such a plan we cannot enter as fully into details or take up as many different subjects as if our work was confined to the use of "thumb rules;" but we are sure that the thorough knowledge of principles, gained in this way, will more than repay the work spent upon them. We do not, however, confine ourselves to the demonstration of theories, but in each case show just how these theories are practically applied.

During the year the students in both courses have been given many problems in the application of their text-book instruction, which, carefully preserved, cannot fail to be of use to them in future life. The last term of their course was devoted to the designing and calculation of the parts of a number of bridges, cranes, roofs, engines, &c.

Below is given a list of the graduates in this department at the last commencement, with the subject of their theses:

*Civil Engineering.*

G. E. Fernald, Lewiston Iron Bridge, first span.
F. J. Oakes, Lewiston Iron Bridge, second span.
J. C. Patterson, Topsham Iron Bridge.
W. E. Tripp, Surveying.

*Mechanical Engineering.*

A. J. Caldwell, Valve-motions.

Besides these, C. H. Benjamin and C. C. Elwell received certificates of having satisfactorily completed all the purely engineering studies in the mechanical and the civil engineering courses respectively, and having presented satisfactory theses, the subject of C. H. Benjamin's being the Crank, and of C. C. Elwell's the Roof Trusses in the Orono Town Hall.

The present Senior class in mechanical engineering have this term had an opportunity for obtaining practice in running the engine attached to the forge shop, to be hereafter described. They have, by turns, had the whole charge of engine and boiler, working by a set of rules by which safety, economy and neatness were ensured. This I consider to be of great value to the students, as by this means they get ideas of the practical working of steam that they would not otherwise get.

## Work Shops.

The project of establishing work shops for instruction in the mechanic arts, which has been urged for the last two years, has at last received a trial here, sufficient to show that the plan proposed is capable of doing even more than was promised for it. Last spring, after the decision of the Legislature by which an appropriation for this purpose was refused, it was found that many of the students in mechanical engineering were very much discouraged, and felt if they could not get the much desired instruction in the mechanic arts at Orono, they must seek it elsewhere. This state of affairs was presented to the Trustees, and it was decided to make an attempt to start a shop for instruction in vise-work at once. The matter of providing funds for even this small beginning proved to be so difficult that the plan must have been dropped if Ex-Gov. Coburn had not generously subscribed two hundred and fifty dollars for this purpose. With this sum, and agreements from thirteen students to furnish their own tools and materials, it was decided to undertake the shop. Materials for benches were purchased and the students who were to take the course offered to make them,

which they did in a very workmanlike manner. The only thing that remained was to find an instructor who should combine the skill of an expert with ability to impart his knowledge to others. We were very fortunate in securing the services of Mr. Valentine Wallberg of Boston, who had already carried a number of classes through this work at the Massachusetts Institute of Technology. We also received permission to use the course in vise-work that had been already so successfully used at the Institute.

In this connection I wish to acknowledge gratefully the many ways in which Pres. Runkle and Prof. Whittaker of the Institute have aided me in my efforts to introduce this shop-work at Orono.

We were obliged to locate our shop in a small room over the chapel, originally intended for a photographing room. This room was small and badly lighted, but nevertheless answered our purpose very well. As we were not ready to begin work till quite late in the term, the class was obliged to have daily lessons of three hours' duration in order to complete the whole course. The course consisted of twenty-two pieces, which may be classified as follows:

Filing to line, five pieces, occupying twenty-four and one-half hours.

Filing to template, one piece, occupying eleven hours.

Free-hand filing, two pieces, occupying eighteen hours.

Fitting, three pieces, occupying twenty-six hours.

Hand-vise filing, four pieces, occupying eleven hours.

Sawing, one piece, occupying two hours.

Chipping, six pieces, occupying twenty-nine and one-half hours.

From this it may be seen that the whole course was carried out in one hundred and twenty-two hours of actual work, or about twelve regular working days. Special attention is called to this fact, as when taken in connection with the really fine work done, it demonstrates the great superiority of this system of mechanical instruction over that of the old appren-

tice system, in which at least a year is spent in work of very little value to the apprentice.

In order that the student may know just what things are most important in each piece, and that they may be ranked on their work, a carefully arranged set of points is posted before each lesson on which the completed piece will be ranked. As an example of the care used and pains taken to make every stroke count I add Mr. Wallberg's points for piece No. 10, which is the fitting of a rectangular steel slide:

| | | |
|---|---|---|
| Point No. 1. | Good joints on bottom of slide, both edges, | 20 per cent. |
| " 2. | Good joints on sides and top, | 20 " |
| " 3. | Top of slide flush with sides, and square from sides, | 15 " |
| " 4. | Both sides square, from bottom on outside, | 10 " |
| " 5. | Ends flush with sides and square from sides, | 10 " |
| " 6. | No cross-marks, | 5 " |
| " 7. | Slide to push through with finger and fit both ways, | 20 " |
| | | 100 " |

By careful attention to these points the student knows just what to look out for, and the ranking becomes as definite as could be wished. This system does away with simple opinion as to the merits of any piece, and makes its rank depend on actual testing of the various points. The best average rank for the whole course was 97.76 per cent., received by Mr. W. F. Decker, while the average of the whole class was 93.7 per cent., a record to be proud of.

The work done in this course has been on exhibition at the college, at the State Fair at Portland and at the Orono town hall. It has everywhere excited surprise for its excellence, and has attracted attention to the college which it would not otherwise have received. At the State Fair, as elsewhere, it was very carefully examined by a great many mechanics, all of whom were loud in its praise. As a recognition of the value of the work it was awarded a medal at the State Fair. It is but just to the college and the students who did the work, to state the fact that wherever we have shown this work we have shown *every* piece done in the course, not a picked set of the best. The *uniform* excellence of the work is what shows the value of the system.

Having made so satisfactory a beginning, and as the students were very anxious to keep on with their shop work, it was decided to get up a course in forge work for the fall term. Gov. Coburn again generously came forward with pecuniary help, and some of the students agreed to do something towards the equipment of the shop, so that enough was promised beforehand to warrant the undertaking.

A serious difficulty arose from the fact that we had no place that could be adapted for such a shop. Permission was however obtained, from the donors, to use the lumber originally given for a gymnasium to erect a building for a forge shop, and the students again agreed to give their services in its erection. With this lumber and other materials costing about sixty dollars, a building forty-one by twenty-one feet, with ten feet posts, was erected without a cent being expended for labor. The shop stands immediately behind the Laboratory, is boarded and battened, and presents quite a neat appearance.

The original intention was to purchase portable forges, but an unexpected help coming in the very generous gift from Mr. B. F. Sturtevant of Boston, of one of his patent blowers, and the promise to make us a set of forges, changed this plan. It was then decided to move the engine, bought for this department two years ago, from the Laboratory cellar, and use it for running the blower for supplying the blasts.

We had hoped to be ready to begin work by September 1st, but the building was not quite completed, nor had the promised forges arrived. Finding that the illness of Mr. Sturtevant had prevented his attending to the forges, we were obliged at the last minute to put up some temporary ones, which though not nearly as convenient as those we expected, have answered our purpose very well. At last, however, everything was ready and work began October 3d. For this shop we were fortunate enough to find in Bangor a blacksmith, Mr. C. S. Webber, to give the required instruction, though of course the system and method were entirely new to him. He took hold of the idea at once and has given complete satisfaction. The course followed has been substantially that of the Insti-

tute of Technology, with a few modifications to suit our circumstances. We worked out a system of points for making this course on the same plan as was described above under vise work, and have very satisfactory results to show. The highest average rank received was 94 per cent. by W. F. Decker and C. S. Loring, the general average was 90 per cent. In this course as in the other, and according to the system, the work begins with the easiest possible lesson, in this case bending round iron into a staple, and by easy steps passes on to the more complex. The lessons of this term have covered the following operations: Bending, upsetting, drawing out, punching, splitting and shaping, drawing to a point, welding and various combinations of the same. It was intended to take up steel working, including tempering, but as it was so late when work began we were obliged to postpone it till next term.

We have now had the experience of two shops conducted on the Russian system, so that the matter is no longer doubtful, but is an established fact that this system of industrial education is *the* system for us, and that we can by its aid accomplish results in a given time that could hardly be begun by the apprentice plan. The fact that the students have taken such an interest in the shops, aiding so materially by their labor and money, is sufficient proof that there is a call for this instruction, and that any money expended in this direction will be an investment that cannot fail to pay. Having tested the question of the applicability of this system to our needs, without expense to the State, and having shown that it will fully meet them at a very moderate cost, we now feel that there can be no valid reason for refusing to carry out a plan which will turn the thoughts and labor of our young men to productive pursuits.

Last year I gave estimates for the building we need for shop purposes, made by a reliable builder, and I copy them this year as then given. They are for a two story building sixty-five by forty-five feet.

| | | |
|---|---|---|
| (1) | Plain wooden building, shingled, 65x45, | $1,500 |
| (2) | " " " slated, 65x45, | 1,800 |
| (3) | " " " mansard roof, slated, 65x45, | 2,300 |
| (4) | Plain brick building, slated, 65x45, | 3,300 |
| (5) | " " " mansard roof, slated, 65x45, | 3,800 |

(3) and (5) are estimates for a building with a third story, divided into drawing rooms. This plan is proposed as relieving very much the lack of room now felt by the whole faculty. By putting a mansard roof on the shop building, a number of rooms now occupied by the drawing department would be set free and the pressure released.

The estimates for equipment now required are as follows:

| | |
|---|---|
| For tools for vise shop, to be kept in good repair by a small assessment on students using them .. | $225 00 |
| For tools for forge shop ..... | 200 00 |
| fitting up wood shop..... | 500 00 |
| " " foundry ..... | 500 00 |
| " " engine room and for shafting..... | 300 00 |
| " " lathe shop ..... | 2,000 00 |
| " " instruction ..... | 800 00 |
| | $4,525 00 |

Trusting that the very satisfactory beginning made this year in the direction of industrial education may be followed by a still greater advance next,

I am, very respectfully,

W. A. PIKE,
*Professor of Engineering.*

## DEPARTMENT IN NATURAL HISTORY.

*President Allen:*

The work in this department during the past year has been substantially as in previous years. Instruction has been given in human anatomy, physiology and hygiene by means of text-books and lectures; in botany by text-books, lectures and excursions; in zoology, entomology and comparative anatomy by lectures, excursions and cabinet work; in determinative mineralogy by lectures and laboratory practice; in geology by lectures and excursions.

Because of the great amount of labor involved in the instruction and demonstrations in this department, to Prof. Farrington has been assigned the study of physical geography, and I have therefore been able to give a more extended course of lectures on cryptogamic botany, including such plants as are of special and economic importance to the agriculturist.

The facts stated in my report of last year concerning the need of larger and better arranged rooms, together with more apparatus for the work in this department, still exist, and it is to be hoped that such facilities may soon be afforded in this respect, that the best possible instruction may be given.

A considerable number of specimens have been given to this department during the year by the friends of the college, but by far the most important are a collection of shells and corals obtained from the islands of the Pacific, and presented by the Rev. B. G. Snow; and a collection of foreign woods presented by the Department of Agriculture in Washington.

The work of filling up the collections with the species of Maine plants and animals has been carried on as rapidly as time would allow, but confined principally to the smaller forms or such as occupy but little space, which course must be pursued until cabinet room is provided, when the larger forms may be obtained.

Respectfully submitted,

C. H. FERNALD.

# DEPARTMENT OF CHEMISTRY.

*President Allen:*

No changes of importance have taken place in the course of instruction in this department. The spring term was devoted to the study of Organic Chemistry by the Senior class of students in the course in chemistry. After having completed the study of the important parts of Naquet's Chemistry, second volume, I gave them a few notes upon chemical apparatus and chemical manipulation. The Junior students of the same course pursued the study of Inorganic Chemistry, completing the first volume of Naquet's Chemistry.

Besides the above classes, the students of the Sophomore year spent two hours every morning in the laboratory, working upon qualitative analysis. At the commencement in June, 1878, three students of the course in chemistry graduated, each presenting a thesis upon some subject connected with their special study, as given below:

The Minerals of Maine, by Mr. C. C. Chamberlain.

The Chemistry of the Carbon Compounds, by Mr. James Heald.

Water (including the mineral waters of Maine), by Mr. O. C. Webster.

The Junior and Senior classes worked in quantitative analysis every afternoon. Some of the time was spent by the Seniors in assaying silver ores, this being a new feature in the course, as the department has been without an assay furnace until this year, when a part of last year's appropriation was used to procure the necessary apparatus for such work. Gravimetric and volumetric analyses were performed by the students as heretofore.

During the fall term I have held recitations in General Chemistry with the Sophomore class and Agricultural Chem-

istry with the Junior class. This class has used as text-books Johnson's "How Crops Grow" and "How Crops Feed," and it is my intention to use the French translation of "Wolff's Practical Study of Manuring" and the translation of "Wolff's Study of the Rational Feeding of Domestic Animals;" this, together with notes upon some special points, will give the class a good drill in the chemical principles involved in agricultural processes. The Senior chemical students recited daily in organic chemistry.

In the afternoon my time was occupied by the Junior and Senior classes who worked in the laboratory. The Junior class, owing to a lack of balances, were obliged to work upon qualitative analysis during the whole term, contrary to my intention, which was to have them begin quantitative analysis about the middle of the term. It is to be hoped that some arrangement may be made by which a balance may be obtained, as it is indispensable for our work.

Owing to the departure of Prof. Hills before the close of the term, I have had for a short time the Sophomore class in French, most of the time being given to the translation and reading of Sardou's Perle Noire.

The wants of the department still remain what they were last year. A balance must be obtained by the beginning of next term, in order to give the students a proper drill in quantitative analysis. There are many pieces of apparatus needed to make the course of work in the laboratory as complete as it should be, and it is to be hoped that a liberal appropriation will be made to the department. The want of sufficient space makes itself felt more and more. Something should be done at an early date to provide for more class rooms.

As my time is taken up by purely educational work, I have had to refuse to analyze substances which have been sent to the college. It would seem that the interests of the institution demand that some means be provided by which such analyses might be properly attended to in our laboratory.

I append to this report some sugar beet determinations by myself, as well as a few analyses made by students, illustrating the kind of quantitative work done in the college laboratory.

Respectfully submitted,

ALFRED B. AUBERT.

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Determination of the sugar in the juice of beets grown from large and small seed of several varieties upon the college farm, by Prof. A. B. Aubert.

*Beets grown from large seed.*

| Name of Variety. | Specific gravity of juice. | Weight of 230 seeds. | Per cent. of sugar in juice. |
|---|---|---|---|
| | | Grammes. | |
| Carter's Prize Nursery ..... | 1.048 | 9.550 | 7.9 per cent. |
| Vilmorin's Improved Sugar Beet... | 1.061 | 9.255 | 12.1 " |
| *Sugar Beet ..... | 1.050 | 9.660 | 9.5 " |
| White Silesian Sugar Beet..... | 1.047 | 9.900 | 8.7 " |
| Imperial Sugar Beet..... | 1.059 | 9.970 | 9.5 " |

*Beets grown from small seed.*

| | | | |
|---|---|---|---|
| Carter's Prize Nursery ..... | 1.051 | 3.690 | 8.0 per cent. |
| Vilmorin's Improved Sugar Beet... | 1.064 | 3.140 | 12.7 " |
| *Sugar Beet ..... | 1.047 | 3.120 | – |
| White Silesian Sugar Beet..... | 1.055 | 2.685 | – |
| Imperial Sugar Beet..... | 1.055 | 3.545 | 9.0 " |

I give the above results without comment for the present, as I expect to prepare an extended report upon the manuring of beets at an early date. For further particulars as to cultivation of the above beets, etc., I must refer the reader to the report of the professor of agriculture.

Sample of analyses done by students in the Laboratory of the Maine State College:

Quantitative analysis of milk of cow Topsy of College Herd:

| | |
|---|---|
| Specific gravity, - - - - - - | 1.032 |
| Water, - - - - - - | 85.74 per cent. |
| Fat, - - - - - - - | 4.41 " |
| Casein, - - - - - - | 4.77 " |
| Sugar, - - - - - - | 4.49 " |
| Ash, - - - - - - - | .62 " |

[Average of two analyses by Mr. W. H. Jordan.]

*Sold by W. C. Sawyer of Portland, to the farmers of the State for the purpose of raising beets for the extraction of sugar.

Analysis of butter made from milk of Shorthorn cow Cornelia:

| | |
|---|---|
| Water - - - - - | 15.377 |
| Fat, - . - - - | 74.046 |
| Salt and ash, - - - - | 8.595 |
| Curd, - - - - - | 1.982 |
| Total - - - - | 100.00 |

[ Analysis by Mr. A. M. Farrington. ]

Quantitative determination of manganese in manganous sulphate Mn. S O 4:

23.1 per cent. - - - 23.3 per cent.

[ Two analyses by Mr. G. P. Merrill. ]

Quantitative determination of alumina ( Al 2, O 3 ), in alum (K 2, Al 2, ( 4 S O 4) + 24 H 2, O ):

11.70 per cent. - - - 11.73 per cent.

[ Two analyses by Mr. A. L. Moore. ]

Partial quantitative analysis of Bradley's X L Superphosphate:

| | |
|---|---|
| Matter volatile at 100° C - - - | 17.92 per cent. |
| Total phosphoric acid ( P 2, O 5 ) - | 11.64 " |
| Sulphuric anhydride ( S O 3 ) - - | 20.43 " |
| Iron oxide ( Fe 2, O 3 ) - - - | 3.95 " |
| Lime ( Ca O ) - - - - | 19.40 " |
| Magnesia ( Mg O ) - - - | .18 " |
| Alkalies ( potash and soda ) ( Na 2, O&K 2, O ) | 1.47 " |
| Ammonia ( Nitrogen ) as ( N H 3 ) - | 2.72 " |

[ Analysis by Mr. A. M. Farrington. ]

Assay of silver ore:

Assay No. 1—70 ounces of silver to ton of ore.

Assay No. 2—69 ounces of silver to ton of ore.

[ Two assays of the same ore by Mr. C. C. Chamberlain. ]

Quantitative analysis of feldspar. Alkalies calculated as sodium oxide ( Na 2, O ):

| | |
|---|---|
| Silica ( Si O 2 ) - - - | 65.00 per cent. |
| Alumina ( Al 2, O 3 ) - - - | 19.80 " |
| Lime ( Ca O ) - - - | .65 " |
| Sodic oxide ( Na 2, O ) - - - | 14.74 " |
| Total - - - - | 100.19 " |

[ Analysis by Mr. W. H. Jordan. ]

Quantitative determination of copper in copper ore:

| | |
|---|---|
| Analysis No. 1, - - - - | 62.8 per cent. |
| Analysis No. 2, - - - - | 62.7 " |

[ Two analyses of the same ore by Mr. O. C. Webster. ]

Analysis of Ruta Bagas:

| | |
|---|---|
| Water, | 87.08 per cent. |
| Sugar, | 5.10 " |
| Fat, &c., | .09 " |
| Crude fibre, | 1.16 " |
| Albuminoids, | 1.15 " |
| *Pectose compounds, Starch and loss, | 4.01 " |
| Ash, | 1.41 " |
| Total, | 100.00 " |

[Analysis by Mr. A. M. Farrington.]

Determination of soluble and insoluble phosphoric acid and nitrogen in Cumberland superphosphate (old sample):

| | No. 1. | No. 2. |
|---|---|---|
| Soluble phosphoric acid ($P_2O_5$) | 5.65 per cent. | 5.59 per cent. |
| Insoluble phosphoric acid ($P_2O_5$) | 8.33 " | 8.38 " |
| Total | 13.98 " | 13.97 " |

Nitrogen, 1.81 per cent.

[Two analyses by Mr. W. H. Jordan.]

* Estimated by difference.

## DEPARTMENT OF MODERN LANGUAGES AND MILITARY INSTRUCTION.

*President C. F. Allen:*

I have the honor to report that the classes under my instruction this year have gone over the complete course in French, German, U. S. Constitution, Mechanics, Logic and Book-keeping.

*French.*—Keetel's Analytical and Practical French Grammar has been used in place of Smith's French Principia with marked success. The class has translated a work entitled "*La Perle Noire*," with very satisfactory results, when the time devoted to this study is considered.

*German.*—The class in this language have used Otto's German Grammar, and after translating the short stories contained therein have used Storm's "*Immensee*" for more advanced practice. This class completes its course in June of each year.

*Mechanics.*—The text-book used has been Peck's Mechanics. If this branch could be followed by studies pertaining to agricultural engineering, it would be an improvement to the agricultural course.

*U. S. Constitution.*—Andrew's Manual of the U. S. Constitution has served as text-book. The result of the examination in June was very pleasing and of credit to the class.

*Book-keeping.*—The instruction in this study has been given without the aid of text-books, and each student has kept a set of books in the same manner as was done last year. Result of examination quite satisfactory.

*Logic.*—Schuyler's Logic has been used as text-book with the present Senior class, whose progress has been fair.

*Military Instruction.*—But two hours a week are allotted to this branch. The complete ground of infantry tactical instruction in the schools of the squad, company and battalion has been gone over with the students. The State authorities have kindly consented to loan this department the necessary field-pieces and equipments, from the Banger arsenal, to enable artillery instruction to be given. My plan would be to take up artillery tactics in the latter part of each fall term.

This department has been liberally provided with ball cartridges by the Adjutant General, to encourage the instruction in target practice. Good use has been made of the supply, and the students have received benefit from the practice.

The plan proposed by me for a course in military science and the art of war, to be voluntarily taken by the students in addition to the regular tactical instruction, and the provision for a *Special Military Diploma*, to be given students satisfactorily completing this course, was adopted by the Trustees in the early spring and immediately put into operation. The diploma recommends the holder to a commis-

sioned rank in the militia of any of the several States, and is intended to be of service to the State as well as to the student, its recommendation to be of value, and acquired only upon a complete mastery of the necessary course. The plan has received the approval of the State authorities, who appreciate its worth so long as its standard is maintained. Eight students of the last Senior class were able to master the course, and received the diploma, but for the future my plan would be to devote more time to it, beginning earlier. I trust its importance may be appreciated and its standard supported.

On May 30th of this year the battalion of cadets participated in the exercises incident to Memorial Day at Brewer in the forenoon, and at Bangor in the afternoon. The Cadets were accompanied by Andrews' Bangor Band, to whom the thanks of the corps were due for special attentions. During commencement week in June the battalion was reviewed by the Adjutant General, Gen. J. P. Cilley, and followed by the last dress-parade of the graduating class, at which the officers for the ensuing year were announced, and the old officers were relieved. No other opportunity has been presented to bring the cadets before the public. The usual attendance at the fall meeting of the State Board of Agriculture had to be dispensed with, as free transportation could not be provided by the Board.

The lumber that has been on hand for several years for a gymnasium and drill shed—a present from several citizens of Orono—has been used by the Department of Mechanical Engineering, with the Trustees' consent, to be replaced when the necessary funds for completing the gymnasium can be obtained.

Most respectfully submitted,

FRANCIS L. HILLS.

## DRAWING AND FIELD WORK.

*President Allen:*

I have instructed, during the year, the Sophomore class in mechanical drawing, in the field practice of surveying, and in free-hand drawing; the Junior class in the civil and mechanical engineering courses, in field practice and drawing, and the Senior class in the same courses, in descriptive geometry, drawing and field practice.

The Sophomore class, during the first ten weeks of the spring term, worked two and a half hours each day, in the drawing room, on general problems in mechanical drawing and elementary geometrical projections. Of the remaining nine weeks, six were devoted to practical surveying in the field, where the students worked two and a half hours each suitable day, becoming familiar with the use and care of instruments, putting into practice the problems found in their text-book, and making detailed surveys of farms and house lots in the village. After this work had been completed they were engaged afternoons for three weeks, in the drawing-room, making the necessary plans from their field notes.

During the fall term the Sophomore class was occupied one hour each day in the study and practice of free-hand drawing. In this work we have used Bartholomew's national system of industrial drawing, after which I gave a short course in object drawing. The whole of this term should be devoted to object drawing, but as our students receive no instruction in drawing at the town schools, before coming here, it is necessary to devote the greater part of the time to preliminary work.

The members of the Junior class, in civil engineering, have worked two and a half hours each suitable day in the field, during the greater part of the fall term, and have laid out nearly all of the railroad curves found in Henk's field-book,

put in turnouts and frogs, and practiced leveling and setting slope-stakes.

The Senior class in civil engineering, during the spring term, worked in the drawing-room afternoons, on isometric and cabinet projections and perspective drawing. During the fall term they have made a topographical survey of a portion of the college farm, and have surveyed the route, made the necessary drawings, and calculated the excavations and embankments for a railroad extending from Webster station, Orono, to the college buildings, a distance of a mile and a third. In this work, the termini, way stations, gauge of track, use of the road, and the financial condition of the company being given, the students are required to exercise their own judgment in determining its preliminary location, grades and position of stations, all necessary changes being made at the final location. After the survey has been made, together with the plans and profiles, each student is required to make a careful estimate of the cost of building and equipping the road.

The students in mechanical engineering have not been able to do the usual amount of drawing on account of the time which they have devoted to shop work, which has been considered an equivalent for the drawing. It seems necessary that some permanent provision be made for this work, so that it will not necessitate the loss of so great an amount of the drawing, the importance of which, to the mechanical engineer, can hardly be over estimated. The wants in this department remain as set forth in my report of last year.

Respectfully submitted,

G. H. HAMLIN.

## Condition of the Library.

During the past year 131 volumes of books and 37 pamphlets have been added to the library. The whole number of books in the library at the present time is 3,783, and 674 pamphlets. All the books and pamphlets added to the library this year have been given by

Hon. Hannibal Hamlin, 50 volumes.

Hon. S. L. Boardman, 25 volumes and 5 pamphlets.

Prof. A. B. Aubert, 25 volumes and 16 pamphlets.

U. S. Department of Interior, 7 volumes and 11 pamphlets.

U. S. Navy Department, 1 volume.

U. S. Commissioner of Education, 1 vol. and 4 pamphlets.

U. S. Treasury Department, 1 volume.

Bussey Institute, 1 pamphlet.

Superintendent U. S. Coast Survey, 2 volumes.

Smithsonian Institute, 1 volume.

Prof. Hitchcock, 1 volume.

New Jersey Agricultural Society, 1 volume.

The Coburn Fund, 18 volumes, which are mostly bound magazines.

Hon. W. J. Corthell, 2 volumes.

Mr. Freeland Jones, 2 volumes.

I have devoted all the time which I could spare from other duties to making an accession card catalogue of the library, and have catalogued now over a thousand volumes.

There is a constant demand, both by the Faculty and students, for books of reference, and it is very necessary that a small sum should be appropriated each year to supply such books, and to meet other expenses of the library.

Respectfully submitted,

G. H. Hamlin.

# DEPARTMENT OF AGRICULTURE.

*President Allen:*

No very important changes have been made in the studies of this department since last year. Physical geography, heretofore assigned to the department of natural history, has been transferred to me. With this exception, my work in the class-room is like that of previous years. Guyot's Physical Geography is the text-book employed, and supplementing this a globe, wall-maps and blackboard diagrams are used for the purposes of illustration.

Farm drainage is taught in the second term of the Freshman year. The text-book used is "Draining for Profit and Health," by George E. Waring, Jr. Practical illustrations of the principles taught are obtained from the experience of farmers who have drained their fields, and from the results of draining on the college farm. By means of blackboard and chart, plans of fields to be drained are given, measurements taken, lines of ditches marked, areas calculated, and the required size of tiles determined. Suitable tools for digging drains and laying tiles are shown, and the manner of using them explained. Estimations are made of the probable cost of the work, also of the returns that may reasonably be expected from the outlay. Opportunity to do actual draining on the farm would afford better illustration of the principles taught, and prove advantageous both to the students and the college.

During the Sophomore year, "Farm Implements" and "Mechanical Cultivation of the Soil" are taken up wholly by lectures. A small outlay authorized by the Trustees has been used to procure enlarged drawings of farm implements and illustrations of different modes of tillage, which give

increased value and interest to the subject. The twenty dollars expended for these drawings was profitably invested, and it is desirable that it be followed by other sums to be equally well applied.

The agricultural studies pursued in the Senior year are, Dairy Farming and the Principles of Stock Breeding, the first term; Cultivation of the Cereals, Landscape Gardening, Rural Architecture and Sheep Husbandry, the second term. Of these studies, cultivation of the cereals is taken up by lectures, and the others partly by lectures and partly by text-books.

Scientific investigations are constantly shedding new light upon agriculture as an art and as a science; but as little of the recent knowledge is put in suitable form for text-books, it becomes necessary to present it to the class orally. My work in this direction has, in former years, been seriously embarrassed by cares connected with the superintendence of the farm. Relief from this care, afforded by the appointment of a farm superintendent, permits me to devote my whole time to work in the class-room and on experiments in agriculture.

Students of the course in agriculture are expected to work with me in the experimental fields in the afternoon of each day, during the proper season, for care and observation of the growing crops. The knowledge gained from the labor and observation is considered sufficient pay for the services rendered. Efficient help was received from that source the past season. When additional labor is necessary, students from the Freshman class are employed and are paid for their work as provided by the college regulations.

By devoting the greater part of the summer vacation to work on the experiments, I have been able to materially reduce the expenditures in that direction. The same kind of economy can be practiced again if it shall be necessary.

A committee from the Board of Trustees, Messrs. Boardman, Wingate and Hinks, authorized the experiments herewith reported. The selection was made with a view to choose

those that would be educationally valuable to the students who care for them, and will, when properly wrought out, furnish results of practical value to farmers.

*Experiments in feeding swine with cooked meal and raw meal, to ascertain the relative value of such food for the production of pork.*

This experiment has been tried nine years in succession, the time devoted to the trial having been in most instances twenty-four weeks. The results have in every case pointed to the superior value of uncooked meal for the production of pork. The only apparent exception to the uniform results occurred last year, when in comparing cooked meal fed to pigs Nos. 1 and 2, with raw meal fed to the same pigs, a small advantage appeared in favor of cooked meal; but the average of the results obtained from all the pigs fed that year was largely in favor of raw meal.

The four pigs fed this year were from three litters. Nos. 1 and 2 were pure bred Yorkshires, six months old. Their food during the winter and spring had been raw sugar beets. No. 3 was a White Chester pig, six weeks old. No. 4 was eight weeks old and of the same blood. The pigs were kept separately in small pens with open yards, affording good opportunity for exercise, and for access to the fresh earth. Grass, weeds and charcoal were occasionally fed to them as conducive to appetite and health. A quantity of food, adequate to the wants of each, was fed daily. The food for each pig was weighed and prepared every day. No. 1 was fed with raw meal during the twenty-four weeks of the experiment. No. 2 was fed cooked meal for the same time. During the first four weeks of the experiment, No. 3 was fed cooked meal and No. 4 received raw meal. For the second period of four weeks, No. 3 received raw meal and No. 4 was fed with cooked meal. This manner of alternating the kind of food given was continued with three pigs throughout the time of the experiment. In computing the cost of pork produced by feeding cooked meal, the expense of cooking the meal is not taken into account.

| | No. of pig. | Raw or cooked meal. | No. lbs. meal fed per week. | | Cost of food consumed. | Pounds of gain in weight during each week. | Cost per lb. of increase in live weight. |
|---|---|---|---|---|---|---|---|
| | | | lbs. | oz. | cents. | | |
| End of first week..... | 1 | Raw meal, | 30 | 8 | 38.12 | 17 | 2.24 |
| | 2 | Cooked, | 25 | 0 | 31.25 | 23 | 1.36 |
| | 3 | Cooked, | 8 | 0 | 10. | 2½ | 4. |
| | 4 | Raw, | 11 | 8 | 13.37 | 6½ | 2.06 |
| End of second week ..... | 1 | Raw meal, | 49 | 0 | 61.25 | 23 | 2.66 |
| | 2 | Cooked, | 46 | 8 | 58.12 | 22 | 2.64 |
| | 3 | Cooked, | 8 | 0 | 10. | 9 | 1.11 |
| | 4 | Raw, | 11 | 8 | 13.37 | 2½ | 6.15 |
| End of third week..... | 1 | Raw meal, | 60 | 0 | 75. | 22½ | 3.33 |
| | 2 | Cooked, | 56 | 0 | 70. | 19½ | 3.64 |
| | 3 | Cooked, | 10 | 0 | 12.50 | loss,7 | - |
| | 4 | Raw, | 14 | 12 | 18.43 | 4½ | 4.09 |
| End of fourth week ..... | 1 | Raw meal, | 39 | 0 | 48.75 | loss,4½ | - |
| | 2 | Cooked, | 41 | 0 | 51.25 | loss,5 | 10.05 |
| | 3 | Cooked, | 7 | 0 | 8.75 | loss,0 | - |
| | 4 | Raw, | 10 | 12 | 13.43 | 3½ | 3.83 |
| End of fifth week ..... | 1 | Raw meal, | 42 | 8 | 53.12 | 11 | 11.01 |
| | 2 | Cooked, | 41 | 8 | 51.87 | 8½ | 6.10 |
| | 3 | Raw, | 5 | 4 | 6.56 | loss,1 | - |
| | 4 | Cooked, | 10 | 12 | 13.43 | 1½ | 8.96 |
| End of sixth week..... | 1 | Raw meal, | 50 | 8 | 63.12 | 23½ | 2.69 |
| | 2 | Cooked, | 50 | 8 | 63.12 | 29½ | 2.14 |
| | 3 | Raw, | 3 | 0 | 3.75 | 3 | 1.25 |
| | 4 | Cooked, | 14 | 4 | 17.81 | 3½ | 5.09 |
| End of seventh week ..... | 1 | Raw meal, | 55 | 12 | 69.68 | 16½ | 4.22 |
| | 2 | Cooked, | 55 | 12 | 69.68 | 10½ | 6.63 |
| | 3 | Raw, | 6 | 4 | 7.81 | 6 | 39.77 |
| | 4 | Cooked, | 17 | 8 | 21.87 | 3½ | 6.25 |
| End of eighth week ..... | 1 | Raw meal, | 48 | 0 | 60. | 2 | 30. |
| | 2 | Cooked, | 56 | 0 | 70. | 1 | 70. |
| | 3 | Raw, | 9 | 0 | 11.25 | 7 | 1.61 |
| | 4 | Cooked, | 19 | 0 | 23.75 | 2 | 11.87 |
| End of ninth week ..... | 1 | Raw meal, | 58 | 0 | 72.50 | 20 | 3.62 |
| | 2 | Cooked, | 58 | 8 | 73.12 | 17 | 4.30 |
| | 3 | Cooked, | 14 | 0 | 17.50 | 3 | 5.83 |
| | 4 | Raw, | 19 | 0 | 23.75 | 4 | 5.93 |
| End of tenth week ..... | 1 | Raw meal, | 54 | 0 | 67.50 | 7 | 9.74 |
| | 2 | Cooked, | 59 | 8 | 74.37 | 4 | 18.59 |
| | 3 | Cooked, | 19 | 0 | 23.75 | 2 | 11.87 |
| | 4 | Raw, | 9 | 12 | 12.18 | 8 | 1.52 |
| End of eleventh week. ..... | 1 | Raw meal, | 61 | 8 | 76.87 | 22 | 2.49 |
| | 2 | Cooked, | 42 | 8 | 53.12 | 17 | 3.12 |
| | 3 | Cooked, | 12 | 0 | 15. | 6 | 2.50 |
| | 4 | Raw, | 18 | 0 | 22.50 | 4 | 5.62 |
| End of twelfth week..... | 1 | Raw meal, | 54 | 0 | 67.50 | 8 | 8.43 |
| | 2 | Cooked, | 59 | 8 | 74.37 | 9½ | 7.80 |
| | 3 | Cooked, | 8 | 4 | 10.31 | loss,3 | - |
| | 4 | Raw, | 21 | 0 | 26.25 | 4 | 1.87 |
| End of thirteenth week ..... | 1 | Raw meal, | 63 | 0 | 78.75 | 17 | 4.63 |
| | 2 | Cooked, | 53 | 0 | 66.25 | 3½ | 1.89 |
| | 3 | Raw, | 14 | 0 | 17.50 | 9 | 4.63 |
| | 4 | Cooked, | 19 | 12 | 24.68 | 3 | 8.22 |
| End of fourteenth week ..... | 1 | Raw meal, | 58 | 8 | 73.12 | 7 | 10.44 |
| | 2 | Cooked, | 39 | 0 | 48.75 | 10 | 4.87 |
| | 3 | Raw, | 15 | 8 | 19.37 | 11 | 1.76 |
| | 4 | Cooked, | 31 | 0 | 38.75 | 9 | 4.30 |

| | No. of pig. | Raw or cooked meal. | No. lbs. meal fed per week. | Cost of food consumed. | Pounds of gain in weight during each week. | Cost per lb. of increase in live weight. |
|---|---|---|---|---|---|---|
| | | | lbs. oz. | cents. | | |
| End of fifteenth week..... | 1 | Raw meal, | 36 0 | 45. | 13 | 3.46 |
| | 2 | Cooked, | 42 0 | 52.50 | 7 | 7.50 |
| | 3 | Raw, | 19 8 | 24.37 | 5 | 4.87 |
| | 4 | Cooked, | 23 8 | 29.37 | 4 | 7.34 |
| End of sixteenth week ..... | 1 | Raw meal, | 45 8 | 56.87 | 6 | 9.48 |
| | 2 | Cooked, | 33 8 | 41.87 | loss, 1 | - |
| | 3 | Raw, | 15 8 | 19.37 | 7 | 2.77 |
| | 4 | Cooked, | 21 8 | 26.87 | 2 | 13.43 |
| End of seventeenth week..... | 1 | Raw meal, | 37 0 | 46.25 | loss, 2 | - |
| | 2 | Cooked, | 46 0 | 57.50 | 15 | 7.09 |
| | 3 | Cooked, | 30 0 | 37.50 | 11 | 3.41 |
| | 4 | Raw, | 25 0 | 31.25 | 8 | 3.91 |
| End of eighteenth week..... | 1 | Raw meal, | 26 8 | 33.12 | 20 | 4.41 |
| | 2 | Cooked, | 54 0 | 67.50 | 2 | 33.75 |
| | 3 | Cooked, | 25 0 | 31.25 | 4 | 7.81 |
| | 4 | Raw, | 30 8 | 38.12 | 5 | 7.62 |
| End of nineteenth week..... | 1 | Raw meal, | 59 0 | 73.75 | 12 | 6.14 |
| | 2 | Cooked, | 36 0 | 45. | 21 | 2.14 |
| | 3 | Cooked, | 26 8 | 33.12 | 4 | 8.28 |
| | 4 | Raw, | 38 0 | 47.50 | 8 | 5.94 |
| End of twentieth week ..... | 1 | Raw meal, | 31 0 | 38.75 | 2 | 19.37 |
| | 2 | Cooked, | 49 0 | 61.25 | loss, 4 | - |
| | 3 | Cooked, | 29 0 | 36.25 | 5 | 7.25 |
| | 4 | Raw, | 22 12 | 28.42 | 0 | 28.42 |
| End of twenty-first week..... | 1 | Raw meal, | 41 12 | 52.18 | 11 | 4.74 |
| | 2 | Cooked, | 47 8 | 59.37 | 9 | 24.12 |
| | 3 | Raw, | 28 4 | 35.31 | 5 | 7.06 |
| | 4 | Cooked, | 32 8 | 40.62 | 9 | 4.51 |
| End of twenty-second week ..... | 1 | Raw meal, | 60 0 | 75. | 8 | 9.37 |
| | 2 | Cooked, | 37 0 | 46.25 | 5 | 9.25 |
| | 3 | Raw, | 25 4 | 31.56 | 13 | 2.42 |
| | 4 | Cooked, | 31 0 | 38.75 | 6 | 6.45 |
| End of twenty-third week..... | 1 | Raw meal, | 43 8 | 54.37 | 12 | 4.53 |
| | 2 | Cooked, | 48 8 | 60.62 | 17 | 3.56 |
| | 3 | Raw, | 32 8 | 40.62 | 8 | 5.08 |
| | 4 | Cooked, | 35 8 | 44.37 | 9 | 4.93 |
| End of twenty-fourth week..... | 1 | Raw meal, | 41 4 | 51.56 | 2 | 25.78 |
| | 2 | Cooked, | 56 0 | 70. | 8 | 8.75 |
| | 3 | Raw, | 30 8 | 38.12 | 7 | 5.44 |
| | 4 | Cooked, | 41 8 | 51.87 | 5 | 10.37 |
| End of twenty-fifth week..... | 3 | Cooked, | 40 0 | 50. | 4 | 12.50 |
| | 4 | Raw, | 29 8 | 36.87 | 15 | 2.45 |
| End of twenty-sixth week..... | 3 | Cooked, | 29 0 | 36.25 | 12 | 3.02 |
| | 4 | Raw, | 16 12 | 20.94 | 2 | 10.47 |

| Period of Four Weeks. | No. of pig. | Food. | Pounds in four weeks. | Cost for four weeks. | Pounds of gain in four weeks. | Cost per pound of increase in weight. |
|---|---|---|---|---|---|---|
| First | 1 | Raw meal, | 178.5 | 233.12 | 58. | 3.84 |
| | 2 | Cooked, | 168.2 | 210.25 | 59.5 | 3.53 |
| | 3 | Cooked, | 33. | 41.25 | 4.5 | 9.16 |
| | 4 | Raw, | 48. | 60. | 18. | 3.33 |
| Second | 1 | Raw meal, | 196.75 | 245.93 | 51.5 | 4.77 |
| | 2 | Cooked, | 203.75 | 254.68 | 50. | 5.09 |
| | 3 | Raw, | 23.5 | 29.37 | 15. | 1.95 |
| | 4 | Cooked, | 61.5 | 76.87 | 10.5 | 7.32 |
| Third | 1 | Raw meal, | 227.5 | 284.37 | 57. | 4.99 |
| | 2 | Cooked, | 220. | 275. | 47.5 | 5.79 |
| | 3 | Cooked, | 53.75 | 67.18 | 8. | 8.39 |
| | 4 | Raw, | 67.75 | 83.68 | 20. | 4.18 |
| Fourth | 1 | Raw meal, | 203. | 253.75 | 43. | 5.90 |
| | 2 | Cooked, | 167.5 | 209.37 | 19.5 | 10.73 |
| | 3 | Raw, | 64.5 | 80.62 | 18. | 4.48 |
| | 4 | Cooked, | 85.75 | 107.18 | 14. | 7.65 |
| Fifth | 1 | Raw meal, | 154.' | 292.50 | 30. | 9.75 |
| | 2 | Cooked, | 185.5 | 231.87 | 34. | 6.82 |
| | 3 | Cooked, | 111. | 138.75 | 24. | 5.78 |
| | 4 | Raw, | 116.75 | 145.93 | 21. | 7.38 |
| Sixth | 1 | Raw meal, | 186.5 | 233.12 | 33. | 7.06 |
| | 2 | Cooked, | 189. | 236.25 | 39. | 6.05 |
| | 3 | Raw, | 116.5 | 145.62 | 33. | 4.41 |
| | 4 | Cooked, | 140.5 | 175.62 | 29. | 6.05 |
| Seventh (two weeks) | 3 | Cooked, | 69. | 86.25 | 16. | 5.41 |
| | 4 | Raw, | 46.75 | 58.43 | 17. | 3.44 |

Each pound of live weight produced by feeding raw meal to pig No. 1, cost 5.27 cents.
" " " " " No. 3, cost 4.87 cents.
" " " " " No. 4, cost 4.59 cents.
" " " cooked meal to pig No. 2, cost 5.68 cents.
" " " " " No. 3, cost 6.34 cents.
" " " " " No. 4, cost 6.72 cents.
Average cost per pound of live weight produced by feeding raw meal, 4.95 cents.
" " " " " cooked meal, 6.25 cents.

Comparing the cost of increase in live weight obtained by feeding raw meal to No. 1, to the cost of that obtained by feeding cooked meal to No. 2, the advantage is 7.8 per cent. in favor of raw meal. Comparing raw meal fed to No. 3, with cooked meal fed to the same pig, raw meal has a greater feeding value of 30.2 per cent. Comparing raw meal fed to No. 4, with cooked meal fed to the same pig, raw has a greater feeding value of 46.4 per cent. The aggregate results from feeding raw meal compared with the aggregate results from feeding cooked show a percentage of 27.3 in favor of raw meal. Nos. 1 and 2 were fed twenty-four

weeks, and were killed November 15th. Nos. 3 and 4 were fed twenty-six weeks, and were killed November 30th.

| Weight of pigs June 1st. | Gain in live weight. | Live weight when slaughtered. | Average weight of pigs. | Shrinkage. |
|---|---|---|---|---|
| No. 1, 108 pounds..... | 276 lbs. | 384 lbs. | 334 lbs. | 50 lbs. |
| No. 2, 96 " ..... | 249 lbs. | 345 lbs. | 298 lbs. | 47 lbs. |
| No. 3, 17½ " ..... | 118½ lbs. | 136 lbs. | 105½ lbs. | 30½ lbs. |
| No. 4, 22½ " ..... | 128½ lbs. | 151 lbs. | 114 lbs. | 37 lbs. |

*Results obtained from this experiment during nine years.*

In 1870, scalded meal fed warm was to raw meal fed cold, as..... 95.5 to 100.
1871, value of cooked meal was to the value of raw meal, as..... 74.8 to 100.
1872, " " " " ..... 82. to 100.
1873, " " " " ..... 91.6 to 100.
1874, " " " " ..... 98.8 to 100.
1875, " " " " ..... 72.3 to 100.
1876, " " " " ..... 88.8 to 100.
1877, " " " " ..... 64.2 to 100.
1878, " " " " ..... 78.5 to 100.

*Experiment in the use of manures for top-dressing grass land.*

The field in which the experimental plats are situated, is near the easterly corner of the farm. The surface is nearly level. The soil is a heavy undrained clay, of a remarkably even and unvarying character. It was last sown to grass in 1867, and has yielded a crop of hay each year since that time. The portion of the field devoted to the experiment has received no other fertilizers than those here indicated.

The experimental plats are two rods square, each one containing one-fortieth of an acre. They are staked out in two rows, four plats in a row, and are separated from each other by a strip of land four feet wide, which received no manure.

The manures were first applied May 20th, 1873. No improvement was apparent in the crop from the top-dressing that year; equal quantities of like manures were therefore applied in the same manner May 22d, 1874.

The weight of the hay gathered from those plats in 1873, the first year of the experiment, indicates that the manures had no effect to increase the crop of that year, since the plat marked "Nothing" produced as much as any of the plats, and more than some of them.

Assuming it to be true that the crop harvested in 1873 was in no way influenced by the manures, and assuming also that the natural exhaustion of the soil, and the effect of other natural causes, such as favorable or unpropitious seasons, are fairly indicated by the plat marked "Nothing," a calculation is given to show the amount of increase per acre obtained from these manures, and the cost per ton of such increase. The expense of applying the manures is included in the prices given. The value of manures applied in 1874 only is reckoned in the "Cost per ton of gain in hay." The growth on the plats this year was nearly all white-weed, and the yield very light. The land was pronounced exhausted, and was plowed up soon after haying.

| | Time of cutting. | MANURES. | Cow manure, 5 cords per acre. | Horse manure, 5 cords per acre. | Fine old muck, 5 cords per acre. | Fine old muck, 5 cords; salt, 3 bush. per acre. | Plaster, 2 bushels per acre. | Wood ashes, 5 bushels per acre. | Salt, 3 bushels per acre. | Nothing. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs |
| 1873. | July 10..... | Weight of hay..... | 63 | 71 | 83 | 73 | 51 | 81 | 87 | 87 |
| 1874. | " 29..... | " " ..... | 150 | 127 | 148 | 121 | 115 | 97 | 92 | 88 |
| 1875. | " 26..... | " " ..... | 182½ | 152 | 117 | 108 | 79 | 103 | 101 | 88 |
| 1876. | " 19..... | " " ..... | 122 | 102 | 76 | 67 | 33 | 56 | 43 | 46 |
| 1877. | " 10..... | " " ..... | 75 | 50 | 45 | 35 | 30 | 35 | 25 | 40 |
| 1878. | " 1..... | " " ..... | 38 | 21 | 22 | 20 | 13 | 16 | 10 | 9 |
| | | Value per cord or bushel of manure applied, | $5 per cord | $5 per cord | $2.50 p. cord. | $2.50 p. cd. 33⅓ p. bush. | 50 p. bush. | 25 p. bush. | 33⅓ p. bush. | |
| | | Cost per ton of gain in hay..... | 4 59 | 7 88 | 4 70 | 10 23 | no value. | 2 08 | no value. | |

*Experiment in cutting grass at different times.*

A series of experiments was commenced last year, to ascertain the effect, if any, that cutting grass at different times, as early or late in the season, has upon the quality and quantity of the crop. The experiments will be continued on these plats until the hay producing power of the land is reduced to a low degree, in order that the effect of cutting the grass at different times in the haying season shall be made quite evident.

The plats are located in field No. 1, which lies along the town road next to the southerly line of the farm. The land was manured and cultivated with field crops in 1874–5, and sown to grass in the latter year. The catch of grass from this sowing was not good, and grass seed was again sown on the land in April, 1876. This gave a good sod as the yield of the plat shows. An area of one acre, eight by twenty rods, is divided in the direction of its greatest length into eight plats, each one containing one-eighth of an acre. These plats are marked in two equal divisions, each division contains four plats. In the treatment of the experiment, two plats, one from each division, will be cut at the same time; that by obtaining results in each condition of the experiment from plats somewhat separated from each other, we may counteract, in part, the errors arising from natural inequality of soil and fertility.

One year ago the plats were all mowed, dried and weighed at the same date. This gave the natural yield of each plat as a basis for further conclusions. The results of both years are given below, those of 1876 being first.

| No. of division. | Description of plat. | Weight of green crop. | Weight of hay. | Per cent. of loss in drying. |
|---|---|---|---|---|
| I | a, I, | 1,377 lbs. | 551 lbs. | 59.98 |
| | b, I, | 1,215 " | 554 " | 54.43 |
| | c, I, | 1,384 " | 502 " | 63.74 |
| | d, I, | 1,256 " | 498 " | 60.35 |
| II | a, II, | 1,263 " | 476 " | 62.44 |
| | b, II, | 1,173 " | 465 " | 60.35 |
| | c, II, | 1,154 " | 479 " | 58.49 |
| | d, II, | 1,136 " | 508 " | 55.29 |
| Total | ..... | 9,958 lbs. | 4,033 lbs. | |

Average weight of green crop, 1244.78 lbs.
" " dry crop, 504.125 lbs.
" per cent. of loss in drying, 59.44

Plat b, I, had become partly dry before it could be weighed. Plats c, II, and d, II, contained more herds-grass and less clover than other plats.

*Results obtained this year*, (1877).

| No. of divsion. | Description of plats. | Time of cutting. | Weight of green crop. | Weight of hay. | Per cent. of loss in drying. |
|---|---|---|---|---|---|
| I..... | d, | June 19... | 1,154 lbs. | 468 lbs. | 59.44 |
| II..... | d, | " 19... | 1,258 " | 465 " | 63.03 |
| I..... | c, | July 2... | 1,436 " | 527 " | 63.30 |
| II..... | c, | " 2... | 1,440 " | 475 " | 67.01 |
| I..... | b, | " 19... | 1,247 " | 696 " | 44.17 |
| II..... | b, | " 19... | 1,130 " | 518 " | 54.11 |
| I..... | a, | August 3.. | 1,005 " | 566 " | 43.68 |
| II..... | a, | " 3.. | 692 " | 362 " | 47.69 |
| | | | 9,362 lbs. | 4,078 lbs. | |

Average weight of green crop, 1170.25 lbs.
" " dry crop, 509.75 lbs.
" per cent. of loss in drying, 55.30

At the time of the first cutting, June 19, the Timothy was just beginning to head, and the clover was showing its earliest blossoms.

July 2, the heads of Timothy were fully formed, a few were in blossom, and the clover was in full bloom.

July 19, the seeds of Timothy were beginning to harden, and the clover heads were brown and ripe.

August 3, the Timothy seeds were shelling out; the clover was over-ripe, with many leaves fallen off.

The quality of hay from the different cuttings may be judged with some accuracy from its appearance, but the exact knowledge needful to make the experiment complete can only be obtained by chemical analysis of the samples. A reliable analysis requires more time and money than are yet placed at the disposal of the Professor of Chemistry, who is ready to do the work whenever these are granted him.

*Experiment in the culture of sugar beets.*

The efforts that are made to establish the manufacture of beet sugar as a permanent industry in our State, authorized some experiments relating to the cultivation of the sugar beet. One, designed to test several points of practical importance in the growing of these beets, has been carried on this season. In this experiment we ask three questions:

1st. Is the relative size of beet seeds indicative of their vitality and germinating power?

2d. Under similar cultivation, which variety is the most productive?

3d. Which variety contains the highest per cent. of sugar?

The beets were sown in a part of the farm garden, on a rich sandy loam, to which no manure was applied this year. Each variety was sown on a plat ten feet square, in rows eight inches apart, with the plants fourteen inches distant from each other. Each plat was divided in the center, and one-half of it sown with small seeds selected from an average lot; the other half with large seeds selected from the same lot. Two seeds were planted in every place where a beet plant was wanted. The weight of the seeds required for each plat was found and recorded for reference.

The greater number of vacant places occurred where the small seeds were used. The missing plants in each plat were supplied by transplanting from the same plat. The plats received the cultivation needful to keep them free from weeds. The crop was harvested and weighed October 15th. A few beets, selected from each plat, were packed in sand to preserve them for analysis.

| Beets from Large Seeds. | Weight of 144 large seeds. | Vacancies. | Yield per acre in pounds. | Specific gravity of juices. | Per cent. of sugar. |
|---|---|---|---|---|---|
| Carter's Prize Nursery | 5.979 grammes | 31 | 40,066 | 1.048 | 7.9 |
| Imperial Sugar | 6.241 " | 38 | 57,486 | 1.059 | 9.5 |
| White Silesian | 6.198 " | 23 | 70,115 | 1.047 | 8.7 |
| Vilmorin's Sugar | 5.788 " | 20 | 49,211 | 1.061 | 12.1 |
| * Seed from W. C. Sawyer, Portland | 6.048 " | 27 | 72,293 | 1.050 | 9.5 |

* The seeds furnished farmers who grew beets for the manufacture of sugar.

| Beets from Small Seeds. | Weight of 144 small seeds. | Vacancies. | Yield per acre in pounds. | Specific gravity of juice. | Per cent. of sugar. |
|---|---|---|---|---|---|
| Carter's Prize Nursery | 2.309 grammes | 45 | 47,905 | 1.051 | 8.0 |
| Imperial Sugar | 2.219 " | 39 | 52,260 | 1.055 | 9.0 |
| White Silesian | 1.660 " | 40 | 58,357 | 1.055 | – |
| Vilmorin's Sugar | 1.946 " | 27 | 48,340 | 1.064 | 12.7 |
| *Seed from W. C. Sawyer, Portland | 1.952 " | 45 | 58,892 | 1.047 | – |

It is a matter of surprise that so many of the seeds failed to germinate. The test would have been more satisfactory if one seed instead of two seeds had been sown in each place where a plant was desired; as it was, with two seeds to insure each plant, from one-fourth to one-half of the places were vacant. It is gratifying to notice the high per cent. of sugar and large yield of roots from seeds furnished the farmers who grew beets for the manufacture of sugar.

The specific gravity of the juice of the beets and the per cent. of sugar, were given me by Prof. A. B. Aubert, to whose report of the analysis I would refer for further information.

*Experiment in planting potatoes.*

The following experiment in planting potatoes has been continued since 1873. It was originated in connection with the Scientific Society of the Maine State College, in the expectation that the different methods would be tested by students on the college farm, and by farmers in other parts of the State; so that by comparison of results in different conditions and localities, definite conclusions may be reached, which shall be of real value to those seeking the best methods of planting potatoes.

The potatoes used for seed are classed as follows: Large, those weighing seven to eight ounces; medium, those weighing three to four ounces; small, those weighing one to two ounces.

* The seeds furnished farmers who grew beets for the manufacture of sugar.

Where not otherwise stated, large potatoes are cut into four pieces; medium potatoes are cut into two pieces; and one piece dropped in a hill. In each experiment ten hills are planted in rows three feet apart, and with the exception of No. 4, the distance between the hills is eighteen inches. This gives 1-968 of an acre to each condition of the experiment, except No. 4.

The experiment was this year conducted on the college farm by G. H. Wilson, class of 1881. The results he reports were obtained from clay loam soil that was broken from grass three weeks before the potatoes were planted, May 25. The field has been mown five years, and was in fair condition, yielding one ton of hay to the acre. Manure from the cow stable was spread on the furrows at the rate of five cords to the acre, and worked into the soil with Randall's Harrow. The potatoes were dug September 14.

The average results from ten trials of the experiments are given in the last column of the following table. Four of these trials were made by G. O. Weston, a graduate of the State College, on his farm in Norridgewock; five of them were conducted by students on the college farm.

| No. Exprm't. | Potatoes. | CONDITION OF EXPERIMENTS. | Large lbs. | Small lbs. | Total lbs. | Average for ten trials. |
|---|---|---|---|---|---|---|
| 1 | Seed end. | Potatoes divided through the centre and the product of the seed end and the butt end compared. | 12 | 3 | 15 | 173-10 |
| | Butt end. | | 12 | 3 | 15 | 184-10 |
| 2 | Large potatoes. | Large, medium and small potatoes compared; the seed planted each year to be the product of potatoes of a like class. | 14½ | 1 | 15½ | 17¾ |
| | Medium " | | 10 | 2½ | 12½ | 17 |
| | Small " | | 11¾ | 1½ | 13¼ | 11⅝ |
| 3 | Large potatoes. | Large, medium and small potatoes compared; the seed to be selected from an ordinary pile of potatoes. | 10 | 2½ | 12½ | 15½ |
| | Medium " | | 8½ | 2 | 10½ | 15 1-5 |
| | Small " | | 8½ | 2¼ | 11¼ | 16 |
| 4 | 6 inches. | The product of large potatoes compared, when planted six, twelve, eighteen and twenty-four inches apart. | 10¼ | 6 | 16¼ | 14¾ |
| | 12 " | | 10¼ | 2½ | 12¾ | 14¾ |
| | 18 " | | 9¼ | 1¼ | 10½ | 15 2-10 |
| | 24 " | | 6½ | 2 | 8½ | 16 2-10 |
| 5 | Large potatoes. | Equal weight, per acre, of large, medium and small potatoes, planted at equal distances. | 9¾ | 2½ | 12¼ | 19½ |
| | Medium " | | 9 | 2¼ | 11¼ | 173-10 |
| | Small " | | 7¾ | 2 | 9¾ | 16½ |

| No. Exprm't. | Potatoes. | CONDITION OF EXPERIMENTS. | Large lbs. | Small lbs. | Total lbs. | Average for ten trials. |
|---|---|---|---|---|---|---|
| 6 | 2 inches. | Seed planted on the surface and covered to the depth of 2, 4, 6 and 8 inches. | 7¼ | 1¾ | 9 | 15 2-8 |
| | 4 " | | 8 | 3 | 11 | 19 |
| | 6 " | | 7 | 1½ | 8½ | 14 |
| | 8 " | | 11¼ | 1¼ | 12½ | 16½ |
| 7 | 2 inches. | Seed planted below the surface 2, 4, 6 and 8 inches, and covered to the same depth. | 7 | 2½ | 9½ | 14¾ |
| | 4 " | | 11 | 1¾ | 12¾ | 15⅜ |
| | 6 " | | 8 | 1¼ | 9¼ | 12 1-5 |
| | 8 " | | 7½ | 3 | 10½ | 13 |
| 8 | One piece. | Medium potatoes cut to two parts and the product of one part in a hill, compared with two parts in a hill. | 8 | 2¼ | 10¼ | 15¾ |
| | Two pieces. | | 8 | 4½ | 12½ | 17¼ |
| 9 | Whole potatoes. | Medium, potatoes planted whole, compared with the same cut to two eyes, and one piece planted in each hill. | 15 | 3 | 18 | 16 |
| | Cut to two eyes. | | 8 | 1 | 9 | 15 1-5 |
| 10 | Flat hills. | The amount of potatoes produced by planting in flat hills, compared with the amount produced from pointed hills. | 10¼ | 2 | 12¼ | 15 |
| | Pointed hills. | | 9½ | 2 | 11½ | 18¼ |
| 11 | Small hills. | The product of potatoes planted in small hills, compared with the product of potatoes planted in large hills. | 11¼ | 2 | 13¼ | 15⅞ |
| | Large hills. | | 7¾ | 2 | 9¾ | 16⅜ |
| 12 | One piece. | Large potatoes cut to two pieces, the product of one piece in a hill compared with two pieces in a hill. | 8 | 5 | 13 | 19 |
| | Two pieces. | | 11¼ | 5¼ | 16½ | 18¾ |
| 13 | Two stalks. | An equal number or eyes planted in each hill, and an equal number of stalks allowed to grow. | 10¾ | ½ | 11¼ | 15½ |
| | Four stalks. | | 6¼ | 1½ | 7¾ | 14 |
| | Six stalks. | | 5 | 3¾ | 8¾ | 18⅞ |
| 14 | 2 inches. | Seed planted at the ordinary depth, and covered to the depth of 2, 4, 6 and 8 inches. | 7½ | 2¼ | 9¾ | 14 1-5 |
| | 4 " | | 7½ | 3 | 10½ | 16 |
| | 6 " | | 4½ | 3½ | 8 | 17¾ |
| | 8 " | | 7¼ | 3 | 10¼ | 16⅓ |

The figures in the column of averages do not represent chance results; they are obtained from ten trials of the experiment, and are therefore worthy of confidence. They are of practical importance to the farmer, since they fairly indicate what may be expected from the different methods of planting potatoes. The yield per acre may be obtained by multiplying any given result by 968, the fractional part of an acre contained in each plat. The only exception to this rule occurs in No. 4, where the plats are greater or smaller than the rule, as the distance between the hills is more or less than eighteen inches.

*Experiment to ascertain what elements of plant food are wanting in the soil.*

These experiments were proposed by Prof. W. O. Atwater, Director of the Connecticut Agricultural Experiment Station, in his report for January, 1877. Their design is thus explained in that report:

"One of the main results of the vast amount of work done in field experiments with fertilizers, is the clear demonstration that soils vary greatly in their capabilities of supplying food to crops; that different ingredients are deficient in different soils, and that the results of any given experiment are, in the main, applicable only to the particular soil on which it is made. The chief object of commercial fertilizers is to supply the plant food which the plant needs and the soil fails to supply. To use them economically then, we must know what materials are deficient in the soil where they are to be applied. The most sensible method for determining what are the deficiencies of soils and how they will be most economically supplied to given crops, is to put the question to the soil with different fertilizing material, and obtain its reply in the crops produced."

The experiments were tried last year on old pasture land. Striking results were obtained, but before basing any instruction on them we wished to do more. A single experiment is of some value; it indicates what may be expected from a like trial made under similar circumstances, but it *proves* nothing. What at first appears to be a fact, other tests may show to be no fact at all, only a chance result. Trustworthy rules of practice can only be obtained from the average results of repeated trials.

This year the experiments were made in a field near the easterly corner of the farm, that had been in mowing since 1867; soil, a heavy undrained clay, naturally fertile, but reduced to low condition by continued cropping. A swell running across the center of the plats gives inclination sufficient for surface drainage. The ground was broken up May

25–30. After plowing, the land was divided into plats 35 rods and 3 feet long, by 7½ feet wide, equal to one-tenth of an acre. Each plat was divided lengthwise into three equal parts, designated as sections A, B, C. Section A of each plat was planted to corn; B, to yellow-eyed beans; C, to ruta-bagas. Each section was one-thirtieth of an acre. The first plat was dressed with old manure from the cow stable, spread on the furrows at the rate of ten cords to the acre, and harrowed in. The mineral fertilizers were sown on the line of the rows previously marked, and worked into the soil. The planting was done the first week in June. The appearance of crops on different plats through the growing season is fairly indicated by the amount of yield. The character and condition of the soil were against an abundant crop. Except on plat one, the amount of fertilizer was not sufficient to give large returns.

The following table shows the fertilizing materials, their value and the order in which they were applied:

1st column, number of plat.
2d " kind of fertilizer or mixture.
3d " amount per plat of one-tenth acre.
4th " valuable ingredients furnished by each.
5th " per cent. of nitrogen, phosphoric acid and potash in each.
6th " cost of fertilizer applied to each one-tenth acre.

| No. of plat. | FERTILIZING MATERIALS. | | | Cost per bag. |
|---|---|---|---|---|
| | Kind. | Amount. | Valuable ingred's per 100 lbs. | |
| 1 | Stable manure | 1 cord. | | $4 00 per cd. |
| 2 | Nitrate of soda | 20 lbs. | Nitrogen, 15 per cent | 1 00 |
| 3 | Dissolved bone-black | 30 " | Phosphoric acid, 15 per cent. | 70 |
| 4 | Muriate of potash | 20 " | Potash, 50 per cent. | 60 |
| 5 | Nitrate of soda | 15 " | Nitrogen, 6.42 per cent. | 1 30 |
| | Muriate of potash | 20 " | Potash, 28.57 per cent. | |
| 7 | Nitrate of soda | 15 " | Nitrogen, 5 per cent | 1 40 |
| | Dissolved bone-black | 30 " | Phosphoric acid, 10 per cent. | |
| 8 | Dissolved bone-black | 30 " | Phosphoric acid, 9 per cent | 1 25 |
| | Muriate of potash | 20 " | Potash, 20 per cent. | |
| 9 | Nitrate of soda | 15 " | Nitrogen, 3.46 per cent | 1 90 |
| | Dissolved bone-black | 30 " | Phosphoric acid, 6.92 per cent | |
| | Muriate of potash | 20 " | Potash, 15.38 per cent. | |
| 10 | Plaster | 20 " | | 15 |

Section A, comprising in each plat one-thirtieth of an acre and planted to corn, yielded as given in the table below:

1st column, yield in weight of good corn.
2d " " " unsound corn.
3d " " " stalk.
4th " total weight of good corn.
5th " increase of good corn per acre.
6th " increase of stalks per acre.
7th " value of increase of good corn.
8th " value of increase of stalks.
9th " total value of increase per acre.
10th " cost of manure per acre.

In this table the cost of applying the chemical manures is reckoned at $2 per acre. Cost of applying stable manure is included in the price.

Two bushels of ears well dried, weighing 40 pounds each, are estimated to furnish one bushel of corn worth 62½ cents. The stalks are valued at $5 per ton.

| No. of plat. | FERTILIZERS. | Yield in Weight. | | | Total weight of corn. | Increase of good corn per acre. | Increase of stalks per acre. | Value of increase of good corn. | Value of increase of stalks. | Total value of increase. | Cost of manures. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Good corn. | Unsound corn. | Stalks. | | | | | | | |
| | | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | | | | |
| 1 | Stable manure..... | 123 | 12 | 155 | 135 | 68 | 72 | $22 44 | $5 40 | $27 84 | $50 00 |
| 2 | Nitrogen ..... | 78 | 11 | 95 | 89 | 23 | 12 | 7 59 | 90 | 8 49 | 12 00 |
| 3 | Phosphoric acid..... | 63 | 21 | 105 | 84 | 8 | 22 | 2 64 | 1 65 | 4 29 | 9 00 |
| 4 | Potash..... | 112 | 14 | 126 | 126 | 57 | 43 | 18 81 | 3 22 | 22 03 | 8 00 |
| 5 | Nitrogen ..... Potash..... | 119 | 19 | 145 | 138 | 64 | 62 | 21 12 | 4 65 | 25 77 | 15 00 |
| 6 | Nothing..... | 55 | 22 | 83 | 77 | | | | | | |
| 7 | Nitrogen . ..... Phosphoric acid .... | 107 | 17 | 124 | 124 | 52 | 41 | 17 16 | 3 07 | 20 23 | 16 00 |
| 8 | Phosphoric acid .... Potash..... | 75 | 10 | 95 | 85 | 20 | 12 | 6 60 | 90 | 7 50 | 14 50 |
| 9 | Nitrogen ..... Phosphoric acid .... Potash..... | 105 | 11 | 129 | 116 | 50 | 46 | 16 50 | 3 45 | 19 95 | 21 00 |
| 10 | Plaster..... | 64 | 16 | 98 | 80 | 9 | 15 | 2 97 | 1 12 | 4 09 | 3 50 |

Section B of each plat was planted to yellow-eyed beans. In the table beans are valued at $1.86 per bushel—3 cents a

pound; vines, $5 per ton—¼ of a cent a pound. Results are given in the following order:

1st column, kind of fertilizer.
2d " yield in weight of beans over unmanured plat.
3d " yield in weight of vines over unmanured plat.
4th " gain in yield of beans.
5th " gain in yield of vines.
6th " market value of increased product per acre.
7th " cost of manure per acre.

| No. of plat. | FERTILIZERS. | YIELD IN WEIGHT. | | GAIN IN YIELD. | | Market value of increased product per acre. | Cost of manure per acre. |
|---|---|---|---|---|---|---|---|
| | | Beans. | Vines. | Beans. | Vines. | | |
| 1 | Stable manure | 27 lbs. | 15.5 lbs. | 9 lbs. | 4 lbs. | $8 40 | $50 00 |
| 2 | Nitrogen | 22 " | 14 " | 4 " | 2.5 " | 5 47 | 12 00 |
| 3 | Phosphoric acid | 21 " | 11.5 " | 3 " | 0 " | 2 70 | 9 00 |
| 4 | Potash | 25.5 " | 15 " | 7.5 " | 3.5 " | 7 01 | 8 00 |
| 5 | Nitrogen<br>Potash | 33 " | 16.5 " | 15 " | 5 " | 13 65 | 15 00 |
| 6 | Nothing | 18 " | 11.5 " | - | - | - | - |
| 7 | Nitrogen<br>Phosphoric acid | 23 " | 14 " | 5 " | 2.5 " | 4 68 | 16 00 |
| 8 | Phosphoric acid<br>Potash | 20 " | 11 " | 2 " | loss, 5 " | 1 76 | 14 50 |
| 9 | Nitrogen<br>Phosphoric acid<br>Potash | 25 " | 15 " | 7 " | 3.5 " | 6 56 | 21 00 |
| 10 | Plaster | 18 " | 12 " | 0 " | 5 " | loss, 04 | 3 50 |

In each plat section C was sown to ruta-bagas. They were pulled October 14–15, left in piles a few days, then carefully weighed. The ruta-bagas are reckoned at 25 cents per bushel of 60 pounds. Results are given in the following order:

1st column, kind of fertilizer.
2d " yield in bushels.
3d " yield in weight.
4th " gain in yield over unmanured plats.
5th " market value of increased product per acre.
6th " cost of manure per acre.

| No. of plat. | FERTILIZERS. | Yield in bushels. | Yield in weight. | Gain in yield over unmanured plats. | Market value of increased product per acre. | Cost of manure per acre. |
|---|---|---|---|---|---|---|
| 1 | Stable manure | 10 bush. | 603 lbs. | 157 lbs. | $19 62 | $50 00 |
| 2 | Nitrogen | 9.5 " | 569 " | 123 " | 15 37 | 12 00 |
| 3 | Phosphoric acid | 10.5 " | 636 " | 190 " | 23 75 | 9 00 |
| 4 | Potash | 8 " | 471 " | 25 " | 3 12 | 8 00 |
| 5 | Nitrogen<br>Potash | 6.75 " | 405 " | loss, 41 " | loss, 5 12 | 15 00 |
| 6 | Nothing | 7.5 " | 446 " | - | - | - |
| 7 | Nitrogen<br>Phosphoric acid | 14.25 " | 857 " | 411 " | 51 37 | 16 00 |
| 8 | Phosphoric acid<br>Potash | 13.75 " | 833 " | 387 " | 48 37 | 14 50 |
| 9 | Nitrogen<br>Phosphoric acid<br>Potash | 17.25 " | 1,035 " | 589 " | 73 62 | 21 00 |
| 10 | Plaster | 8.75 " | 526 " | 80 " | 10 00 | 3 50 |

There are points worthy of note in the results of these experiments, some of which are,

1st. With turnips, the crop with phosphoric acid is good, and without, it fails every time. It is more profitable to mix phosphoric acid with either potash or nitrogen than to use it alone. Phosphoric acid with nitrogen does a little better than phosphoric acid with potash, but not enough better to pay the greater cost of nitrogen. The complete fertilizer is more profitable than any other.

2d. With beans, potash has much greater influence. In no case does the fertilizer give a profitable return. In every case but one, omitting the potash increases the loss. The loss is greatest with stable manure.

3d. With corn the case is similar. Taking Nos. 2–4, where the ingredients are used singly, potash is very profitable; nitrogen and phosphoric acid give a loss. Where two ingredients are used together, potash with nitrogen does best of all. Still, there are discrepancies in these results which would destroy the value of the experiment, were it not for duplicate tests in the corn experiment on page 53, where the potash has a more marked advantage. Just here can be seen the great importance of duplicating trials. With one experiment the answer would be uncertain; with two trials the testimony is more reliable; when the trials have been repeated many times their teachings may be accepted as a safe rule for practice.

*Experiment for studying the capacity of corn to get its food from the soil, and the effects of different fertilizers upon it, with special reference to the nitrogen supply.*

Potash and phosphoric acid (with sulphuric acid and lime) supplied in proportions contained in a crop of 48–50 bushels; nitrogen in one-third, two-thirds, and full amount contained in same crop.

| | Plat, No. | FERTILIZERS PER ACRE. | Nitrogen per acre. | YIELD IN WEIGHT. Good corn. | Unsound corn. | Stalks. | Total wgh't of corn. | Increase of good corn per acre. | Increase of stalks per acre. | Value of increase of good corn. | Value of increase of stalks. | Total value of increase. | Cost of manure. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Group A. Valuable ingredients separately. | 1 | Nitrate of Soda, 150 lbs | 24 lbs. | 96 | 79 | 298 | 175 | 470 | 510 | $5 17 | $1 27 | $3 90 | $5 62½ |
| | 2 | Sulphate of Ammonia, 112 lbs | 24 lbs. | 110 | 64 | 275 | 174 | 330 | 280 | 3 60 | 70 | 2 90 | 5 04 |
| | 3 | Dried Blood, 225 lbs | 24 lbs. | 99 | 67 | 294 | 166 | 440 | 440 | 4 84 | 1 10 | 3 74 | 5 06 |
| | 0 | No Manure | – | 127 | 31 | 221 | 158 | | | | | | |
| | 4 | Superphospate, 300 lbs., (Phos. Acid, 48 lbs) | – | 190 | 28 | 318 | 218 | 470 | 710 | 5 17 | 1 77 | 6 94 | 5 25 |
| | 5 | Muriate of Potash, 150 lbs., (Potash, 75 lbs.) | – | 214 | 33 | 308 | 247 | 710 | 610 | 7 81 | 1 52 | 9 33 | 3 37½ |
| Group B. Valuable ingredients two by two. | 6 | Nitrate of Soda, 150 lbs. + Superphosphate, 300 lbs. | 24 lbs. – | 239 | 40 | 290 | 279 | 960 | 430 | 10 56 | 1 07 | 11 63 | 10 87½ |
| | 7 | Nitrate of Soda, 150 lbs. + Muriate of Potash, 150 lbs. | 24 lbs. – | 284 | 33 | 372 | 317 | 1410 | 1250 | 15 50 | 3 12 | 18 62 | 10 00 |
| | 8 | Superphosphate, 300 lbs., + Muriate of Potash, 150 lbs. = Mixed Mineral Fertilizers | – | 256 | 34 | 322 | 290 | 1130 | 850 | 12 40 | 2 12 | 14 52 | 3 62½ |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 00 | No Manure | – | 158 | 40 | 273 | 198 | | | | | | |
| Group C. Complete Fertilizers. Nitrogen in different proportions and combinations. | 9 | Mixed Mineral Fertilizers,* (as No. 8,) Nitrate of Soda, 150 lbs | 24 lbs. | 265 | 27 | 330 | 392 | 1220 | 830 | 13 42 | 2 07 | 15 49 | 14 25 |
| | 10 | Mixed Mineral Fertilizers, Nitrate of Soda, 300 lbs | 48 lbs. | 295 | 24 | 321 | 319 | 1520 | 740 | 16 72 | 1 85 | 18 57 | 19 87½ |
| | 11 | Mixed Mineral Fertilizers, Nitrate of Soda, 450 lbs | 72 lbs. | 356 | 24 | 469 | 380 | 2130 | 2220 | 23 43 | 5 55 | 28 98 | 25 50 |
| | 12 | Mixed Mineral Fertilizers, Nitrogen Mixture,† 150 lbs | 24 lbs. | 323 | 32 | 465 | 355 | 1800 | 2180 | 19 80 | 5 45 | 25 25 | 13 87½ |
| | 13 | Mixed Mineral Fertilizers, Nitrogen Mixture, 300 lbs | 48 lbs. | 301 | 35 | 409 | 336 | 1580 | 1520 | 17 38 | 3 80 | 21 18 | 19 12½ |
| | 14 | Mixed Mineral Fertilizers, Nitrogen Mixture, 450 lbs | 72 lbs. | 273 | 30 | 388 | 303 | 1300 | 1410 | 14 30 | 3 52 | 17 82 | 24 47½ |
| Group D. Complete Fertilizers. Nitrogen in different combinations. | 15 | Mixed Mineral Fertilizers, Sulphate of Ammonia, 225 lbs | 48 lbs. | 234 | 34 | 369 | 268 | 910 | 1220 | 10 11 | 3 05 | 13 16 | 18 75 |
| | 16 | Mixed Mineral Fertilizers, Dried Blood, 450 lbs | 48 lbs. | 302 | 17 | 360 | 319 | 1590 | 1230 | 17 49 | 3 07 | 20 56 | 18 75 |
| | 17 | Peruvian Guano, "standard," 550 lbs .... Muriate of Potash, 150 lbs | 48 lbs. – | 328 | 18 | 392 | 346 | 1850 | 1450 | 20 35 | 3 62 | 23 97 | 19 32½ |
| | 18 | Stable Manure, good quality, well cured, 15,000 lbs | 72 lbs. | 234 | 19 | 459 | 253 | 910 | 2120 | 10 01 | 5 30 | 15 31 | 40 00 |

* It will be remembered that superphosphates (in this case from bone-black) contain phosphoric acid, sulphuric acid and lime. This mixture will, therefore, furnish all the mineral ingredients of plant-food that are commonly deficient in soils.

† Nitrate of soda, sulphate of ammonia, and dried blood, in equal parts, and containing sixteen per cent. nitrogen.

This trial was made on a part of the field with experiment just described, which see for dimensions of plats, manure and time of planting, kind of soil, condition and previous treatment. The corn was cut up before frost; remained in stalk until dry and hard; husked and weighed Oct. 15 to Nov. 9.

In group A, where the ingredients are used singly, nitrogen is a decided failure; phosphoric acid gives a small return, but not large enough to pay the cost of applying it; potash yields a profitable return.

In group B, the ingredients used two by two, show again the superior value of potash for this soil.

Group C, Nos. 9–11, tests the effect of the mineral ingredients of a complete fertilizer with nitrogen, in the form of nitrate of soda, added in different proportions. Nos. 12–14, the varying proportions of nitrogen are mixed with the mineral ingredients in different forms and combinations. The two series, Nos. 9–11 and Nos. 12–14, do not accord very well, but averaging the results they are conclusive that the extra nitrogen does not pay.

In group D stable manure appears, as it did in the preceding experiment, to be a pecuniary loss. It must be borne in mind, however, it is a lasting manure, and will be efficient in the soil after the commercial fertilizers have ceased to act.

Our experiments with fertilizers last year and this, illustrate several facts.

1st. Chemical manures may sometimes be used with great profit. See potatoes last year, ruta-bagas last year and this year.

2d. They may also be used with great loss. See beans last year and this; also nitrate of soda on corn this year.

3d. Good fertilizers often fail because they do not fit the case. See corn experiment No. 6, which lacks the potash.

4th. The proportions of a mixture are important. Compare average of one-third nitrogen ration, Nos. 9 and 12, with one nitrogen ration, Nos. 11 and 14.

5th. Farmers cannot afford to use commercial fertilizers at random, and it is time they understood it and knew the reason

why. Nor can they always afford to manure with a complete fertilizer, although it is sometimes profitable. It is better to let the crop get what it can from the soil, and buy only what it cannot get.

6th. What fertilizers are best for the different farm crops can be learned by experiment. It will be slow work, results of such vast importance are not got in a day or in a year, but they can be had for the working.

The grand problem for Maine farming is to get manure. The first duty is to make and economize all that is possible on the farm. The next, to get from outside what is necessary and profitable to help out the scanty home supply. That commercial fertilizers may be made of immense advantage to Maine farmers is certain, but to get the best profit they must be such as will make up the deficiencies of the soil and supply the needs of the crop. There are different theories about them—we want to learn the facts. This we are doing by experiment. Other State colleges, together with some enterprising farmers, are working in the same direction. Our object is by hearty, vigorous co-operation, to help on the work. It may take years to reach the desired result, but every dollar now invested will hereafter bring ample returns.

I herewith submit a report of the farm from December 1, 1877, to March 30, 1878, when my connection with it ceased.

*Farm receipts and expenditures for each month from December* 1, 1877, *to March* 30, 1878.

| Year. | Month. | Receipts. | Expenditures. | Excess of Receipts. | Excess of Expenditures. |
|---|---|---|---|---|---|
| 1877, | Dec., | $204 48 | $289 10 | – | $84 62 |
| 1878, | Jan., | 171 47 | 278 50 | – | 107 03 |
| " | Feb., | 317 78 | 195 67 | $122 11 | – |
| " | March, | 484 45 | 287 74 | 196 71 | – |
| | | $1,178 18 | $1,051 01 | $318 82 | $191 65 |

Excess of receipts over expenditures, $127.17.

Paid for building brick wall to separate furnace in house cellar from potato cellar..... $25 00
Paid for house furnishing and improvements ..... 30 60

These may properly be classed as permanent improvements, and added to farm credits. Sixty dollars and forty-two cents of the above expenditures were for cutting wood. The other expenditures were for labor, feed for stock, provisions for family, blacksmith and harness work, and sundries in about the same proportion as reported last year.

*Turned over to T. G. Rich, Farm Superintendent.*

Farm credits payable within eight months, $278.16; 100 cords wood at brick-yard, 15 cords at farm-house; 25 cords hemlock bark yarded in field; 1,500 feet pine logs at river landing; 25,000 feet hemlock logs, half at river landing, half yarded in pasture; 2,000 feet fence boards; 200 bushels large potatoes, 100 bushels small potatoes; 21 bushels seed wheat; 24 bushels seed barley, 35 bushels damaged barley; 18 bushels corn in the ear; 108 bushels beets for stock; 5 bushels corn meal; 2½ tons straw; hay sufficient to winter stock; several bushels beans, peas, millet, a variety of grass seeds and garden seeds; full supply of ice stored in cellar.

Thirty-one head neat cattle, 22 of which were thoroughbred stock. These were, with one exception, either the animals purchased by the trustees in 1874, or the descendants of these animals. They are classed as follows: 6 Shorthorns, 8 Ayrshires, 8 Jerseys—and 9 grades of these breeds. From the natural increase of thoroughbreds the herd may, in a few years, be altogether pure bloods.

Other stock, 5 horses, 43 sheep, 30 lambs, 2 boars, 4 breeding sows, 9 pigs and 6 Yorkshire shotes.

The farm tools and equipments were those enumerated in my last report. Part of these were on the farm when I took charge of it in 1871. Valuable additions were made by liberal friends of the college, the rest were bought at a cost of $700.00.

I have also the pleasure of turning to my successor a farm-house new, convenient, and well supplied in its working department with furniture, utensils and ware for the dairy, kitchen and dining-room; its larders furnished with provisions, and the sleeping-rooms for hired help provided with bedding and furniture. Except the bedding for hired help, these all have been procured at the expense of the farm. The house and barn thus supplied present a pleasing contrast to the old and empty buildings I entered in April, 1871. Two tons of hay and 100 bushels of potatoes then comprised the supplies on hand. There were on the farm 26 head of cattle, only two of which were thoroughbred, 4 horses and 40 sheep, and the keeping of these until summer was at a cost of more than $400.00.

Among the more noticeable improvements made at the expense of the farm since 1871, may be mentioned the repairs and improvements on the old farm buildings, at a cost of $1,000; the increase in the yearly production of hay from forty tons to one hundred tons; the bringing into tillage or mowing of twenty-six acres of pasture land, eleven of which had never been plowed before; the clearing and sowing to grass of ten acres of heavy forest growth; the cutting and clearing from bushes and wood of twenty-five acres more to increase area of pasturage; the building of more than a mile of substantial fence and the thoroughly repairing of an equal amount.

Improvements have also been made by ditching and plowing swales, filling and draining pond-holes, and clearing hard and neglected places that apparently had been left because they were difficult to clear and would not return the money expended in the work. There is opportunity to do more work of the same kind before the farm becomes what it should be made, a model farm and an agricultural experiment station.

Respectfully submitted,

J. R. FARRINGTON.

## FARM SUPERINTENDENT'S REPORT.

PRINCIPAL FARM CROPS.

| | | |
|---|---|---|
| Hay, | 80 acres, | 90 tons. |
| Potatoes, | 8 " | 640 bushels. |
| Beets for stock, | 1⅛ " | 1,060 " |
| Sugar beets, | ⅛ " | 100 " |
| Corn, | 1 " | 60 " |
| Sweet corn, | 2 " | 50 " |
| Barley, | 11 " | 192 " |
| Rye, | 6 " | 72 " |
| Wheat, | 4½ " | 66 " |
| Beans, planted with corn, | | 17½ " |
| Onions, | 10 rods, | 26 " |
| Turnips, | | 20 " |
| Table beets, | | 20 " |
| Squash, | | 2,000 lbs. |
| Garden vegetables, | | Excellent crop. |

Three acres of the potatoes were of the Granite State variety, planted the first week in June, on green sward dressed with barn manure, harrowed in with Randall's harrow. There would have been an excellent crop if it had not been for the early rust in August. The remaining five acres were Early Rose and Orono, planted the same as the former, but owing to the warm and wet weather rotted badly.

The wheat was sown on ground planted to potatoes and turnips last year. The ground being wet it was not sown until late. Early wheat in this vicinity has given better returns this year.

The barley was sown on ground where barley grew last year, but owing to the non catch of grass was again sown this year. The ground was plowed, harrowed with Randall's harrow, and leached ashes spread on eight acres at the rate of one hundred bushels to the acre; two acres were sown to unleached ashes at the rate of fifty bushels per acre, and the remaining one acre was sown to ground bone-dust at the rate of 1,000 lbs. per acre, and all were harrowed in with Thomas'

smoothing harrow. The seed being poor it did not germinate well, which accounts for the light crop. The catch of grass was excellent. We could perceive no difference in the barley raised on the leached or unleached ashes, but the grass was much the best on the unleached. The growth of the barley and grass was much less raised on bone dust than on the ashes.

*Farm receipts and expenditures for eight months.*

| Year. | Month. | Receipts. | Expenditures. | Excess of Receipts. | Excess of Expenditures. |
|---|---|---|---|---|---|
| 1878. | April, | $138 23 | $95 74 | $42 49 | – |
| " | May, | 272 68 | 193 47 | 79 21 | – |
| " | June, | 508 47 | 412 52 | 95 95 | – |
| " | July, | 35 05 | 326 49 | – | $291 44 |
| " | Aug., | 109 12 | 196 11 | – | 86 99 |
| " | Sept., | 44 15 | 132 59 | – | 88 44 |
| " | Oct., | 276 00 | 232 21 | 43 79 | – |
| " | Nov., | 677 87 | 788 27 | – | 110 40 |
| | | $2,061 57 | $2,377 40 | $261 44 | $577 27 |

Excess of expenditures, $315.83. Bills due farm, and farm products to be sold, will cover this excess of expenditures.

No money has been drawn from the treasury for farm purposes.

*Receipts for farm labor, produce, &c., for eight months.*

| | |
|---|---|
| From J. R. Farrington, balance due farm | $158 47 |
| Labor students, farm hands and teams | 195 40 |
| Milk and cream sold | 309 30 |
| Butter | 56 82 |
| Hay | 45 00 |
| Stock | 407 26 |
| Pigs and shotes | 89 96 |
| Wool | 59 98 |
| Wood | 91 34 |
| Potatoes | 246 58 |
| All other farm produce, board, &c | 401 46 |
| | $2,061 57 |

*Expenditures for labor on farm, for groceries, meats and fish, board of family and hired help, corn and fine feed for stock, for hired help in house, &c., &c.*

| | |
|---|---|
| Labor of farm hands | $482 51 |
| " students (term work) | 421 79 |
| " students in haying and vacation | 198 40 |
| " all others on farm | 28 40 |
| " hired help in house | 119 25 |
| Groceries and provisions for board of family and hired help | 178 69 |
| Meats for board of family and hired help | 114 25 |
| Fish for board of family and hired help | 20 55 |
| Meal, corn and fine feed for neat stock and swine | 306 21 |
| Blacksmith's and wheelwright's work | 71 96 |
| Farm machines, implements and hardware | 181 47 |
| Fertilizers and seeds | 255 85 |
| Harness repairs and team furnishings | 22 06 |
| House furnishing | 78 69 |
| Paints for stable and wagons | 34 40 |
| Stock | 89 62 |
| Sundries | 9 60 |
| | $2,615 40 |
| Of the above, bills not yet paid | 238 00 |
| Amount paid out to date | $2,377 40 |

*Permanent improvements, farm implements and fertilizers, included in the above expenditures.*

| | |
|---|---|
| Cutting bushes and clearing land for pastures | $127 30 |
| Improvement of land around farm buildings | 161 20 |
| Hauling and laying stone on culvert | 25 00 |
| Farm tools and machines | 170 55 |
| Fertilizers | 207 00 |
| Painting stable | 41 40 |
| | $732 45 |

*Names and value of Stock on farm of Maine State College.*

| | |
|---|---|
| Shorthorn cow Cornelia, 12 years old | $50 00 |
| " " Cornucopia, 4 years old | 75 00 |
| " " Duchess of Maine, 4 years old | 80 00 |
| " heifer Cornucopia 2d, 15 months old | 35 00 |
| " bull Duke of Maine, 15 months old | 40 00 |
| Ayrshire bull Hiempsal, 5 years old | 75 00 |
| " cow Olivia, 4 years old | 40 00 |
| " heifer Oleeannee, 3 years old | 35 00 |
| " " Olivia 2d, 17 months old | 25 00 |
| " " Isabel 2d, 15 months old | 20 00 |
| Jersey cow Hebe, 12 years old | 50 00 |
| " heifer Pride of the Island, 2 years old | 65 00 |
| " heifer Helen, 22 months old | 65 00 |
| " bull Harry 2d, 18 months old | 40 00 |
| Grade Shorthorn cow Maggie 3d, 4 years old | 50 00 |
| " Shorthorn heifer Lady Stone, 3 years old | 60 00 |
| " Ayrshire heifer Jennie, 2 years old | 40 00 |
| " Ayrshire heifer Gipsy 2d, 2 years old | 40 00 |
| " Jersey cow Gipsy, 6 years old | 50 00 |
| " " cow May, 4 years old | 50 00 |
| " " heifer Topsy 2d, 2 years old | 40 00 |
| " " heifer Topsy 3d, 22 months old | 35 00 |
| " Hereford cow Emma, 6 years old | 40 00 |
| " Hereford heifer White Face, 2 years old | 25 00 |
| " Dutch heifer Duchess of Orono, 2 years old. | 40 00 |
| | $1,165 00 |

HORSES.

| | |
|---|---|
| Dick, 14 years old | $125 00 |
| Louis, 13 years old | 100 00 |
| Robin, 11 years old | 175 00 |
| Nell, 12 years old | 225 00 |
| Goody, 10 years old | 75 00 |

SHEEP.

| | | |
|---|---|---|
| 1 | Shropshiredown buck | $25 00 |
| 5 | Shropshiredown ewes | 50 00 |
| 3 | Cotswold ewes | 20 00 |
| 2 | Cotswold lambs | 8 00 |
| 1 | Grade Cotswold buck | 10 00 |
| 25 | " ewes | 140 00 |
| 11 | " lambs | 33 00 |
| 2 | Southdown ewes | 8 00 |
| 2 | Southdown lambs | 6 00 |
| 3 | Grade Southdown ewes | 12 00 |
| 3 | Grade Southdown lambs | 9 00 |

SWINE.

| | | |
|---|---|---|
| 1 | Berkshire boar | 10 00 |
| 3 | White Chester breeding sows | 50 00 |
| 2 | Grade Suffolk | 30 00 |
| 1 | Fatting hog | 15 00 |
| 4 | Spring pigs | 50 00 |
| 2 | Fall pigs | 5 00 |
| | | $2,346 00 |

There has been a great reduction made in the valuation of the stock on the farm, on account of the general depreciation of prices throughout the country.

## Inventory of Farm Tools and Equipments.

1 Sward Plow with Subsoil Attachment.
1 Subsoil Plow.
4 Sward Plows.
4 Stubble Plows.
1 Charter Oak Swivel Plow.
1 Light one-horse Plow.
1 Garden Plow.
1 Furrow Plow.
1 Frenche's Cultivator.
1 Nishwitz's Pulverizer.
1 Share's Coulter Harrow.
2 Scotch Harrows.
1 Chase Revolving Tooth Harrow.
1 Burnt Land Harrow.
1 Powels' Wheel Harrow and Grain Coverer.
1 Thomas' Smoothing Harrow.
1 Randall's Harrow.
1 Chandler's Improved Horse Hoe.
1 Share's Horse Hoe.
1 Farm Roller.
1 Farm Scraper.
2 Stone Drags.
2 Warrior Mowers.
1 Superior Hay Spreader.
1 Bay State Horse Rake.
1 Yankee Horse Rake.
1 Whittemore's Horse Rake.
8 Long Handle Shovels.
5 Short Handle Shovels.
1 Long Handle Garden Spade.
2 Spading Forks.
6 Manure Forks.
1 Garden Trowel.
15 Garden Hoes.
9 Potato Diggers.
1 Grubbing Hoe.
5 Garden Rakes.
10 Grass Scythes.
15 Scythe Snaths.
2 Bush Scythes.
12 Hay Rakes.
5 Drag Rakes.
25 Hay Forks.
1 Hay Knife.
1 Hay and Straw Cutter.
1 Fanning Mill.
1 Root Cutter.
6 Potato Baskets.
4 Iron Pails.
6 Wooden Pails.
20 Grain Bags.
1 Steelyard.
1 Beam Scales.
1 Fairbanks' Platform Scales.
3 Wheelbarrows.
3 Grindstones.
1 Jackscrew.
4 Clay Picks.
4 Gravel Picks.
2 Iron Bars.
2 Steel Bars.
2 Cant Dogs.
1 Queen Harvest Separator.
1 Patent Wain Jack.
1 Two-horse Hay Rack.

FARM TOOLS AND EQUIPMENTS—Concluded.

1 Two-horse Farm Wagon.
1 Two-horse Farm Jigger.
3 Two-horse Farm Carts.
1 One-horse Farm Cart.
1 One-horse Express Wagon.
1 One-horse Riding Wagon.
1 One-horse Pung.
1 Two-horse Tag Sled.
2 Two-horse Logging Sleds.
1 Two-horse Wood Sled.
2 Double Team Harnesses.
1 Single Team Harness.
1 Carriage Harness.
4 Sets Double Whiffletrees and Chains.
3 Crotch Chains.
4 Logging Chains.
1 Draft Chain.
1 Set Tag Chains for Logging.
6 Horse Blankets.
6 Head Halters.
4 Surcingles.
2 Spring Scales.
1 Pike Handspike.
3 Stone Hammers.
8 Chopping Axes.
2 Broad Axes.
2 Hand Axes.
3 Nail Hammers.
3 Jack Planes.
2 Jointing Planes.
1 Smoothing Plane.
4 Mortise Chisels.
5 Paring Chisels.
2 Bitstocks.
1 Set Auger Bits.
1 Extension Bit.
3 Handsaws.
1 Splitting Saw.
1 Fine Saw.
1 Pruning Saw.
1 Cross-cut Saw.
3 Wood Saws.
1 Meat Saw.
2 Carpenters' Squares.
1 Try Square.
1 Carpenter's Bevel.
1 Draw Shave.
1 Spoke Shave.
1 Saw Set.
1 6-8 inch Gauge.
1 Eagle Pruning Tool.
1 Ralph's Oneida Cheese Vat.
1 Ralph's Cheese Press and Equipments.
1 Lactometer.
7 Milk Testing Tubes.

T. G. RICH, *Farm Superintendent.*

# TREASURER'S REPORT.

*To the Trustees of the State College of Agriculture and the Mechanic Arts:*

GENTLEMEN,—I present herewith my annual report, showing the receipts and expenditures of the college since November 20th, 1877, the date of my last report:

## GENERAL ACCOUNT.

| | | |
|---|---|---|
| 1877. | RECEIPTS. | |
| Nov. 20, | By balance to date of old account | $241 25 |
| 1878. | | |
| Jan. 25, | By college note indorsed by Trustees, dated January 24, 1878, at 2 months, sum of $2,000, less discount at 6 per cent., $20.67 | 1,979 33 |
| Mar. 9, | By legislative appropriation | 6,500 00 |
| | | $8,720 58 |
| 1877. | EXPENDITURES. | |
| Nov. 22, | Paid S. L. Boardman, expenses as Trustee | 22 92 |
| 1878. | | |
| Jan. 25, | D. M. Howard, insurance of college buildings | 195 16 |
| | P. M. Blake, " " | 131 05 |
| | F. M. Sabine, " " | 173 89 |
| | Wiggin & Champlin, " " | 131 05 |
| Jan. 26, | Clark & Small, " " | 198 88 |
| | J. C. Buzzell, paints and oils | 117 64 |
| Feb. 2, | J. R. Farrington, construction of house | 500 00 |
| 8, | Same, farm purposes | 275 00 |
| 8, | D. M. Howard, insurance of natural history collection | 15 00 |
| 12, | N. W. Bond, two furnaces for farm house | 225 00 |
| 26, | A. Leighton, repairs of apparatus | 50 03 |
| Mar. 25, | Lyndon Oak, expenses as Trustee | 61 04 |
| | Samuel F. Dike, expenses as Trustee | 53 10 |
| | Caleb A. Chaplin, expenses as Trustee | 47 45 |
| Mar. 27, | College note, (discounted January 25th at 2 months) | 2,000 00 |
| 29, | J. R. Farrington, balance due on farm house | 509 87 |
| 29, | Same, balance due on farm account | 227 95 |
| April 26, | S. T. Hincks, expenses and labor | 175 85 |
| May 17, | J. R Farrington, to pay balance of farm debts | 553 81 |
| 29, | W. P. Wingate, expenses and labor as Trustee | 125 50 |
| July 20, | J. R. Farrington, fertilizers | 34 00 |
| Aug. 17, | J. C. Buzzell, locks, keys and hardware | 29 19 |
| | | 5,853 38 |
| Nov. 29, | S. L. Boardman, expenses as Trustee | 38 80 |
| | | $5,892 18 |

## CONGRESSIONAL ENDOWMENT FUND.

| | | | |
|---|---|---|---|
| 1877. | RECEIPTS. | | |
| Dec. 3, | Interest on State of Maine bonds | | $2,145 00 |
| 1878. | | | |
| Jan. 1, | Interest on Bangor bonds | | 180 00 |
| 4, | Three months' interest on preferred stock of St. P. & S. C. R. R. | | 111 57 |
| Feb. 21, | Interest on State of Maine bonds | | 990 00 |
| April 5, | Three months' interest on preferred stock of St. P. & S. C. R. R. | | 225 36 |
| 9, | Registered State of Maine bond, No. 248, due March 1, 1878, paid by State Treasurer | $1,000 00 | |
| | One month's interest on State bond bought by State Treasurer—$900—for college fund | 4 50 | |
| | | | 1,004 50 |
| | Said bond is retained by said Treasurer with other State bonds belonging to the college. | | |
| June 3, | Interest on State of Maine bonds | | 417 00 |
| | " " " | | 2,145 00 |
| July 2, | Interest on Bangor bonds | | 180 00 |
| 6, | Three months' interest on preferred stock St. P. & S. C. R. R. | | 225 36 |
| Aug. 16, | Interest on State of Maine bonds | | 900 00 |
| | College note for $3,000, at 6 months, discounted at 5 per cent. per annum | | 2,973 25 |
| Oct. 5, | Three months' interest on preferred stock St. P. & S. C. R. R. | | 225 36 |
| Nov. 5, | Interest on State of Maine bonds | | 504 00 |
| | | | 12,226 40 |
| Nov. 29, | Sales 3 Bangor bonds, $1,000 each | $3,000 00 | |
| | Accrued interest | 74 00 | |
| | Premium at 4½ per cent | 135 00 | |
| | | | 3,209 00 |
| Dec. 3, | Interest on State of Maine bonds | | 2,145 00 |
| | | | 17,580 40 |
| 1877. | EXPENDITURES. | | |
| Nov. 22, | A. B. Aubert, three months' salary | | 375 00 |
| Dec. 1, | M. C. Fernald, " " | | 450 00 |
| | C. F. Allen, " " | | 500 00 |
| | G. H. Hamlin, " " | | 375 00 |
| | W. A. Pike, " " | | 450 00 |
| | C. H. Fernald, " " | | 375 00 |
| | F. L. Hills, " " | | 375 00 |
| 1878. | | | |
| Jan. 17, | J. R. Farrington, " " | | 225 00 |
| Feb. 11, | W. C. Fuller, " " | | 100 00 |
| Mar. 1, | W. A. Pike, " " | | 450 00 |
| Mar. 2, | M. C. Fernald, " " | | 450 00 |
| | C. H. Fernald, " " | | 375 00 |
| | A. B. Aubert, " " | | 375 00 |
| | F. L. Hills, " " | | 375 00 |
| | G. H. Hamlin, " " | | 375 00 |
| | C. F. Allen, " " | | 500 00 |
| April 6, | W. C. Fuller, balance of his salary | | 66 67 |
| | J. R. Farrington, balance of his salary | | 192 50 |
| | State Treasurer for State of Maine coupon bond, due October 1, 1879 | $900 00 | |
| | Premium paid on same, 12½ per cent | 110 25 | |
| | | | 1,010 25 |
| May 17, | J. R. Farrington, department of agriculture | | 24 63 |
| 31, | C. H. Fernald, three months' salary | | 375 00 |
| | W. A. Pike, " " | | 450 00 |
| June 1, | C. F. Allen, " " | | 500 00 |
| | M. C. Fernald, " " | | 450 00 |
| | A. B. Aubert, " " | | 375 00 |
| | G. H. Hamlin, " " | | 375 00 |
| | F. L. Hills, " " | | 375 00 |
| July 1, | J. R. Farrington, " " | | 300 00 |

## CONGRESSIONAL ENDOWMENT FUND—Concluded.

| 1878. | EXPENDITURES. | | |
|---|---|---|---|
| Aug. 14, | T. G. Rich, three months' salary | | $125 00 |
| Sept. 1, | C. F. Allen, " " | | 500 00 |
| | F. L. Hills, " " | | 375 00 |
| | W. A. Pike, " " | | 436 67 |
| | M. C. Fernald, " " | | 436 67 |
| | A. B. Aubert, " " | | 375 00 |
| | C. H. Fernald, " " | | 375 00 |
| | G. H. Hamlin, " " | | 355 00 |
| Oct. 7, | J. R. Farrington, " " | | 300 00 |
| 23, | F. L. Hills, salary for one month seventeen days | | 195 83 |
| Nov. 5, | C. H. Fernald, cash advanced by him in 1877 for drawings and apparatus | | 203 15 |
| | C. H. Fernald, three months' salary | | 375 00 |
| 16, | A. B. Auburt, " " | | 375 00 |
| 29, | Paid college note dated, August 16th, at six months, sum of | $3,000 00 | |
| | Rebate two months twenty-one days' interest, at 5 per cent | 37 75 | |
| | | | 2.962 25 |
| Dec. 3, | M. C. Fernald, three months' salary | | 400 00 |
| | G. H. Hamlin, " " | | 300 00 |
| | W. A. Pike, " " | | 400 00 |
| | C. F. Allen, " " | | 500 00 |
| Dec. 8, | T. G. Rich, " " | | 125 00 |
| | | | $19,733 62 |

## SUMMARY.

| | Receipts. | Expenditures. |
|---|---|---|
| General account | $8,720 58 | $5,892 18 |
| Congressional Endowment account | 17,580 40 | 19,733 62 |
| | $26,300 98 | $25,625 80 |
| Balance to new account | - | 675 18 |
| | $26,300 98 | $26,300 98 |

Agreeably to a vote of the Trustees, passed on the 25th day of June last, instructing the Treasurer to hire money on the pledge of bonds of the city of Bangor, held by the college, to pay salaries, &c., I obtained on the 16th day of August last the amount at that time deemed necessary, by a discount of the note of the college of the above date for $3,000 on 6 months, at 5 per cent. Three city of Bangor bonds for $1,000 each were hypothecated for the security of said note. At a meeting of your Board, held in November last, an order was passed directing the Treasurer to sell said

bonds and pay said note. This has been done, and the amount realized therefrom, $3,209, placed to the credit of the endowment fund.

The interest from the college investments for the ensuing year is estimated at $8,200.

Respectfully submitted,

ISAIAH STETSON, *Treasurer.*

December 17, 1878.

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Having been directed by the Trustees to audit the Treasurer's annual report of receipts and expenditures for the past year, I have attended to that duty and report that I find said account properly vouched and correctly cast.

W. P. WINGATE.

December 17, 1878.

# CATALOGUE

OF THE

## OFFICERS AND STUDENTS

OF THE

## Maine State College of Agriculture and the Mechanic Arts.

ORONO, MAINE, 1878-9.

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## FACULTY.

CHARLES F. ALLEN, D. D., President and Professor of English Literature and Moral Science.
MERRITT C. FERNALD, A. M., Professor of Mathematics and Physics.
ALFRED B. AUBERT, B. S., Professor of Chemistry.
WILLIAM A. PIKE, C. E., Professor of Engineering.
CHARLES H. FERNALD, A. M., Professor of Natural History.
FRANCIS L. HILLS, Professor of Modern Languages, and Military Instructor.
GEORGE H. HAMLIN, C. E., Professor of Drawing and Field Engineering.
JOSEPH R. FARRINGTON, Instructor in Agriculture.
Prof. G. H. HAMLIN, Librarian.
Prof. W. A. PIKE, Secretary.

T. G. RICH, Farm Superintendent.
HENRY M. LANDER, Steward.

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## STUDENTS.

### SENIOR CLASS.

| | |
|---|---|
| Bean, Harry Percy, | Bangor. |
| Blake, Edward Josiah, | North Bridgton. |
| Crosby, Simon Percy, | Dexter. |
| Cutter, John Dana, | Brewer. |
| Decker, Wilbur Fisk, | Bowdoinham. |
| Ferguson, Willis Edwin, | Bangor. |
| Gibbs, Charles Wingate, | Glenburn. |

SENIOR CLASS—CONCLUDED.

| | |
|---|---|
| Gould, Annie May, | Stillwater. |
| Holt, Nellie Maud, | Orono. |
| Kidder, Frank Eugene, | Bangor. |
| Libby, Mark D., | Riverside. |
| Loring, Charles Sewall, | Phipsburg. |
| Merrill, George Perkins, | Auburn. |
| Meserve, John William, | Rockland. |
| Moore, Arthur Lee, | Limerick. |
| Morse, Charles Adelbert, | Bangor. |
| Potter, Fred David, | Waldoboro'. |
| Shaw, Alton Jhacelous, | Auburn. |
| Vinal, Percia Ann, | Orono. |
| Warren, George Otis, | Fryeburg. |
| Webster, Herbert, | Orono. |

JUNIOR CLASS.

| | |
|---|---|
| Allen, Charles Morse, | Orono. |
| Bartlett, James Monroe, | Litchfield. |
| Brown, Albert Hinckley, | Oldtown. |
| Cleaveland, Woodbury Fremont, | Skowhegan. |
| Davis, Marcia, | Stillwater. |
| Elliot, Fred Burton, | Bowdoin. |
| Farrington, Sarah Perkins, | Orono. |
| Fernald, Charles Wilbur, | South Levant. |
| Fickett, Fred Wilden, | Etna. |
| Jones, Daniel Sherman, | Dennysville. |
| Lufkin, George William, | North Yarmouth. |
| Mansfield, Frank Albert, | Camden. |
| Matthews, Annie A., | Stillwater. |
| Murray, Henry Wilson, | Solon. |
| Oak, Willis Laurens, | Garland. |
| Patten, Franklin Rand, | Hampden. |
| Pease, Charles Truman, | Bridgton. |
| Purinton, James Frank, | Bowdoin. |
| Webster, Daniel, Jr., | Bangor. |
| Wellington, Arthur Lee, | Fort Fairfield. |

SOPHOMORE CLASS.

| | |
|---|---|
| Adams, Henry Walton, | Bowdoin. |
| Andrews, Henry Harris, | Montross, Va. |
| Boynton, Lorin Thompson, | Ashland. |
| Brown, Henry William, | Orono. |
| Buck, Clara Louise, | Stillwater. |
| Colburn, Fannie Eliza, | Orono. |
| Farrington, Edward Holyoke, | Orono. |

SOPHOMORE CLASS—CONCLUDED.

| | |
|---|---|
| Farrington, Oliver Cummings, | Orono. |
| Fogg, Charles Henry, | Biddeford. |
| Ingalls, Adam Theodore, | South Bridgton. |
| Johnson, Robert John, | Portland. |
| Libby, Clara Alice, | Orono. |
| McIntyer, Horace F., | Waldoboro'. |
| Moor, Charles Lincoln, | Hartland. |
| Murray, Benjamin Franklin, | Solon. |
| Nichols, Charles Stuart Davis, | Saco. |
| Osborn, Edwin Winthrop, | Pembroke. |
| Pease, Oscar Leroy, | Stillwater. |
| Plaisted, Harold Mason, | Bangor. |
| Ring, Alice Isabel, | Orono. |
| Ring, May Lilian, | Orono. |
| Smith, Roscoe Loring, | East Orrington. |
| Sturtevant, George Washington, | Bowdoinham. |
| Tidd, Charles Plummer, | Springfield. |
| Wade, Frank Swan, | Athens. |
| Wales, William Gorton, | Hampden. |
| Weeks, Frank Benjamin, | Orono. |
| Wilson, George Henry, | Orono. |
| Wilson, John Barrows, | Orono. |
| Wyman, Levi Augustus, | Ellsworth. |

FRESHMAN CLASS.

| | |
|---|---|
| Bartlett, Joshua Burr, | Ashland. |
| Boynton, Jacob Leighton, | Ashland. |
| Brown, Charles Weston, | Hampden. |
| Chapin, Charles Edward, | Orrington. |
| Dunn, Charles Lincoln, | Ashland. |
| Dunton, Oscar Howard, | Hampden. |
| Fenlason, Charles Wallace, | Bridgewater. |
| Flint, Walter, | West Baldwin. |
| Fuller, George Ripley, | Tremont. |
| Garland, Charles Clinton, | Great Works. |
| Gould, Joseph French, | Stillwater. |
| Greenlaw, John Irving, | Brownfield. |
| Hurd, Alonzo L., | Brownfield. |
| Keith, Alfred Justin, | Oldtown. |
| Kelleher, Bartholomew Patrick, | Orono. |
| Keniston, Frederic Andrew, | Ellsworth. |
| Kent, Frederic Otis, | Bremen. |
| Kimball, Frank Issacher, | Alfred. |
| Nason, Walter Herbert, | Hampden. |
| Page, Parker James, | Orono. |

FRESHMAN CLASS—CONCLUDED.

| | |
|---|---|
| Patten, James Herbert, | Newport. |
| Poole, Harry Kelsey, | Bremen. |
| Reed, Frederic Martin, | Bangor. |
| Starrett, Avery Palmer, | Warren. |
| Tilley, Lewis Kossuth, | Castle Hill. |
| Todd, Frank H., | Georgetown. |
| Trafton, Eugene M., | Georgetown. |
| Webster, Eben Crowell, | Orono. |
| Wight, Willard Alberto, | Windsor. |
| Woodward, Daniel Carr, | Winthrop. |

SPECIAL COURSE.

| | |
|---|---|
| Atwood, Horace Wood, | Northbridge, Mass. |
| Carver, Benjamin Vanness, | Carver's Harbor. |
| Fuller, Osgood Everett, | Camden. |
| Howard, | Belfast. |
| Welch, Flora, | Orono. |

SUMMARY.

| | | | |
|---|---|---|---|
| Seniors, | 21 | Special, | 5 |
| Juniors, | 20 | | — |
| Sophomores, | 30 | Total, | 106 |
| Freshmen, | 30 | | |

OFFICERS OF THE COBURN CADETS.

MAJOR—Prof. F. L. Hills.
QUARTERMASTER—F. D. Potter.
SERGT. MAJOR—C. M. Allen.
QUARTERMASTER SERGT.—G. W. Lufkin.

| COMPANY A. | COMPANY B. |
|---|---|
| Captain, E. J. Blake. | Captain, H. Webster. |
| Senior 1st Lieut., L. F. Goodale. | Senior 1st Lieut., W. F. Decker. |
| Senior 2d Lieut., M. D. Libby. | Senior 2d Lieut., J. D. Cutter. |
| Junior Lieut., G. P. Merrill. | Junior Lieut., C. A. Morse. |
| 1st Sergeant, B. V. Carver. | 1st Sergeant, F. W. Powers. |
| 2d Sergeant, C. T. Pease. | 2d Sergeant, G. W. Lufkin. |
| 3d Sergeant, A. L. Wellington. | 3d Sergeant, F. W. Fickett. |
| 4th Sergeant, O. C. Fuller. | 4th Sergeant, P. Keyes. |
| 1st Corporal, H. W. Brown. | 1st Corporal, G. W. Sturtevant. |
| 2d Corporal, H. H. Andrews. | 2d Corporal, G. W. Holmes. |
| 3d Corporal, W. A. White. | 3d Corporal, C. L. Moor. |
| 4th Corporal, E. C. Luques. | 4th Corporal, L. T. Boynton. |

## PRIZES FOR 1878.

Coburn Prize for best Sophomore Declamation, awarded to C. M. Allen.
Coburn Prize for best Junior Essay, awarded to S. P. Crosby.

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## DESIGN OF THE INSTITUTION.

It is the design of the Maine State College of Agriculture and the Mechanic Arts, to give the young men of the State who may desire it, at a moderate cost, the advantages of a thorough, liberal and practical education. It proposes to do this by means of the most approved methods of instruction, by giving to every young man who pursues the course of study an opportunity practically to apply the lessons he learns in the class-room, and by furnishing him facilities of defraying a part of his expenses by his own labor.

By the act of Congress granting public lands for the endowment and maintenance of such colleges, it is provided that the leading object of such an institution shall be, "without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to Agriculture and the Mechanic Arts."

While the courses of study fully meet this requisition, and are especially adapted to prepare the student for agriculture and mechanical pursuits, it is designed that they shall be also sufficiently comprehensive, and of such a character, as to secure to the student the discipline of mind and practical experience necessary for entering upon other callings or professions.

## CONDITIONS OF ADMISSION.

Candidates for admission to the Freshman class must be not less than fifteen years of age, and must pass a satisfactory examination in Arithmetic, Geography, English Grammar, (especial attention should be given to Orthography, Punctuation and Capitals) History of the United States, Algebra as far as Quadratic Equations, and five books in Geometry.

Although the knowledge of Latin is not required as a condition of admission, yet the study of that language is earnestly recommended to all who intend to enter this institution.

Candidates for advanced standing must sustain a satisfactory examination in the preparatory branches, and in all the studies previously pursued by the class they propose to enter.

Satisfactory testimonials of good moral character and industrious habits will be rigidly exacted.

The day after commencement, which is the last Wednesday of June, and the day of the beginning of the first term, are the appointed times for the examination of candidates.

## COURSES OF INSTRUCTION.

Five full courses are provided, viz: A course in Agriculture; in Civil Engineering; in Mechanical Engineering; in Chemistry; and in Science

and Literature. The studies of the several courses are essentially common for the first two years.

There will be regular exercises during the four years in English Composition, Declamation and Military Tactics. Lectures will be given to the Freshman class, on Physics, Meteorology, Physical Geography and Botany; to the Sophomore class, on Chemistry, Horticulture and Practical Agriculture; to the Junior class, on Anatomy, Physiology, Astronomy and English Literature; and to the Senior class, on Rural Law, Mineralogy, Geology, Stock Breeding, Cultivation of Grasses and Cereals.

## SPECIAL COURSE.

Students may be received for less time than that required for a full course, and they may select from the studies of any class such branches as they are qualified to pursue successfully. Students in a Special Course are not entitled to degrees, but may receive certificates of proficiency.

## DEGREES.

The full course in Civil Engineering entitles to the Degree of Bachelor of Civil Engineering; the full course in Mechanical Engineering, to the Degree of Bachelor of Mechanical Engineering; the full course in Agriculture, Chemistry, or Science and Literature, to the Degree of Bachelor of Science.

Three years after graduation, on presentation of a thesis with the necessary drawings, and proof of professional work or study, the Bachelors of Civil Engineering may receive the Degree of Civil Engineer; the Bachelors of Mechanical Engineering, the Degree of Mechanical Engineer; the Bachelors of Science, the Degree of Master of Science.

# COURSES OF STUDY.

## FIRST YEAR.

FIRST TERM. Physical Geography, Meteorology, Algebra, Rhetoric. P. M. Labor on Farm.

SECOND TERM. French, Algebra and Geometry, Farm Drainage and Botany. P. M. Book-Keeping and Labor.

## SECOND YEAR.

FIRST TERM. French and Farm Implements, Botany and General Chemistry, Trigonometry. P. M. Free Hand Drawing and Chemistry.

SECOND TERM. Mechanical Cultivation of the Soil and Surveying, or (L) History of England, English Literature and Physics, Analytical Geometry and Calculus or Qualitative Chemistry. P. M. Mechanical Drawing and Field Work.

## THIRD YEAR.

COURSE IN AGRICULTURE—FIRST TERM. Physics, Physiology, Human Anatomy and Hygiene, German, Agricultural Chemistry or *English Literature. P. M. Chemistry or *Analysis of English Authors.

SECOND TERM. Zoology and Entomology, German, Astronomy and Mechanics. P. M. Chemistry and Experimental Farming or *Analysis of American Authors.

COURSE IN CIVIL ENGINEERING—FIRST TERM. Calculus, Hencks' Field Book, Physics, German. P. M. Field Work and Shading.

SECOND TERM. Astronomy, Descriptive Geometry, First Part of Rankine's Civil Engineering and Mechanics, German. P. M. Isometric and Cabinet Projection and Perspective.

COURSE IN MECHANICAL ENGINEERING—FIRST TERM. Calculus, Machinery and Mill Work, Physics, German. P. M. Machine Drawing and Shading.

SECOND TERM. Astronomy, Descriptive Geometry, Machinery and Mill Work, German. P. M. Isometric, Cabinet Projection and Perspective.

COURSE IN CHEMISTRY—FIRST TERM. Physics, Physiology, German, Chemistry, P. M. Laboratory Work.

SECOND TERM. Zoology and Entomology, German, Chemistry. P. M. Laboratory Work.

## FOURTH YEAR.

COURSE IN AGRICULTURE—FIRST TERM. Comparative Anatomy, History of Civilization, Dairy Farming and Stock Breeding, Logic. P. M. Experimental Farming and Agricultural Botany or *Historical Readings and Analysis.

SECOND TERM. U. S. Constitution and Political Economy, Mineralogy and Geology, Cultivation of Cereals, Landscape Gardening, Rural Architecture and Sheep Husbandry, Mental and Moral Science.

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*In the course of Science and Literature the studies marked with a star are to be taken in place of those that immediately precede them in the Agricultural Course.

COURSE IN CIVIL ENGINEERING—FIRST TERM. Second Part of Rankine's Civil Engineering, Logic, Physiology (with Juniors). P. M. Stereotomy, Topography and R. R. Work.

SECOND TERM. U. S. Constitution and Political Economy, Mineralogy and Geology, Third part of Rankine's Civil Engineering, Designs and Specifications. P. M. Machine Drawing and Designing.

COURSE IN MECHANICAL ENGINEERING—FIRST TERM. Steam Engine, Logic, Physiology (with Juniors). P. M. Applied Descriptive Geometry and Machine Drawing.

SECOND TERM. Steam Engine, Designs and Specifications, U. S. Constitution and Political Economy, Mineralogy and Geology. P. M. Machine Drawing and Designing.

COURSE IN CHEMISTRY—FIRST TERM. Comparative Anatomy, History of Civilization, Logic, Chemistry. P. M. Laboratory Work.

SECOND TERM. U. S. Constitution and Political Economy, Mineralogy and Geology, Chemistry. P. M. Laboratory Work.

## SPECIAL FEATURES OF THE COURSES.

The prominence given to the Natural Sciences, and the practical element associated with the studies, render the first two years exceedingly valuable, as the groundwork of whatever more specific department may be pursued.

Those who complete the course in Agriculture will have attained a good knowledge of Mathematics, French, German and English Literature, besides the studies in Natural Science that have a direct bearing upon agriculture. The study of Botany extends through nearly a year, commencing early in the spring and extending late in the autumn. General Chemistry and Physics continue through a whole year. Under Agricultural Chemistry will be considered composition of soils, relations of air and moisture to vegetable growth, chemistry of farm processes, methods of improving soils, fertilizers, and other topics which properly come under this department. This course, slightly modified so as better to adapt it to those wishing a thorough practical education for other employments, is called the course in Science and Literature. This includes mental and moral science, logic and more of general literature.

The student in Civil Engineering, having laid a good foundation of general culture in literary studies, modern languages, mathematics and natural science, in his Junior year enters upon his engineering studies, embracing the theory and practice of constructing roads, railroads, bridges, canals, dams and other structures, and has thorough instruction and practice in mechanical and topographical drawing. The afternoons are devoted to field work and drawing.

With the same instruction in general studies, those who take the course in Mechanical Engineering study the elements of mechanism, machinery and mill work, steam engines, water wheels, estimates and specifications for machinery. They are instructed to draw working plans from descriptions, models and inspection of machinery, as well as to design machines.

Shops have been fitted up in which practical instruction is given in vise work and forge work. Other branches of practical mechanics will be taught as soon as the necessary means are furnished.

The course in Chemistry includes general, analytical and agricultual chemistry. Under analytical chemistry is comprised the qualitative and quantitative analysis of minerals, alloys, earths, fertilizers and farm products. The students devote three hours a day to laboratory practice.

## LABOR.

It is a peculiarity of the college, that it makes provision for labor, thus combining practice with theory, manual labor with scientific culture. Students in this institution are required to labor a certain portion of each day, not exceeding three hours, for five days in the week.

The labor is designed to be as much as possible educational, so that every student may become familiar with all the forms of labor upon the farm and in the garden. In the lowest class the students are required to work on the farm, and they receive compensation for their labor according to their industry, faithfulness and efficiency, the educational character of the labor being also taken into accouut. The maximum amount paid is thirty cents for three hours' labor.

## MILITARY INSTRUCTION.

Thorough instruction is given in Military Science by a competent officer. The instruction extends through the whole college course, and embraces personal, squad, company and battalion drill. The students are enrolled in companies under their own officers. Arms are furnished by the State. The uniform is navy blue yacht cloth, sack coat and pants, without brass buttons or trimmings that attract attention, and is required to be worn during the military exercises.

## LOCATION.

The college has a pleasant and healthful location, between the villages of Orono and Stillwater, about a mile from each. Stillwater river, a tributary of the Penobscot, flows in front of the buildings, forming the western boundary of the college farm, and adding much to the beauty of the surrounding scenery.

The European and North American Railway, over which trains pass several times each day, has a station at the village of Orono. The college is within nine miles of the city of Bangor, and is consequently easily accessible from all parts of the State.

## FARM AND BUILDINGS.

The college farm contains three hundred and seventy acres of land of high natural productiveness, and of great diversity of soil, and is therefore well adapted to the experimental purposes of the institution.

White Hall, the building first erected, affords excellent accommodations for a limited number of students. The lower rooms ot this building are appropriated to general and class purposes.

Brick Hall contains forty-eight rooms, and has connected with it a boarding house for students. With these buildings, the institution furnishes desirable accommodations for one hundred and twenty-five students.

The Laboratory contains two apparatus rooms, a lecture room, a cabinet, a library and weighing room, a recitation room, and rooms for analytical and other purposes, and is in all respects admirably adapted to the wants of the chemical and mineralogical departments.

## APPARATUS.

The college is furnished with new and valuable apparatus for the departments of Physical Geography, Chemistry, Physics, Surveying, Civil Engineering and Mechanical Engineering, to which additions will be made as the exigencies of the several departments require. Models have been obtained from the United States Patent Office, and others have been purchased, that serve for purposes of instruction.

## LIBRARY.

The library already contains 3,777 volumes, some of which have been obtained by purchase, while others have been kindly given to the college. The volumes secured through the liberality of Governor Coburn, and the gifts of other friends, are a valuable addition to this department. It is earnestly hoped that so important an auxiliary in the education of students in the college will not be disregarded by the people of the State, and that liberal contributions will be made to the library, not only of agricultural and scientific works, but also of those profitable to the general reader.

## READING ROOM.

The reading room is supplied with a number of valuable newspapers and periodicals. Grateful acknowledgment is herewith made for the following named papers, generously sent by the proprietors to the college:

Agricultural Gazette, American Cultivator, American Sentinel, Bangor Weekly Courier, Aroostook Valley Sunrise, Camden Journal, Chronicle, Dexter Gazette, Eastern Argus, Eastport Sentinel, Gospel Banner, Kennebec Journal, Lincoln County News, Lewiston Gazette, Maine Farmer, Maine Standard, New England Farmer, N. Y. Observer, North Star, Official Gazette U. S. Patent Office, Oxford Democrat, Patten Tribune, Rockland Weekly Courier, Piscataquis Observer, Somerset Reporter, York County Independent, Zion's Herald.

The following are furnished by subscription:

American Agriculturist, American Naturalist, American Journal of Science and Art, American Architect and Builder, Appleton's Journal, Atlantic Monthly, Bangor Daily Whig and Courier, Boston Journal of Chemistry, Chemical News, Chicago Times, Engineering Magazine, Entomologist, Galaxy, Gardeners' Monthly, Harper's Monthly, Harper's Weekly, International Review, Journal Royal Agricultural Society, England, Journal Franklin Institute, London Punch, Lippincot's Magazine, Leslie's Illustrated News, New York World, Rural New Yorker, Pilot.

Popular Science Monthly, Poultry World, Portland Transcript, Live Stock Journal, Scribner's Monthly, Springfield Republican, Scientific Farmer, Agricultural Gazette, St. Louis Weekly Times.

## CABINET.

Rooms have been fitted up with cases of minerals, and specimens of natural history, and several hundred specimens have been presented to the college. The valuable private cabinets of Prof. C. H. Fernald and President C. F. Allen are placed in these rooms, and are accessible to the students. All specimens presented will be properly credited and placed on exhibition. Rocks illustrating the different geological formations, and minerals found within the State, are particularly solicited. Additions have been made during the past year.

## LITERARY SOCIETIES.

Flourishing societies have been organized by the students of the college, which hold weekly meetings for declamations, discussions, and other literary exercises.

## PUBLIC WORSHIP.

All students are required to attend daily prayers at the college, and public worship on the Sabbath at some one of the neighboring churches, unless excused by the President.

## EXPENSES.

Tuition is free to students residing within the State. Those from other States will be charged twelve dollars per term. Rooms are free. All bedding and furniture must be supplied by the students, who will also furnish their own lights. Board, washing and fuel will be furnished. The price of board is two dollars and sixty cents per week; washing averages sixty cents per dozen. These bills, with those for incidental expenses, are payable one-half at the commencement and the remainder at or before the close of each term.

The terms are so arranged that the long vacation occurs in the winter, that students may have an opportunity to teach during that time. The summer vacation is in the haying season, when farm labor is most profitable. By availing themselves of the opportunities thus afforded, together with the allowance for labor on the college farm, industrious and economical students can cancel the greater part of their college expenses.

# GRADUATES.

## CLASS OF 1872.

Benjamin F. Gould, C. E., Farmer ..... San Juan, California.
George E. Hammond, C. E., Civil Engineer and Contractor ..... Elliot.
Heddle Hilliard, C. E., Civil Engineer ..... Grand Southern R. R., N. B.
Edwin J. Haskell, B. S., Manufacturer ..... Saccarappa, Haskell Silk Co.
Eber D. Thomas, B. S., Civil Engineer ..... Grand Rapids, Mich.
George O. Weston, B. S., Farmer ..... Norridgewock.

## CLASS OF 1873.

Russell W. Eaton, C. E., Mill Engineer ..... Providence, R. I.
George H. Hamlin, C. E., Professor ..... Maine State College, Orono.
Fred W. Holt, C. E., Civil Engineer ..... Grand Southern R. R., N. B.
Charles E. Reed, C. E., Assistant Editor Free Press ..... Detroit, Mich.
John M. Oak, B. S., Merchant ..... Garland.
Frank Lamson Scribner, B. S., Teacher ..... Girard College, Philadelphia.
Harvey B. Thayer, B. S., Apothecary ..... Monson.

## CLASS OF 1874.

William A. Allen, C. E., Civil Engineer ..... Portland, M. C. R. R.
Walter Balentine, B. S., Student of Agricultural Chemistry ..... Germany.
William H. Gerrish, B. S., M. D ..... Portland.
John I. Gurney, B. S., Farmer ..... Dorchester, Mass.
David R. Hunter, B. S., Teacher ..... Comptonville, Cal.
Louise H. Ramsdell, B. S., (Mrs. Milton D. Noyes) ..... Atkinson.

## CLASS OF 1875.

Solomon W. Bates, C. E., Civil Engineer ..... Waterville.
Wilbur A. Bumps, C. E., Apothecary ..... Dexter.
Samuel H. Clapp, C. E., Superintendent of Schools ..... Comptonville, Cal.
Lewis F. Coburn, C. E., Teacher ..... California.
Charles F. Durham, C. E., Superintendent of Schools ..... Crescentville, Cal.
Edson F. Hitchings, C. E., Farmer ..... Waterville.
Allen G. Mitchell, C. E., Civil Engineer ..... Madison.
George M. Shaw, C. E., Teacher ..... Comptonville, Cal.
* Edgar A. Work, C. E ..... U. S. Military Academy, West Point.
Edward D. Mayo, M. E., Teacher ..... Clear Water, Minn.
Albert E. Mitchell, M. E., Machinist ..... Pennsylvania R. R., Pittsburg, Penn.
Minott W. Sewall, M. E., Machinist ..... Philadelphia, Penn.
Charles F. Colesworthy, B. S., Teacher ..... California.
Alfred M. Goodale, B. S., Machinist ..... Saco Water Power Co., Saco.

* Deceased.

Whitman H. Jordan, B. S., Agricultural Chemistry.....Wesleyan University.
*Fred L. Moore, B. S .....California.
Luther W. Rogers, B. S., Merchant.....Stillwater.
Wesley Webb, B. S., Farmer.....Unity.

CLASS OF 1876.

Abbott, Edmund, B. S., Medical Student .....New York City.
Allen, Charles Plummer, B. S., Lawyer .....Presque Isle.
Beckler, Eldridge Harlow, C. E., Civil Engineer.....Empire City, Minn.
Bisbee, Fred Milton, C. E., Engineer.....A. T. & S. F. R. R., Topeka, Kan.
Blanding, Edward Mitchell, B. S., Local Editor Commercial.....Bangor.
Brainard, Charles Marcellus, B. S., Lumberman .....Skowhegan.
Buker, George Haskell, B. S., Apothecary .....Searsport.
Cowan, Florence Helen, B. S., Teacher.....Orono.
Crosby, Oliver, M. E., Foreman of Machine Shop.....St. Paul, Minn.
Cyr, Vetal, B. S., Teacher.....Fort Kent.
Dike, James Edward, C. E., Book Agent .....Boston, Mass.
Dike, Willis Oliver, B. S., Farmer.....Sebago.
Estabrooke, Horace Melvyn, B. S., Teacher.....Pembroke.
Farrington, Arthur Manly, B. S., Veterinary Student.....Cornell University.
Foss, George Obed, C. E., Draughtsman.....Red Wing, Minn.
Haines, William Thomas, B. S., Lawyer.....Hallowell.
Hamilton, Henry Fairfield, B. S., Dentist .....Boston, Mass.
Haskell, Newall Prince, B. S.....New Gloucester.
How, Edward Stevens, M. E., Book-keeper.....Portland.
Hubbard, Philip Wadsworth, B. S., Apothecary.....Farmington.
Jones, Samuel Messer, M. E.....Boston.
Lewis, Albert Augustus, B. S., Teacher.....Orono.
Long, Herbert Augustine, M. E., Farmer .....Bluehill.
Lothrop, Luther Ramsdell, C. E., Teacher.....West Gardiner.
Martin, Nelson Hussey, B. S., Teacher and Superintendent Schools....Fort Fairfield.
Oak, Charles Edson, M. E., Surveyor.....Caribou.
Parks, George Daniel, C. E., Civil Engineer.....Richmond.
Peirce, Hayward, B. S., Granite Works.....Frankfort.
Reed, Frank Radford, C. E., Farmer .....Roxbury.
Reynolds, Henry Jones, B. S., Druggist.....Dennysville.
Rogers, Charles Wilson, M. E., Machinist.....Charlestown, Mass.
Stevens, William Lewis, M. E., Agent for Flouring Mills.....Minneapolis, Minn.
Williams, John Howard, B. S., Teacher.....Milo.

CLASS OF 1877.

Blackinton, Alvah DeOrville, B. C. E., City Engineer.....Rockland.
Burns, Robert Bruce, B. C. E., Teacher.....Fort Fairfield.
Dakin, Eugene Herbert, B. S.....Bangor.
Danforth, Edward Franklin, B. S., Law Student.....Boston, Mass.
Elkins, Augustus Jerome, B. M. E., Draughtsman.....Oldtown.
Emery, Alicia Town, B. S., Teacher.....Orono.
Gould, Samuel Wadsworth, B. S., Merchant.....Hiram.

* Deceased.

Lunt, Joseph Cony, B. C. E., Teacher.....Benton.
Phillips, Fred Foster, B. S., Farmer.....Hermon.
Shaw, Samuel, B. M. E., Teacher.....Augusta.
Stone, Frank Pierce, B. S., Farmer.....Jay.
Stevens, Thomas Jefferson, B. M. E., Teacher.....Auburn.
Sturgis, George Eugene, B. C. E., Apothecary.....San Francisco, Cal.
Towne, Charles Elmer, B. C. E., Teacher.....East Dover.
Weeks, James Walter, B. M. E., Military Instructor.....Castine.
Weeks, Nellie Estelle, B. S., Teacher.....Orono.
Webster, Ivan Eldorus, B. S., Lumberman.....Orono.

CLASS OF 1878.

Brown, Emma, B. S., Teacher.....Orono.
Caldwell, A. J., B. M. E., Student.....Cornell University.
Chamberlain, C. C., B. S., Teacher.....Foxcroft.
Fernald, G. E., B. C. E., Teacher.....Elliot.
Heald, James, B. S.....Orono.
Locke, John, B. S., Merchant.....Fryeburg.
Oakes, F. J., B. C. E.....Oldtown.
Patterson, J. C., B. C. E.....Dexter.
Tripp, W. E., B. C. E., Teacher.....Elliot.
Walker, E. C., B. S., Law Student.....Lovel.
Webster, O. C., B. S., Teacher.....Augusta.

## Officers of the Associate Alumni.

President—Whitman H. Jordan, New Gloucester.
Vice President—William T. Haines, Hallowell.
Recording Secretary—Russell W. Eaton, Providence, R. I.
Corresponding Secretary—Wilbur A. Bumps, Dexter.
Treasurer—Philip W. Hubbard, Farmington.

Class Secretaries.

1872—E. J. Haskell, Saccarappa.
1873—J. M. Oak, Garland.
1874—Walter Balentine, Waterville.
1875—Wesley Webb, Unity.
1876—A. M. Farrington, Orono.
1877—R. B. Burns, Fort Fairfield.

## CALENDAR.

1879—Feb. 11. Tuesday, Second Term commences.
June 19, 20. Thursday and Friday, Examinations.
" 21. Saturday, Prize Declamation by Sophomores.
" 22. Sunday, Baccalaureate Address.
" 23. Monday, Prize Essays by Juniors.
" 25. Wednesday, Commencement.
" 26. Thursday, Examination of Candidates for Admission.
Vacation of five weeks.
Aug. 5. Tuesday, Examination of Candidates for Admission.
Term commences.
Nov. 19, 20. Wednesday and Thursday, Examinations.
Vacation of eleven weeks.
1880—Feb. 10. Tuesday, Second Term commences.