BIENNIAL REPORT

OF THE

STATE AGRICULTURAL COLLEGE.

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REPORT

To His Excellency,
Governor Grover,
Salem, Oregon:

SIR:—I have the honor to submit the first Biennial Report of the Agricultural Department of Corvallis College. As this is the first regular Report of this Institution, I desire to be somewhat explicit.

PRELIMINARY REMARKS.

When I took charge of this Institution in the fall of 1872, I was met by three very serious embarrassments. First, the Institution was in debt in every department. This, I may remark, has been removed. In the second place, there was no money and scarcely any resources. In the third place, there was no chemical apparatus; there was a tolerably good apparatus for physics. Of course all was paralyzed. Nothing could be done till an appropriation was made. An appropriation of $5,000 a year was made on the 15th of October, or rather the bill appropriating that amount was approved at that date.

ORGANIZATION.

As it was getting late in the first Session before the appropriation was made, not much could be done during the first year; however, we proceeded to organize under the Act of Congress which requires each State that accepts of the land grant to "maintain at least one College

where the leading object 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, in such manner as the Legislatures of the States may respectively prescribe in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

We conld do but little with only $5,000; however, we organized, and as far as possible furnished and manned two general departments: 1. A Literary. 2. A Scientific Department.

LITERARY DEPARTMENT.

The Literary Department comprehends: 1. A School of Ancient Languages. 2. A School of Modern Languages. 3. A School of History and Literature. A reference to the catalogue of 1873–74 will make the details of these Departments plain.

SCIENTIFIC DEPARTMENT.

This comprehends: 1. A School of Mathematics. 2. A School of Engineering. 3. A School of Practical Mechanics and Technology. 4. A School of Physical Science in general, comprehending Chemistry, Natural Philosophy, Biology and Agriculture. 5. A School of Moral Science.

Having only three teachers, we can teach only such subjects as are conditions of the others. Accordingly we have put into active operation the Schools of Mathematics, the School of Languages, the School of Physical Science and the School of Moral Science. This is as far as our means allow us to go.

GENERAL CONDITION OF THE DEPARTMENTS IN OPERATION.

We have, during the two years past, had, in the Institution, forty-four (44) State students. The most of them are of the best young men in the State, men of fine muscle and brain; men who come here to learn; who wish to learn because they feel the need of education.

Nothing can better show the wisdom of the Act of Congress than the actual teaching of such men. I must make one remark about the State law, providing for the appointment of students. That law renders eligible to the college any youth sixteen years of age, no other qualification being required. The consequence of this is, that many young men are received here who are really in the primary studies, such as Arithmetic, Elementary Algebra, etc.; and even some who could not read have been taught here. I mention this to show that we have, in the Agricultural Department, many who cannot be put in agricultural studies when they enter college; and, as they stay here only four years, they never can reach such studies. Many of them remain only one year, some two, and others longer. Probably these are troubles that cannot at present be well avoided. These facts show, at least, the great need of education among the people.

The four departments named above are in successful operation. It is, of course, necessary to distribute the work of these departments among the teachers. Professor Emery has charge of the Department in Mathematics. Professor Hawthorne has charge of the Department of Languages. Captain Boswell has charge of the Military Department. I have charge of the Departments of Physical Science and Moral Science. Under the head of Physical Science comes the Agricultural Department, in so far

at least as the Science of Agriculture is specially dependent on chemical science. The following are the reports of the teachers:

SPECIAL WORK OF EACH DEPARTMENT.

Department of Physical Science—B. L. Arnold, Teacher.

In this department are taught: 1. Chemistry, general and analytical; 2. Chemical Physics; 3. Natural Philosophy; 4. Biology. Under the head of Chemistry comes Agricultural Science. The course in Chemical Analysis relates chiefly to Agricultural Analysis. The course in Qualitative Analysis consists chiefly in the separation of the metals and some classes of salts. I shall extend this course as soon as relieved from other studies, and supplied with suitable arrangements.

Chemical Apparatus.

When I took charge of this Institution, two years ago, there was almost no chemical apparatus; absolutely none for analytical purposes. We have, however, succeeded in collecting a tolerably good apparatus; enough, with some few exceptions, to perform all the analytical operations in agricultural chemistry. Some important improvements are to be made during the coming year. We shall then be pretty well equipped; but we need at least $10,000 worth of apparatus.

Agricultural Chemistry.

Agricultural Chemistry is the only scientific foundation of agriculture; and hence it is thought best to bestow much attention on this subject. After the preliminary studies in general Chemistry and other subjects, the student begins with the analysis of soils, rocks, etc., then

proceeds to the analysis of fertilizers, farm products, such as food, wool, beverages, etc. In order to bring the student into direct contact with the best authorities on the subject, I have introduced the methods of Prof. Emil Wolff, who is, perhaps, at the head of all scientific agriculturists. During the past year, six students, five gentlemen and one lady, studied Agricultural Analysis. As it was late in the session before they could reach the subject, they studied only the analysis of soils. I may remark, however, that under my supervision, they each and all worked through the Qualitative Analysis of the Metals. The five gentlemen in this class were agricultural students. They studied, in addition, the general methods of preparing soils, the subject of fertilizers, drainage, etc., and the nature and constitution of plants. Other subjects were taught, but not thoroughly, for the simple reason that we had no time. When it is remembered that we each have an average of eight recitations a day, it will not be wondered at that we do not teach a greater variety of subjects. This subject will be enlarged as we have time and means.

By referring below to Prof. Emery's report, it will be seen that he has taught during the two years, two classes belonging to this department, viz., Natural Philosophy and Astronomy.

Agricultural Farm.

In order to apply the principles demonstrated in the laboratory and verify the result of analysis, a farm is attached to the College and under its control. I have accordingly begun the analysis of the soil and instituted experiments with wheat. I used the "white soil," because more difficulty is experienced in the cultivation of this

than of any other land. I experimented with wheat because this is the great staple of Oregon. It would not be wise to predicate much on the faith of a few analyses, and hence I shall not give a public statement of the nature of the soil till I shall have made a thorough investigation and many analyses. I am diligently at work on this subject and shall soon be able to speak with confidence. So far as my investigations for the present extend I find all the ingredients of a fertile soil. Some few elements seem to exist in rather small quantities; such as potash, lime and sulphuric acid. These elements are *absolutely* necessary to the life of agricultural plants, as all the investigations of Salm, Horstman, Sachs, Knop, Birmer, Lucanus and others demonstrate. But I am disposed to think that thorough draining is more needful for this land than anything else. The following is the plan of treatment indicated by the analysis and other investigations, as published in our catalogue of 1873–74.

White Soil.

I have during this session made an analysis of the so-called "white soil." The sample used was selected by Mr. J. S. Palmer, a first-class farmer of Benton County, and was taken from the Agricultural Farm. The following inorganic substances were found in this sample, viz.: Silica, Sulphuric Acid, Phosphoric Acid, Potash, Soda, Lime, Oxide of Iron, Alumina, Magnesia, and a trace of Manganic Oxide. All these were found in sufficient quantity, except Sulphuric Acid. The amount of Lime is not great. And the indications are that Sulphate of Lime (Plaster of Paris) is the proper chemical remedy. I would suggest its use particularly in connection with grass crops. The chief cause why the soil fails to yield grain perfectly

is that it is too wet. It requires many analyses to justify positive assertions, but so far as I have examined the white soil chemically and physically, the following mode of treatment is suggested by every fact: In the first place every mode of treatment will be useless without *thorough draining*. *Water furrows will not drain this land;* it must be drained by underground drains, sunk at least 30 inches deep, and about 30 feet apart; and further, they should not be more than 100 feet long; this requires that the main open ditches be only about 200 feet apart, and unless this method or some such method be pursued the land cannot be properly drained. This is the method recommended by the best *scientific agriculturists*. After draining pulverize as deep as possible and treat with Plaster of Paris (say 200 lbs. to the acre), cultivate green crops for a few seasons (always plowing them under when in full growth), and the land will soon be rendered fit for grain. Plaster cannot be procured conveniently in Oregon, therefore, as far as possible, supply its place with ashes and marl; quicklime mixed with organic matter may be used, but should not be used alone, or at least it must be used in very small quantity. Sand, straw, good barn manure, all are good for this land. But let this be indelibly fixed in every farmer's mind, that the best remedy is *thorough draining*. This is the best way to correct the sourness of the soil.

Mr. Palmer sent me last Fall a sample of marl from the Yaquina Bay district; upon analysis, I find as much as from ten to twelve per cent. of lime; this marl is, therefore, a good article, and can be applied with advantage.

Experiments on the Farm.

Experiments in any thing can attain to truth only by

fixing some point to be reached, and by working steadily to it; the series of experiments must be varied so as to exclude the possibility of error.

In Agriculture a long period of time is generally required to effect anything with certainty, because the perfection of any set of experiments requires a year. I have proposed the following points to be gained by experiment:

First. To ascertain the nature of the soils of this State as far as possible.

Secondly. To ascertain the best methods of draining the clayey soils.

Thirdly. To ascertain the character of the several varieties of wheat cultivated in the State.

These are some of the subjects belonging to the Agricultural College, but we cannot enter on any others till better furnished with teachers and apparatus.

During the first year no chemical experiments were made on the Farm, because no analysis of soils had been made,—the reason of this is shown above. We experimented with cereals sent from Washington, D. C.

Without entering into details, we may state that the Oran Wheat, a Spring variety, seems well suited to this climate; it is early and prolific. Dealers complain that it is shriveled and has a thick bran.

The Yellow Scottish Oats seem to be well suited to Oregon; the yield is good and the plant seems to be hardy. Dealers complain that the grain is too hard. The other varieties turned out poorly.

During the second year we made chemical experiments with various fertilizers and wheat, Spring Club, on the white soil; this, in order to verify an analysis of the soil. By reference to our Catalogue for the last scholastic

year, you will find the following remarks: "All these substances were found in sufficient quantity, except sulphuric acid. The amount of lime is not large, and the indications are that sulphate of lime (plaster of Paris) is the proper chemical remedy." Accordingly we instituted the following experiments with plants. We used the same amount of surface, small plots, (Professor Caldwell, of Cornell University, recommends a surface of about twenty inches square), and assuming unity as the standard of comparison, the following are the results:

Plot 1.	Superphosphate	10½
" 2.	Fresh horse manure	8
" 3.	Burnt bones, pulverized	9
" 4.	Spent ashes, treated with sulphuric acid	11
" 5.	Sulphate of lime	12
" 6.	Fresh ashes, treated with sulphuric acid	11½
" 7.	Air-slacked lime	8
" 8.	Urine (human)	9
" 9.	Spent ashes	8½
" 10.	Fresh ashes	9½

Thus it is seen that the largest yield is given by sulphate of lime, precisely the substance pointed out by the chemical analysis. The table shows the following striking fact: that in every case in which sulphuric acid was used there was a marked increase in the yield; thus, while spent ashes yielded only 8½, the same kind of ashes, treated with sulphuric acid, yielded 11; here is a difference of 2½ in favor of the sulphate. From 4 and 5 we learn that only a very small per cent. in the increase is attributable to the alkalies. So far as these experiments go, they show that sulphate of lime is indicated. I have done all I could under the circumstances,—pressed with numerous classes, poorly supplied with apparatus, and annoyed

by official business, forced to prepare many of the chemicals used, and also the fertilizers, it has been impossible to do as much as could otherwise have been done. I have laid out for the coming year some hundred experiments with plants (chiefly wheat), and if I can be supplied with means, and relieved of some of my classes, I hope at no distant day to publish a pamphlet on the soils of the Willamette Valley. As long as I have charge of this Department I shall continue to work diligently on this subject.

Department of Moral Science—B. L. Arnold, Teacher.

There are two classes in this Department and both have been quite well attended.

The Junior class studies Political Economy and Social Science. The Senior Class studies Logic, Mental Philosophy and Ethics. The following table shows the amount of work in this Department for the last two years:

YEAR.	*Agricultural students.*	*Non-Agricultural students.*	*Total.*
1st Year	4	1	5
2d Year	8	6	14
Aggregate	12	7	19

Logic and Mental Philosophy.

YEAR.	*Agricultural students.*	*Non-Agricultural students.*	*Total.*
1st Year	13	5	18
2d Year	13	6	19
Aggregate	26	11	37

During the first year I taught several classes in Latin, two in Greek and one in German. These are in addition

to my Department proper. So during the second year I taught in addition to my regular classes one class in Latin, one in German and one in English Grammar. One hour a day has been allowed me to prepare chemical experiments. The average number of recitations, including the hour allowed for preparing chemical experiments, is eight.

Very respectfully,

B. L. ARNOLD.

Department of Languages—B. J. Hawthorne, Teacher.

To the President of Corvallis State Agricultural College—Sir: I have the honor to present the following report of my Department for the Collegiate year, ending June 17, 1874. During the whole session I heard eight classes every day as follows:

1. Latin, 22 students, of whom 9 were Agricultural students.
2. Latin, 19 students, of whom 6 were Agricultural students.
3. German, 10 students, of whom 4 were Agricultural students.
4. English Grammar, 17 students.
5. Greek, 3 students, of whom 2 were Agricultural students.
6. French, 7 students.
7. German, 8 students.
8. German, 8 students.

President Arnold heard 3 classes of this Department:

1. Latin, 5 students, of whom 4 were Agricultural students.
2. German, 4 students.
3. English Grammar, 18 students, of whom 13 were Agricultural students.

Prof. Emery also heard a class belonging to this Department:

1. English Grammar, 36 students, of whom 15 were Agricultural students.

Thus it is seen that there were 12 classes in this Department, averaging 13 students each.

Latin students	45
Greek students	3
French students	3
German students	30
English Grammar and American History students	71
Total	156

Number of Agricultural students, 56.

The students manifest an earnest desire to learn and they labor faithfully. At least two assistants are needed in this Department, as may be readily seen by the amount of work to be done.

Respectfully submitted,

B. J. HAWTHORNE,
Prof. Languages.

Department of Mathematics—Joseph Emery, Teacher.

To the President of the State Agricultural College —Sir: I have the honor of submitting to you the following biennial report of my department, commencing September —, 1872, and ending June 17, 1874:

First year, from September —, 1872 to June 19, 1873, I taught the following studies:

Mathematics (Preparatory)—First session: Arithmetic, 48 st.—15 ag. st.; Book-keeping, 8 st.—6 ag. st. Second session: Algebra, 26 st.—15 ag. st.

College Proper (Junior Class)—Bourdon, 14 st.—9 ag. st.; Geometry, 14 st.—9 ag. st.

Intermediate Class—Trigonometry, 7 st.—5 ag. st.; Surveying and Engineering, 7 st.—5 ag. st.

Senior Class—Analytics, 7 st.—4 ag. st.; Calculus, 7 st.—4 ag. st.; Higher Philosophy, 7 st.—4 ag, st.; Higher Astronomy, 7 st.—4 ag. st. I also taught English Grammar, 36 st.—15 ag. st.; Physiology, 7 st.—4 ag. st.; Latin, 7 st.—2 ag st.; English Literature, 4 st.—3 ag. st.; Geology, 5 st.—3 ag. st.

Second year, from September 14, 1873, to June 17, 1874.

Mathematics (Preparatory)—First session: Arithmetic, 28 st.—16 ag. st.; Elementary Algebra, 26 st.—17 ag. st.; Book-keeping, 7 st.—2 ag. st. Second session: Bourdon, 24 st.—10 ag. st.; Geometry (4 b.), 12 st.—10 ag. st.

College Proper (Junior Class)—Bourdon (comp.), 14 st.—9 ag. st.; Geometry (comp.), 12 st.—9 ag. st.; Trigonometry (plane and spherical), 19 st.—11 ag. st.

Intermediate Class—Surveying and Engineering, 18 st.—10 ag. st.; Analytical Geometry, 11 st.—8 ag. st.; Dif. Calculus, 9 st.—8 ag. st.

Senior Class—Calculus, 5 st.—5 ag. st.; Astronomy (Olmstead's), 6 st.—5 ag. st.; Higher Philosophy, 6 st.—5 ag. st. I also taught all year English Grammar, 23 st.—12 ag. st.; U. S. History, 18 st.—9 ag. st. Second session: Geology, 5 st.—4 ag. st.

JOSEPH EMERY,
Professor of Mathematics.

CORVALLIS, Oregon, Aug. 10, 1874.

Military Department—B. D. Boswell, Teacher.

TO THE PRESIDENT OF CORVALLIS STATE AGRICULTURAL COLLEGE—SIR: I have the honor to report that during

the past year the number of students enrolled in my Department was 64. Average daily attendance, 15.

I would respectfully represent that the cause of the discrepancy between the number enrolled and the average daily attendance is:

1. There is no room attached to the College suitable for drilling.

2. There are no books on Military Science and Tactics to be had in this city.

3. The majority of the students in my Department are the sons of farmers; hence, they are withdrawn from school during seed time and harvest, which embraces the greater portion of the scholastic year suitable for military drill out of doors.

Notwithstanding these difficulties, the average progress of the class was remarkably good, the students were attentive and seemingly much interested.

I would respectfully suggest that a suitable room for exercise, and the enforcement of some prescribed uniform for cadets would, in my opinion, greatly advance the interests of the State Agricultural College.

Respectfully submitted,

B. D. BOSWELL,
Prof. Mil. Science,
2nd Lieut. 11th U. S. Infantry.

TREASURER'S REPORT.

From October 15, 1872, to June 15, 1874, received from the State in warrants.....		$8,333 31
Paid salary to Pres. Arnold two years.....	$3,000 00	
Paid salary to Prof. Emery, two years.....	2,400 00	

Paid salary to Prof. Hawthorne, one year	1,200 00	
Paid salary to Prof. Finley	500 00	
Paid salary to Farmer Liggett	400 00	
Discount on warrants	833 31	
		$8,333 31

Respectfully submitted,

A. CAUTHORN,
Treasurer C. C.

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