

FIRST ANNUAL REPORT

OF THE

AGRICULTURAL EXPERIMENT STATION,

OF THE

UNIVERSITY OF TENNESSEE,

FOR 1888,

TO THE GOVERNOR.

KNOXVILLE, TENNESSEE.
1889

KNOXVILLE, TENN., Jan. 12th, 1889.

To His Excellency, ROBERT L. TAYLOR,

Governor of Tennessee:

SIR:—We have the honor to submit to you herewith the Annual Report of the Agricultural Experiment Station of the University of Tennessee, in accordance with the Act of Congress commonly known as the "Hatch Experiment Act," and the Act of the General Assembly of Tennessee, accepting the same and bestowing them upon this Experiment Station. Section 5 of the first mentioned Act contains the following: "It shall be the duty of each of said Stations, annually, on or before the first day of February, to make to the Governor of the State or Territory in which it is located, a full and detailed report of its operations, including a statement of receipts and expenditures; a copy of which report shall be sent to each of said Stations, to the said Commissioner of Agriculture, and to the Secretary of the Treasury of the United States."

The Act of the General Assembly of Tennessee, Laws of 1887, ch. 220, accepted this donation and bound the State and us to conform to its requirements. This report is presented to you in conformity with this requirement.

Hoping that it will prove satisfactory to your Excellency, we remain, with great respect,

Your obedient servants,

THE BOARD OF CONTROL AND THE BOARD OF TRUSTEES:

CHAS. W. DABNEY, JR., *President.*

S. H. SMITH, *Secretary.*

THE REPORT
OF THE
AGRICULTURAL EXPERIMENT STATION
OF THE
UNIVERSITY OF TENNESSEE.

REPORT OF THE DIRECTOR.

To the Honorable the Board of Control of the Agricultural Experiment Station, and the Board of Trustees of the University of Tennessee:

GENTLEMEN—I have the honor to submit below "A full and detailed report of the operations" of the Agricultural Experiment Station under our direction, for the fiscal year ending July 1st, 1888, and the working year ending January 1st, 1889, together with the reports of the several Divisions of this Station.

It is not understood that this should be a report for the farmers, or contain a full account of the experiments made; but it is to be an official statement or account of our stewardship over the funds given us. The law provides that the Bulletins which must be sent to all farmers who desire them, shall contain this other matter.

HISTORY AND ORGANIZATION.

The so called "Hatch Experiment Station Act," under which this Station is now operating, is already too well known to you and the people of the State, to need lengthy explanation at this place; but it is necessary to refer to a few points in this Act in order to explain the relations of this Experiment Station to the State and the United States. The preamble of this Act states that its purpose was "To aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science." In order to carry this out, the Act provided that there should be established "under the direction of

the college or agricultural department of colleges in each State or Territory, in accordance with the provisions of the Act approved July 2d, 1862, entitled, 'An Act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts,' a department to be known and designated as 'an Agricultural Experiment Station.'"

This new institution was thus to be established under the direction of the college, or the agricultural department of the college already established in the State, under the Act of July 2, 1862, commonly known as the Land-grant Act. This, and the other donations for this purpose, were made "subject to the Legislative assents of the several States and Territories to the purposes of said grants."

In accordance with this Act of Congress, the General Assembly of Tennessee passed an act on the 28th of March, 1882, accepting the donation and bestowing it upon the Agricultural College of the University of Tennessee, as it was bound to do, and instructing the Board of Trustees of the said University to carry out all the purposes of the said Act of Congress. The Board of Trustees of the University of Tennessee promptly decided, in order the better to carry out all the purposes of the Act of Congress, to thoroughly re-organize the Agricultural Department of the University, with which the new institution was connected by law, and proceeded to do so at the annual meeting in July, 1887.

The undersigned, who up to that time had been the Director of the North Carolina Agricultural Experiment Station, was called to take the Directorship of the Tennessee Station, and entered upon his duties on the 4th of August, 1887.

Impressed with the importance of establishing closer relations between the farming interests of the State and their Agricultural College, your Board of Trustees had, in June, 1882, established an Agricultural Experiment Station upon the basis of its Agricultural Department of the College of that time. At that time, this action of the Board of Trustees exhibited a most progressive and commendable spirit. There were then very few experiment stations in this country, and though the station established by the Board was at first very inadequately supported, this action secured the State of Tennessee the credit of having started one of the first five of these institutions in America, which have since proved so useful that they secured this magnificent recognition from the United States Congress. The action of the Board of Trustees referred to, deserves, therefore, to be noted in the history of agricultural science and education. The resolution of the Board, establishing this Station, on June 8th, 1882, is published in the appendix to this Report. It states that the object of the

Experiment Station was to be "the promotion of the agricultural interests of Tennessee by practical and scientific experimentation and investigation."

The General Assembly of the State passed an Act providing for fertilizer inspection and analysis and devoted a part of the license tax collected on this account to the support of the Experiment Station, which was charged, in turn, at the same time, with the duty of analyzing samples of fertilizers and other things of interest to the farmers of the State. This tax yielded only a very small revenue, varying from \$700 to \$1,000 per annum. Your Board of Trustees had very limited funds from other sources which could be devoted to this purpose and the Station, as a result, suffered severely from want of means from that time, until its re-organization under the "Hatch Experiment Station Act."

In spite of these disadvantages, however, the Station was organized with a Board of Control, Director and Chemist, and did a considerable amount of most excellent work. During this period, three reports of 150 to 200 pages each, which gave the results of the experimental work, consisting, for the most part, of field and feeding experiments, were published, and attracted most favorable attention. They were highly appreciated by the farmers and eagerly sought for and read.

When the Act of Congress referred to was passed, in March, 1887, it was believed that it carried the necessary appropriation with it and that the Experiment Station could be organized at once. Much to the surprise of the friends of the Act, but, as it appeared later, most wisely and properly from a legal standpoint, the Comptroller of the Treasury ruled that a separate provision would have to be made in the regular appropriation bills of Congress for the support of these Stations. As this had not been done by the Congress just adjourned, it was necessary to wait until the next session of Congress. So it was that, though your Board organized the Tennessee Experiment Station under Act of Congress in July, 1887, it had to suspend its proceedings in large part until the Spring of 1888, when the first funds were actually received under the Act.

Desiring to do all you could under the circumstances, it was determined however, in September, 1887, to place two other men on the Station staff and to begin to make plans and preparations for its work. The services of Professor Charles S. Plumb, who at that time filled the position of Assistant Director of the New York Agricultural Experiment Station, at Geneva, one of the oldest and most famous of these institutions, were secured for the proposed Division of "Field and Feeding Experiments," and Mr. C. L. Newman, originally an Assistant at the Alabama Agricultural

Experiment Station, was engaged as Assistant. Professor Plumb entered upon his duties on the 15th of October, 1887, and Mr. Newman on the 1st of September. Such experimental work as could be carried on with the very limited means supplied by the University, were undertaken at once, but the time of the Station staff, as then organized, was occupied for the most part in making plans and looking up men for the work of the extensive bureau which was established in the following spring. These Reports will show that no time was lost in making these arrangements, and that considerable work was done with very limited means.

The old Experiment Station of the University of Tennessee had never had any building, or even apartments, of its own, no laboratories or scientific apparatus, no stock or utensils, no land or equipments of any kind. It occupied such rooms in the University buildings as could be provided for it, and used the instruments, stock and land of the Agricultural College, free of rent. Analyses were made by the Chemist in the close quarters afforded by the College laboratory.

An Experiment Station of the kind projected in the Act of Congress, could not possibly be carried on in such quarters and under such circumstances. It must have a building for Chemical, Botanical and Biological Laboratories, for a Library and for offices and workrooms. It should have stables, plant and tool houses, and other experimental farm buildings. Facilities for strictly scientific work were the first to be provided.

The friends of the Experiment Station Act found no trouble in getting Congress to pass a bill, at a remarkably early date, which made the funds for the Station available about the 1st of March, 1888. In anticipation of this, the plans for an Experiment Station building, to contain the required laboratories and offices, were made, so that the building could be commenced promptly upon the receipt of the funds. A number of the leading scientific men of the country were consulted about the plans for the building, and they were drawn by Mr. Charles L. Carson, of Baltimore, who was the architect of some of the John Hopkins University laboratories.

The University had undertaken to erect a building for its Agricultural Department some years before. This was a simple structure of brick 30x60 feet, two stories high, and divided off into two apartments below and one above, which were connected by a large hall and staircase. This building had never been entirely completed, though it was occupied by the Agricultural Department for several years. It was decided to make a large and handsome addition to this building and complete it for the exclusive uses of the Experiment Station and the Agricultural Department of the

University. The addition was to be two stories, 60x40 feet over an ample basement, the whole to be nicely finished and fully supplied with the best gas, water, steam heating and ventilating fixtures. It was to contain the following apartments: On the first floor, a large lecture room, library and reading room; three offices and three chemical laboratories, with instrument and store rooms connected, besides halls. On the second floor, a large museum; two botanical laboratories, and a room for cultures; two biological and entomological laboratories; a dark room for photographic work; with the necessary halls and entrances. For full description of this building, with the plans and illustrations, you are referred to Bulletin No. 2, July, 1888.

Only \$3,000 of the first year's appropriation to the Experiment Station could be used, according to the Act of Congress, for a building or repair of buildings, but your Board wisely determined to make every sacrifice to put the Experiment Station at once upon a good basis and provided additional funds, completing the building as planned, which gave us altogether \$6,800. It was evidently the belief of Congress that the State should and would supply the additional means necessary to put up proper Experiment Station buildings, just as they were required to supply the means for buildings for the agricultural colleges. It is hoped and believed, therefore, that the General Assembly of Tennessee will reimburse your Board for the additional expenditures incurred in completing this building for the Experiment Station.

The corner-stone of the new building was laid by the President, and members of the Tennessee Farmers' Association while in session in Knoxville, in May, 1888; and the building was finished about the first of November following. It was furnished and occupied in time to entertain the Annual Convention of American Agricultural Colleges and Experiment Stations, which met in its halls on the 1st of January and continued in session until the 5th. The fact that this distinguished body of men, representing all of the Land-grant Colleges of the country, in addition to all of the newly established experiment stations, came here to visit us and then heartily approved of, and commended our plans, as shown in the building and its equipment, is very encouraging to us. The meeting which assembled contained representatives from all the colleges and experiment stations in the country with the exception of eight, and all the States east of the Mississippi, with the exception of Florida. It is believed that their presence here and the information and advice secured at this meeting must prove of very great benefit to us, and through us to the farmers of Tennessee.

As in regard to the building, so in regard to apparatus and other equipments—your Board was determined to lay the founda-

tion broad and strong for the great institution. Believing that it was to be a permanent one and that the work must grow until it covers many of the agricultural interests of Tennessee, it was decided to build it up on a liberal plan and to use a very large proportion of the first appropriation in providing scientific apparatus, books, furniture and the other necessary facilities for the highest scientific work.

The Station was organized with a Director and four sub-departments or Divisions, arranged to represent the leading lines of agricultural investigation. These Divisions are :

I. *The Division of Field and Feeding Experiments.* Prof. Charles S. Plumb, a graduate of Massachusetts Agricultural College, at one time assistant Editor of the *Rural New Yorker*, and more recently Assistant Director in charge of the same line of work at the New York Agricultural Experiment Station at Geneva, was placed in charge of this Division.

II. *The Division of Chemistry.* Dr. W. E. Stone, a graduate of the Massachusetts Agricultural College, at one time in charge of Houghton Farm Experiment Station, then Assistant Chemist and Biologist of the Massachusetts Experiment Station, and a graduate of the University at Göttingen, in Germany, was chosen to take charge of this Division.

III. *The Division of Botany and Horticulture.* Prof. F. Lamson Scribner, a graduate of the Maine State College, eight years professor in Girard College at Philadelphia; Botanist of the Transcontinental Survey, and recently in charge of the Section of Vegetable Pathology of the Department of Agriculture at Washington, was secured to take the direction of this Division. Professor Scribner was decorated on the first of January, by the President of the French Republic, with a membership in the Legion of Honor. This was for his discovery of remedies for the diseases of the grape, and in recognition of his services to the French Government in connection therewith.

IV. *The Division of Entomology.* To take charge of this Division, the services of Professor Henry E. Summers, a graduate and Fellow of Cornell University, were secured. Professor Summers was a student of the well-known Entomologist, Professor Comstock, formerly of the Department of Agriculture at Washington, and has served as instructor in Veterinary Science in Cornell University.

As general assistant in the Experiment Station, Mr. C. L. Newman, a graduate of the Agricultural and Mechanical College of Alabama, and an assistant for several years at its Experiment Station, was selected.

Although other subjects of investigation might have been

undertaken, it was found that these Divisions were the most important for Tennessee, and that it would be wiser to first provide well for these, than to crowd the Station with numerous offices, or Divisions, some of which could not be adequately sustained. As has been stated, Professor Plumb and Mr. Newman commenced work in connection with the Station during the Fall of 1887; the other gentlemen could not be secured, as they were already under engagements, until the Summer and Fall of 1888. Their salaries commenced from the time they entered upon their active duties, although these gentlemen rendered us valuable services before these dates, in connection with the plans for the building and laboratories and the purchase of apparatus.

DIVISION OF FIELD AND FEEDING EXPERIMENTS.

This Division was organized, as has been said, in October, 1887, and at once addressed itself to making preparations for its future work. To start with, the Division inherited from the University very little in the way of good buildings or equipment. It was decided to make the Experiment Station a sort of tenant of the University, rather than burden it with a lot of buildings, stock implements, etc., for which it might have no permanent use after the given experiments were completed. On the plan adopted, this Division is to use such land on the College farm as it may select, free of rent; to have the use of teams and implements belonging to the farm, at a fair rental and at such times as shall not interfere too seriously with the interests of the farm. Similarly, the Division is to use the College farm stock for feeding experiments, or experiments in breeding and milk production, without charge, unless it should turn out that they are injured or killed in this work. Managing in this manner, it was not necessary for the Experiment Station to buy any considerable amount of stock, implements, or general farm equipment. So far the Experiment Station only owns one horse, which it used in its business, and a limited number of tools, which are used only in the Horticultural Department.

Much time last fall, winter and spring, was consumed in making preparations for future field and feeding experiments. The Division also had charge of the Horticultural Department. The land for this was prepared last winter and 260 varieties of small and large fruits were set out. A tool and seed house was erected upon these grounds and the old plant house of the University was thoroughly overhauled and repaired (at the expense of the University) so as to be used for experimental work. Although the largest part of the time of the officer in charge has been occupied with making these preparations and plans for the future,

considerable good work has been done, as will be shown by the Bulletins herewith.

DIVISION OF CHEMISTRY.

The chemist's first duty was to select and purchase chemical and other apparatus and books for the Experiment Station in Germany. He was occupied one month in this way during last summer. Arriving here on the 1st of September, he addressed himself immediately to arranging his laboratory for work. This was done as promptly as possible, and he has since been occupied in analyzing samples accumulated upon the hands of the Experiment Station during the period that it was without a laboratory. His report will give a full account of the work done to date.

DIVISION OF BOTANY AND HORTICULTURE.

Some preparations were made by the Division of Field and Feeding Experiments for this Division before the arrival of Professor Scribner, on the 1st of November. During the brief time that he has been here, Professor Scribner has arranged his laboratories, prepared a paper on the "Weeds of the Farm," which was published in the last Bulletin, and has commenced an investigation of the rot of the sweet potato; and made preparations for a grass and forage garden, for an investigation of the fungus diseases of the strawberry, and for other promising pieces of work. The last named investigation, that of the strawberry, will be in the hands of Mr. C. L. Newman, Assistant. For description of the botanical laboratory and its equipments, the reader is referred to the report of this Division.

DIVISION OF ENTOMOLOGY.

Professor Summers, chief of this Division, went to work on the 1st of August, to arrange his laboratories and make collections for future use. As he has to do a moderate amount of work and instruction in the Agricultural Course of the University, his time is so arranged that he can do this work during the fall and reserve his time in the spring and summer for the investigation of insect depredations. He has already secured a considerable collection of insects of interest in agriculture, and commenced a number of most important investigations; among the latter are investigations upon the insects injurious to cabbages and plum trees in this locality, with the remedies to be used against them.

We found it somewhat difficult to get farmers interested, at first, in the work proposed to be done here for them, but by attending farmers' meetings, and advertising the work of the Experiment Station through the columns of newspapers and supplements to

newspapers, we are succeeding now in getting up a large list of names and post-offices of farmers with whom we shall correspond and to whom bulletins and reports will be regularly mailed.

Three Bulletins have been published, one in April, one in July, and one in October. A copy of each accompanies this report.

Respectfully submitted,

CHAS. W. DABNEY, JR., *Director.*

REPORTS FROM DIVISIONS.

I. REPORT FROM THE DIVISION OF FIELD AND FEEDING EXPERIMENTS.

Owing to the work of organization during the year 1888, and the fact that the Experiment Station staff proper, did not assemble here until late in the year; and further, as I was the only person on the ground during most of this time, when I was largely engaged in executive work, there is but little experimental work to report upon.

HORTICULTURAL FIELD WORK.

In the fall of 1887, the hill-side south of the Station building, then unbroken, was plowed and fitted for an orchard. Two hundred and fifty-nine varieties of standard fruits, received from one of the most reliable nurseries in the United States, were planted. They embrace the following number and varieties for each kind:

Apples, ...	50	Figs, ...	3
Pears (standard), ...	28	Almonds, ...	2
Pears (dwarf), ...	22	Quinces, ...	4
Peaches, ...	42	Currants, ...	12
Nectarines, ...	3	Gooseberries, ...	6
Apricots, ...	25	Blackberries, ...	6
Cherries, ...	25	Raspberries, ...	14
Plums, ...	32		
Total, ...			259

At the College farm, on a level clay-loam was planted 25 varieties of strawberries in the spring of 1888. These varieties have flourished as a rule, and will fruit the coming season. For most of plants we are indebted to the New York and Ohio Agricultural Experiment Stations.

In addition to the above, a few varieties of vegetables were planted at the farm, but owing to lack of assistance, no notes were taken concerning the special features of each, such as would give results suited to this report.

FIELD EXPERIMENTS.

A reasonable amount of field work was attempted, in plat experiments, some of which will be reported upon, on the completion of the chemical analyses..

Twenty plats, of one-eighth acre each, were planted to varieties of grasses and clovers, on broken sod, on a hill-side. The seed

from these did not generally germinate well; while crab grass later in the season came up in such profusion as to completely destroy all seed which had germinated.

A large number of varieties of sorghums were planted for sugar test, but owing to the delay attending the completion of the chemical laboratory, could not be analyzed.

On October 31st, forty varieties of wheat were planted in plats 10x10 feet, and about fifteen plats planted by various methods. On the further College farm, five plats were planted to wheat on land very much impoverished of plant food. No manure was applied, as it was thought best to ascertain, if possible, their productive power the first year without manure. After this year, they will be kept in permanent wheat experiments, and the same manures applied to each plat with each succeeding year.

FEEDING EXPERIMENTS.

During the months of December, 1887, and January, February and March, 1888, two sets of feeding experiments were in operation, one upon six steers, to show the influence of food upon growth, and one upon six milch cows, to show the influence of food upon milk production.

Considerable work has been done in the way of dehorning cattle, which is reported upon in Bulletin No. 1 of the Station.

In Bulletin 2 may be found a report upon germination of seed-corn.

At the present time, two sets of experiments are in progress in the College green house, with manures, to determine in one case the influence of manure on flower production and quality, and in the other case to note the effect of fertilizers upon foliage plants.

C. S. PLUMB.

II. REPORT FROM THE DIVISION OF CHEMISTRY.

The following report, relating to the Division of Chemistry of the Tennessee Agricultural Experiment Station, during a part of the year 1888, is respectfully submitted:

My official appointment as Chemist of this Station was received in May, 1888; active duty at Knoxville began on the 10th of the following September. That part of the Experiment Station building assigned to the use of this Division was found in an unfinished condition. My first efforts were therefore directed toward fitting up and equipment of the laboratory, which occupied the time until December 1st.

As completed, the laboratory now embraces five rooms, viz: two general work rooms, a combustion room, balance room and

store-room, the arrangement of which is shown by the floor plan. (See Bulletin 2.) The main work room is 16x23 feet in dimension with four windows looking toward the south and west. The west side of the room is occupied by the working desk twenty-three feet in length, along which are distributed fourteen gas cocks, two sinks, with four water cocks, and an opening into the ventilating flue. On the opposite, inner, side of the room, arranged on each side of the ventilating stack is a large enclosed hood (built from plans by Prof. C. E. Wait) with a frontage of about twenty-two feet. By means of this hood, and openings into the chimney flues from near the ceiling, the ventilation of the room is in the highest degree satisfactory.

Connecting with this main laboratory is the balance room, 7x8 feet, also used as an office. The balance table consists of a heavy oak slab resting on a solid brick pier which rises from the foundation of the building. Adjoining this is a store-room 7x9 feet, fitted with shelving for the reception of apparatus, reagents and samples. The combustion room, 9x14 feet in dimension, is supplied with a stone table and ventilating hood, working table and sink. The second working laboratory, size 12x18 feet, is detached from the other rooms, and, like the main room, well supplied with gas, water, working desk and ventilating hood.

The laboratory has been arranged with the primary aim of obtaining abundance of light, air, gas and water, with working space for four people; in short, all the necessary conveniences for the ordinary lines of agricultural chemical investigation, with opportunities for enlargement and special modification, as subsequent work may require.

The apparatus was purchased by me of Gerhardt and Co., of Bonn, Germany, and imported duty free. In this way a considerable sum of money was saved. The same idea was carried out in the selection of equipment, as in the fitting up of the laboratory, viz: to secure an abundance of the staple necessities, leaving the purchase of complicated and special apparatus until actually required. Among the articles purchased may be mentioned: a fine Sartorius' balance, short-armed, with aluminium beams, patent compensating hangers, and latest improvements; a Laurent's polariscope, made by Schmidt and Haensch, of Berlin; a Westphal's specific gravity balance; complete sets of apparatus for nitrogen determinations according to Kjeldahl, Will-Varrentrap, and the "absolute" method; a Bunsen combustion furnace; a Wiesnegg muffle; water-blast lamp, according to Beutell; full sets of reagent bottles, with indestructible labels—black letters on white background—burned into the glass; collection of platinum dishes and crucibles; supply of combustion tubing and

filter papers, and a variety of ordinary glass and porcelain articles.

The report of work performed covers only the month of December, hence must be brief. The relation of the Station to the State Fertilizer Inspection, requires the analysis of samples of commercial fertilizers sold within the State, at this place. The samples which had accumulated at the opening of the laboratory, engaged my immediate attention, and up to date, twelve have been analyzed. As soon as this work has been completed, plans have been prepared for a systematic chemical investigation of some of the staple crops of the State, and the study of certain questions connected with dairying. These, with the general investigation of forage crops, and the variety of incidental work constantly arising, will, it is thought, fully occupy the attention of this Division during the coming year.

WINTHROP E. STONE, PH. D., *Chemist.*

III. REPORT FROM THE DIVISION OF BOTANY AND HORTICULTURE.

The rooms of the Botanist, who assumed charge of his Division November 1, are on the second floor of the Station building and consist of a well lighted laboratory, 16x27 feet, provided with heat, gas and water, and a culture room 9x13 feet, connected with the laboratory by a vestibule. The culture room is not fully completed but will be as soon as the requirements of the Station make it necessary. The room is designed for the propagation by artificial cultures, of fungi injurious to vegetation, for the purpose of investigating and determining their habits and life histories. This work relates to the investigation of the diseases of plants which is especially called for in the Hatch bill.

In the laboratory are desks and work-tables adapted to the special uses of the Division. The microscopical outfit consists of a Zeis' dissecting microscope and a II^a compound stand provided with a AA, ordinary, and two apochromatic objectives with a full series of compensating eye-pieces. A small hand and a large microtome, turn-table, camera lucida and dissecting instruments, together with bell-jars, hot air sterilizer and thermometers, are some of the accessories already purchased.

Many of the leading works on vegetable morphology and physiology, vegetable pathology, and systematic botany, have been secured for the library during the past season. Among these are the publications of Sachs, DeBary and Goebel; Bentham and Hookers, *Genera Plantarum*; Winter's *Pilze*; Saccardo's *Sysloge Fungorum*; Sorauer's *Pflanzen Krankheiten*; Frank's *Die*

Krankheiten der Pflanzen, etc. The leading American, English and French botanical and microscopical journals have been subscribed for and are now being received.

The Division is provided with a fine collection of seeds, embracing over one thousand varieties, and, by a recent purchase of the University, has access to the large and most excellent herbarium of Dr. Gattinger, of Nashville, which includes nearly all the flowering plants and ferns native to the State. For the proper determination of the many fungi which infest the higher plants, particularly the cultivated and ornamental species, it is imperative to have at hand for comparison large and authoritatively named collections. Such collections of fungi are on sale both in this country and in Europe, and by the expenditure of a few hundred dollars the Station could become fairly well equipped in this direction. At present the funds of the Station are insufficient to meet this expense, but as these collections will be of equal value to the University as affording means of instruction to its students, it is hoped that the State will provide the funds necessary for this purpose. The importance of these collections of plants cannot well be overestimated; they are alike useful to the scientific investigator and the student, and are equally valuable with books. They fill a place which the best stocked library cannot fill and afford a knowledge of the objects they illustrate which the clearest writer cannot impart.

The private collection of grasses of the Botanist, which is unsurpassed in completeness, save in two or three of the public herbaria of the country, has been placed in the Station building, where it will be available for the investigation of this important order of plants.

Upon assuming the duties of his Division, the Botanist at once began an investigation of the weeds growing on the University farm and grounds, the results of which formed the basis for Station Bulletin No. 3.

Arrangements are now being made for investigating the grasses and forage plants of the State, with the view of determining what they are; their distribution and prevalence; their value for hay or for grazing, and the diseases with which they are affected. In conjunction with this work, it is contemplated to introduce native species of promise from other parts of the country, to test their adaptability to our soil and climate.

If found possible to do so, the work of the Division the coming season will also embrace the investigation of some one or more of the fungus diseases which so seriously affect many of our cultivated crops. For the investigation of the grasses, and for doing a limited amount of work on the injurious fungi, the Division is well equipped.

F. L. SCRIBNER.

IV. REPORT FROM THE DIVISION OF ENTOMOLOGY.

Since assuming his duties August 1st, 1888, the Entomologist, being employed by both University and Experiment Station, has devoted himself largely to University work, with the idea of giving the major portion of his time to Station work when it is most valuable for that purpose, namely, during the spring and summer months. However, the Division of Entomology, of the Experiment Station, has been placed on a good basis for beginning active investigations with the commencement of insect depredations in the spring. The Division occupies an office and laboratory, 16x16 feet, fitted with a special table for microscopic work, and other ordinary office furniture. Connected with this laboratory is a photographic dark-room, 7x7 feet. Also connected with the office is a large laboratory used for students, but which is, so far as it may be needed, at the disposal of the Station. In it are the Station insect spreading boards, in a pest tight cupboard, the cupboard for chemical reagents for microscopical work, room for collections, etc. The apparatus already on hand comprises a Leitz microscope, with three objectives, the highest a $1\frac{1}{2}$ inch, oil immersion, three oculars, one with micrometer, Abbe condenser and Zeiss camera lucida; a Bauch & Lomb dissecting microscope; turn-table; equipment for collecting, preparing and preserving insects. Plans for a complete outfit of breeding cages, etc., are prepared, and it is hoped the funds of the Station will be sufficient for obtaining them.

A beginning was made, during the autumn, toward a collection of the insects of the State. This will be enlarged as rapidly as possible, as such a collection accurately named and as complete as practicable, is absolutely necessary in order that a large part of the work of the Entomologist may be expeditiously performed.

In addition to the special lines of investigation to be pursued the coming season on the experimental grounds and the laboratory, the Division is prepared to answer questions concerning the habits of, and, to give information regarding the best known remedies to be applied for injurious insects, provided specimens are sent to the Station for examination.

H. E. SUMMERS.

REPORT OF THE TREASURER.

*The Agricultural Experiment Station of the University of Tennessee,
in Account with the United States:*

Dr.	Cr.
1886-87. To appropriation for the fiscal year ending June 30, 1888, ... \$15,000 00	By Salaries paid, ... \$4,187 46
	" Field Experiments, ... 259 73
	" Experiment Farm Sup- plies, ... 550 50
	" Traveling Expenses, ... 248 64
	" Field and Feeding, ... 565 65
	" Printing and Publishing, ... 339 25
	" Labor, ... 1,186 74
	" Office Expenses, ... 1,053 68
	" Furniture and Equipm't, ... 282 68
	" Apparatus and Supplies (including Library), ... 3,325 67
	" Building, ... 3,000 00
\$15,000 00	\$15,000 00

R. CRAIGHEAD, *Treasurer.*

This is to certify that, as the authorized Auditing Committee of the Board of Trustees of the University of Tennessee, we have examined the accounts of the Treasurer of the Agricultural Experiment Station for the fiscal year ending June 30th, 1888, and find them correct; that the above is a true balance sheet corresponding with the said accounts; that the said accounts show that the sum of three thousand dollars and no more was expended for building, and that there is no cash balance.

H. L. McCLUNG,

F. A. R. SCOTT,

SAM. B. LUTTRELL,

Auditing Committee.

We hereby certify, that Messrs. H. L. McClung, F. A. R. Scott and Sam. B. Luttrell are the authorized Auditing Committee of this Board of Trustees.

CHAS. W. DABNEY, JR.,

President of the University of Tennessee.

S. H. SMITH, *Secretary.*

APPENDIX A.

ACTION OF THE BOARD OF TRUSTEES OF THE UNIVERSITY.

The following action of the Board of Trustees was taken June 8th, 1882:

In order to increase the efficiency of and give wider usefulness to the Agricultural Department of the University of Tennessee, and bring it into closer relations with the farming interests of the State, by affording to the Commonwealth the advantages to be derived from the practical results of experiments persistently prosecuted through a series of years, the Board of Trustees hereby establishes and inaugurates, upon the College Farm, an Experiment Station, which shall be a distinct department for the promotion of the general interests of agriculture in Tennessee.

1. This department shall be conducted under the general management of a committee of the Board of Trustees, which shall be denominated "The Board of Control," and shall consist of five members, who shall be elected annually by the Board of Trustees. The Board of Control, in addition to the duties that shall be devolved upon it touching the Experiment Station, shall also discharge the duties heretofore appertaining to the Farm Committee, which is hereby abolished.

2. The work of the Experiment Station shall be under the administration of a Director, who shall be charged with the oversight and conduct of the experiments, investigations, etc., contemplated in the erection of the Station.

3. The Experiment Station shall be furnished with a chemist as assistant to the Director, to whom the chemical part of the work, especially of analysis, shall be entrusted.

4. The Director and Chemist shall be under the supervision of the Board of Control and directly responsible to the Board of Trustees, and the work required in the prosecution of the business of the Station shall not interfere with the discharge of any of the duties appertaining to the professional chairs of any members of the Faculty who may hold positions in the Station.

5. The accounts of the Station for all experimental work shall be kept separate and distinct from those of the Farm as far as practicable.

6. As the object of the Experiment Station is to be the promotion of the agricultural interests of Tennessee, by practical and scientific experimentation and investigation, the Station shall hold

itself ready to make for the citizens of Tennessee analyses of seeds, fertilizers, soils, minerals, etc., under the following conditions, viz:

The results must promise to promote the cause of agricultural progress, to prove of interest to the public, and be free for publication. Such experiments or analyses shall be made without charge, provided, the samples furnished are made in accordance with the instructions that will be furnished on application. Botanical determinations, analyses of drinking waters and other work of benefit to the public, will fall under this head.

No more work shall be done by the Station than the means of of the University will allow.

All analyses shall be made in the order of the arrival of the samples and at the discretion of the authorities of the Station.

Examinations and analyses for the benefit of private parties will be made on reasonable terms.

The Board of Control shall elect their own Chairman.

The details of the practical working of the Experiment Station is committed to the Director, subject to the approval of the Board of Control.

Appropriations of money for the prosecution of the ends of the Station shall only be made by the Board of Trustees.

APPENDIX B.

THE SO-CALLED "HATCH EXPERIMENT STATION ACT."

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science, there shall be established, under the direction of the college or colleges, or agricultural department of colleges, in each State or Territory established, or which may hereafter be established, in accordance with the provisions of an act approved July 2, 1862, entitled, "An act donating public lands to the several States and Territories which may provide colleges for the benefit agriculture and the mechanic arts," or any of the supplements to said act, a department to be known and designated as an "Agricultural Experiment Station;" *Provided,* That in any State or Territory in which two said colleges have been or may be so established the appropriation hereinafter made to such State or Territory shall be equally divided between such colleges, unless the legislature of such State or Territory shall otherwise direct.

SEC. 2. That it shall be the object and duty of said Experiment Stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotating cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each be deemed advisable, having due regard to the varying conditions and needs of the respective States or Territories.

SEC. 3. That in order to secure, as far as practicable, uniformity of methods and results in the work of said Stations, it shall be the duty of the United States Commissioner of Agriculture to furnish forms, as far as practicable, for the tabulation of results of investigation or experiments; to indicate, from time to time, such lines of inquiry as to him shall seem most important; and, in general, to furnish such advice and assistance as will best promote the purposes of this act. It shall be the duty of each of said Stations, annually, on or before the first day of February, to make to the Governor of the State or Territory in which it is located, a full and detailed report of its operations, including a statement of receipts and expenditures, a copy of which report shall be sent to each of said Stations, to the said Commissioner of Agriculture, and to the Secretary of the Treasury of the United States.

SEC. 4. That bulletins or reports of progress shall be published at said Stations at least once in three months, one copy of which shall be sent to each newspaper in the States or Territories in which they are respectively located, and to such individuals actually engaged in farming as may request the same, and as far as the means of the Station will permit. Such bulletins or reports and the annual reports of said Stations shall be transmitted in the mails of the United States free of charge for postage, under such regulations as the Postmaster General may from time to time prescribe.

SEC. 5. That for the purpose of paying the necessary expenses of conducting investigations and experiments, and printing and distributing the results, as hereinbefore prescribed, the sum of fifteen thousand dollars per annum is hereby appropriated to

each State, to be especially provided for by Congress in the appropriations from year to year, and to each Territory entitled under the provisions of section eight of this act, out of any money in the Treasury proceeding from the sales of public lands, to be paid in quarterly payments, on the first day of January, April, July and October in each year, to the treasurer or other officer duly appointed by the governing boards of said college to receive the same, the first payment to be made on the first day of October eighteen hundred and eighty-seven; *Provided, however,* That out of the first annual appropriation so received by any station an amount not exceeding one-fifth may be expended in the erection, enlargement or repair of a building or buildings necessary for carrying on the work of such station; and thereafter an amount not exceeding five per centum of such annual appropriation may be so expended.

SEC. 6. That whenever it shall appear to the Secretary of the Treasury, from the annual statement of receipts and expenditures of any of said stations, that a portion of the preceding annual appropriation remains unexpended, such amount shall be deducted from the next succeeding annual appropriation to such station, in order that the amount of money appropriated to any station shall not exceed the amount actually and necessarily required for its maintenance and support.

SEC. 7. That nothing in this act shall be construed to impair or modify the legal relation existing between any of the said colleges and the government of the States and Territories in which they are respectively located.

SEC. 8. That in States having colleges entitled under this section to the benefits of this act, and having also Agricultural Experiment Stations established by law, separate from said colleges, such States shall be authorized to apply such benefits to experiments at Stations so established by such States; and in case any State shall have established, under the provisions of said act of July 2d aforesaid, an Agricultural Department or Experimental Station, in connection with any University, College, or institution not distinctively an agricultural college or school, and such State shall have established or shall hereafter establish a separate agricultural college or school, which shall have connected therewith an experimental farm or station, the legislature may apply, in whole or in part, the appropriation by this act made to such separate agricultural college or school; and no legislature shall by contract express or implied disable itself from so doing.

SEC. 9. That the grants of money authorized by this act are made subject to the legislative assents of the several States and Territories to the purposes of said grants: *Provided,* that payments of such installments of the appropriation herein made as

shall become due to any State before the adjournment of the regular session of its legislature meeting next after the passage of this act, shall be made upon the assent of the Governor thereof, duly certified to the Secretary of the Treasury.

SEC. 10. Nothing in this act shall be held or construed as binding the United States to continue any payments from the Treasury to any or all States or institutions mentioned in this act, but Congress may at any time amend, suspend, or repeal any or all the provisions of this act.

APPENDIX C.

LAWS OF TENNESSEE, 1887.

AN ACT empowering the Treasurer of the University of Tennessee to accept and apply certain grants of money authorized by an Act of the United States Congress, approved March 3d, 1887, and entitled "An Act to establish Agricultural Experiment Stations in connection with the Colleges established in the several States under the provisions of an Act approved July 2d, 1862, and of acts supplementary thereto."

SECTION 1. *Be it enacted by the General Assembly of the State of Tennessee*, That the State of Tennessee hereby assents to the condition of An Act of the United States Congress, approved March 3d, 1887, entitled "An Act to establish Agricultural Experiment Stations in connection with the Colleges established in the several States under the provisions of An Act approved July 2d, 1862, and of Acts supplementary thereto," and authorizes the Treasurer of the University of Tennessee to accept any grants of money authorized by that Act in the State of Tennessee, and to give his official receipt for the same.

SEC. 2. *Be it further enacted*, That said grants of money to Tennessee shall, as a part of the Agricultural Fund, be committed to the Trustees of the University of Tennessee, now in charge of the State Experiment Station, there to be applied as the said Act of Congress directs, and all results and expenditures shall be reported in accordance with the provisions of the Act making the grants which is hereby accepted.

SEC. 3. *Be it further enacted*, That all laws in conflict with this Act be, and the same are hereby repealed.

Passed March 28th, 1887.

BOARD OF TRUSTEES OF THE UNIVERSITY OF TENNESSEE.

His Excellency ROBERT L. TAYLOR, Governor of Tennessee, *Ex-Officio*

Hon. JOHN ALLISON, Secretary of State, ... *Ex-Officio*

Hon. FRANK M. SMITH, Superintendent of Public Instruction, *Ex-Officio*

HUGH L. MCCLUNG.

Hon. O. P. TEMPLE.

FRANK A. R. SCOTT.

ROBERT A. R. ARMSTRONG.

S. H. SMITH, M. D.

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JAMES COMFORT, Esq.

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J. W. GAUT.

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WM. MORROW, M. D.

WM. B. REESE, Esq.

MOSES WHITE, Esq.

Hon. W. C. WHITTHORNE.

SAMUEL B. LUTTRELL.

ROBERT CRAIGHEAD.

JNO. M. FLEMING.

THE EXPERIMENT STATION.

BOARD OF CONTROL:

O. P. TEMPLE.

R. H. ARMSTRONG.

JAMES PARK, D.D.

R. CRAIGHEAD.

J. W. GAUT.

TREASURER:

R. CRAIGHEAD.

THE STATION COUNCIL:

ITS OFFICERS.