

ANNUAL REPORT

OF THE

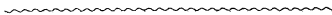
Agricultural Experiment Station,

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE OF ALABAMA

FOR

1889.



ALABAMA POLYTECHNIC INSTITUTE,
A. & M. COLLEGE,
AUBURN, ALA., Feb. 1, 1890. }

To His Excellency, THOS. SEAY,
Montgomery, Ala.:

SIR—I have the honor herewith, in accordance with Section 3 of the “Hatch Act,” accepted by joint resolution of the State Legislature, to transmit the Annual Report of the Agricultural Experiment Station of the A. & M. College for the year 1889.

Respectfully,
WM. LEROY BROUN,
President.

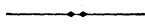
S31
'E23
no. 1-8
1888-96

MAY 28 '59

CONNELL AGRICULTURAL EXPERIMENT STATION.



BOARD OF VISITORS.



COMMITTEE OF TRUSTEES ON EXPERIMENT STATION:

- HON. J. G. GILCHRIST,
- HON. R. F. LIGON,
- HON. J. B. MITCHELL.



BOARD OF DIRECTION—OFFICERS OF THE STATION:

- W. L. BROUN President.
- J. S. NEWMAN Director and Agriculturist.
- N. T. LUPTON Vice-Director and Chemist.
- *P. H. MELL Botanist.
- GEO. F. ATKINSON Biologist.

ASSISTANTS:

- ISAAC ROSS, First Ass't Agriculturist in charge of Live Stock and Dairy.
- JAMES CLAYTON Second Assistant Agriculturist.
- J. T. ANDERSON, PH. D. First Assistant Chemist.
- L. W. WILKINSON, B. SC. Second Assistant Chemist.
- P. L. HUTCHINSON... .. Third Assistant Chemist.
- A. M. LLOYD, B. SC. Assistant Botanist.

* Prof. Mell has also charge of Meteorological Observations.

THE HATCH ACT.

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 second, eighteen hundred and sixty-two, and of the acts supplementary thereto.

Be it enacted in 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 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 second, eighteen hundred and sixty-two, 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," 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 such colleges have been or may be so established, the appropriation hereinafter made to such States 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 rotative 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 case 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 and 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 specially 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 equal 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 colleges 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 or 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 second aforesaid, an agricultural department or experimental station, in connection with any university, college or institution not distinctly 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 of such State 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 assent 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 the 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.

Approved, March 2, 1887.

ORGANIZATION OF THE ALABAMA AGRICULTURAL EXPERIMENT STATION.

The Board of Trustees of the Agricultural and Mechanical College, met in Montgomery February 24 and 25, 1888, and organized the Agricultural Experiment Station under the provisions of the "Hatch act," as follows:

1. In accordance with the act of Congress, approved March 2d, 1887, to establish experiment stations in the several States, the Governor of this State having given his certified assent to the purposes of the grant, as required in the act, there is hereby established under the provisions of said act, for the purposes therein named, the experiment station of the Agricultural and Mechanical College, of Alabama; and said station is hereby made a department of the Agricultural and Mechanical College, and as such shall, as other departments, be under the general supervision of the president of the college.

2. All moneys received from the United States Treasury under the aforesaid act of Congress, shall be faithfully used for the purposes designated in said act.

3. The president of the college shall present in his annual report to the trustees such recommendations as in his opinion will promote the efficiency of the station; and to him all reports of the several departments of the station shall be made.

4. The president of the college and such other officers attached to the station, as may be appointed by the trustees, shall constitute a board of direction, and to said board all subjects relating to the experiment station shall be referred. And in order to secure unity of purpose in research, the board of direction shall confer together and determine the experimentation and research which shall be undertaken, and adopt each year a definite line of work; it being provided the work undertaken shall, as far as possible, have reference to questions of practical interest to the farmers of Alabama. The board shall meet at regular periods, and at any time subject to the call of the president, and shall keep a record of its proceedings.

5. A member of the board of Direction shall be appointed by the trustee officer in charge; who in addition to the special duties of the station to which he may be assigned, shall conduct the general correspondence incidental to the work of the station.

6. It shall be the duty of the station to examine free of charge articles relating to agriculture, sent by citizens of the State, when of public utility, under such regulations as may be prescribed, and to perform all duties now required of the experiment station established at the college by the trustees under the law of the State.

7. No officer of the station shall engage in any occupation, or accept any position that will in any manner interfere with the faithful performance of his duties; and no property of any character belonging to the experiment station shall be used for private purposes.

8. All proceeds arising from sales from the proceeds of the farm shall be paid to the Treasurer of the College, who shall account for the same to the trustees; and when the Director receives any money from farm products, he shall make an itemized statement in writing from what source such money is received, which statement shall, with the money, be turned over to the Treasurer, and no money shall be paid to the Director unless upon warrant signed by the President of the College.

9. A committee of visitors composed of three trustees shall be appointed, who shall during the year, as often as they may deem necessary, visit and inspect each department of the experiment station, and make a special report at the annual meeting of the Board, and no permanent improvement shall be constructed without the approval of the committee.

10. The organization of the experiment station herein provided for shall take effect April 1st, 1888, and continue so long as the act of Congress remains in force; and the Agricultural and Mechanical College receives the money therein appropriated.

ASSENT OF THE STATE LEGISLATURE.

Joint Resolutions of the State Legislature to Give Assent to the Purposes of the Grant made, by the Act of Congress, to Establish Agricultural Experiment Stations in Connection with the Land Grant Colleges.

WHEREAS, The Congress of the United States having passed an act, approved March 2, 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 2, 1862, and of the act supplementary thereto," and

WHEREAS, It being provided in said act "That the grants of moneys authorized by this act are made subject to the legislative assent of the several States and Territories, to the purposes of said grants;" therefore be it—

"Resolved, By the House of Representatives, the Senate concurring, That the assent of the General Assembly of Alabama is hereby given to the purposes of the grants made in said act of Congress; and that the trustees of the Agricultural College of Alabama, at Auburn, are hereby authorized and directed to comply with the terms and conditions expressed in the act aforesaid."

Approved, February 27th, 1889.

The following is from the act of Congress, making the appropriation for the Agricultural Experimental Station for the fiscal year ending June, 1890, and for other purposes.

The section making the appropriation has this *proviso*:

"Provided, That as far as practicable, all such stations shall devote a portion of their work to the examination and classification of the soils of their respective States and Territories, with a view to securing more extended knowledge and better development of their agricultural capabilities."

Approved March 2, 1889.

TREASURER'S REPORT

For the year ending July 1st, 1889.

The Agricultural Experiment Station of the A. & M. College of Ala.,
In account with U. S. Treasurer:

RECEIPTS.

To amount of appropriation.....\$ 15,000

DISBURSEMENTS.

By amount paid salaries.....	\$ 7,970 71
Equipment farm department.....	400 36
“ chemical department.....	384 37
“ botanical department.....	735 92
“ biological department.....	2,260 46
“ dairy department....	168 41
Uniontown station.....	2,000 00
Printing.....	648 23
Library.....	188 18
Trustees.....	52 27
Traveling expenses of officers....	89 35
Arboretum.....	47 12
Stationery.....	22 85
Postage.....	31 11
Balance.....	66—\$ 15,000

E. T. GLENN, Treasurer,
A. & M. College.

AUBURN, ALA., February 1, 1890.

I, the undersigned, duly appointed auditor for the corporation, do hereby certify that I have examined the books and accounts of the Agricultural Experiment Station of the Alabama Agricultural and Mechanical College for the fiscal year ending June 30th, 1889, and have found the same well kept and correctly classified as above; and that the receipts for the above named are shown to be \$15,000.00 and the corresponding disbursements \$14,999.34; there being a balance of 66 cents to be accounted for in the fiscal year ending June 30th, 1890. All the proper vouchers are on file and have been by me examined and found correct,

F. M. REESE, Auditor.

AUBURN, ALA., February 1, 1890.

I hereby certify that the foregoing is a true copy from the books of account of the Agricultural Experiment Station of the Agricultural and Mechanical College of Alabama.

E. T. GLENN, Treasurer.

AUBURN, ALA., February 1, 1890.

I hereby certify that E. T. Glenn is Treasurer of the Agricultural and Mechanical College of Alabama, and that the above is his signature.

WM. LEROY BROWN,
President Alabama Agricultural and Mechanical College.

REPORT OF DIRECTOR.

J. S. NEWMAN, DIRECTOR AND AGRICULTURIST.

Since the last annual report, the work of the station has been more thoroughly systematized—a more complete co-ordination of the forces of the different departments has been effected.

The work of the year 1889 has been partly printed in seven bulletins, covering more than 250 pages, from which the following abstract is made.

Bulletin No. 3, January, 1889, reported experiments with corn, sweet potatoes, ground peas, turnips, and grapes, analyses of fertilizers, soils, feed stuffs, a continued classification and description of the woods of the State, and a meteorological report.

Bulletin No. 4 contains practical instructions for the cultivation and management of strawberries, grapes, and raspberries.

Bulletin No. 5 contains experiments with fertilizers under cotton, a comparison of the productiveness and general merits of different varieties of cotton, and an inquiry as to the needs of typical soils of the State. These were collected, soil and subsoil, placed under identical circumstances, and treated with different elements and combinations of elements of plant food, and the response in the growth and productiveness of the cotton plants noted. It also contained results of experiment in pig feeding, description of barn and dairy, the report of experiments with different home products as butter producers, analyses of soils, fertilizers and feed stuffs, and a report of the temperature of the soil at depths from one inch to ninety inches, and atmospheric conditions and rainfall.

Bulletin No. 6 embodies a report of the Botanist upon "grasses and their cultivation," with an account of their economic value as shown by their nutritive constituents found by chemical analyses.

Bulletin No. 7 contains report of experiments with different

species of vegetables and their classification with reference to the merits of the respective varieties; results of some practical experiments with different methods of setting milk, and a comparison of the economy of the DeLaval separator with the Cooly system of creamery, with results in favor of the DeLaval; a report of the meteorological conditions; and a circular announcement of the Biologist, indicating the line of work to be pursued.

Bulletin No. 8 contains a discussion of the formation and composition of soils; the composition of plants; the sources of phosphoric acid, potash, and nitrogen employed in the manufacture of commercial fertilizers; the value and uses of several home manurial resources; the manufacture of fertilizers; the manipulation of composts; analyses of commercial fertilizers and some natural guanos.

Bulletin No. 9 consists of a preliminary report of the investigations of nematode root-galls, the injury effected by them to certain cultivated plants and noxious weeds, with some suggestions as to means to be used to diminish the injurious effects of this insidious enemy.

Bulletin No. 10 embodies a report of progress in grape culture upon the station grounds, including methods of preparing, fertilizing and cultivating the soil for this fruit, with a practical classification and description of the varieties which have fruited during the last two years.

DISTRIBUTION OF BULLETINS.

While only 3,000 copies of the bulletins are distributed from the station, the Commissioner of Agriculture prints and distributes from fifteen to twenty-five thousand of such as are of a popular character.

Apart from the very valuable and instructive work of a strictly scientific nature, which does not appeal so directly to the practical farmer, much good has been accomplished by disseminating amongst the farmers of the State information relating to the economic use of fertilizers, the economy and other advantages of improved methods of cultivation, and the growing of fruits and vegetables.

Indeed, quite an interest has been excited in the cultivation of grapes and small fruits since some knowledge of their

management and of varieties adapted to our soil and climate has been acquired. The number and character of the letters of inquiry received by the director of the station indicate a wide spread and intelligent search for reliable knowledge of the principles of science related to practical agriculture.

CO-OPERATIVE SOIL TESTS.

A beginning was made last year in this direction, and while in consequence of the absence of a knowledge on the part of the experimenters of the accurate record of details necessary to render them valuable, very little was accomplished. Better results are confidently expected this year.

The stock yard and dairy have served the purpose of attracting the attention of farmers to this neglected industry, and the publication of experiments in feeding can be but educating in its tendency. The well directed energy of the Biologist promises important results in combating the insect and parasitic enemies of our cultivated crops.

DEPARTMENT OF CHEMISTRY.

N. T. LUPTON.

The working force in the Chemical Department consists of the chemist in charge and three assistants. In addition to the regular work in connection with the Station, this Department is charged with the chemical work of the State Department of Agriculture. This includes the analysis of such fertilizers, minerals, and products of all description, as, in the judgment of the Commissioner of Agriculture, are necessary for the development of the Industrial Resources of the State. This work for the commissioner, has largely increased within the past year, and so has the work of the Station. Its variety and extent can be seen from the following tabular statement of the number and character of the quantitative analyses made during the year 1889.

In the analyses of fertilizers, the State law requires the determination of water-soluble, citrate-soluble, and acid-soluble phosphoric acid, nitrogen and potash. When requested by the party sending the sample, moisture is also determined.

SUBSTANCES.	ANALYSES MADE.	No. OF SAMPLES.
Acid phosphates with nitrogen and potash.....		171
Acid phosphates with potash.....		3
Acid phosphates.....		58
Natural phosphates.....		47
Marls.....		11
Miscellaneous substances.....		48
Feeding stuff.....		20
Milk.....		76
Butter.....		8
Pea Vines.....		4
Roots of pea vines.....		4
Soils.....		9
Total.....		459

Under the head of miscellaneous substances are included cotton seed, cotton seed meal, cotton seed ash, kainite, muriate, nitrate, ammonium sulphate, tankage, etc.

In addition to the quantitative work, above mentioned, a large number of mineralogical specimens, the character of which could be ascertained by simple qualitative tests, were examined and their values determined.

A special Bulletin was prepared during the year on commercial fertilizers. It embraced a brief discussion of the composition and formation of soils, their deterioration, the composition of plants, of commercial fertilizers, the sources of materials used in the manufacture of fertilizers, the estimation of commercial values, and the preparation of composts. This Bulletin, intended especially for the farmers of the State, has been widely circulated by the Commissioner of Agriculture, and the Director of the Experiment Station.

The Bulletins issued from time to time contain the results of analyses made. An interesting investigation of the relative amount and value of pea vines and roots as fertilizers, was undertaken a few months ago, and also a determination of the waste of nitrogen caused by allowing the vines to lie upon the ground until late in the winter or early spring before turning them under.

The impression prevails among some farmers that the roots of pea vines contain substantially all that is valuable in this crop as a fertilizer. This opinion, from the results obtained, is erroneous. The vines analyzed, show a value over eight times that of the roots. The loss of nitrogen by exposure to atmospheric agencies is considerable, as it is natural to suppose. The details of this investigation will be published in a future bulletin.

DEPARTMENT OF BOTANY AND METEOROLOGY.

P. H. MELL.

The work conducted in this department during the year 1889 is of the following character :

I—A large number of species of grasses were collected during the summer and spring, analysed and studied, and descriptions with methods of cultivation were published in Bulletin No. 6, a copy of which is herewith submitted.

II—Sections of the wooded plants of the State are being prepared and studies made of them to determine the following questions : How do the grains of woods growing in moist places compare with grains of trees growing on up-lands? the relative values of the wood at different years of growth? the physiological effects produced in lumber that is air dried or that is steam dried? the character of damage, if any, produced upon trees used for lumber that have been previously tapped for turpentine or rosin ?

III—During the year many experiments have been made on the cotton plant by means of the microscope and frequent field observations. Twenty-three varieties were included in these investigations. A number of cross sections were made of the fibres to determine the degree of maturity. Careful examinations were made, also, to determine the effect produced upon the cellular structure of the plant by certain kinds of fertilization and cultivation, to note, also, if any material difference actually existed between the various brands of cotton sold in the market under the many different names. In "improving" the cotton, is the fibre developed or is simply the weed enlarged to the detriment of the fibre? The bulletin on this subject will be issued sometime in February. Part of the manuscript is now in the hands of the printer.

IV—Much material has been collected during the past year for a bulletin on "Noxious Weeds ;" the work of examining and classifying these plants is now under way, and it is ex-

pected the bulletin will be ready for the printer some time during the spring or summer.

V—Daily observations of meteorological instruments, and on the changes of the atmosphere have been carried on during the entire year. The meteorological outfit consists of the following instruments :

1. Maximum thermometer.
2. Minimum thermometer.
3. Dry-bulb thermometer.
4. Wet-bulb thermometer.
5. Barometer.
6. Anemoscope.
7. Rain Gauge.
8. Solar Radiator.
9. Terrestrial Radiator.
10. Thirty soil thermometers ; ranging in depth from 1 to 96 inches.
11. Anemometer, Robinson's make, with electric recording attachment.

The first seven instruments belong to the United States Signal Service, and the remainder were purchased by the Experiment Station. Reports have been made from time to time in the bulletins of the station concerning the work in Meteorology. Copies of these bulletins are appended to this report.

Manuscript copy of a bulletin on "The Climate of the State" has just been completed. This work will be put in the hands of the printer as soon as the Board of Directors order its publication. This manuscript has been written from material furnished during the past five years by observers of the State Weather Service, and others, voluntary workers in Alabama, and covers periods from two to twenty years.

DEPARTMENT OF BIOLOGY.

GEO. F. ATKINSON.

ORGANIZATION.—The Department of Biology was organized during the latter part of the year. Owing to the necessity for the careful selection and importation of special apparatus and books, together with the fact that the suite of rooms for the biologist has but recently been in a condition for occupation, few investigations could be attempted. There are four rooms in the new building devoted to this department; a suite of three rooms on the third floor, as follows: an office, laboratory room, and lecture room where subjects of practical interest are presented to the classes, and a room in the basement devoted to the manipulation of coarser material from collections in preparing it for the laboratory and cabinet, and for special cultures. The work of furnishing these rooms and mounting the special apparatus is now in progress.

The office, besides the ordinary furniture, will contain cases for an herbarium where will be preserved specimens illustrating the fungi injurious to plants, and a cabinet illustrating the insects collected; also a well selected small library of special literature on these practical subjects which needs to be enlarged to meet the demand for reference in such a broad field of investigation.

The more prominent pieces of apparatus in the laboratory are as follows:

One Rohrbeck's No. 10 Vegetative apparatus.

One Rohrbeck's Steam Sterilizing apparatus, No. 1, D.

One dry oven.

One Pasteur water filter.

One balance.

Microtomer.

Four Leitz microscopes, No. 6.

One Zeiss microscope, No. 2a stand with the 2 mm a apo-

chromatic objective, a series of compensation oculars and objectives, triple nose piece, Abbe condenser, long arm camera, etc.

Besides there is a large list of vessels and smaller pieces of apparatus, reagents, etc., essential in such a laboratory.

On one side of the laboratory will be partitioned off a culture room to be occupied by the apparatus for use in growing certain fungi in connection with the investigations.

Notwithstanding the inconveniences attending investigations during the period of organization I have been enabled to make quite an extended original preliminary study of a root-gall nematode, *Heterodera radiculicola* (Greeff) Müll., which is doing serious damage to some crops in various parts of the South. The results of this study were published in a bulletin (Science Contributions, Vol. 1, No. I, Dec. 1889), as a preliminary report on Nematode Root-Galls, including the life history and metamorphosis of the worm which is the cause of the disease. The bulletin is illustrated with six large plates. The principal topics discussed in the report can be seen from the table of contents.

TABLE OF CONTENTS.

- I. Introductory.
- II. External characters of the disease.
- III. Microscopic characters.
- IV. General characters of the mature female cyst.
- V. Development and metamorphoses.
 - Eggs.
 - Larval stage.
 - Cystic state.
 - Transformation of the male.
 - Structure of the male.
 - Development of the female.
 - Length of life cycle.
 - Brief recapitulation of life history.
 - Metamorphosis of *Heterodera*.
 - Comparison with *Heterodera Schachtii* Schmidt.
 - Distribution of *Heterodera*.
- VI. Structural characteristics of the diseased roots.
 - Nomenclature.
 - External characters.
 - Histological characters.
 - Comparison of the external appearance of the root-gall disease of the potato with "potato scab."

Comparison of root-galls with "club-foot" of cabbage.

Comparison of the root-galls with the "tubercles," or "Wurzelknollchen" of leguminous plants.

VII. Treatment.

Difficulty of remedial applications to plants already diseased.

Sterilization of the soil by starvation.

Rotation of crops.

Clean cultivation.

Treatment of perennials.

Trapping the worms.

Composts.

VIII. Plants affected.

List of works consulted.

Explanation of the plates.

It is proposed to continue these investigations during the coming year.

The "Army Worm" (Leucania unipunctata).—With the aid of a special student in the department I have begun a study of the Army Worm, which, during the mild weather in January, has appeared on rye here to an extent which suggests the possibility of their developing in sufficient numbers to do serious harm the coming spring, if such mild weather continues.

Investigations for the coming year.—It is impossible at this time to carefully outline for the coming year definite series of investigations, but attention will be chiefly given to such diseases and enemies of the cotton plant and grape as present themselves in aggravated forms.