

ELEVENTH ANNUAL REPORT

OF THE

Agricultural Experiment Station

OF THE

A. & M. COLLEGE,

AUBURN, ALABAMA,

FOR

1898.

MONTGOMERY, ALA. :

THE BROWN PRINTING CO., PRINTERS AND BINDERS.
1899.

ALABAMA POLYTECHNIC INSTITUTE, (A. & M. COLLEGE,)

AUBURN, ALA., Jan. 24th, 1899.

Governor JOSEPH F. JOHNSTON,

Executive Department,

Montgomery, Ala.

SIR:—I have the honor herewith to transmit to you the Eleventh Annual Report of the Agricultural Experiment Station of this College.

The report of the Treasurer, herewith included, is for the fiscal year ending June 30, 1898.

This report is made in accordance with the provisions of the act of Congress (approved March 2nd, 1887), establishing Agricultural Experiment Stations in the several States and Territories.

It contains the report of the Botanist, the Chemist, the Veterinarian, the Agriculturist, the Biologist and the Horticulturist, for the year ending December 31st, 1898.

Respectfully,

WM. LEROY BROUN,
President.

TRUSTEES.

His Excellency, JOSEPH F. JOHNSTON, President----- *Ex-Officio*.
J. O. TURNER, Superintendent of Education----- *Ex-Officio*.

J. G. GILCHRIST ----- Hope Hull.
TANCRED BETTS ----- Huntsville.
WALTER C. WHITAKER ----- Tuscaloosa.
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J. A. BILBRO ----- Gadsden.
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T. H. FRAZER ----- Mobile.
H. CLAY ARMSTRONG ----- Auburn.
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J. T. GLENN, Treasurer.

J. H. DRAKE, M. D., Surgeon

AGRICULTURAL EXPERIMENT STATION.

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*C. F. BAKER.....	Entomologist.
J. T. ANDERSON.....	Associate Chemist.

ASSISTANTS.

C. L. HARE.....	First Assistant Chemist.
R. G. WILLIAMS.....	Second Assistant Chemist.
T. U. CULVER.....	Superintendent of Farm.

*On leave of absence in South America.

†In charge of Farmers' Institutes.

REPORT OF TREASURER.

TREASURER OF A. & M. COLLEGE,

In account with United States Appropriation
Hatch Fund for the year 1897-98.

To cash received from U. S. Treasurer for the fiscal year
ending June 30th, 1898-----\$ 15,000 00

Cr.

By amount paid	Salary Account-----	\$ 9,150 00
“ “ “	Labor-----	1,095 50
“ “ “	Publications-----	933 38
“ “ “	Postage and Stationery-----	91 79
“ “ “	Freight and Express-----	428 37
“ “ “	Heat, Light and Water-----	180 01
“ “ “	Chemical Supplies-----	496 97
“ “ “	Seeds, Plants and Supplies----	704 75
“ “ “	Fertilizers-----	350 62
“ “ “	Feeding Stuff-----	99 35
“ “ “	Library-----	614 92
“ “ “	Tools and Implements-----	107 05
“ “ “	Furniture and Fixtures-----	92 50
“ “ “	Scientific Apparatus-----	286 07
“ “ “	Live Stock-----	25 80
“ “ “	Traveling Expenses-----	89 06
“ “ “	Contingent Expenses-----	10 00
“ “ “	Building and Repairs-----	245 86—\$ 15,000 00

E. T. GLENN,

Treasurer A. & M. College.

THE STATE OF ALABAMA,)

Lee County.)

Personally appeared before me, Chas. Gachet, a Notary Public in and for said county and State, E. T. Glenn, known to me as Treasurer of the A. & M. College of Alabama, who, being duly sworn, deposes and saith that the above and foregoing account is true and correct.

Witness my hand, this 23rd day of January, 1899.

CHAS. GACHET,

Notary Public & Ex-Off. J. P.

This is to certify that I have compared the above account with the Ledger account of the Treasurer, and this is a correct transcript of same.

WM. LEROY BROWN,

President A. & M. College.

REPORT OF DIRECTOR AND BOTANIST.

DR. WM. LEROY BROUN, *President*:

SIR: I have the honor to submit the following report of the work under my charge in the Agricultural Experiment Station during the year 1898.

REPORT OF DIRECTOR:

At the meeting of the Board of Trustees in 1898 I was elected to the position of Director of the Experiment Station.

My official connection with the Station as Director has been so brief I am only able to report at this date some of the more important routine work of the office. Suffice it to say however, that the regular duties demanding attention each day are numerous, and, when taken in connection with the other interests pertaining to my position as teacher in the College and as Botanist to the Station, my time is amply occupied from an early hour in the day until often a late hour at night. Suggestions looking to the development of the Station work along certain lines will be submitted for your consideration and approval in my annual report prior to the next meeting of the Board of Trustees. In the present paper I will simply discuss that portion of the work of the office now in operation and which may be of special interest for this report.

CORRESPONDENCE AND PUBLICATIONS

It is gratifying to note the growing interest the farmers of Alabama are taking in the Station and its work, as is manifested by the increasing demand for the bulletins, and by the many letters addressed to the Director seeking for information upon all lines of agricultural and allied scientific investigations. Parties living in distant portions of the United States have also read the bulletins of the Station and numerous letters have reached the office asking for additional information concerning the climate, the soil and the agricultural operations of the State with the expectation of eventually settling in Alabama. The foreign mailing list is showing a healthy growth, thus indicating an appreciative interest in the work of the Station by parties in other countries.

The number of bulletins issued during the year just closed was 12—from 89 to 100 inclusive. These bulletins comprise volume 6 which contains 320 pages. The following is an analysis of these bulletins :

No. 89. *Experiments with Cotton.*

Summary : The weather in growing season ; varieties ; classification of lint ; where to get seed ; seed from different latitudes ; old versus new seed ; effect of late cultivation ; distance experiments ; topping ; subsoiling and liming ; composting versus mixing in furrows ; one-fourth of fertilizer in drill ; relative value of cotton seed, cotton seed meal and nitrate of soda ; relative values of different phosphates ; experiments with fertilizers. 24 pages.

No. 90. *The Peach Tree Borer ; The Fruit Tree Beetle.*

Life history ; remedies ; experiments at Auburn. Illustrated. 13 pages.

No. 91. *Co-operative Fertilizer Experiments with Cotton in 1897.*

Summary: objects and methods of experiments; names of farmers in Alabama making the experiments; character of fertilizers used; details of experiments made in different parts of the State; effects of kainit on rust. 63 pages.

No. 92. *Experiments with Lime on Acid Soils.*

Experiments at Auburn; experiments at Deer Park, Alabama. 8 pages.

No. 93. *Peanuts, Cowpeas and Sweet Potatoes as Food for Pigs.*

Summary: The pig's food; pasturing peanuts; peanut pasture versus corn meal; peanuts versus corn meal; cowpeas pasture for shoats; ground cowpeas and corn versus ground corn alone; sweet potatoes versus corn meal; effect of cowpeas and peanuts on quality of pork; effect of foods on quality of lard. 22 pages.

No. 94. *Strawberries.*

Introduction; soils and fertilizers; preparation of soil and planting; cultivation and mulching; insects and diseases; marketing; varieties. 18 pages.

No. 95. *Experiments with Oats.*

Summary: Varieties; what is the best variety; time of sowing; cotton seed and cotton seed meal as fertilizers for oats; cowpeas and velvet beans as fertilizers for oats; time of applying nitrate of soda; effects of lime; co-operative fertilizer experiments; prevention of smut. 26 pages.

No. 96. *Experiments with Crimson Clover and Hairy Vetch.*

Summary: Soil improving plants and root tubercles; inoculation of soil or seed; crimson clover and hairy vetch; inoculation experiments with crimson clover; hairy vetch inoculated with vetch earth; inoculation experiment with hairy vetch; inoculation practicable; lespedeza earth as inoculating material for crimson clover; natural methods of inoculation; cause of frequent failure of nitrogen; co-operative tests of crimson clover and hairy vetch; relative yields of rye and hairy vetch; nitrogen in inoculated and non-inoculated plants; fertilizer experiments with hairy vetch. Illustrated. 28 pages.

No. 97. *Dairy and Milk Inspection.*

Why inspect dairies and dairy products; dairy and milk inspection should begin at the dairy; how to make the tuberculin test; kind and condition of feed; time and manner of feeding; water supply for dairy cows; drainage of barns and lots; ventilation; location of dairy barns and building; keeping the cows clean; personal cleanliness of milker; impurities found in milk; Grotenfeldt's principles to regulate work in the dairy; source of water used at dairy; composition of milk; fat in milk; milk sugar or lactose; casein and albumen in milk; ash or mineral matter in milk; colostrum; specific gravity of milk; variation in composition of various kinds of milk; determining the per cent. of fat in milk by Babcock test; determining the per cent. of fat in milk by gravimetric method; gravimetric method of determining the total solids in milk; a close method of estimating the total solids and the solids not fat; gravimetric method of determining the ash or salts in milk; milk adulteration by

adding water and abstracting cream, and chemical impurities ; acidity of milk ; bacteria ; sour milk ; alkaline-producing germs ; other germs in milk ; casein ferments ; bacillus tuberculosis in milk ; typhoid bacillus in milk ; diphtheria, scarlet fever and Asiatic cholera transmitted by milk ; Pasteurization of milk ; sterilization ; how to disinfect a dairy house ; milk ordinance ; references. 50 pages.

No. 98. *Orchard Notes.*

Contents : Apples ; drawback to apple culture ; whole root versus piece root apple trees ; northern versus southern grown apple nursery stock ; Japanese versus French pear stocks for the South ; the Stringfellow method of short pruning ; the blooming season of plums ; spraying with whitewash to retard blooming ; Japanese persimmons. 19 pages.

No. 99. *Cotton Rust.*

Summary : Mosaic disease, or yellow leaf blight ; experiments at other places ; experiments on the Station farm, 31 pages.

No. 100. *Lawns, Pastures and Hay.*

Lawns : Preparation of soil ; selection of seed ; time of planting, or sodding ; description of the species recommended ; pastures and how to make them ; kinds of grass recommended. 10 pages.

In this connection it may not be out of place to make an analysis of the bulletins issued by the Station since it was organized in 1888. Before the passage of the Hatch act an Experimental Station existed in connection with the college and the State Department of Agriculture, which published, from 1863 to 1888, 32 bulletins. This

series comprises volume 1 and consists of 600 pages with 7 illustrations. Since the reorganization of the Station under the provisions of the Hatch law there have been issued 100 bulletins comprising 5 volumes with an aggregate number of 2,843 pages with 304 illustrations.

- 1 bulletin treats of natural phosphates in Alabama.
- 13 bulletins treat of fruits and their cultivation.
- 11 relate to cotton and its cultivation.
 - 4 treat of grasses and forage plants.
 - 6 give information in regard to vegetables.
 - 4 are on milk or dairying.
- 16 are on analysis of fertilizers and fertilizer experiments.
 - 9 treat of diseases of plants.
 - 9 give the results of co-operative soil, fertilizer and seed tests.
 - 4 are on the microscopic study of the cotton.
 - 4 are on insecticides.
- 10 relate to the cultivation of corn.
 - 2 are on rye.
 - 1 treats of chufas.
- 16 of the bulletins are devoted partially or completely to climatology.
 - 1 gives instructions on road building.
 - 5 are devoted to feeding experiments.
 - 2 are on potatoes and their cultivation.
 - 4 are on wheat.
 - 4 on oats.
 - 4 on cultivation and curing of tobacco.
 - 4 relate to diseases of animals.
 - 6 describe insects and their extermination.
 - 1 is devoted to foreign plants.
 - 2 are on cane and syrup making.
 - 1 on the flora of Alabama.
 - 2 are devoted to fungi.
 - 1 relates to flour from the standpoint of nutrition.
 - 1 is on horticultural suggestions.
 - 1 is given to the analysis of soils.
 - 1 to meat inspection.
 - 1 is on turnips.
 - 1 is devoted to soil inoculation for legumes.
 - 1 gives experiments with lime on acid soils.
 - 2 give information in regard to the woods of Alabama.
 - 1 is on stock.
 - 1 is on fishes, and how to raise them in ponds.

Many of these bulletins are devoted each to a special topic while others treat of several subjects in each issue.

A careful examination of these publications show a wide range of original investigation and research and at the same time knowledge of the discoveries made by scientific workers elsewhere.

Of the 132 bulletins printed by the Station, belonging to the old and new series, 76 are now exhausted and cannot be supplied by the Station.

EXPERIMENTS ON THE RAISING OF STOCK AT THE FARM.

Now that there is an awakening interest manifested among the farmers of Alabama in the raising of stock, it would seem to be wise for the Station to devote more attention to this question, particularly with stock suitable for beef. There are so many native grasses in the State, excellent for producing pasturage almost continually throughout the year, it seems to be the part of wisdom to encourage the farmers to devote portions of their lands to grass cultivation for pasturage and hay and raise stock for the market. Experiments on the improvement of the "scrub" cattle of Alabama by crossing with superior breeds of stock would be an interesting investigation for the Station to undertake. This matter of stock raising appears to be of special importance at this time now that cotton is commanding such a low price in the markets, and at the present rates is no longer a profitable crop.

FARMER'S INSTITUTES.

I have attended several farmer's institutes during the year and delivered lectures on botany, geology and disseminated information in regard to the working of the

Experiment Station, and its importance to the farmers. These trips were taken at the invitation of the State Commissioner of Agriculture and also at the request of Dr. C. A. Cary, who is Director of Farmers' Institutes under the auspices of the College.

AMERICAN ASSOCIATION OF STATIONS AND COLLEGES.

November last I attended the meeting in Washington of the American Association of Agricultural Colleges and Experiment Station. This session of the Association was specially important because of the questions discussed relating to the interests of the several colleges and stations located in the different States. The Board of Trustees of the Alabama College are wise in sending a delegate each year to take part in the deliberations of this national body.

STATION LIBRARY.

The following papers and magazines are sent to the Library in exchange for the bulletins of the Station :

American Cultivator.
 American Swine Herd.
 Boletín de la Sociedad Nacional de Agricultura.
 Boletine do Instituto Abrionomico do Estado de Sao Paulo
 —Brazil,
 Breeders' Gazette.
 Bulletin Botanical Department, Jamaica.
 Bulletin Essex Institute.
 Commercial and Financial Chronicle.
 Cotton Planters' Journal.
 Cotton Ginnners' Journal.
 Drainage Journal.
 Dairy World.
 Elgin Dairy Report.
 Farm and Home.

Farmers' Guide.
 Farm and Fireside.
 Florida Farm and Fruit Grower.
 Farmers' Voice.
 Farming.
 Farming Foreign.
 Farmers' Magazine.
 Farmers' Home.
 Gazette of New South Wales.
 Gentleman Farmer Magazine.
 Hoads Dairyman.
 Homestead.
 Indiana Farmer.
 Kansas Farmer.
 Montana Fruit Grower.
 Massachusetts Ploughman.
 New England Florist.
 National Rural Family Magazine.
 Our Grange Home.
 Practical Farmer.
 Rural New Yorker.
 Southern Cultivator.
 Southern Farm Gazette.
 Sunshine.
 Southern Farm Magazine.
 Strawberry Specialist.
 Sheep Breeder and Wool Grower.
 Tri-State Farmer.
 Western Rural.
 Wallace's Farmer.
 West Virginia Farm Review.
 Western Fruit Grower.
 Public Ledger of Philadelphia.
 Baltimore Sun.

The subscription list comprises 27 American papers and journals, 18 English periodicals, 19 German, 11 French.

The Library is also on the mailing lists of the various Divisions and Bureaus of the Department of Agriculture at Washington, and, in most instances, complete files of the bulletins, reports and circulars issued from the Department are to be found in the Station Library. All the

publications of the various State Experiment Stations are coming regularly to the Library, and as fast as a volume is completed it is bound and placed on the shelves.

Since my report to you for the period ending June, 1898, 135 bound volumes have been added to the Library, and 763 unbound pamphlets, bulletins and extras.

BOTANICAL EXPERIMENTS.

The work on the improvement of the cotton fibre has been continued, and the crop gathered this past season has solved some important problems relating to the development of long staple by hybridization of American with Egyptian cotton. A bulletin giving the results of these investigations is nearly ready for publication. A bulletin on lawns, pastures and hay making has been printed and will be distributed within the next week. This bulletin was prepared in answer to many letters addressed to the Station seeking for information concerning the making of lawns and the cultivation of grass for hay and pastures.

The experiments on the cultivation of the wild and domestic grasses still remain an important feature of my work.

During the past year an Aermotor and irrigation system have been placed in the Botanic Garden to supply sufficient water for the grass experiments and other botanical investigations. A number of the native forest trees has been planted in the Garden as an addition to the arboretum commenced two years since. Some interesting foreign plants, shrubs and trees, have also been added to this collection to determine their adaptibility for the soil and climate of this region of the State.

Several hundred species of pressed plants have been secured from Mr. A. H. Curtiss of Jacksonville, Florida,

comprising his last series of plants. The entire collection of Curtiss' Florida flora is now in the Herbarium of the Department. Within the closing days of the year the Department has received the collection of economic seeds sent out by the Division of Botany of the United States Department of Agriculture. This collection consists of the seeds of 500 species and varieties of plants grown for the use of man. It will be especially valuable to the Station in the determination of unknown seeds sent in by farmers and others for identification.

Miss M. E. Reese, the Assistant Librarian, has rendered faithful service during the year, and she has been prompt and industrious in the discharge of the duties required at her hands.

Thanking you for the interest you have manifested in the work under my charge I remain,

Respectfully,

P. H. MELL,

Director and Botanist.

REPORT OF CHEMIST.

DR. WM. LEROY BROUN, *President.*

SIR:—I beg leave to submit the following report with regard to the work of the Chemical Department of the Experiment Station for the past year :

The analytical work of the year includes analyses of marls, soils, waters, foods and feeding stuffs, fruits and other vegetable products, and miscellaneous materials, in addition to more than 400 samples of fertilizers forwarded by the Department of Agriculture and by individuals.

Analyses have been and are being made of a number of agricultural products from the Experiment Station, including chiefly forage plants, grown under different conditions, fodder, ensilage, etc. Some of the analyses which have proved of value and interest are those of certain leguminous plants grown upon inoculated and non-inoculated soils, the results, as regards nutritive value and nitrogen content, being largely in favor, in all cases, of the plants grown on inoculated soils, while the results as regards yield were even more striking.

Analyses are now in progress to determine the comparative nutritive or food value of certain forage plants, when cured under ordinary conditions and when ensilaged, and it is hoped that results of some value from an economic standpoint will be secured.

Some interesting experiments have been made in this laboratory with regard to the character and properties of the lard obtained from pigs fattened upon varying kinds of foods, especial attention being given to the melting point of the various samples of lard tested. The results of these experiments were of quite an interesting

character, and it is hoped that the investigation can be continued further.

This department is now completing the work commenced some years upon an investigation of the composition and nutritive value of foods and food materials consumed within the State. All of the principal kinds and forms of food materials have been investigated, and attention is now being given to the food value of some of the edible fungi of the State. During the past summer the investigation was devoted largely to the examination of fruits, a number of samples of grapes from the Station vineyard being tested analytically, both as regards nutritive value and adaptability to wine making.

The department has endeavored to meet all demands made upon it in the performance of analytical work required by other departments of the Station, and has engaged in co-operative work along several different lines of investigation. In connection with the Agricultural Department of the Station, this office has held itself in readiness to co-operate with the farmers throughout the State to test the adaptability of the sugar beet to this section, and it was hoped that a number of samples of beets would be forwarded to the laboratory for analysis. Only a few samples, however, were sent to this office for examination, and the results of the analytical tests were not of an encouraging character.

Numerous inquiries with reference to the subject of soil analysis have been addressed to this department, and a considerable number of soils have been forwarded for analysis. At least a partial analysis has been made of all samples of soils received, but in making reports of analyses and in answering communications upon this subject, attention has been called to the fact, that in many cases a simple chemical analysis of a soil fails to give a definite idea of its fertilizer requirements, and

such analyses are of value, as a rule, in those cases only where the analysis happens to reveal a marked deficiency in some important fertilizing constituent. Where such a deficiency is indicated, it is easy to prescribe a fertilizer adapted to the needs of the soil, but particular emphasis has been laid upon the importance of practical soil tests in determining the needs and treatment of most of our soils. A number of marls and mucks have been forwarded to the laboratory for analysis, and in the case of a majority of the samples analyzed, the materials have been found to be of value for local use. The local application of such materials has been recommended in all cases where the soil conditions and requirements would justify it, as it has been the practice of this department to encourage the use of any natural manurial resources, whenever practicable, rather than to depend exclusively upon artificial manures.

Experiments in the manufacture of syrup from sugar cane have been conducted during the past year, as well as during several preceding seasons, and some new clarifying agents have been tested with varying success. Every effort has been made to encourage this industry in this State, as the southern and middle parts of the State should be able to produce all of this article required for consumption throughout the State, whereas, under present conditions, only a portion of the market is supplied by the home product, and that for only a small portion of the year.

A limited amount of work upon food adulterations has been performed in this laboratory, but the subject will be more fully investigated as soon as the bulletin on foods is completed.

A press bulletin upon the subject of commercial and domestic fertilizers was issued during the past year, in addition to the annual bulletin prepared for the State

Department of Agriculture, while the data and materials for a bulletin upon Foods and for another on Syrup Making are at hand and will be utilized at an early date.

A series of soil and fertilizer tests are being conducted under the supervision of Dr. J. T. Anderson, Associate Chemist, and fuller information as to the details and character of this work is embodied in a report submitted by him.

Very respectfully,

B. B. Ross,
Chemist.

REPORT OF THE ASSOCIATE CHEMIST.

To the President :

The following report of original investigations undertaken for the Agricultural Experiment Station by the Associate Chemist is respectfully submitted :

I. *To Determine Available Plant Food in Soils.*

The constituents of the soil exist in different degrees of solubility. Some are soluble in water, others, only in acids, and others still are insoluble even in the strongest acids. Only such constituents may be assimilated by plants as are soluble under the action of the agencies which are at work in the soil. One of these agencies is soil water, that is, water holding in solution such soluble material as it may come in contact with, particularly, certain organic acids or other products of fermentation in the soil. This soil water, therefore, is a more powerful solvent than pure water. Again, in the process of growth plants emit from their rootlets certain substances which act strongly on the constituents of the soil, bringing much into a state of solution which would otherwise be insoluble. Food particles which yield to the solvent action of soil water and organic life are classed as *available* food. To determine, both practically and by chemical means, how much of this available food a given soil contains, is the task here set. First in order is the direct practical determination by culture tests. These investigations are confined to the three essential constituents, phosphoric acid, potash, and nitrogen, in as much as these are the only constituents which are liable to be exhausted from the soil. The cotton plant has been selected for culture

tests. The method employed is based on the assumption that *all* the available portion of a given constituent may be withdrawn from the soil by the continuous cultivation of plants in it, and that when this point is reached, the plants will die of starvation. To insure accuracy of results, the normal fertility of the soil as regards all other constituents must be maintained by proper fertilization. Zinc cylinders imbedded in the ground and filled with known weights of soil and sub-soil are used. In this way, nothing in the soil under examination can leak out and nothing from without can get in. From one set of cylinders, phosphoric acid is withheld, from another set, potash, and from a third, nitrogen, in every case the other two constituents being added in suitable form and amount. In each cylinder, thus prepared, cotton is planted and at the end of the season, the plants are gathered and preserved separately for analysis. This process is repeated from year to year until each constituent has been exhausted from its respective cylinders, the analysis of the aggregate yield from each cylinder showing the amount of the given constituent that the plant has been able to get from its soil. Having thus determined practically how much of each of these three elements of plant food a given soil contains, steps will be taken to find a chemical solvent which will extract like amounts of these constituents from the same soil when tested in the laboratory. The solvent used in the existing method of soil analysis is acknowledged to be too strong and hence extracts from the soil more than is available. It does not give, therefore, an adequate knowledge of the agricultural value of a soil tested by it.

II. *To Determine the Water Requirements of the Cotton Plant.*

That water in the soil is indispensable to plant growth, goes without saying. The deleterious effects of a too wet or a too dry soil are also of universal recognition, but the importance to the highest attainable productiveness of plants of just the proper amount of moisture in the soil, is not sufficiently recognized. Besides being itself in one sense a food, water in the soil is the carrier of food to the plants. When the supply of water is scanty, the plants suffer from thirst, both because of the absence of a sufficiency of that element, and because that which is present is rendered less accessible to the plant by virtue of its scantiness. It becomes surcharged with soluble material and on that account the osmotic action of the rootlets is retarded, thus hindering the inflow of water. On the other hand, besides being otherwise injurious, too much water so dilutes the solution of plant food that the plants suffer for lack of sufficient nourishment. The relation, therefore, of the proper supply of moisture in the soil to the important problem of plant fertilization, is apparent. Some recently published European investigations on this subject show that the effect of fertilizers on the productive capacity of plants depends upon the moisture content of the soil to such an extent that the highest absolute yield from the application of fertilizers was obtained with a content of soil moisture corresponding to the optimum. This optimum amount of soil moisture is not the same for all plants. It has been determined for other agricultural crops, but not for cotton hitherto. The Division of Soils of the United States Department of Agriculture has begun this work for cotton, but by a different, and it is believed, less reliable process than the one here pro-

posed. For convenience in controlling the water supply, the cotton is cultivated in metal pots in the vegetation house. By frequent weighing and watering, the water contents are kept within desired ranges, some pots being kept at a high content, others at a medium, and others at a low content. The effect of these different amounts of water can thus be closely studied.

Some relation of cause and effect is believed to exist between the moisture content of the soil and certain diseases of the cotton plant, notably rust and shedding. With the co-operation of Prof. Earle, attention will be given to this matter, also, during the progress of these investigations.

III. *Investigations to Determine to What Extent Legumes Depend on the Soil, and What Extent on the Atmosphere, for Their Nitrogen.*

The bearing of this question on the renovation of worn-out soils by the cultivation of leguminous crops is apparent.

The experiments are made with a variety of soils in metal pots. The nitrogen in each pot is determined at the beginning and at the end of the experiment and the difference between the two represents what the plants have taken out of the soil. The total nitrogen in the plant is, also, determined by analysis, and this less that gotten from the soil will give that gotten from the air. Prof. Duggar is associated with me in these studies.

IV. *Investigations to determine the amount of available phosphoric acid in the several phosphatic materials from which that constituent may be obtained for the purposes of soil fertilization.*

Known weights of soil and subsoil are put into clay cylinders imbedded in the ground, and from each cylin-

der all the available phosphoric acid originally in the soil is extracted by the continuous culture of plants, as described in I. The normal fertility of the soil as regards all constituents other than phosphoric acid must be maintained throughout the investigation by proper fertilization as often as is necessary. When the soil has become completely sterile as to phosphoric acid, each cylinder is fertilized fully for cotton, using known weights of the phosphatic materials to be tested as sources of phosphoric acid. Cotton is then cultivated in the cylinders thus prepared until all the available phosphoric acid in each case has been exhausted. The analysis of plants which each cylinder has produced, will show the available phosphoric acid in each material used. Thus will be determined practically the value, absolute and relative, of these several materials as sources of phosphoric acid. In addition it is hoped by this investigation to secure data which will be of service in testing the accuracy of, in making corrections in, the existing method of determining available phosphoric acid in fertilizers.

Respectfully submitted,

JAS. T. ANDERSON,

Associate Chemist.

Accompanying this report, request is hereby made for an appropriation of \$100 to be used in providing equipments for, and in defraying expenses to be incurred in the prosecution of the work herein detailed.

ESTIMATES IN DETAIL.

1 Case of drawers for air-drying green sample . . .	\$ 35
1 Case of shelves for holding special apparatus and samples in bottles	10
Chemicals and apparatus not required for general laboratory use	30
Sample bottles, glass stoppered, for holding ground samples	15
Labor and small sundries	10
	<hr/>
	\$100

Respectfully submitted.

JAS. T. ANDERSON,
Associate Chemist.

E - 2745

MISS. EXPERIMENT STATION LIBRARY
STATE COLLEGE, MISS.

REPORT OF VETERINARIAN.

TO DR. WM. LEROY BROUN, *President.*

DEAR SIR—The following is a brief synopsis of the work done during the year 1898 in the Veterinary Department.

As director of Farmer's Institutes for the Station I have conducted institutes at Cullman, Florence, Huntsville, Livingston, Linden, Talladega and Rockford. At these institutes morning and afternoon sessions were held; at Cullman and Florence night sessions were held also. The interest taken by the former in these institutes has usually been very encouraging. The common sense talks and demonstrations made by the different institute workers upon agricultural subjects have been more effective or more readily understood by the farmers than publications upon similar subjects. One thing is being done in these beginning institutes, that is, such an interest is being awakened that the next institutes held in the same places will be attended by greater numbers.

Prof. Duggar has attended and worked in all the institutes but one; Prof. Earle has worked in five; Prof. Mell has attended assisted in two and Prof. Baker one. The work done by the station professors has been very good and without doubt many good points have been given to the farmers in the localities visited.

I have also assisted the Commissioner of Agriculture, Major I. F. Culver, in Farmer's Institutes held at Monroeville, Albertville, Wetumpka, Jackson and Troy. I have attended the State Swine Breeders meeting; the State Dairyman's Association and Stock Convention—at all of which I lectured upon stock or diseases of domestic animals. I have twice visited the Jefferson county Dairy and Live Stock Association and lectured

to them upon Diseases of Dairy Animals, and Dairy and Milk Inspection.

I have visited all places where cattle or other domestic animals were attacked by infectious or contagious diseases, when called upon by the proper authorities. I have also answered numerous letters concerning domestic animals and their diseases.

In September, Bulletin No. 97 on Dairy and Milk Inspection was issued. It embraces full directions for inspecting dairy cattle, barns, lots, dairy surroundings, testing milk to detect impurities and adulterations and for determining the number and kind of bacteria in milk. It also tells dairymen and milk-dealers how to keep milk pure and clean without using chemical preservatives. Great emphasis is placed upon the necessity for cleanliness in all milking operations, in handling milk and in the cleanliness and the healthfulness of the cows that produce the milk. The bulletin gives some idea of the necessity for milk inspection, since tuberculosis, typhoid fever, scarlet fever, diphtheria and other diseases are some times transmitted to human beings by means of infected milk. It is possible for *every city or town* in Alabama with a population of 2,000 or more to have an efficient system of *Meat, Dairy and Milk Inspection*.

I have given my assistance to the city of Montgomery whenever called upon by the city physician, to aid him or his inspectors in the line of meat or milk or dairy inspection.

The department has also furnished the city of Montgomery, free of cost, all the tuberculin used in testing the cattle for tuberculosis. Several veterinarians have been supplied with tuberculin; this was done upon condition that full reports of all tuberculin tests be sent to the department.

The toxic effects of cotton seed and cotton seed meal upon pigs has been studied but so far no positive reason has been found to explain why they are poisonous when fed to pigs. This work is being continued. The department is investigating the cause, pathology and treatment of Big-Head or *osteoporosis* in horses and mules. It is possible that we may issue a bulletin upon this subject this year.

Our collection of animal parasites, pathological and anatomical specimens is increasing. Data are being collected concerning the distribution of infectious and contagious disease among domestic animals in Alabama. Infectious keratitis among cattle, tuberculosis swine plague, hog cholera, Texas fever, glanders and rabies appeared in our State during the year.

Our Saturday free clinic has furnished ample material for practical demonstrations before the students and also supplies the laboratory with many valuable pathological specimens. Owing to the fact that I have been called away so often upon Saturdays during the year, the number of cases has decreased but the variety and value of the clinics have increased. There were 408 cases at the Saturday free clinic during 1898.

Respectfully submitted,

C. A. CARY,
Station Veterinarian.

REPORT OF THE AGRICULTURIST.

DR. W. L. BROUN, *President* :

SIR:—I have the honor of submitting the following statement with regard to the work of the Agricultural Department for the past year :

The experiments made during the year 1898 have covered a number of subjects. Of these numerous subjects of investigation, those which have received the largest share of attention are the following :

- (1) The economical improvement of worn soils.
- (2) Cotton culture.
- (3) Pork production.
- (4) Culture of oats and other grains.

The investigation of the best means for restoring the fertility of worn or exhausted soils led to a careful study of the class of plants known as legumes or soil-improving plants. Of plants of this class we have given most attention to cowpeas, velvet beans, crimson clover, and hairy vetch. All of these are valuable for forage as well as for renovating the soil.

Numerous questions relating to the cultivation and best means of utilizing the cowpea have been investigated and the results will be published at an early date. Velvet beans have been studied for several years, and special efforts have been made to ascertain how they compare with cowpeas as a means of improving the soil. Problems connected with the culture of velvet beans have also received attention and the results will be published as soon as they can be edited.

The most useful work which this Department has done during the past year and the work which has attracted most favorable and general comment from pro-

gressive farmers, not only in Alabama, but in Georgia, Florida, Mississippi and many other States, has been the investigation of crimson clover and hairy vetch. This work has effected the very practical end of showing the cause of the frequent failure of these plants in the past and of demonstrating the easy and simple means by which they may be made to thrive on the same fields where they have previously failed.

The method referred to as the means of transforming failure into success with these incalculably valuable plants consists in "inoculating," or as might be said, in "vaccinating," the field where clover or vetch generally fails, using soil from a field of thrifty clover or vetch, or using specially prepared material. Two bulletins have been issued on this subject, describing the methods of inoculation and narrating the startling effects of inoculating clover and vetch at Auburn, where the yield of clover and vetch hay has been increased 200 to 500 per cent. and more, as the result of inoculation.

Other leguminous plants which have been studied during the past year are beggarweed, a promising renovating plant for deep sandy soils and for fields infested with rootknot or nematodes; soja beans, bur clover, etc.

The work in cotton culture falls into two general divisions, (1) experiments made on the Experiment Station Farm at Auburn and (2) fertilizer experiments conducted in 40 localities in the State under the direction and with the material aid of this Department.

The work at Auburn deals with varieties, methods of culture, effects of various rotations, and with numerous other questions which confront the cotton farmer. The manuscript giving the results of this work for 1898 is nearly ready for the printer. The fertilizer tests conducted on typical soils in various parts of the State should save the farmers of the neighborhood in which

they are located considerable money by pointing out what fertilizer materials they need to purchase and what class of fertilizers are unprofitable. The hope is to continue these tests long enough to learn the fertilizer needs of the principal soil belts of the State and to enable us to make a soil map of the State which shall be highly valuable to our own people and to settlers from other States.

The investigations relative to pork production have in view the same end as our earlier work along this line, viz., to demonstrate the means by which Alabama farmers may most cheaply produce their pork and to ascertain the relative values of crops that may be grown as partial substitutes for corn,—as peanuts, cowpeas, chufas, artichokes, sweet potatoes, and various pasture plants.

Oats, rye, wheat and a number of miscellaneous plants have been under test in 1898.

The bulletins published by the Agriculturist during 1898 were as follows :

- Bulletin No. 89. Experiments with cotton.
- “ No. 91. Co-operative fertilizer experiments with cotton in 1897.
- “ No. 93. Peanuts, cowpeas and sweet potatoes as food for pigs.
- “ No. 95. Experiments with oats.
- “ No. 96. Experiments with crimson clover and hairy vetch.

Four bulletins are now in course of preparation, to be published within the next two months.

During 1898 the correspondence of the Agriculturist was large as usual. During the year the writer delivered addresses at fourteen (14) Farmers' Institutes, eight of these being held under the direction of the State Commissioner of Agriculture and six under the direction of the Alabama Polytechnic Institute.

Respectfully submitted,

J. F. DUGGAR,
Agriculturist.

REPORT OF THE BIOLOGIST AND HORTICULTURIST.

DR. WM. LEROY BROUN, *President*:

SIR: During the year 1898, the following fruits have been planted on the Horticultural grounds: Apples, 85 varieties; figs, 20 varieties; grapes, 100 varieties; peaches, 25 varieties; Japanese persimmons, 5 varieties; plums, 6 varieties; pear 1 variety; cherries, 12 varieties; raspberries, 8 varieties, and strawberries, 26 varieties.

In the vegetable garden particular attention has been given to experiments with Irish potatoes, tomatoes, beans and cabbage. Work has been continued with means for preventing injury from the nematode root knot, and various other diseases of fruits and vegetables.

Three bulletins have been published during the year from the Horticultural Department.

No. 92. Experiments with Lime for Acid Soils.

No. 94. Strawberries,

No. 98. Orchard Notes.

In the Biological Department, special attention has been given to diseases of the cotton plant, and bulletin No. 99 has just been issued on cotton rust. Considerable work has also been done on diseases of tomatoes, beans and cow peas, the results of which are not yet ready for publication.

At the time of my last report the herbarium of this Department contained

11,154 specimens of fungi.

530 " " algae.

452 " " lichens.

200 " " mosses and hepatics.

12,336 - Total.

There have been added during the year from various sources, 3,018 fungi; 229, algae; 139 lichens, and 44 mosses—total additions, 3,430 specimens, making the total number now mounted in the herbarium, 15,766. This does not include the large quantity of duplicates that have been collected for the purpose of making exchanges.

Work on the Biological and Agricultural Survey of the State has been prosecuted as vigorously as other duties would permit. An herbarium of 11,237 flowering plants has accumulated from various sources besides a large amount of duplicate exchange material.

Contributions from the Alabama Biological Survey No. 1 has been published containing two papers on Alabama fungi, and material is in the hands of specialists for two other contributions, one on the spiders and one on the myriapods of the State.

Respectfully submitted,

F. S. EARLE,

Biologist and Horticulturist.