1896

Ninth Annual Report of the Agricultural Experiment Station of the University of Tennessee to the Governor. 1896

University of Tennessee Agricultural Experiment Station

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NINTH ANNUAL REPORT

OF THE

Agricultural Experiment Station

OF THE

UNIVERSITY OF TENNESSEE

TO THE GOVERNOR.

1896.

KNOXVILLE, TENN.:
Bean, Warters & Gaut, Printers.
1897.
Bulletins of this Station will be sent, upon application, free of charge, to any Farmer in the State.

THE AGRICULTURAL EXPERIMENT STATION
OF THE UNIVERSITY OF TENNESSEE.

CHAS. W. DARNEY, Jr., President.

EXECUTIVE COMMITTEE:
O. P. TEMPLE, T. F. P. ALLISON,
JAMES MAYNARD, HUGH G. KYLE.

TREASURER:
JAMES COMFORT.

SECRETARY:
J. W. GAUT.

THE STATION COUNCIL IS COMPOSED OF ITS OFFICERS:
Dr. CHAS. W. DARNEY, Jr., President.
CHAS. F. VANDERFORD, Secretary.
R. L. WATTS, Horticulturist.
J. B. McBRAYDE, Chemist.
S. M. BAIN, Botanist.
C. E. CHAMBLISS, Entomologist.
CHAS. A. MOORES, Assistant Chemist.
F. H. BROOME, Librarian.
J. L. SPINKS, Farm Manager.

The Station has facilities for analyzing and testing fertilizers, cattle foods, milk and dairy products; seeds with reference to their purity or germinating power; for identifying grasses and weeds, and studying forage plants; for investigating the diseases of fruits and fruit trees, grains and other useful plants.

The Station Bulletins and Reports will be sent, free of charge, to any farmer within the State.

Packages by express, to receive attention, should be prepaid.

All communications should be addressed to the
SECRETARY OF THE
AGRICULTURAL EXPERIMENT STATION,
KNOXVILLE, TENN.

The Experiment Station building, containing its offices, laboratories and museum, and the plant-house and horticultural department, are located on the University grounds, fifteen minutes walk from the Custom House in Knoxville. The Experiment farm, stables, milk laboratory, etc., are located one mile west of the University, on the Kingston pike. Farmers are cordially invited to visit the buildings and experimental grounds.

Bulletins of this Station will be sent, upon application, free of charge, to any Farmer in the State.
KNOXVILLE, TENN., January 7, 1897.

To His Excellency, Peter Turney,
Governor of Tennessee:

SIR:—We have the honor to submit herewith the Ninth Annual Report of the Agricultural Experiment Station of the University of Tennessee. This report is made in accordance with the Act of Congress, approved March 3rd, 1887, and the Act of the General Assembly of Tennessee, approved March 28, 1887. 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 Secretary of Agriculture, and to the Secretary of the Treasury of the United States.”

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

Your obedient servants,

O. P. Temple,
Chairman Experiment Station Committee.

Chas. W. Dabney, Jr.,
President of the University.

J. W. Gaut, Secretary of the Board of Trustees.
TREASURER'S REPORT.

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

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<th>Dr.</th>
<th>Cr.</th>
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(Signed) JAMES COMPORT, 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 30, 1896, and find them correct; that the above is a true balance sheet corresponding with said accounts; that the said accounts show no more than seven hundred and fifty dollars was expended for building, and that there is a cash balance of $18.35.


I hereby certify that Messrs. J. W. Gaut, F. A. R. Scott and S. B. Luttrell are the authorized Auditing Committee of this Board of Trustees.

(Signed) J. W. GAUT, Secretary of the University of Tennessee.

Personally appeared before me, W. W. Lee, Notary Public, the foregoing signers, personally known to me to be trustees and officers of the University of Tennessee, who made oath in due form of law that the above statements are true to the best of their knowledge, information and belief.

(Signed) W. W. LEE, Notary Public.
REPORT OF THE AGRICULTURAL EXPERIMENT STATION.

Dr. Chas. W. Daniel, Jr.,
President University of Tennessee:

Dear Sir,—Herewith I submit a report of the operations of the Agricultural Experiment Station of the University of Tennessee for the year 1896.

During the current year the active members of the Station staff were as follows:

Chas. F. Vanderford, Secretary.
J. B. McBryde, Chemist.
R. L. Watts, Horticulturist.
Samuel M. Bain, Botanist.
Chas. E. Chambliss, Entomologist.
Chas. A. Mooers, Assistant Chemist.
Chas. H. White, Librarian, until September 1st.
F. H. Broome, Librarian, since September 1st.
J. L. Spinks, Farm Manager.

A year ago it was confidently expected that during the year 1896, we should be able to build and properly equip a first class barn at the Station. The necessity for such a building, so contrived as to make possible the best methods of experimentation in the various lines determined upon, has been fully recognized, not only by the Secretary and the Station staff, but by the Executive Committee of the Station. Careful estimates of the cost of such a structure show that to obtain the needed accommodations, and of proper character, will require an expenditure of $4,000 to $5,000. This amount of money was not available for the purpose. Reluctantly, but, as we think, properly, it was decided to postpone construction until a sufficient amount of money was accumulated to do the work in the most satisfactory manner. We shall endeavor to begin early enough during the coming year to have the entire structure and its fittings complete in time for the grain, hay and silage storage of the coming year.

A number of experiments upon forage plants, embracing, not only those commonly grown in this section of the country, but also a number of introduced species, have been carried on. Progress in this line has been satisfactory. We are giving special attention to the numerous varieties of cow peas, and shall be able,
at an early date, to distribute throughout the State seeds of varieties best adapted for the various purposes of soiling, hay making, for silage, and for yield of the peas themselves. It is our intention to select from among the varieties of forage plants of all kinds tested upon the Station farm and to gather, at the best time and under the best conditions, seeds to be distributed to such of our correspondents as will undertake to grow them and make report to the Station of the results. This kind of work requires time to do it thoroughly, so that we may be able to send out to various portions of the State seeds of plants true to name, and presumably best adapted to the varied soils and conditions in the several sections of the State. That work of this kind shall bring the best results and be of the greatest value to the farmers of the State, we must ask the hearty cooperation of all those to whom such seeds may be sent.

The horticultural work upon the Station farm has gone steadily forward upon the lines already determined. The hillside overlooking Third Creek has been terraced completely, and by midsummer of the coming year will be covered from foot to summit with the plantation. The work so far has been most satisfactorily pursued, and terraces are now sufficiently settled to allow of the finishing work of adjusting profiles permanently, so that the slopes may be either sodded or seeded, to remain so for all time to come.

Our methods of cropping, cattle feeding, and the disposition of our farm manures have enabled us to increase the fertility of our lands in the most effective way, and with the greatest economy. The experiments in handling and application of farm manures, assisted by a very moderate expenditure for commercial fertilizers, have given most gratifying results. It must be understood that fertilizer experiments, as with all others of field culture and general cropping, are continuous, and with varying results, due to varying conditions of temperature, rainfall, etc. Such experiments give conclusive results only after a series of years.

As frequently as it was possible, the several members of the Station staff have attended meetings of horticultural societies and farmers' conventions and associations. It is certainly desirable that this way of getting into close communication with the agriculturists and horticulturists of our State could be more frequently adopted. We earnestly hope that the time is not far distant when we can have in Tennessee at least an approach to the methods adopted in many of the Northern, and in a few of
the Southern States, by which the Station workers can be permitted to attend farmers' institutes in all sections of the State.

The inspection of fertilizers for the spring distribution was quite thoroughly made by the officials of the State Bureau. Later in the year, when the improved condition of the farmers, and their consequent greater ability to purchase fertilizers, brought into the State an unusually large tonnage of commercial manures, the State Bureau was unable to order the large number of analyses required because of the inadequate sum permitted by the existing law to be expended by the Bureau for such purpose. As has been stated heretofore, the Chemists of the Station make the analyses under such restrictions as are imposed by the Commissioner. The Station does not publish, and has no authority to make any publication, concerning the fertilizers analysed by our Chemists.

That it may not escape attention on the part of our correspondents, we take occasion to repeat that every member of the Station staff is willing and ready to reply, to the best of his ability, to all inquiries about our work here, and to advise when necessary upon any subject properly pertaining to our several departments. This sort of work is done as carefully and as thoroughly as though in personal conference with the party addressing us.

During the year there have been issued bulletins:

Vol. IX. No. 1.—“Apples of Tennessee Origin.” A study of the seedling apples of this State, with careful description and illustration of a number of the most valuable, a history of their origin, etc. This work will be continued.

No. 2.—“Strawberries.” Tests of varieties upon the Station farm, with illustrations of certain of the most desirable sorts. Also an account of the most satisfactory varieties grown in the several sections of the State.

No. 3.—“A Contribution to the Study of Southern Feed Stuffs.” A chemical and physical examination of cottonseed products; the more generally used feed-stuffs from corn, wheat, oats, etc.; and an investigation of a number of mixed feeds found on sale in the markets of the State. Contains a table of analyses of Southern feed-stuffs, compiled from all accessible reliable sources; a comparison of the average composition of Southern with the average of American feed-stuffs; table of digestibility of American feed stuffs so far as determined by U. S. Experiment.
Stations; with a brief discussion of the practical use of feed-stuff analyses and the factors of digestibility.

No. 4—"Grapes." Contains descriptive notes on a large number of varieties tested at the Experiment Station, with illustrations of the fruit of ten desirable sorts for planting in Tennessee. The bulletin is designed to assist fruit growers in the selection of varieties adapted to various purposes.

Respectfully,

CHAS. F. VANDERFORD.

REPORT OF THE CHEMIST.

DR. CHAS. W. DARBY, JR.,
President University of Tennessee:

Dear Sir—The following report of the work of the Chemical Division of the Experiment Station for the year 1896 is respectfully submitted:

The work which was begun last year in a study of the cattle foods of the State has been completed, and the results embodied in a bulletin entitled, "A Contribution to the Study of Southern Feeding Stuffs." Besides the results of our work in Tennessee cattle foods, we have included in this bulletin a compilation of all available analyses of southern grown feeding stuffs. The preparation of this compilation required the expenditure of considerable time and labor, as it was necessary to recalculate and correct many of the analyses included. We hope to extend the work begun in the bulletin, so that in time we may establish a standard by which to judge our Tennessee feeding stuffs.

During the past year Mr. C. A. Moore has had charge of the fertilizer work, making analyses of all samples received during that time. Besides his regular work in fertilizers, Mr. Moore made a number of analyses of miscellaneous products, and also spent some time investigating the methods of estimating iron and aluminum in phosphate rock. In connection with the dietary studies which are being carried on by the Chemical Department of the University, Mr. Moore has estimated the nitrogen in some eighty samples.

A large hand mill, to be used in preparing for analyses of samples of cattle foods, has been added to the equipment of the laboratory; best samples of fertilizer, samples of soil, and samples of ensilage are being made to an improved and more accurate analysis. The analytical work of Mr. Moore has been extended to include many new products sent in by the people of the State, and the results of this work are being prepared for publication. The bulletin sections of a new edition of the "Grapes" of Tennessee have been prepared and will be ready for publication shortly.

The apple season was one of failure, or at least a failure in comparison with that of the past season, although all the apples were in a good condition.

In July, the season was one of failure, or at least a failure in comparison with that of the past season, although all the apples were in a good condition.
laboratory; besides this, only such apparatus and chemicals were
bought as were needed to replace those destroyed.

The analytical work may be summarized as follows:

<table>
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<tr>
<th>Samples of fertilizers</th>
<th>154</th>
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<tbody>
<tr>
<td>Samples for nitrogen in dietary studies</td>
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<tr>
<td>Samples for study of cattle foods</td>
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<td>Samples for physical analyses of bone meals</td>
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<td>Samples for physical analyses of phosphate rock</td>
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<td>Samples of cow manure</td>
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<tr>
<td>Samples of ensilage</td>
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</tr>
<tr>
<td>Samples of ashes from Tantalus Acid Factory</td>
<td>1</td>
</tr>
</tbody>
</table>

Respectfully,

J. B. McBryde.

REPORT OF THE HORTICULTURIST.

DR. CHAS. W. DABNEY, JR.,
President University of Tennessee:

DEAR SIR—I have the honor to submit the following report of
the Horticultural Division for the year 1896:

In former annual reports of this Division reference has been
made to an investigation, begun in January, 1893, of the seedling
apples of Tennessee. It is a pleasure to state that the farmers
and fruit growers of the State have earnestly co-operated by
sending new seedling apples, accompanied by full information
concerning the history and fruiting qualities of such varieties.
From the records preserved, a bulletin was compiled on "Apples
of Tennessee Origin," and published in May, 1896. It
contains descriptions of twenty-eight seedlings, all of Tennessee origin.
The bulletin is illustrated with twenty figures showing half
sections of apples which are most highly prized.

The apple investigation was continued during 1896. Although
the season was not so favorable for this work as 1895, on account
of failure, or partial failure, in most sections, many valuable specimens
have been received. Notes on the promising ones studied
the past season will be published early in 1897.

In July, 1896, a bulletin on strawberries was issued, consisting of
notes made on varieties tested at the Experiment Station, and
on varieties cultivated throughout the State.

A bulletin on grapes, of the same character as that on straw-
berries, was published in December. In both these bulletins we
have tried to give the best obtainable information on varieties of grapes and strawberries adapted to cultivation in Tennessee. The people of our State have depended to a great extent upon the Experiment Station to furnish information on varieties; hence, we have found it necessary to do some work of this nature. It is gratifying to note that our gardeners and fruit growers are testing varieties on their own places more than formerly, so that little attention will be given to variety tests at the Experiment Station in the future.

A small vineyard was planted on the farm last spring, and another will soon be established on the horticultural grounds at the University. The vines in these two vineyards will be used in conducting various experiments of importance in the culture of grapes.

All of the area designed for pears has been planted. The last lot of trees was set in November. It seems to be difficult to produce pears of high quality in most sections of the State. Insect and fungous enemies are quite numerous, and are probably the main causes of failure. The young orchard on the farm should prove of decided value in determining the real hindrances to success and in showing how to overcome them.

The greenhouse, completed in November, 1895, and described in the Eighth Annual Report, is being used this winter for cultural experiments with lettuce. It is well adapted to investigations with all the vegetables that can be commonly forced in the greenhouse.

We believe the gardeners and fruit growers of the State are in closer sympathy with the Horticultural Division than at any previous time. Letters of inquiry are numerous, and it affords us pleasure to give them careful attention.

The assistance of Mr. F. M. Cargile has been highly valued. He was employed in the early part of the season to superintend the work in the greenhouse, garden and orchard.

Respectfully,

R. L. WATTS,
Horticulturist.
REPORT OF THE BOTANIST.

DR. CHAS. W. DABNEY, JR.,

President University of Tennessee:

DEAR SIR—The Botanist has continued his investigations of the effect of fungicides on peach foliage. Some progress of a purely technical character has been made; but much of the work is as yet incomplete, and no definite report can now be given. It is designed to continue this work during the winter. To this end, seedling peach trees are being grown in pots in the greenhouse. It is hoped that some definite results can be obtained before the close of the next season by thus experimenting with plants under perfect control.

Some experiments were made early in the present season with a view to testing the efficiency of spraying with the Bordeaux mixture as a preventive of peach rot. In the light of results obtained last season and published in Bulletin No. 3, Vol. VIII, it was hoped that some measure of success would be attained. Mr. William Jenkins, of Knoxville, kindly tendered his peach orchard for the purposes of experimentation. Several trees of the Early Rivers variety were treated—this being the variety specially attacked by the fungus the last time the trees fruited. It was decided to try the efficiency of the Bordeaux mixture with an excess of lime; and an effort was made to have the fruit well covered by the fungicide just before and during the so-called “swelling period.” The mixture was made by adding six pounds of copper sulphate and eight pounds of lime, to a barrel of water. The first application was made May 8, the second on June 5. Before the swelling state, or period of rapid growth of the fruit was reached, the trees were almost completely defoliated as a result of the action of the copper mixture; hence, the experiment had to be discontinued. This result was somewhat surprising, as a mixture of the same strength applied to trees in the Experiment Station orchard in the season of 1895 produced absolutely no injury. The result of the experiment only shows how little the toxic action of the copper fungicides on plants is understood, and emphasizes the necessity of further investigation along this line.

The months of July and August were spent in Middle and West Tennessee, collecting specimens and taking notes of the various diseases of field, garden and orchard crops. Some valuable observations were made as to the occurrence of certain diseases of fruits and vegetables within the State, the methods used for pre-
venting those diseases, &c. The Botanist was brought into direct touch with the problems that constantly confront the practical farmers and fruit growers of the State, and received many valuable suggestions from them. A record of these observations has been filed with the Secretary to be used at his discretion.

Several valuable additions to the equipment for botanical investigation have been made during the year. Special mention may be made of a complete outfit of stains and micro-chemical reagents, some appliances for physiological work, and several sets of fungi which have been added to the herbarium.

Respectfully submitted,

SAMUEL M. BAIN,
Botanist.

REPORT OF THE ENTOMOLOGIST.

Dr. Chas. W. Darney, Jr.,
President University of Tennessee:

DEAR SIR—By the first of May the insectary, built as an annex to the new conservatory, was completed. This structure is the same as if constructed for botanical purposes. The foundation is of brick, and the superstructure of wood and glass. It is provided with wooden tables along the sides on which are placed the breeding cages. The central space is reserved for potted plants on which certain insects may be studied. For the study of aquatic insects an aquarium is provided. This occupies an end table, and is connected with the water pipes so that a continuous stream can be had. The insectary is further supplied with a closet for the storage of glassware, etc.

Though by no means an ideal insectary, it answers the present needs. With these facilities for biological work the entomologist has been able to study, with a decided advantage over last year's work, the habits of more than one hundred species of insects. Of these, many are well known enemies. Although this part of the work was done principally to increase the biological collection, several additional facts concerning the habits of some of the commoner species have been obtained. A portion of the original work prosecuted during the past summer will be ready for publication by spring.

As to the insects which have caused some alarm during the year, four species may be mentioned.

From reports on the chinch bug (Blissus leucopterus (Say.) that were received in the past season, it was ascertained that the pest is spreading from the prairie region, and is not likely to be confined to the State. The army worm, which was so destructive last year, is reported to be worse than ever. The tomato fruit borer, which has become very troublesome, is spreading from the south.

On the third of the year, the pests of the State were visited, and inspection resulted in the discovery of the following:

1. The tomato fruit borer, which has become very troublesome, is spreading from the south.

2. The army worm, which was so destructive last year, is reported to be worse than ever.

3. The chinch bug, which has caused some alarm during the year, is spreading from the prairie region.

4. The tomato fruit borer, which has become very troublesome, is spreading from the south.

Respectfully submitted,

SAMUEL M. BAIN,
Botanist.
were received in early spring, it seemed that the ravages of the insect for this year would surpass those of last. Serious damage, however, was averted by the wet weather of May and June. As well as can be learned from correspondents, the chinch bug did not spread from the counties named in bulletin No. 4, Vol. VIII.

The army worm (Lepidoptera unipuncta (Haw.) appeared in injurious numbers in each of the three sections of the State. All sections report that the meadows were badly damaged by this insect, while the wheat crop was only slightly affected. The damage was done by the first brood.

On the third of September the orchards in and around Harriman were visited, and thoroughly inspected by the entomologist. This inspection resulted in finding the San Jose scale (Aspidiotus perniciosus (Metc.) upon the plum trees in the orchard of the Land Company. At once the Station decided to take steps to destroy the pest in this orchard, which work will be conducted during the winter months. In addition to this an effort has been made to locate this scale insect within the State, but so far without success.

In all sections of the State the grape leaf folder (Dessia maculalis (Wetw.) is quite common. Generally they are so few in number that they do not attract attention, but when in large numbers their work gives a vineyard an ugly appearance and produces a marked effect upon the vines. For the coming season they can be reduced in number by burning the dead grape leaves in which they are now hibernating.

Respectfully submitted,

CHAS. E. CHAMBLISS,
Entomologist.

REPORT OF THE LIBRARIAN.

Dr. CHAS. W. DABNEY, JR.,
President University of Tennessee:

Dear Sir—There are now upwards of 1575 volumes in the Station Library—some of which are not yet catalogued—besides a number of pamphlets and bulletins which are soon to be bound.

The following is a list of periodicals added to the Library during the year by subscription: Agricultural Gazette of New South Wales; American Chemical Journal; American Gardening; Annals of Botany; Botanical Gazette; Canadian Entomologist; Gardener’s Chronicle; Garden and Forest; Bulletin of the Torrey
Reports of State Boards of Agriculture, and Transactions and Proceedings of a number of scientific societies have been received. Also the following exchanges: Agricultural Epitomist; American Manufacturer and Iron World; American Corn and Hog Journal; Elgin Dairy Report; The Farmer's Call; Farmer's Home; Farmer's Guide; Farmer's Magazine; Farmer's Voice; Farm and Fireside; Farm and Home; Grange Visitor; Holstein Friesian Register; Homestead: Industrial American; Mirror and Farmer; Monroe County Monitor; Market Garden: New England Florist; Oregon Agriculturist; Pacific Coast Dairyman; Practical Farmer; Southern Planter; Southern States; Southern Farmer; St. Louis Journal of Agriculture; The Weekly Call; Wallace's Farmer and Dairyman; Indiana Farmer; The Progressive South; Baltimore Weekly Sun; Horticultural Gleaner; Montana Fruit Grower; Farm News; The Public Ledger; Howard's Dairyman; American Agriculturist; American Fertilizer; Farming; Breeder's Gazette; The Successful Farmer; Jersey Bulletin.

Many of the agricultural papers in the above list are sent to the library at the Station farm.

Pursuant to an established custom, two copies of each Bulletin and Report received from other Stations, are retained; all over this number are immediately returned, unless special need is found for them.

The table below shows the number of Bulletins of the present year received from the different Stations:

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<td>Maine</td>
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<td>Maryland</td>
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<td>New York</td>
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<td>North Dakota</td>
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<td>Ohio</td>
<td>7</td>
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<td>Pennsylvania</td>
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Total: 11,208.
Rhode Island     3  South Carolina     5  South Dakota     3
Texas             1  Utah         4  Vermont         4  West Virginia     5
Virginia          2  Washington     1
Wisconsin         7  Wyoming     3

Total               183
Reports received    31

Besides the above, Bulletins issued in 1895, and back numbers for preceding years, have been received from many of the Stations.

An effort is being made to get together all missing Bulletins and Reports, preparatory to binding; but the indications are that some of the files will have to remain incomplete, there being now only sixteen full sets of Bulletins and fifteen of Reports.

The following Bulletins of this Station are either out of print or very nearly exhausted: Vol. II. No. 2; Vol. III. No. 3; Vol. IV. Nos. 1 and 2; Vol. VIII. Nos. 2, 3 and 4; Special A. and D. The supplies of several recently issued are running low.

A large number of Bulletins have been sent, by special request, to parties in this State, and also to non-residents.

Publications of the U.S. Department of Agriculture are received and filed by Division. The index cards have been distributed to number 11,200.

Following is the present status of the mailing list:

Newspapers in Tennessee                       154
Farmers, Fruit Growers and others in Tennessee 4,923
Experiment Stations and U. S. Department of Agriculture 631
Exchanges                                       43
Private Individuals non-residents of Tennessee     4

Total                                           5,765

Respectfully submitted,

F. H. Broome,

Librarian.
NOTES ON CERTAIN PLANT DISEASES IN TENNESSEE.

With Suggestions as to Their Treatment.

S. M. BAIN, BOTANIST.

During July and August of 1896, the writer made a tour of inspection through certain portions of Middle and West Tennessee, with a view to learning something of the distribution of plant diseases within this State. The counties visited on this trip were Rutherford, Williamson, Davidson, Chester, Madison, Gibson, Obion, Dyer, Lauderdale, Tipton and Haywood. Careful notes as to the occurrence of diseases in each locality were taken, together with specimens of the diseased plants. The following notes were compiled from observations made during this trip, and from correspondence for the past few seasons:

APPLE.—So far as I know, only three diseases of the apple merit the attention of growers in this State, viz: leaf rust, bitter rot and scab. There seems to be no section of our State that is free from the apple leaf rust. It does not yet seem to be generally known that this disease is caused by the same fungus that produces the “cedar apple.” There are two generations, so to speak, of the fungus; the first lives on the apple, the second on the red cedar. So far as known, the disease cannot spread from apple tree to apple tree, but must be communicated from the apple to the cedar, and vice versa. It would be possible to prevent the spread of the disease in an orchard by removing all the cedar trees near it, or else pruning out all of the cedar apples. The writer gave special attention to this question during the aforesaid tour of the State. The disease certainly does more harm where cedar trees are most abundant. A number of small orchards in the neighborhood of the Cedar Glades of Middle Tennessee have been actually wiped out through the attacks of this fungus alone. Out of the large number of orchards inspected in different parts of the State, I have never once failed to find affected cedar trees within one hundred yards of affected apple trees. The red cedar grows naturally on all the limestone soils of Middle and East Tennessee, and their removal in these portions of the State seems to be rather more serious a matter than their extermination in West Tennessee, where they seem to have spread sparingly from cultivation as an ornamental tree. I doubt if the treatment of this disease gets a hold. It is known to some varieties, especially "rot," and is due to failure of maturity. It is known to attack some varieties of disease, or reproduce in circular rings within the tree, but the spores, or reproductive organs, have not yet been thoroughly studied. The third apple disease known as the scab. The spores of this disease are carried by the wind to adjacent trees, where they will infect the tree. The fruit is generally infected about the third apple season, and the tree is infected about the fifth.

PEACH.—Only two diseases of peach have been observed by the writer, namely scab and taste of spores, or reproduction organ, upon the ripe fruit. The spores of the fungus are produced in the peach, and are carried by the wind to adjacent trees, where they will infect the tree. The fruit is generally infected about the third apple season, and the tree is infected about the fifth.
ornamental tree. I doubt if spraying would accomplish much in the treatment of this disease, for it seems to live perennially after it once gets a hold. It attacks the fruit as well as the leaves in some varieties, especially the Shockley.

The bitter rot of apples is the disease commonly causing apples to "rot", and is due to a fungus which attacks the fruit even before maturity. It is not confined to any particular locality. It seems to attack some varieties much more virulently than others. The spores, or reproductive bodies of the fungus, appear in concentric circles within the shrunken rotten spots. Successful experiments have been made in the treatment of this disease by spraying, at intervals of about three weeks, with ammoniacal copper carbonate. Begin just before the flower buds open.

The third apple disease, so far as observed in this State, is known as the scab. This disease has come to us from one or two localities in West Tennessee, and is likely to occur in any part of our State. Several remedies have been tried for this disease. Bordeaux mixture is probably as good as any. An application should be made before the flowers open, followed by another just after the flowers shed, and afterwards applied at intervals of about three weeks during the growing season.

Peach.—Only two fungus diseases of the peach occur in Tennessee, so far as I know; viz: the peach rot and mildew. The first disease has been made a subject of special investigation at this Station for the past two years; and although it is one of the most serious of all fruit diseases, but little progress has been made in the way of successful treatment. The ashen-colored dust that appears in spots on the surface of a rotted peach is made up of myriads of spores, the crop from one peach being sufficient to infect a whole orchard, if applied under proper conditions. The old mummified peaches remaining in the orchard over winter begin to infect the young peaches even in the blossom, in most cases destroying both bloom and twig; and the effect of the fungus upon the ripe or half ripe fruit is too well known. It is a popular idea that warm, damp weather causes peaches to rot. This is true if we consider that just under these conditions the fungus thrives best and gets easier access to the pulpy part of the fruit. This disease does great injury to the peach crop throughout this country, and much good would result from the discovery of a successful method of treatment. About all that can be recommended at present is the removal and destruction,—
best by burning,—of all mummified fruits remaining in the orchard after the crop is gathered.

The mildew of the peach has been sent to us from near Chattanooga. It may be recognized by its white powdery appearance on the leaves and twigs. It attacks only a few varieties, but deserves further attention.

PLUM AND CHERRY.—The same fungus causing peach rot also attacks the plum and the cherry, and the statements made relative to that disease also apply to the plum and cherry rot.

By far the most serious disease of these trees that we have is the black knot. This disease attacks the younger wood of the plum and cherry, being more prevalent on the plum. I have not seen specimens anywhere in the State except about Knoxville, but it doubtless occurs in all parts of Tennessee. The only method of treatment known is to cut out all knots as fast as they appear and burn them.

PEAR.—Only two diseases of the pear have been observed in this State, viz: leaf blight and fire blight. These two diseases are due to entirely different causes. Leaf blight is caused by a fungus, while the fire blight is caused by bacteria—the same group of vegetable parasites that produce the infectious diseases of the human body. The leaf blight has been observed only in East Tennessee. It can be controlled very well by spraying with the Bordeaux mixture according to the usual methods.

In the writer's opinion, the most serious disease that orchardists have to contend with in this State is fire blight of the pear. The many orchards in all parts of the State in which are found trees dead or partly killed bear witness to the statement. I have inspected very few pear orchards in the State that do not contain blighted trees. The only remedy is to cut out every blighted twig and burn it. Mr. M. B. Waite, formerly of the U. S. Department of Agriculture, has succeeded in exterminating this disease in an orchard by following this line of treatment and observing certain other rules. When an orchard is attacked every precaution must be taken to prevent rapid growth and the formation of soft wood. This is one time when all cultivation, fertilizing, and irrigation should be discontinued. The pruning process should be applied to every apple (which the disease also attacks), pear, quince, or crab apple within a quarter of a mile of the orchard.

RASPBERRY AND BLACKBERRY.—The orange rust was very abundant the past season on wild blackberries in all parts of the State. I did not find any raspberries affected. Some specimens
of raspberry anthracnose have been sent to us from near Columbia. The Bordeaux mixture may be used for anthracnose, but the rust is best controlled by destroying affected plants, root and branch.

Strawberry.—The leaf blight of strawberry has been observed about Knoxville, and near Humboldt, but not in sufficient quantity to merit serious attention. If abundant, spray with Bordeaux. Suggestion as to spraying may be gotten from Bulletin No. 1, Vol. VIII.

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

VOLUME I, 1888.
No. 1.—History and Reorganization. Dehorning Cattle. No. 2.—The Experiment Station, Building and Laboratories. Germination of Seed Corn. Analyses of Commercial Fertilizers. No. 3.—Weeds of the Farm. First Annual Report, 1888.

VOLUME II, 1889.

VOLUME III, 1890.
No. 1.—Experiments in Growing Potatoes. No. 2.—Tests of Varieties of Barley, Corn, Oats, Wheat and Sorghum; Methods of Culture of Wheat, and Effects of Fertilizers on Oats and on Clover. No. 3.—Points about Country Roads. No. 4.—Practical Experiments in Reclaiming "Galled" or Washed Lands, with Notes on Mulch and Mulch Materials. No. 5.—Fruit Trees at the Experiment Station. No. 6.—Index to Volumes I, II, and III.

SPECIAL BULLETINS.
C.—Treatment of Certain Fungous Diseases of Plants.
D.—Potash and Paying Crops.
VOLUME IV, 1891


No. 2.—The Peanut Crop of Tennessee, Statistics, Culture and Chemistry.
No. 3.—The True Bugs, or Heteroptera of Tennessee.
No. 4.—Some Fungal Diseases of the Grape.
No. 5.—A Chemical Study of the Cotton Plant.

Fourth Annual Report, 1891.

VOLUME V, 1892

No. 1.—Fruit Trees and Experiments with Vegetables.
No. 2.—The Grasses of Tennessee. Part II.
No. 3.—A Contribution to the Study of Economies of Milk Production.
No. 4.—Experiments with Fruit Trees and Vegetables.

Fifth Annual Report, 1892.

VOLUME VI, 1893

No. 1.—Some Injurious Insects of the Apple.
No. 2.—The Rational Use of Feeding Stuffs. Winter Dairying in Tennessee.
No. 3.—Small Fruits: Strawberries, Raspberries, Blackberries, Grapes.
No. 4.—Field Experiments with Tomatoes and Onions. The Boll-worm, Corn-worm, or Tomato-worm [Heliothis armiger Hubn].

Sixth Annual Report, 1893.

VOLUME VII, 1894

No. 1.—Grasses of Tennessee. Part II.
No. 2.—Fruits: Grapes, Strawberries, Raspberries, Blackberries, Pears, Apples, and Peaches.
No. 3.—Co-operative Experimentation.
No. 4.—Dehorning Cattle. Notes to Correspondents.

Seventh Annual Report.

VOLUME VIII, 1895

No. 1.—Spraying Apparatus.
No. 2.—The Wild Onion.
No. 3.—Some Experiments with Fungicides on Peach Foliage.
No. 4.—The Chinch Bug.

Eighth Annual Report.

VOLUME IX, 1896

No. 1.—Apples of Tennessee Origin.
No. 2.—Strawberries.
No. 3.—A Contribution to the Study of Southern Feeding Stuffs.
No. 4.—Varieties of Grapes.

Ninth Annual Report.