

THIRTY-SECOND ANNUAL REPORT
OF THE
Agricultural Experiment Station
OF THE
UNIVERSITY OF TENNESSEE
FOR 1919



SUPERINTENDENT'S RESIDENCE
WEST TENNESSEE EXPERIMENT STATION, JACKSON

KNOXVILLE, TENNESSEE

Agricultural Experiment Station

OF THE UNIVERSITY OF TENNESSEE

H. A. MORGAN, President

EXPERIMENT STATION COMMITTEE

W. S. SHIELDS

W. P. COOPER

T. W. HUNTER

STATION OFFICERS

H. A. MORGAN, Director
C. A. MOOERS, Vice-Director and Agronomist
G. A. METCALF, Veterinarian
C. A. WILLSON, Animal Husbandman
MAURICE MULVANIA, Bacteriologist
W. H. MACINTIRE, Soil Chemist
O. M. WATSON, Horticulturist
G. M. BENTLEY, Associate Entomologist
L. R. HESLER, Plant Pathologist
S. H. ESSARY, Botanist
C. E. ALLRED, Agricultural Economist
H. R. WATTS, Assistant Entomologist
F. C. GRANNIS, Assistant Chemist and Agronomist, to Dec. 1
J. B. YOUNG, Assistant Chemist
F. J. GRAY, Assistant Chemist
W. A. CAMPBELL, Farm Foreman
S. M. SPANGLER, Assistant in Plot Work
S. A. ROBERT, Supt. West Tenn. Exp. Station, Jackson
C. M. HUME, Actg. Supt. Middle Tenn. Exp. Station, Columbia
J. E. CONVERSE, Assistant in Cooperative Experiments, Crossville
H. W. JONES, Assistant, Tobacco Exp. Station, Clarksville
A. W. KIMBRO, Assistant in Cooperative Experiments, Murfreesboro
R. L. LONG, Assistant in Plot Work, Jackson
F. H. BROOME, Librarian and Secretary
MISS RUBY FRANKLIN, Assistant Librarian
MISS EFFIE M. KLOSS, Stenographer

The Experiment Station building, containing the offices and laboratories, and the plant house, are located on the University campus, 15 minutes' walk from the Custom House in Knoxville. The experiment farms, the barns, stables, dairy building, etc., are located about one mile west of the University, on the Kingston Pike. The fruit farm is adjacent to the Industrial School, and is easily reached by the Lonsdale car line. 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.

LETTER OF TRANSMITTAL

KNOXVILLE, TENN., January 1, 1920.

To His Excellency, A. H. Roberts, Governor of Tennessee.

Sir: I have the honor to transmit herewith, on behalf of the Board of Trustees of the University of Tennessee, a report of the work and expenditures of the Agricultural Experiment Station for the year 1919. This report is submitted in accordance with the law requiring that the Board having direction of the Experiment Station shall annually submit to the Governor of the State a report of its operations and expenses.

Very respectfully,

H. A. MORGAN, *President.*

THE UNIVERSITY OF TENNESSEE AGRICULTURAL EXPERIMENT STATION

in account with

THE UNITED STATES APPROPRIATIONS, 1918-1919

	Hatch Fund	Adams Fund
To United States Treasury Draft.....	\$15,000.00	\$15,000.00
By Salaries	11,195.00	11,597.66
Labor	1,316.31	872.05
Publications	233.54	
Postage and Stationery	328.16	57.64
Freight and Express	38.90	28.29
Heat, Light, Water and Power	421.76	250.09
Chemicals and Laboratory Supplies	16.25	707.52
Seeds, Plants and Sundry Supplies	460.06	64.10
Fertilizers		18.00
Feeding Stuffs	513.13	
Library	95.02	75.53
Tools, Machinery and Appliances	243.80	284.64
Furniture and Fixtures	45.96	154.90
Scientific Apparatus and Specimens		354.70
Traveling Expenses	71.01	205.13
Contingent Expenses	20.00	
Building and Land	1.10	329.75
Totals	\$15,000.00	\$15,000.00

We, the undersigned, duly appointed auditors of the Corporation, do hereby certify that we have examined the books and accounts of the University of Tennessee Agricultural Experiment Station for the fiscal year ended June 30, 1919; that we have found the same well kept and classified as above; that no balances were brought forward from the preceding year on the Hatch and Adams Funds; that the receipts for the year from the Treasurer of the United States were \$15,000.00 under the act of Congress of March 2, 1887, and \$15,000.00 under the act of Congress of March 16, 1906, and the corresponding disbursements \$15,000.00 and \$15,000.00; for all of which proper vouchers are on file and have been by us examined and found correct.

And we further certify that the expenditures have been solely for the purposes set forth in the acts of Congress approved March 2, 1887, and March 16, 1916, and in accordance with the terms of said acts, respectively.

Signed:

W. S. SHIELDS,
T. A. WRIGHT,
H. A. MORGAN,

Auditors.

(SEAL.)

Attest:

THOS. D. MORRIS,
Custodian.

THIRTY-SECOND ANNUAL REPORT OF THE AGRICULTURAL EXPERIMENT STATION OF THE UNIVERSITY OF TENNESSEE FOR 1919

REPORT OF THE VICE-DIRECTOR

To President H. A. Morgan:

NEW EXPERIMENTAL FIELD

The various lines of experimental and investigational work progressed almost normally during the year. A new experimental field of 12 acres was established on the farm of James Smith, near Crossville. It was leased for a period of twelve years. The land lies along both the railroad and a well-traveled county road. The lay of the land is excellent for experimental purposes and the soil is considered to be typical of the major portion of the Cumberland Plateau.

NEW PROJECTS

Four new projects were started. Two were life-history studies of insects, the strawberry root louse and the ox louse. The former is of importance to our strawberry growers and the other is a parasite affecting cattle. The third project concerns diseases affecting the soybean. The fourth project relates to the question of the reliability of experiments conducted in pots, cylinders and the like.

NEAL PAYMASTER CORN

From time to time rather outstanding results are obtained. The value of the results of varietal trials as conducted by the Station is illustrated in a practical way by the almost remarkable success of Neal Paymaster corn. In common with other varieties it had its supporters among the farmers of a limited locality. However, when tried for several years by the Experiment Station at both Knoxville and Jackson, it was found to be almost in a class to itself as a high yielder, so that its introduction was recommended to the county agents, who soon spread it over almost the entire State. The farmers, on their part, found it to come up to expectations and the result has been highly gratifying to all concerned. During the past year this variety led all competitors by a wide margin. The average yield of the two nearest competitors planted at the same time under the same conditions as the Neal Paymaster was 49.3 bushels. In a similar manner six plots of Neal Paymaster at the Jackson Station averaged 49.0 bushels per acre and the two nearest competitors averaged 44.9 bushels.

The work of the Soil Chemist has been directed in the main along lines which have further developed the major problems: (1) the compar-

isons between calcic and magnesian materials of different forms and varying amounts in their effect upon the soil, and (2) the divergent effects of lime and magnesia upon conservation of soil sulphur. Both problems are based upon lysimeter investigations, which, however, were supplemented by a considerable amount of amplifying laboratory control work. The data from these investigations are cumulative and are increasing both in value and academic interest. Two rather extensive contributions have been published in Soil Science, and detailed information may be obtained by reference to those articles.

The data throw considerable light upon the activities of the oxide and hydroxide forms of lime when incorporated with soils, and upon the supposed liberation and resultant increased availability of potash native to the soil, as a result of the use of lime and limestone.

Many data, as yet unpublished, were secured upon the utilization of native iron pyrites as a source of sulphur available to growing plants.

The vacancy in the staff caused by the resignation of Mr. L. G. Willis, to become head of the Department of Chemistry of the Porto Rico Station, was filled by the appointment of Mr. F. J. Gray, a graduate of the University of Pennsylvania.

The Station has been unfortunate in losing by death two valuable members of its staff, Dr. W. G. Shaw and Prof. S. M. Bain. Dr. Shaw, the Veterinarian, had been on the staff only a short time, but was highly esteemed by all who knew him. Professor Bain was one of the oldest members of the staff, and was not only recognized by all as a very capable man in his line of work, but was esteemed for his fine qualities of heart as well as of mind. Because of his long connection with the University, it seems fitting to append to this report a brief sketch of his life and work, written by his friend and associate, Prof. S. H. Essary. Resolutions (in part) adopted by the Board of Trustees in memory of President Brown Ayres, are also appended.

CHANGES IN STAFF

There were an unusual number of changes in the personnel of the staff, as shown in the list that follows:

- S. M. Bain, Botanist, died January 30.
- W. G. Shaw, Veterinarian, died April 24.
- C. A. Mooers, Vice-Director from July 1.
- L. R. Hesler, Plant Pathologist from September 1.
- C. E. Allred, Agricultural Economist from August 1.
- S. H. Essary, Botanist, from July 1.
- G. A. Metcalf, Veterinarian from May 1.
- F. J. Gray, Assistant Chemist from March 21.
- R. H. Milton, resigned as Superintendent of the Clarksville Station February 1.
- H. W. Jones, Superintendent of Clarksville Station from February 1.
- F. C. Grannis, Assistant Chemist and Agronomist to December 1.
- J. F. Voorhees, Consulting Meteorologist, resigned June 30.

PUBLICATIONS

The following publications were written by members of the staff:

"A Comparison of Azotobacter with Yeasts," by Maurice Mulvania. Agr. Exp. Sta. Bul. 122, April, 1919.

"The Abnormality of Soils in Field-Placed Cylinder Experiments," by C. A. Mooers. Soil Science, Vol. VII, No. 4, pp. 247-251, April, 1919.

"Rates and Dates of Seeding for Tennessee Farm and Garden Crops," by C. A. Mooers. Div. of Ext. Pub. 78, 1919.

"A Plan for Horse-Breeding Clubs in the State of Tennessee," by H. A. Morgan and C. A. Willson. Agr. Exp. Sta. Press Bul. 46, June, 1919.

"The Carbonation of Burnt Lime in Soils," by W. H. MacIntire. Soil Science, Vol. VII, No. 5, pp. 325-453, May, 1919.

"The Liberation of Native Soil Potassium Induced by Different Calcic and Magnesic Materials, as Measured by Lysimeter Leachings," by W. H. MacIntire. Soil Science, Vol. VIII, No. 5, pp. 337-395, Nov., 1919.

Respectfully submitted,

C. A. MOOERS, *Vice-Director.*

REPORT OF THE AGRONOMIST HATCH EXPERIMENTAL WORK VARIETAL TRIALS

The outstanding results obtained with Neal Paymaster corn, as referred to in the report of the Vice-Director, has been duplicated in varietal trials of certain other crops. For example, Fulcaster wheat, an old, standard variety, has more than held its own against all newcomers, at least for common upland conditions.

In like manner, Burt oats is a leader for spring sowing, but Kherson, or 60-Day Russian, is a close second, and could well be used by farmers whenever the seed of Burt is scarce. On average thin upland, Virginia Grey Turf is unsurpassed in yield as winter oat, but the Station selection of Culberson is a higher yielder under rich-land conditions, and is from ten days to two weeks earlier than the Grey Turf, an advantage which is of considerable value. The Honey variety of sorghum is the outstanding high yielder both of forage and of juice for syrup making.

In time our farmers can have better varieties of soybeans than are now obtainable. Tokio outyields the commonly grown Mammoth Yellow and has other advantages, such as finer stem and a quicker early growth. On the other hand, lack of inoculation, with unsatisfactory growth, is the rule the first year it is grown. This can of course be avoided by the use of either artificial or soil inoculation of the soil. The seed of early varieties is not easily obtained at present, but they have a place in our agriculture. Cer-

tain new introductions by the U. S. Department of Agriculture are very promising in our trials, and in time will find their way into common use.

TILLAGE EXPERIMENTS

More attention to experiments in methods of tillage appears to be warranted. Results recently gotten at this Station indicate that plowing, i. e., turning the land, may, under some conditions, be dispensed with without reduction in yield of the crop following. For instance, land that is free from trash and is loose in the spring may not require the use of a turn plow for a cotton crop, but can be put in the best of condition by the disk harrow alone. There is also considerable evidence to show that extra-deep plowing is not profitable under average soil conditions, even for a crop like corn.

PLANT IMPROVEMENT

Plant-improvement selection was continued with various crops as usual. Some of the rye selections appeared promising in the 1919 crop, but several years will be required to reach conclusive results. Many selections are made, but few prove to be really choice. Rye is valuable in this State for both grazing and grain. The ideal variety would be suited to both purposes, but will probably be difficult to obtain, especially as an upright habit of growth in the cold months of the year, as desired in a pasture rye, seems to be associated with tenderness and winterkilling.

FERTILITY EXPERIMENTS

Certain experiments bearing on soil fertility have been continued for the past 14 years. One of these relates to the crop which can be manured to most profit in a five-year rotation of corn, soybeans, wheat and clover and grass. The results have not been compiled, but the effect of manure applied as a top-dressing to wheat has had an evidently favorable effect in getting superior stands of clover and grass from the following spring seeding. In the cowpea-wheat rotation, manure applied directly for the wheat crop has done better than the same quantity of manure applied to the cowpea crop preceding the wheat.

MIDDLE TENNESSEE COOPERATIVE EXPERIMENTS

At State Normal School, Murfreesboro: A fairly extensive series of fertility experiments was established at Murfreesboro on the State Normal School farm. These experiments are cooperative with the School, being used in connection with their instruction in agriculture. Two distinct types of soil are used in these experiments; one is a characteristic red soil of Rutherford County and the other is a gray-colored soil, such as is of frequent occurrence in that county. In addition to the fertility experiments, variety trials were made of several crops. The main object of this work is to determine the soil's need of various fertilizer and lime treatments.

At Crossville, Cumberland County: A similar group of experiments was started at Crossville, on typical Plateau soil, which had been cleared the previous year. The field is located about a mile north of town,

bordering the railroad right-of-way, and is reached by a good wagon road, making it easily accessible to visitors. The experiments are expected to be continued for at least ten years, and were designed not only to show the immediate soil requirements, but to tell both the kind and quantity of phosphate which can be used most profitably; also the amount and form of lime which will give best results on this type of soil. Advantage was taken of the information previously obtained in our experiments on the Plateau to make this series as valuable as possible as a practical guide in the future development of the agriculture of this large section.

The Clarksville work was continued as previously.

WEST TENNESSEE EXPERIMENT STATION

The work in agronomy at Jackson supplements that done elsewhere in the State. The difference in climate and soil between West Tennessee and other parts of the State makes the work here of special value. The experimental field lies well for the purpose and the work is planned to extend over a number of years. Fertility, tillage experiments, and variety trials make up most of the work, which is designed to be practical in nature and to answer questions of the most fundamental importance.

ADAMS FUND PROJECTS

The lysimeters used in the soil nitrogen studies were seeded in the fall of 1919 to either tall oat grass or alfalfa, the principal object being to compare the effects of those two crops on the nitrogen output of the two soils used. The preliminary studies are, however, being continued, under a separate project.

Respectfully submitted,

C. A. MOOERS, *Agronomist.*

REPORT OF THE BOTANIST

TOMATO DISEASE WORK

The work of selecting a variety of tomatoes, and of improving this selection to make it more uniform and more nearly the type desired by the best truck-growers of the State, was continued during the growing season of 1919. This variety, which was selected some years ago on account of its resistance to attacks of the wilt disease, was grown again in a number of sections of the State, and also in other states where wilt was prevalent. It was found that the variety was still resistant to the wilt disease, and was very much improved as to earliness and productiveness. This was the result of several years of selection for these qualities. A good quantity of seed was collected for propagation of this variety in 1920. A careful study was made of methods commonly used by tomato-growers in the trucking regions of Tennessee. Many improved methods have been suggested to them as a result of these studies, and have proved very effective in aiding them to reduce their losses from the wilt disease. Particular attention has been paid to seed-bed sanitation. Experiments carried on in the greenhouse have shown that plants grown in clean seed-beds

survive much longer in wilt-infested fields than those grown in old and unsanitary beds. It was found that tomatoes of common varieties started in clean beds would ripen the principal part of the fruit crop before dying from wilt. From evidence at hand, it is believed that more is to be expected from careful seed-bed sanitation and a proper crop rotation than from the use of varieties resistant to the wilt disease.

JAPAN CLOVER

The work of selecting and standardizing new and improved varieties of lespedeza, or Japan clover, was continued. The new and improved varieties previously reported were grown in plots large enough to admit of comparison with the ordinary variety as to hay and seed production, and also for pasture purposes. The tall variety mentioned in a previous report showed conclusively that it is a superior hay producer. It made nearly one-half more dry hay to the acre than the best strain of the ordinary variety. The pasture, or bunchy, late green variety maintained all the characters previously mentioned as making it a very desirable variety for pasture purposes. Both varieties have maintained all the characters which distinguished them from the kinds ordinarily grown from southern seed. A new variety, a very early-maturing kind, was further studied. It matures seed nearly a month earlier than the common variety. It promises to be a valuable addition to the varieties of lespedeza, since it will mature in sections where the season is too short for the development of the ordinary variety, or the two new varieties mentioned above. Enough seed has been harvested from these three new varieties to carry on further tests on a larger scale next season.

PLANT DISEASE SURVEY

During the year, a large part of the time of the Botanist was devoted to making a plant-disease survey of the State in cooperation with the U. S. Department of Agriculture. This was done as a war measure, to assist in increasing and conserving the food supply. It was found from the survey that a much larger part of the crops produced in the State is destroyed by plant diseases than had been suspected. A large number of correspondents throughout the State cooperated in the work, and much valuable information was accumulated. Advice and help were given in controlling diseases, and it is believed that much of the losses that would otherwise have occurred were prevented. The same work will be carried on in the future. From our reports, the U. S. Department has made up a report of the losses sustained. The amount of loss of some of our principal crops from plant diseases is given below for the year of 1919:

Wheat 1,710,000 bushels.
Oats 800,000 bushels.
Corn 10,679,000 bushels.
Tomatoes 9,837 tons.
Cotton 33,110 bales.
Dry beans 1,669,000 bushels.

The losses in all other crops are in proportion to those given above, since none of our crops are free from diseases. Most of these losses are preventable by well-known methods. The importance of all this is seen when the losses are figured in the money value of the farmer's labor which is lost each year from these causes.

Respectfully submitted,

S. H. ESSARY, *Botanist.*

REPORT OF THE SOIL CHEMIST

SULPHUR CONSERVATION IN SOIL AS INFLUENCED BY LIME AND MAGNESIA

A further contribution will be offered subsequent to the compilation of data now being assembled relative to the influence of lime and magnesia, in different forms and amounts, upon the formation and outgo of sulphates from native and applied sulphureous materials during a five-year period. One very interesting observation in this connection has been made in a preliminary report concerning the divergent effects of lime and magnesia upon the outgo of native soil sulphur as sulphates.

A supplementary study involving treatments of sulphur compounds has been summarized for the initial two-year period. The investigation has yielded experimental data pointing to the fact that the function of surface is an inherent property in the oxidation of iron pyrites; and it has made necessary a study of the oxidation induced by surface as contrasted with biologically induced sulphofication.

The accumulated data point to the fact that attention must be directed toward iron pyrite as a source of progressive formation of sulphates within the soil.

DECOMPOSITION OF CALCIUM AND MAGNESIUM CARBON- ATES IN SOILS UNDER FIELD CONDITIONS, INCLUDING DRAINAGE INVESTIGATIONS

The somewhat extensive contribution entitled "The Carbonation of Burnt Lime in Soils" was approved in May, 1919, for publication in Soil Science. This study embraces an investigation of the chemistry of the carbonate reaction under various normal and imposed conditions; the influence exerted by the soil, under various conditions of contact, upon the speed of the reversion; the persistence of $\text{Ca}(\text{OH})_2$ occurrences within the soil; a comparison between soil surface exposures with intra-soil treatment; the humidity factor; the source of the CO_2 effecting carbonation; the effect of different rates of lime upon the composition of the soil atmosphere; and the effect of lime upon native and applied soil organic matter. The report was based upon six years' work upon cylinder, field lysimeter, and pot studies, supplemented by laboratory investigations.

NOTEWORTHY RESULTS

The probable outstanding features of the results offered are: CaO and $\text{Ca}(\text{OH})_2$ treatments, in equivalence, are identical in their effects; humidity is one of the major factors in determining the speed of the reversion reaction; lime applied at practical rates will revert to the carbonate within four or five days; surface applications will revert to the carbonate more rapidly than will treatments mixed throughout the mass or a mulch of the soil; the aerial atmosphere furnishes the major portion of the CO_2 essential for carbonation; no chemical disintegration of organic matter appears to be induced by the burnt-lime or hydrated-lime treatments.

Data are nearing completion as the basis of an article representing a five-year study of the action of various forms and different amounts of calcic and magnesian materials upon the liberation of native soil potassium. The article carries an abundance of data to support the conclusion that admixtures of both moderate and excessive amounts of calcic and magnesian materials actually depress the amounts of potassium entering the free water and film water of the soil. Exception was found only in the case of the heavy treatment of CaO , where evidence of potassium liberation appeared only after two years, and where the persistence of $\text{Ca}(\text{OH})_2$ was established. The magnesian compounds were even more pronounced than were the calcic materials, in effecting the repressive action. The absorptive function of the subsoil, conclusively demonstrated in this and the previously mentioned burnt-lime lysimeter investigations, fully justifies the utilization of surface soil only and shallow subsoil lysimeters, in conjunction with tanks carrying deeper subsoil in those investigations wherein studies are to be made of the loss of fertility by leaching.

As a practical application of the work, it should be stressed that with similar types of rock-derived soils, formed *in situ*, the several forms of calcic, calcareous, and dolomite materials are not to be depended upon as direct liberants of native soil potassium.

Respectfully submitted,

W. H. MACINTIRE, *Soil Chemist.*

REPORT OF THE ASSISTANT LIBRARIAN

Bound volumes	5,778
Accessions during the year	138
Purchased	24
Obtained by exchange and gift	37
Bound by the Station	77
Journals subscribed for	45
Agricultural papers received in exchange for bulletins	87

Respectfully submitted,

RUBY FRANKLIN, *Assistant Librarian.*



RESOLUTIONS

ADOPTED BY THE BOARD OF TRUSTEES OF THE
UNIVERSITY OF TENNESSEE IN MEMORY OF
DR. BROWN AYRES

Dr. Brown Ayres, the twelfth president of the University of Tennessee, * * * died in the sixty-third year of his life and the fifteenth year of his service as President of the University, at his residence on the Campus, at 6:30 o'clock, A. M., Tuesday, January 28, 1919, after a short illness.

He was born in Memphis, May 25, 1856. His father was Samuel W. Ayres, a lawyer of that city; his mother, Elizabeth (Cook) Ayres; his lineage, Scotch-Irish and English.

He received his early education in private schools in Memphis, and later in New Orleans, where he lived with his guardian after his father's death. He was, from the beginning, an excellent student. He entered, at an early age, Washington and Lee University, where he took the course in engineering. He then entered the Stevens Institute of Technology, graduating in 1878, with the degree of Bachelor of Science. In 1879-80 he was a Fellow in Physics at Johns Hopkins University, where he worked under Dr. Roland, the eminent physicist. On completing this study, he was, in 1880, elected Professor of Physics and Elementary Engineering at Tulane University of Louisiana, and held this chair until 1901, when he became Professor of Physics and Astronomy, a position which he retained during the remainder of his twenty-four years' service in that University. When the College of Technology was organized at Tulane University in 1894, he was made its first Dean, serving in this capacity until 1900, and making it, as its creator, one of the greatest engineering schools in the South. From 1900 to 1904 he was the Vice-Chairman of the Faculty and Dean of the Academic Colleges of Tulane University, and in 1904 Acting President of the University. * * *

In 1904, the presidency of the University of Tennessee became vacant by the resignation of Dr. Charles W. Dabney. The Board of Trustees, after devoting painstaking thought and study to the task of suitably filling the vacancy, on August 2, 1904, elected Dr. Ayres as President of the University. * * *

Time abundantly justified the wisdom of this selection. For more than fourteen years, Dr. Ayres worked unceasingly, with single-minded devotion and greatest success, in the task of administering and up-building the University. * * * Under his wise leadership, and with the aid of the skilled and loyal assistants by whom his hands have been upheld and strengthened, the University has steadily, without variableness or shadow of turning, advanced upon its upward path. Its faculty has been enlarged; the number of its students multiplied; its buildings and equipment increased in extent and value. The College of Agriculture has been enlarged and greatly strengthened; the College of Law established as an integral part of the University; and the Medical and Dental Colleges placed on a firm and enduring foundation at Memphis. As a final result, splendidly rewarding the labor of many steadfast years, the State, in 1917, enacted the ever-memorable legislation by which it established a permanent tax-levy for the support and maintenance of the University and gave it One Million Dollars for the erection of buildings and other necessary expenses. * * *

During the fateful year which has just passed, in which the United States was engaged in the world war for freedom, Dr. Ayres, as President of the University, entered loyally and with the heartiest cooperation into the Government's plan for the use of the University as a training school for officers, and, with the fidelity of a soldier, worked tirelessly and efficiently in the transformation of the University into a school for the Students' Army Training Corps.

To the discharge of his innumerable duties, which comprised not only the administration of the University, with its many departments, but also incidentally, for many years those of the Summer School of the South, Dr. Ayres brought an unceasing industry and gave untiringly of his thought and energy. * * *

His scholarly attainments and successful administration of the University brought him wide recognition among men of letters and the esteem of his professional associates. In addition to the degree of Ph. D., which he obtained from Stevens Institute of Technology in 1888, he received many honorary degrees from other colleges and universities; that of LL. D. from Washington and Lee University in 1894, South Carolina College in 1905, Tulane University in 1905, and the University of Alabama in 1906; and that of D. C. L. from the University of the South in 1907.

He was President of the Association of Colleges and Preparatory Schools of the Southern States in 1904-5, and of the National Association of State Universities in 1909-10. A few weeks before his death he was unanimously offered the presidency of the Association of Land Grant Colleges of the United States, but declined this position on account of his other duties, and was elected Vice-President of that Association. He was a member of the Jury of Awards at the World's Columbian Exposition in 1893, of the Atlanta Exposition in 1894, and the Tennessee Centennial Exposition in 1897; a Fellow of the American Association for the Advancement of Science and Secretary of its Physics Section in 1892; and a member of the American Institute of Electrical Engineers, the American Physical Society, the Association for the Promotion of Engineering Education, and the Phi Beta Kappa and Phi Kappa Phi Societies * * *

In the last months of his life he devoted himself with intense earnestness to the plans for the construction of the new buildings to be erected by the University, and especially for the Main Building, which is to crown the University Campus, of which he had so long dreamed, and the Agricultural Building on the University Farm, matters which he had greatly at heart and to which he devoted painstaking thought. * * *

Reviewing his life work and his faithful and imperishable services to the University he so deeply loved, and in honor of his memory:

BE IT RESOLVED, by the Board of Trustees of The University of Tennessee:

That in the death of Dr. Ayres, the members of the Board have lost a true, sincere and honored friend and fellow-worker;

That the University has lost a President and member of the Board of Trustees, whose nobility of character, strength of intellect, breadth of learning, administrative capacity, steadfastness of purpose and unswerving devotion to the interests of the University, will always be gratefully enshrined among its most cherished memories; whose faithful, wise and efficient services have contributed, in a degree which cannot be adequately measured, to the sure growth of the University and its permanent and

secure establishment, an adequately equipped University worthy of the State and of its youth; and whose life of high and honorable attainment and public service is part of the enduring annals of the University and of the State; and

That these resolutions be entered at large upon the minutes of the Board of Trustees on pages set apart for that purpose, and that a copy thereof, suitably engrossed, be sent by the Secretary of the Board to Mrs. Ayres.

EDWARD T. SANFORD,
WM. P. COOPER,
I. B. TIGRETT,
Committee.



SAMUEL McCUTCHEN BAIN*

S. H. ESSARY

Samuel McCutchen Bain was born at Eagleville, Rutherford County, Tennessee, January 14, 1869, and died at Knoxville, Tennessee, January 30, 1919. He was reared on a farm and educated in the public and private schools of his neighborhood. He received the equivalent of a classical college course in Eagleville School, but his scientific education was obtained for the most part by independent study. He studied French and German under the instruction of Miss Evelyn Franklin, whom he married at Henderson, Tennessee, June 6, 1891.

Early in his life he developed a love for the sciences, especially for botany. With the few books he had at his command, he commenced the study of the flora of his neighborhood. Before his graduation he was asked to give courses in the sciences in Eagleville School, where he showed

* Sketch published in *Phytopathology*, April, 1920.

great proficiency and ingenuity in the construction and handling of apparatus in teaching chemistry and physics. In 1890 he was called to Union University at Jackson, Tennessee, to assist in the teaching of sciences and French. He soon took up the study of the flora of that section and the collection of material for his "*Plantae Tennesseae Occidentalis*." During a vacation in 1892, he took a portion of his collection to the University of Tennessee to compare it with the specimens in the University herbarium. Doctor F. Lansom-Scribner, who was at that time Professor of Botany in the University, was greatly impressed with his work, and asked him to return for the following year (1893) as his assistant. A short time later Dr. Scribner left the University, and Professor Bain was made Instructor in Botany and Geology and Assistant Botanist in the Agricultural Experiment Station. He was advanced in position gradually and was made Professor of Botany in the University and Botanist in the Station in 1901. He continued his studies of the flora of the State, and added very materially to the University herbarium. In his Experiment Station work he soon became interested in the preparation and use of fungicides. After several years of intense study and experimenting, he published in 1902 his bulletin on "The Action of Copper on Leaves," which gained for him wide notice among the agricultural workers of America and Europe.

In 1904 he was appointed Special Agent and Collaborator in Cotton Breeding Experiments in the boll weevil investigations of the U. S. Department of Agriculture. He devoted one-half of his time to this work for a number of years, working in West Tennessee, Arkansas, and Texas. While he was actively engaged in this work, he brought out the well known "Trice Cotton," which is now grown very extensively in the South. He spent more than a year in studying the oil content of cotton seed, the results of which have never been published.

About the time of his appointment in the U. S. Department of Agriculture, he became interested in the selection of plants resistant to disease. He selected and propagated a strain of red clover resistant to anthracnose, a disease which had well-nigh put an end to the growing of red clover in the State. This selection work had much to do with restoring the growing of red clover in Tennessee. He soon started on a comprehensive scale the selection of other crop plants resistant to specific diseases, but this work was greatly hindered by illness during the latter years of his life. Several projects along this line were unfinished at the time of his death.

Professor Bain was as successful a teacher as an investigator. He never sought after large classes; but he had the ability to draw about him a small band of deeply interested students, who were inspired by his earnestness and devotion to his subject, as well as by his cheerful and lovable disposition. No teacher ever had more loyal pupils. He believed in teaching Botany as a pure science, believing that the practical application of the subject would take care of itself. As he had never had a teacher of Botany himself, he developed his own peculiar methods of presenting the subject. Through his wise study and his own researches, he was able to give his students instructions fully up to the standards set by other institutions.

Many of his pupils have been called to teaching and station positions in other institutions. He published a number of papers on botanical subjects, and there are several unfinished manuscripts among his files. Some years ago, he began a paper, "Southern Contributions to Natural History," which was never finished. He left a valuable collection of pictures of the plants of the Tennessee mountains, among which are a number of color photographs unexcelled for their beauty. He was a pioneer in the development and application of the autochrome process of color photography in this country.

As a man, Professor Bain was noted for his unfailing good humor and optimism. He was under all conditions polite, genial, kind, and good-natured. Even during the years of his ill health, he never lost the spirit of good cheer. He was always ready to offer counsel, and not afraid to ask advice of others. My personal recollections of him are very vivid. His teaching was mostly out of doors, in the woods and fields. He took his classes on many long trips around the country. During the long summer vacations, he spent his whole time collecting and studying the flora of West Tennessee.

Professor Bain was a Fellow of the American Association for the Advancement of Science, a member of the Association Internationale des Botanistes (1900); member auxiliaire (1902), Associe libre de l'Academie Internationale de Geographie Botanique (1912); member of the St. Louis Academy of Sciences; member of Royal Society of Arts (1911); member Botanical Society of America; charter member of American Phytopathological Society; charter member of Tennessee Academy of Science (1912), and President of same (1916).

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