

THIRTY-FIRST ANNUAL REPORT
OF THE
Agricultural Experiment Station
OF THE
UNIVERSITY OF TENNESSEE
FOR 1918



VIEW OF TOBACCO STATION AT CLARKSVILLE

KNOXVILLE, TENNESSEE

The Agricultural Experiment Station

OF THE UNIVERSITY OF TENNESSEE

BROWN AYRES, President

EXPERIMENT STATION COMMITTEE

BROWN AYRES

SAMUEL N. WARREN

I. B. TIGRETT

J. E. HITE

H. CLAY EVANS

STATION OFFICERS

H. A. MORGAN, Director

S. M. BAIN, Botanist

C. A. MOOERS, Chemist and Agronomist

W. G. SHAW, Veterinarian

C. A. WILLSON, Animal Husbandman

MAURICE MULVANIA, Bacteriologist

W. H. MACINTIRE, Soil Chemist

O. M. WATSON, Horticulturist

G. M. BENTLEY, Associate Entomologist

S. H. ESSARY, Assistant Botanist and Mycologist

J. F. VOORHEES, Consulting Meteorologist

H. R. WATTS, Assistant Entomologist

W. A. HOLDING, Assistant Chemist

J. B. YOUNG, 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

W. N. RUDD, Assistant in Cooperative Experiments, McMinnville

ROY H. MILTON, Supt. Tobacco Exp. Sta., Clarksville

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 buildings, etc., are located 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, 1919.

To His Excellency, Tom C. Rye, 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 1918. 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,

BROWN AYRES, *President.*

THE UNIVERSITY OF TENNESSEE AGRICULTURAL EXPERIMENT STATION
in account with
THE UNITED STATES APPROPRIATIONS, 1917-1918

To United States Treasury Draft	\$15,000.00	\$15,000.00
By Salaries	10,568.35	11,933.35
Labor	1,467.95	966.12
Publications	351.65	
Postage and Stationery	263.04	53.59
Freight and Express	134.38	53.21
Heat, Light, Water and Power	616.08	162.01
Chemicals and Laboratory Supplies ..	17.06	518.55
Seeds, Plants and Sundry Supplies	516.66	151.54
Fertilizers	4.00	6.50
Feeding Stuffs	187.03	21.25
Library	193.25	68.50
Tools, Machinery and Appliances	308.50	165.68
Furniture and Fixtures	36.10	257.68
Scientific Apparatus and Specimens ..	168.03	188.03
Traveling Expenses	19.35	145.78
Contingent Expenses	20.00	
Building and Land	128.57	308.21
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, 1918; 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, 1906, and in accordance with the terms of said acts, respectively.

Signed:

HU. L. McCLUNG,
JAMES MAYNARD,
BROWN AYRES,

Auditors.

(SEAL)

Attest:

THOS. D. MORRIS,
Custodian.

THIRTY-FIRST ANNUAL REPORT OF THE AGRICULTURAL EXPERIMENT STATION OF THE UNIVERSITY OF TENNESSEE FOR 1918

REPORT OF THE DIRECTOR

To President Broten Ayres:

LAST OF THE N., C. & St. L. RAILWAY FARMS

The work of the Station was carried on successfully throughout the year. Another experimental field was established on the N., C. & St. L. Railway farm at Somerville, in Fayette County. This was the third field of the kind to be established in West Tennessee. All were especially valuable as supplementary to the work at the Jackson Station. It is very unfortunate, however, that the Railway administration has decided that all N., C. & St. L. demonstration farms must soon be sold. Accordingly, no plans are being made for the continuance of any of the experimental fields. Fortunately, some of them have been in use for several years, so that results of value have been obtained.

WORK OF THE DEPARTMENTS

Considerable progress is reported by the different departments. The results obtained this first year of the sulphur project promise to be of practical value. Liming appears to accelerate the availability and consequent outgo of soil sulphur, but several years will be required to determine the final outcome.

Two new and promising legumes were tried this year. One is lotus, a plant looking somewhat like alfalfa, and the other is a giant white clover, said to be extensively grown in Italy, where it is planted on rich bottom lands and mowed for hay. Perhaps the most hopeful character of lotus is its ability to grow on soils poor in lime. Plantings made on worn and gullied hillsides not only survived, but made a healthy growth, where nothing was growing previously. Ladino closely resembles common white clover, except that it is much larger. Plants of lotus and seed of Ladino were both received from the U. S. Department of Agriculture, at Washington.

One of the complaints made by students of Agriculture is of the limited exact rules that can be followed in crop culture. The Agronomy Department has recently worked out a method of calculating the proper stand of corn for highest yield and best quality of product. This method takes into consideration the quality of the land and the variety of corn to be grown. The first year's experience by county agents with tables devised for practical use was very satisfactory.

CHANGES IN THE STAFF

A few changes took place in the Station staff, as follows:

Mr. O. A. Campbell, Plot Assistant at the Jackson Station, resigned, and Mr. R. L. Long was appointed to take his place. Mr. Campbell did excellent work for the Station, and leaves with the best wishes for his future success.

Mr. J. B. Young, a graduate of Maryville College, was made Assistant Chemist.

The Station is especially sorry to lose Mr. L. G. Willis and Mr. W. A. Holding. Both were Assistant Chemists in the Soils Department. They were not only highly efficient in their line of work, but were men of high character and fine personality. Mr. Willis goes to Porto Rico as Chemist to the Agricultural Experiment Station at Mayaguez. Mr. Holding resigns to go into business.

The Station is also very sorry to lose Mr. W. N. Rudd, Assistant in Cooperative Experiments, and Mr. S. M. Spangler, Plot Assistant at the Knoxville Station. Mr. Rudd did excellent work in connection with the fertilizer and crop experiments on Highland Rim soils. His intimate knowledge of these soils and his enthusiasm were a great help to the Station. Mr. Spangler has been in charge of the plot experiments for a number of years. The zeal and care which he exercised in his work are in large degree responsible for the reliable results obtained. The Station will miss him, and hopes for his speedy recovery from ill health.

PUBLICATIONS

Two bulletins were published during the year:

No. 120, "The hog louse," by H. R. Watts, is the result of the life-history study of an insect pest of swine. Both the life-history of the insect and methods of control are given in the bulletin.

No. 121, "Pruning and spraying the home orchard and vineyard," by G. M. Bentley, is a practical treatise of the subject given.

"The Growth of sheep sorrel in calcareous and dolomitic media," by W. H. MacIntire, was published in the Journal of the American Society of Agronomy, Vol. 10, No. 1, pp. 29-31. Experiments conducted with sheep sorrel (sour dock) showed that it would grow freely in ground limestone, if supplied with the other necessary elements of plant food. It appears therefore that liming the land can not directly reduce the growth of this weed. The true explanation appears to be that liming encourages the growth of grass and clover to such an extent that the "sour dock" is unable to stand the competition, and either dies out or is greatly reduced in its growth.

"Cottonseed meal for hogs" and "Cheap feed for steers" were written by C. A. Willson for the Division of Extension. They are practical one-page circulars, Publications 62 and 63, Feb., 1918.

Respectfully submitted,

H. A. MORGAN, *Director.*

REPORT OF THE ASSISTANT BOTANIST

During the year 1918 the work of the Botanist was continued along the same lines mentioned in previous reports. The ill health of the Botanist, Prof. S. M. Bain, impeded the work to some extent, but satisfactory progress was made on the projects of the physiology of resistance in red clover to *Colletotrichum*, studies of resistance of *Spirogyra* to the attacks of various fungi, and apple and pear selection for resistance to fire blight.

Clover Experiments: The resistant strain of red clover has been scattered among farmers over the State and is being grown on a large scale in a few places with entire success. The seed is being placed on the market and planted widely by farmers. The resistance of the strain has been maintained. Further studies have been made on the physiology of resistance in clover, but nothing new has developed far enough to report.

Spirogyra Experiments: Collections of *Spirogyra* were made toward the close of the year, in different parts of the State.

Pear and Apple Selections: Many seedlings of pears were obtained from seed secured from various sources. These were inoculated with pure cultures of the blight organism. Only a small per cent of the plants survived, and these are being subjected to further tests, and it is hoped that resistance will be secured for further study.

Tomato Disease Work: During the year the Assistant Botanist continued the selection of tomatoes for resistance to *Fusarium*. The strains previously selected were again tested under serious *Fusarium* wilt conditions. Plots were grown on the West Tennessee Station farm and by a number of farmers in the tomato sections of West Tennessee. Resistance was very marked wherever there was an attack of the disease on non-resistant varieties. Seed was sent to other state experiment stations and tested with other wilt-resistant strains. Reports from these tests show that our wilt-resistant strains are equally as resistant under conditions in those sections as they have been in our own tomato sections. In each case non-resistant varieties were grown with them, and suffered severely from wilt.

Improvement of the Resistant Strains: While field tests were being made of the resistant qualities, the strains were further improved by selection for better qualities, as earliness, better shape and size of fruit, shipping qualities, and freedom from blossom-end rot.

Laboratory Studies: It was demonstrated that two strains of *Fusarium* are responsible for wilt in Tennessee. They show structural and cultural characters different and constant enough to warrant the belief that they are different strains and probably different species.

Greenhouse Work: It was demonstrated by greenhouse studies that infection occurs in the seed-bed as well as in the field soil. Plants grown in infected soil were compared with those grown in sterile soil. Plants

grown in infected soil and transplanted into sterile soil showed wilt symptoms much earlier than those grown in sterile soil and transplanted into infected soil. It was further demonstrated that plants grown in clean soil will produce a fair crop of fruit even when placed in infected fields. This leads to the conclusion that disinfection of seed-bed soil is of greatest importance in the control of the wilt in tomatoes.

Seed Distribution: This experiment has reached the point where seed can be distributed to the farmers and truckers, and the production of seed of these resistant strains taken up in a commercial way. Seed from the 1918 crop has been distributed for test in several sections of Tennessee, Georgia, Alabama, Maryland, and Mississippi. A commercial seedsman has undertaken to test some of the best strains for resistance in the Southern States and in California, with a view to putting them on the market if they prove entirely satisfactory.

Japan Clover: The project of the life-history, habits and improvement of Japan clover was continued during the year. The experiment for the determination of the value of lime to Japan clover was not repeated. It has been demonstrated that liming is decidedly beneficial to the growth of this plant. Plots limed and unlimed were planted in 1914. It was found that the yield of dry hay for the first year was 90 per cent higher on the limed plots than on the unlimed. The second year the yield was 65 per cent higher, the third year 30 per cent.

New Strains: Three new strains superior to the ordinary kinds were selected out of the experimental plots. One of them is very early in maturity, making it suitable for short seasons. Another is very much taller and of an upright habit of growth, which makes it a superior hay plant. A third one is a late-maturing variety, semi-upright and very leafy, making it well suited to pastures. All these and the best of the flat-growing kinds are being tested and grown for seed.

Hybridizing Experiments: Attempts to cross Japan clover, an annual *Lespedeza*, with perennial species have so far failed. Some seed have been obtained, but they have either been from accidental self-fertilization, or failed to germinate. In one doubtful case, a real cross-fertilized seed germinated; but a very weak plant resulted, and died in the seedling stage. The difficulty of handling flowers so small and delicate as those of *Lespedeza striata*, and the fact that the annual and perennial species are so far separated botanically, make successful hybridizing doubtful. However, many attempts were again made to cross them, with what appears to be good seed as a result.

Seed Tests: Experiments on the viability of the seed in the ground indicate that they are comparatively short lived. Seed buried at different depths in the soil and under different moisture conditions were either decayed when taken up 18 months later, or, if still firm, failed to germinate in the incubator. There is still much to be learned about the activity of

the seeds of Japan clover, and these experiments will be continued with better facilities.

Respectfully submitted,

S. H. ESSARY, *Assistant Botanist and Mycologist.*

REPORT OF THE CHEMIST AND AGRONOMIST

HATCH FUND WORK—KNOXVILLE STATION

Varietal trials of various kinds of farm crops make up a part of the field experiments at the Knoxville Station. This kind of work is necessary not only to try out old, standard varieties, but to furnish information desired by the farmers in regard to varieties which are new, either in name or in fact. These variety trials do not always lead to quick answers, the reason being that varieties differ in adaptability both to different soils and to different dates of planting. Our usual method of procedure is to try a new variety on both rich and poor land at the Station farm; then, if evidence of promise appears, to make further trials in other parts of the State. The trials frequently suggest new lines of investigation.

Formula for Rate of Planting Corn: For example, varietal trials of corn suggested the necessity of rate-of-planting experiments, for observation of the mature varieties shows plainly the necessity of different rates of planting in order to give each a fair chance to show its merit. Data on rates of planting of corn have been obtained for the past dozen years from various parts of the State, and have been assembled for publication. The results indicate that a simple formula can be used for calculating approximately the proper stand of corn under any given condition of soil fertility. The formula may be stated as follows: The number of plants to leave per acre equal the expected yield in bushels per acre for the field in question, multiplied by 56, and divided by a factor. This factor is determined by experiment for the variety in question. Variety factors have been obtained for about two dozen of the commonly grown varieties, and have varied from .35 to .65, with .50 a fair average for varieties in common use. Tables were published last year for practical use in the Division of Extension, and distributed to the county agricultural agents throughout the State. An article giving the full evidence on hand is being prepared for publication.

Plant Breeding: A line of work to which more attention is now being given than previously is the improvement of crops by selection and breeding.

The winter beardless barley produced by this Department several years ago, and distributed on a small scale, is attracting increased attention, and has considerable merit as an early hay crop, as well as value for grain and pasture. Barley, however, has a rather limited place, being

well suited only to land above the average in fertility. For this reason, and also because of its hardness and freedom from disease and insect enemies, the getting of a rye which is better adapted to Tennessee conditions than any now on the market has been undertaken. Numerous selections have been made, and some are showing promise.

Ladino Clover, Lotus, etc.: Experiments with various forage crops make up an important part of the field work. Ladino clover continues to be promising under common conditions throughout the State. Seed of this clover, also of *Lotus corniculatus*, were obtained through the courtesy of the Bureau of Plant Industry of the U. S. Department of Agriculture. Lotus plants were put out under various soil conditions, and have thrived on very poor soil without the aid of lime, and have maintained themselves in competition with weeds and crab-grass. This lotus is a perennial legume, somewhat resembling alfalfa, but makes a much weaker growth, its value being limited, apparently, to soil improvement and pasturage under poor-land conditions.

Soybeans: Soybeans continue to receive much attention in variety trials and rate-of-planting experiments, both for seed and hay production.

Wheat: Cooperative wheat work with the Cereals Division of the Bureau of Plant Industry, U. S. Department of Agriculture, was undertaken on a larger scale than heretofore. In this undertaking, breeding work will be emphasized.

ADAMS FUND PROJECTS

Humus and Nitrogen Investigations: The investigational work relating to humus and nitrogen has been continued much as in the past. Special attention, however, has been given to the nitrogen studies, the importance of this element in agriculture, and the accuracy of its quantitative determination, warranting the preference. In addition to the main study, some valuable data have been incidentally collected with reference to the amount of water that leaches through lysimeters of different depths; also on the time required for the nitrogen of nitrate of soda and other nitrogenous fertilizers to leach through different depths of soil. Data of this kind have been obtained from each of two rather widely different soil types.

Abnormality of Soil in Cylinders: The data from the cylinder experiments, as published in Bulletin 118, show that soils placed in galvanized iron cylinders and lysimeters (even when these were coated with asphalt) and exposed to the weather, behaved in a decidedly abnormal manner as compared with soils in the field. This abnormality shows itself in the complete failure, in the course of a few years, of even a highly durable and productive soil to produce crops without the aid of liming. Experiments are now planned to find out definitely to what this result is attributable, and to devise a remedy. At present the assumption is that zinc from the cylinders, and the lack of "run-off" caused by the projection of the rims

for two or three inches above the soil, are the sources of the trouble. Soluble zinc salts in only small quantities are toxic to plants. The lack of "run-off" forces an extra amount of water to leach through the soil and results in the removal of soluble salts of all kinds much faster than under normal field conditions. With these difficulties overcome, it is expected that cylinders can be used to greatly increased advantage in soil studies.

The cylinder experiments for the study of nitrogen and humus changes, in the four different soils used in this investigation, were modified in September by the introduction of a rate-of-liming series from very small to moderately heavy applications.

Soil Chemistry Work: The work in soil chemistry has been directed toward the continuation of cylinder and lysimeter studies upon the problems of nitrogen conservation, the activities of lime and magnesia in various forms and amounts, and the relation of these two earth-alkalis to the conservation of soil sulphur. One phase of the lime work—the carbonation of burnt lime in soils—has been completed, and will shortly appear in print. The results of four years' work upon a study of the loss of lime and magnesia by leaching from the several forms, and in varying amounts, have been calculated and reduced to graphic form preparatory to publication. The same is true of the outgo of potash under similar conditions. In the sulphur-conservation studies, the results of the first four years from the original lime-magnesia tanks, and the results from the initial annual period, in the case of the supplementary tanks, have been calculated and reduced to graphic form. These studies have demonstrated characteristic and consistently divergent influences exerted by lime as contrasted with magnesia. In the original lime-magnesia tanks only the native soil sulphur and that precipitated were considered. However, in the supplementary sulphur tanks consideration was given to applications of sulphur in the three forms of sulphate, iron pyrites, and elemental sulphur. As one phase of the sulphur problem, quarterly analyses were made of the rainfall collected at ten different localities throughout the State. These studies have advanced to the point where progress can be reported and it is believed that the results have practical as well as academic value.

One short article from the laboratory has appeared in the *Journal of the American Society of Agronomy*, January, 1918. This represents a study on "The growth of sheep sorrel in calcareous and dolomitic media," and was offered in an effort to demonstrate the fact that sorrel is as resistant to calcareous media as to acid-soil conditions, under which it is known to thrive. The study embraced media varying from 100 per cent limestone and dolomite and no sand, through varying proportions of limestone and dolomite with sand, to sand alone. The media were fortified by the use of nutrient solutions.

The work of the laboratory has been subjected to a considerable handicap because of the loss of experienced and efficient scientific aid. Mr. L. G. Willis, for six years Assistant Chemist, resigned in December to become Chemist of the Porto Rico Station. This was a well-merited

promotion for Mr. Willis, whose work was at all times of a high order. Mr. W. A. Holding also resigned, after four years of efficient service as Assistant Chemist, in order to enter business for himself.

MIDDLE TENNESSEE COOPERATIVE EXPERIMENTS

N., C. & St. L. Ry. Farms: In 1916 the Middle Tennessee cooperative experiments were apparently greatly strengthened and enlarged by the encouragement and liberality of the N., C. & St. L. Railway in donating land and labor on their demonstration farms at Decherd, Tullahoma, Dickson, and elsewhere. Unfortunately, this is the last year of this cooperation, due to the entire change in policy of the management, instituted during the war. This change results in the disposal of the farms to private ownership, and the Station thereby loses rather extensive experiments which had been planned to continue for a term of years. However, some valuable data were secured.

Clarksville Tobacco Station: The work of the Clarksville Tobacco Station, in cooperation with the tobacco investigations of the Bureau of Plant Industry of the U. S. Department of Agriculture, has been continued for the sixth year along the same lines as agreed upon at the outset. The work of this Station is chiefly experimental, but also, in part, in the nature of a demonstration of the value of alfalfa and crop rotation in connection with tobacco culture.

WEST TENNESSEE STATION

The work of the West Tennessee Station, at Jackson, continues to be highly satisfactory. Mr. O. A. Campbell, who proved to be an efficient plot man, resigned to take a position as a farm manager, and his place was taken by Mr. R. L. Long. The assistance of Mr. S. A. Robert, Superintendent, has at all times been very valuable in the experimental work, and is highly appreciated by the Agronomist.

The work continues to be carried out along the lines of soil fertility and farm crops, and a larger number of plots are in use than elsewhere in the State. The Station is especially valuable for soil and crops work because of its location in a cotton-producing section, and because of the soils, which represent types common in West Tennessee.

Some changes are being made in the fertility experiments. The comparison of phosphates is to be discontinued, for the reason that the soil supply of phosphate is so good that it is not suited to the comparison desired. This change will admit of a strengthening of other lines of endeavor.

Respectfully submitted,

C. A. MOOERS, *Chemist and Agronomist.*

REPORT OF THE ASSOCIATE ENTOMOLOGIST

The work in the Department of Entomology for the past year has been directed to the insects of chief importance to the agricultural and horticultural interests of the State. Following the severity of the weather in the winter of 1917-18, which had a marked influence upon the insect fauna of the State, the insect depredations have been unusual. In no previous year has the beneficial effect of parasites been more clearly shown. Parasites which in normal Tennessee winters have survived and been effective in controlling insects were killed, and their hosts have surpassed in numbers those of former years. On the other hand, the severity of the weather has directly influenced the hosts, weakening many of the economic insects to such an extent that they have caused little, if any, injury during the present year. Special work has been done with the following insects and insecticides:

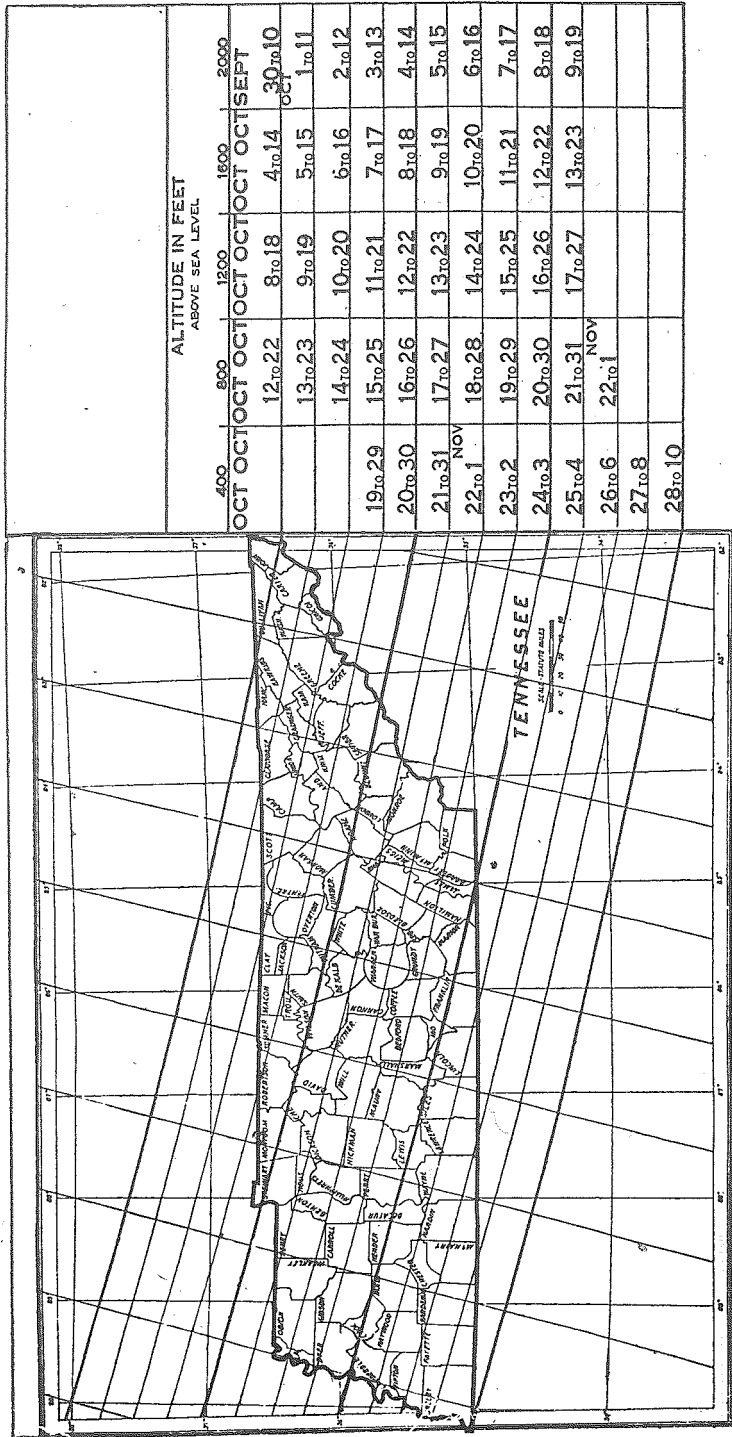
Hessian Fly: Only in limited areas, at a few places in the State, has the Hessian fly been a serious pest this year. The time of sowing wheat was delayed on account of the physical condition of the soil caused by dry weather. More attention has been directed to the importance of destroying volunteer crops, and the turning of infested stubble shortly after harvest. These three effective methods conclusively prove the practical method of fly control. The accompanying map, showing the dates for sowing in the different counties of the State, is the result of data obtained by this Department over a period of thirteen years, and arranged in graphic form by Dr. Hopkins, of the U. S. Bureau of Entomology. Observations have been taken and records made of the distribution of the fly and its effect on plantings of different dates in the State.

HOW TO FIND YOUR BEST SOWING DATES FOR WHEAT TO AVOID HESSIAN FLY

1. Find your county on the accompanying map, then the position of your farm in the county.
2. Follow the nearest line below your location to the calendar on the right of the map.
3. On this line find your dates in the column which is headed by the altitude nearest the average elevation of your general locality.

In a normal season, you should not sow wheat before the earliest date, and if possible you should have the seed in the ground by the latest date. Use your experience and judgment in interpreting these dates to apply to your own conditions this season.

Sow after first date to avoid fly.—The Hessian fly menaces those who sow too early. Destroy all volunteer wheat by plowing, disking, or otherwise. Cooperate with your neighbors in sowing just after the fly-free dates. One early-sown field may infest all the others next spring.



Map, Calendar, and text, from poster issued by U. S., Dept. Agr., September, 1917.

Sow before last date to avoid winterkilling.—Have seed-bed prepared in the best possible manner, finely pulverized and firmly compacted. Early pulverizing and fallowing will conserve moisture and soluble plant food, so that the wheat, even though sown late, will grow quickly and strongly.

Wheat Joint-worm: Injury from wheat joint-worm has been recorded in many parts of the State. Previous to 1918, while it has been found in very limited numbers, it has been a serious pest only in Jefferson, Cocke, and Greene Counties. Fields in these counties were visited and recommendations given to the owners, and very beneficial results have been effected, based chiefly on crop rotation. As this report is being written, notice has been received from the Greeneville section, Greene County, to the effect that there is a serious outbreak, and arrangements have been made for a meeting with the farmers of Greene County for the purpose of giving further instructions in methods of control.

Cotton Boll Weevil: The influence of the early cold weather upon the last brood of the cotton boll weevil, and the severity of the weather upon hibernating adults, greatly reduced the weevil-infested area in Tennessee. In 1917, twenty counties in the southwestern and south-middle portions of the State had boll weevils in part, or in all, of them, but the dissemination in November, 1918, noted by this Department in cooperation with the U. S. Bureau of Entomology, includes, in all, or in part, only eight counties. No appreciable weevil injury as yet has been experienced in Tennessee.

Seventeen-Year "Locust": A few early emergences of the "seventeen-year locust," which is due to appear in several counties of Tennessee in the spring of 1919, have been noticed this year. Only occasional specimens have been taken. By press notices, information has been given in regard to the 1919 occurrence of Brood X, and warnings issued in regard to planting young orchards in proximity to woodlands.

Bag Worm: During the summer and fall of 1918, not only were the cedar trees, but many of the orchard trees, defoliated by the unusual numbers of bag worm larvae. Large acreages of cedar trees on the Cumberland Plateau, as well as in Wilson, Davidson, and Rutherford Counties, have been killed outright by the ravages of this pest. In no previous year had such extended damage resulted from this larva. Many larva and egg masses have been studied in cages, with the result that, contrary to the condition in normal years, it was found that very few were parasitized. The inference may be drawn that the parasites of this pest were killed by the severity of the winter of 1917-18.

Heel Fly, or Ox Warble: On March 20, eggs and young larvae were found upon the heels of cattle in different counties of East Tennessee. Evidence of the entrance of larvae through the skin was noticed in cattle in pastures. The dipping or the wiping of the ankles and legs of cattle in March, to kill the egg stage of this animal parasite, is suggested.

Strawberry Weevil: In the vicinities of Ripley and Covington, in the spring of 1918, the strawberry weevil, in certain strawberry fields, caused considerable damage and appreciably lowered the yield of strawberries. Through correspondence and through county agents, growers were advised to burn over the infested fields and turn under deep the remaining plants.

Honey Bee: In the winter of 1918, experiments were conducted with a view to comparing single- and double-walled hives and different amounts of winter food. These experiments will be continued at least one more season. This year's results indicate that ten pounds of honey per colony in a single-walled hive is insufficient, while the same amount in a double-walled hive is sufficient for winter and spring. Observations were made on the storing of honey by pure-blood Italian bees in comparison with hybrids, with indications that the hybrid is equal to the Italian bee in gathering honey, but is not as careful in guarding the hive, and is decidedly more unsatisfactory to handle.

Sodium Fluoride: Extensive tests have been made with sodium fluoride in controlling the "water bug" and roaches. This preparation is found to be effective and inexpensive. Its use has been also carefully tried out in the controlling of pigeon and poultry lice, with highly beneficial results.

Calcium Arsenate: Different proportions of calcium arsenate, with wood ashes, air-slaked lime, or fine road dust as a reducer, have been used in the controlling of the potato beetle. The efficiency of this chemical and its cheapness in comparison with arsenate of lead and Paris green, have proved it a very desirable insecticide.

Hog Louse: A report of the investigations of the life-history and habits of the hog louse, by Mr. H. R. Watts, was published as Bulletin 120. This is a practical bulletin based on scientific study of this pest. All interested in the raising of swine would do well to get this publication.

The Peach Tree Borer: Investigations on the life-history of the peach tree borer are being continued.

Publications: During 1918, two bulletins have been published: Bulletin No. 120, "The hog louse," referred to above, and Bulletin No. 121, "Pruning and spraying the home orchard and vineyard."

Respectfully submitted,

G. M. BENTLEY, *Associate Entomologist.*

REPORT OF THE ASSISTANT LIBRARIAN

Bound volumes	5,640
Accessions during the year	157
Purchased	13
Obtained by exchange and gift	46
Bound by the Station	98
Volumes complete, ready for binding	77
Journals subscribed for	43
Agricultural papers received in exchange for bulletins	86

Respectfully submitted,

RUBY FRANKLIN, *Assistant Librarian.*