

Twenty-seventh Annual Report

1913-1914

OF THE

Agricultural Experiment Station

OF THE

Alabama Polytechnic Institute

Auburn, Alabama

January 31, 1915

1913-1914

Montgomery, Ala.:

THE PARAGON PRESS

1915

ALABAMA POLYTECHNIC INSTITUTE.

Auburn, Ala., January 31, 1915.

GOVERNOR CHARLES HENDERSON,
Executive Department,
Montgomery, Ala.

Sir:—I have the honor herewith to transmit to you the Twenty-seventh Annual Report of the Agricultural Experiment Station of this College.

The report of the Treasurer, herewith included, is for the fiscal year ending June 30, 1914.

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

It contains the report of the Director, the Chemists, the Veterinarian, the Agriculturist, the Botanist, the Horticulturist, the Entomologist, the Plant Pathologist, and the Animal Husbandman, for the year ending December 31, 1914.

Respectfully,

CHAS. C. THACH,
President.

AGRICULTURAL EXPERIMENT STATION.

TRUSTEES.

His Excellency, Charles Henderson, President.....	Ex-Officio
W. F. Feagin, Superintendent of Education.....	Ex-Officio
A. W. Bell.....	Anniston, Ala.
Harry Herzfeld.....	Alexander City, Ala.
Oliver R. Hood.....	Gadsden, Ala.
C. S. McDowell, Jr.....	Eufaula, Ala.
W. K. Terry.....	Birmingham, Ala.
W. H. Oates.....	Mobile, Ala.
T. D. Samford.....	Opelika, Ala.
R. F. Kolb.....	Montgomery, Ala.
J. A. Rogers.....	Gainesville, Ala.
C. M. Sherrod.....	Courtland, Ala.

STATION COUNCIL.

C. C. Thach.....	President
J. F. Duggar.....	Director and Agriculturist
B. B. Ross.....	Chemist and State Chemist
C. A. Cary.....	Veterinarian and Director of Farmers' Institutes
J. T. Anderson.....	Chemist, Soil and Crop Investigations
C. L. Hare.....	Physiological Chemist
W. E. Hinds.....	Entomologist
L. N. Duncan.....	Junior and Home Economics Extension Work
F. A. Wolf.....	Plant Pathologist
J. S. Caldwell.....	Botanist
George S. Templeton.....	Animal Husbandman
Ernest Walker.....	Horticulturist

ASSOCIATES AND ASSISTANTS.

E. F. Cauthen.....	Associate Agriculturist and Recorder
M. J. Funchess.....	Associate Agriculturist
E. S. Girton.....	Associate in Animal Husbandry
L. F. Pritchett.....	Assistant in Veterinary Science
J. C. C. Price.....	Associate Horticulturist
J. E. Buck.....	Assistant in Entomology
A. B. Massey.....	Assistant in Botany
D. J. Burleson.....	Assistant Agriculturist
J. T. Williamson.....	Field Agent in Agriculture
O. H. Sellers.....	Assistant in Agriculture and Secretary to Director
G. V. Stelzenmuller.....	Field Agent in Horticulture
Miss Madge Reese.....	Assistant in Girls' Demonstration Work
S. Adler.....	Assistant in Chemistry
G. W. Ells.....	Field Agent in Entomology
I. B. Kerlin.....	Assistant in Junior Agricultural Extension Work
H. B. Tisdale.....	Assistant in Agriculture
E. Gibbons.....	Assistant in Animal Husbandry

REPORT OF HATCH AND ADAMS FUNDS FOR 1913-1914.

RECEIPTS.

	Hatch	Adams
To amount from U. S. Treasury.....	\$ 15,000.00	\$ 15,000.00

DISBURSEMENTS.

By Salaries	\$ 7,525.83	\$ 9 881.67
By Labor	1,558.91	1,550.90
By Publications	1,299.78
By Postage and Stationery	423.07	153.85
By Freight and Express	272.05	138.27
By Heat, Light, Water and Power.....	749.16	360.19
By Chemicals and Laboratory Supplies.....	750.08	195.93
By Seeds, Plants and Sundry Supplies.....	220.66	390.79
By Fertilizers	361.50	226.71
By Feeding Stuffs.....	257.56
By Library	496.54	96.58
By Tools, Machinery and Appliances.....	485.97	252.84
By Furniture and Fixtures.....	48.50	360.35
By Scientific Apparatus and Specimens.....	45.15	530.91
By Live Stock.....	120.90	222.30
By Traveling Expenses.....	163.91	107.30
By Contingent Expenses.....	20.00
By Buildings and Land.....	457.99	273.85
Total	\$ 15,000.00	\$ 15,000.00

State of Alabama:

Lee County.

Personally appeared before me, B. L. Shi, a Notary Public in and for said county, M. A. Glenn, known to me as Treasurer of the Alabama Polytechnic Institute, who, being duly sworn, deposes and says the above foregoing account is true and correct. Witness my hand this 25th day of January, 1915.

B. L. SHI,

Notary Public, Lee County.

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

C. C. THACH,

President Alabama Polytechnic Institute.

REPORT OF DIRECTOR AND AGRICULTURIST.

J. F. DUGGAR.

Dr. C. C. Thach, President,
Alabama Experiment Station,
Auburn, Alabama.

Sir:

I respectfully submit the following report for the past year of the work under my charge as Director and Agriculturist of the Alabama Experiment Station:

PUBLICATIONS.

During the calendar year 1914 the publications of the Alabama Experiment Station consisted of the annual report, eight bulletins, six circulars, seven press bulletins, and five reprints of earlier publications, making a total of 27 publications. These constituted a total of 274,000 copies and an aggregate of 4,615,500 pages in all editions. The titles are given below:

Bulletin No. 175: Local Fertilizer Experiments with Cotton in North Alabama in 1913; by the Director and Assistants. (From Local Experiment Fund).

Bulletin No. 176: Reducing Insect Injury to Stored Corn; by the Entomologist. (From Local Experiment Fund).

Bulletin No. 177: Raising and Fattening Beef Calves in Alabama; by D. T. Gray and W. F. Ward. (From Local Experiment Fund).

Bulletin No. 178: Boll Weevil Effect Upon Cotton Production; by the Entomologist. (From Local Experiment Fund).

Bulletin No. 179: Wheat in Alabama; by the Director and the Associate Agriculturist.

Bulletin No. 180: Leaf Spot and Some Fruit Spots of Peanuts; by the Pathologist.

Bulletin No. 181: Local Fertilizer Experiments with Corn in South Alabama in 1911, 1912, 1913, and 1914; by the Director and Field Agent. (From Local Experiment Fund).

Bulletin No. 182: Local Fertilizer Experiments with Corn in North Alabama in 1911, 1912, 1913, and 1914; by the Director and Field Agent. (From Local Experiment Fund.)

Circular No 25: Annual Report of the Director of the Experiment Station on Work Done Under the Local Experiment Law in 1913. (From Local Experiment Fund).

Circular No. 26: Silos and Silage; by the Dairyman. (From Local Experiment Fund).

Circular No. 27: Citrus Canker; by the Pathologist and Assistant Botanist. (From Local Experiment Fund).

Circular No. 28: The Oak Scale and its Control; by the Assistant Entomologist.

Circular No. 29: Bur Clover Seed; Means of Hastening Their Germination; by the Director and Assistant.

Circular No. 30: Program of County Organization Day for Boys' Corn Club; by the Superintendent of Junior and Home Economics Extension and Assistant. (From Local Experiment Fund).

Press Bulletin No. 70: Tests of Varieties of Cotton in 1913; by the Director and the Associate Agriculturist.

Press Bulletin No. 71: County Organization in the Campaign Against the Boll Weevil; by the Entomologist. (From Local Experiment Fund).

Press Bulletin No. 72: Cotton Worm Control; by the Entomologist. (From Local Experiment Fund).

Press Bulletin No. 73: Wheat in Alabama; by the Director and the Associate Agriculturist.

Press Bulletin No. 74: Cotton Boll Weevil Infested Area and Quarantine Line in Alabama 1914 to 1915; by the Entomologist. (From Local Experiment Fund).

Press Bulletin No. 75: Tests of Varieties of Cotton in 1914; by the Director and the Associate Agriculturist.

Press Bulletin No. 76: Infectious Itching Disease; by the Veterinarian.

In addition to the above publications the following reprints were published.

Bulletin No. 174: Local Fertilizer Experiments with Cotton

in South Alabama in 1913. (From Local Experiment Fund).

P. B. No. 64: Boll Weevil Control in Early Summer. (From Local Experiment Fund).

P. B. No. 67: Oat Smut; Directions for Preventing it by Treating Seed Oats with Formalin.

P. B. No. 68: Tests of Varieties of Corn in 1913. (From Local Experiment Fund).

P. B. No. 69: Cotton Boll Weevil Infested Area in United States and Quarantine Line in Alabama 1913, to 1914. (From Local Experiment Fund).

ENLARGED FIELD OF USEFULNESS OF THE EXPERIMENT STATION.

The changed agricultural conditions growing out of the war in Europe and the great reduction in the price of cotton have led to demands on the part of Alabama farmers for a more extensive dissemination than heretofore of accurate information regarding diversified crops, livestock, and methods of growing and marketing crops that have heretofore received relatively little attention from farmers. This has resulted in an especially heavy correspondence.

How well the Experiment Station is capable of serving the State in a crisis like the present is shown in the case of the wheat crop, which is only one of numerous such instances.

In Alabama, except in a few counties in the northern part of the State, wheat culture had become practically a lost art. The rising price of wheat and the necessity of finding partial substitutes for cotton aroused last fall a widespread demand for information whether wheat could be profitably grown in the counties all over the State, and created an imperative demand for accurate information regarding the best varieties, best methods of culture, and best means of fertilizing wheat. *The Experiment Station was ready to meet this demand.* It had on hand awaiting publication the results of field experiments with wheat made during 16 years at Auburn, and also the results of several years' experiments with this crop made in various parts of the State under the State appropriation for Local Experiments.

Hence, in the early fall of 1914 a bulletin entitled "Wheat in Alabama" was published in large edition and widely distributed all over the State, not only by the Station, but by demonstration agents, bankers, and others. Brief articles on wheat were sent to every newspaper in the State, giving the results of these experiments in condensed form. Multitudes of letters of inquiry about wheat were answered.

Note the result, for which the Experiment Station was largely, though not exclusively, responsible. The acreage of wheat in Alabama was increased from 32,000 acres in 1913 to the estimated amount of 97,000 acres in the present season. If the yield averages only 15 bushels per acre, the increase in the wheat crop will be worth, at \$1.25 per bushel, about \$1,181,250. According to official preliminary estimates Alabama leads all other Southern States in the percentage of increase in the area in wheat.

Likewise the acreage in oats in Alabama has been increased from 390,000 acres in 1913 to an estimated acreage of about 648,000 acres in 1914-15.

This Experiment Station played an important part, both directly and indirectly, (through the demonstration agents and the press), in preparing public opinion for this change, and especially in making possible the more general adoption of improved methods for increasing the yield of oats per acre. The Experiment Station helped in this line by conducting in the fall of 1913 and again in the fall of 1914 a systematic campaign for promoting a larger area in and a larger yield of oats per acre. It did this,

(1) By publishing in large edition a bulletin on oats, which gave the results of 17 years of experiments at Auburn in regard to varieties, methods of seeding, and fertilization of oats;

(2) By furnishing repeatedly to every newspaper in the State brief articles calling attention to the best methods of growing oats;

(3) By showing in more than a hundred field experiments, —conducted in nearly every county in the State,—that the usual loss of from 2 to 8 bushels of oats per acre from the disease, oat

smut, may be certainly prevented by treating the seed oats with a solution of formaldehyde, at a cost of a few cents per acre.

STAFF.

The year 1914 has fortunately been free from changes in the staff of a nature to interfere seriously with the continuity of experimental work. The following appointments were made during the year:

In Agriculture, O. H. Sellers and D. J. Bursleson; in Animal Husbandry, E. Gibbens; in Junior and Home Economics Extension, J. C. Ford, I. B. Kerlin, Miss Madge J. Reese and Miss Nellie M. Tappan.

AGRICULTURAL DEPARTMENT.

(Work under Hatch and Adams Funds from Congress.)

Since field experiments must be often repeated in order to give reliable averages, much of the work in this department is a continuation of the lines of experimentation heretofore reported.

As usual, plant breeding with cotton, corn, and oats has employed more of the time of the staff in this department than any other single line of investigation. Very satisfactory progress has been made in this line of endeavor, as shown by the popularity of these pedigreed seed with the farmers who have tried them. Among the pedigreed seed bred up on the Station farm which are meeting with special commendation are the following:

(1) Experiment Station Yellow Corn, prized because of its hardiness of grain and hence its relative resistance to weevil.

(2) The Henry Grady Corn, recommended for rather late planting or for that part of the State where weevils do least damage to corn and where a pedigreed strain of large-eared red-cob is desired, with one ear per plant.

(3) Cook No. 307-6, a wilt-resistant strain of cotton with all the good qualities of the Cook variety and with the added quality of wilt-resistance. This strain was originated by the Alabama Experiment Station.

Some strains of Cook have been bred up by this Station until they afford more than 43 per cent. of lint. Two strains of Cook thus bred up ranked second and third in yield of lint per acre among all varieties tested at Auburn in 1913, and one strain ranked third in 1914.

The following is an incomplete list of field experiments conducted on the Station farm in 1914:

- Alfalfa, fertilizer and culture experiments.
- Barley, variety tests.
- Cotton, effects of planting light and heavy seed.
- Cotton, variety tests.
- Cotton, tests of long staple varieties.
- Cotton, best time for applying nitrate of soda.
- Cotton, calcium cyanamid versus other forms of nitrogen.
- Cotton, subsoiling.
- Corn, variety tests.
- Corn, Williamson versus other methods of culture.
- Corn, subsoiling.
- Corn, best rotation for.
- Corn, best time of applying nitrate of soda.
- Cowpeas, variety tests.
- Cowpeas, for soil improvement.
- Clovers, tests of species and varieties.
- Clovers, effects of liming.
- Clovers, best plants for sowing with the legumes.
- Fertilizing effects of different crops.
- Forage crops, tests of a large number of species and varieties.
- Grasses, tests of species and varieties.
- Hog crops, (chufas, peanuts, soybeans, etc.)
- Nitrogen, best sources of, for cotton, oats, and corn.
- Oats, variety tests.
- Oats, time of sowing.
- Oats, fall versus spring strains.
- Oats, breeding experiments.
- Oats, tests of Auburn-made hybrids.
- Rotation experiments.

Seed treatment to increase and hasten germination.

Soybean and cowpea mixtures for hay.

Soybeans, effects of different phosphates.

Soybeans, varieties.

Soybeans, tests of varieties.

Sorghum, tests of varieties.

Subsoiling.

Sudan grass, culture tests.

Sugar cane, Japanese, as a forage crop.

Velvet beans, varieties.

Vetches, varieties.

Vetches, varieties and best mixtures.

Wheat, breeding experiments.

Wheat, varieties.

Yokohoma beans, varieties.

Among the newer economic plants, especially interesting results were obtained with the following:

Fulghum Oats. This is a variety of oats valuable on account of its earliness. At Auburn it has proved nearly two weeks earlier than Red Rust Proof, Appler, Bancroft, etc., and even a little earlier than Burt, which latter it excels in size of grain and other important qualities. While it has not at Auburn quite equalled the yield of the Red Rust Proof varieties, its earliness, freedom from beards, and heavy weight per bushel commend it. The use of this variety for a part of the crop greatly extends the harvesting season and hence enables a grain binder to cut a greater number of acres than if only the usual Red Rust Proof varieties were grown.

Sudan Grass. This plant, which resembles Johnson grass except that it can be easily exterminated, has proved at Auburn to be very productive of hay. Unfortunately, our experiments of the last three years have proved that it is a failure as a seed crop in this climate. Sudan grass is promising for farmers who do not wish to introduce Johnson grass, but its culture will be practicable only when the supply of seed produced in a dryer

climate becomes sufficient to lower the price to a point at which an Alabama farmer can afford to purchase seed annually.

Rhodes Grass. This plant has proved worthy of further attention, though thus far less productive of hay than Sudan grass.

Kudzu. Each year's experience with this increases our appreciation of its possibilities for soil improvement and probably for grazing. Its luxuriant growth when cultivated suggested that this was the plant needed for occupying galled spots and for stopping gullies; but at Auburn it has required cultivation for the first year or two and has made but scant growth when set in a field and uncultivated. It has made a luxuriant growth where it has been given cultivation during the first year.

Beardless barley. This pedigreed barley, tested for several years by this Station, commends itself because of the early date at which it matures. In 1914 it was ripe on May 8. Barley requires a good soil, and this particular variety has the disadvantage of shattering easily during harvesting, which observation suggests that this variety should be grown only in fenced fields where hogs could pick up the shattered grain.

LOCAL EXPERIMENT WORK THROUGHOUT THE STATE.

Nineteen fourteen was the fourth year during which the Experiment Station had the opportunity, under a state appropriation, to conduct experimental work in all parts of the State. This work has been continued along the same general lines as heretofore reported. Each department of this local work is under the charge of the corresponding head of the department in College and Station.

This local work has embraced work in crops and fertilizers (mentioned in more detail in a later paragraph of this report;) in horticulture; in animal industry, including feeding experiments with cattle, hogs, and poultry; in entomology, including the enforcement of boll weevil quarantine regulations and the giving of information on the boll weevil and other insect pests;

in plant diseases; in extension work, including boys' corn and pig clubs, and girls' canning clubs; and in drainage and farm machinery. Detailed information on all these lines of work is contained in a separate report which will soon be submitted as provide by law.

LOCAL EXPERIMENT WORK IN AGRICULTURAL DEPARTMENT.

In plant breeding the principal work has consisted in testing in a number of localities those varieties and strains of cotton, corn, oats, and other plants that have been selected and bred at Auburn in previous years.

Drainage investigations have been continued in co-operation with the Drainage Division of the Office of Experiment Stations, U. S. Department of Agriculture. Seventeen farmers in twelve different counties were assisted in the design and construction of tile drainage systems in 1914, and preliminary examinations were made regarding the drainage of about 60,000 acres of land.

Tests of and notes on farm machinery have been continued.

The following is a list of the local experiments, (that is experiments conducted elsewhere than at Auburn), undertaken with field and forage crops by the Agricultural Department during the calendar year 1914:

- Cotton, complete fertilizer experiments.
- Cotton, time of applying nitrate of soda.
- Cotton, extensive variety test.
- Cotton, tests of wilt resistant varieties.
- Cotton, variety test, short.
- Cotton breeding.
- Special fertilizer test with corn after legumes.
- Corn, complete fertilizer experiments.
- Corn, time of applying nitrate of soda.
- Corn, variety tests, extensive.
- Corn variety tests, short.
- Corn breeding.
- Cowpea, variety test.

- Peanuts, complete fertilizer experiments.
 - Peanuts, variety tests.
 - Sugar Cane, complete fertilizer experiments.
 - Sweet potatoes, complete fertilizer experiments.
 - Soybean tests.
 - Wheat experiments.
 - Velvet bean, variety tests.
 - Extensive forage crop tests.
 - Bur clover fertilizer experiment
 - Bur clover, variety tests.
 - Crimson clover experiments, methods of inoculation.
 - Vetch, variety tests.
 - Oats, variety tests.
 - Oats, breeding experiments.
 - Alfalfa experiments.
 - Rice experiments.
 - Lespedeza fertilizer experiments.
 - Lime tests with rape.
 - Kudzu experiments.
 - Sudan grass experiments.
 - Oats, treatment for smut.
- These local experiments aggregate more than 700 separate tests, requiring several thousand plots.

Respectfully submitted,

J. F. DUGGAR,
Director and Agriculturist.

REPORT OF VETERINARIAN.

C. A. CARY.

President C. C. Thach,

Dear Sir:

The following is a brief summary of work done during the year 1914.

A study of the pathologic effects of *Stephanurus Dentatus* (*Sclerostoma Penguicala*) in pigs has been made. We have found this worm in the lungs, liver, kidney fat, kidneys, lumbar muscles and in the spinal canal. This worm has been found in the kidneys, kidney fat, and lumbar muscles in every hog that has been examined, which had paraplegia (paralysis of hind limbs). The complete life history of this worm is not fully known. The eggs are voided or passed in the urine and feces and in 4 to 7 days, under favorable moisture and temperature, develop embryos which break the egg shell. The embryos may be swallowed by swine or may penetrate the skin and in some way get into the circulatory system. Larval forms have been found in the postal veins and liver while adult forms are generally found in cysts in the kidney fat. Each cyst contains a pair of worms and the cyst is said to communicate with a ureter by fine canals through which the eggs are passed into the ureter and thence into the bladder and out with the urine.

At present no remedy can be given that will destroy or eliminate these worms in the liver, kidney fat, kidneys, muscles or other parts of the body. Some have employed large doses of arsenic. Small doses might safely be given but it is doubtful if large doses of arsenic would destroy or kill the worms in the liver, kidney fat, or kidney and in some instances large doses might kill the hog or pig. Prevention is the only known means of avoiding this parasite. Keep pigs and hogs away from infested barns, lots and pens. Change pastures frequently, water only in clean troughs and get the water only from deep wells or a protected pure water supply. Drain all the surface holes and stagnant pools or unprotected water holes. See that the

feed troughs are frequently cleaned and moved to new pastures and clean pens. The troughs for feed and water should be so arranged that they can not be contaminated with urine and feces. Burn all the hog and other carcasses and keep hogs and pigs away from slaughter pen waste and from water which drains from them. Never use hotel, restaurant or kitchen slops or waste. If hogs are fed on cement floor, flood and clean it frequently.

Moldy, spoiled corn is being fed to mules for prolonged periods to study its effects clinically and the changes found after death.

This year we found that the toxic actions of unfermented china berries was not so pronounced or characteristic as that of fermented berries.

When cases were presented, observations and records were made on osteoporosis in horses and mules.

Records on the parasites of swine and chickens have been continued.

During the summer and fall quite a number of cases of Bulbar Paralysis or Itching Disease occurred in cattle in Alabama. A press bulletin on this disease was issued in December.

During the year the following Farmers' Institutes were held in places where the boll weevil had made its appearance or was in close proximity.

The number of Institutes held in 1914.....	34
Total number of Sessions	57
Total Attendance	5,785
Average Attendance per Session	102
Number of Counties visited	24

The Summer School for Farmers, or Round-Up Farmers' Institutes or Short Course for Farmers, was held at Auburn, August 1st to 8th, 1914. The total attendance was 810 and every county in Alabama was represented. The interest manifested in live stock, soil improvement, home economics, and general agriculture was greater than at any Short Course of previous years.

Respectfully submitted,

C. A. CARY,
Veterinarian.

REPORT OF CHEMIST OF SOILS AND CROP
INVESTIGATIONS.

J. F. ANDERSON.

Dr. C. C. Thach, President,
Alabama Polytechnic Institute.

Sir:

I beg to submit the following report of the work done in the section of Soil and Crop Investigations of the Chemical Department of the Agricultural Experiment Station during the year 1914.

The Determination of the Fertilizer Requirements of Soils by the Chemical Analysis of Cotton Plants Grown in Them.

This project was begun several years ago under the Adams Fund and was continued along the same lines during this year. As for two or three years past, the particular soil under study, after proper preparation and mixing, is put into a series of earthenware pots of about six kilos capacity. Each pot is fertilized according to a fixed system and then planted in cotton. To protect from injury from without, and to preserve uniform conditions for all the pots, the series is placed in a glass case with adjustable cover to provide suitable ventilation. All water needed is supplied by a system of sub-irrigation, by means of a perforated galvanized iron tube placed in the middle of each pot, into which the water runs from an inverted bottle with a long, slender neck. As no water is applied to the surface, there is no hardening or baking of the surface of the soil, and the drawing of the plants for analysis is thus facilitated.

This drawing of samples for analysis is done when the plants are at the four-leaf stage, they being then from four to six inches high. This stage of growth was arbitrarily selected because up to that point the plants are believed to grow naturally under the conditions surrounding them, and at the same time they make sufficient demands upon the soil to test its fertility. An additional reason may be stated. At the four-leaf stage the va-

riation between the composition of the plant grown in a poor and in a rich soil is widest, thus affording opportunity for the elimination of the disturbing influence of the personal error.

It is believed that sufficient data, from soils of every type, have been accumulated to warrant the conclusion that the method under consideration affords a feasible way of determining the fertilizer requirements of soils. It is recognized, however, that it is of the greatest importance to check the chemical method with field tests whose purpose is to determine the crop-producing power of soils under the same system of fertilization. The Agricultural Department of the Station is conducting a series of co-operative fertilizer experiments with cotton in various parts of the state, whose purpose and method are those just referred to. Through the courtesy of that Department we have secured for use in our pot experiments samples of a number of soils which they are using in their field tests; and in this way we are getting the checks desired. Owing to the difficulty of getting as many samples of soil as we would like, and to the further fact that with many of the soils we do get, the Agricultural Department gets "inconclusive" results in their field tests, we have been delayed in getting thus far a sufficient number of checks to warrant definite conclusions. It is expected that the season of 1914 will add materially to the number of these. The analysis of the samples for the season will soon be completed, and the publication in bulletin form of the field tests made, when comparisons may be had.

Arsenate of Lead Project.

In co-operation with the Department of Entomology there has been undertaken an investigation of the factors affecting the distribution, adhesion, economy of application and insecticidal efficiency of arsenical insecticides with particular reference to arsenate of lead in its various forms. The chemical side of this project involves (1) The analysis of the samples of the arsenates of lead to be used in the experiments to determine the forms in which the arsenates are present, whether acid, neutral or basic, what proportions of the arsenates are soluble in water and

what insoluble, and finally, what impurities or adulterants, if any, they contain; (2) The stability in composition of the various forms of arsenate; (3) The determination of the power of adhesion to foliage of the arsenates, when applied alone or when mixed with such adhesives as sugar, glue, starch paste, syrups, glucose, &c.

Thus far the nine samples of lead arsenate selected for the experiment have been analyzed in accordance with the outline under (1).

Fertilizer Inspection.

As usual, the fertilizer inspection work for the State claimed our attention from the first of April to the middle of July. During this period no opportunity is afforded for any analytical work connected with the Adams projects. The inspection work, however, is not allowed to interfere with the culture of the cotton plants referred to under the first of these projects.

Respectfully submitted,

JAMES T. ANDERSON,
Chemist, Soils and Crop Investigations.

REPORT OF PHYSIOLOGICAL CHEMIST.

C. L. HARE.

Dr. C. C. Thach,
President, Alabama Polytechnic Institute,
Auburn, Ala.

Sir:

During the past year the work of this Department has been along the same general lines as for the past several years.

Experiments in breeding cotton with seed consistently high in oil content show some promise of positive results.

One or two strains of cotton have maintained a high average percentage of oil in seed throughout the breeding experiments, even during years when the amount of oil in cotton seed generally was below the yearly average.

The results secured in breeding for higher protein seed would seem to promise some measure of success.

Experiments designed to show the effect of different kinds of fertilizer upon the amounts of oil, protein and mineral matter in cotton seed indicate that these quantities are not materially affected by differences in fertilizer used, although the number of analyses so far made is not sufficient to give conclusive results.

Determination of the more important mineral constituents in cotton seed has hitherto failed to show any definite relationship between these constituents and the percentage of oil and protein in the seed.

The results on lards as affected by feeds are being continued.

Following are the experiments now under way:

First. Production of lards from raw cotton seed meats.

Second. Production of lards from cooked cotton seed meats.

Third. Production of lards from cotton seed meal.

Fourth. Production of lards from cotton seed oil.

Fifth. Production of lards from cotton seed meal with oil extracted.

Respectfully,

C. L. HARE,
Physiological Chemist.

REPORT OF ENTOMOLOGIST.

W. E. HINDS.

President C. C. Thach,
Auburn, Ala.

Sir:

I submit below a statement in regard to the most important phases of entomological work during the past year. The principal lines of work have been under the Adams Fund. We have continued projects previously undertaken.

Principal Investigations and Experiments: (a) Adams Fund projects dealing with the life history and control of the rice weevil attacking corn (b) fumigation investigations and (c) arsenate of lead investigations.

Important Results:

(a) Determination of practicable methods of so handling production and storage of corn as to avoid necessity of fumigation of the major part of the crop carried into storage, yet preventing in other ways *more than half* of the loss that now amounts to probably more than \$4,000,000 annually for Alabama.

(b) Demonstration of the occurrence with some brands of arsenate of lead of a considerable shedding of sprayed fruit that is not attributable to insect injury. This arsenical shedding is very slight with one or two brands now on the market. Reasons for these differences are being investigated and when discovered will enable us to point the way for still more extensive and profitable use of arsenate of lead for fruit insect control.

(c) Demonstration that a single early fall fumigation of corn with carbon disulphide will be efficient in so controlling insect species occurring therein that corn may be carried in storage for the balance of the year without any serious loss from these insects.

Progress of Investigations: (a) Rice weevil. Storage test work through two complete seasons confirmed our earliest conclusions

as to the injuriousness of storing corn with the husk on and especially as commonly practiced when the corn is stored wet and sprinkled with salt as it is put in the crib. This practice, which is the most common method supposed to secure weevil control, actually increases the insect injury materially so that corn thus treated may weigh at least 15 per cent less on the cob by the end of the storage season than will similar corn stored under the same conditions but not salted.

Methods of handling the crop in the field so as to prevent the spread of the first generation of weevils produced in the field and consequent infestation of the main crop have been worked out. Better methods have been determined for handling the corn as it is harvested so as to reduce and avoid a large part of the insect injury that has been commonly suffered. A large series of tests of various materials sometimes used to secure, or promising to have value in insect control, has been conducted in tight boxes under laboratory conditions and the most valuable of these things are being tested out under practical crib conditions.

During the year 1914 we have had no unusually severe insect outbreaks. Many of the common insect species have occurred in normal abundance. Through the use of our publications it has been possible to save materially in the matter of correspondence.

In the past year we have issued the following publications: Bulletin No. 176, "Reducing Insect Injury to Stored Corn," Bulletin No. 178, "Boll Weevil Effect Upon Cotton Production", Circular No. 28, "The Oak Scale and its Control", Press Bulletins No. 69, "Cotton Boll Weevil Infested Area in United States and Quarantine Line in Alabama, 1913 to 1914," No. 71, "County Organization in the Campaign Against the Boll Weevil," No. 72, "Cotton Worm Control," and 74, "Cotton Boll Weevil Infested Area and Quarantine Line in Alabama, in 1914 to 1915."

In addition to the regular station publications, we have had numerous articles in the Journal of Economic Entomology, Proceedings of the Alabama State Horticultural Society and South-

ern agricultural papers dealing particularly with various phases of our station work and insect control.

We have delivered more than twenty-five public addresses on insect control, dealing most commonly with the boll weevil and the insects affecting stored corn.

It has been impossible for us to participate in any public exhibitions as we have done heretofore with gratifying results. It would seem that we should resume this work as soon as possible as we are enabled in this way to reach and interest large numbers of people who could not be reached through our station publications. There is, unquestionably, a very inviting field in the line of traveling exhibits which might represent different departments of the station work presenting some important features thereof.

In 1914 there occurred a rather extensive outbreak of the cotton worm (*Alabama argillacea*). The most extensive damage occurred in the northern part of the State, particularly in the Tennessee Valley. Undoubtedly the extremely hot, dry weather occurring in the southern part of the State up to the middle or latter part of July, had a very important effect in decreasing the abundance of cotton worms in that section as it certainly had in decreasing the injury by the Mexican cotton boll weevil (*Anthonomus grandis*.) As a result of this unusual seasonal condition, the boll weevil failed to advance in Southern Alabama much beyond the line reached by it in 1913. In the northern part of the State the advance was practically normal reaching a maximum of about 45 miles in the vicinity of Jefferson county. The boll weevil infested area now includes approximately three-fifths of the cotton growing area of Alabama. In the southwestern corner of the State where it has become thoroughly established, it has already greatly decreased cotton production. Our Bulletin No. 178 is designed to give a reasonably reliable basis upon which we may estimate the effects of the weevil upon cotton production in any particular section of Alabama.

There is urgent need for us to take up the following especially important lines of entomological investigations: A study of the life history, natural enemies and methods of artificial control of

the boll weevil under Alabama conditions. The weevil has so changed in its habits during the past twelve years since its life history was studied particularly in Texas and Louisiana, that this ground needs to be gone over again under local conditions.

There are at the present time, some seven or eight million fruit and nut trees growing in Alabama. We need to be in position to give the growers of these trees much additional information in regard to the important insect pests found thereon and methods for their control. Another extremely important field of work is in the study of methods for controlling the typhoid fly and malarial mosquitoes, particularly as these insects have such an extremely important effect upon human health and efficiency.

We trust that it may be possible for us so to increase the scope of our work during the coming years as to enable us to show the farmers of Alabama how to save a large part of the insect loss which, at the present time, averages approximately 15 per cent of the total value of our farm products. The prevention of this loss in most cases will change what would ordinarily be a failure into a successful and profitable operation.

Respectfully submitted,

W. E. HINDS.

Entomologist.

REPORT OF THE PLANT PHYSIOLOGIST.

JOSEPH S. CALDWELL.

Dr. Chas. C. Thach,

President Alabama Polytechnic Institute.

Sir:

I present herewith my report of the work done as Plant Physiologist of the Alabama Agricultural Experiment Station during the calendar year 1914.

As in previous years, the major portion of the available time has been devoted to continuation of work on the Adams project "An experimental investigation of the theory of antagonism with especial reference to its applicability to conditions existing in the soil". The methods and purposes of this investigation have been stated in previous reports of this department (Ann. Rep. Agric. Exper. Sta. Ala. Poly. Inst. 25:28-32. 1913, and 26:29-30. 1914) and need not be repeated here. The antagonistic relations reported by other workers as existing between fifteen different pairs of salts have now been rather fully examined with reference to presence or absence of antagonism in pot cultures of maize rooted in pure quartz. The work has necessarily proceeded slowly, since the investigation of any pair of salts involves the growing of many hundred paraffined-pot cultures under carefully controlled conditions for definite periods; each of these cultures must be weighed repeatedly in order that replacement of the water lost by transpiration may be made; and final determination of the dry weight of tops and roots of each culture must be made, while frequent repetitions of entire series are necessary in order to clear up doubtful points. For these reasons, certain portions of the investigation are not yet ready for final report. The completed results are embodied in three papers which are now ready for publication; the first of these, which is concerned with results obtained from the investigation of the six pairs of salts sodium plus calcium, sodium plus magnesium, sodium plus potassium, sodium plus strontium, sodium plus ammonium, and sodium plus copper, has been accepted by

the Department of Botany of the University of Chicago in fulfillment of these requirements for the doctorate of philosophy, and will shortly appear in the *Botanical Gazette*; the second awaits publication in the same journal, and is concerned with results of the work with seven additional pairs of salts. The third paper includes a complete account of the work done to date, together with a rather full resume of the literature, and is now undergoing final revision in preparation for publication as a technical bulletin of the Station series. It should be ready for publication within a month.

The writer spent the period between June 13 and September 7 in the laboratories of Physiological Chemistry of the University of Chicago, in continuation of his studies of the chemistry of the mucilage of certain cacti. The work was especially directed toward the determination of the nature of the organic acid nucleus of the mucilage molecule. The percentages of pentose and hexose sugars occurring in combination with this acid were re-determined and previous determinations were checked over; the occurrence in the molecule of acetic acid, which had been previously undiscovered, was determined, and the close chemical relationship existing between this mucilage and the commercially important plant gums, as gum tragacanth and gum arabic, is thereby emphasized. The possible utilization of the cactus mucilage as a source of an adhesive gum has been kept prominently in mind, and it is hoped that a further study may definitely determine whether such utilization is possible on a commercial scale. The work thus far done consists in the development of methods for the separation of the mucilage from associated degradation products and other impurities, of preparation of barium salts of the purified substance, of graduated hydrolysis to quantitatively separate the pentose and hexose polymers and the acetic acid groups from the acid nucleus, and of determination of the elementary composition of this nucleus. Certain portions of the work are being repeated. A paper dealing with the physical properties and the chemical composition of the mucilage is in preparation, but work thereupon has been suspended temporarily in favor of other work in progress.

Examination of a number of soils of this area for the presence of organic constituents by methods devised and perfected by workers in the Bureau of Soils have revealed the presence of a number of physiologically active compounds, some of which have been positively identified while others appear not to be identical with any substances heretofore isolated from soils. While this work was going on, some experiments carried out by Professor M. J. Funchess of the Department of Agronomy yielded results which indicate that under the conditions prevailing in our soils, certain supposedly stable and relatively highly toxic nitrogenous organic compounds are readily decomposed, their nitrogen being set free in forms available for the use of plants. The results obtained by the independent preliminary work conducted along these lines appeared to be such as to justify more extended study, and a co-operative project has therefore been formulated by the two departments concerned. This project, which has recently been approved as an Adams project, will involve a detailed study of a number of soils of known origin, physical character, and previous cultural history with reference to the presence or absence of physiologically active organic constituents, the isolation, identification, and quantitative estimation, of such substances as are found, the determination of the capacity of these compounds for undergoing decomposition in the soil, and the nature of such decompositions; the determination of the groups of organisms concerned in these decompositions, and the study of the effects of various cultural treatments upon the process, with especial reference to the effect of chemical correctives of toxicity. As above stated, the work thus far done has been preliminary merely, but the results obtained are such as to indicate that the problems involved are of great practical as well as of scientific interest, and work will be pushed as rapidly as the resources of the departments concerned will permit.

Professor Massey of this department has been associated with Dr. Wolf, Plant Pathologist, in the study of citrus canker. The work done will be covered in the report of the Pathologist. The gravity of the situation confronting the citrus industry by

reason of the presence of this extremely destructive disease is such as to demand immediate and exhaustive study, and it will be the policy of the department not only to leave Professor Massey's time free for assisting in such study but also to aid in every way possible in furthering the investigation.

Respectfully submitted,

JOSEPH S. CALDWELL,

Plant Physiologist and Head, Department of Botany.

REPORT OF PLANT PATHOLOGIST.

F. A. WOLF.

Dr. C. C. Thach,

President Alabama Polytechnic Institute,

Dear Sir:

I am herewith submitting a brief report of the work of the Department of Plant Pathology of the Alabama Experiment Station for the year 1914.

A preliminary report of the investigation of peanut diseases which has been in progress under the Adams fund for three years has been published as Bulletin 180 from this Station. It is planned to continue this work and as far as possible to clarify the most destructive citrus disease known, to which a very considerable amount of time has been devoted during the past year. A circular, calling attention to the presence of this disease within Alabama, has already been published. The urgent need for this investigation is apparent when it is known that the growing of citrus fruits in Southern Alabama is already an industry of great magnitude and is threatened by a disease so serious that the Federal Horticultural Board, in order to prevent its further dissemination, has prohibited the importation of all citrus nursery stock into the United States.

Under the Local Experiment Fund several successful demonstrations on the control of peach brown rot were conducted. The work on the control of apple black rot was begun in several places. Soil treatment for the control of aster stem rot was continued. Co-operative work with a number of planters on the control of cotton boll rot by the selection of disease-free seed was also begun. It is hoped to be able to finish the work on a bur clover leaf blight during the ensuing year. The investigations of the rots of eggplants and a leaf blight of Persian walnuts, which were previously reported as being in press, have been published. A brief discussion of strawberry leaf blight has been prepared for the State Horticultural Society and published in their proceedings. A number of articles dealing with certain

plant diseases have been prepared for agricultural journals.

Besides several dozen scientific notes and reviews prepared for current botanical journals the following papers have appeared.

(1) A leaf disease of walnuts. Mycol. Centr. 4:65-69, figs. 7, 1914.

(2) Eggplant rots. Mycol. Centr. 4:278-287, figs. 4, 1914.

(3) Strawberry leaf blight. Proc. Ala. State Hort. Soc. 11: 56-58, 1914.

(4) Citrus Canker. (With A. B. Massey) Ala. Agr. Exp. Sta. Circ. 27:97-101, figs. 6, 1914.

(5) Leaf spot and some fruit rots of peanut, *Arachis hypogaea*. Ala. Agr. Exp. Sta. Bul. 180: 127-150, Pls. 5, 1914.

Very respectfully submitted,

FREDERICK A. WOLF,

Plant Pathologist.

REPORT OF ANIMAL HUSBANDMAN.

G. S. TEMPLETON.

Dr. C. C. Thach,
Alabama Polytechnic Institute,

Sir:

I respectfully submit the following report of the experimental work in the Animal Husbandry Department for the year 1914.

The experimental work conducted at Auburn is supported by the Hatch and Adams Funds appropriated by Congress, while the work in Bullock, Henry, Mobile, Marengo, and Marion Counties is supported by the State appropriation provided by the Local Experimental Law.

The lines of investigation with the various classes of live stock are as follows:

BEEF CATTLE.

For several years the Department has been co-operating with the Bureau of Animal Industry at Washington in cattle feeding investigations in Sumter County. In March, 1914, the Bureau discontinued the co-operative work in this state in order to start work in tick-free areas. The Department transferred the feeding experiments from Sumter County to Judge B. M. Allen's farm in Marengo County.

The questions under consideration are:

First, to determine the relative values of the following feeds for fattening beef cattle:

(1) Cotton seed meal and cotton seed hulls; (2) Cotton seed meal and corn silage; and (3) Cotton seed meal with equal parts of cotton seed hulls and corn silage.

Second, to determine the value of paved feed lots for fattening beef cattle.

Third, to determine the value of shelter for young cattle while being fattened.

Fourth, to determine whether or not there are any toxic effects on hogs following steers that are being fed cotton seed meal.

DAIRY CATTLE.

Several feeding projects were started with the dairy herd during the year.

First, a study of the relative feeding value of wheat bran, cotton seed, and cowpea hay as part of the ration for milk and butter fat production.

Second, a comparison of cotton seed hulls, oat hay, and corn silage as roughage for milk and butter fat production.

Third, a comparison of skim milk, Blatchford's Calf Meal, and oat meal as feeds for rearing dairy calves up to sixteen weeks of age.

The co-operative dairy work with M. W. Hall & Son, in Bullock County, is still in progress. The problems studied are as follows:

First, a comparison of corn meal and rice polish as a part of the concentrates for milk and butter fat production.

Second, a comparison of cotton seed hulls, corn stover, and cowpea hay as roughages for milk and butter fat production.

Third, to determine the cost of raising dairy heifers to a producing age.

SWINE.

First, the work at Auburn in co-operation with the Department of Chemistry to ascertain the influence of some Southern feeds upon the properties (melting point, iodine value, keeping quality, and color) of lards is still in progress.

Second, a comparison of rape and rye pasture vs. dry lot feeding for economical wintering of brood sows.

Third, to determine the acre value in terms of pork production of rye, oats, and oat and vetch as winter pasture crops.

Fourth, the experimental work in co-operation with the Sixth District Agricultural School in Marion County is being continued. The project is to determine the acre value in terms of pork production of soy beans and peanuts, as well as to determine the proper amounts of concentrates to be fed with these crops.

Fifth, the work in Henry County has been continued to determine the cost of raising and fattening hogs under farm conditions.

POULTRY.

The poultry experiments continue as reported in the last annual report.

The value of oat and rye pasture in influencing the cost of egg production is being studied in the co-operative work with the Sixth District Agricultural School in Marion County.

The Mobile County experiment is a study of the various feeds to determine the cost of egg production.

Respectfully submitted,

GEO. S. TEMPLETON,

Animal Husbandman.

REPORT OF HORTICULTURIST.

ERNEST WALKER.

Dr. C. C. Thach, President,
Alabama Polytechnic Institute,

Sir:

The following is a brief statement of affairs and lines of work in progress in this department.

The writer took charge in October 1913, a little over a year ago. The time of the Horticulturist is divided between college teaching, duties as State Horticulturist, and Local Experiment work at several points over the state.

A very large correspondence, some Extension and Institute work and duties as State Horticulturist have consumed a large amount of time the past year owing to the advent of "canker" in the citrus orchards of South Alabama. The disease seemed to be of a very virulent and destructive character, and awakened great alarm on the part of all interested in citrus planting in this and other Gulf States. Money was raised locally to fight the spread of the disease, and squads were put to work the past fall and winter locating infections and destroying such trees, or kinds that were hopelessly infected. This work is still in progress and the indications now are that the prompt action will result in the extermination of the disease, and the saving to the State of many thousands of dollars, possibly the industry itself, already amounting to possibly two or three million dollars annually. The State Horticulturist was looked to to organize and direct this campaign.

The lines of work mentioned in my report of a year ago have been continued as seen below.

Published—Results of Fertilizers on Irish Potatoes, Jan, 1915.

Completed—Cultural notes and tests of several vegetable crops.

In progress—The storage of Irish Potatoes for use as seed the following year, and methods of handling or treating the

early crop to induce prompt sprouting when the same are to be used as seed for the fall crop. (Adams Fund.)

Hatch Fund.

Means of controlling "root rot" of the grape.

Mulching asparagus in lieu of tillage.

Fertilizers for asparagus.

Fertilizers on pears (except nitrogen.)

Sweet potatoes—storage, varieties, and methods of culture.

Pecans—varieties

Peach—varieties, control of diseases and insects.

Apple—control of twig blight—spraying.

Wood oil nut—co-operative trial with U. S. Dept. of Agriculture.

Preservatives for fence post—co-operative with U. S. Bureau of Forestry—Forest Products laboratory.

Under Local Experiment Fund.

A number of tests, experiments, etc. are being made at different points over the state. These have already been outlined in a recent special report to the Director of the Station, I may say here, however, they include:

Experiments with numerous vegetables.

Fertilizers for pecans with reference to their effect on yields, the filling out of kernels, especially of certain large varieties, cultural methods for pecans, etc.

Satsuma Oranges.

Fertilizer, cover crops, cultivation as to effects on early seasonal maturity of wood, color of fruit and hardness of the trees.

Sweet Potato—storage varieties.

Home vegetable garden—fall and spring.

Strawberries.

Fertilizers.

Tests of little known kinds of fruit trees, nuts, vegetables, and herbaceous perennials, under different conditions in Alabama.

The collection of data relative to horticultural methods—varieties, kinds and their possibilities in Alabama.

Respectfully submitted,

ERNEST WALKER,

Horticulturist.