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THIRTY-THIRD ANNUAL REPORT
OF THE
SOUTH CAROLINA
EXPERIMENT STATION
OF
Clemson Agricultural College

H. W. BARRE, Director

For the Year Ending June 30, 1920

Clemson College, S. C.

December, 1920.

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CLEMSON AGRICULTURAL COLLEGE

W. M. RIGGS, PRESIDENT

SOUTH CAROLINA EXPERIMENT STATION

BOARD OF CONTROL

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EXPERIMENT STATION STAFF

H. W. BARRE, A. M., Botanist and Director.

C. C. NEWMAN, B. S., Horticulturist.

A. F. CONRADI, M. S. Entomologist.

R. O. FEELEY, D. V. S., Consulting Veterinarian.

W. W. FITZPATRICK, B. S., Dairyman.

C. P. BLACKWELL, M. S., Agronomist.

A. B. BRYAN, B. S., B. Litt., Agricultural Editor.

L. V. STARKEY, M. S., Animal Husbandman.

W. L. LIPPINCOTT, B. Chem., Chemist.

C. A. LUDWIG, Ph. D., Associate Botanist and Plant Pathologist.

W. B. AULL, B. S., Associate Bacteriologist.

_____, Associate Horticulturist.

GILBEART H. COLLINGS, M. S., Assistant Agronomist.

H. S. McCONNELL, M. S., Research Assistant Entomologist.

T. S. BUIE, B. S., Assistant Agronomist.

W. B. ROGERS, B. S., Assistant Agronomist.

R. E. CURRIN, Supt. of Pee Dee Expt. Station, Florence, S. C.

J. A. RILEY, M. S., Supt. of Coast Expt. Sta., Summerville, S. C.

BURNS GILLISON, Foreman of Experiment Station Farm.

Mail and Telegraph Offices: Clemson College, S. C.

Freight and Express Offices: Calhoun, S. C.

The Bulletins and Circulars of the Station are issued at irregular intervals and are sent free to all citizens of the state who apply for them.

REPORT OF SOUTH CAROLINA
EXPERIMENT STATION

LETTERS OF TRANSMITTAL

Clemson College, S. C., December 1, 1920.

Hon Alan Johnstone, President Board of Trustees, The Clemson Agricultural College.

Dear Sir:—I beg leave to submit herewith the Thirty-third Annual Report of the South Carolina Agricultural Experiment Station, which in accordance with the law, must be submitted to the Governor on or before February 1, 1921.

Yours very truly,

W. M. RIGGS,

President.

Clemson College, S. C., December 1, 1920.

Hon. Robert A. Cooper, Governor of South Carolina.

Sir:—I have the honor to submit herewith the Thirty-third Annual Report of the South Carolina Agricultural Experiment Station in accordance with the requirements of an Act of Congress, approved March 2, 1887, for the establishment of Agricultural Experiment Stations in connection with the colleges of the several States, organized under the provisions of an Act approved July 2, 1862.

Respectfully submitted,

ALAN JOHNSTONE,

President Board of Trustees.

REPORT OF SOUTH CAROLINA EXPERIMENT STATION

Clemson College, S. C., November 22, 1920.

Dr. W. M. Riggs, President,

Clemson College, S. C.

Dear Sir:

I have the honor to submit herewith the thirty-third annual report of the South Carolina Experiment Station for the fiscal year ending June 30, 1920.

One effect of the World War on agriculture has been an increased appreciation of research. The Experiment Stations during the past three years have been called upon to demonstrate in concrete form the value of their researches and they have done this in a way which merits the approval of all agricultural workers. During the campaigns for increased food production every effort was made to secure the application of all scientific data that seemed to be bearing on food production and agricultural advancement. This emphasized in the minds of the public the value of the results of agricultural experimentation and caused farmers everywhere to appreciate as never before the fundamental importance of the application of science to practical agriculture. As a result a more appreciative public is now clamoring for information on all kinds of important questions. The Extension forces, the teachers of agriculture, and those having charge of agricultural control work are continually being embarrassed by demands for more accurate information on many fundamental agricultural problems. These forces in turn pass the requests on to the Experiment Stations, and our research workers are constantly confronted with demands for information on many problems which they have neither funds nor facilities for solving.

In addition to the problem of increasing production and controlling animal and plant diseases, on which we have worked for the past thirty years, there are new lines of investi-

gation which the Experiment Stations are being called upon to undertake. I refer to the economic problems affecting farm management, home economics and the distribution and marketing of farm products. The Hatch and Adams funds of the federal government were appropriated especially for investigation of agricultural questions bearing on production, and the majority of the Experiment Stations have not had the facilities for conducting studies in farm and home economics. These problems are now becoming so acute that investigations along these lines seem absolutely essential if we are to continue to advance.

In the face of appreciation of the work of the Experiment Stations, and the increased demands for results, the research agencies have been seriously handicapped on account of the fact that many of the workers have been attracted to other fields, where larger opportunity for financial betterment existed. Many of the workers who had been contented to devote their entire time and energies to investigation work before the war have seen the vision of larger opportunities in commercial fields and are permanently lost to research. The more attractive salaries in teaching and extension work have also depleted the ranks of research workers, so that it is difficult to fill the vacancies in the Experiment Station staff. This is especially true of the assistants and the lower salaried positions. It has been impossible for us to meet competition of other organizations because our funds have not increased and many of our projects require large expenditures for labor, fertilizer, supplies and equipment, which have likewise greatly advanced in price.

The appropriation made by the State Legislature at the last session for agricultural research has enabled us to enlarge the work to some extent at our sub-stations, and has also enabled us to undertake additional projects bearing upon crop production and livestock development.

I am giving below a summary of some of the important results accomplished during the year, as well as a general discussion of some of the activities not covered by reports of heads of divisions, which are attached hereto and made a part of this report.

AGRONOMY

The Agronomy Division has more projects under way than any other division of the College, and a large number of its investigations are of fundamental importance. This division continues to devote special attention to problems relating to field crops and soil fertility. With South Carolina spending over \$50,000,000 a year for fertilizer we naturally feel that it is the duty of this division to conduct such investigations with reference to the fertilizer requirements of our soils and crops as will enable us to advise our people what kinds and quantities of fertilizers it is best for them to use. The work which we have had under way with this end in view at our main station and at the Pee Dee Station, at Florence, has been continued and enlarged to include additional tests. Data compiled from these tests during the past three years are now being prepared for publication in bulletin form.

We have during this year inaugurated a new series of fertilizer tests in cooperation with farmers in different sections of the state. These are financed from the appropriation for agricultural research made by the last legislature, and are being conducted on the major soil types of the state. South Carolina has a very variable soil, consisting of about ten types which are of special agricultural importance. Results secured from tests conducted on one soil type in the western part of the state will not, of course, apply to a different soil type in the eastern part of the state. From these tests we hope to find out: (1) What combination of phosphoric acid, ammonia and potash will give best results on a certain soil type and for a certain crop; (2) What is the most prolific rate of the application for each crop on each soil type; and (3) Does the soil type being tested need lime? One of these tests conducted this year on sandy loam soil in Allendale County, under heavy boll weevil infestation, gave very interesting results. The best plots yield more than a bale of cotton per acre, and the results indicate that nitrogen is our greatest limiting factor, with phosphoric acid second in importance, in producing cotton on this type of soil, under boll weevil conditions.

We have continued to study the effect of Trona potash and borax on crops. Co-operative tests were conducted on six farms in Darlington County this season, and serious injury resulted from all rates of Trona potash applied. At the Lee Dee Station the results were about the same as last year; that is, little injury resulted when moderate amounts of Trona potash containing borax was applied to cotton and corn. We now feel that Trona potash is very injurious under some conditions, but that the results are influenced largely by the kind of soil, the climate, and other factors. This, we believe, is the true explanation why there has been injury in some places and not in others, and why so many conflicting reports have been given out in regard to the matter.

Variety tests with various crops continue to give interesting and valuable information. As a result of our variety tests with cotton for the past several years we are prepared to make the following recommendations for boll weevil conditions in South Carolina:

The best short staple cotton for land free from wilt is Cleveland big boll.

The best short staple cotton for land infected with wilt is Dixie Triumph.

The best long staple varieties are Webber No. 49 and Webber No. 82.

Fulghum and Appler oats, Boggs' Blue Stem, and Leap's Prolific wheat; and Douthit, Coker's E-1, Lowman Yellow, and Garric corn, continue to give the highest yields in our tests. Detail results for these tests for the past three years are being prepared for publication in bulletin form.

Satisfactory progress has been made in the breeding work with cotton, corn, rye, wheat, and barley, and what seem to be superior strains have been isolated and are being further tested and increased.

The study of the factors affecting the oil content of cotton seed is yielding some interesting results, which promise to have an important bearing on the formation and production of oil in plants.

The other Adams fund projects on "Barrenness in Corn"

and "Inheritance in Oats" are being continued and are yielding results.

ANIMAL HUSBANDRY

The better part of the year has been spent in building up and enlarging the Animal Husbandry Division. Professor L. V. Starkey, now head of this division, has shown considerable enthusiasm for his work and has done a great deal of constructive work during the year in developing this division.

Realizing that we would not have funds sufficient to develop all phases of the work at one time, we decided last fall to concentrate on hogs, and to build up this feature of the division as rapidly as possible. We are just completing a new hog barn, which has cost about six thousand dollars (\$6,000.00), and we have purchased during the year twenty purebred Duroc-Jersey and Poland China sows, and an exceptionally good boar of each of these breeds. The Poland China boar was grand champion at the Ohio State Fair and at the Tri-State Fair at Memphis last year, and is, we believe, the best Poland China boar in the South. We have on hand now about four hundred and fifty (450) head of hogs and pigs, and are planning to use a great many of these in our experimental work. We have set aside about sixty acres of land for the hog farm, and have purchased wire and posts for fencing this. When these fields are fenced, we plan to undertake other extensive experiments with crops, which will be hogged off and converted into pork.

We are now cooperating with the Bureau of Animal Industry of the United States Department of Agriculture in an investigation to determine the factors influencing the production of soft pork. In order to develop the soft pork project, and other experimental work needed along this line, we need a man who can devote his entire time to the research work, and provision is made for this in the estimates for agricultural research submitted to the Budget Commission.

Professor Starkey is planning experimental work with beef cattle at the Coast Experiment Station, and has purchased fifteen head of purebred Aberdeen Angus cattle, which have

just been delivered to this station. We plan to begin some experimental work with beef cattle here at Clemson College, just as soon as funds are available.

This division is also conducting some tests with the different breeds of sheep,—Hampshire and Southdowns are being used. Three ewes of each breed were purchased. One of the Southdowns is an imported ewe from the King of England's flock, and was grand champion in her class at the International Livestock Show at Chicago, in 1919.

Dry-lot feeding tests have been conducted with hogs to determine the comparative value of tankage and fish meal as protein supplements to corn. These tests were conducted here at the College, and duplicated at the Pee Dee Experiment Station. Fish meal proved to be an economical substitute for tankage, and the results of these experiments show that the hogs fed fish meal made slightly larger gains, and at a little less cost, than those fed tankage.

The horse breeding project is being continued and we now have a number of grade Percheron mares, from which we are raising mules. These mule colts from grade Percheron mares look very promising, and we believe that they are going to make mules which will be well suited to South Carolina farm conditions.

BOTANY

The Botany Division has continued to study the influence of physical factors on the vitality of the Anthracnose fungus in cotton seed. The seed have been dried by passing currents of hot air over them and by heating them in a vacuum. The seed have also been treated with various chemicals and with different gases under pressure. It has been found that the fungus can be killed in the seed by some of these methods, but no practical method has been devised which kills all of the fungi, without serious injury to the seed. Some of these methods, which give promise of yielding encouraging results, are being continued.

Attention has been given during the year to corn root diseases, which have appeared in several sections of the state.

Dr. Ludwig is studying some of the organisms which have been isolated from the diseased plants, and is also making a study of soil and climatic factors, which might be responsible for the trouble.

The breeding work with wilt-resistant cotton, which has been conducted in cooperation with the Bureau of Plant Industry, has reached the point where it seems advisable to turn this work over to the farmers and cotton breeders. The varieties that have been developed have proved of such great value, and have come to be so widely used, that it no longer seems necessary to continue using public funds for the work.

This division has received a large number of specimens of diseased plants during the year, and has kept up active work with the farmers and the county agents relative to the control of the diseases of our common crops.

The research work in plant pathology has been closely correlated with the work of the Crop Pest Commission, and the data which the research workers have obtained relative to various destructive diseases have been applied in working out quarantine regulations and control measures.

CHEMISTRY

Dr. Lipscomb, of the Chemistry Division, continued his work on a method of determining moisture in soils and agricultural materials and has published an additional article on this subject. This method consists of heating samples in a vacuum, and collecting and analysing the products given off.

The analytical work connected with several important projects conducted by other divisions of the Station has been done by this division. Dr. Lipscomb has continued to cooperate with the Botany Division, in the effort to develop a method for destroying anthracnose in cotton seed, by drying the seed and by treating them with various chemicals and gases. He is also making the chemical analyses in connection with two projects which the Agronomy Division is conducting; that is, "The study of the effect of soils and fertilizers on the oil content of cotton seed", and "The study of the effect of stirring soil on moisture content, oxidation, and nitrifica-

tion and crop yields." More than forty samples of cotton seed have been analysed in the study of the influence of factors on oil content and a large number of samples taken from various fertilizer plots, and from different soil types, still remain to be analysed. There has been so much routine and analytical work of this kind to do that there has been little time available for purely chemical research. The analyses of the cotton seed so far indicate that potash is an important factor in the formation of oil; definite conclusions cannot be drawn, however, until a larger number of samples from different fertilizer plots and soil types have been analysed.

DAIRY

The Dairy Division continues to co-operate with the Alabama and North Carolina Experiment Stations, in a study to determine a more economical concentrate to supplement cottonseed meal as a feed for dairy cows in the South. Practically all of our purebred cows have been on official test this year, and we have, therefore, not been in a position to make as extensive feeding tests as we hope to make in the future.

Data have been kept on more than fifty Jersey and Holstein calves, during the year, in an effort to determine the feed required and the cost of raising calves. The calves are weighed each week, and measurements made once a month. With the exceptionally high price which we have paid for feed, it has cost an average of \$12.00 each to raise Jersey heifers to one month of age and \$84.51 to raise them to one year of age. With the completion of our new calf barn we will have better facilities for conducting more accurate work along this line.

In continuing the study of the prepotency of the purebred bulls used in the Station herd, this division is making a study of the results of line-breeding and out-crossing as systems of breeding dairy cattle. In this project the Jerseys will be used and we are fortunate in having a number of animals that will fit in well with the plans of the experiment. Chromo's Sensation, the bull which we bought from the Shanklin sale, will be used for line-breeding, with daughters and granddaughters of

Blue Fox's Eminent's Chromo; and Vive Glow Chief, the bull we purchased from Oregon will be used for out-crossing.

We are also conducting line-breeding of Holsteins, in cooperation with the Dairy Division of the United States Bureau of Animal Industry. The Bureau has loaned us a bull which we will use in this project.

Our herd has been tested twice during the year for tuberculosis, and at the last test none of the animals reacted. This indicates that the herd is entirely free from tuberculosis, and we have planned to go ahead and add a foundation herd of purebred Guernseys in the immediate future.

We have continued the official testing of the herd and now have six registered Holsteins, with Advanced Registry records, and four more cows on test. We also have twelve Jersey cows with Register of Merit records and have six more on test which are making good records. We are placing all of the purebred animals on official test as rapidly as they freshen and will, of course, make these records the basis of our breeding operations in the future.

This division has charge of the official testing of all the dairy cows in the State, and under Professor Fitzpatrick's supervision the official testing in the state has developed from almost nothing three years ago until now we have two cow-testing associations in operation and about one hundred and twenty cows on official test. There is, probably, no other line of dairy work which means as much in increasing the production of the individual cows in the state. The production of the average dairy cow is about 200 pounds of butter-fat per year. The range of production of the cows tested in this state is from 300 pounds of butter-fat to 867 pounds. If all of our purebred cows were put on test, and only the better ones used for increasing the herds there would be rapid strides in increasing production.

We hope to put on a man who can devote his entire time to experimental work with our herd and supervision of the official testing in the state. Provision is made for this in our budget for agricultural research, which has been submitted to the legislature.

ENTOMOLOGY

The Division of Entomology continues to devote the larger share of its time and energies to the study of the influence of temperature-moisture on insect activity. During the last fiscal year this work has been conducted along the lines of insect ecology and studies have been made in the fields along economic lines. These have included experiments with the army worm, the red spider, and the boll weevil. All of the data obtained in these biological studies have been used to forecast probable outbreaks of destructive pests.

With the spread of the boll weevil over the entire state, considerable attention has been paid to the biology of this insect, and its life-history and habits have been studied under various conditions prevailing in different sections of the state. Special studies along this line have been conducted on Little Edisto Island, on James Island, and at Summerville.

Experiments on poisoning the boll weevil were conducted at these places. The records for this season, however, are too incomplete at this time to make any definite statement as to results. Weather conditions were adverse for poisoning.

During last winter a large hibernating cage was constructed on Edisto Island, about 3400 boll weevils were used in this, and their activities carefully checked up during the winter and spring. During the coming winter there will be a number of these cages located at suitable points for the purpose of studying the behavior of the weevil, and finding out what percentage will survive the winter under different conditions. Data are also being secured on the time that the weevil emerges from winter quarters in different sections, and will be valuable in planning control measures. Data collected this year indicate that the period from egg-laying to emerging to adult weevils averages, under our conditions, 17 1-2 days, and that the period from emerging to egg-laying averages 7 1-2 days, giving a life cycle of 25 days.

This division continues its studies on wintering bees out-of-doors. Many different packing materials have been used for protecting the bees in winter. Among the most promising of these are saw-dust, forest leaves, and straw.

Professor Crandall, the head of this division, continues to give a large share of his time to the work of the Crop Pest Commission. This is necessary because of the constant danger of the inportation of new and destructive pests. During the year there have appeared in this country a number of pests which we must guard against very carefully. The Pink Boll Worm, the Bean Beetle, the European Corn Stalk Borer, and the Japanese Beetle are a few of these. It is necessary, of course, that we give some time to the study of these pests and be prepared to plan measures which will prevent their introduction into the state.

HORTICULTURE

The Horticultural Division has continued to study the factors which influence seed production and tuber formation in Irish potatoes. A number of promising strains of the Look-out Mountain seedlings have been isolated and have been increased. The original lot of twenty-one hundred seedlings, which we started several years ago, has been culled down to eighty-one which seem to be of sufficient promise to continue. The investigation is yielding very interesting information on Irish potato breeding and production, and we have every reason to believe that we shall get very valuable new varieties from some of the strains which we have growing.

Several foreign vegetables which have been brought in by the United States Department of Agriculture have been experimented with during the year. Among the most promising of these are Chinese cabbage, Yudo and Japanese celery. Mr. Young, who is conducting the tests of these, feels that they all have considerable promise as vegetables for this country.

The sweet potato fertilizer test has been continued in cooperation with other states and the results here indicate that potash is not necessary in our Piedmont soil, even for sweet potatoes. The use of large amounts of nitrogen has resulted in the production of luxuriant foliage, but has not increased the yield.

A number of foreign fruits, imported by the United States Department of Agriculture have been added to our orchards. These embrace a variety of common fruits, as well as some which are not so common. Among the latter one of the most promising is the Jujube, a Chinese fruit, which when boiled in syrup and dried, bears a close resemblance to the date.

Work looking to the utilization of the muscadine grape has been continued. A bulletin is now in the press, giving the results of this work. A number of crosses have been made with Brighton and Lindley and other varieties of bunch grapes. These hybrids are being grown for further breeding and experimental work.

A large number of tests with small fruits have been made and breeding work started with raspberries and blackberries, with a hope of producing improved varieties adapted to South Carolina conditions. One hundred and fifty pure seedlings of the Haymaker raspberry have been grown and several of these have borne fruit of sufficient promise to be propagated for further tests.

Further experiments in frost prevention have been conducted and it has been found that spraying the trees with whitewash and other mixtures has no effect in delaying the opening of the buds. The temperature was, however, raised from two to three degrees in the orchards during the cold spell in the spring, when frost threatened, by means of small open fires at frequent intervals through the orchard.

COAST EXPERIMENT STATION

The outstanding feature at the Coast Experiment Station is the lack of adequate drainage. Our soil fertility studies and many of our other field experiments have had to be temporarily abandoned until the drainage system can be put back in working order.

An investigation of this system was made and a complete report on its condition was prepared last December by H. M. Lynde, of the office of Drainage Investigation of the United States Department of Agriculture. This report sets forth the facts that the outlets of the system are inadequate and that many of the tiles in the lateral drains are filled up with sand

and silt. A part of the appropriation made by the last legislature for agricultural research was set aside by the Board of Trustees for the purpose of improving the outlets and taking up and relaying the tile. A flood gate has been put in at the outlet at Rumph's Creek, to prevent the water from this stream from entering the drainage system, and the outlet ditch leading to Platt's Branch has been cleaned out and the bottom regraded. Mr. Riley, the Superintendent of this Station, is now engaged in taking up the tile in the laterals, cleaning them out and relaying them. When this is completed, we have every reason to expect that the system will again function in such a way as to give us good drainage.

Labor conditions have improved during the year, and the seasons were such that we made a fairly good crop on all of the land, in spite of the poor drainage. Even under the conditions of boll weevil infestation which we had, we made a little more than one-half a bale of cotton to the acre. Experiments were undertaken looking to the control of these pests, but the rains were so constant at the time the poison was applied that little benefit resulted from the dusting. The weevil was so late in making its appearance at the Station this year, and labor at that time so scarce, that other control measures, such as picking squares and special cultural practices, were not attempted. We have experiments along these lines outlined for next season.

The corn and hay crops were good, and we have ample feed for the horses and hogs and plenty of hay and roughage for the cattle. The old variety orchard, which had served its purpose by indicating which varieties of peaches and grapes were best suited to this section of the state, has been abandoned and a new home orchard, including fruit and berries, has been put out. Experiments are also under way with Irish potatoes, sweet potatoes, and asparagus. An acre also has been seeded in alfalfa, and this is doing well. We have purchased three mules during the year, and now have enough work stock to take care of ordinary work at this Station. The forestry experiments are being continued and the plantings of different species of pine which have been made from year to

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STA-
TION—(Including the Sub-Station) 1919-1920.

(SUPPLEMENTARY STATEMENT)

This supplementary statement, while not required by law, is desired as an aid in interpreting the account rendered for the United States appropriation. While it will be more useful if made in conformity with the schedule fixed for that appropriation, if this is not practicable, such a summary of receipt and expenditures from the sources indicated below as can be conveniently prepared from the books of the Station may be substituted. Whenever practicable it should be for the fiscal year ended June 30.

DR.

To balance on hand -----	\$ 3,857.44
Receipts from other sources than the United States for the year ended -----	27,418.70
Total -----	\$31,276.14

CR.

By Salaries -----	\$ 5,148.87
Labor -----	7,953.72
Publications -----	307.50
Postage and stationery -----	323.91
Freight and express -----	140.75
Heat, light, water and power -----	819.84
Seeds, plants, and sundry supplies -----	2,572.33
Fertilizers -----	3,359.54
Feeding stuffs -----	451.77
Library -----	157.31
Tools, machinery, and appliances -----	2,500.10
Live stock -----	2,221.02
Traveling expenses -----	685.15
Buildings and land -----	2,414.90
Balance -----	2,219.43
Total -----	\$31,276.14

Report of The Division of Agronomy

The work of the Agronomy Division has made material improvement during the past year. We have had some serious handicaps, chief among which are the following:

1. We have not had sufficient funds and this has resulted in a lack of help and a lack of necessary tools and machinery.
2. The very wet spring prevented us from getting our crop started as early as it should have been started for best results.
3. Inability to get chemical analyses made has been a serious handicap to the progress of some of our projects.

But in spite of the above handicaps we have been able to accumulate a great deal of valuable data. The special appropriation made by the state legislature last spring enabled us to start some co-operative fertilizer experiments, which have given us some good results this year and promise to be of great value in the future if continued. The appropriation came so late this year that we could not get a competent man to begin the work in time to start a large number of tests. We did get three tests started and they have all given valuable results. Mr. T. S. Buie was secured to take charge of this work and reported for duty in June. Mr. Buie has been connected with this Station before and is thoroughly familiar with the state, and we are very fortunate to secure his services. The plan of his work and the results will be discussed later in this report.

Mr. Rogers and Mr. Buie have both been compiling data on the effects of various fertilizers, and cultural treatments on the different characters of the cotton plant. Under boll weevil conditions it is necessary to know the influence these treatments have on earliness, vegetative growth, rate of fruiting, and other factors.

ADAMS PROJECTS

Project No. 6. This project on the inheritance of barrenness in corn has been continued as planned. We have not

secured data enough yet to enable us to draw conclusions.

Project No. 24. This project is a study of inheritance in oats and has been continued as planned. We have secured the F_2 generation from a number of crosses and these are being planted for a study of the F_3 . We also have a number of F_1 plants which are being planted for a study of the F_2 . We also have some hybrid seeds which will be planted this fall.

Project No. 26. This project is a study of the effects of stirring a soil on the moisture content, oxidation, nitrification, and crop yields. This is conducted in co-operation with the Experiment Station chemist. This year the project received little attention because of the disorganized condition of the office of the Station chemist. We will get the crop yields, but because of inability to get analyses made the other phases of the work have not been studied.

Last year the crop was very late and, as we expected, a larger yield of seed cotton was secured where the ground was not stirred but had weeds removed with a hoe.

Next year we hope to continue all phases of this study in good shape.

Project No. 27. This project is a study of the factors affecting the oil content of cotton seed. It is being conducted in co-operation with the Experiment Station chemist. We collected a large number of samples last year and have analysed a considerable number of these. We are studying the influence of four factors: variety, fertilizer, soil, and climate. We are getting some very interesting results and hope to be able to report on them as soon as we have finished the analyses of the samples taken this year.

HATCH PROJECTS

Project No. 1. Cotton variety tests are being conducted at the main station and at each of the sub-stations. Good results are being secured at all stations this year, though the data is not all in yet.

Last year this test was very interesting and showed a wide variation between the best and the poorest varieties. At the Pee Dee Station the Dixie Triumph gave the highest yield

(2123 lbs. of seed cotton). This is a new variety which is proving of great value, as it is not only a good yielder and early, but is also wilt-resistant. The next highest yielding varieties were the Pee Dee Dixie and the Wannamaker Cleveland. One of the very interesting features of the test was the high yield made by Webber No. 49. This long staple cotton made a yield of 1800 pounds of seed cotton per acre, which is nearly as much as any of the short staple varieties, and more than the average short staple variety. Since this variety sold at approximately twice the price of the short staple varieties, it was easily our most profitable variety.

At the main station Dixie (Currin) gave the highest yield, and Improved Dixie (Coker) the second highest yield. The lowest yield of the short staple varieties was made by the Bates Prolific and the Simpkin Ideal.

The results of our variety tests for the past several years we believe justify us in making the following recommendations for the boll weevil conditions in South Carolina:

Best short staple cotton for land free from wilt, Cleveland Big Boll

Best short staple cotton for wilt infested land, Dixie Triumph.

Best long staple varieties, Webber No. 49 and Webber No. 82.

Project No. 2. Wheat variety tests are being conducted at the main station. This is now being organized into a co-operative project with a number of other stations in the southeast. This year our highest yield was made by Boggs' Blue Stem, which made 14 1-3 bushels per acre. The second best was Leap's Prolific, which made 13 bushels.

Project No. 3. Cowpea variety tests are conducted at the main station but have never given satisfactory results.

Project No. 4. Oat variety tests are being conducted at the main station and at the Pee Dee Station. The best yielding varieties have been Fulghum and Appler. This year Fulghum was highest with 35 bushels per acre, and Appler second with 24 bushels.

Project No. 5. Corn variety tests are being conducted at

the main station and at each of the sub-stations. In the 1919 tests the Douthit made the highest yield at both of the sub-stations, the yield being 62.2 bushels per acre at Florence, and 28 bushels at Summerville. The Lowman Yellow made the highest yield at the main station, and the lowest of any at both the sub-stations. Other good yielding varieties were Coker's E-1, Garric, and Weekley's Prolific.

The year 1920 has been an exceptionally good corn year all over the state, and we expect some high yields. The crop is not yet harvested.

Project No. 7. This is a comparative test of grasses and forage crops conducted at the Coast Station and at Clemson College. It has not made satisfactory progress at the Coast Station where most of the seed were planted, because of the failure of the drainage system there. Little has been done at the main station.

Project No. 8. This is a soybean variety test at the main station. The high yielding variety last year was the Mammoth Yellow. This seems to be decidedly our best variety at present.

Project No. 9. This is a variety test of peanuts at the main station. This test was practically destroyed by rabbits this year.

Project No. 10. This is a variety test of velvet beans at the main station. The very late season this year made it impossible to secure a crop.

Project No. 13. This is a study of the effects of companion cropping of corn and legumes. This test has not made satisfactory progress so far.

Project No. 14. This is a general comparative fertilizer test at the main station. This test has run continuously in cotton for 15 years. We expect to publish the results of this test at the end of this season, and then abandon the test as there has been some washing on the plots and it is very difficult to get a satisfactory stand of cotton on these plots.

Project No. 15. This is a comparative test of phosphate fertilizers and is being conducted at the main station. Good results are being secured with this test this year. We hope to have some good data at the end of this season.

Project Nos. 19, 20, and 21. These are comparative tests of nitrogenous fertilizers at the three stations. Some of these tests gave good results last year and some did not. At the Coast Station the heavy rains and poor drainage rendered the results of no value.

COLLEGE PROJECTS

Project No. 11. This is a culture test of cotton and is conducted at the main station, at the Coast Station, and at the Pee Dee Station. The results so far indicate that rather close spacing is best.

Project No. 12. This is a culture test with corn. This project has been running for several years and has given some valuable results.

Project No. 16. This is a general comparative fertilizer test at the Pee Dee Station. It includes 180 tenth-acre plots divided into four series. Series A, B, C, are in a three-year rotation of cotton, corn, oats and cowpeas. This test has given some very interesting results. We are planning to publish these results in a separate bulletin soon.

Project No. 17. This is a general comparative fertilizer test at the Coast Station. This test has been temporarily abandoned, because of the stoppage of the drainage system. We hope to get this drainage system repaired in time to start a new test of this nature at the Coast Station.

Project No. 22. This is a breeding project with Cleveland Big Boll cotton. Plant selections are made each year and are planted in a plant-to-row test the following year. The best rows from this test are planted in increase plots the following year. From these increase plots the seed are taken to the general field.

Project No. 23. This consists of plant-to-row selection work with some of our best varieties of wheat. Very satisfactory results are being secured with this project.

Project No. 25. This consists of breeding work with barley. We are working for a high yielding strain of beardless barley and the project is meeting with good success.

Project Nos. 28 and 29. These projects are on breeding work with Lee County and Lowman Yellow corn. The Belmont variety has been dropped. The work on the other two was hindered greatly last year by late planting which produced unsatisfactory yields.

Project No. 30. This consists of breeding work with Abruzzi rye. We have produced some strains of Abruzzi rye which promise to be high yielders.

Project No. 31. This project is directed to the breeding of a high yielding strain of Cook cotton which will be resistant to anthracnose. At times we think we are having some success and again there seems to be little hope. We cannot predict now whether this project will succeed or not.

Project No. 32. This is a study of the effects of Trona potash and borax on crops when applied to the soil in different amounts and different combinations with other fertilizers. This work has consisted of both field tests and greenhouse tests. The results of our work last year were published as a progress report in South Carolina Experiment Station bulletin Number 202. There was abundant evidence last year that Trona potash had injured crops in many sections of the state. On the Pee Dee Station farm at Florence we did not get injury from Trona potash or borax except in very heavy applications. In the greenhouse at Clemson College we had no injury from any rates of application used.

This year we have conducted six co-operative tests on farms of prominent farmers in Darlington County. We also continued our work at Florence on the Pee Dee Station farm. These co-operative tests all show serious injury from all the rates of application used. On the station farm at Florence the results are very similar to those of last year. We have not finished harvesting crops at this time (Nov. 3), but it seems that there has been no injury except with heavy applications.

We now feel very sure that Trona potash is very injurious under some conditions but that its effects are influenced largely by the kind of soil, the climate, and other factors. This we believe to be the true explanation of why there has been injury in some places and not in others, and why so many

conflicting reports have been given out in regard to the matter.

COOPERATIVE FERTILIZER TESTS

Last spring (1919) the legislature appropriated funds with which to conduct fertilizer experiments. Although it was late in the season before the money became available we succeeded in getting three tests started this year. We have gotten valuable data from all of these already, and they should be of immense value to the state in a few years if continued. This state is now using more fertilizer than any other state in the union. Our fertilizer bill for this year is over \$50,000,000. The amount we are spending for experiments is \$5,000 or one dollar out of every \$10,000 spent for fertilizer. This seems to be a very small investment to make for the purpose of finding out whether or not we are using the right things.

We have planned this work so that it will tell us three specific things with reference to each of the leading soil types in the state. These three things are:

1. What fertilizer formula, or what combination of phosphoric acid, ammonia, and potash, will give best results on a certain soil type, and for a certain crop?
2. What is the most profitable rate of application for different crops?
3. Does the soil type being tested need lime for the crops grown, and what is the effect of lime on the soil?

There are many soil types in the state, about ten being of special agricultural importance. It is very obvious that results secured on one soil type in one part of the state would not apply to a different soil type in another part of the state. We hope by next year to get tests located on each of the principal soil types of the state.

The tests in the boll weevil section of the state are of special interest and importance just now. Our most interesting test this year was the one located at Allendale where there was a heavy infestation of boll weevil. Our best plots gave more than a bale to the acre, and the whole test was very interesting.

Our tests are planned to use a complete fertilizer as a check and then eliminate one element at a time by grading it from nothing to a high percentage while keeping the other two constant. This tells us not only whether or not that element is needed at all, but also how much of it is needed if we have an abundance of the other two.

At Allendale on a Norfolk Sandy Loam this year we found nitrogen to be our greatest limiting factor and acid phosphate our second. Potash was of much less importance.

The large applications of fertilizer gave us a larger weed but failed to give us any more cotton than medium applications, as the boll weevil got most of the crop on the heavy applications. We got our largest yields with our heaviest applications of nitrogen (ammonia). This was 1000 pounds of a fertilizer analyzing 8-4-4. This test included not only cotton but also corn and tobacco.

The other two tests are located at State Park, Richland County, and at Sumter, Sumter County. The test at State Park includes cotton and corn and the one at Sumter includes cotton and peanuts.

Considering the circumstances under which we have worked during the past two years, we believe the work of this division has made good progress. We do not believe it has made the progress which should be made by this line of work in a great agricultural state like South Carolina. Before this work can be placed where it belongs, we shall have to have more money with which to conduct the work. We have many important problems not yet solved, but we have a good foundation for our work and we are looking forward to better results next year.

Respectfully submitted,

C. P. BLACKWELL,

To Director H. W. Barre.

Chief of Division.

Report of the Animal Husbandry Division

The following is a report of the experimental work being conducted by the Animal Husbandry Division:

SWINE

(1) Tankage, versus fish meal as a protein supplement to corn.

Two trials were conducted to show whether tankage or fish meal was the more economical supplement to corn. The first trial ran for 90 days with 9 hogs in each lot, and the second trial ran for 60 days with 5 hogs in each lot.

The rations consisted of 10 parts shelled corn and 1 part tankage for one lot, and 10 parts shelled corn and one part fish meal for the other lot.

Fish meal proved to be an economical substitute for tankage. Our results in this experiment show that fish meal made slightly larger gains at a little less cost than tankage.

(2) Some work on soft pork investigation in co-operation with the United States Department of Agriculture was begun, but failed on account of season.

CATTLE

(1) The breeding project with beef cattle has been discontinued. In a few days we expect to start an experiment on feeding beef cattle.

SHEEP

(1) Breed tests with sheep—Hampshires versus South down sheep for South Carolina.

Many are of the opinion that sheep will not do well in this state. The object of this test is to determine whether Hampshire or Southdown sheep are the better adapted to South Carolina. There are three ewes in each lot. The ewe lambs will be retained and bred so as to lamb at two years of age. Every two years we will purchase a ram of each breed.

HORSES

(1) The breeding project with horses is being continued. We have several grade Percheron mares which are bred to a splendid jack. Indications are that mules from this cross are particularly well adapted to South Carolina.

Respectfully submitted,

L. V. STARKEY,

To Director H. W. Barre.

Chief of Division.

Report of the Botany Division

The work of the Division of Botany and Plant Pathology has been interfered with by the changes in the personnel, and little progress has been made with some of the projects during the year. Mr. G. W. Wilson, who filled a temporary appointment with us while Mr. Faulwetter was on leave in the army, made his plans to leave in August, when we expected Mr. Faulwetter back. After Mr. Wilson had accepted work elsewhere Mr. Faulwetter resigned and the position was then left open until the first of January. At that time Dr. C. A. Ludwig reported for duty and took up the work as Associate Botanist and Plant Pathologist. We have also been unable to fill the graduate assistant's position in this Division, and this has handicapped the work to some extent. Mr. McHugh, who took this work in July, 1919, remained with us until the first of January when he accepted a position elsewhere at a higher salary.

COTTON ANTHRACNOSE

Since Dr. Ludwig reported for duty he has continued the work with the cotton Anthracnose, along the lines as reported last year. The major part of his time has been devoted to the study of the influence of the physical factors effecting the vitality of the fungus in the seed. In co-operation with Dr. Lipscomb he has continued the study of the effect of dehydration on the vitality of the fungus. The work which Dr. Lipscomb and Mr. Wilson reported last year has been carefully

checked over with different lots of seed and different varieties of cotton and the results have not agreed exactly with earlier data obtained. Dr. Ludwig has also used the electrical dryer, which we secured last year. This is made to kill the fungus in the seed by passing currents of hot air over the seed and in this way drying off the moisture. The results from these studies have not been as encouraging as the preliminary investigation led us to expect. We have succeeded in killing, practically, all of the fungus in the different lots of seed studied, but in many instances there has been a trace of disease remaining, even after the most severe treatment. This makes us feel that this method of treatment will not prove as satisfactory as we had hoped as a practical control measure. Seed have also been treated with chemicals and gases and a great deal of data has been accumulated from these studies. So far, however, no seed treatment has been developed which will take the place of practical control measures that have already been worked out and put in practice throughout the state. These have proved entirely satisfactory for the control of the disease under farm conditions, but we had hoped to develop some seed treatment which would give absolute control, and which could be used by seed breeders and seed growers to eliminate Anthracnose entirely from their fields, where seed are being grown especially for planting purposes. There are still several minor phases of the seed treatment and seed storage problems to be worked out, after which we hope to close up this project and devote our energy to the study of other diseases.

ANGULAR LEAF SPOT OF COTTON

The work with Angular Leaf Spot has been held up this year because of our inability to get infected seed during the winter and spring with which to continue our experiments looking to the control of this disease. Seed treatment with sulphuric acid gave very satisfactory results in our preliminary studies and proved entirely satisfactory in tests conducted at Clemson College and at the Pee Dee Station in the summer of 1918. We expect, however, to repeat this so as to make sure that these control measures will work under all conditions.

MISCELLANEOUS

The co-operative breeding work with wilt-resistant cotton, which has been conducted in co-operation with the Bureau of Plant Industry, has been discontinued. This was partly due to the reduction in appropriations for research work in the Bureau of Plant Industry, and partly due to the fact that we feel that the problem is pretty well solved. The men who have been in charge of this work have developed the wilt-resistant varieties to the point where it seems to us that the farmers and cotton breeders can maintain their purity and resistance and continue to improve them about as rapidly as could college and government men working in the same line. It would, therefore, seem fairly worth while to continue to use public funds for this work. The demand for wilt-resistant seed is constantly increasing, and the men who are breeding and growing these seed are now producing seed of the best varieties in large quantity, and we believe that everyone who needs wilt-resistant seed will be able to secure them.

The plant disease survey has been continued, in co-operation with the Bureau of Plant Industry, and in connection with the work of the Crop Pest Commission of this State. Mr. J. L. Seal, who has been doing inspection work for the commission, resigned in June, in order to take up research work at the University of Minnesota, and we have been unable to secure anyone to take his place. This has interfered to some extent with the pathological instruction work of the Crop Pest Commission, as well as the survey work, which Mr. Seal was doing.

The forestry experimental work, which is being conducted at Drainland, in co-operation with the United States Forestry Service, has been continued, along lines reported last year. The Slash Pine is continuing to develop rapidly and promises to be a valuable tree, under the conditions that exist at Drainland, which are typical of the lower flat lands of the Coastal Plain.

H. W. BARRE,
Botanist and Plant Pathologist.

Report of the Dairy Division

Following is a report of the experimental work in progress in the Dairy Division during the year ended June 30, 1920.

HATCH PROJECTS

I. *Feeding Dairy Cattle.*

(1) A study to determine the most economical concentrate to supplement cottonseed meal as a feed for dairy cows in the South.

No further results have been obtained in this experiment since the last report. We had all of our registered cows on official test during the past year. But a part of them have recently finished test, making it possible to use some of these animals for the experiment. We should be able to continue this experiment during the winter months. This experiment is to be undertaken and continued in co-operation with the Alabama and North Carolina Experiment Stations, where similar experiments are being conducted under identical conditions.

(2) A comparison of corn silage and sorghum silage for milk production.

We were not able to get sorghum for silage planted this year, and therefore have no further results to report on this project.

II. *To ascertain the feed required and the cost of raising dairy calves from birth to two years of age, by monthly periods.* During the year we have kept data on more than fifty calves; registered Jerseys and Holsteins, and grade Holsteins. The calves were weighed once each week and at the end of each month the height to withers was recorded. It is our purpose to continue this experiment until we are able to tell the farmers of the state just what they should expect a calf from any of the leading dairy breeds to weigh at any time from birth to two years of age, and also the amount of

whole milk, skimmilk, grain, hay and silage necessary to bring the average calf to the age-periods as covered by the experiment. In order to do this we shall need to carry a sufficient number of calves on experiment in order that we may average the results and eliminate chance for errors. Due to the conditions in the past year, it has cost us an average of \$12.29 each to raise nineteen Jersey heifers to one month of age, \$25.90 each to two months of age, \$44.22 each to four months of age, \$60 each to six months of age, and \$84.51 each to one year of age. With the completion of the calf barn there will be better facilities for getting accurate data in this experiment.

III. *A study of the prepotency of the bulls used in the Experiment Station herd.* The records of the foundation cows, including registered Jerseys and Holsteins and grade Holsteins, have been compiled and these records are being compared with the records of the daughters of these cows sired by the different herd bulls. Complete data on all bulls formerly used in the herd can be given as soon as some cows now on official test have finished their year's tests. This experiment should be continued indefinitely as it will give valuable information as to our breeding operations for use in the future.

IV. *A comparison of line-breeding and out-crossing as systems of breeding dairy cattle.* In this project we expect to use in the line-breeding experiment, Chromo's Sensation, a son of Blue Fox's Eminent's Chromo. This cow has a record of 17,217 pounds of milk and 867 pounds of butter-fat in one year. We now have a son and a daughter of this cow in the herd, and as an out-cross on the daughters of this bull we expect to use Vive Glow Chief 165178. This bull has 62½ percent of the blood of Golden Glow's Chief. He is entirely unrelated to any other animal in the herd and is backed by some of the greatest producing blood of the breed. We expect to make comparison of the conformation and production of the daughters of these bulls, one group of which shall be line-bred, and the other out-crossed.

V. *Line-breeding of Holsteins.* This project is being undertaken in co-operation with the breeding specialists of the

Dairy Division of the United States Bureau of Animal Industry. We have secured from that bureau on loan a Holstein bull which we expect to try out and if his daughters are satisfactory we will follow him with one of his sons in an effort to secure data as to the value of line-breeding in improving the conformation and production in our herd of Holsteins.

During the year we have had two tuberculin tests of the entire herd. On the last test we had no reactors or suspects, and now we feel that we have entirely eradicated tuberculosis from our herd. We shall continue to keep practically all of the heifers dropped in the herd, and expect both to enlarge the herd and to replace some of the older animals which we now have.

We shall continue to carry on Advanced Register and Register of Merit work. We now have six Registered Holsteins with official tests ranging from 300 to 427 pounds of butterfat in one year, and four more cows on test. We also have twelve Jersey cows which have completed Register of Merit records ranging from 308 to 527 pounds of butterfat in one year, and now have seven cows on test, some of which will make records in excess of any which have already been made. All of our Registered Jerseys and Holsteins which have completed one or more lactation periods will have official records by the end of this year. None of these records are very large but they will give a basis of comparison for results of our breeding work, and will enable us to select intelligently our breeding animals and cull our herd. Most of the above records were made by two-year-old heifers.

With the completion of the calf barn and pit, and with the animals which we now have in the herd, we have about reached the stage where we can carry on experimental work and expect accurate results. With intelligent direction and a good herdsman we should be able to do excellent work with this herd in the future.

Respectfully,

W. W. FITZPATRICK,

To Director H. W. Barre.

Chief of Division.

the greater number of blooms resulting from the enlarged fruiting surface increases the chances for a crop."

On my return to the College in September I made a careful examination of the horticultural work of the Station, and was informed by both Mr. Young and Mr. Hoffmann that it had been very difficult indeed to secure labor during the past year, and that on this account many of the experimental and other crops had been more or less neglected.

PEE DEE STATION

A report from Mr. R. E. Currin, Superintendent of the Pee Dee Station, shows that the horticultural work there has progressed very satisfactorily during the past year.

Quite a number of varieties of small fruits were planted in the spring of 1919. Varieties of strawberries, raspberries, blackberries and dewberries were planted in order to determine the varieties best adapted to this section. A large number of comparatively new varieties of fruits have been introduced in the last few years that have never been tested in our experiment stations in this state. It was, therefore, considered desirable to give these a test at the Pee Dee Experiment Station.

The orchards are reported to be in good condition, with the exception of a few trees which are badly infested with root-knot. The other disease and insect pests which frequently destroy the trees and fruits have been kept under control. A careful record has been kept in regard to the varieties of peaches and grapes over a period of six years. This information will be of value in determining the varieties of fruits best adapted to the Pee Dee section.

Experimental work with the sweet potato has been conducted and the reports obtained are very satisfactory indeed.

Our experiments show that grapes and peaches may be grown in the Pee Dee section at a profit.

Recommendations.—The soil and climatic conditions in the Pee Dee section of South Carolina are well adapted to the growing of certain kinds of truck crops extensively for northern markets. Growers in this section have had little experience in the growing of truck, and I therefore think it

would be wise to conduct experiments with the principal truck crops at the Pee Dee Station during the next three or four years. Irish potatoes have already been grown rather extensively in this section, but so far as I know, no fertilizer tests with the Irish potato have been made in this section of the state. Such crops as Irish potatoes, sweet potatoes, onions, cabbage and cantaloupes will grow to perfection in this section, and as there is usually great demand for these truck crops, I believe that now is the logical time to encourage the farmers in this section of the state to grow them more extensively, in order that they may reduce their acreage in cotton.

If the experimental work in horticulture is to be carried on successfully at the Pee Dee Station, I consider it necessary to have an assistant horticulturist to serve under Mr. R. E. Currin. If this is done, the superintendent will be able to devote more of his time to other phases of agricultural work. Experimental work in horticulture requires close supervision, and for that reason I consider it necessary to have one in immediate charge of this work who is familiar with every detail.

COAST EXPERIMENT STATION

A report from the superintendent of the Coast Experiment Station shows that the horticultural work there is progressing very nicely.

The old orchard and vineyard, however, were beginning to fail on account of the poor drainage, it being necessary to remove them.

A small orchard of different varieties was planted last year and seems to be doing nicely.

Grapes and peaches seem to thrive well at the Coast Station, but it is absolutely necessary that they be planted in well drained upland.

Experiments were conducted during the past year in the growing of Irish potatoes and a few other truck crops. A new plantation was made of strawberries and asparagus. Ex-

periments were also conducted in testing the different varieties of sweet potatoes.

Recommendations.—As the Coast Experiment Station is located so near the trucking district of South Carolina, I think it would be advisable to plan a series of experiments with the principal truck crops now being grown along the coast, and that a fertilizer experiment with cabbage, Irish potatoes, sweet potatoes, lettuce and beans should be undertaken. Experiments to determine the best source from which to purchase seed Irish potatoes should also be conducted. This is one of the principal causes of failure in the growing of Irish potatoes in the eastern part of the state.

The horticultural work of the Coast Station should be confined almost entirely to experiments with truck crops. Co-operative experiments should also be carried on on some of the principal truck farms in the several counties along the coast where the truck crops are grown most extensively for northern markets.

Resignations.—Mr. W. J. Young, Assistant Research Horticulturist, resigned his position on October 15th, 1920, to accept a position with the government experiment station at Haiti. As yet this position has not been filled.

Respectfully submitted,

C. C. NEWMAN,

To Director H. W. Barre.

Chief of Division.

Report of the Division of Publications

The following is a report of the Experiment Station work conducted by the Division of Publications for the fiscal year ended June 30, 1920.

PUBLICATIONS

Bulletin 200, Analyses of Commercial Fertilizers, 4500 copies.

Bulletin 201, Creosoting Fence Posts, 4000 copies.

Bulletin 202, Trona Potash: A Progress Report, 4000 copies.

Thirty-second Annual Report, year ended June 30, 1919, 1100 copies.

MAILING ROOM

With the new equipment for cutting name plates and addressing envelopes provided during the previous fiscal year the routine of the mailing room has been greatly facilitated. In addition to the distribution through the classified mailing list and to individuals of the bulletins published during the fiscal year, there has been a large distribution to individuals of the bulletins issued previously.

The list of classified names on the Experiment Station mailing list now amounts to nearly 5000 and additions are being made constantly. Necessary revisions are made promptly to keep the mailing list up to date.

SOUTH CAROLINA EXPERIMENT STATION LIBRARY

At the beginning of the fiscal year provision was made for a full time librarian, and Mrs. Crown Torrence was appointed to that position. The work of classifying and cataloging the large quantities of material which had accumulated during several decades was undertaken at once by the librarian, and much progress has been made in this work. Her report shows the following:

Volumes accessioned 288.

Volumes marked and shelf-listed 288.

Volumes bound 108.

In addition to this work of classifying and cataloging, much time has been given by the librarian to helping Experiment Station workers, teachers, and students in finding and gathering information. Some impression of the way in which the library is being used may be obtained from the librarian's report that during the year 1905 readers were recorded, 192 borrowers were registered, and 504 volumes were issued.

Naturally the library is not yet in position to render maximum service because of the lack of necessary equipment, but with reasonably liberal provision for such equipment during the next few years it will be possible to make the library an efficient aid to all agricultural workers and students.

PUBLICITY WORK

As heretofore, a considerable amount of the publicity material sent out by the Agricultural Editor in the Weekly News Notes, news letters, and special articles to newspapers and agricultural journals is obtained from Experiment Station sources and deals with Experiment Station work. News articles and special feature articles are made from material provided in the annual report and other Experiment Station sources, and these give wide publicity to the experiments conducted and results obtained, thus furnishing the public with the benefits of the work of the Station. No opportunity is lost to call attention to the publications of the Station, so that an increasing demand for these publications is being created.

There seems to be need still, however, for a clearer realization on the part of the Station workers in general of the importance of more publicity for the work which they are doing; this not in any advertising spirit, but to enable the people of the state to know what is being undertaken, what progress is being made, and what results have been obtained by the South Carolina Experiment Station.

Respectfully submitted,

A. B. BRYAN,

Agricultural Editor.

To Director H. W. Barre,

Report of the Coast Experiment Station

The following is the annual report of the Clemson Coast Experiment Station for the year ended June 30, 1920.

DRAINAGE

Drainage being a very important factor in the production of crops in both general and experimental work at this Station, and it being apparent during the year 1919 that the system of drainage was for some reason inefficient, an investigation was made during December, 1919, by Mr. Lynde of the United States Department of Agriculture. This investigation showed that a number of lateral drains were totally or partially filled with silt, and gave certain other information which was included in a special report made to the Director by Mr. Lynde. It was thought that there was a possibility that the waters from Rumph Creek entered the tile at the creek and was forced up the main into silt basin No. 1 and out through the outlet into the ditch leading to Platt's Branch; therefore a flood gate was constructed at the outlet at Rumph's Creek to relieve this possible condition.

Provision was made to dig up the lateral drains that were inactive for the purpose of cleaning them out and relaying them. This work has just been begun, it being thought advisable to do it after the crops had been harvested.

The open ditch leading to Platt's Branch has just been thoroughly cleaned out to a point 576 feet below where the ditch crosses the Southern Railroad. Along the public road from one to two feet of mud had to be removed from the bottom of the ditch.

With the drainage work as outlined accomplished, there should be much more satisfactory results derived from these lands for production and experimental work.

ORCHARD AND TRUCK

The old orchard and vineyard were abandoned and destroyed because of the fact that they had become unprofitable

and had more or less served their purpose as an experimental proejct.

A new orchard was planted which consists of mixed trees and small fruits. This is made as a home orchard and occupies about one acre. Five rows of strawberries were planted on one-half acre of land. Six rows of Washington asparagus were planted between the rows of pecan trees in the pecan grove. This made a satisfactory growth this year.

Three and one-half acres of Irish potatoes were planted for market. These made a fairly satisfactory yield but not as high a yield as should have been made, because of conditions beyond our control.

Approximately two acres of sweet potatoes were planted. Harvest is just being made of these and a very good yield will be made.

AGRONOMY

Our fertilizer tests had to be discontinued during this year because of the lack of proper drainage and because of the fact that the plots were so narrow (12 ft.) that they were merged into each other through continual breaking up of the land in preparation for crops.

A plot of flax was planted which made a very good growth. The seed were sown broadcast in March and the crop was ready for removal in June.

The time of applying fertilizer test, the variety test of cotton, and the spacing test of cotton were planted; but on account of cold weather after the seed had come up the stand was so bad that the results were not recorded. The lack of drainage was also a factor in the loss of the time of applying fertilizer test and also of the spacing test.

A variety test of corn was attempted, this being planted twice but on both occasions the corn was destroyed by insects and disease to such an extent that the results were not trustworthy and were therefore not recorded.

GENERAL CROPS

Cotton planted in the general crop did fairly well considering the stand and the effect of the boll weevil on the latter

part of the crop. A total of about seven bales was made. This, however, has not yet been ginned.

Corn was very good, and all except two acres has been harvested. The yield I estimate at between 800 and 900 bushels from about 20 acres. Twelve acres of corn was shredded, which made a very good quantity of stover.

The hay crop was good and was harvested in good condition. The hay has not yet been baled but is now in stacks near the barn. I estimate that there are between twenty and twenty-five tons of this mixed peavine and crab grass hay. We are still carrying over a good quantity of hay from last year.

The oats planted were harvested and fed in the sheaf to the work animals.

A few rows of sugar cane was planted on a very wet area. This, however, has not made a very good growth and will be put away for planting purposes next year.

One acre of alfalfa was seeded this fall. It came up to a good stand and now is looking all right.

About fifteen acres of velvet beans were planted in corn, which will be harvested by the cattle and hogs.

FORESTRY

The forestry area fence has been repaired. Areas having plantings have been re-marked during the year. The fire guard has already been plowed and will be burned as soon as the grass is sufficiently dry.

PASTURES

The old pasture area has been put in repair by replacing decayed fence posts. The new 300-acre tract purchased during the past summer has been enclosed with a woven wire fence.

Lespedeza was seeded in the spring on a 10- or 12-acre tract of the old pasture and came up to a good stand and has done well during the summer months. This was seeded in March on the open ground after the land had been burned over but without any other preparation. One hundred pounds of carpet grass seed has been purchased for planting next spring.

WORK ANIMALS

The work animals on the Station at the beginning of the year were not sufficient for the proper performance of the work. One mule died early in the spring and was replaced in May. Two other young mules were bought this fall. With what we now have on hand the land should be cultivated better than during the year just past.

LABOR

Labor conditions have been better this year than last year. But at times it has been rather hard to get and unfortunately this condition occurred at a critical time in the cultivation of the crop this year.

LIVESTOCK

In preparation for the livestock project at this Station twenty-four head of goats were purchased for the purpose of clearing the pasture land of bushes and rubbish not eaten by cattle. The results of the work of the goats has been entirely satisfactory.

The cattle and hogs now on hand are in good condition. A lot of purebred Angus cattle has been bought but has not been shipped here yet.

Respectfully submitted,

J. A. RILEY,

Superintendent.

To Director H. W. Barre.

Report of the Pee Dee Experiment Station

The following is a brief report of the experimental and other work being conducted at the Pee Dee Experiment Station for the year ended June 30, 1920.

FERTILIZER TESTS

The importance of the fertilizer tests conducted here is more widely impressed on the thinking farmers each year. The many problems in regard to the use of fertilizers that came up during the war convinced us that a great deal was to be learned about the so-called commercial fertilizers. Farmers and manufacturers are already making use of the information obtained here and the wide field covered by these tests will make them of even greater value as the work continues. All tests were planted as early as thought advisable on properly prepared land. The unusual cool weather during April and early May retarded the growth somewhat. The spring conditions, together with those of the summer months, caused the cotton crop on these plats to mature rather late. The yields promise to be fairly good as compared with past years.

The first fertilizer project commenced here, was the general fertilizer test in series A, B, C, which are planted in cotton, corn and grain in rotation, and D, which is cotton continuously, consisting of 45 plats in each series. This test has attracted much attention from farmers and agricultural workers generally and a bulletin covering three years' results has been published. This work has been conducted for seven years and so much data obtained that most of the time of an agronomist will be necessary to interpret it and get it in shape for publication. Some of the outstanding results point to the necessity of using the three important elements, nitrogen, phosphate, and potash, in the production of cotton and emphasize the value of rotation in the production of cotton, corn and oats.

In series G and H the residual effect of former applications of different fertilizers in a two-year rotation of cotton and corn is being studied. The results show the benefits of rotation and indicate that excessive amounts of fertilizer applied

to the soil continue to influence the growth of succeeding crops. In series M, acres No. 4 and 5, the testing of different sources of nitrogen mixed as a complete fertilizer under corn and cotton is proving very interesting and valuable. Fish, cottonseed meal, dry blood, cyanamid, nitrate of soda, sulphate of ammonia, ammonium nitrate are some of the sources of the nitrogen used in these tests.

In series N, acre No. 4, "The theoretical amount of fertilizer necessary to produce a bale of cotton per acre", is applied along with greater or lesser amounts than the theoretical amounts. This experiment has created considerable interest among a class of farmers who are skeptical as to the use of commercial fertilizers being of much benefit in cotton production.

Acre No. 5, series N, is devoted to the application of potash in combination with other fertilizer ingredients at different stages of growth of the cotton plant.

In cooperation with the United States Department of Agriculture, we are conducting fertilizer tests with cotton in acres Nos. 4 and 5, series O, and with corn in acres No. 4 and 5, series P. The different formulas and ingredients used in these fertilizer tests are many and would consume too much space to name here. Perhaps these are the most important fertilizer tests we are conducting.

The fertilizer tests under cotton and tobacco in series 2, acre No. 4, is carried on as a part of the tobacco fertility tests. The same ingredients and formulas are used under tobacco and cotton, and these crops are planted in rotation in order to secure data on the effect of different cropping systems and fertilizers on tobacco. This series is planted in cotton this year and is giving us some very valuable data.

The uses of domestic potash in commercial fertilizers during the war brought about many problems especially when the potash contained borax. Continuing experiments conducted last year to ascertain something about this matter, further tests are being conducted this year in series 2, acre No. 5, with variable results. The domestic potash in different mixtures is being compared with other formulas containing no domestic potash.

TOBACCO

Tobacco is such an important crop in the Pee Dee section that the results of the fertility tests made here under this crop are proving of general interest and of the greatest value to the farmers. Besides our fertilizer tests under this crop, some methods of insect control and of cultivating and handling the crop are being studied. The tobacco crop was damaged by rains and adverse weather conditions generally. However, the crop proved to be a very good one in the end. Acres No. 3 in series N, O, and P are devoted to the fertilizer tests under this crop.

VARIETY TESTS

Series I and J, consisting of two acres each, are devoted to the testing of varieties of corn and cotton. Fifteen varieties of the most promising corns are tested and sixteen of the most prominent varieties of cotton are planted in such a way as to eliminate soil differences that might affect yields. The immediate value of knowing the best variety of corn or cotton to plant in any particular section is apparent to all. The usual interest in varieties of cotton has been greatly increased by the presence of the boll weevil in the counties adjacent to the Pee Dee Station, and many inquiries regarding what kind of cotton to plant under boll weevil conditions are being received. The data from these tests should be of much value in determining what varieties are suitable to this section under any conditions. Two more acres in I and J are devoted to a study in rotation.

SWEET POTATOES AND PEANUTS

The experiments here with sweet potatoes and peanuts are conducted in cooperation with the United States Department of Agriculture. These experiments consist of fertilizer tests, variety tests, rotations, breeding and selecting with both of these crops. This work was planned five or six years ago so that the data could be accumulating by the time the boll weevil reached South Carolina. A storage house was built for

storing and keeping sweet potatoes. This house was built on the most approved plans of that time.

Each year sweet potatoes have been gathered and stored under different conditions and data kept. From data obtained we can safely assert that if sweet potatoes are properly stored in properly constructed storage houses only a small percentage of loss will occur. The experiments in storing sweet potatoes in certain types of tobacco curing barns have also proved very satisfactory. With certain inexpensive and easily made changes in these barns, as many as five or six hundred bushels of sweet potatoes to each barn have been stored and kept safely throughout the winter.

Of the 56 varieties of sweet potatoes planted here, only about ten seem to have any particular value under general market demands.

Peanuts and sweet potatoes are mentioned under the same head for the reason that one of the questions we are trying to answer with some of the experiments that we are conducting with these two crops is: "Can peanuts and potatoes be planted in a rotation of any kind that will keep up the humus content and fertility of the land on which they are planted?" A rotation scheme which takes in all the fertilizer plats used in these experiments was inaugurated this year. Oats and vetch find a place in this rotation. Both the sweet potatoes and the peanuts on these plats are very good. Arrangements have been made to have a moving picture taken of the methods of harvesting potatoes and threshing peanuts. Much valuable work has been done along the lines of selection and breeding of these crops. These crops occupy acres No. 2, 3, 4, and 5 in series K, and acres 2, 3, and 5 in series L, and acre No. 3 in series M.

CORN AND COTTON BREEDING

In series L, acre No. 4, the breeding of Dixie-Cook cotton is conducted. This variety of cotton seems particularly adapted to our soil and, as most of the land on the Station is infested with wilt, it is necessary that some wilt-resistant strain be used in all plats planted in cotton. The old strain of Dixie

was used up to this year, but on account of its luxuriant growth it was not suitable for boll weevil conditions. The Dixie-Cook has been substituted in both breeding and fertilizer tests. This strain of wilt-resistant cotton is much earlier than Dixie and is one of the best wilt-resistant cottons. It is too early to say just what the yield will be as compared with Dixie. Should it prove as good as or superior to the Dixie-Cook has been substituted in both breeding and fertilizer tests. Progeny rows of this variety are planted and careful selections for desirable qualities made by experts. Increase plots give us seeds for planting the general crop.

Acres 1 and 2 in Series M are used for breeding Pee Dee No. 5 corn. Some improvement is noted in this corn from year to year.

PRODUCTION OF FLAX

Some time during the spring of 1920 arrangements were made to grow some flax for parties in Canada, who wanted to test some flax pulling machinery which they thought could be used in harvesting this crop. The preparation and seeding of the flax crop was under the direction of experts from the United States Department of Agriculture. Five acres were devoted to this crop. The stand was good and the crop of flax compared favorably with that grown in the regular flax producing sections of this country and of Canada. It was thought well to try out this crop, as it puts this Station in possession of much information relative to flax under local conditions.

THE GENERAL FARM

It was found necessary from a labor standpoint to share-crop some of the Station land this year. This share crop, along with the other general crops on the Station, is good and will prove profitable if the price of cotton does not remain too low.

HORTICULTURAL WORK

The peach crop and the grape crop were both fine. The hor-

ticultural work here continues to receive its full share of interest. There seems to be a greater demand for fruit trees in this section than ever before, which to a certain extent can be attributed to the horticultural work conducted here. Many new varieties of peaches and other fruits were planted last spring. These have suffered some from lack of attention caused by insufficient labor, and from bad seasons. Most of the trees are living and if given attention this winter will pull through all right.

ALFALFA, CRIMSON CLOVER, AND VETCH

These three crops continue to be valuable crops here both as soil builders and as forage crops. The method of preparation and seeding of these crops as pursued by this Station has been followed with fair success by a good many farmers throughout this section.

BUILDINGS

During the year our office building was completed and is now occupied. This building was much needed and is much appreciated by those who have any office work to do at this Station. The new corn barn completed this year fills a long felt need. Most of the buildings need painting, and some repair work is needed on most of them.

HOG FEEDING EXPERIMENTS

Besides our regular grazing crop experiments a few dry feeding experiments were conducted here this year. No disease has attacked our herd, largely, we believe, because of the fact that as soon as the pigs were large enough they were given the simultaneous treatment for the prevention of cholera. Alfalfa, corn, crimson clover, and dwarf essex rape have proved to be the best forage crops. We have now growing on the hog experiment plats all of the above crops. The data from all of our hog feeding tests is very full and valuable to the hog growers of this section.

LABOR CONDITIONS

After all is said and done, man power is very necessary at the Station. The scarcity of labor has been our greatest trouble. The labor expenses are greater than usual for the reason that our work has been driving us instead of being driven by us. Certain work done just a little too late costs twice as much as if done when it should have been. The higher wages to common laborers given in town have about exhausted the country supply except the maimed, the halt and the blind among the males; and the old women and children are the only ones left who will pretend to work. We can no longer depend upon day labor to help us. We must in some way have control of enough labor to do our work when it should be done, in a better manner than it has been done this year. I believe that one of the solutions of this problem is to have a sufficient amount of good houses for laborers built on the Station land. The application for positions next year by good men are coming in every day and without promise of a place to live they will have to be turned away as usual. We should have at least as much accommodation for our men as the average farmer has. The few laborers we have, have done well, considering that two of our best ones were sick a good deal during the year. Boys are very unsatisfactory laborers at the Station and the necessity for their continued employment is not exactly fair to the managers who wish to make good.

The Superintendent wishes to thank the President, members of the Board of Trustees, heads of divisions, and the men in the Extension forces for the valuable assistance and hearty co-operation given him in the work here.

Respectfully submitted,

R. E. CURRIN,

Superintendent.

To Director H. W. Barre.