Thirty-Ninth Annual Report

OF THE

South Carolina Experiment Station

OF

Clemson Agricultural College

H. W. BARRE, Director

FOR THE YEAR ENDED JUNE 30, 1926

Clemson College, S. C. December, 1926

CLEMSON AGRICULTURAL COLLEGE

E. W. SIKES, President

SOUTH CAROLINA EXPERIMENT STATION

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* On leave.
** Detailed by United States Department of Agriculture.
† S. C. State Crop Pest Commission.
Mail and Telegraph Offices: Clemson College, S. C.
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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.

Letters of Transmittal

Clemson College, S. C., November 17, 1926.

Dr. E. W. Sikes, President.
Dear Sir:

I have the honor to submit herewith the Thirty-ninth Annual Report of the South Carolina Experiment Station for the fiscal year ended June 30, 1926.

Very truly yours,

H. W. BARRE, Director.

Clemson College, S. C., November 17, 1926.

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

I beg leave to submit herewith the Thirty-ninth Annual Report of the South Carolina Experiment Station, which in accordance with the law, must be submitted to the Governor on or before February 1, 1926.

Very truly yours,

E. W. SIKES, President

Clemson College, S. C., November 17, 1926.

Hon. T. G. McLeod, Governor of South Carolina.
Sir:

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

Respectfully submitted,

ALAN JOHNSTONE, President Board of Trustees.

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The
THIRTY-NINTH ANNUAL REPORT
of the
South Carolina Experiment Station

INTRODUCTION

Thirty-one years ago the introduction to Bulletin No. 19 of this Experiment Station began with this sentence: "In consequence of the low price of cotton, farmers are anxious to engage in some line of production that promises more remuneration." This sentence applies to 1927 as it did to 1895 for we have again gone headlong into the over-production of cotton. We are confronted with an 18,000,000-bale crop and a 3,542,560 bale carry-over from last year with a consequent reduction in price. This presents a serious situation, yet it is not a hopeless one. There are in South Carolina many progressive farmers who have acted on the advice of the Experiment Station and the Extension Service and who are at this time independent of the price of cotton. There are others who have adopted the practices developed by the research staff and have increased their yields per acre and reduced their cost of production to the point where they will not lose money at the present very low price. Cotton could not be produced under present conditions with the practices in vogue just a few years ago for less than 18 cents a pound. It cannot be produced now at the present price except on fertile soil by the best farmers following the most improved practices and with efficient farm organization and wise diversification. We still need to give more serious consideration to "some line of production that promises more remuneration."

It has been the aim of the agricultural research agencies from the beginning to find, through experimentation better practices for more abundant production of our staple crops, to reduce the production cost per unit and to determine practices and methods for producing new crops and products which will enable us to have greater diversification, more profitable farm organization and an increased revenue. Fortunately for our people the scientific researches conducted by the Experiment Station staff have developed many facts and fundamental principles which will be of great value in planning farm organization, production, and marketing programs for meeting the present discouraging situation. During the past

thirty-nine years this station has published 233 bulletins and thirty-eight reports which give results and reports of the progress of research in this state and these are available to aid in meeting the present emergency. It is true that many of the problems of economic adjustment, social changes, market demands, utilization of new productions are new and their solution will require renewed efforts and enlarged facilities for further research, but our staff is alive to these needs and is attacking these problems with a zeal that must in the end produce results.

Fig. 1—New library building now housing the Experiment Station offices and laboratories.

The work of the Research Department has been conducted along the lines previously reported, with the addition of special projects on agricultural economics, marketing, and rural sociology in line with the facilities at our disposal and the needs as indicated by previous researches in these fields. No effort will be made in this brief report to cover all of the research work under way, but it will be our aim to give a summary of the progress and results of the more important investigations.

RESEARCH WORK WITH COTTON

Our cotton research work has been continued along the lines reported in the Thirty-eighth Annual Report and in bulletins 223 and 225 of this Experiment Station. We are still aiming at improved practices for the economic production of cotton under boll weevil conditions. Since the new cotton areas of the West have

increased their acreage to such a great extent, it is all the more important that we develop the best possible practices for economic production. We must now compete with these new areas which seem to have many advantages or we must surrender cotton production as we gave up rice growing a generation ago. Progress already made on these problems encourages us to believe that by continuing our research along these lines and by using all of the knowledge we already have, we shall be able to compete successfully with the western part of the cotton belt.

Our general field plat poison experiments for boll weevil control have been completed, so far as the testing of materials now in use is concerned, and the research with poisons has been confined to tests at the Coast Station of some new materials developed by the Chemical Warfare Service and to experiments with certain new combinations tested at Clemson College in connection with the insecticide investigations. The weevil biological and plant physiological research, the fruiting, cultural and varietal studies with cotton are still centered largely at Florence but certain of these investigations are being repeated and checked by experiments at the Coast Station and at Clemson College. A short summary of the several lines of work is given below under appropriate headings.

Weevil Biological Work

During the past three years Dr. F. A. Fenton and Mr. E. W. Dunnam, of the Bureau of Entomology, together with several scientific assistants, have made intensive studies of the life history and activities of the weevil at the Pee Dee Station and in the vicinity of Florence. Some very valuable data have been obtained from these studies of thousands of weevils at close range.

The past three growing seasons have been quite different from each other, and weevil behavior in the field under natural conditions has varied with the seasons, thus emphasizing the need for a long-time study of any biological problem likely to be influenced to any great extent by climatic conditions.

In 1925, from September 18 to November 17, 51 hibernation cages were stocked with 12,425 field collected weevils. Of these, 102 survived the winter. In other words, there was an average survival of 0.82 percent. The first weevil to issue from hibernation appeared in the cage March 2, 1926, and the last appeared June 22. Fifty-four percent of the weevils were out of hibernation April 28, when cotton was first coming up, and 99 percent were out June 7, when the first squares were developed. The general plan of install-

ing the weevils was the same as in 1924, except that an effort was made this year to determine the influence on survival of a varying number of weevils per cage. The total survival in this test was so low, however, that no reliable data were secured on this point.

Cages located in the woods gave an average survival of 0.42 percent, as compared to 1.20 percent for those in the open. Not only was the percentage of survival lower in the woods than in the field, but emergence was completed there before it was in the open, the reverse of what happened in 1925. The last weevil issued from cages located in the woods May 24, and in the field, June 22. Weekly releases of weevils in hibernation cages were made from September 18 to November 5. There was a survival of 0.1 percent from the cage stocked September 18, while no weevils issued from those stocked September 24 and October 1. There was little difference in the percentage of weevils surviving in cages installed from October 7 to November 5. For these cages, the percentage surviving ranged from 0.8 percent for the weevils placed into cages on October 29 to 1.5 percent for those released on November 5.

During 1925-26 the two kinds of shelters giving the best protection in the hibernation cages were pine straw and saw dust, there being a survival of two percent from each.

Weekly counts made in the field throughout the season showed that early weevils were exceedingly scare but that they increased at a steady rate. At practically all times, however, there were considerably fewer weevils in the field than in 1925.

Experiments to determine the longevity of weevils emerging before squares began to form showed that 100 percent of the weevils issuing from hibernation from April 27 to May 28, and placed in cages over cotton in the field were dead by June 7, when cotton began to fruit. That this high rate of mortality was not entirely due to cage conditions is shown by the fact that these same cages were used for life history experiments later on with a very much lower weevil death rate.

During the past season, there were four generations of weevils. Conditions for development during the past summer were less favorable than in 1925. The first generation weevils emerged from July 5 to August 27, and the second from July 25 to September 24, the peak of weevil emergence being reached about August 2.

Studies on the migration of the boll weevil were continued in 1926. Ten screens were placed in cotton fields, one in a pea field, one in a tobacco field, and one on the roof of the Experiment Station building. In all cases where the screen was located in a

cotton field, weevil infestation and plant fruiting counts were made in this field. The first weevil was captured on the screen July 7 and the last to date (Nov. 1), October 20. The period of greatest migration, however, came between August 28 and September 14.

Experiments conducted on cotton boll growth in relation to boll weevil injury have been continued. The results of the work previously done show that certain varieties harden their bolls faster than others.

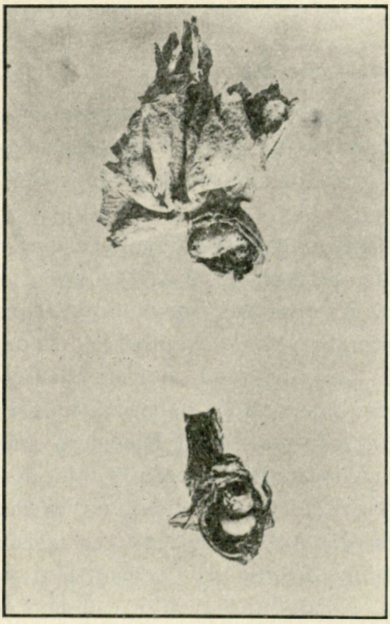


Fig. 2—Upper: Microbracon parasite larva feeding on weevil grub. Lower: Microbracon cocoon in weevil-infested square.

Measurements to determine the thickness of hulls were made by Dr. Armstrong on bolls 24, 34 and 41 days old. When we compare the thickness of hulls on the varieties tested with the average number of eggs deposited, we find that there is a correlation between these two factors.

In order to determine the influence of temperature on weevil development, a multiple constant temperature apparatus was constructed, having thirty-four chambers. One series of weevil eggs has been run through and it was found that weevils could develop at a constant minimum temperature of 48 degrees F. and a maximum temperature of 100 degrees F.

The boll weevil is attacked by several species of insect parasites, six of which have been bred out in the vicinity of Florence. Of these, **Microbracon mellitor** is the commonest and is by far the most important species attacking the boll weevil. It has been under observation for three years but was studied intensively for the first time in 1926. It is a small tan-colored wasp, varying in size from two to four millimeters in length, not including the ovipositor which is about 3 millimeters long in the larger females. This species appears in cotton fields just as soon as weevil-infested squares become plentiful. The female wasp selects only mature or nearly mature weevil grubs in hanging squares to parasitize, and will not attack

a grub in a fallen square. Since the square usually falls shortly after the weevil reaches this stage, the latter is susceptible to the attack of the Microbracon for only a day or two, at the most. This explains the low percentage of parasitism in fallen squares by this species and the much higher percentage in hanging squares. The parasite paralyzes the weevil grub with her sting and then deposits an egg loosely in the square, often on the grub itself. The larva of the parasite hatches from the egg in about 24 hours and soon completely devours the weevil grub. During the summer the adult emerges in about nine days.

Cotton Plant Investigations

Following the lines previously reported, we have continued to study the influence of different factors on the growth and development of cotton squares and bolls and the different cultural practices, spacings, varieties, etc.

Physiological Studies.—The failure of cotton to fruit properly under certain conditions prompted us several years ago to begin a detailed study of the carbohydrate and nitrogen content of cotton plants when grown under different fertility and growth conditions, and the correlation between this and fruitbud formation and development. To further this work a greenhouse and a chemical laboratory have been built and equipped at the station at Florence, and Dr. Armstrong and Dr. Albert are conducting carefully planned tests to determine the effect of different fertility conditions on the fruiting and growth of cotton. Sets of plants were matured in the greenhouse under controlled conditions through the season and in the fields under natural conditions. No definite results can be reported at this time, but the preliminary indications are interesting and encouraging. A thorough-going study of this kind has never before been undertaken with cotton, although somewhat similar investigations have been conducted with tomatoes, apples and other fruits.

Marked differences in the carbohydrate-nitrogen ratio of plants grown under different conditions have already been noted, and these are being studied with reference to their possible effect on square formation and boll development.

Resistance of Bolls to Puncture.—The study of the influence of different factors on the resistance of bolls to needle puncture has been continued along the same lines as reported last year. These studies have been conducted with Humco-Cleveland, Dixie-Triumph and Webber, the same varieties used last year, and the differences

noted in resistance to needle puncture are found to be closely correlated with the resistance to puncture by the weevil. As a rule bolls of all three of these varieties increased in hardness from day to day until they were from three to four weeks old, after which time there is relatively little change in the resistance to puncture. Some preliminary data indicate that the hardness of the bolls is influenced by fertility conditions under which the cotton is growing, low fertility conditions apparently causing the bolls to harden a little earlier. This seems to be especially true for early-season bolls, but in the case of bolls developing from blooms after July 20, those grown under high fertility conditions hardened as rapidly as those produced on poorer soil. Soil moisture, air humidity, and temperature also seem to have direct bearing on hardness and resistance to puncture, and data have been collected along this line. These and other data bearing on this problem have not yet been completely analyzed. In seasons of heavy weevil infestation the injury caused by boll punctures represents a large part of the loss, so it is important that we secure as much information as possible on the factors affecting boll resistance to punctures.

Fruiting Studies.—We have continued to make careful observations and accurate records of the square formation, blooming, and boll development of a large number of plants growing in the fields at Florence, Clemson College, and the Coast Station. This work has followed the same lines as previously reported, and there are no marked differences in the results. On account of the excessively dry weather in the early summer, a complete stand was not obtained in the experimental plats at Clemson College until about June 20. We were therefore able to make direct comparisons of the rapidity of fruiting and boll development on plants that came up early in May and others in the same rows that came up after June 20. These results are very interesting but have not been completely analyzed at the present time. These studies have been continued with the large number of varieties grown at the stations and have also been made on the spacing and distance plots. In this way we are securing a great deal of information on the rapidity with which different varieties put on and develop their fruit under different conditions, and we are getting data on some of the fundamental factors influencing earliness. See figure 3 pages 44 and 45.

Spacing Tests.—Dry weather early in the season interfered seriously with the spacing tests at Clemson College and at the Coast Station, but perfect stands were obtained at Florence. The experiments were conducted along the same lines as reported last

year, except that this year we used three different varieties in the spacing tests at Florence. These were Cleveland, Dixie-Triumph and Carolina Foster. There has been some indication that the varieties of cotton having different growth habits might respond in a different way to close spacing. We therefore selected three varieties which vary somewhat in their habits of growth. The spacings used this year were one stalk per hill every six, nine, twelve, sixteen and twenty-four inches. A fruiting study made throughout the season on these tests shows that the increased earliness due to close spacing is about equal in the three varieties. On June 30 the number of squares per acre of Carolina Foster were as follows for the different spacings: 6-inch, 228,690; 9-inch, 191,584; 12-inch, 148,104; 16-inch, 117,604; 24-inch, 78,952. In the case of Coker-Cleveland No. 5 the number of squares per acre on the same date at the different distances was as follows: 6-inch, 254,826; 9-inch, 242,543; 12-inch, 190,575; 16-inch, 168,240; 24-inch, 102,910. In bolls per acre on July 15 similar earliness in favor of close spacing is noticed. With Carolina Foster six-inch spacings showed 41,389 bolls per acre and a gradual decrease in number of bolls with the increased spacing, so that on the 24-inch spacings there were 11,434 bolls per acre. In the case of Coker-Cleveland No. 5 on the same date the six-inch spacing had 32,676 bolls per acre and the 24-inch spacing, 10,345. By August 11 the Carolina Foster had set on the six-inch spacings 233,046 bolls per acre and the Coker-Cleveland No. 5.

Fig. 4—Rank cotton growth showing ideal conditions for weevil development.

307,098. With the plants 24 inches in the drill the Carolina Foster had set 179,685 bolls and the Coker Cleveland No. 5, 172,062. Just about the same variations were noted throughout with the Dixie-Triumph as with the varieties quoted.

This difference in earliness is also indicated in the yields of seed cotton per acre. In the case of Cleveland the six-inch spacing produced 53.8 percent of the total yield on first picking, while the 16-inch spacing produced only 40.7 percent of the total yield at the first picking. In the case of Dixie-Triumph these percentages were 44 and 34 respectively, and for Carolina Foster they were about the same. The final yields this year did not vary so greatly, the highest yield in practically every case, however, being produced with a six-inch spacing, though there is very little difference in the 6, 9 and 12-inch spacings with either of these varieties. In the case of Dixie-Triumph the six-inch spacing yielded 2,287 pounds and the 24 inch spacing 2,048 pounds. In the case of the Carolina Foster the yield of the six-inch spacing was 2,033 pounds and for the 24-inch spacing was 1,689. The 12-inch spacing yielded 2,039 pounds. With Coker-Cleveland No. 5 the total yield of the six-inch spacing was 2,082, and of the 24-inch spacing 1,755. All of the other spacings up to 16 inches yielded 2,000 or more pounds per acre.

There was, of course, very little weevil damage to any of these plats this year. On this account there were not the marked differ-

Fig. 5—Cotton wilting at midday. Most weevil stages in fallen squares are exposed to sun and killed under this condition.

ences in the yields from the different spacings as are observed during years when the weevil infestation is heavy. We repeated the spacing tests this year using no poison except two pre-square applications. In these tests, since the weevil infestation was exceptionally light, the results were practically the same as in the tests reported above where poison was applied as seemed necessary. These tests were planted with Humco-Cleveland 20, and the six-inch spacing yielded 2,149 pounds of seed cotton per acre, the 24-inch spacing, 1,882 pounds. The 6, 9 and 12-inch spacings yielded almost the same amounts.

We have also continued the spacing tests where we have used 1, 2, 3 and 4 plants per hill every 12, 16 and 24 inches on the row. Carolina Foster and Cleveland varieties were used and the cotton was protected against weevils throughout the season by several applications of calcium arsenate dust. As has been the case in the past, there was an increased earliness from a larger number of plants per hill and in most cases an increased yield. Where the hills were 12 inches apart, one plant to the hill gave 1,538 pounds of seed cotton. There was a gradual increase of yield as the stalks per hill increased, four stalks per hill yielding 1,808 pounds. The same was true with reference to the hills 16 inches apart and in case of Carolina Foster for the tests in which the hills were 24 inches apart. In the test where a Cleveland variety was planted there was a somewhat noted difference in the yields with different numbers of plants per hill where the hills were 12 inches apart. Where the hills were 18 inches apart there was a gradual increase in the yield with increase of number of plants per hill up to three, one plant per hill yielding 1,820 pounds, three plants per hill yielding 2,144 pounds, and four plants per hill yielding 2,076 pounds.

From results of these tests we have no reason for changing our recommendations that cotton should be spaced so as to average about one stalk every six inches in the row when the rows are planted four feet apart. This makes about 21,000 plants per acre. During the past four years this number has produced a higher average yield and an earlier crop.

Time of Planting.—Weather conditions are, of course, the prime consideration in the time for planting cotton. In an effort to determine the best dates for planting during an average season we have made plantings every week from about the middle of March to the middle of May. During 1926 these plantings were made between March 17 and May 12. Owing to low temperature and lack of soil moisture, no stand was obtained from the plantings made

between March 17 and April 10. The first good stand was secured from plantings of April 21 and this produced the highest yield in the planting test. The yields from several of these are as follows: April 21—1,829 pounds of seed cotton per acre; May 5—1,687 pounds; May 12—1,627 pounds. Our results for the past four years indicate that higher yields are obtained on the average from plantings made at Florence between the first and the middle of April when conditions are favorable for germination during this period.

Variety Tests.—During the average season there are rather marked differences in the yields of different varieties of cotton when produced under identical conditions. We have therefore for a number of years conducted tests of fifteen to thirty different varieties at three points in the State—Clemson College, Florence and Summerville. The test at Clemson College this year will have to be thrown out on account of the poor stand and early freezes which resulted in a very uneven production and poor yield. The yields at Summerville were very good, as also were the yields at Florence.

At Florence this year two variety tests were conducted; one, the regular test which was replicated four times from as nearly uniform conditions as could be obtained and was dusted throughout the season as necessary; the other, where only two pre-square applications of poison were used against the weevil. The cotton is late at Florence this year and all of the corrections have not yet been made for a stand there, so that final results are not available now. It is especially interesting to note that we did not get as great difference in yield this year as has usually been observed in the different varieties. From the preliminary data the indications are that the highest yield on the dusted plats was made by a strain of Cleveland which we used as a check and this was closely followed by Humco-Cleveland 20 and Coker-Cleveland 5, the highest yielding variety in this test producing 2,412 pounds of seed cotton per acre, and the lowest yielding strain, which was Humco-Delta 30, yielding 2,042 pounds. In the test where only two applications of poison were used, the yields compared very favorably with yields from cotton that was dusted throughout the season, since there was an exceedingly light weevil infestation at all times. Here, too, there was little difference in many of the varieties in the test, the highest yield of 2,254 pounds being produced by Coker-Delta; the lowest 2,010 pounds by Lightning Express 6. The other varieties in the test ranged between these figures.

Several varieties that have not been grown ordinarily in our

variety tests at Florence were grown this year in what we term an adaptation variety test. In this test Piedmont-Cleveland, Lone Star, Okra Leaf Acala, Miller, and Trice were compared. All these varieties produced excellent yields of 2,100 pounds or more, and there was very little difference in the totals.

The wilt-resistant test this year was conducted on badly infested soil at Mayesville on the farm of Mr. R. J. Mayes. Twelve varieties were included in the test, and while we are not prepared at this time to give the figures on comparative resistance, the yields are somewhat indicative of this. The Dixie-Triumph with a yield of 1,588 pounds per acre produced the highest yield in this test.

As wilt infection spreads throughout the lighter soils of the state, the interest in wilt-resistant varieties is constantly increasing. The county farm agents in the section around Mayesville held meetings in the field where this test was conducted the past season and a great many farmers throughout the area visited the test and showed marked interest in it.

Quality of Cotton.—During the past few years there has been a tendency for many of the cotton manufacturers in South Carolina to use cotton shipped in from certain western states in preference to that produced locally. The seasons of 1924 and 1925 seemed unfavorable for the production of cotton of the best quality, and this has been responsible for the increased tendency in this direction. There has also been a tendency for farmers generally to plant the higher-yielding, shorter-stapled varieties, since the local markets have not discriminated against the varieties producing three-fourths-inch and seven-eighths-inch staple. In other words, these varieties have produced a larger percentage of lint and larger yields than some of the better varieties and have brought just as good prices on the local markets. The mills are now beginning to discriminate much more closely and have a feeling that in order to get the length of staple that they require they have to purchase cotton from certain sections of the central South and Southwest. The majority of the mills of this area claim that they require cotton that will measure thirteen-sixteenths or a full inch.

For several years the Cotton Marketing Division of the Bureau of Agricultural Economics has conducted spinning tests with different varieties of cotton produced in different sections of the South in an effort to determine the comparative value of the cotton from different sections for manufacturing purposes. During the summer of 1925 this station began cooperative work with the office of Cotton Marketing and aided in securing representative samples of

some of our principal varieties for such tests. Spinning tests made by Mr. H. H. Willis at Clemson College for the Bureau of Markets indicates that cotton grown on the Experiment Station farm and at other points in the state in 1925 produced lint of rather high spinning quality in spite of the unfavorable seasonal conditions. The staple in some cases was a little shorter than is normally produced by these varieties, but the spinning quality was good for this length of staple.

Realizing the need for more accurate information as to the factors influencing the quality of cotton, the directors of the Southern experiment stations and the members of the Bureau of Agricultural Economics held a conference in Memphis in May, 1926, and formulated a cooperative project for studies along this line. Under a cooperative agreement which was prepared at that time, practically all of the Southern states are working together on this project. Samples of cotton have been collected from the various test plats in the different areas and these have all been sent to the South Carolina Experiment Station where the Bureau of Agricultural Economics, U. S. Department of Agriculture, is cooperating with us in having them ginned and in making a detailed study of the quality, length, and strength of fiber.

In addition to the cooperative features of this project in which all of the stations are participating, this station is growing on its farm, for use in spinning tests, six of the most popular varieties and is preparing for certain other tests a large number of samples from our fertilizer plats on eight different soil types in the state. We hope in this way to get some evidence as to the value of lint produced by the different varieties of cotton and on the different soil types and under the different soil fertility and seasonal conditions that obtain throughout the state.

FERTILIZER AND ROTATION STUDIES

From the standpoint of economy of production of our common field crops, soil fertility is our biggest problem. South Carolina continues to pay between $25,000,000.00 and $30,000,000.00 per year for commercial fertilizer. Since its establishment this station has been studying the influence of different fertilizer combinations on crop production and has conducted investigations with certain soil-building crops in an effort to develop practices for soil improvement which will produce larger yields at a smaller outlay for commercial fertilizer. This work has centered very largely around

the research at our own stations, but a great deal of very valuable information has been secured through cooperative fertilizer tests.

Sources of Nitrogen.—One of the most important problems of fertilizer research has been a study of the sources of nitrogen best suited for cotton production. Experiments along this line have been conducted from time to time during the past fifteen years. During the summer following the war when efforts were being made to develop a supply of nitrogenous materials in this country for use in mixed fertilizer and for top dressers, a special set of experiments was planned in cooperation with the Bureau of Plant Industry in Washington and these have now reached the stage where we feel justified in publishing the results. Our Bulletin 227 by Dr. J. J. Skinner and Professor T. S. Buie, published in May, 1926, gives these results.

These researches indicate quite clearly that the air-derived nitrogen compounds are very effective in mixed fertilizers, and some of these can be used satisfactorily as top dressers. Some of the air-derived nitrogen compounds compare favorably with nitrate of soda and sulphate of ammonia. An average of all the yields shows that ammonium choloride has produced a slightly smaller average yield and ammonium nitrate a slightly larger average yield, than nitrate of soda and sulphate of ammonia when applied in equivalent amounts.

Other tests were made where nitrate of soda and sulphate of ammonia were used separately and in comparison with certain of the organic ammoniates, such as dried blood, cottonseed meal, fish scrap and tankage. In these tests a mixture of sulphate of ammonia and nitrate of soda produced just about as good results as a mixture of either sulphate of ammonia or nitrate of soda with organic sources. The averages from a large number of tests indicate that when nitrate of soda is given the rating of 100, a mixture of soda and sulphate rates 110; a mixture of one-fourth soda, one-fourth sulphate of ammonia and one-half dried blood rates 112; and one-fourth soda, one-fourth sulphate and one-half fish scrap rates 114. There is so little difference in the comparative value of nitrate of soda and sulphate of ammonia as compared with the usual organic sources that this station has recommended for several years the use of the inorganic sources under the price conditions that have prevailed. This is especially true for side applications and for top dressing.

Since we must economize in every possible way in purchasing fertilizer for cotton, we find that it is a distinct advantage to use the inorganic sources and apply them at the time the crop needs

them rather than to purchase the higher priced organic ammonias to go under the crop. It is, of course, not safe to make large applications of readily soluble ammoniates under the crop but these can be used to advantage where they are applied as the crop uses them. With different combinations of nitrogenous fertilizers used under corn, the highest yield was obtained where two-thirds of the nitrogen was obtained from nitrate of soda and one-third from sulphate of ammonia, although there was very little difference in the yields from these sources when used separately or in combination with each other or with organic sources.

Time of Applying Ammoniates.—We have continued to make applications of readily available ammoniates to cotton at different times during the growing season and the results for this year are in accord with those previously reported, the greatest increase in yield being obtained where fifty pounds of nitrate of soda was supplied at chopping time and fifty pounds when the first squares formed. The second greatest increase occurred where 100 pounds of soda was applied at the time the first squares were beginning to form. Varying amounts of nitrate of soda were also used as top dresser on different plats, as has been the practice in the past, the amounts varying from 100 to 300 pounds per acre, in addition to 750 pounds of a 9-4-3 applied at planting time.

In one of these tests at Florence, 100 pounds of soda was applied to all of the plats at chopping time and the additional application of 50, 100, 150 or 200 pounds was added on July 10. The greatest yield of 2,040 pounds of seed cotton was obtained where 100 pounds was applied at chopping time and 200 pounds on July 10. The weather was extremely dry following the application on July 10 and the cotton crop did not get the maximum benefit from the larger applications.

The experiments with nitrogenous fertilizers conducted at Clemson this year are not yet completed because of the very late season.

Cooperative Fertilizer Tests.—Much of our most interesting information as to the comparative value of different fertilizer elements upon different soil types in the state comes from our cooperative experiments with farmers in nine counties in the state. Some of these tests have now been under way for six years and the fertilizer and rotation results are interesting and valuable. In practically all of these tests we are using the three-year rotation in which cotton, small grain, cowpeas and corn are used in the order named. In four of these tests that have been running for five and

six years the rotation is already proving of considerable value. The average yield of cotton for the first rotation plat at these four places—Bishopville, Trenton, Gaffney, State Park—was 543 pounds of seed cotton per acre. The average for the second period in the rotation at these same places was 673 pounds. On certain of these farms one-half of every plot has been limed. An average of four years' results shows that the limed portions have produced at the rate of 816 pounds of seed cotton per acre and the unlimed portions at the rate of 654 pounds of seed cotton per acre. This increase in yield is attributed to the lime increasing the amount of legume growth that is turned under each year.

Cover Crop Tests

On the Experiment Station farm at Clemson College, our experiments with cover crops on land that is grown in cotton are beginning to yield results. In these experiments we are comparing the value of an annual application of six tons of stable manure with a cover crop of rye and vetch planted in the cotton middles each fall and turned under in the early spring. Our results indicate that land can be improved rapidly and planted to cotton each year provided a good cover crop of rye or vetch is produced every winter and turned under. Where rotation is practised and a legume is planted following the small grain, the land, is, of course, improved more rapidly.

Recommendations.—Based upon the results from all of our fertilizer experiments the recommendations for cotton fertilizing for the main soil regions of South Carolina are as follows: For the Coastal Plain, 600 to 800 pounds per acre of fertilizer containing 9 to 12 percent of acid phosphate, 3 to 5 percent of ammonia, and 3 to 4 percent of potash, with 150 pounds of nitrate of soda or 110 pounds of sulphate of ammonia per acre as a side application. For the Piedmont Section, 600 to 800 pounds of fertilizer analyzing 10 to 12 percent of phosphoric acid, 3 to 5 percent of ammonia, and 2 to 3 percent of potash, with the same top dressing as indicated for the Coastal Plain soils.

Our experiments indicate that where sufficient phosphorus and potash are applied to cotton to give the maximum earliness in production, satisfactory yields of corn can be made with applications of 200 to 300 pounds of nitrate of soda or sulphate of ammonia. We have also secured satisfactory yields of small grain in our three-year rotation plats without the application of phosphorus or potash especially when nitrogen is applied to meet the needs of these crops.

RESEARCH WORK IN AGRICULTURAL ECONOMICS

The object of research work in agricultural economics is to provide a foundation for economic production and marketing of farm products. These researches include investigation of general economic problems such as farm organization, cost of production, price movements, tenancy, marketing, taxation, and credit. In determining the most profitable methods of agricultural production and the most scientific system of marketing it is absolutely essential that facts be used as a basis. In this kind of research the farms and farmers themselves, the markets and the marketing agencies furnish the facts and the research workers secure the information from these original sources, work up the results in accordance with approved methods, and make the conclusions available for all of the people.

Realizing the real need of beginning studies along these lines, some research in agricultural economics was begun by the South Carolina Agricultural Experiment Station in 1923. Since then the investigations have been gradually expanded. The early studies were principally in the field of farm management and led towards tentative conclusions regarding economic farm organization and economic efficiency in farming in Anderson, a representative Piedmont county. The later investigations include studies in consumption, demand, and marketing, and such special studies as the place of livestock in the Coastal Plain, a survey of peach production, cotton marketing, and such general studies as land prices and cycles, problems of taxation, and the attitude of farmers toward cooperative business.

A summary of the progress made during this year in each of these projects is given below.

Land Prices and Cycles

This work continues to be done in cooperation with the Division of Land Economics of the Federal Bureau of Agricultural Economics. It is planned to prepare the manuscript covering the Anderson study soon and then possibly to extend the investigation to other parts of South Carolina, the ultimate aim, as stated in our cooperative project agreement with the Bureau, being to study thoroughly the economic utilization of land in the state. The final analysis of this material, to be made in bulletin form, will bring out important principles in connection with land utilization and land ownership during normal as well as abnormal periods.

During the past fiscal year many individual farms were traced,

using specially designed cards, for the period 1910-1925, as to indebtedness, prices paid in each exchange, and character of deeds and mortgages. This supplements the tabulation of selling prices for a period of about seventy-five years which was previously made.

Normal conditions are represented by 1910-1914, a pre-war period, when the number of sales of farms and the prices of land were representative of usual conditions in Anderson County. The boom or war period, 1915-1920, was found to be one of rapid transfers of a given piece of property and temporarily over- capitalized land values. This is the period when an economic catastrophe was started, so far as bankers and farmers are concerned. Our study included the post-war period, 1920-1925, when liquidation was made and reconstruction began, a period in which inevitable economic laws worked out rewards for those who had exercised good judgment, as well as disaster for those who had shown bad judgment, during the boom years preceding.

Problems in Taxation

Problems of taxation are confronting all of our people, and the question of taxes on farm property has been especially acute in recent years. This condition is accentuated by the fact that increases in taxes were made after the World War was over and the farm depression had begun, tax index numbers being thrown out of line with the trends of other index numbers in that way. Tax studies have recently been begun in several states.

Dr. W. H. Mills devoted all of his time during the first half of the fiscal year 1925-1926 to a study of the tax situation in South Carolina and Experiment Station Bulletin 231, "The Taxation System of South Carolina," has been published, based on the studies made.

This bulletin gives a digest of the laws relating to taxation in the state. The different constitutional provisions are shown and discussed. An analysis of the general property tax as regards its source and county assessments is made, and certain inequalities pointed out. Other taxes, such as income, inheritance, gross sales, and license, are also discussed and their functionings explained. The following recommendations are made. Reduction in expenditures may be made; local levies should be made with reservation of right of appeal, to some state body; administration may be improved by getting on a cash basis, as should be possible by means of the income, inheritance and license taxes now in force; bonds for state, county, municipal and school district purposes may be

paid serially rather than as a total principal sum; a just and equitable system of taxation in the state should be set up; women as well as men should pay a poll tax; the present income tax law should be repealed and modelled after income tax laws in other states; restriction upon the taxing power of the General Assembly should be removed; and a careful survey, revaluation and reassessment of property needs to be made.

The Comparative Advantages of Various Forms of Intermediate and Long-time Credit

Providing adequate credit for farmers is one of the large economic problems. It is desirable that credit facilities be adequate for all reasonable needs, that money be easily available on sound security and that it be equally obtainable to farmers engaged in different kinds of production.

The object of this study is to determine the kind of credit relied upon by farmers for long time and intermediate needs and to show their relative efficiencies; also to study the credit situation in general, through bankers as well as farmers. The investigation will extend over several years and will include an analysis and comparison of credit institutions. The interpretations must be made with the aid of our farm management records and in the light of the farm management interpretations, in this way also centering in well-defined type-of-farming areas of the state such as the Upper Piedmont, Central, and Coastal Plain regions.

Continuous Farm Management Study of Anderson Area

Our investigation in the Anderson area began with 1922 and includes that year as well as 1923, 1924 and 1925. A study of 114 farms in 1914 made by A. G. Smith of the Office of Farm Management, United States Department of Agriculture, has also been available to us. Five years of results are therefore used, with a large number of records for each year. The bulletin giving the analysis of the five years of results is being published as Experiment Station Bulletin 230 and is called "Farming for Profits".

In this bulletin the principal tools employed in arriving at conclusions are better-average-poorer farm comparisons, historical trend analysis, enterprise analysis, and multiple correlation. It is attempted to develop a body of principles rather than a mass of detail, which will apply to the area for some time. The more detailed facts are given in Experiment Station Bulletin 221, which was published in 1924.

The interpretations are made in the light of life-time conditions rather than those of momentary situations. The results apply in a general way to such Upper Piedmont counties as Anderson, Greenville, Spartanburg, Oconee, Pickens and Laurens.

In the recommendations and interpretations, an economic zoning of the land in Anderson County is given, showing roughly the place of cotton farming, dairying, truck farming, poultry farming and forestation. Most of the farmers in the area depend on regular cotton farming for a living. A detailed farm organization is laid out showing, in the light of our studies, the most economic yields and the best production practices to employ under farm conditions. It seems practically impossible for the usual one-horse farmer to make a really good living. Likewise, it has been shown that certain kinds of farm organization in the area are unprofitable.

The multiple correlation analysis based on 1924 and 1925 data has borne out our other kinds of evidence in showing that acreage of cotton per farm during these years was more important than acreage of all other crops combined in determining success. Earnings in 1924 increased markedly up to 200 or more acres of cotton per farm. Beyond this point, earnings responded less to increases in the cotton acreage per farm. This shows the extensive margin of cultivation, or the approximate point of diminishing returns. The same economic laws apply to the intensive margin, that is applying more and more fertilizer or labor, say, to a given piece of land. A point of diminishing returns is reached, and this is shown in the bulletin, for a range of prices of both cotton and fertilizer.

Obviously, when cotton prices are high, it pays to increase the acreage and also the yield by relatively high applications of fertilizer and labor. On the other hand, when cotton prices are about to decline or have declined is no time to increase acreage or try for unusually large yields; it pays, then, to retract to the better cotton lands which will produce satisfactory yields without excessive use of fertilizer, and permit economic use of labor and other cost goods. Many farmers, unconsciously, recognize these truths.

The 1914 records throw light on the economic problems of the area for a period when prices were low, cotton averaging about eleven cents a pound in price. The best farm organization, however, seemed to be about the same then as in recent years.

Special types of farms, such as dairy, truck and poultry are discussed in Bulletin 230, based on Greenville County results obtained in connection with the Greenville trade area study. It is recognized that there is a place for these enterprises along with

cotton in the Anderson area; especially dairy and poultry production are developing with the increase in population.

Farm maintenance, as a safety factor, is stressed for all farms. The Bulletin discusses maintenance under the three headings of family, stock and soil, and outlines methods and requirements for each. This is important in connection with successful farming when a long period of time is considered, and it goes hand in hand with land ownership.

Special Farm Management Study of Lexington Area

A farm business analysis and enterprise study of about 140 farms in Lexington and adjoining counties, made by B .A. Russell, gives a picture of economic conditions for that area and also serves partly as a foundation for the marketing analysis of the Columbia trade area recently begun. The Lexington material has been published as Experiment Station Bulletin 233, "A Study of Economic Conditions in the Lexington-Batesburg Section of South Carolina." In the field, the county farm agent and agricultural teachers did a considerable part of the actual work. The station worked up the results, in this way carrying out the general plan for cooperation with local bodies in such research. A brief summary of the findings is given below.

The physical organization shows that the distribution of total acres on the average farm is as follows; 73 acres in crops; 71 acres in woods, 20 acres in pasture; 9 acres in tillable land lying out; and 12 acres in wasteland. Of the 73 acres in crops, cotton occupied 27.4 acres; corn, 25.1; oats, 11.3; wheat, 3.4; rye, one acre. The miscellaneous patches, garden and truck combined amounted to 4.8 acres.

The financial organization shows that the total average investment per farm was $13,708. The distribution is as follows: $7,450 in land; $3,426 in buildings; $1,237 as cash to run the farm; $663 in livestock; $558 in feeds and supplies; and $344 in machinery and equipment.

The cash crops in the area are cotton, asparagus and peaches. The supply crops are corn, wheat, oats, and cowpeas. The miscellaneous crops are rye, sweet potatoes, velvet beans, soybeans, sugar cane, watermelons, garden and truck. Specialized livestock farming is found occasionally; while every farm has workstock, a family cow, several killing hogs, and a flock of chickens.

The main sources of receipts were cotton, corn and asparagus. The receipts from peaches were significant on some farms. The

main kinds of expenses were labor, fertilizer, taxes and insurance, feeds, ginning, livestock inventory decrease, and feed inventory decrease.

Summing up the farm business, the farm income averaged $915; labor income, $230; return to capital, 4.9 percent; and operator's earnings, $1,221. The factors affecting incomes are type of farming, size of business, quality of business, marketing practices, fertilizer use, and labor distribution.

Special Farm Management Study of Seneca Community

A similar investigation to the one at Lexington, but on a smaller scale, was made in the Seneca community, T. L. Ayers, the local agricultural teacher, securing the field records with the help of one of the Clemson summer school students. Some of the findings are given below, as applied to the better farmers in the community.

The operators possess about $12,000.00 capital, own about 100 acres of land, 60 acres of which are planted to crops. They plant approximately 30 acres to cotton, 22 acres to corn, oats and other grain crops, producing about 300 pounds of cotton, 17 bushels of corn and 23 bushels of oats per acre. They grow about 20 acres of crops to each man equivalent and 19 acres to each work animal, and obtain 170 work units per man and 90 work units per mule annually. They have invested 56 percent of their capital in land, 31 percent in buildings, 3 percent in work stock, and 1 percent in productive livestock. They produce an average of nearly $500.00 worth of food and other products for family use annually.

Record-Book Route Study

This project continues to be pursued with B. A. Russell in charge and includes about twenty farms in each of two areas. A regular farm business record book, with supplementary labor record, is employed as a means of getting accurate records of the farmer's business and activities for every day in the year. It is planned to summarize and tabulate these records carefully in order to determine elements of strength and weakness in the farm organization. The findings will furnish very valuable material for publication when a few years of results are obtained.

The Peach Enterprise in South Carolina

The material on cost of production and market comparisons obtained during the last two years in cooperation with the Federal Bureau of Agricultural Economics is being prepared for publication in bulletin form. This is part of a regional study covering the

peach industry of the United States, the principal objectives of which are to determine the relative efficiency of production of peaches in different states or regions and to find out the sizes of the different markets for peaches, also the relative economy with which the commodity may be carried from producer to consumer. Such knowledge forms the basis for suggesting expansion in certain areas and slowing-up of plantings in other areas.

Fig. 6—Peaches, a profitable enterprise in the Sand Hills.

The Place of Livestock in the Coastal Plain Region

The Coastal Plain region of our state was seriously damaged by the boll weevil, which first appeared in 1918. For a few years farming was badly disorganized. In the last two or three years cotton came back strong as a result of stimulating prices. However, frequent inquiries of a farm organization nature come in from people in this region and it is generally felt that if livestock can be introduced on a profitable basis and in a supplementary way, it would raise earnings and be a good thing. There is also a local demand for dairy products, beef, pork and poultry. These enterprises are now assuming some importance around Coastal Plain cities such as Charleston, Florence, Sumter and Orangeburg.

This study was begun during the last two months of the fiscal year and is conducted in cooperation with the Federal Bureau of Agricultural Economics. It is part of a regional study which includes South Carolina, Georgia, Alabama and Mississippi.

The purpose of the investigation is to develop principles for organizing the businesses of individual farms in the region on a

permanently more profitable basis; to find out the economc place of the different kinds of livestock in the farm organization in each of the farming areas in the region; and to determine the most profitable method of handling each class of livestock in these farm organizations.

Approximately 130 field records have been obtained and tabulated. An analysis of in-and-out shipments of livestock and livestock products has been made for two representative Coastal Plain cities. The Bureau plans to publish as soon as possible a regional report summing up the work of all cooperating states.

Production, Supply and Demand Study of Greenville Trade Area

The survey of the Greenville trade area, started in 1925 in cooperation with the Greenville Chamber of Commerce, is about ready for publication as "A Production, Supply and Demand Study of the Greenville, South Carolina, Farm Trade Area."

The bulletin will give a description of the area as to farm organization based on Anderson results. It will give commodity analyses under headings of cotton, truck crops, fruit crops, feed crops, meats, poultry and dairying. Very little livestock is supplied to Greenville from local farms, but livestock products such as milk and butter seem to be largely locally supplied. More than half the eggs consumed are shipped in. The area ships in enormous quantities of feeds, also large amounts of vegetables of many kinds.

Most of the farms in the area consider cotton as the principal money enterprise. These farms may improve their organization by growing more feeds and foods for farm and home use. They could also supply feeds profitably to local dairy farmers near town who persist in buying practically all their feeds. A special study of alfalfa requirements and costs was made on 23 farms. Alfalfa is a very promising feed crop and is produced at a very small cash outlay. It is somewhat particular as to land, but does well on thoroughly prepared red Cecil soils.

Dairying was given special consideration because it is developing with the growing population. A number of dairymen near Greenville retail whole milk, buy nearly all their feeds, and usually have very little farm land.

Another group, further out from the city, largely wholesales whole milk. Still further out is found a large number of farms with only a few cows and selling butter. The study indicates that the raising of feeds is important if success is to be realized. Incomes respond markedly to increases in size of herd. Other factors

making for success in dairying are high production per cow, economical equipment, good pastures, cheaply produced feed, dependable labor and efficiency in delivery. Some of the farmers combine dairying and poultry and cotton as leading cash enterprises.

The poultry business was given special study, an analysis of twenty commercial flocks being made. It seems impossible to get any reliable figures on ordinary farm flocks. It is recognized that practically every farm does well to have its flock of fifty to a hundred chickens to supply home needs. These farmers make about as much on poultry as the other farmers make on dairying, cotton or other enterprises. They are practically all producing for a premium market and use the best methods so far as production is concerned, but not as regards economy, in all cases. The observations show that financial success with poultry depends on careful feeding and use of home-grown feeds and good pasture as much as possible; also on economical equipment and buildings, careful watch for and control over disease, clean quarters, rigid culling, economic size of flock, and efficient marketing both of eggs and by-products.

There is some opportunity for farmers in this area who are near town to supply the local market with certain vegetables now shipped in in large quantities. The older truck farmers claim that hard work, good seed, good soil, accurate fertilization, earliness of crop, and painstaking efforts in marketing are the requirements for success in this business. Farmers intending to raise some truck would profit by studying the methods of these older truckers as well as the discussions to be included in the bulletin.

Cotton Marketing Study

Much western cotton is being brought in by the mills of South Carolina for manufacturing purposes, and the trend in this direction seems to be increasing. There is considerable difference of opinion as to grade, quality, and length of staple of cotton produced in the different communities of the state. On some local markets cotton is apparently not bringing market price, because the buyers and consumers claim that the cotton is of inferior grade and quality. The mills seem to be discriminating against cotton grown locally. Spinning tests conducted by the Federal Bureau of Agricultural Economics in cooperation with the station indicate that this discrimination is not fully justified.

In order to get at the true relationships in this large and important question, research was begun by the Bureau and the station cooperatively in September, 1925; and, later, a study was laid out

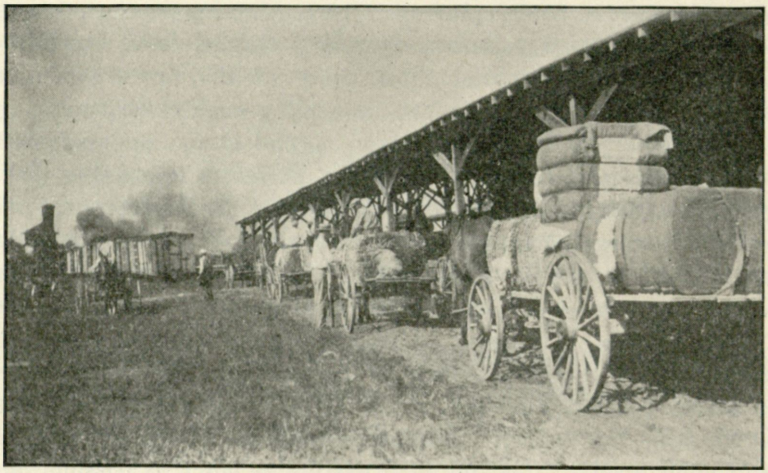


Fig. 7—Field man obtaining cotton samples at Sumter.

which amounts to a four- or five-year investigation. The object is to determine the actual grade, quality and length of staple being produced in the several areas of the state, determine how closely the local markets discriminate between cotton of different grades and qualities and how closely the prices of the central markets are reflected in local markets. The demand of South Carolina mills and the broader markets will be studied. The larger aim is to find out finally how to produce for definite needs, with prices in accord with quality so far as justified.

Weather conditions in the Piedmont region in 1925 were unfavorable, and practically no results were obtained except for the Orangeburg, Barnwell and McCormick markets. Samples were collected; and price, seed, variety, gin, and farm organization data were obtained in connection with each sample. The samples were later graded by the United States Board of Cotton Examiners. Considerable information was obtained from the South Carolina Cotton Growers' Cooperative Association. The results show in a tentative way the accomplishments of the first year of work.

Considerable discrepancy was noted between buyers' grades and government grades for identical cotton, also between local market prices and prices in central markets such as Augusta and Atlanta, Georgia, on the same days. In the local markets there was more cotton graded below middling than middling and above grades combined. Study of gin and seed conditions in the area in a preliminary way shows that farmers are not all using the best seed, nor are proper precautions taken to keep pure seed pure at the gin.

The project is being pursued along similar lines for the year 1926. The questionnaire card has been revised and improved; larger samples (six-ounce) will be obtained. A field man will gather the samples and data in four local markets—Spartanburg, Greenwood, Orangeburg and Sumter.

Measures of Purchasing Power of Farmers

For some time it has been realized that we have no accurate index of purchasing power of farmers in our state. This project is an attempt to obtain the necessary information on which to base a purchasing power index which is representative of local conditions. Practically no field work is necessary, secondary sources furnishing most of the material.

One phase of the study has been completed and is contained in Experiment Station Bulletin 226, "Price Economics of What Farmers Sell." The Division of Education of Clemson College assisted financially and otherwise in preparing the material in this bulletin.

It gives long-time and short-time price, index number, and purchasing power tables for the United States and South Carolina for farm commodities which are of any importance. The bulletin is intended to serve largely as a compendium on farm price data and can be kept to date by copying in current data as published monthly in Agricultural Education, a monthly serial printed at Clemson College. An example of how to use and apply farm price data to profitable farm organization is given in the first part of the bulletin, using the Irish potato cycle.

It is believed that studies of this kind point the way to safer farming by the plan of doing the opposite from rather than exactly the same as other people do. The fact that most farmers go heavily into a certain enterprise simultaneously and just at the wrong time is one principal cause of the disagreeable price cycles which are so common with every farm product but more pronounced with some than with others. As soon as facilities permit, it is planned to extend the research of this project to its other two branches—Price Economics of What Farmers Buy, and Price Economics of Business Indicators.

INSECT PESTS

During the year much progress has been made in replacing equipment and facilities which were lost by fire in April, 1925, and at same time all active projects of work have been continued.

Minor studies have been made aside from the officially approved projects.

Certain of our standard insect pests were less destructive during 1926 than usual (or than last year) while others were more destructive,—indicated as follows:

Less Destructive	More Destructive
Cotton boll weevil.	Cotton flea-hopper.
Caterpillars of soybeans.	Corn ear-worm (various crops).
Red spider on cotton.	Cotton leaf-worm.
Mexican bean-beetle.	Codling moth of apples.
Curculio, of peaches and plums.	Chinch bugs, on corn.

Other standard insect pests have apparently maintained about their average rate of damage in the state.

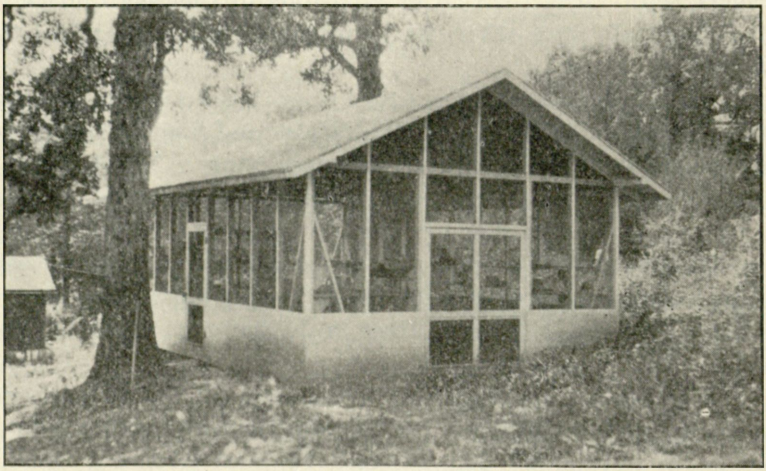


Fig. 8—Insectory at Clemson College.

Studies of Cotton Insects

Whatever affects the cotton crop is of concern to our people, and this interest has increased since the boll weevil spread through the state. We have given some attention to the insects which have affected this crop during the year.

Boll Weevil.—Four thousand weevils were placed in hibernation cages at Clemson College in November, 1925. Only 11 emerged during the spring of 1926, only 0.27 percent, or only 1 weevil from each 372 which were placed in the cage in the autumn. This low winter survival, combined with the early-season drought, undoubt-

edly accounts for the slight weevil damage in this section this year; and these observations gave us confidence in allaying the anxiety of farmers. A few puctured squares were to be found late in the season, but not enough to be serious. The weevils were more abundant eastward, where the studies conducted by the Pee Dee Station are more applicable than the studies at Clemson College.

Fig. 9—Cotton plant which shows results of cotton flea-hopper damage (tall plant in foreground).

Cotton Flea-hopper.—The first serious damage to cotton in this state by this native insect was in 1924 when its damage was worst in the Coastal Section. During 1925 there was no severe damage by it. In 1926 it did considerable damage, chiefly in the Piedmont. Data on the distribution of the damage were collected by Mr. D. M. McEachern of the U. S. Bureau of Entomology, as well as by our own workers.

The best known wild plants upon which this insect is known habitually to develop are a species of croton and two species of evening primrose; but there is reason to believe that it can subsist on other wild plants than these, and upon other crops than cotton. Late in season adults were found on rag-weed, **Polygonum,** aster, golden-rod and potato (white), but young insects were not observed to develop on these plants. When cotton and croton plants were put into the same cage with the insects, the croton seemed to be preferred. The insects kill the very young squares of cotton, and in our cages they sometimes killed the terminal buds of the young plants also.

As yet, dusting with superfine dusting sulphur (not mixed with other substance) is the best known remedy.

Work on the cotton flea-hopper is now one of our approved projects.

Leaf-hopper.—A species of leaf-hopper which is common on beans, apples, potatoes, soybeans, cowpeas, and other plants was abundant on cotton early in the season, becoming less abundant

after midsummer. Its attacks caused a retarding of growth and sometimes a curling and partial wilting of the leaves.

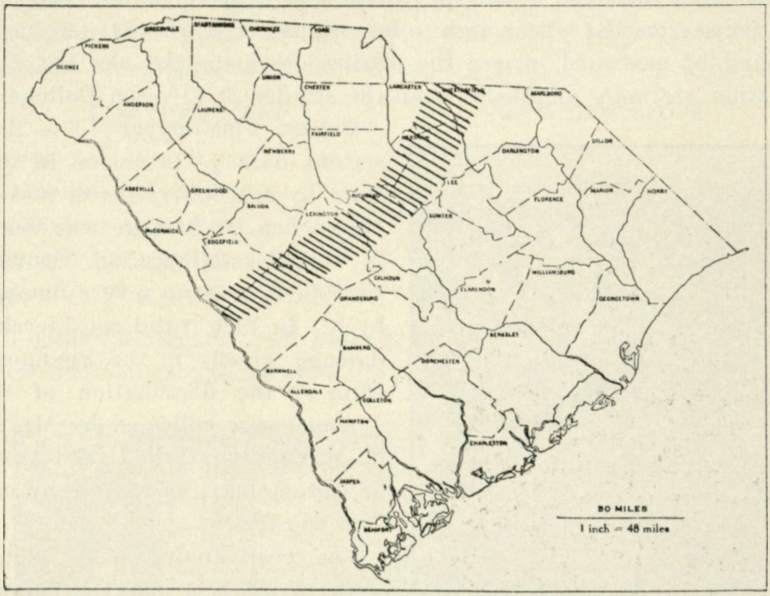


Fig. 10—Cotton in area west of shaded portion severely injured by cotton flea-hopper in 1926.

Boll Worm.—For several years this common pest of corn, tomatoes and cotton has been giving trouble on soybeans, alfalfa and snapbeans. We are suspicious that this insect is extending its list of favorite food plants and increasing the intensity of its attacks in general average. Not infrequently it assumes the typical habit of its relatives the army worms in migrating to new fields when its food supply is depleted, and this season it was observed to migrate from freshly-cut alfalfa stubble into cotton fields. Poisoning was used with some success, and many were killed by dragging a log in a furrow run between the infested field and the one to be protected. The migration movement usually covered one to three days.

Other cotton insects which have been observed throughout the season are the cotton leaf aphis, thrips, grasshoppers, cotton leaf worms, cotton square borers, and red spiders. While some of these have been somewhat more active than is ordinarily the case, none of them has caused serious harm in cotton fields this season except the cotton leaf worm. This insect is a migratory species and is not

known to pass the winter in the United States. It was observed by the Bureau of Entomology on the lower gulf coast in midsummer and by the end of August had migrated to this territory. On account of the cotton crop being unusually late this year, the caterpillars caused considerable damage in many fields in the Piedmont Section. The station sent out warnings as soon as the pest appeared, however, and where the cotton was poisoned in the usual way, little damage resulted.

Corn Bill-bug (Sphenophorus maidis, Chitt.)

Studies of this difficult pest have been conducted in Lee County, where its ravages have been severe. Much attention has been given both to the field activities of the insect and to its life history to see if some vulnerable point may be discovered for the application of control measures. This study has been one of our chief projects of work.

The first active out-door bill-bug for the season was found crawling about in the field on April 22, when the earliest plantings of corn were only an inch or so above the ground, and on May 7 eleven were found. In this same planting one week later (May 14) in a row of 350 plants, 295 plants were dead and 204 bill-bugs were found. About the middle of July there was a slight decrease in their numbers and by the latter part of August few were to be found, the last one being found feeding on a grass stem on August 30. The first eggs had been found in the field on May 25, mating having been first observed on May 13.

When counts are made in fields one side of which adjoins where corn was grown the year before and the other side removed from where corn was grown before, it is then found that the side next to where corn was previously grown is heavily infested, while the other side (not near where corn grew the year before) is much less infested. This finding strongly suggests a rotation of the crop as one means of lessening the damage.

Many cage studies were made. Cages were stocked with one male and one female bill-bug. In the cages the first eggs were found on June 1, and the last were laid on September 11. The largest number laid by one female was 189, and the general average was 43 eggs. The largest number laid by one female in twenty-four hours was 9 eggs. Eggs hatched in slightly less than six days on an average. In one cage the pair of beetles, evidently having lived through the winter of 1925-26, outlived all others, the male dying September 30, and the female October 4, 1926. It is pre-

sumed that both the beetles in this cage lived nearly a year in the adult stage of life, which attests to the hardiness and tenacity of life of this destructive pest. The average duration of the grub stage of life was about 48 days, and the average duration of the pupal stage about nine days; which with six days for the egg, gives an average of 63 1-2 days from egg to adult, the minimum time observed for this being 47 and the maximum 90 days.

A number of tests of insecticides were made, including dusting the base of plants with calcium arsenate and with fluosilicate both pure and mixed with equal quantity of lime. In cage tests the fluosilicate mixed with equal quantity of lime gave slightly the best results. In field plots treated with the fluosilicate lime mixture 19 percent of the plants were killed by bill-bugs, while with no treatment 26 percent were killed by bill-bugs, thus showing a slight protection from the treatment.

The land for certain plots was plowed in preparation on April 1, and was kept free of growth but not planted until about June 15, a late date to be sure; yet these plots showed only 15 percent infestation when plots of the same plowing which had been planted earlier showed as high as 62 percent infestation. This indicates that late planting may be one possible means of partial escape from bill-bug damage, and this appears to be in line with the observation that the insects became less abundant by mid-July.

It has been realized from the beginning of this project that the corn bill-bug presents a difficult problem, especially in view of the hardiness of the insects and the imperative necessity for inexpensive remedies. From the facts here recounted it would appear that at present the best possibilities lie (1) in practicing such rotation that corn shall not follow corn and shall be removed if possible from where corn was grown the previous year, and (2) in late planting. It has been noticed that the particular bill-bug here concerned seems to be as destructive on the more elevated lands as on the lower lands.

Apparently another species of bill-bug, closely related yet not the same, is present at Clemson College, especially in our bottom lands; but does not usually do serious damage.

Insecticide Studies

Many tests have been made of combinations of dusts in the effort to find insecticide combinations which shall be effective and cheaper than those now usually employed. The need for such research is indicated by the increasing need for applying insect

remedies to such crops as cotton, soybeans, and others grown in large acreage.

These studies involve an understanding of chemical processes and have consequently been made with the helpful cooperation of Professor J. H. Mitchell, who has made the necessary analyses.

In a series of tests four different poisons and five different "carriers" were used each in varying proportions, putting the ingredients through such processes that the actual amount of poison used is very small and carried on the outside of the particles of the "carrier". Liquid preparations have been made from the dusts so prepared. The results have been better from the dust combinations than from the liquids.

Details from some of these tests have been published in the Journal of Economic Entomology, and much data are on record which can be utilized when the findings reach the point for general publication.

Many insecticidal substances have been tested in the prosecution of this project, including poisons, contact substances, and gases,—and it is hoped that findings of value will be developed.

Mexican Bean Beetle

During 1926 this insect was less destructive than usual. It was nearly a month late in starting, and many were killed by the heat wave in July; yet it is by far the worst insect enemy of beans in

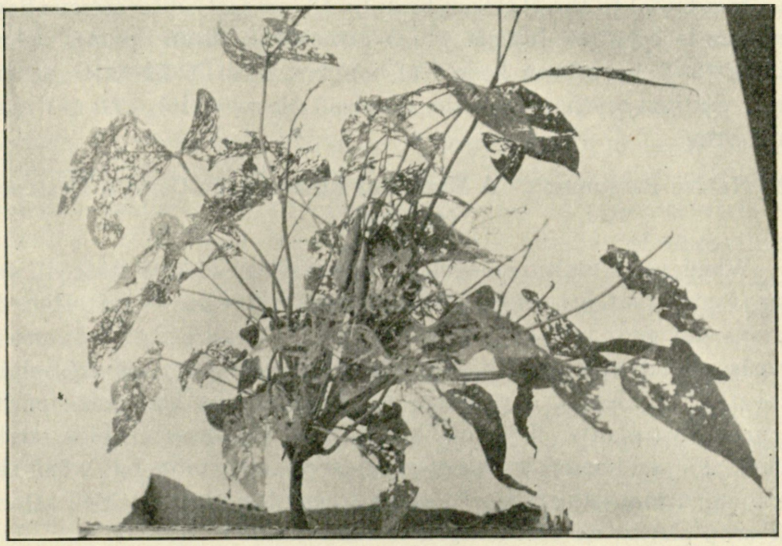


Fig. 11—Bunch lima bean injured by Mexican bean beetle.

the Piedmont Section of the state. Observations indicate that its seriousness will vary from year to year like many other pests, largely dependent upon weather conditions.

For three years careful records have been made concerning the life-history, habits, and general activities of this pest. Some of this material has been reviewed in previous reports and a large amount is yet on hand awaiting publication. The studies of the Mexican bean-beetle constitute one of our regular projects of work.

At close of 1924 the bean beetle had spread as far to the eastward as it has yet been found. It held to the same line during 1925, but during 1926 it lost considerable ground in Aiken, Edgefield, McCormick, Lexington, Saluda, and Newberry Counties.

That this insect may be controlled largely by hot dry weather was made quite evident by the studies of the year. During July the temperature went above 100 degrees for several days, and all stages of the insect were killed in large areas. During the autumn, however, there was a long period favorable to the insect, so it has probably recuperated to some extent in some of the area which it now occupies. Its abundance in the spring of 1927 will yet be determined largely by the weather of the coming winter.

As it is hoped to issue a publication on the studies made on this project, further details are omitted at this time.

Other Bean Insects

Incidental to the Mexican bean beetle project, observations have been made on other insects which attack the bean plant. Chief among these have been bean leaf-hoppers, bean leaf-beetle (an entirely distinct species from the Mexican been-beetle), and the corn ear-worm.

The Native Persimmon. A Host and Resevoir for Certain Destructive Insects

When pecan culture began to be practiced in this state, it was soon found that an insect known as twig girdler would often do serious damage; and investigations soon revealed that this insect breeds abundantly not only in our native hickory (as we might expect), but also in our native persimmon, this being one of its favorite host plants. Previous to that time the insects which might attack the persimmon were not considered important, but when the persimmon plays the role of a nurse plant for insects which attack our crop plants, we feel obliged to take notice of it.

At about the same time, and gradually since, there has develop-

ed some interest in the Japanese persimmon both as an ornamental plant and for its fruit, and it was also found that an insect known as the persimmon psylla does considerable damage to the young foliage of both plants, particularly the younger trees. Both the twig girdler and the psylla have been studied by our workers to some extent, more especially the psylla.

It is also known that several wood-boring insects (both "flat-heads" and "round-heads") attack our native persimmon, and doubtless some of them also attack other trees which are of more value than the persimmon itself.

Corn Weevil (Calendra Oryzae L.)

While we have added much new information concerning this insect during the year, it is listed as one of our subjects of study, and data has been gathered on the extent of its injury to stored corn. It is to be hoped that at the new station at Pontiac a bin of metal construction will be erected which will be suitable for fumigation tests.

Miscellaneous Studies

Tomato Fruit Worm.—This is the same insect as the corn ear-worm and cotton boll worm, which has already been mentioned as attacking also alfalfa, soybeans and others. It has long been known as a pest of tomatoes, the worms eating into the developing fruits at any age from the time they are formed until they are ripe. Some minor studies were made of it this year. The first eggs were found on the tomato plants under observation on June 9, when by careful search of about 20 entire plants 57 eggs were found, 53 of which had been deposited on the lower surfaces of the leaves. Of these 57 eggs, 31 were dark-colored as if nearly ready to hatch or possibly parasitized; the other 26 eggs were lighter in color as if fresh-laid and healthy; the two lots were placed in separate vials for hatching. Both vials developed a goodly number of exceedingly small parasitic insects from the eggs which should normally have hatched fruit-worms, not more than two or three worms being observed to have hatched. By July 19 it was evident that all emergence from the eggs was completed, hence two days later (calculating that by this time egg-parasitism in the field should be at its height) a close examination was given of about the same number of plants as before, with result that only 6 eggs were found on the foliage on July 21 as compared with 57 eggs on June 9.

This indicated that something (presumably the egg-parasites) had greatly lessened the laying of eggs on the tomatoes.

Four rows of tomatoes, not staked, with a total of 127 plants, were under observation until the middle of September, by which time the bulk of their fruits had been picked. Three of these rows had each a different treatment with poisons and the fourth was left untreated. Records were kept of the number of fruits picked from each row and the number showing worm injury. The percentage of fruits injured by the worms was far less than we anticipated when we found eggs so abundant on June 9, but this was not so surprising after we noted the scarcity of eggs on July 21.

While the on-coming of other food such as ears of corn and squares or bolls of cotton may have enticed some of the parent moths away from the tomatoes, yet we are forced to believe that the egg parasites mentioned were a powerful protective factor.

Insect Survey.—As noted in the report one year ago, it is felt that a comprehensive study of the insect life of the state will throw much light on many problems and will point the way and furnish a starting point for more elaborate studies in many directions. Such an undertaking would be of assistance in all phases of our work (Station, College, Extension, and Crop Pest Commission), and the workers in each of these lines indicate an interest in the undertaking. It is found also that the students of the college, and especially those specializing in entomology, are interested in this because it furnished a wealth of material with which to illustrate the courses of instruction. Such a study, intensively prosecuted, might have made us at least aware of the presence of the cotton flea-hopper before it became a pest of our cotton; just as it might have given preliminary information about the various species of worms which have attacked soybeans during the last several years; and just as it now seems that a study of the insects of the native persimmon may give light on some matters not well understood at present. Workers in the entomological profession are mindful that insects comprise about four times as many species as all other animals combined, that a very large proportion of them are destroyers of vegetation; hence they hold immeasurable potentialities for harm; while on the other hand certain great groups of insects are predaceous or parasitic upon other insects and are thus of untold (and unappreciated) benefit. The whole presents a complex of forces.

No less an authority than Dr. L. O. Howard, Chief of the U. S. Bureau of Entomology at Washington, in making a studiously prepared plea for the furtherance of careful studies of all phases

of insect problems, pointed out that no hard and fast line can be drawn between studies that are of value and ones that are not, and declared that "All entomology is economic".

Coincident with our studies upon the listed and approved projects, we are gathering all possible data, records and collections concerning the insect life of the state as a whole, in the belief that it will give a better understanding of our entire field of work.

PLANT DISEASES

The research work with plant diseases was seriously interfered with by the complete loss of all of our laboratory equipment when the agricultural building was destroyed by fire in April, 1925. This resulted in our having to begin anew with many of the lines of research. The time during the summer and fall of 1925 was devoted to a careful ecological study of some of the factors influencing the growth and development of cotton buds and bolls. Through the courtesy and cooperation of the University of Illinois Dr. C. A. Ludwig was permitted to work in their laboratories and greenhouses during the winter on the cotton seed study which had been started here before the fire. The plant disease survey and the miscellaneous investigations of new diseases have been continued as time and facilities permitted.

Plant Disease Survey

As has been our custom in the past, the plant disease survey has been conducted in cooperation with the Bureau of Plant Industry of the U. S. Department of Agriculture. The prevalence of the common diseases of our crops varies from year to year, and we are from time to time discovering new diseases which are proving destructive to plants in different sections of the state. In 1926 corn smut was much more severe than usual. This seems to have been due to the weather conditions which were favorable to the infection of the crop with the smut organism. Careful counts were made of the variety tests at the Experiment Station in an effort to determine any varietal resistance that might exist. The infection in this test varied from 6 to 36 percent. There seemed to be no strong indication of resistance, however. The early varieties in any case showed less infection, but this was probably due to the weather conditions that existed at the time infection was taking place.

Ear rots were much more abundant than usual. This condition seems to have been brought about by a severe infestation of the

corn ear-worm which opens a way for infection by the rot-producing organisms.

The ashy stem-blight of beans which was referred to in the last report as a new disease in this section has now been found in a number of different places in this state. It has also been reported from Georgia and Mississippi, indicating a wide distribution through this section of the country. This disease has caused serious damage in a few places, which indicates that it is capable of being a very destructive pest under some conditions.

Angular leaf spot of cotton was much more prevalent than usual and continued in the fields throughout the season, causing considerable damage where no control measures had been used.

Cotton wilt was also very prevalent and was reported from several new localities during the season. The demand for seed of wilt-resistant varieties is constantly increasing and this is being met in a large measure by the increased production of such varieties as Dixie-Triumph, Humco-Dixie 14, and Super-Seven, all of which have produced well in our varietal tests on wilt infested land this season.

A rot of gladiolus caused by **Bacterium marginatum** was reported in this state for the first time this year, being found in serious proportions in two widely separated localities. Owing to the dry season during the early part of the summer the diseases of grapes and peaches were not nearly so prevalent as in previous years.

Cotton Physiological Studies

When we were confronted with the problem of continuing botanical and bacteriological researches without the use of a laboratory during the summer of 1925, we naturally turned to field work on some of the problems which we had already under way. On this account the entire summer was devoted to ecological studies with cotton. We had observed in our fruiting studies during the past few years that there is a considerable difference in the number of days required for squares and bolls to develop during different seasons. We started experimenting therefore in an effort to determine the influence of light and moisture on the fruiting and on the square and boll periods of cotton. Through irrigation and construction of shades of different degrees in the field, some very interesting results were secured. These were mentioned in the last annual report and indicate that soil moisture is the most important factor in

varying the length of the boll period of cotton, the period being shortened by insufficiency of soil moisture.

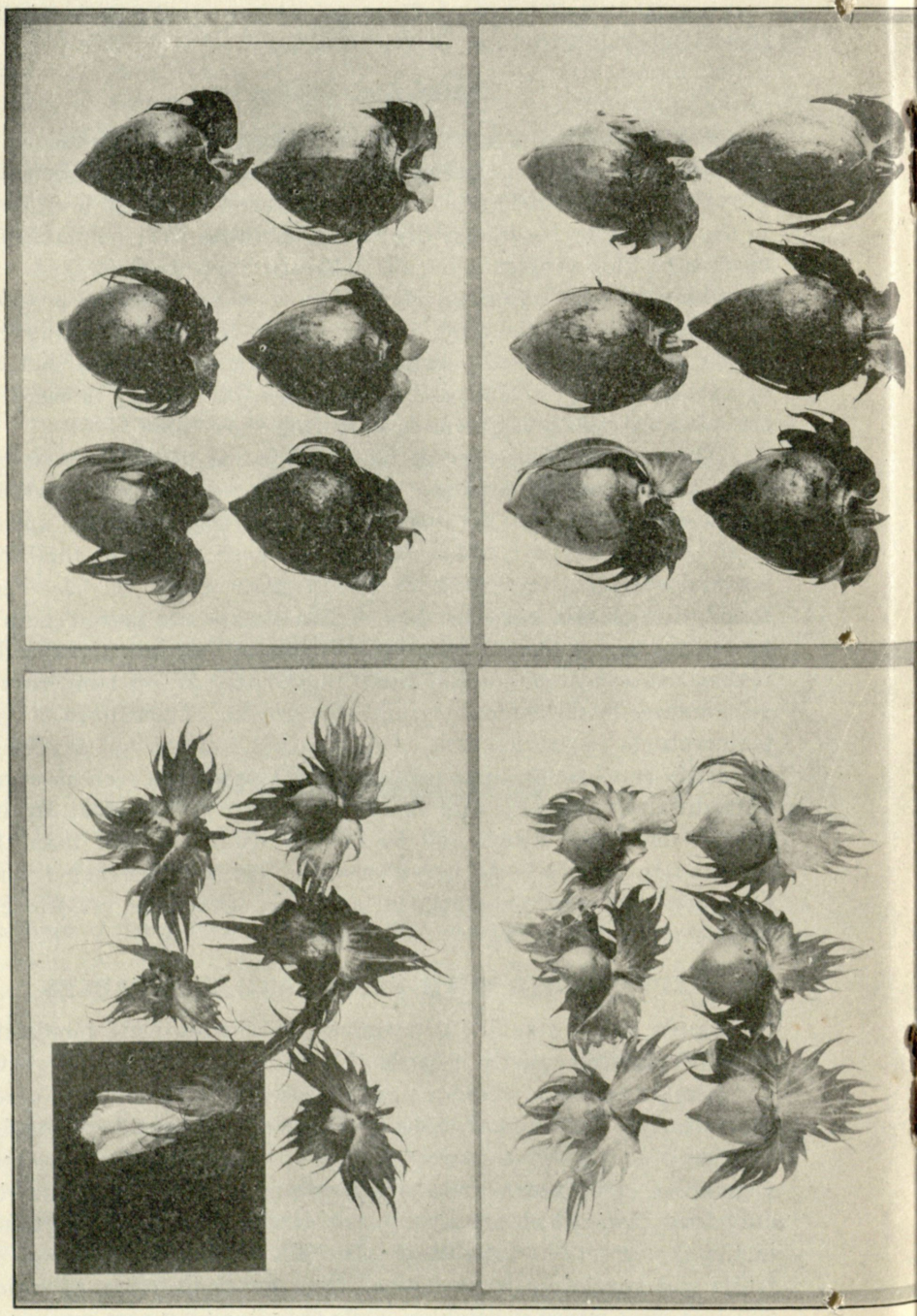
Cotton Seed Studies

For several years we have been interested in the influence of low temperatures on the germination of cotton seed and on the early growth of cotton seedlings. Some preliminary work had been done in the laboratory before the fire but no facilities were available for continuing this project after the laboratories were destroyed. In the absence of laboratory facilities here we considered the possibility of continuing this work at some other institution during the winter months and finally arranged, through the courtesy and cooperation of the University of Illinois, for Dr. Ludwig to work in their laboratories and greenhouses during the winter.

The most critical stage in the development of cotton is at the time the seed are germinating and the young seedlings are getting established. The cool wet spells which are frequent in the spring of the year often destroy the seedlings to such an extent that it is necessary to plant the crop over. With other crops it has been found that certain varieties and certain strains are more resistant to cold than are other varieties. We began this investigation by testing out a large number of varieties of cotton in low temperature germinators in the laboratory and the growing of seedlings at low temperatures in greenhouses. One season's work is not sufficient to justify conclusions, but considerable difference has been observed with different varieties, and there is reason to believe that strains can be developed which will be more resistant to cold than the cottons now in use. A greenhouse is being constructed and equipped with low temperature tanks and chambers for the enlargement of this work.

EXPERIMENTS WITH FRUITS AND VEGETABLES

Fruits and vegetables are gradually becoming more important in South Carolina, partly because of the invasion of the boll weevil and partly because of the low price of cotton, which seems to occur periodically. The annual value of exported fruits and vegetables is around $8,000,000, the greater part of which, however, is from vegetables. The peach and, to a lesser extent, the apple are the only fruit crops which are of any considerable economic importance in the export trade of this state. In 1925 nearly 16 000 cars of fruits and vegetables were shipped from South Carolina, of which 690 cars were mixed vegetables, while the remaining part was made



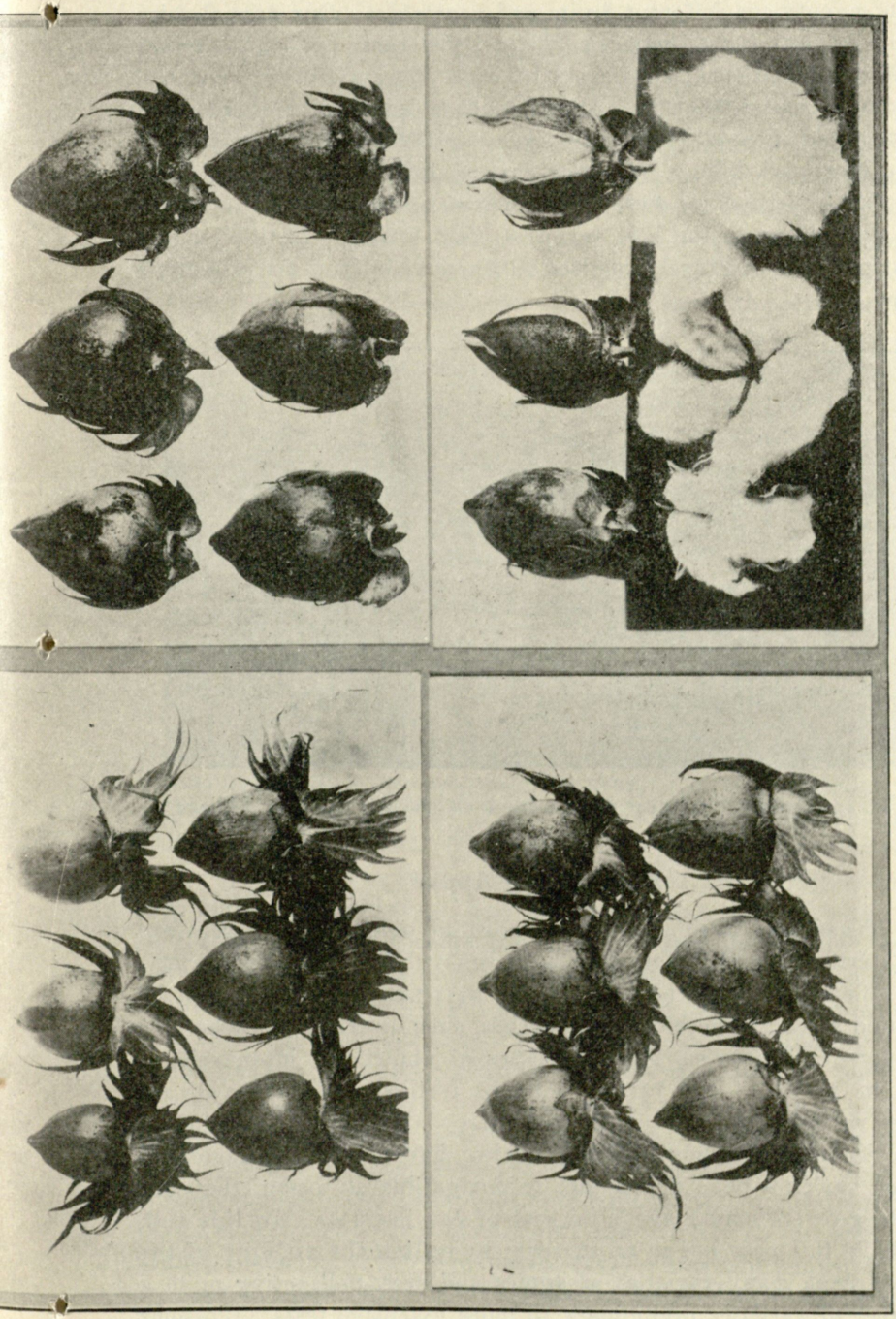


Fig. 3—One series of cotton bolls from bloom to opening stage photographed at one-day intervals.

up of twenty-one different fruits and vegetables. Our annual shipments of lettuce are between 700 and 900 cars; cabbage between 3,000 and 4,000 cars; cucumbers between 500 and 800 cars; watermelons around 4,000 cars. Our spinach shipments have increased from a few cars in 1920 to 501 cars in 1925. Tomato shipments have increased from a very few cars in 1920 to 568 cars in 1925.

Our experimental work is planned so as to enable us to advise our growers as to the best varieties, most efficient fertilizers, and most profitable cultural practices with our main fruit and vegetable crops.

Fig. 12—Group of farmers at roadside fruit market, Clemson College, South Carolina.

Pollination of Apples

It has long been known that most of our apple varieties are self-sterile,—that is, they must be pollinated from another variety. For this reason large blocks of many varieties of apples cannot be planted as can large blocks of peaches, since nearly all peaches are self-fertile. Likewise, many varieties of apples are intersterile,—that is, pollen of one variety will not fertilize the flowers of another variety, even though the pollen is viable. For these reasons it is necessary to know which varieties have viable pollen and which varieties have pollen that is compatible in order that the apple growers may make a success of the business. To this end, we have this year begun an experiment testing the viability of the pollen from many varieties of apples and cross-pollinating quite a number of varieties preliminary to more extensive tests. Blossoms

of thirty varieties of apples were bagged with glassene bags as one method of determining self-sterility. Of our main commercial varieties over 100 blossoms were bagged of each variety, and of the lesser varieties less than 100. All of the flowers bagged except those on Golden Russet, Ozark, Bismark, Western Beauty, and Early Harvest, failed to set fruit. Pollen of these thirty varieties was also tested for viability by germination in a 10 percent sugar solution. Of these thirty varieties the following made a very good germination of pollen: Golden Queen, Golden Delicious, Scotch Cluster, York Imperial, Apple of Commerce, Bismark, Kansas, Coffelt, Payne's Late Keeper, Simmons Red, Early Harvest, and Red Delicious. Only three of these—Red Delicious, Golden Delicious, and Early Harvest, are commercial varieties in this state. Our other commercial varieties, as Red Winesap, Stayman Winesap, and Blacktwig, produced either pollen which did not germinate or in which an insignificant number of grains germinated. A few cross pollinations were also made with a few varieties. This preliminary work showed that the Red Delicious, York Imperial, Golden Delicious, and Early Harvest pollen is suitable for pollinating Red Winesap, Stayman Winesap, Blacktwig, and others.

Cooperative Fertilizer Tests with Peaches

The two commercial fertilizer tests with peaches, one located on the farm of Mr. W. M. McCoy, McBee, in the Sand Hill section, and the other on the farm of Mr. B. M. Gramling, Gramling, in the Piedmont section, were continued this year. The crop at McBee was very small, owing to a late freeze which killed a considerable percentage of the blossoms. The freeze occurred when the trees were almost in full bloom. In the Gramling orchard we had a very large crop for five-year-old trees. The 1926 season was rather dry and our results are probably considerably different from what they would have been had we had plenty of rain, since in a dry season all of the fertilizer applied does not go into solution and therefore cannot be used by the plants or trees. At McBee, even under the condition of this season, our results continue to show that an 8-8-4 fertilizer produces the largest number of peaches per tree, 277.1, and an 8-0-4 the smallest number per tree, 91.2. The check plots fertilized with an 8-4-4 averaged 167.9 peaches per tree. At Gramling we obtained similar results. The plots fertilized with plenty of nitrogen produced more peaches than plots which had little or no nitrogen. At McBee plots on which leguminous cover crops are grown in the summer in addition to the ordinary amount of fertilizer applied

produced a larger number of peaches than the plots which did not have cover crops. The nitrogen also delayed the maturity of the fruit. In 1925 the delay was as much as 9 to 10 days. This year, however, the weather conditions at ripening were such that the fruit ripened in half the normal season time. While the delay in ripening due to nitrogenous fertilizer was not so marked this season, those plots which had larger amounts of nitrogen than the average ripened their fruits a few days later. In 1926 all of the fruit was gathered in four pickings while in an average season it requires about eight.

Fig. 13—Cowpeas in orchard at McBee.

Cooperative Fertilizer Experiments with Asparagus

The acreage in asparagus is gradually increasing, particularly in certain sections of the state. South Carolina at the present time is one of the three largest Eastern asparagus growing states and is usually surpassed in carlot shipments only by California. The carlot shipments have increased from 89 cars in 1920 to 263 in 1925.

Asparagus requires heavy applications of fertilizer and the fertilizer used by the growers at the present time varies greatly in the percentages of the different elements. In order to determine the correct formula and amount of fertilizer for asparagus, we are conducting cooperative experiments at Monetta, with Mr. B. R. Gantt and Mr. J. E. Boatwright. Two years' records of yields have been obtained from Mr. Gantt's planting and three from Mr. Boatwright's. In spite of the past year's drought we feel that we are from year to year building up data on the proper fertilization of this important crop which will be the means of considerable saving

to the growers. In addition to the tests of different kinds and amounts of fertilizer we are also testing the time of application.

Asparagus Experiments at Clemson College

At Clemson College we are testing different fertilizers for asparagus, time of application, spacing, and time of cutting. The variety used in our fertilizer and time-of-cutting experiment is the Washington.

In the time-of-cutting tests, the second year after planting (1925), the plants were divided into two plots, one of which was harvested as long as the shoots were of sufficient size. In 1926, which was the third season for this planting, the entire area was harvested and most of the twenty plots produced a greater weight of shoots by reason of not having been cut until the second year after planting. Harvesting the first year was over a duration of thirty days while the past year harvesting was continued over five to six weeks. From this one season's results it would seem that harvesting the first year after planting is a bad practice. It will be interesting to learn whether too early cutting of shoots will continue to show an ill effect in future years.

Fertilizer Tests with Irish Potatoes

Between 15,000 and 20,000 acres are annually planted in this state to the spring, or truck, crop of Irish potatoes, and between 3,000 and 4,000 carloads are shipped annually. The potato crop is one which requires heavy applications of fertilizer, the average application being one ton per acre—in some cases 1 1-2 tons.

We are conducting fertilizer tests with Irish potatoes at Clemson College and at Florence and Summerville. At Clemson College and Summerville the experiments have been conducted for four years and at Florence for five years. The past two years the yields were very low because of extremely dry weather, and for that reason the results obtained in those years are somewhat different from those obtained during a normal season. We expect to continue this experiment for several more years in order to include data in dry, wet, and average seasons.

Source of Seed Test of Irish Potatoes

A source of seed test of Irish potatoes has been carried on for five years at three of our stations with seed from ten different sources, although all sources were not tested every year. All pota-

toes used in this test were certified seed with the exception of Virginia seed, which was second crop seed but not certified.

Seed from Virginia, Wisconsin, New York, and Vermont were tested each year at all three stations. At Clemson College, New York seed have produced an average of 58.48 barrels per acre, Vermont seed 56.1 barrels; Wisconsin seed 55.2 barrels; and Virginia seed 51.48 barrels. At Florence, Vermont seed have produced the highest average yield of 56.6 barrels per acre; New York seed 53.18 barrels; Wisconsin seed 51.04 barrels; and Virginia seed 50.46 barrels. At Summerville Wisconsin seed have made the highest average of 53.4 barrels per acre; Vermont seed 49.9 barrels; Virginia seed 43.9 barrels; and New York seed 42.16 barrels. None of the sources tested has shown as much as one percent of any tuber-borne disease and it is believed that the average yields would have been higher in all cases except for two unusually dry seasons.

Fig. 14—Lucile, one of the large pink grape varieties which do well in this state. A heavy fruiter.

A complete report of these investigations is now being prepared for publication.

Miscellaneous Horticultural Experiments

In addition to the experiments already referred to, we are also testing out a great many varieties of apples, peaches, grapes, strawberries, pecans, cherries, blackberries, dewberries, and raspberries, together with a number of varieties of different vegetables. We are also cooperating with the Office of Foreign Seed and Plant Introduction of the U. S. Department of Agriculture, from which we receive each year varieties of fruits and vegetables, nuts and ornamentals introduced from foreign countries, and some of these seem to be at home in this climate and soil. Any that prove suitable for our conditions are propagated and tested in other parts of the state before being recommended for general planting.

We have a number of varieties of grapes that are doing exceptionally well in this section and which we can recommend for planting in home orchards. A few of these varieties we are also recommending for planting on a commercial scale.

In our peach variety test we are trying primarily to find some variety that will ripen one or two weeks after the Elberta. At present there are almost no peaches in this state ripening after the Elberta, and if we can find a variety which ripens at this time it will be a source of considerable revenue to our peach growers.

EXPERIMENTS WITH LIVESTOCK

The research work of the Animal Husbandry Division is a continuation of our program, which involves the economical production of feeds, the proper utilization of feeds, points of correct management, and the various systems of breeding.

The low price of cotton has caused many farmers to become interested in a diversified agriculture including the production of more feed crops. We are endeavoring to secure information which will enable the farmers to market their home-grown feeds at a profit through livestock. We feel confident that this system of agriculture will aid in bringing permanent prosperity to South Carolina farmers.

Feeds in the South are becoming cheaper, or more nearly on a par with prices in the West. This is of course in favor of livestock because it will mean that we can produce meats at a lower cost. This fact, coupled with the possibility of continuous grazing

throughout the year, gives the livestock producer an encouragement which he has never before had.

HOGS

Dry Lot versus Soybean Forage for Pigs

During the fall of 1925 the fourth test was conducted to determine the relative economy of dry lot and forage for producing pork. Twenty-five pigs averaging 36 pounds were divided into two lots, 10 pigs in dry lot and 15 on soybean forage. Lot 1 received corn and tankage in dry lot, while Lot 2 grazed on mature soybeans plus 2 percent corn ration. After the grazing period of 56 days, the pigs on soybeans were finished on corn and tankage. During the grazing period the pigs in dry lot on corn and tankage gained .51 pounds per pig per day and cost $9.43 per 100 pounds of gain. The pigs on soybean forage and a limited corn ration gained .75 pounds per pig per day and cost $6.66 per 100 pounds of gain. Thus by the use of soybeans as forage there was a saving of $2.77 per 100 pounds of gain.

During the entire test, including both the grazing and the finishing periods, the pigs on corn and tankage gained 1.10 pounds per pig per day and cost $8.55 per 100 pounds of gain. The pigs that grazed on soybeans and were finished on corn and tankage gained 1.24 pounds per pig per day and cost $8.26 per 100 pounds of gain.

This test was conducted in cooperation with the U. S. Department of Agriculture and several other experiment stations to determine the quality of pork produced by pigs grazing on mature soybeans and receiving a limited corn ration. At intervals of 28 days during the finishing period on corn and tankage, five pigs were shipped to the U. S. Experiment Farms, Beltsville, Maryland, and were slaughtered under government supervision. A report will be made on the softness of pork as soon as it is released for publication.

Comparison of Green Forage Crops for Hogs

The most economical gains are made by the use of forage crops the year round. This test was a continuation of those conducted to determine the relative value of various green forage crops for summer grazing. Fifty pigs averaging 40 pounds were divided into five lots and the following results were secured.

	Ration	Av. daily gain	Cost of 100 pounds gain
Lot 1	Corn and tankage, full fed in dry lot	.54	$ 9.70
Lot 2	Green soybean forage plus 2 1-2% corn ration	.69	6.70
Lot 3	Green soybean forage plus 2 1-2% corn and tankage	.77	6.32
Lot 4	Sudan grass plus 2 1-2% corn and tankage	.41	11.05
Lot 5	Cowpeas and sorghum plus 2 1-2% corn and tankage	.50	9.13

Due to the dry weather the growth of forage was not as good as would be expected during a normal season, and the gains made by the pigs were rather low. The pigs in Lot 3 receiving a limited ration of corn and tankage while grazing on green soybeans gave the best results. Sudan grass was affected most by the drought and became parched and dry near the close of the test, and consequently the results were poor on this lot.

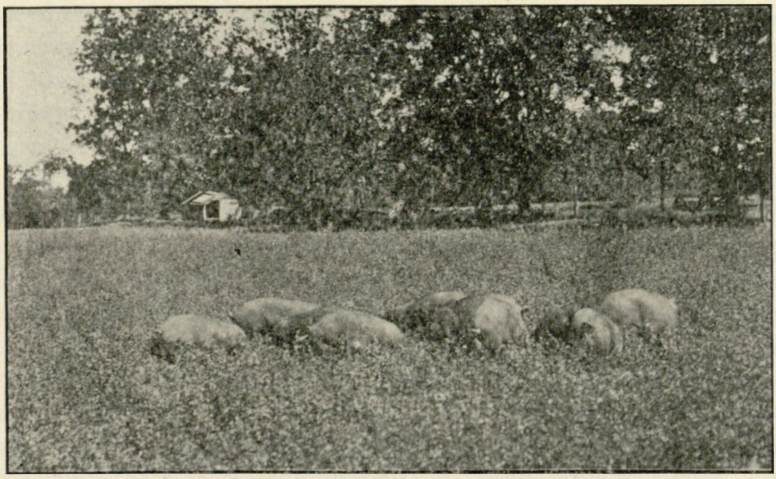


Fig. 15—Purebred Berkshire pigs grazing on alfalfa pasture.

Hogging down Peanuts, Sweet Potatoes, and Corn at the Pee Dee Station

The test of hogging down forage crops was repeated this year at the Pee Dee Station. Two series of tests were conducted, one with later crops following after the hogs had consumed the forage

in the previous tests. Forty hogs averaging 118 pounds at the beginning of the first series were used in these trials and the follow- results were secured:

	Ration	Av. daily gain, lbs.	Cost per 100 pounds gain
First Series			
Lot 1	Corn and tankage in dry lot	1.66	$10.97
Lot 2	Peanuts alone hogged down	1.07	9.04
Lot 3	Peanuts hogged down plus 2% corn	1.58	8.31
Lot 4	Peanuts hogged down plus 2% corn and tankage	1.79	8.73
Second Series			
Lot 1	Corn and tankage in dry lot	1.88	$11.26
Lot 2	Sweet potatoes hogged down plus tankage	1.02	8.36
Lot 3	Standing corn hogged down plus tankage	1.64	4.71

In the first series the pigs receiving a limited ration of corn and tankage made the fastest gains, but Lot 3 with peanuts and limited corn ration made the cheapest gains. The addition of tankage increased the rate of gain, but it also increased the cost. In the second series standing corn and tankage gave the best results.

Protein Supplements to Corn for Pigs

Most economical gains are made by allowing the pigs to gather their own feed. But in cases where forage crops are not available for hogging down, it is often a question what feeds are best. With the increase in soybean and peanut production in the South the oil mills are turning their attention to these crops as sources of oil and are putting out by-products which are rich in protein. The third test comparing these proteins with the older, well established protein supplements of animal origin was conducted this year. These feeds were compared singly and in combination as a supplement to corn for fattening pigs. Seventy pigs averaging seventy pounds were divided into seven lots of 10 pigs each with the following results:

	Ration	Av. daily gains, lbs.	Cost of 100 pounds gain
Lot 1	Corn and tankage	1.61	$10.01
Lot 2	Corn and fish meal	1.86	9.18
Lot 3	Corn and soybean meal	1.29	10.43
Lot 4	Corn and peanut meal	.90	14.43
Lot 5	Corn and peanut feed	1.07	11.80
Lot 6	Corn, soybean meal and fish meal	1.84	8.72
Lot 7	Corn, peanut feed and fish meal	1.77	8.92

These results check very closely with the two previous experiments. Lot 2 on corn and fish meal made the fastest gains, but Lot 6 on corn, soybean oil meal, and fish meal made the most economical gains. In all cases where a combination of plant and animal protein was used the gains were more economical than where a single feed supplied all the protein.

Berkshire Breeding Herd

The breeding work with the purebred Berkshire herd was continued this year. This herd has been produced from one boar, Clemson Baron, and one sow, Michigan Baroness 3rd, purchased in 1922 from Parker Brothers, Niles, Michigan. The descendants of this one sow and boar constitute almost the entire show herd this year. From this mating individuals were produced decidedly superior to either sire or dam. This mating has made a real contribution to the Berkshire breed. The new type having been secured, the next problem was to prevent it from reverting to the old type. Inbreeding has been practiced to fix this type and it is intended to follow this by line breeding. No signs of lack of constitution or size have been noted. One of the outstanding sows in the herd, Clemson Revelation Lady, the undefeated junior yearling and grand champion sow at the fairs this year, was produced from a brother-sister mating. Competent judges have pronounced this junior yearling the greatest sow ever produced in the Berkshire breed. This close mating is made only with the animals exceptionally strong in the desired points and not showing any similar weaknesses. There is no herd in America today which has Berkshires of such uniformity of type and outstanding quality.

A well balanced ration, pastures, plenty of shade and fresh water were provided the year round. Thus the proper matings, abundance of feed and exercise have produced results which prove that the best hogs can be produced in South Carolina.

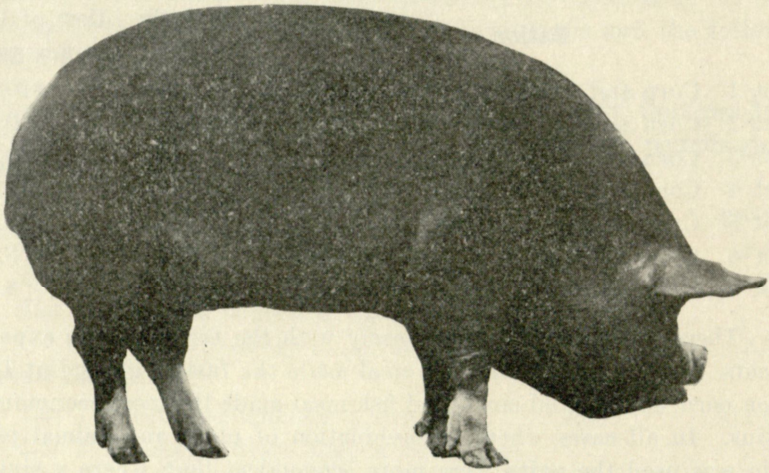


Fig. 16—Clemson Revelation Lady 331839, undefeated junior yearling and grand champion sow, 1926.

The show circuit this year consisted of seven fairs, including the National Swine Show and some of the best State fairs in the country. The herd was first shown at the Ohio State Fair, Columbus, Ohio. The winnings from this show were as follows:—1 and 2 aged boars; 1 senior yearling; 4 junior yearlings; 1 and 3 senior boar pigs; 3 junior boar pigs; 3 and 6 aged sows; 2 and 4 senior yearling sows; 1 and 2 junior yearling sows; 1 and 5 senior sow pigs; 2 and 4 junior sow pigs; 1 aged herd; 1 young herd; 2 and 3 get of sire; 1 and 2 produce of dam; senior champion boar; grand champion boar; senior champion sow, and grand champion sow. We were limited to two entries in each class at this show.

At the National Swine Show the herd was awarded: 1 and 3 aged boars; 2 senior yearling boar; 1 junior yearling boar; 1, 2, 5, 6 senior boar pigs; 1 and 7 junior boar pigs; 1 and 2 aged sows; 1 and 2 senior yearling sows; 1, 2 and 3 junior yearling sows; 1, 2 and 6 senior sow pigs; 1, 2, 3, 4 and 6 junior sow pigs; 1 and 2 aged herd; 1 and 2 breeders herd; 1 and 2 young herd; 1, 2, 3 and 4 get of sire; 1, 2, 3, 4 produce of dam. This is the first time that any herd has ever taken the first four places in the get of sire and produce of dam at the National Swine Show. No championships were offered at this fair.

Besides the Ohio State Fair and the National Swine Show, this herd was shown at the Indiana and Tennessee State Fairs, the Tri-State Fair at Memphis, the Southeastern Fair in Atlanta, and the South Carolina State Fair in Columbia. At all of these fairs the

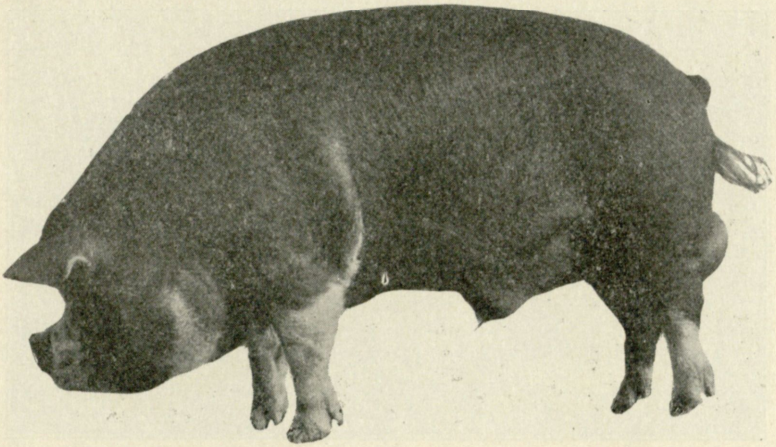


Fig. 17—Clemson Revelation 327098, undefeated aged and grand champion boar, 1926.

Clemson herd won all of the grand champion awards and won over practically all competitors in the various classes.

BEEF CATTLE

Steer Feeding

Considerable interest is now being shown in the feeding of steers in this state and many farmers are making it a practice to feed a car of steers each year and use the manure to improve the land. The most common ration used for fattening steers is cottonseed meal and cottonseed hulls. Soybeans and soybean oil meal are also increasing in importance in the South. A test was planned to compare cottonseed hulls and corn silage as roughages and cottonseed oil meal and soybean oil meal as the sole concentrate for fattening steers. Twenty-four grade steers under 2 years old, averaging 675 pounds were divided into three lots of eight steers. They were fed for 112 days with the following results:

	Ration	Av. daily gain lbs.	Cost per 100 pounds gain
Lot 1	Cottonseed oil meal and cottonseed hulls	1.75	$15.84
Lot 2	Cottonseed oil meal and corn silage	2.13	12.39
Lot 3	Soybean oil meal and corn silage	2.07	13.95

With the high price of feeds prevailing last winter when this test was made the steers in Lot 2 on cottonseed meal and corn

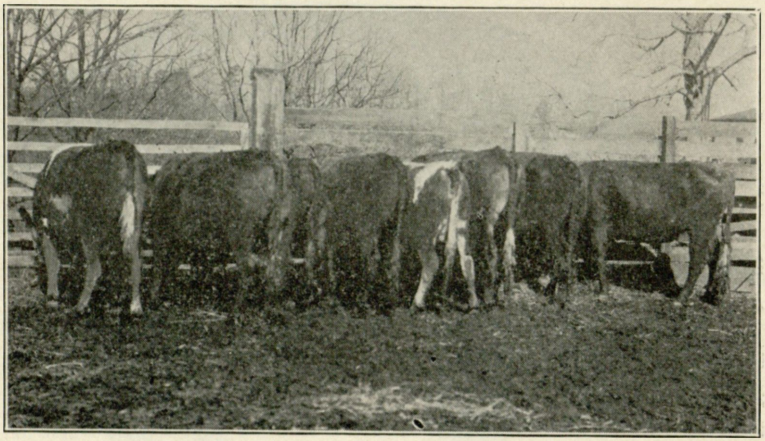


Fig. 18—Steers on cottonseed meal and cottonseed hulls made an average daily gain of 1.75 pounds and cost $15.84 per hundred pounds of gain.

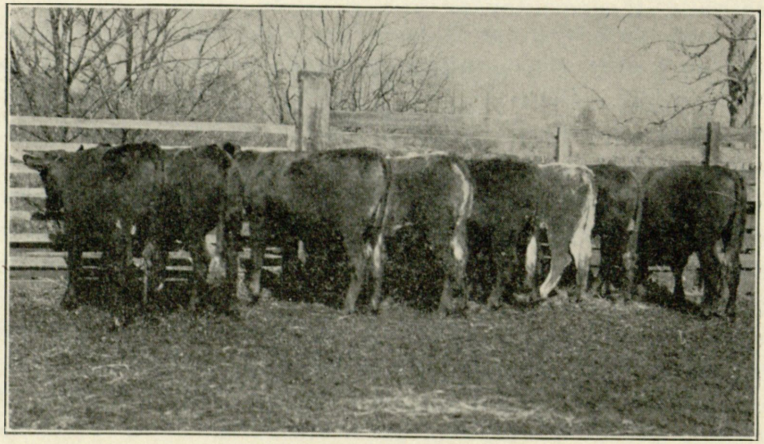


Fig. 19—Steers on cottonseed meal and corn silage made an average daily gain of 2.13 pounds and cost $12.39 per hundred pounds of gain.

silage made the fastest and most economical gains, followed by soybean oil meal and corn silage. But the present low prices of cottonseed by-products would make quite a difference in favor of cottonseed meal and hulls. With cottonseed meal at $24.00 a ton, cottonseed hulls at $7.00 a ton, and corn silage at $7.00 a ton the cost per 100 pounds would be $8.15 on cottonseed meal and hulls, $9.90 on cottonseed meal and corn silage.

Fig. 20—Steers on soybean oil meal and corn silage made an average daily gain of 2.07 pounds and cost $13.95 per hundred pounds of gain.

Wintering Beef Cattle at the Coast Station

The test to determine the cost of maintaining beef cattle at the Coast Station was continued this year. The purebred Aberdeen Angus herd used in this test was divided into two lots, one lot of mature cows and the other lot of heifers. These cattle were fed from December 22 to March 30 on cottonseed meal, sorghum silage, and either hay or straw as additional roughage. Mixed soybean and crab grass hay was used during the first part of this experiment and oat straw during the latter part. During this 98-day wintering period the mature cows gained 112 pounds per animal costing $17.87. The heifers gained 78 pounds costing per animal $13.01.

SHEEP

Sheep Improvement by Use of Purebred Rams

Most of the sheep in this state are native scrubs that are poor in mutton qualities and shear a light fleece of wool. A test is in progress to determine the value of purebred rams in improving these native sheep. Sixty native ewes were purchased from the coastal section of the state and shipped to the college for this purpose. These ewes were bred to a purebred Southdown ram. These grade lambs from the first cross were sheared for the first time in the spring of 1926. The average fleece of the lambs weighed 5.08 pounds while the fleece of their mothers weighed only 4.15 pounds.

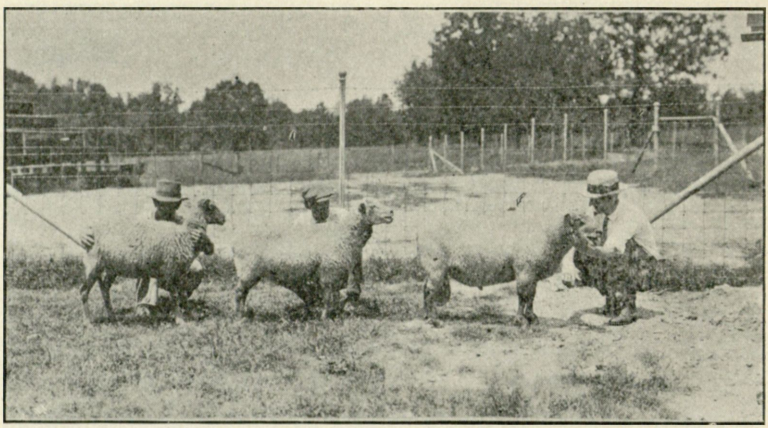


Fig. 21—Purebred Southdown ram, grade ewe lamb and native scrub ewe.

The fleeces of the lambs also showed less kemp and graded higher than the ewes. The lambs also showed marked improvement in mutton qualities, being more blocky and better filled out in the leg of mutton.

Remarkable improvement has also been noted in the old native scrub ewes because of better feed and care. The average weight of the ewes at the time of purchase in September, 1923, was 65 pounds and now the average weight is 80 pounds. Two years ago the average wool clip was 1.8 pounds and this spring the average fleece weighed 4.15 pounds. Thus it is clear that considerable improvement can be obtained by better feed and management of our flocks.

Cottonseed Meal and Hulls versus Mixed Soybean and Grass Hay for Wintering Ewes

With the increase in interest in the sheep industry a test was planned to determine the value of some of our common feeds for wintering breeding ewes. Forty ewes were divided into two lots. One lot received cottonseed meal and hulls, the other mixed soybean and grass hay. This test was continued for 70 days until the ewes began to lamb. After the first 28 days the ewes on hay failed to show any gain, and cottonseed meal was added to the ration for the balance of the feeding period. During the entire period the ewes on cottonseed meal and hulls gained 18 pounds apiece, and those on soybean-grass hay and cottonseed meal (after 28th day) gained 13 pounds per ewe. The cost per ewe on cottonseed meal and hulls was $1.54; on hay, $2.09. Records on the weights of

lambs at birth showed that the average weight of the lambs produced by the ewes receiving cottonseed meal and hulls was 7.77 pounds while those from the ewes receiving mixed soybean and grass hay weighed 7.95 pounds. The hay used in this test was mostly grass hay and contained very little soybeans. Better results would be expected if good quality soybean hay had been used.

The Searing Iron versus the Knife for Docking Lambs

The third of a series of tests was conducted in the spring of 1926 to determine which method of docking is the better—the searing iron or the sharp knife. This subject has been much discussed among sheep men of this country and there seems to be a divergence of opinion. Some claim fatalities due to excess bleeding by the use of the knife, while others claim that the searing iron leaves a wound which heals more slowly and is more likely to become infested. Forty grade lambs from one to two weeks old were divided into two lots of twenty each. Those in one lot were docked with a sharp knife and those in the other lot were docked with the searing iron. The results continue to indicate that the lambs docked with the knife make larger gains and the wounds heal faster than those docked with the searing iron.

EXPERIMENTS WITH DAIRY CATTLE

With a program of diversified farming becoming essential to the success of agriculture in this state, dairying is constantly assuming a more important place in our livestock development. The local demand for dairy products is still far in excess of the supply, and with the per capita consumption increasing annually the problem of greater and more efficient production still leads in the field of dairy investigation.

The research work of the Dairy Division this year has dealt largely with methods of breeding and feeding dairy animals. A special effort is being made to help solve the feeding problems of our dairymen with the purpose constantly in mind of larger and more efficient utilization of farm-grown feeds, especially roughages.

Feeding trials, though essential, are often times elementary in nature. With added facilities, both in personnel and equipment, now at its disposal the Dairy Division is planning a program of investigational work covering a wider field of fundamental research including in its scope problems of interest not only to the farmer dairyman but to men engaged in the more technical and detailed study of dairy science.

Corn versus Sorghum for Silage for Dairy Cattle

Corn silage and sorghum silage was fed during the winter of 1925-1926 to determine their relative efficiency for milk production. It was hoped to make this the final of a series of similar trials with these feeds, but because of the more accurate methods employed in the last trial the results differed considerably from those of previous years. The two silages will again be fed comparatively during the coming winter, and with the data thus available a defiite comparison of the feeds should be possible.

The Value of Grinding Hay for Dairy Cattle

The manufacturers of feed-grinding machinery are extensively exploiting the idea of increasing the utilization of roughage by grinding. In some instances the economic value to the farmer is based upon statements not as yet thoroughly proven sound by careful investigation. It seems essential, therefore, that more information be obtained regarding the true value of grinding hay from the nutritive and economic viewpoint before definite advice can be given to prospective users of grinding machines.

Feeding Trial.—The results of a single trial in which two groups of cows were fed by the double reversal method for a period of 120 days, comparative rations differing only in the form of hay used, unground alfalfa versus ground alfalfa, disclosed the following:

1. The palatability of the alfalfa hay was unaffected by grinding. In this trial an ordinary ration was fed, no attempt being made to force the consumption of hay by decreasing the silage or grain portion of the ration. The hay used was an excellent grade of fancy peagreen leafy Western alfalfa.

2. The feeding of ground alfalfa exhibited no marked effect upon the quantity or quality of milk produced.

3. Ground alfalfa did not enhance the efficiency of the ration.

4. The increased cost of production for one hundred pounds of milk and one pound of butterfat with the ground alfalfa was $0.09 and $0.02 respectively. This was due almost entirely to the cost of grinding, an estimate of $2.25 per ton being used for this calculation. This includes power, man labor, depreciation, interest, and taxes.

All of the ground hay used was ground in a hammer-type mill, using an eleven-sixteenths-inch mesh screen.

Digestion Trial.—A digestion trial was conducted during the summer of 1926 in order to furnish more data on the feeding value

of ground hay. Four cows in milk were used and the following results, based on an actual digestion period of fifteen days preceded by a ten-day premilinary period, were obtained:

Coefficients of Digestibility of Unground and Ground Alfalfa

Type of hay	Dry matter	Ash	Protein	Crude fiber	Nit.-free extract	Ether extract
Unground	64.46	55.48	78.14	51.91	71.01	56.38
Ground	63.58	54.32	78.24	51.83	68.59	60.77

The difference in digestibility is very small in every case, and is within the limits of experimental error. The results however, are fairly conclusive that the digestibility of the alfalfa hay was not increased by grinding.

Wintering Dairy Heifers on Roughage Only

Eight dairy heifers whose average age was 381 days were fed on a ration consisting of roughage only for a period of 90 days. These heifers were kept in a one-acre lot with an open shed as the only shelter. Another group of eight heifers, with as average age of 382 days, was fed for a similar period on a ration consisting of roughage and grain and housed during the night in the regular dairy barn. Both lots of heifers were weighed and measured at regular intervals to determine their respective rates of growth.

The roughage fed consisted of soybean hay and corn silage for the first sixty days and oats and vetch hay and sorghum silage the remaining thirty days. The silage was fed in the morning and the hay in the afternoon.

Lot No. 1, on roughage only, averaged 90.4 percent normal weight and 96.4 percent normal height at the beginning of the trial. At the end of ninety days they were 91.7 percent normal weight and 97.4 percent normal height. Lot No. 2, with an initial average for weight and height of 88.0 percent normal and 97.9 percent normal respectively, at the end of the ninety days had increased their weights to 93.8 percent and heights to 100.7 percent normal. The heifers receiving the grain ration gained .39 pounds more per day than those on roughage only. The daily difference in height growth was .009 inches for the entire group in favor of the grain-fed heifers. Normal skeletal growth in immature animals is of more importance than body weight. The animals on roughage only showed no indications of nutritional disturbance at any time. The added weight in the grain-fed group was due apparently to the laying on of fatty tissue, which is non-essential during this period of an animal's life.

The results of this one trial would indicate that dairy heifers can be safely wintered on roughage alone without seriously checking skeletal or body growth.

Breeding Dairy Cattle

The fall of 1926 marks the completion of the sixth year of the line-breeding and out-crossing experiment with Holstein cattle, being conducted in cooperation with the Bureau of Dairying, U. S. Department of Agriculture. This experiment must necessarily extend over a long period of time with a definite program to be followed year after year. Twelve daughters of Sarcastic Hero Lad 301535 have completed yearly official records, two are now on test, and ten heifers remain in the herd to be tested when they are of milking age.

Sir Colantha Ona Fayne 376935 is being bred to the daughters of Sarcastic Hero Lad. This mating is giving us our second generation out-cross, a bull from which mating will be selected to again mate to the daughters of Hero for the first generation of line-breeding.

Undoubtedly the surest way to determine a bull's hereditary make-up is to compare the producing ability of his daughters with that of their dams. Geneticists agree that probably not less than six daughters should be used in such a comparison. With a smaller number the bull's true production transmitting ability can not be determined as most of our cows at present are probably heterozygous for their inheritance-governing producing capacity. Ten daughters of Sarcastic Hero Lad, out of cows with yearly records, were tested in a comparison with their dams to afford an example of the method of determining the transmitting ability of the bull in question.

No one has yet determined the number of factors concerned in the inheritance governing the producing capacity of an animal for either quantity or quality of product. A study of the records obtained in our experiment indicates that the same factors do not control milk production that control butterfat percentage. In three instances the daughters' milk production exceeded that of their dams, in six instances they exceeded their dams in butterfat production, and in every instance the percentage of butterfat was higher with the daughters. The average of the yearly records of the dams as compared with the daughters shows that the milk production was 5.18 percent less for the daughters while the butterfat was 10.7 percent greater, the daughters actually producing 8.31 percent more

butter than their dams. The findings from these ten individuals may not be enough to determine definitely the hereditary make-up of the sire but the evidence would lead us to suspect that he is homozygous for the hereditary factors determining a high butterfat percentage and either heterozygous or homozygous for the recessive factors determining low milk production.

A similar study will be made of all of the females freshening during the course of this experiment in an attempt to formulate some definite method for an exact determination of the producing transmitting ability of a sire. It is only by such means that we may hope to breed a strain of superior producing individuals which will transmit from generation to generation.

Photographic Studies of Growth and Development of Dairy Animals

The Dairy Division is cooperating with the U. S. Bureau of Dairying in a systematic study of the growth and development of dairy animals as depicted by actual photographs. Calipers and measuring instruments are invaluable aids to the study of body growth and conformation, but with the camera as an adjunct to this work an indisputable story of the development and appearance of the individual from calfhead to maturity is portrayed. All animals included in this study are photographed according to prearranged schedule.

Animals up to one year of age are photographed at ages 1, 3,

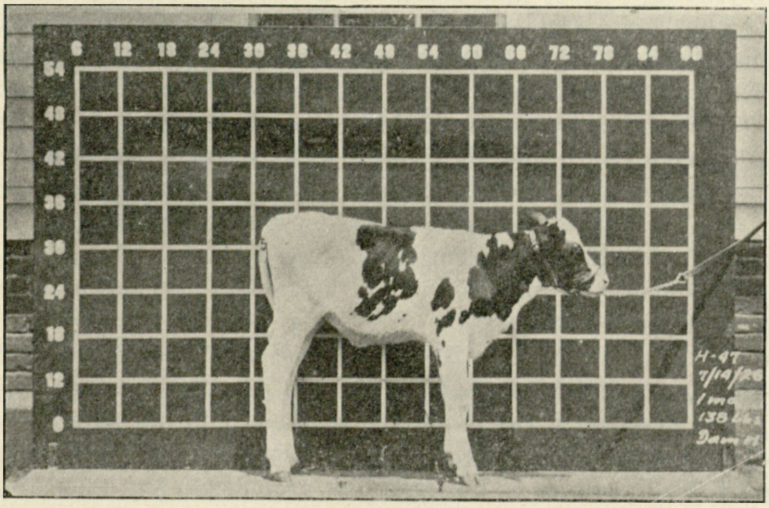


Fig. 22—Illustrating the method of photographing animals against a board background.

6, 9 and 12 months. These pictures are taken against a checkered board background. The work is scheduled for Wednesday of each week and the animals are taken as near the above age as possible.

At the ages of 12, 18, and 24 months the animals are photographed on a track with an open background. Subsequent to two years of age all females are taken just before and after calving and 180 days after calving.

Close adherence to the above schedule over a period of years will result in the accumulation of material unsurpassed for uniformity and accuracy for the study of the many factors affecting body growth and conformation.

Advanced Registry Testing

The official testing of dairy cattle continues as one of the important projects. This work consists of supervision and certification by the Dairy Division of the milk and butterfat records made by all the cows under official testing conditions throughout the state.

A very healthy increase during the past year is evident both in the number of records completed and in the actual size of the individual records. South Carolina again lays claim to a world's record dairy cow, Blue Fox's Eminent Queen 649491. Queen's records of 11,348 pounds of milk and 642.16 pounds of butterfat in 305 days entitles her to the distinction of world's champion senior two-year-old Jersey, class AAA. It is worthy of note to mention that Blue Fox's Eminent Queen is owned by Fred H. Young, Timmonsville, S. C., also the owner of Sensation's Mikado's Millie 568901, world's champion senior two-year-old Jersey, Class AA. These two animals are the only world's record animals ever developed in the South and they bring quite a distinction for themselves, their owner, and the state.

The forty-three 365-day Guernsey records completed this year, averaging 540.13 pounds butterfat, exceed those of last year by four in number of records and by thirty-eight pounds in average butterfat production.

The seventeen yearly Holstein records averaged thirty-five pounds of butterfat less than the eighteen records of a year ago.

The twenty-five yearly Jersey records show an average of 590.01 pounds of butterfat as against eleven records with an average of 561.27 pounds of butterfat last year.

The 365-day records, 85 in number, on all breeds, average 555.11 pounds of butterfat or an increase of nearly 28 pounds over that

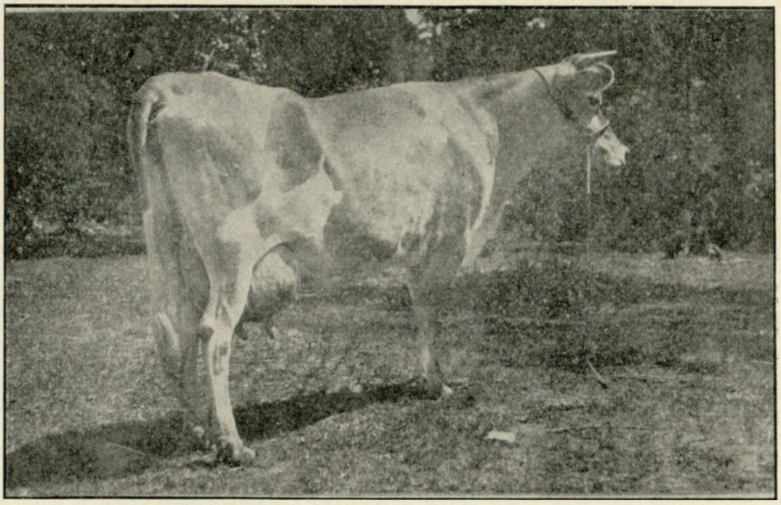


Fig. 23—Blue Fox's Eminent Queen 649491. World's champion senior two-year-old Jersey cow, Class AAA. Owned by Fred H. Young, Timmonsville, S. C.

made by 68 animals last year. In all, including the 305-day and 7-day records, there were 125 records completed since the last published report.

In the Experiment Station herd at Clemson College, approximately 20 cows are constantly on official test. The following averages were obtained for the three breeds represented this year: Two Guernseys, 618.7 pounds of butterfat; four Holsteins, 503.9 pounds of butterfat; three Jerseys, 557.5 pounds of butterfat (365 days); and four Jerseys, 474.9 pounds of butterfat (305 days).

Our present policy is to place all cows on test with their first calf and if the opportunity permits, to allow them to make a second record at a mature age.

State Fair Prizes, 1926

Five cows from the Experiment Station herd were exhibited at the 1926 South Carolina State Fair. The winnings are listed below:

First—four-year-old Jersey cow, Senior and Grand Champion, on Blue Fox's Mona.
First—three-year-old Jersey cow, on Vive Glow's Primrose.
Second—three-year-old Guernsey cow, on May King's Golden Dot.
Fourth—four-year-old Guernsey cow, on golden Ann of the Flats.

A tuberculin test of our herd made by the state veterinarian in September, 1925, showed all animals free from tuberculosis.

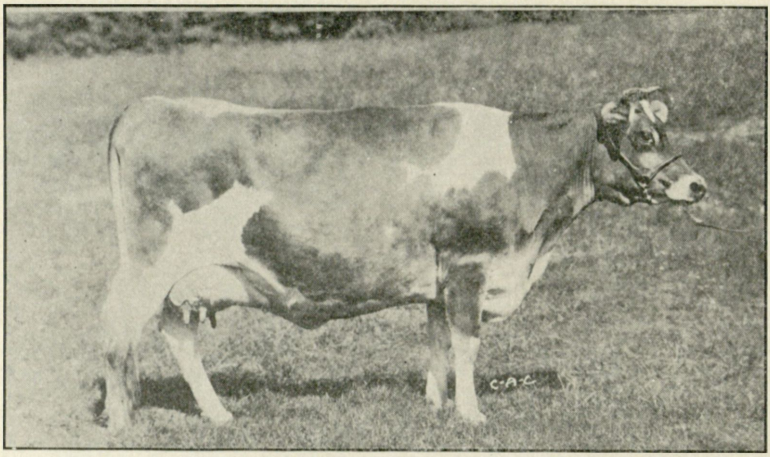


Fig. 24—Blue Fox's Mona 537740. Senior and grand champion Jersey cow. South Carolina State Fair 1926. Owned by South Carolina Experiment Station.

THE COAST EXPERIMENT STATION

As in the past the work at the Coast Station has been largely a continuation of projects designed to cover a number of years of work, and little new or additional work has been carried on during the year. We have made some progress with most of the projects being conducted.

With a few exceptions the crops here have been very good in

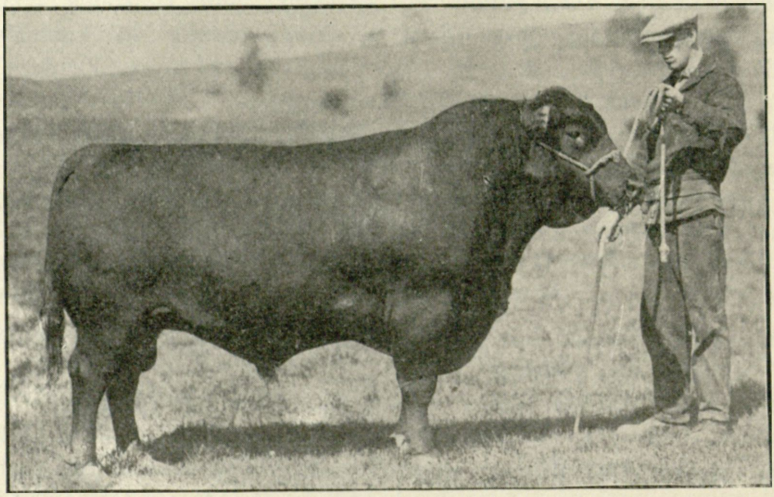


Fig. 25—Parlee 320291, Aberdeen Angus bull, recently purchased to head the herd at the Coast Station.

spite of the unfavorable spring weather conditions. We were fortunate in securing early stands of crops and we had very much better weather conditions later than were had in other parts of the state.

Beef Cattle

Our beef cattle herd was used again during the winter of 1925-1926 to study the cost of wintering a herd of beef cattle in the Coastal region. The herd came through the winter in good condition and made good growth during the summer months on pasture. We have been disposing of all of the grade cattle in the herd as our purebred herd has been built up so that we have now only a few grade cattle on hand. These will be disposed of at an early date, leaving the herd made up entirely of purebred animals. A new herd bull has been purchased replacing our former herd bull.

Pasture Development

Along with our development of the beef herd has gone the

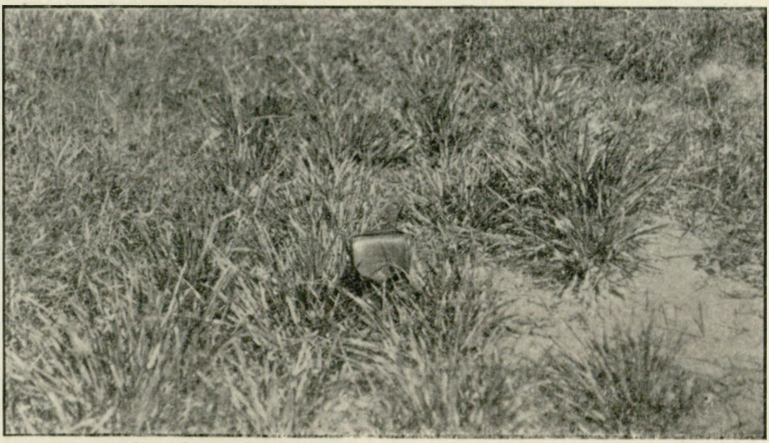


Fig. 26—Bahia grass (Paspalum notatum), Coast Station, 1926. Each bunch two months growth from small cutting.

development of pasture lands. This work has not progressed as rapidly as we desired, but gradual progress along this line has been made each year, and our pastures are showing up better as the grasses become more thoroughly established and as we remove bushes and other weeds. Where fire is kept off of the lands which we are utilizing for pasture development (and this is necessary where we establish grasses) black gum and sweet gum bushes quickly come in, forming a dense shade and it becomes necessary to re-

move these for the proper growth of grass. We have recently introduced several new grasses which are proving of considerable value in areas to the south of us. These grasses are Bahia, which is one of the paspalums, and Centipede grass, which is a creeping grass. Only after it has been determined to what extent they will stand our winters will their value be known.

Rice Experiments

We have continued our work with rice varieties in cooperation with the Division of Cereal Investigations, Bureau of Plant Industry, and progress has been made. We have several bushels of seed rice now which we are distributing for the production of rice for home use in the Coastal region where rice may be planted.

Fig. 27—Delitus rice, Coast Station, September, 1926

Cotton Experiments

With cotton we have continued the following tests: cover crop and rotation, time of applying fertilizer, spacing, variety testing of eighteen varieties, and weevil control work. The spacing test had to be discounted this year on account of a lack of stand. We secured results on the other tests and they have been previously referred to in this report. On the weevil control plats we used for control several substances which have been developed by the Chemical Warfare Service in their search for other poisons which may be used in the place of calcium arsenate. In these tests all of the poisons used seemed to hold the infestation down as well as calcium arsenate. Because of severe injury by excessive rains to the crop on certain areas in the field plats, the data secured on yields are of little or no value this year.

Forestry Experiments

Our forestry work has continued as usual, fire protection being afforded the area given over to this work. In the spring we transplanted some slash pine seedlings to a portion of this area, this was done just prior to a dry spell of weather and many of the seedlings died, we, however, still have a considerable number of these plants living. This is our first effort to transplant to this area, all previous plantings having been made directly from seed.

Miscellaneous Experiments

Nine varieties of corn have been tested, but the yields have not yet been obtained, as is also the case with the corn in the rotation and cover crop work.

We continued our fertilizer studies and source-of-seed studies with Irish potatoes, the results of which are summarized under the section of this report which deals with fruits and vegetables.

Fig. 28—Yates apple, Coast Station, 1926. Planted March, 1920.

During the year we added a number of blueberry plants of the northern varieties to our blueberry test. These plants have made a fair growth but are yet too small to give indications as to the character and yield of fruit under Southern conditions.

The general crops at the station have been very good. A good crop of corn has been made and an excellent crop of oats, while one and a fourth tons of peavine hay was harvested per acre. Our yield of cotton was fourteen bales on approximately nineteen acres. A considerable quantity of cowpeas has been harvested for planting purposes. The sorghum planted for silage although late, turned out a good yield and has been put in silo.

Some clearing of land has been continued at slack times, but no large work along this line has been undertaken. Some of this

land was put in crops this year for the first time and will be improved for further work next year.

THE PEE DEE EXPERIMENT STATION

In soil and climate this station is typical of large areas of the Coastal Plain section not only of this state but of neighboring states, and on this account the United States Department of Agriculture has been willing and anxious to cooperate with us in conducting many important experiments here. We have important cooperative projects under way with the Bureau of Entomology and the Bureau of Plant Industry. Some of the most comprehensive work with fertilizers, peanuts, sweet potatoes and forage crops under way in this country is being conducted at this station. These cooperative arrangements with the different offices of the federal government have greatly increased our facilities for thorough research work at the Pee Dee Station.

Fig. 29—Scene at Pee Dee Station, 1926.

The kind and number of projects conducted this year have been much the same as reported last year, because all of the available land has been assigned to projects that are being continued over a period of years. Additional lands have had to be rented, in fact, to take care of some of the short-time experiments and to provide additional facilities for some of the work of the Division of Boll Weevil Control. The experiments conducted here include nearly all of the crops indigenous to this state and to the South, such as corn, cotton, sweet potatoes, Irish potatoes, peanuts, oats,

velvet beans, soybeans, vetch, rye, and tobacco, as well as such fruits and vegetables as grapes, peaches, plums, strawberries, persimmons, apples, pears, lettuce, cabbage, and celery.

Cotton being the most important money crop of this section as well as of the South, much of our experimental work is done with this crop. Cheap production of cotton in our section is becoming more and more imperative, consequently, we must know more about fertilizers, rotations, varieties, and cultural methods, and then follow where the facts lead. In an effort to obtain this much needed information, many experiments are conducted here with this crop.

Rotations and Fertilizers

The Keitt fertilizer experiments are perhaps the most comprehensive fertilizer studies in this country. These involve 180 tenth-acre plats arranged in four series, three of which are run in a three-year rotation of cotton, corn, and small grain, and the fourth series in cotton continuously. In the rotation series peas are broadcasted in the corn and allowed to remain on the land, and the peas sown after the oats are cut for hay. It is very interesting to note that this rotation has maintained the fertility of the soil for twelve years without any appreciable decrease in the yields, even where no fertilizer was used.

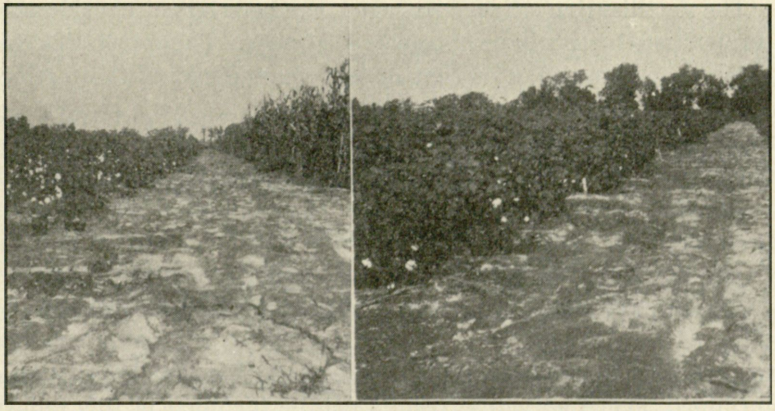


Fig. 30—Left: General view Keitt plots, rotation series A and B, 1926. Right: General view Keitt plots, continuous series D and E, 1926.

We are also studying a two-year rotation where cotton is planted one year and corn the next, as compared with similar plats grown to cotton continuously and others planted to corn every

year. In this series the rotated plats which are not fertilized have of course been decreasing in yield, but the yields of both cotton and corn have been larger than on the plats which are not fertilized and are planted to the same crop continuously. In this cotton-and-corn rotation where sufficient fertilizer is applied each year the yields have not decreased. In all of this work the importance of a complete fertilizer is emphasized, and nitrogen has proven to be more important than any other element in maintaining the yield, especially for corn, small grain and cotton.

Cooperating with the Bureau of Plant Industry, U. S. Department of Agriculture, we are conducting a fertilizer ratio test with both cotton and corn. The results obtained compare very closely with those obtained in the Keitt plots. Again this year the importance of a well balanced fertilizer is clearly shown. In no case where single elements or combinations of two elements were supplied was the yield as good as where a combination of all three plant foods was supplied.

Besides the regular fertilizer ratio experiment which has been running for six years, we have conducted this year, also in cooperation with the Bureau of Plant Industry, another test known as the Concentrated Fertilizer Experiment. Indications are that the concentrated materials are comparable to the less concentrated forms of fertilizer as to yields, etc., per pound of plant food.

The fertilization of corn as usual has been given consideration in proportion to the importance of the crop. The work this year has been a continuation of that of last year. Some of the fertilizer plats are in a three-year rotation while others are in a two-year rotation and several in corn continuously. In the case of corn continuously, we have been unable to keep stands because of the ravages of insects which live over in the old stalks and hence become more and more of a menace from year to year. The entire corn crop this year is fair, though the yield was considerably shortened by dry weather during July. Indications are that heavy applications of nitrogen at the proper time and in a quickly available form will give best results. The yields from this year have not been determined, hence no actual results can be included in this report.

The fertilizer test with Irish potatoes at this station, mentioned elsewhere in this report, is being continued for several years in order that the results may be more comparable.

Plant Breeding and Variety Studies

The breeding of Pee Dee No. 5 corn has been continued this year both by ear-to-row and by field selection, We expect again to receive good reports of this corn in variety tests throughout the South. In the past several years this corn has led in a number of tests. We are still cooperating with the U. S. Department in the breeding of Garrick corn, Dr. C. H. Kyle and Mr. J. M. Hammerly doing the work here. We now have several strains of this corn which promise to be most excellent.

In the variety tests we have 15 varieties of corn and 25 varieties of cotton. Three of these are wilt-resistant. The cotton yields are referred to in another section of this report. The corn yields for 1926 have not yet been determined.

Studies of the Peanut

In cooperation with the Bureau of Plant Industry, we have continued the extensive as well as the comprehensive study with peanuts. This work is under the supervision of James H. Beattie, horticulturist for the Bureau. In this work we have a rotation study, a lime and gypsum test, a spacing test both as to width of rows and distance in drill, a variety test, including a number of foreign selections, fourteen recognized varieties, a test on the effect of storage at different temperatures on germination, the effect of shelling at different dates previous to planting as related to germination, and breeding work with most of the leading varieties and foreign selections. Some of these foreign selections are quite promising and may in time supercede some of our present leading varieties. The crop this year has been harvested but not picked. We are glad to note that this crop is much better both as to quality and quantity this year as compared to previous years.

Sweet Potato Investigations

We are still enjoying the distinction of being one of the two places in the world where all of the recognized varieties of sweet potatoes are grown. Of these varieties, thirty-eight in number, Porto Rico still leads both as to yield and quality. Each year we furnish the college with specimens of the different varieties for class work, fairs for exhibitional purposes, other experiment stations for experimental purposes, and an occasional farmer calls for a new variety which he desires to try.

We have been conducting for the past six years a fertilizer test

under sweet potatoes with results that have been constant from year to year. The 1926 crop has not been harvested but the indications are that the results will be comparable to those of past years. The most striking results have been from the use of potash, the yields having increased with each increase in the potash applied.

Our spacing study of sweet potatoes has been continued, but since the crop has not been harvested no figures are obtainable. We believe this to be a very valuable study in that it is very important to know how to make not only a large yield of potatoes per acre but a large percent of desirable potatoes. This work is designed to give us this much-needed information.

Tobacco

The only experiment conducted with tobacco this year was that of comparing topped with untopped. The topped tobacco produced 205 pounds per acre more than the untopped. Under the prevailing demand for light, thin tobacco this year there was no difference in price of the grades. The return per acre from the topped tobacco was about $45.00 more than from the untopped. The general tobacco crop was satisfactory considering the adverse season prevailing during the spring. The returns were very good. It seems pertinent to make mention here of the numerous inquiries from sections in which no tobacco is planted in regard to the advisability of going into this crop. We write them the facts and offer assistance if requested. There is great danger of overproduction of tobacco, which, unlike cotton, cannot be held without much expense in preparing it for storage; consequently, our farmers should be warned of all the dangers of going into this crop.

Oats

The fertilizer work with oats is the same as that of cotton and corn in the Keitt fertilizer work. Nitrogen seems to be the limiting factor for oats, as is shown by results of this fertilizer work. The general oat crop was fine and we now have on hand about 800 bushels of excellent seed oats.

Legumes and Cover Crops

Legumes were planted in all corn plats and in fields except where the outline of the experiment required that they be omitted. On lands planted to oats, summer legumes are planted and harvested for hay. This practice gives us enough roughage of good quality and at the same time keeps up the humus content and helps main-

tain the fertility of the soil. Cover crops consisting of rye alone, rye and vetch, and oats and vetch were sown on some of the lands in the fall and were turned under in early spring. On one acre in the sweet potato, peanut, and oats and vetch rotation, we harvested 3,516 pounds of oats and vetch hay and 1,940 pounds of peavine hay, making a total of 5,456 pounds of hay per acre this year.

Hog Feeding Experiments

Hog feeding experiments are conducted here in cooperation with the Animal Husbandry Division and reference has already been made to some of the results under the section on Experiments with Livestock. This year at the Pee Dee Station we have arranged our tests so as to include the following: soybeans plus a two percent corn ration, soybeans and corn grown together, soybeans and corn grown separately, and standing corn and tankage. We are this year planting two varieties of soybeans, one early and one later, so as to prolong the grazing period.

The latest of these feeding experiments was begun here on October 12, 1926. The hogs on test will be shipped to the U. S. Laboratories for slaughter and for a determination of the quality of pork produced by the different rations.

PUBLICATIONS

The increased demand for publications of the Experiment Station which has been noticeable in the last half dozen years continues, notwithstanding the fact that the Extension Service publications meet a larger part of the popular demand for agricultural information. It is very evident that there is a growing interest in scientific agriculture and consequently a greater appreciation of agricultural research work. The result is that supplies of Experiment Station publications are used up rapidly, so that there is urgent need for new publications as soon as new information becomes available through research. The demand is particularly noticeable in certain lines of agriculture which have become more popular under changing conditions.

The mailing list of the station now contains nearly 6,000 names and new names are being added more rapidly than formerly. However, no "dead" names are allowed to remain very long on the list, which is kept closely revised. The mailing list is so classified that any given publication is sent only to those who have asked for information on the subject to which the publication belongs. In this way much waste of printed material is prevented.

Publications Issued

During the fiscal year eight new publications were issued as follows:

Bulletin 224, "Analyses of Commercial Fertilizers."
Bulletin 225, "Cotton Experiments at Florence."
Bulletin 226, "Price Economics of What Farmers Sell."
Bulletin 227, "Sources of Ammonia."
Bulletin 228, "Soybean Forage for Hogs."
Bulletin 229, "Analyses of Commercial Fertilizers."
Bulletin 230, "Farming for Profits."
Thirty-eighth Annual Report for the year ending June 30, 1925.

Experiment Station Library

The Experiment Station Library was housed during most of the fiscal year in temporary quarters in the Textile Building. Near the end of the year the material accumulated since the fire of April 2, 1925, was moved to the new quarters in the reconstructed Library-Agricultural Building.

Mrs. Helen Sloan Torrence, Librarian, continued to accumulate, arrange and have bound, material coming through gifts and purchases so that by the end of the fiscal year a very considerable body of material was on hand for a new start. Mrs. Torrence resigned effective at the end of the fiscal year.

Under the new arrangement whereby the management of the library of the South Carolina Experiment Station is merged with the management of the college library, effective July 1, 1926, this work passes from the control and management of the Division of Publications. It is hoped and believed that the new arrangement will prove advantageous in many respects.

Publicity Work

The usual practice has been followed of writing News Letters and special articles for The Weekly News Notes and for newspapers and agricultural journals, calling attention to the new publications of the station and to older publications of new importance, and special articles have been prepared summing up various phases of research work for the benefit of the public. Articles by various members of the station staff have also been prepared and given publicity through the Division of Publications, and otherwise. The material in these articles is, of course, based largely on the results of our research work as conducted during the fiscal year or before.

In this way the public is given a wider and better knowledge of the work which the station does, and this in turn enables us to be of great service to the public. No opportunity is lost to remind the public of the need and value of agricultural research.

RURAL ELECTRIFICATION

Electricity is needed in the country for two purposes; first, to produce light and power for increasing the efficiency of the farm; and, second, for providing comforts and conveniences for the farm homes.

The application of power to farming practices has been one of the greatest achievements of American agriculture and American inventive genius. Since the early days our production per man has been gradually on the increase as a result of greater use of horse power and motor power in place of hand labor. Sixty years ago it required three hours of man labor to produce one bushel of wheat. By the most improved methods of the present time the same result can be accomplished by nine minutes and fifty-eight seconds of man labor. In the early days of American history it required eighty per-cent of the population to produce food and feed and fiber to supply the needs of the entire population. Today it takes less than one-third of the population to supply all of the staple crops. This change has resulted largely from the use of power on the farm. There is reason to believe that the efficiency of the individual can be still further increased by proper use of power. Electric power is already being used successfully to replace other forms of power on the farms and the economy, convenience and efficiency of electric power over other forms has already been demonstrated.

The sociological aspects of the question are also important. Many of our most progressive leaders agree that what we need most at the present time is not more farmers but better farmers. In other words, we are badly in need of some development which will cause our best farmers and most intelligent people to be content to remain on the farms. Experience indicates, however, that we need not expect this until means have been provided for furnishing the conveniences and comforts in the country homes that electricty now furnishes for the urban homes. Until this can be done and farm women can be relieved of a large part of the drudgery which they now endure, until some of the conveniences which electricity can supply can be made available in rural communities, agriculture can not successfully compete with commerce and industry for the ser-

vices of the most intelligent and progressive of our people. To build and maintain an enduring agriculture it is necessary that we have our best minds thinking and working on rural problems and living with these problems in the country.

The relation of electricity to agriculture and to rural development is a question that is demanding the attention of our agricultural leaders in all sections of this country. In South Carolina the movement took definite shape in February, 1926, when President E. W. Sikes, of Clemson College, called a group representing the agricultural and power interests to meet in Greenville. At this meeting, after a full discussion of the subject, a State Committee on the Relation of Electricity to Agriculture was organized. On this committee Major E. B. Cantey, of Columbia, and Mr. H. A. Orr, of Anderson, represent the power and public utility interests, Messrs. J. W. Shealy, Commissioner of Agriculture, and K. W. Marett, of Westminster, represent the farmers, and Professors S. B. Earle, J. T. McAlister and H. W. Barre, of Clemson College, the industrial and agricultural educational interests. The committee organized by selecting Director H. W. Barre, of the South Carolina Experiment Station, chairman and J. T. McAlister secretary and began its work by studying some of the perplexing problems involved in supplying electrical current to rural communities on an economic basis and at reasonable rates. The committee hopes to function as a fact-finding and fact-interpreting agency and help solve some of these problems. They not only desire to learn how electricity can be used to reduce the cost of farm operations, to improve the quality of farm production and to better living conditions on the farm, but they realize that before electric service can be supplied to the thinly populated rural sections, current will have to be used in much larger quantities than is ordinarily required for lights and for the smaller power units and conveniences. A rather general survey indicates that many of the lines that have been built in rural communities have lost money for the utilities and power interests because of the fact that the current is not used in sufficient quantities to make the lines profitable. If we are going to put rural electrification on a sound economic basis therefore, it is necessary to learn first how much one can afford to spend for line extensions and what profitable applications can be made of electric current on a farm.

Studies made elsewhere indicate that there are certain types of agriculture which lend themselves readily to a profitable use for electric current, such as poultry farming, dairy farming, irrigation,

and intensive truck and fruit growing. One handicap that this work suffers in the South is the lack of sufficient capital on the part of the rural people to pay the initial cost of much of the equipment that is so badly needed in the home. It would seem that there is a possibility of designing equipment for rural homes which might be less expensive and just as satisfactory from the standpoint of service and current consumption.

Some of these problems are now being solved by work in other states. We only need to have the results applied to our conditions. The South Carolina Committee is very hopeful that funds will be made available for such demonstrations as will convince both farmers and power interests of the place of electricity in agriculture. The committee realizes that this problem is one that has a very important bearing on the future of agriculture as well as the future of power development and is shaping its plans just as rapidly as funds are available for pushing the work forward.

PROJECTS UNDER WAY

The following is a list of projects now under way:

Agronomy Division

A study of the factors influencing cost of producing cotton, corn, small grains, hay and other crops.

Cotton culture and spacing tests.

Ear-to-row breeding work with corn.

Effects on corn of companion cropping with legumes.

General comparative fertilizer tests.

Comparative tests of phosphoric fertilizers.

Comparative tests of potash fertilizers.

Comparative tests of sources of nitrogen.

Variety tests with corn.

Variety tests with cotton.

Variety tests with wheat.

Variety tests with oats.

Variety tests with barley.

Variety tests with sorghum.

Variety tests with peanuts.

Variety tests with velvet beans.

Comparative tests of grasses and forage crops.

Tests with imported grasses and forage plants.

Plant-to-row selection of wheat.

A study of factors influencing oil content of cotton seed.

Comparative tests of nitrogenous fertilizers at the Pee Dee and Coast Stations.

General comparative fertilizer tests with cotton, corn, and small grain at the two substations.

Breeding work with cotton.

Breeding work with corn.

Breeding work with wheat.

Breeding work with barley.

Breeding work with rye.

Tests on time of applying potash to cotton.

Test on time and method of applying fertilizers to cotton .

Test of theoretical amount of fertilizer compared with popular formulas.

The comparative value of different legumes as soil improvers when used in rotation with cotton and corn.

General comparative fertilizer tests conducted in cooperation with farmers on various soil types.

Animal Husbandry Division

Investigation of factors influencing the hardness of fat in hogs.

Tests with the breeds of sheep.

Comparative tests of peanuts, sweet potatoes, soybeans, velvet beans and corn for pork production.

Cost of producing hogs.

Comparative tests of value of vegetable or animal proteins in feeding hogs.

Hog feeding experiments with Berkshires.

Botany Division

A study of the factors influencing the growth and development of cotton buds and bolls.

A study of rust resistance in small grains.

Plant disease survey.

Miscellaneous cotton disease investigations.

Forestry experiments to determine methods of seeding and rate of growth of various species.

Influences of temperature on germination of cotton seed and growth of seedlings.

Dairy Division

Preparation and economic uses of hay in feeding dairy cattle.

The determination of the most economical carbohydrate concentrate to balance the dairy ration in the South.

The prepotency of bulls.

Corn silage as compared with sorghum silage for milk production.

The feed required and the cost of raising dairy calves.

Line-breeding and out-crossing as systems of breeding dairy cattle.

Line-breeding of Holsteins.

Official testing of dairy cows in the state.

A study of the influence of different feeds on growth and development of dairy heifers.

A study of the relationship between certain mineral elements of farm-grown roughages and the mineral content of the soil.

Entomology Division

Tomato fruit-worm studies.

Investigation of the biology and control of the Mexican bean beetle.

Investigation of pecan insects.

The influence of different factors on the hibernation of the boll weevil.

Dusting as a means of boll weevil control.

The toxicity of insecticides.

Corn bill-bug investigations.

Corn weevil studies.

A study of the biology and control of the cotton flea-hopper.

A study of the persimmon psylla.

Horticultural Division

Nitrate of soda tests on bearing peach trees.

Fertilizer tests on young and bearing peach trees.

Variety tests with apples and grapes.

Methods of pruning bunch grapes.

Tests of sources of Irish potato seed.

Fertilizer tests on Irish potatoes.

Comparison of certified and noncertified potato seed.

Breeding work on Lookout Mountain potatoes.

Fertilizer tests on lettuce.

A study of methods of propagating apples.

Pollenation studies with apples.

Boll Weevil Control Division

Field tests with various makes and kinds of machinery for applying poison to cotton.

Effect of quality of cotton seed on yield, staple, lint percentage, and money value per acre.

Effect of topping cotton on rate of fruiting and development and yield.

Effect of pruning on fruiting of cotton.

Effect of time of planting on development and fruiting of cotton.

Effect of seed treatment on yield, etc., of cotton.

Tests of methods of cultivating cotton.

Effect of late cultivation.
Hill test of cotton.
Cotton spacing tests.
Effect of fertilizers on fruiting habits of cotton.
Time of applying fertilizers to cotton.
Cotton variety tests.

Agricultural Economics Division

A continuous farm management study of cotton farms in Anderson county, South Carolina.

Special farm management studies.

Farm business and cost-of-production studies with farmers.

Problems in taxation.

Land prices and cycles.

The comparative advantages of various forms of intermediate and long-time credit.

Investigations into the attitude of farmers to the marketing contract of the cooperative cotton and tobacco associations in South Carolina.

Investigations into the foreclosures of farms since 1919.

Production, supply and demand studies.

Measuring purchasing power of farmers.

Cotton marketing investigations.

Route study of farm business and cost of production.

The place of livestock in the Coastal Plain region.

Economic and social effects of membership in cooperative organizations upon the farmers of South Carolina.

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION

In Account With

THE UNITED STATES APPROPRIATIONS, 1925-1926

	Hatch Fund	Adams Fund	Purnell Fund
DR.			
To balance from appropriations for 1924-25	$ 0.00	0.00	0.00
Receipts from the Treasurer of the United States, as per appropriations for fiscal year ended June 30, 1926, under acts of Congress approved March 2, 1887 (Hatch Fund), March 16, 1906 (Adams Fund), and February 24, 1925 (Purnell Fund)			
CR.			
By salaries	$ 8,378.32	$10,278.32	$ 7,000.00
Labor	1,121.20	2,482.71	6,523.46
Stationery and office supplies	285.94	38.10	232.65
Scientific supplies, consumable	94.15	333.25	18.53
Feeding stuffs	0.00	0.00	802.62
Sundry supplies	508.31	189.98	172.12
Fertilizers	374.21	300.00	39.00
Communication service	258.73	113.40	112.73
Travel expenses	154.57	426.97	2,482.17
Transportation of things	50.45	13.87	20.46
Publications	518.68	0.00	1,215.62
Heat, light, water, and power	232.30	0.00	1.34
Furniture, furnishings, fixtures	383.77	30.00	877.85
Library	1,191.09	6.80	96.24
Scientific equipment	4.61	652.13	136.57
Livestock	350.00	0.00	0.00
Tools, machinery, and appliances	1,068.04	134.47	161.15
Buildings and land	25.63	0.00	107.49
Contingent expenses	0.00	0.00	0.00
Balance	0.00	0.00	0.00
Total	$15,000.00	$15,000.00	$20,000.00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the South Carolina Agricultural Experiment Station for the fiscal year ended June 30, 1926; that we have found the same well kept and classified as above; that the balance brought forward from the preceding year was $0.00 on the Hatch Fund and $0.00 on the Adams Fund; that the receipts for the year from the Treasurer of the United States were $15,000.00 under the act of Congress of March 2, 1887, $15,000.00 under the act of Congress of March 16, 1906, and $20,000.00 under the act of Congress of February 24, 1925, and the corresponding disbursements $15,000.00, $15,000.00 and $20,000.00; for all of which proper vouchers are on file and have been by us examined and found correct, leaving balances of $0.00, $0.00 and $0.00, respectively.

And we further certify that the expenditures have been solely for the purposes set forth in the acts of Congress approved March 2, 1887, March 16, 1906, and February 24, 1925, and in accordance with the terms of said acts, respectively.

(Signed) L. A. SEARSON, C. P. A., Auditor

Attest:
S. W. Evans, Treas., Custodian.

SUPPLEMENTARY STATEMENT, 1925-26

Funds of the Experiment Station other than those from Federal Sources

DR.

Sources of Funds

Sources	Balance from Previous Years	Receipts for 1926	Total
1. State appropriations	$	$ 72,255.01	$ 72,255.01
2. Sale of produce	1,805.21	42,363.27	44,168.48
Total	$1,805.21	$114,618.28	$116,423.49

CR.

Classification of Total Expenditures from Supplementary Funds

Salaries	$ 34,368.71
Labor	29,279.04
Stationery and office supplies	507.98
Scientific supplies, consumable	22.00
Feeding stuffs	13,136.09
Sundry supplies	5,776.94
Fertilizers	5,681.89
Communication service	358.82
Travel Expenses	4,598.85
Transportation of things	1,122.56
Publications	2,093.34
Heat, light, water, and power	3,437.50
Furniture, furnishings, and fixtures	220.38
Library	21.19
Scientific equipment	272.74
Livestock	2,439.24
Tools, machinery, and appliances	5,303.22
Buildings and land	5,459.47
Contingent expenses	93.93
Unexpended balance	2,229.50
TOTAL	$116,423.49