Sixty-Fourth Annual Report

Of The

South Carolina Experiment Station

Of

Clemson Agricultural College

H. P. COOPER, Director

FOR THE YEAR ENDED JUNE 30, 1951

Clemson, S. C. December, 1952

Sixty-Fourth Annual Report

Of The

South Carolina Experiment Station

Of

Clemson Agricultural College

H. P. COOPER, Director

FOR THE YEAR ENDED JUNE 30, 1951

Clemson, S. C. December 1952

AGRICULTURAL EXPERIMENT STATION STAFF

BOARD OF CONTROL

J. B. Douthit, Jr., Chairman ---------- Pendleton, S. C.
R. M. Cooper, Ex-Officio ---------- Wisacky, S. C.
T. B. Young ---------- Florence, S. C.
Paul Sanders ---------- Ritter, S. C.
F. E. Cope ---------- Cope, S. C.
W. A. Barnette ---------- Greenwood, S. C.
J. F. McLaurin ---------- Bennettsville, S. C.

R. F. Poole, Ph.D., D.Sc., LLD., Litt.D. ---------- President
H. P. Cooper, Ph.D. ---------- Director

AGRICULTURAL ECONOMICS

G. H. Aull, Ph.D. ---- Head of Department
*F. O. Black, M. A.---Agricultural Statistician
V. A. Boyd, M. S.---Assoc. Rural Sociologist
*C. P. Butler, M. S.---Agricultural Economist
D. E. Crawford, M. S.---Asst. Agr. Economist
C. L. Crenshaw, M. S.--Asst. Agr. Economist
C. D. Evans, M. S. -- Asst. Agr. Economist
W. T. Ferrier, Ph.D.--Agricultural Economist
L. D. Malphrus, M. S. Assoc. Agr. Economist
J. F. Miles, Ph.D.----Assoc. Agr. Economist
D. L. Peery, M. S.----Asst. Agr. Economist
†C. R. Smith, Ph.D.----Assoc. Agr. Economist
H. L. Streetman, M. S. Asst. Agr. Economist
*J. S. Taylor, B. S.---Assoc. Agr. Statistician
B. J. Todd, M. S.----Assoc. Agr. Economist

AGRICULTURAL ENGINEERING

G. B. Nutt, M. S.------Head of Department
H. E. Bland, B. S.------Asst. Agr. Engineer
*J. T. Craig, B. S. Agent, Junior Agr. Engineer
G. H. Dunkelberg, M. S. Assoc. Agr. Engineer
W. P. Law, B. S.-----Assoc. Agr. Engineer
C. M. Lund, B. S.------Asst. Agr. Engineer
*J. K. Park, M. S.----Agricultural Engineer
H. O. Vaigneur, B. S.---Asst. Agr. Engineer

AGRONOMY

W. R. Paden, Ph.D. Head of Station Department
H. G. Allbritten, Ph.D.---Assoc. Agronomist
*O. W. Beale, M. S.----------Soil Scientist
E. B. Eskew, M. S.-------Assoc. Agronomist
R. H. Garrison, B. S.---Assoc. Plant Breeder
C. A. Fennell, B. S.------Asst. Agronomist
†D. H. Horton, M. S.-------Asst. Agronomist
N. R. Page, M. S.-------Assoc. Agronomist
T. C. Peele, Ph.D.----------Soil Scientist
M. M. Phillippe, Ph.D.---Assoc. Agronomist
A. B. Prince, Ph.D.------Assoc. Agronomist
*E. H. Stewart, M. S.----------Soil Scientist

ANIMAL HUSBANDRY

L. V. Starkey, M. S.----Head of Department
G. W. Anderson, D.V.M., M. S. Animal Pathologist
C. A. Dodson, B. S. Asst. in Animal Pathology
E. G. Godbey, B. S.----Animal Husbandman

BOTANY AND BACTERIOLOGY

G. M. Armstrong, Ph.D.--Head of Department
W. B. Albert, Ph.D. Assoc. Plant Physiologist
*Joanne K. Armstrong, Ph.D.---------Agent
C. H. Arndt, Ph.D.-------Plant Pathologist
C. C. Bennett, B. S.--------Asst. in Botany
H. H. Foster, Ph.D. Assoc. Plant Pathologist
N. B. Goebel, M. S.---------Assoc. Forester
*D. H. Petersen, M. S.---Agent (Pathologist)

CHEMISTRY

J. H. Mitchell, M. S.----Head of Department
E. J. Lease, Ph.D.----------Nutritionist
D. B. Roderick, B. A.--------Asst. Chemist

DAIRY

J. P. LaMaster, M. S.---Head of Department
G. M. Barnett, B. S.------Assoc. Dairyman
*G. W. Brandt, M. S. Assoc. Dairy Husbandman
C. C. Brannon, B. S.------Assoc. Dairyman
Victor Hurst, Ph.D. Assoc. Dairy Husbandman
J. W. Kelly, B. S.--------Asst. in Dairying
W. A. King, Ph.D.------Dairy Husbandman
C. H. Strickland, B. S.----Asst. in Dairying

ENTOMOLOGY

M. D. Farrar, Ph.D.----Head of Department
W. F. Chamberlain, Ph.D. Assoc. Entomologist
J. H. Cochran, Ph.D.----Assoc. Entomologist
David Dunavan, M. S.---Assoc. Entomologist
W. H. Purser, M. S.-----Asst. Entomologist

FARMS

C. S. Patrick, B. S.----Head of Department

HOME ECONOMICS

Ada M. Moser, M. S.----Head of Department
Mary Kendall Downing, B. S. Asst. Home Economist
Florence E. Roach, B. A. Asst. in Home Economics
Elizabeth S. Watson, M. A. Assoc. Home Economist

---

*In cooperation with the United States Department of Agriculture.
†On leave.

HORTICULTURE

A. M. Musser, B. S.____Head of Department
*J. T. Bregger, M. S.
Senior Soil Conservationist
J. H. Crawford, B. S.____Asst. Horticulturist
O. B. Garrison, Ph.D._____Horticulturist
J. A. Martin, B. S.____Assoc. Horticulturist
H. J. Sefick, M. S.____Assoc. Horticulturist
L. O. Van Blaricom, M. S.
Assoc. Food Technologist

POULTRY

C. L. Morgan, M. S.____Head of Department
M. A. Boone, M. S._____Assoc. Poultryman
C. P. Willimon, B. S.
Asst. in Poultry Husbandry

PUBLICATIONS

S. C. Stribling, B. S.____Agricultural Editor
Evelyn D. Metz, B. A.____Asst. Agr. Editor
Doris A. Timmerman, B. A.
Asst. Agr. Editor

VETERINARY

R. O. Feeley, D. V. S._____Veterinarian

COAST STATION

Summerville, S. C.

E. D. Kyzer, B. S._____Superintendent
S. G. Woods, B. S.
Asst. Animal Husbandman

EDISTO STATION

Blackville, S. C.

W. B. Rogers, B. S._____Superintendent
Robert Aycock, Ph.D._____Plant Pathologist
W. A. Balk, B. S._____Assoc. Agr. Engineer
*A. H. Bennett, B. S.____Asst. Agr. Engineer
J. C. Etheredge_____Field Assistant
J. H. Horton, Jr., Ph.D._Assoc. Agronomist
J. H. Hoyert, Ph.D._____Assoc. Agronomist
Morris B. Hughes, Ph.D._____Horticulturist
Donald W. Newsom, Ph.D.
Assoc. Horticulturist
M. R. Powers, B. S._____Agr. Engineer
J. G. Watts, M. S._____Entomologist

PEE DEE STATION

Florence, S. C.

E. E. Hall, M. S._____Superintendent
*Norman Allen, M. S._____Entomologist
*J. F. Bullock, M. S._____Agronomist
J. F. Chaplin, M. S._____Asst. Agronomist
*L. C. Fife, M. S._____Entomologist
*Z. T. Ford, B. S._____Agent
*T. W. Graham, Ph.D._____Agent
†*Sam Hagar, M. S._____Geneticist
*D. C. Harrell, B. S.
Agent (Assoc. Agronomist)
F. M. Harrell_____Research Assistant
†C. R. Hodge, B. S._____Asst. Entomologist
Q. L. Holdeman, Ph.D.
Assoc. Plant Pathologist
A. R. Hopkins, B. S.____Asst. Entomologist
*W. H. Jenkins, B. S._____Agronomist
Vernon M. Kirk, Ph.D._Assoc. Entomologist
Alfred Manwiller, Ph.D.
Assoc. Plant Breeder
L. J. Reep, B. S._____Asst. Agronomist
*W. H. Rolfe, B. S._____Agent
*W. E. Vaught_____Agent
†*R. L. Walker, B. S.____Asst. Entomologist
*W. D. Yeargin_____Agent

SANDHILL STATION

Route 3, Columbia, S. C.

J. A. Riley, M. S._____Superintendent
R. H. Hawkins, M. S.____Assoc. Agronomist
†R. J. Higdon, M. S._____Asst. Horticulturist
W. M. Manning, Jr., B. S.
Asst. Horticulturist

TRUCK STATION

Post Office Box 158, St. Andrews Branch
Charleston, S. C.

W. C. Barnes, Ph.D._____Superintendent
*Frank P. Cuthbert, Jr., B. S.
Asst. Entomologist
*Oliver T. Deen, B. S.____Assoc. Entomologist
W. M. Epps, Ph.D.
Assoc. Plant Pathologist
*W. J. Reid, Jr., B. S._____Entomologist
W. T. Scudder, Ph.D.__Assoc. Horticulturist

CROP PEST COMMISSION AND SEED CERTIFICATION

M. D. Farrar, Ph.D._____Entomologist
G. M. Armstrong, Ph.D.__State Pathologist
G. M. Anderson, B. S.
Asst. State Pathologist
J. A. Berly, B. S._____Entomologist
C. A. Fennell, B. S._____Asst. Agronomist
R. H. Garrison, B. S.
Assoc. Plant Breeder in charge Seed Certification
†D. H. Horton, M. S._____Asst. Agronomist
W. H. Purser, M. S.____Asst. Entomologist
J. K. Reed, M. S._____Assoc. Entomologist

FERTILIZER INSPECTION AND ANALYSIS

B. D. Cloaninger, M. S._Head of Department
Janice S. Adams, B. A.__Assistant Chemist
J. T. Foy, B. S._____Chemist
J. W. Gillespie, B. S._____Assistant Chemist
E. E. Leslie, B. S._____Assistant Chemist
H. J. Webb, Ph.D.
Chief Chemist and Toxicologist

---

*In cooperation with the United States Department of Agriculture.
†On leave.
(Staff list compiled September 15, 1952.)

Letters of Transmittal

Clemson, S. C.
February 1, 1952

DR. R. F. POOLE, *President*
The Clemson Agricultural College

Dear Sir:

I have the honor to submit herewith the Sixty-Fourth Annual Report of the South Carolina Experiment Station for the fiscal year ended June 30, 1951.

Yours very truly,

H. P. COOPER, *Director*
S. C. Experiment Station

Clemson, S. C.
February 1, 1952

HON. R. M. COOPER, *President Board of Trustees*
The Clemson Agricultural College

Dear Sir:

I beg leave to submit herewith the Sixty-Fourth Annual Report of the South Carolina Experiment Station.

Yours very truly,

R. F. POOLE, *President*
The Clemson Agricultural College

Clemson, S. C.
February 1, 1952

HON. J. F. BYRNES
Governor of South Carolina

Sir:

I have the honor to submit herewith the Sixty-Fourth 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 several states, organized under the provisions of an Act approved July 2, 1862.

Respectfully submitted,

R. M. COOPER
President, Board of Trustees
The Clemson Agricultural College

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

The Sixty-Fourth Annual Report of the South Carolina Experiment Station

INTRODUCTION

The research program of the South Carolina Agricultural Experiment Station has been planned to aid in meeting the postwar agricultural problems. The recent rapid expansion of industrial plants in the region has decreased the supply of farm labor and made it necessary to mechanize many of the farm production operations. The more general use of mechanical power on the farms has resulted in a marked shift in the commodities produced on many farms. One of the most significant changes has been from the production of row crops to more small grain and sod crops. This shift to the production of fewer row crops has been a very significant factor in establishing the more satisfactory soil conservation practices on many of our commercial farms.

The utilization of more motor power on the farm has made it possible for the average farm worker to produce more crops than he can harvest. The most efficient utilization of farm labor makes it highly desirable that agricultural enterprises not requiring a large amount of hand labor be included in the production program with such major cash crops as cotton, tobacco, and sweet potatoes which require a large amount of hand labor in harvesting operations.

The southeastern forested area of the United States has a favorable climate, but the soils are relatively low in plant nutrients required for field crop production. The relatively high rainfall of the region has resulted in many of the soils being depleted of nutrients by leaching. The majority of our soils require mineralization for the successful production of most forage and pasture crops.

Extensive experiments and demonstrations have shown that it is possible to successfully include grassland farming in our agricultural production program. The relatively low amount of hand labor required in many grassland farming operations makes this type of agriculture desirable in areas where industrial plants have employed a large proportion of the rural people.

The recent social and economic trends suggest that we may expect more specialization on individual farms. There will be a demand for a wide variety of agricultural products to supply local demands. Such commodities as fruit, vegetables, and poultry products require highly specialized production programs. The production of the less perishable products will require a more extensive land-use

program where more emphasis will be placed on labor returns rather than on returns per acre.

The prospect for surplus farm commodities for the next few years will require constant readjustments in our agricultural production activities. The successful conversion of much of our row cash-crop land to grassland enterprises will require much more emphasis upon the fertility requirements of the different feed crops, particularly the forage crops. The native virgin soil fertility of most forest areas is not high enough for the most economical production of many of the more desirable forage crop plants. The mineral content of virgin grassland soils is usually much higher than in forest soils. The successful establishment of profitable grassland enterprises in our area will be determined by economic conditions being such that it will be profitable to add sufficient fertilizers and lime to mineralize our soil.

If the agricultural enterprises which are largely dependent upon the use of forage crops do not yield adequate income to make it profitable to mineralize our soil, our livestock enterprises will have to be largely confined to types of livestock, such as poultry, hogs, and dairy cattle, which consume relatively large quantities of seed and other concentrated feed products.

In the past, most of our crop production enterprises have been with cash crops which respond to applications of nitrogen, phosphorus, and potash—the primary nutrients in mixed fertilizer. The successful production of native grassland crops in the forested areas on many of our soils will require the addition of some of the secondary plant nutrients, including calcium and sulfur, also some of the minor nutrients, such as magnesium, manganese, zinc, iron, copper, boron and molybdenum, in addition to the three primary fertilizer constituents.

The relatively high soil fertility requirements of the most desirable grassland forage crops will require extensive soil fertility investigations to determine the optimum fertilizer practices needed on the different soils to mineralize the soils to the extent required for the most successful production of the different forage crop plants.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

Attainable Agricultural Production Very Great
(G. H. Aull)

Events of the past few decades have emphasized the importance of maintaining the economy of this country at a high level of production, not simply as a result of wartime necessity, but as an effective device for the maintenance of peace. Agriculture's part in this program has been considerable, for not only have large numbers of farm people been drawn into essential industries, but those who remained in agriculture have been called upon for an ever increasing volume of farm products.

Because of the pressures which the total economy has placed upon agriculture, it becomes necessary at times to look ahead, say even 5 years in the future, in an effort to appraise its productive capacity. Such an appraisal of South Carolina agriculture was made about 1945, and it is gratifying to note that the 1950 potentials visualized at that time were generally realized and in some instances exceeded.

A similar appraisal was completed in 1951 in which an attempt was made to evaluate needs and resources and to suggest a level of attainable production by the year 1955.[1] A few figures will suffice to indicate the nature and extent of the changes which are within the realm of reasonable expectation during the 5-year period between 1950 and 1955. For example, as to land use, increases of 32 percent in rotation and permanent pastures and 39 percent in acreage devoted to lespedeza hay are indicated along with a decrease of more than 50 percent in the acreage of idle land. Substantial increases in crop yields are also attainable. The following are representative of changes expected: Corn yields up 57 percent from 23 bushels to 36 bushels per acre; oat yields up 54 percent; tobacco yields up 15 percent; cotton yields up 41 percent; and wheat yields up 111 percent.

These yield and acreage changes will call for the application in 1955 of 57 percent more nitrogen (N), 69 percent more phosphoric acid (P_2O_5), and 86 percent more potash (K_2O) than was used in 1950. They will also call for an increase of 79 percent in the number of farm tractors—from about 31,000 in 1950 to 53,000 in 1955.

Physical Injuries Costly in Marketing Potatoes
(B. J. Todd and G. H. Aull)

A high proportion of the early Irish potatoes produced in the Southeast have some physical defects when they reach the terminal

[1] Attainable production figures represent the combined judgment of agricultural economists and production specialists.

market. These defects constitute an important economic loss and hence add to marketing costs.

A recent study reveals that many physical injuries in the picking up of early Irish potatoes can be eliminated by using rubber-coated wire baskets as pick-up containers.[1] Potatoes picked up by regular pickers with no more than usual care were found to contain only about 3 pounds of injured potatoes per 100 pounds when deposited in rubberized baskets, as compared with 6 pounds of injured potatoes per 100 pounds when picked up in wooden hampers, and 12 pounds when picked up in wire baskets.

Tests conducted with diggers suggest that further reduction in physical injuries may be accomplished by some modifications on the digger chain. Potatoes dug with the conventional digger under usual conditions contained 7 pounds of injured potatoes per 100 pounds. On the other hand, injuries occurred to only 1.5 pounds of potatoes per 100 pounds when the potatoes were dug under the same conditions, but with rubber flaps attached to the digger frame to protect the potatoes from the link ends of the chain and with every second, or "off-set" up, link of the chain covered with rubber tubing.

Further tests conducted with both the conventional digger and modified digger revealed that speed has considerable influence on the amount of injuries. With the conventional digger, without modifications, and at speeds of under 2.5 miles per hour, physical injuries occurred at the rate of 3.5 pounds for every 100 pounds dug. When speed of digging was increased to between 2.5 and 3.0 miles per hour, the amount of injuries increased to 5.0 pounds per hundred weight. At speeds of over 3.0 miles per hour the amount of injuries increased to 9.7 pounds per hundred.

Similar tests were conducted with the conventional digger but using rubber tubing and protective flaps on the digger chain. The results of this test indicate that at speeds of less than 2.5 miles per hour the protective devices reduced injured potatoes from 3.5 percent of the total by weight to 1.1 percent. At speeds of 2.5 to 3.0 miles per hour the figure was 1.3 percent, as compared with 5.0 percent for the conventional digger, and at speeds of over 3.0 miles per hour 1.6 percent, as compared with 9.7 percent for the conventional digger.

Orangeburg County Offers Ample Truck Crop Markets and Facilities

(B. J. Todd)

Orangeburg County is one of the leading counties in South Carolina in the production of truck crops. Its wide range of truck crops

[1] Cooperative study of the agricultural experiment stations in Alabama, Florida, North Carolina, South Carolina, and Virginia, with the Bureau of Agricultural Economics, and the Bureau of Plant Industry, Soils, and Agricultural Engineering, USDA.

includes such crops as sweet potatoes, green beans, green peas, cucumbers, squash, cabbage, lima beans, tomatoes, sweet corn, and Irish potatoes. Obviously this diversity of truck crops gives rise to some serious marketing problems.

Markets for truck crops are now located at Orangeburg, Holly Hill, North, Providence, Eutawville, Norway, and Branchville. In addition there are several markets in adjacent counties. A study of the truck-crop marketing situation in Orangeburg County in cooperation with the State Marketing Commission reveals also that a considerable percentage of the truck crops produced in the county are marketed at the Farmers' Wholesale Market in Columbia. On the basis of these surveys, it appears that there is no real need for new marketing facilities in this area at this time. Expanded educational programs designed to encourage farmers to market high quality products, use existing outlets, and install more modern grading and packing equipment would add more to the improvement of the truck-crop marketing system in Orangeburg County than could be added by any new facilities.

Colleton Needs Market Shed for Truck Crops
(B. J. Todd)

Acreage of commercial vegetable crops has followed an upward trend in Colleton County during the last decade. In 1939 the acreage of commercial vegetables totaled 982 acres compared with 2,592 acres in 1951. Cucumbers, green beans, watermelons, and tomatoes make up the major truck crops in the area.

Results of a survey of truck-crop marketing in Colleton County, made at the request of the State Marketing Commission, indicate that apparently local markets and facilities have not kept pace with the increases in acreage and production. Markets for cucumbers are located at Walterboro, Cottageville, and Smoaks. Most other commodities are sold at the more distant markets, such as Columbia and Charleston. During the past season the hangar at the local airport was used as a market shed for cucumbers. Facts brought out during the course of this study led to the conclusion that this arrangement was far from satisfactory. Interviews with a number of growers in the area strongly suggest that acreages of most truck crops in the area would be increased if more and better market outlets were available.

Based on discussions with growers and others interested in the truck crop industry of the area, it is believed that a small covered platform shed at Walterboro would serve a very useful purpose. It was the consensus of opinion that a market shed of this type would meet a current need and would serve as a starting point for a larger and more diversified market for the variety of truck crops which can be produced in the area.

Changing Agriculture Requires Changing Tenure

(L. M. Bauknight and G. H. Aull)

As long as agriculture followed a fairly uniform pattern from farm to farm and as long as mules provided the bulk of the farm power, it was fairly logical to expect uniformity in tenure arrangements. However, farming has been forced into a more varied and complex pattern, conservation has become an essential part of the farming business, tractors are rapidly replacing mules, and families are not so large as they used to be. All of this suggests that a good many changes are in order in the arrangements between landlords and tenants.

An analysis of the types of rental arrangements in common usage on cotton farms in the Piedmont reveals numerous variations, each seeking a more satisfactory answer to the question as to which type of arrangement lends itself best to a particular system or type of farming. Even the conventional "half and half" (sharecropper) arrangement appears to produce different results—so far as distribution of net returns is concerned—when yields are high and when they are low. High prices do not divide receipts and expenses in exactly the same proportions as low prices.

The conclusions of an economic analysis of tenure arrangements on three sizes of farms and under two levels of prices and productivity may be summed up briefly as follows:

1. Both landlords and tenants need to give careful consideration to the productivity of the farm before agreeing upon the proportionate division of receipts and expenses.

2. For all sizes of farms and with reasonable mechanization hired labor at $0.50 per hour (assuming it is available) is less expensive than cropper labor.

3. On small and medium-sized farms the "half and half" system finds most favor under conditions of high prices and high yields. Where both yields and prices are low, a "hoe-hand" arrangement appears to provide more, both to landlords and tenants, than does a sharecropping arrangement.

Some Rural Churches Very Active

(V. A. Boyd)

In a survey of rural white churches in Anderson County in 1950, 60 open-county churches were reported. Of this number 40 were Baptist, 11 Methodist, 5 Presbyterian (1 ARP) and 4 were of Pentecostal or Holiness faith. Details as to membership, activities, and budgets were obtained from 50 of the 60 churches.

By churches, membership ranged from 18 to 1,100 with an average of 245. Nine of the churches had fewer than 100 members, 20 had between 100 and 245, 15 between 246 and 400, and 5 between 401 and 550. As already noted, 1 had a membership of 1,100. The total membership in the 50 churches reporting was 12,267.

Growth in membership for the year 1950 added a total of 594 members to the rolls of the 50 churches. This was at the rate of just under 5 percent. The average was 12 per church, but the range was from a loss of 13 in one church to a gain of 75 in another. Twelve churches reported that they had experienced no gain during the year, and some of these showed an actual loss.

Attendance at the regularly scheduled service, usually on Sunday morning, averaged 118 for the 50 churches. This is nearly half (48 percent) of the total membership. It should be remembered, however, that part of the average attendance may be made up of nonmembers.

The total annual expenditures of these 50 churches ranged from $272 to $16,039 with an average of $5,177 per church. On a per member basis, the range was from $3.05 to $124.83. Participation in building campaigns by some of the churches was a big factor in causing this wide range in per member expenditures.

The effectiveness of a church might be measured by the coverage of its special services and programs. Of the 50 churches reporting data on membership and budget, 24, or about half, reported that they had 8 regularly scheduled preaching services each month. Of these, several probably also have two services on fifth Sundays. One church reported 12 services per month. At the other extreme, 13, or approximately one-fourth of the churches, had two regularly scheduled services per month, and a few reported only one. Those reporting only two services per month could have had two services on one weekend each month, or they could have had one service on every other Sunday in the month.

Activities and programs other than regular preaching services were reported by all but one church. Thirty of the 50 churches reported that they held week-day prayer services. Sunday Schools were reported in 49 of the churches. Thirty-seven of the churches had Vacation Bible Schools, 34 had a young people's organization, 42 had a women's organization, and only four reported a functioning men's organization.

Poultry Processing Becomes Big Business

(R. B. Anderson)

Gradually and with little fanfare, poultry processing is becoming an important industry in South Carolina and will become more so as farmers and processors obtain a clearer understanding of the needs

and problems of each other. A recent survey of the poultry processing industry reveals a considerably larger number of plants in operation than at first expected. The survey reached a total of 72 commercial plants—not including freezer lockers which process some birds. It is estimated that these 72 plants account for nearly nine-tenths of all those operating in South Carolina.

As to location, 47 percent of the plants surveyed were in the Piedmont section, and these plants processed 62 percent of the more than 7 million birds handled by all plants reporting. About 11 percent of all plants were found in the Sandhills, and the remaining 42 percent were found in the Coastal Plain. They handled, respectively, 18 and 20 percent of the birds.

Most of the commercial poultry processing plants in South Carolina are small, if actual output in birds per hour of operation is indicative of size. Nearly half (43 percent) of the processors indicated that they turn out less than 75 birds per hour. These plants accounted for only 13 percent of the birds processed during 1951. On the other hand, about 3 percent of the plants were processing in excess of 400 birds during each hour of operation. They handled nearly 20 percent of all birds processed in the state last year. These data should provide some measure of efficiency of the different sized plants.

Cotton Statistics Show Wide Fluctuations

(C. D. Evans)

A recent review covering 84 years of cotton statistics in South Carolina reveals some interesting extremes in the figures pertaining to this leading cash crop of South Carolina. Acreage, for example, has varied from less than 500,000 to more than 2,500,000.

The price farmers received for their cotton has varied greatly. The average yearly price ranged from a low of 6.05 cents per pound in 1931 to a high of 40.10 cents per pound in 1950. During the 5 years 1924-28, approximately two-thirds of the total cash receipts from farming came from the sale of cotton lint and cottonseed; and for the years 1946-50, this had dropped to a little over one-third.

The percent of cotton acreage receiving commercial fertilizer is much greater in South Carolina than the average for the United States. Since 1934, from 96 to 99 percent of the South Carolina acreage received applications of commercial fertilizer. The comparable figures for the United States are from 31 to 57 percent. The rate of using commercial fertilizer in cotton production is also about one and one-half times greater in South Carolina than the average of the United States.

AGRICULTURAL ENGINEERING

Forage Crop Seed Harvesting Studies

(J. K. Park)

In 1951, the South Carolina Experiment Station, cooperating with the United States Department of Agriculture, Bureau of Plant Industry, Soils, and Agricultural Engineering, established a research project for the purpose of studying the efficiency of various methods and equipment used in harvesting seed from forage crops. At present the crops primarily considered are reseeding crimson clover, tall fescue, Ladino clover, and the lespedezas, including Kobe, Sericea, and Korean. A large percentage of seed is lost in harvesting these crops, and the main objective of this project is to determine practical methods of preventing this loss.

The amount of seed lost in harvesting represents a considerable monetary loss to farmers. Taking crimson clover, for example, in 1950, the Southeast produced over 15,000,000 pounds of clean seed, about 90 percent of the United States total. Our studies of combine efficiency showed an average seed loss of about 30 percent, due primarily to incomplete threshing at the cylinder. Producers then probably lost 4,500,000 pounds of seed in the chaff from the combine or, at 50 cents per pound, about $2,225,000.

In 1950, the United States produced over 17,000,000 pounds of tall fescue, most of it in the Southeast. Although accurate measurements of seed loss are difficult to make, it appears that probably one-fourth of the crop is lost in harvesting.

At present the acreage of Ladino clover harvested in South Carolina is small, but many farmers would like to harvest seed if they could obtain a satisfactory yield. With favorable conditions, Ladino seed can be harvested in this area.

Lespedeza is generally easy to thresh, but there is still a sizeable amount of seed lost, particularly as a result of shattering at the cutter bar. In this project attempts are being made to determine and, if possible, to reduce these seed losses.

In addition to the seed losses which occur while combining, all of these crops mature unevenly, and shattering from wind and rain is severe.

Harvesting studies during this first season's work included briefly the following:

Crimson clover. Two manufacturers' combines were used in making harvesting tests on about 30 acres of clover. Seed losses under different conditions were determined for each machine. On an aver-

age, about 27 percent of the seed was left unthreshed in the hull and blown out with the chaff. This fact strongly suggests the need for a more aggressive cylinder or higher cylinder speed, particularly since no seed were being cracked. (Cylinders on both machines were running at top speed.) An additional 3 percent on one machine and 9 percent on the other were lost as clean seed blown over with the chaff.

Fescue. In harvesting fescue, comparisons were made between two makes of combines and between direct combining and the windrow pickup method. There was no substantial difference between performance of the two combines. The windrow pickup method was faster than direct combining and produced better quality seed, but yield was slightly decreased because the crop was too mature when windrowed.

Lespedeza. Studies of the effects of variations in combine adjustment were made in harvesting Korean lespedeza. A special attachment designed to save seed shattered by the cutter bar was tested in Kobe lespedeza. This attachment salvaged some seed and with further development may prove quite practical.

Untreated Fence Posts Have Short Service Life

(G. H. Dunkelberg)

Test plots of fence posts cut from 30 common species of South Carolina trees have progressed to the point where the service life of eight untreated species is known. The species reported were cut from post-size trees selected at random from the woods. All posts were round, from 3 to 8 inches in average diameter, 7 feet long, and were set 30 inches in the ground. Sections of barbed and woven wire were stapled to each post. Examinations of the condition of the posts were made every 6 months. As all of the posts of the 8 species reported have failed, the service life given in the table below is that which may be expected on farms in the state.

Table 1.—Service Life of Untreated Fence Posts

Species		Service life	
Common name	Scientific name	Years and months	
Sweetgum	Liquidambar styraciflua	1	0
Slash pine	Pinus caribaea	1	0
Shortleaf pine	Pinus echinata	1	4
Turkey oak	Quercus catesbaei	1	6
Blackjack oak	Quercus marilandica	1	6
American sycamore	Platanus occidentalis	1	7
Yellow poplar	Liriodendron tulipifera	1	9
Pond pine	Pinus serotina	1	10

The life of many of these species can be prolonged if treated with zinc chloride by the trough method. Of 45 treated Shortleaf

pine posts set in 1939, 32 are still in use and show a mean service life of over 10½ years. Additional information on fence posts may be secured from the Publications Department, Clemson College, Clemson, South Carolina.

Irrigation of Peaches Increases Rate of Tree Growth

(W. P. Law, A. M. Musser, C. M. Lund)

The peach irrigation experiment conducted in 1951 indicates that irrigation results in more rapid tree growth even though the extra moisture may not be required for fruit production. This extra growth on a young tree would be valuable. On a full-sized tree, the extra growth may boost yields in following years. Further observations will tell.

Trees in the two irrigated groups made 56 percent more growth than those in the unirrigated groups during the irrigation period, and 15 percent more growth than did those in the unirrigated groups during the following 6 months. Neither yield, size, nor apparent quality of the fruit was affected by the irrigations. The average yield of peaches was 4.1 bushels per tree. Irrigation delayed ripening less than one day. Five-year-old Dixigems, an early variety, were used in the test. See figure 1 for rainfall and irrigation data.

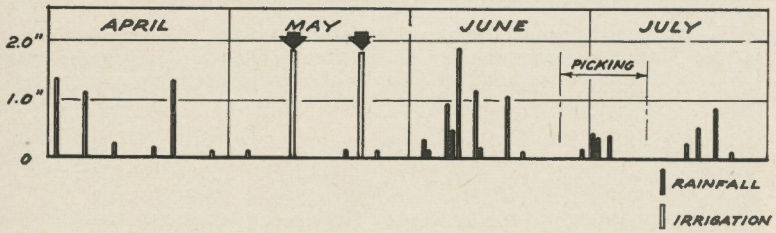

Figure 1.—Water Received by Peach Trees, 1951

The objective of the experiment is to determine the effectiveness of irrigating the soil on only one side of each tree (alternate middles) as compared with uniform distribution of water over the entire orchard. If practicable, this practice would be valuable in coordinating cover-cropping and weed control with irrigation. No difference between the two methods of irrigation was observed this year.

Dug Ponds—Economical Source of Irrigation Water

(W. P. Law and C. M. Lund)

Work done so far in digging, pumping down, and observing pits dug to collect free ground water indicates that, in suitable locations,

they sometimes yield enough water for irrigating substantial acreages as well as water for cattle and other uses. Two of the earliest such pits, or ponds, were dug with draglines at the Truck Station near Charleston in 1943. In the past few years, many ponds have been dug in Lee County and vicinity by farmers with the assistance of Soil Conservation Service technicians. This past winter, the first pit in the Piedmont for irrigation water was excavated at Clemson in a swampy area adjacent to cultivated land (figure 2). Borings made

Figure 2.—A pond dug at Clemson College to collect underground water. This one draws mainly on a 9-foot deep vein under the swamp but also collects water from a shallower seepage vein under the wooded hillside. It overflows when seepage is normal.

at the Edisto Station indicate suitable sites there for this type of pond.

Pumping done to date indicates that a required amount of water may frequently be obtained more cheaply by digging ponds than by impounding surface water. One dugout which was tested by pumping it down three times in succession during last fall's extended drought continued to recover at a good rate. It yielded enough water to irrigate up to 10 acres through a 4-week drought. The pond covers 1/5 acre, is about 10 feet deep, and costs about $350 for dragline excavation.

Selection of the site for a dug pond is based on numerous 12- to 15-foot borings made with a soil auger. Conditions sought by boring include presence of a good supply of free ground water and a soil stable enough to prevent caving banks. Areas usually considered are low ground, such as small stream beds or drainage-ways, swamps, and Grady "ponds."

Work on this source of water is being continued and will be reported in more detail later.

Dug Tank and Irrigation System Reduce Orchard Spraying Costs

(W. P. Law and A. M. Musser)

A small reservoir of 40,000 gallons capacity, bulldozer-dug near the center of the college peach orchards, has eliminated costly water hauling from the spraying operation. Before construction of the reservoir, round trips to the water source at the foot of a steep 500-yard slope consumed one-third of the time of the 3-man spraying crew. Based on a normal spraying schedule, this amounted to 25 to 30 man-days of lost time annually, which, besides being costly, slowed the spraying operation unnecessarily.

The reservoir is filled two or three times a year with an irrigation pump and portable pipe. The total cost of each filling is under $10. Construction cost of the reservoir was approximately $50, most of this being bulldozer rental. The reservoir is built at the head of a small draw, and is 6 feet deep, 50 feet long, and 25 feet wide. Side slopes vary from 1:1 to 3:1. (figure 3.)

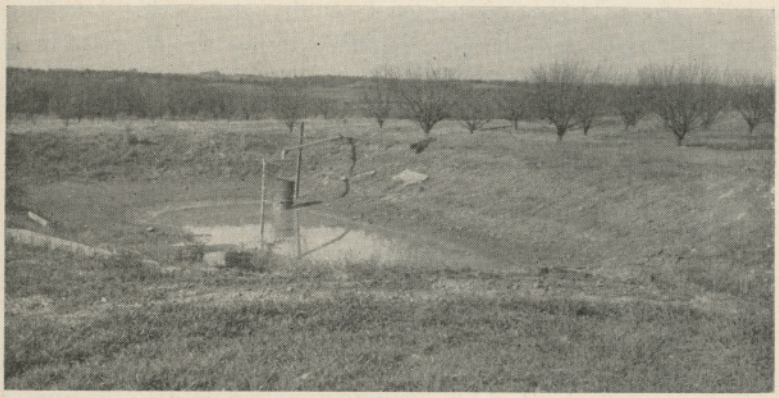

Figure 3.—This bulldozer-dug storage tank saves over $100 every year in orchard-spraying costs and also speeds up the spraying operation.

Prior to digging this type of reservoir, auger borings should be made in order to avoid rock or porous material. In the absence of irrigation equipment, the reservoir can be filled by terrace drainage, provided the water is first filtered of its silt content by flowing across a well-sodded area.

Supplemental Irrigation of Corn for Crop Insurance

(C. M. Lund, O. W. Beale, W. P. Law)

The objective of the studies on irrigation of field corn is to determine under South Carolina conditions how to reduce to a minimum

the amount and cost of irrigation without proportionate reductions in yield.

Irrigation treatments for 1951 were:

M0—Not irrigated

M1—Irrigated only after tasseling when 75 percent of available water had been exhausted at 8-inch depth

M2—Irrigated throughout season when leaves curled before 10 A. M.

M3—Irrigated throughout season when 75 percent of the available water had been exhausted at 8-inch depth

Four fertilizer treatments were made, using 4-10-10 fertilizer, and one ton of lime per acre was applied to the entire area. The fertilizer treatments were as follows:

F1S—400 pounds per acre, applied in conventional manner, plus 56 pounds per acre of nitrogen as side dressing

F2S—800 pounds per acre, applied in conventional manner, plus 112 pounds per acre of nitrogen as side dressing

F2D—800 pounds per acre, one-half applied from 8 to 14 inches deep, with remainder in conventional manner, plus 112 pounds per acre of nitrogen as side dressing

F3S—1200 pounds per acre, applied in conventional manner, plus 168 pounds per acre of nitrogen as side dressing

The F2D treatment was placed in the experiment in an attempt to encourage deeper root development as a factor in using less water for irrigation. An additional ton per acre of lime was placed with the deep fertilizer in the F2D plots. The soil was Cecil sandy loam, and the variety of hybrid corn was NC 27.

Results of the irrigation and fertilizer treatments are shown in table 2. Water received by the various plots is shown in figure 4. The M1 plots, receiving only one irrigation of 1.6 inches, yielded 56 bushels per acre more grain than the M0 (unirrigated) plots. The M3 plots, receiving 4.6 inches in three irrigations, yielded only 9 bushels per acre more than the M1 plots. Obviously, the additional 3 inches of water applied to the M3 plots could have been used to much better advantage in covering additional acreage. This is an important consideration where water supply and irrigation facilities are limited.

The higher fertilizer rates did not result in increased yields even under irrigation. There are other limiting factors, and extremely high yields are not to be obtained through heavy irrigation and heavy fertilization alone. Deep placement of fertilizer shows some promise and will be continued to determine its effectiveness in reducing irrigation requirements.

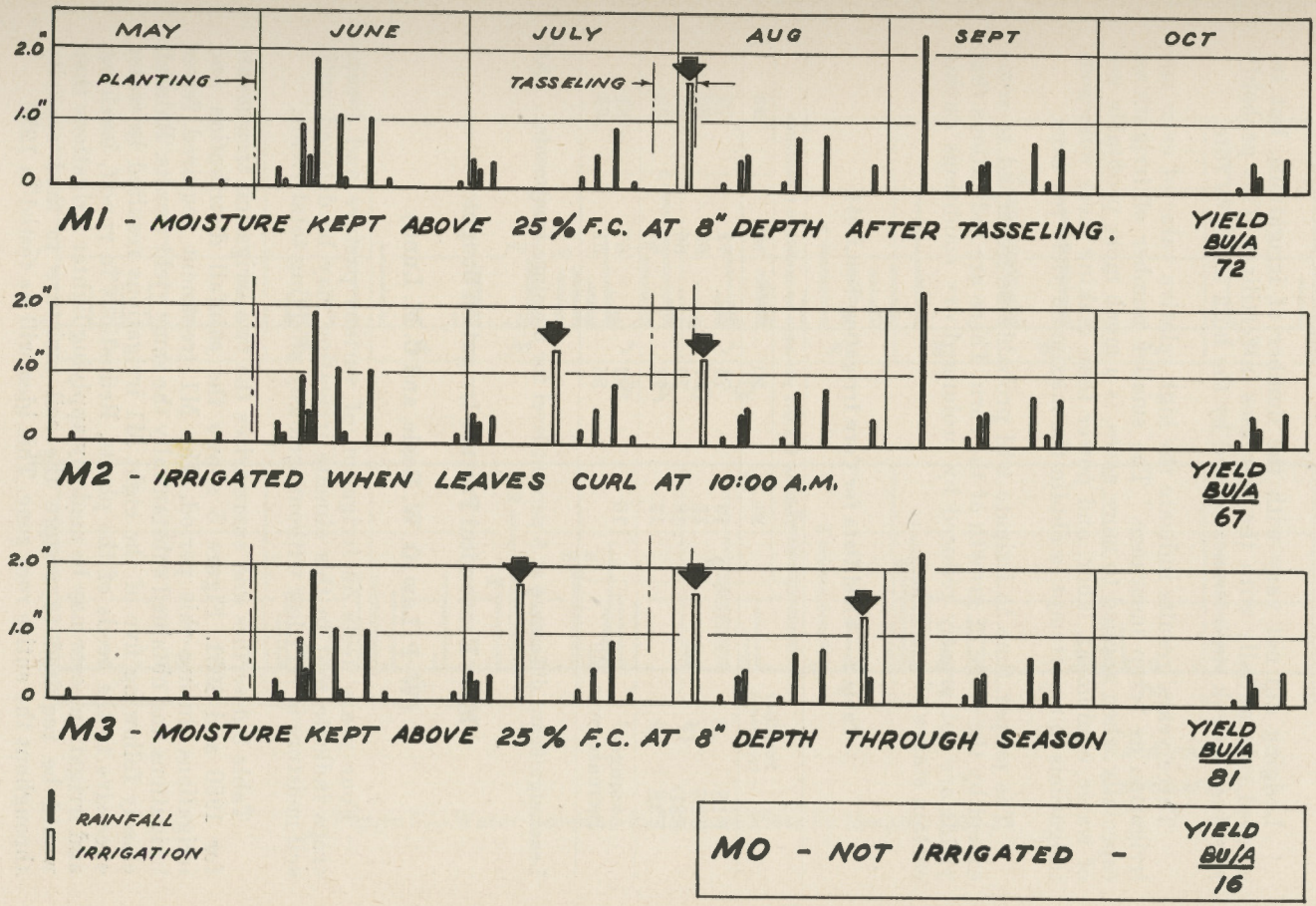

Figure 4.—Water Received by Corn Plots, 1951

Lodging did not vary with the number of irrigations, but increased substantially with the increases in fertilizer. This probably was due to weak stalk tissues caused by the high nitrogen rate.

Three years' results indicate the high relative value of even one irrigation as "crop insurance." The smaller number of irrigations, especially when applied to more acres, is a much more profitable use of water, equipment, labor, and power than making more numerous irrigations in an attempt to obtain the maximum yield per acre.

The proper time to irrigate will probably be governed to some extent by the stage of growth of the corn. There are indications that yields are not greatly reduced by prolonged dry conditions during certain stages of growth.

Table 2.—Yield Data for Corn Irrigation Test, 1951

Fertilizer treatment	Yield in bushels per acre by moisture treatments			
	M0	M1	M2	M3
F1S	19	74	72	73
F2S	15	67	62	82
F2D	18	75	66	92
F3S	12	72	67	76
Average	16	72	67	81
Increase over M0		56	51	65

Least significant difference at 5 percent level for moisture treatments____8.0

More Economical Pasture Irrigation Sought

(W. P. Law, O. W. Beale, and C. M. Lund)

Four years' tests on irrigation of various pasture and forage crops indicate that in this climate irrigation may be delayed until soil moisture is very low without seriously affecting total yields.

Table 3 describes and summarizes the two irrigation treatments for 1950 and 1951. Figure 5 shows the rainfall distribution and irrigations during this period. The M1 treatment required fewer irrigations and obtained substantially the same yield results. Rainfall closely following five of the eight M1 irrigations resulted in water excessive to the needs of the plants. Reductions in runoff, leaching, and irrigation costs may be made by applying lighter irrigations than would be required to restore the soil moisture to field capacity throughout the entire root zone. This idea will be tested in 1952.

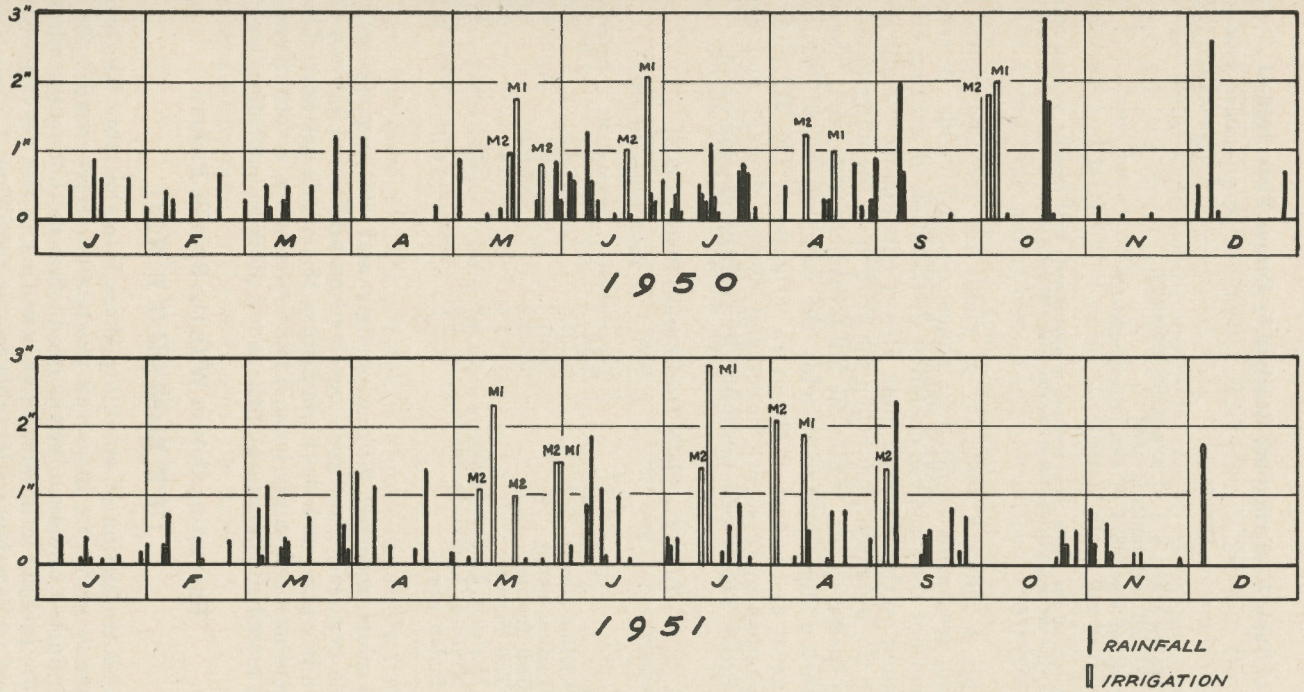

Figure 5.—Water Received by Pasture Plots by Months, 1950-51

Table 3.—Irrigations Received by Forage Plots, 1950-51

Treatment	Total number of irrigations	Total amount applied in inches[1]
M1—Irrigated when 3/4 of available moisture at 18-inch soil depth is used	8	14.1
M2—Irrigated when 3/4 of available moisture at 6-inch soil depth is used	11	14.5

[1] The root zone of the plants were restored to approximate field capacity by each irrigation; therefore, the M1 applications were heavier and the total amounts of water applied were approximately equal.

Table 4 shows a summary of yields for the two years. Each irrigation treatment resulted in almost-doubled yields. A result of irrigation not shown is the excellent distribution of grazing through the summer on the irrigated plots. Heavy cuttings were made several times on the irrigated plots when the growth on the unirrigated plots was too sparse to cut. While the M2 treatment was fairly consistent in producing slightly higher yields, the value of this difference was not as great as the cost of the extra irrigations. The M2 plots generally showed more severe insect and disease damage and greater loss of stand. These were undoubtedly factors limiting yield.

Table 4.—Yields from Forage Plots, 1950-51

Year	Crop	Yields in tons per acre		
		Not irrigated	Irrigated, M1	Irrigated, M2
1950	Ladino clover	1.5	2.8	2.6
1951	Ladino clover	1.3	3.0	3.3
1950	Tall fescue	1.2	1.9	1.9
1951	Tall fescue	1.6	3.4	3.3
1950	Mixture, Ladino-fescue	1.9	2.8	3.2
1951	Mixture, Ladino-fescue	2.4	3.1	3.3
1951	Sudan grass	.9	2.1	2.3

All plots received 2 tons of lime and 800 pounds of 4-10-6 fertilizer per acre. The fescue received an additional 116 pounds of nitrogen per acre, and the Sudan grass 16 pounds per acre. The test plots were on Cecil sandy loam. Yields were taken several times each year by mowing, as grazing of the many plots was not practical.

Harvesting Cotton With the Spindle Picker

(H. E. Bland and G. B. Nutt)

The introduction of spindle pickers into the state has brought about many problems in cotton production. Harvesting tests have been conducted to determine the production methods most adaptable to spindle picking with particular attention to the development and testing of pickers more adaptable to our conditions.

Three spindle pickers were tested at Clemson in 1951. The Allis-Chalmers 2-row, the International Harvester M-14, and the International Harvester experimental C-14 were used on both plot and field scale tests. Field conditions under which these pickers were used included: (1) short, contoured rows, (2) terrace channels and ridges, (3) steep, rocky soils, (4) different varieties, and (5) different materials and methods of defoliation.

All of the spindle pickers did an excellent job, their principal limitation being high initial cost. The International Harvester C-14 should be the most adaptable from the standpoint of cost.

Efficiency of Spindle Pickers

The efficiency of the three spindle pickers is shown in table 5. Coker's 100 Wilt-Resistant Cotton, 24-28 inches in height, was used for the test. No grass or weeds were present, and the degree of defoliation was ideal.

Table 5.—Comparison of Grade, Picker Losses, and Picker Efficiency of Spindle Pickers, Clemson, 1951

Spindle picker		Grade	Picker losses per acre	Picker efficiency[1]
			Pounds	*Percent*
1. IHC M-14	1 picking	SLM	96	94.43
2. A-C	2 pickings[2]	SLM	112	93.34
3. IHC C-14	1 picking	SLM	91	94.48
4. A-C	1 picking	SLM	193	88.30

[1] Percentage of total yield, minus pre-harvest losses, harvested by the picker.

[2] Each row picked twice in succession.

There was no significant difference in grade resulting from any of the spindle pickers. The efficiency of the Allis-Chalmers picker for one picking was significantly lower than the efficiency of either of the International Harvester pickers. However, when the Allis-Chalmers picker was used over the same rows twice, there was no significant difference in efficiency as compared with the International Harvester pickers used on the rows only one time.

Varieties for Spindle Picking

A cotton which produces high yields, and which has high harvesting efficiency, and resistance to weather damage is desirable for harvesting with a spindle picker. Six varieties common to or developed for the Southeast have been included in this test. Table 6 shows the yield, storm losses, and picker efficiency for these varieties.

Figure 6.—These three spindle pickers were tested at Clemson. From left to right, the International Harvester M-14, the International Harvester Experimental C-14, and the Allis-Chalmers 2-row picker.

Figure 7.—The rows from left to right were picked by the spindle pickers in the same order as they appear in figure 6.

Table 6.—Cotton Varieties Related to Yield, Storm Losses, and Efficiency of Spindle Pickers, Clemson, 1951

Varieties[1]	Seed cotton yields per acre	Storm losses per acre	Picker efficiency		
			IHC M-14	IHC C-14	Allis-Chalmers
	Pounds	*Pounds*	*Percent*	*Percent*	*Percent*
1. Coker's 100 WR 47-70	1,455	11.75	91.07	91.31	84.17
2. Coker's 100 WR 1951	1,464	7.25	93.80	93.08	86.79
3. Coker's 100 WR 47-8	1,304	6.75	91.67	92.60	84.19
4. Coker's 100 WR 1952	1,583	11.50	93.62	93.52	85.29
5. Empire WR 1951	1,506	5.25	91.84	92.99	84.90
6. Coker's 100 WR	1,613	11.00	94.18	94.33	86.66

[1] Each variety replicated four times in 4-row plots.

There was no significant difference in yield or storm losses among the varieties. The picking efficiency of the International Harvester M-14 picker was significantly higher on Coker's 100 WR. No significant difference in picker efficiency was found among the varieties for the International Harvester C-14 picker or the Allis-Chalmers picker. On all six varieties the Allis-Chalmers picker gave a significantly lower picker efficiency than the two other pickers. Each picker picked over the cotton one time.

Importance of Early Harvesting

Climatic conditions in South Carolina are such that spindle picking should begin as soon as possible after 60 percent of the bolls are open. The longer the cotton is exposed, the more chance there is of deterioration and discoloration. The differences in grade due to weather and method of harvesting are shown in table 7.

Table 7.—Date of Harvest as Related to Grade of Spindle-picked and Hand-picked Cotton, Clemson, 1951

Date of harvest	Grade	
	Spindle-picked	Hand-picked
October 1 - October 20	SLM	M
October 21 - November 10	SLM	SLM+
November 11 - November 30	LM+	SLM

Defoliation

The defoliation experiments were designed to evaluate the effectiveness of chemical cotton defoliants. Defoliants included in this test were applied when approximately 95 percent of the bolls were mature and when approximately 40 percent of the bolls were open. Application machinery included a 6-row tractor-mounted duster and a 2-row tractor-mounted sprayer.

The defoliants were applied on October 3 under ideal weather conditions. Three weeks of warm sunny days with heavy dews followed the application. Coker's 100 Wilt-Resistant Cotton, 24-28 inches in height with very dense foliage, was used in this test. Results of this test are given in table 8.

There was no apparent loss in effectiveness of calcium cyanamid and Niagarathal DF dust when the rate of application was reduced from 30 to 20 pounds per acre. When the amount of monosodium cyanamid and potassium cyanate 89 spray was reduced 50 percent, there was a slight reduction in the percentage of leaves defoliated. Niagarathal DF spray failed to give the desired degree of defoliation at both 2- and 1-pound-per-acre rates. Twenty percent of the leaves on the check plot were defoliated naturally.

Table 8.—Cotton Defoliants as Related to Percentage of Leaves Defoliated, Dead, and Unaffected and to Efficiency of Spindle Picker, Clemson, 1951

Chemical	Rate per acre	Leaves defoliated	Leaves not defoliated		Picker efficiency
			Dead	Green	
	Pounds	*Percent*	*Percent*	*Percent*	*Percent*
1. Niagarathal	2*	80	5	15	97.90
DF spray	1	30	0	70	----†
2. Calcium	30*	99	1	0	98.00
cyanamid dust	20	97	1	2	----
3. Monosodium	18*	91	4	5	97.00
cyanamid spray	9	80	9	11	----
4. Potassium	10*	95	3	2	98.75
cyanate 89 spray	5	87	5	8	----
5. Niagarathal	30*	95	3	2	96.25
DF dust	20	95	3	2	----
6. No defoliant (check)	--	20	5	75	96.25

* Recommended rate of application.

† Picker efficiency figured only on the plots receiving the recommended rate of application.

There was no significant difference in spindle-picking efficiency from any of the defoliants tested. However, the amount of green leaves in the harvested cotton was considered excessive in treatments 1 and 3 and very excessive in the check plot where no chemical was applied.

Figure 8.—Aero cyanamid, Special Grade, at the rate of 30 pounds per acre was applied to this field. Excellent defoliation was obtained.

In rank cotton, the spray defoliants consistently failed to give desirable results. This was due in most cases to poor coverage and not to the chemicals used. The dust defoliants gave excellent results in all cases.

HOME ECONOMICS

Use of Milk by Farm Families in the Tobacco Area of South Carolina (Ada M. Moser and Elizabeth S. Watson)

An adequate supply of milk is probably the most important year-round dietary need of many farm families in the tobacco farming section of South Carolina. This conclusion is based on a study of food records kept by 149 white and Negro farm families in Horry, Marion, Florence, and Williamsburg Counties for a 7-day period during February, March, or April, 1948, and on information about their home food production for the previous year.[1] Each family included a husband and wife and one or more children 2-18 years of age, with or without other household members.

Calcium, ascorbic acid (vitamin C), and vitamin A value were the three dietary essentials most often below recommended levels during the week of record-keeping. In summer and fall, supplies of the two vitamins would increase with use of greater quantities of fresh vegetables and fruits. On the other hand, calcium intake, very largely tied to milk consumption, would not readily respond to seasonal changes in the food supply.

The majority of families using an average of 1 pint or more of milk per person per day had the recommended amounts of calcium in their diets; few families using less than this quantity of milk had satisfactory supplies of calcium. If a family had no home-produced milk, it was not likely that use of milk products would reach a level which favors good calcium intake.

Over half (56 percent) of the farm families studied were without home-produced milk during the record week; most of them were families that did not own the farm they were working. Information for the previous year, 1947, indicated that 45 percent of the families studied had no home-produced milk during the year. According to the 1950 Census, 68 percent of the farms in the four tobacco area counties where the food study was made did not report milk cows. Though the two sets of data are not strictly comparable, both lead to the conclusion that there is a shortage of home-produced milk among farm families in the area.

[1] Data obtained in South Carolina in connection with the regional cooperative project, "Family Food Consumption in the Southern Region in Certain Types of Farming Areas," with funds available under the Research and Marketing Act. Cooperators included five other state experiment stations and the Bureau of Human Nutrition and Home Economics of the U. S. Department of Agriculture. See Southern Regional Cooperative Series Reports 7 and 20.

Amounts of Milk Used by Families Having Home-Produced Milk and by Families Not Having Home-Produced Milk.

Average quantity of milk per person per day:[1]	Percent using specified quantities, families having—	
	Home-produced milk	No home-produced milk
None	--	23
Some, but less than ½ pint	18	63
½, but less than 1 pint	29	12
1 pint, less than 1 quart	38	2
1 quart or more	15	0
Total	100	100

[1] Includes fluid milk plus the fluid milk equivalent of evaporated, condensed, and dry milk, cream, ice cream, and cheese.

To what extent can increased home production of milk take care of the milk shortage? Should consumer education lay greater emphasis on purchase and use of suitable milk products when the home supply is lacking or insufficient? These are important questions facing rural people in milk-deficit areas.

Rural Family Living Expenditures

(Elizabeth S. Watson and Ada M. Moser)

Increasing industrialization in the state will undoubtedly have some effect on rural family living, and will bring questions for home economics workers who are helping families with home and money management problems. Some of the questions raised are: How much money do rural families have for family living; how are they spending it; how much of their food supply do they grow? To provide some answers (or to raise more questions) a study of family living expenditures by a cross-section of 208 York County rural white families (those families selected had at least one child under 18) was made by the Station's home economists for the year 1950.

Preliminary tabulations of the information obtained reveal that 125 families (60 percent) were living on farms according to the 1950 Census definition of a farm. However, only 16 out of the 208 (8 percent) received more income from farm than nonfarm sources, and only four of the 16 received all of their 1950 income from the farm. The farm families included those who had at least 3 acres of land and who raised agricultural products valued at $150 or more, even though in a good many cases there was little or no cash income from the farm. The farms on which the 125 families lived were further classified as 33 commercial farms (farm products selling for $1200 or more, or, if for less, more income from farm than from other sources), 33 part-time farms, and 59 residential farms.

The average family size was slightly over five persons for each group. The average nonfarm family spent $2,834 on goods and services for family use, while the average farm family spent $2,281. Greater average food expenditures by nonfarm families accounted for a large part of this difference. Nonfarm families, however, had home-produced foods of less value than did farm families as the following summary indicates:

Amount of Money Spent for Food and Value of Home-produced Food at Farm Prices for Farm Families and Nonfarm Families.

	Amount spent for food	Value of home-produced food at farm prices
Farm families:		
Commercial	$ 613	$575
Part-time	719	428
Residential	825	331
Nonfarm families	1,029	104

The automobile expenses, or that part counted for family use, were $488 for the commercial farm group, and came down gradually for each group, with the nonfarm families spending an average of $342. Conversely, other transportation, which was mostly sharing expenses for rides to work, was $49 for nonfarm families, and was down to a $17 average for the commercial farm group.

The average clothing expense for the family was $305 and was practically the same for farm and nonfarm groups. The widest range in expenditures by individual families was in the farm group—from approximately $20 to over $1,000.

Some of the family living expenditures, which also varied little between farm and nonfarm families were: medical care at $127 per family, recreation at $121 average, reading materials and school supplies, etc., at $40, and furnishings and household equipment at an average of $154.

The average nonfarm family spent about 50 percent more for tobacco than the farm family—$81 versus $63. Expenses for personal care, such as barber and beauty shop services and toilet articles, amounted to $56 per family.

Fuel, electricity, and other household operation expenses cost an average of $224. Housing expenditures varied widely among families and groups because of differences in ownership and the difficulty of separating farm and family expenses for housing.

FIELD CROPS AND FERTILIZERS

New Varieties of Small Grains Show Much Promise for Higher Yields

(W. R. Paden, E. B. Eskew, and H. W. Webb)

The small grain variety tests with oats, wheat, and barley were conducted on Cecil sandy loam soil. Fertilizer was applied at seeding at the rate of 300 pounds of 4-10-6 per acre. The varieties were planted in four-row plots and replicated four times. The two middle rows were harvested for yield tests, as shown in figure 9. A top dressing application of 150 pounds of nitrate of soda was made in the early spring.

Figure 9.—Showing small grain varietal nursery in partially harvested stage.

The yields of the three crops were unusually high as a result of the favorable seasonal condition for small grain, such as a low amount of winter killing and optimum moisture condition for spring growth and maturity. There was also a very slight amount of rust and mildew injury. The barley yields were affected, however, by rice birds which destroyed many heads of the grain just before harvest.

Oats. Twenty varieties and varietal strains were included in the test as shown in table 9. A yield of 97.0 bushels was produced by the Arlington variety, which led the list. This variety has shown a high yield performance since its introduction into the state. It is rather late in maturing. A tall although stiff straw and a coarse husk are recognized as somewhat objectionable features of this variety. Coker's Victorgrain 48-93 produced the second highest yield with 93.1 bushels. This variety was released by Coker's Pedigreed Seed Company for fall seeding in 1951. Strains of Marett's Anderson variety responded well in the test. Limited amounts of certain of these strains are available for seeding.

Table 9.—Oat Variety Test, Clemson, 1951

Variety	Source	Yield in bushels per acre
Arlington	Georgia Experiment Station	97.0
Coker's Victorgrain 48-93	Coker's Pedigreed Seed Co.	93.1
Marett's Anderson I-0117	Marett's Farm and Seed Co.	92.1
Marett's Anderson 48-414	Marett's Farm and Seed Co.	88.0
Coker's Fulgrain 50-3	Coker's Pedigreed Seed Co.	87.8
Marett's Anderson I-0111	Marett's Farm and Seed Co.	86.6
Coker's Fulgrain 48-107	Coker's Pedigreed Seed Co.	85.5
Marett's Anderson I-0117	Marett's Farm and Seed Co.	82.7
Marett's Anderson I-0118	Marett's Farm and Seed Co.	82.3
Coker's Victorgrain 50-18	Coker's Pedigreed Seed Co.	81.9
Coker's Hybrid Sel. 49-49	Coker's Pedigreed Seed Co.	81.7
Marett's Anderson I-0133	Marett's Farm and Seed Co.	80.5
Marett's Hybrid Sel. I-0114	Marett's Farm and Seed Co.	79.3
Coker's Fulgrain, B. R. S.	Coker's Pedigreed Seed Co.	75.3
Marett's Hybrid Sel. I-0109	Marett's Farm and Seed Co.	75.1
Coker's Hybrid Sel. 49-41	Coker's Pedigreed Seed Co.	74.6
Marett's Winter Res. #6	Marett's Farm and Seed Co.	74.0
Coker's Hybrid Sel. 50-21	Coker's Pedigreed Seed Co.	72.3
Coker's Victorgrain 50-19	Coker's Pedigreed Seed Co.	71.8
Marett's Hybrid Sel. I-0115	Marett's Farm and Seed Co.	70.9
Least significant difference (5% level)		15.8 bu.
Coefficient of variation		15.4 %

Wheat. Eighteen varieties and varietal strains of wheat, including the three which are given special mention in the discussion, were planted in the test as shown in table 10. Trumbull-Frondosa, Y2375, produced the highest yield with 38.6 bushels per acre. This new and unnamed variety is the result of a cross made by J. W. Taylor of the Division of Cereal Crops and Diseases of the Bureau of Plant Industry, Soils and Agricultural Engineering of the United States Department of Agriculture. It has been tested in the Uniform Southern Regional Nursery program since 1946. Some selection work has been made by this Station from seed harvested from the original planting in 1946. A small area has been seeded for increase and will possibly be released in 1952. This strain has produced consistently good yields of grain having good soft wheat quality. It is resistant to leaf rust and stem rust but susceptible to mosaic and mildew. A name for this variety will be chosen by all interested workers before release is made.

The Purcam variety produced 37.5 bushels per acre. It is the result of a cross made between Purplestraw and a selection between Chinese and Michigan Amber by the Purdue Experiment Station in cooperation with the Division of Cereal Crops and Diseases. It was received through the Uniform Southern Nursery program in 1943. It is medium early in maturity and is characterized in appearance by a purplish amber color and short stiff straw. It has a high resistance to leaf rust in the mature plant stage, although it is very susceptible to loose smut.

Table 10.—Wheat Variety Test, Clemson, 1951

Variety	Source	Yield in bushels per acre
Trumbull-Frondosa, Y2375	S. C. Exp. Station, B.P.I.	38.6
Marett's Chancellor, 1951 F.S.	Marett's Farm and Seed Co.	38.2
Coker's 50-14	Coker's Pedigreed Seed Co.	37.5
Purcam	S. C. Exp. Station, B.P.I.	37.5
Leapland-Fronteira, Y2652	S. C. Exp. Station, B.P.I.	37.3
Marett's Chancellor, 1950 R.S.	Marett's Farm and Seed Co.	36.7
Coker's 50-16	Coker's Pedigreed Seed Co.	36.2
Coker's 50-15	Coker's Pedigreed Seed Co.	35.7
Coker's 47-27	Coker's Pedigreed Seed Co.	35.7
Atlas 50	North Carolina Exp. Station	35.1
Marett's Chancellor 48-37	Marett's Farm and Seed Co.	35.1
Atlas 66	North Carolina Exp. Station	34.0
Marett's M925	Marett's Farm and Seed Co.	33.9
Coker's Coastal	Coker's Pedigreed Seed Co.	33.7
Marett's Chancellor M764-8	Marett's Farm and Seed Co.	33.3
Purplestraw	Marett's Farm and Seed Co.	31.6
Marett's Chancellor M764-39	Marett's Farm and Seed Co.	30.5
Marett's Chancellor M764-47	Marett's Farm and Seed Co.	23.7
Least significant difference (5% level)		5.1 bu.
Coefficient of variation		11.6 %

The Leapland-Fronteira, Y2652 varietal strain, yielded 37.3 bushels per acre. This varietal strain was also bred by J. W. Taylor and was received at this Station through the Uniform Southern Regional Nursery program in 1947. Some mass selection work has been made with it by this Station. It is characterized by a long head and a medium tall but stiff straw having medium late maturity. It is resistant to leaf rust but not stem rust and is susceptible to mosaic. Several bushels of Registered seed under a tentative name of "Anderson" were released to a few farmers of the state for fall planting.

Marett's Chancellor 1951 Foundation Seed produced the second highest yield in the test, 38.2 bushels per acre. Slightly lower yields were produced by Atlas 50 and Atlas 66 and also by Coker's Coastal varieties which are characterized by their high protein contents. Due to the high protein content these varieties are classified as hard wheat suitable for making loaf-bread flour. A premium price is now being offered for these wheat varieties by certain mills equipped to produce hard wheat flour.

Barley. Seven varieties and varietal strains were included in the test as shown in table 11. The highest yield was produced by the Colonial variety. This variety is a cross between Davidson and Sunrise which was made and released by the North Carolina Experiment Station. Marett's Calhoun strains are the result of some selection work made by the Marett's Farm and Seed Company from hybrid lines supplied to them by J. W. Taylor of the Division of Cereal Crops and Diseases.

Table 11.—Barley Variety Test, Clemson, 1951

Variety	Source	Yield in bushels per acre
Colonial	North Carolina Exp. Station	62.0
Marett's Hybrid Sel. I-0143	Marett's Farm and Seed Co.	51.2
Marett's Calhoun M 450-4	Marett's Farm and Seed Co.	50.0
Marett's Calhoun 3, 1950 R.S.	Marett's Farm and Seed Co.	43.6
Marett's Calhoun 3, 1951 F.S.	Marett's Farm and Seed Co.	41.1
Marett's Hybrid Sel. I-0146	Marett's Farm and Seed Co.	39.9
Marett's Hybrid Sel. I-0144	Marett's Farm and Seed Co.	28.2
Least significant difference (5% level)		7.1 bu.
Coefficient of variation		12.0 %

Radiophosphorus Test Shows Value of Residual Superphosphate

(A. B. Prince)

The trend toward higher rates of fertilization often raises the question, Are we getting the most effective use of our plant food? This question is of particular interest when the element phosphorus (P) is considered, because little of it is lost from the soil except by crop removal and erosion. Under conditions where large applications of superphosphate have been made over a period of years, future rates might be reduced to advantage.

A greenhouse experiment was conducted with soil taken from plots that had received superphosphate in varying amounts for 36 years. Crimson clover was grown as a test crop, and the soil was fertilized with additional superphosphate. This superphosphate was tagged with radioactive phosphorus so that when the plants were harvested and analyzed the phosphorus in the plant originating from the fertilizer could be distinguished from that originating from the soil. The results reported in table 12 show that only a small proportion of the phosphorus in crimson clover came from the additional superphosphate, applied broadcast, when the soil contained large amounts of available phosphorus. When the soil phosphorus content was low, the plants obtained nearly half of their phosphorus from the fertilizer.

Liming of acid soils has been shown to increase the availability of soil phosphorus supplies. In the test reported herein, liming the soil decreased the proportion of plant phosphorus coming from the fertilizer, indicating that the availability of the soil phosphorus had been increased.

Table 12.—Effect of Varying Contents of Available Soil Phosphorus in Soils Taken from Plots That Had Previously Received Varying Analyses of Fertilizer Applied Annually Over a 36-Year Period on the Utilization of Residual Superphosphate by Crimson Clover Grown in Unlimed and Limed Greenhouse Pot Cultures

Analyses of fertilizer previously applied to soil	Available soil phosphorus content	Total phosphorus content of plants originating from superphosphate	
		Limed	Unlimed
	Lb. per acre	*Percent*	*Percent*
0-0-0	90	33.55	28.88
4-0-4	56	42.10	38.16
4-2-4	86	29.88	28.75
4-6-4	169	17.85	17.38
4-8-4	428	14.73	13.89
4-12-4	266	11.68	11.81

HORTICULTURE

Peeling Peaches in Highly Concentrated Solutions of Sodium Hydroxide

(L. O. Van Blaricom)

For many years southeastern canners have made a common practice of peeling peaches with solutions of sodium hydroxide. Solutions of sodium hydroxide will readily remove the peeling from any variety of peach at any stage of maturity. Since the hot lye solutions which are generally used in commercial practice tend to disintegrate and soften the outer parts of the fruit's flesh, there has been a tendency for canners to use firm-fleshed peaches. Thus, the major portion of peaches used for canning have been firm-textured, and the full development of flavor in the freestone peach has often been lost. By shortening the length of time the peaches are in contact with the hot chemical solution, there should be less softening of the fruit and riper and softer peaches can be used. It is fairly common knowledge that higher concentrations of sodium hydroxide will increase the peeling speed of lye solutions, but specific data on this process are limited when solutions used are near the boiling point or are used at elevated temperature.

Preliminary trials using one peach at a time in a beaker of boiling lye indicated that the time of lye peeling could be materially reduced by increasing the concentration of the solution. As a result, an experiment was conducted during the summer of 1950 in which Halehaven peaches were peeled in solutions of as high as 32.6 percent sodium hydroxide.

A mill-wheel type of lye peeler, illustrated in figure 10, was constructed for the experiment. This peeler was 30 inches wide and the

wheel was 42 inches in diameter. A rotary washer was used after the lye peeler. The peeling solutions used varied from 1 to 32.6 percent. Strength of the lye solution was determined by titration with standard hydrochloric acid solution.

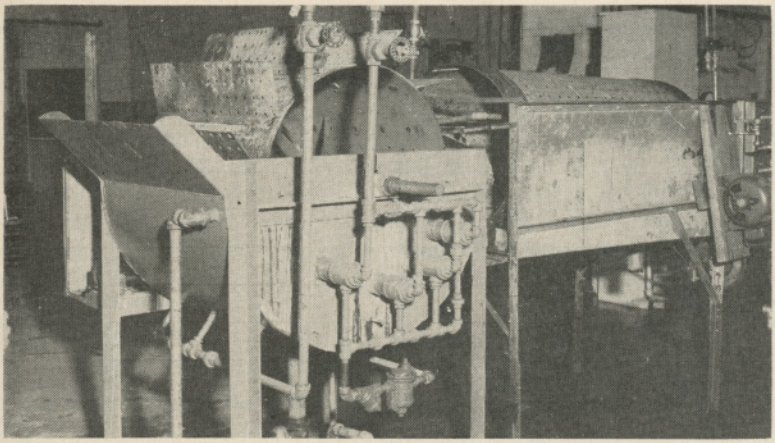

Figure 10.—Mill-wheel type of lye peeler used to peel peaches in high concentrations of sodium hydroxide.

For each concentration tested, Halehaven peaches were fed into the machine continuously while the speed of the machine was adjusted to its maximum speed and satisfactory peeling was attained. The temperature of the peeling solution was kept as close to the boiling point as possible with the machine running. Temperatures of the lye solution were 2 to 6 degrees below the theoretical boiling point at sea level.

Table 13 presents the data obtained. The peeling time varied from 60 seconds at 1 percent to 18 seconds at 32.6 percent sodium hydroxide. The peaches peeled at the higher concentrations were quite black on the surface as they emerged from the machine. However, quick and thorough washing in the rotary washer seemed to clean them satisfactorily.

The decrease in peeling time is substantial, and if the conditions of the experiment could be duplicated in commercial practice, the higher peeling rate might be important. However, there were several factors which were not measured. For example, lye solutions which have been used for several hours may not give the increase in speed of peeling that the relatively new solutions gave under the conditions of this experiment. Since the amount of sodium hydroxide adhering to the surface of the peaches with concentrated solutions would be greater, the cost of peeling with the higher concentrations might be

considerably more than that by the use of low concentrations. Also, when the volume of peaches going through the machine was increased, the temperature of the solutions dropped, so that the advantage of the high temperatures obtained with the high concentrations was lost.

Table 13.—Peeling Time for Halehaven Peaches in Near Boiling Solutions of Caustic Soda

Percent NaOH by weight	Peeling time in seconds	Observed temperature (Degrees F.)	Boiling point at sea level (Degrees F.)
1.0	60	210	212
2.1	45	211	213
4.2	35	212	214
7.8	28	214	216
16.0	23	220	222
32.6	18	236	243

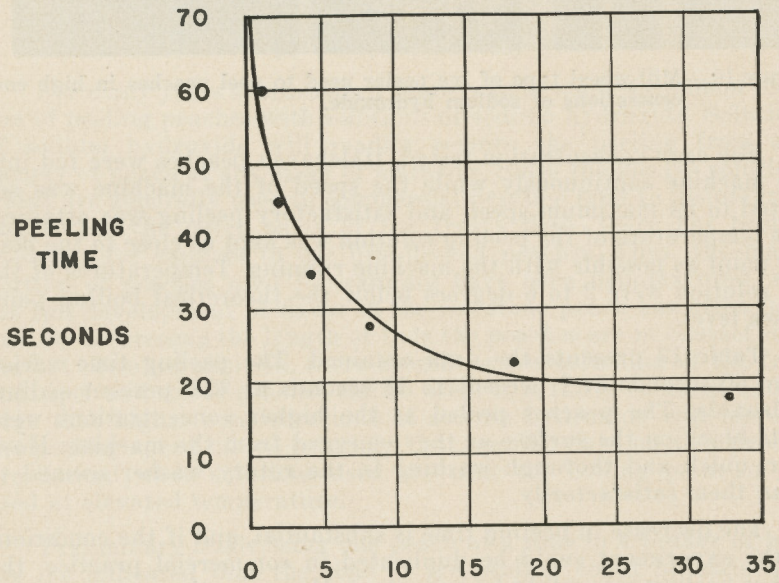

Figure 11.—Percent NaOH

Frozen Peaches for Diabetics
(L. O. Van Blaricom)

Many people who suffer with diabetes mellitus would like to preserve dessert-type peaches by freezing. Peaches frozen alone as

slices or covered with water have generally proved to be undesirable because of the browning of the surface and the development of unpalatable flavors. However, the following method of freezing peaches without adding any sugar has proved to be satisfactory at the Horticultural Products Laboratory.

> Peel soft, ripe freestone peaches with a knife, or slip the skins off after dipping peaches in hot water. Slice or dice the peaches into rather small pieces about ½ inch thick. Add ½ teaspoon of powdered ascorbic acid to each gallon of prepared peaches and mix thoroughly.
> Saccharin, in the amount of 2 to 4 grains or to suit the individual taste, may be added if desired. After mixing the ascorbic acid and saccharin with the peaches, place them in leakproof packages. Shake or tap the package until the peaches are covered by their own juice. Seal and freeze at 0° F. or lower.

Some Experiences in Top-Working Fruit Trees

(H. J. Sefick)

The extensive program of breeding new fruit varieties which is taking place throughout the United States is producing a large number of selections for trial. Planting space, personnel, and funds limit the quantity of these selections that a horticulturist may try. One way to get a quick view of a new selection and to increase the number for trial is to top-work established trees. This method is used at Clemson, especially when propagating material is scarce; it also helps in the training of horticultural students.

In the spring of 1950, for example, scion wood of nine selections of Japanese plum were obtained from California. These selections were whip-grafted into trees of the Santa Rosa variety of Japanese plum shortly before the tree buds opened. Each selection was grafted into a different tree in order to reduce the chance of mislabeling.

The scions were cut from 4 to 6 inches in length and were inserted into one-year wood of the same diameter as the scion. The grafts were tied with raffia and covered with a hot wax. The formula for this wax is 5 pounds of rosin, 2 pounds of beeswax, ½ pint of linseed oil, and a tablespoonful of lampblack. Of the 46 grafts made 42 survived. Since the work was done by inexperienced senior students, a survival of 91 percent is remarkable. A few of the grafts fruited in 1951.

The cleft-grafting method has been used in top-working apple trees with equal success during the past 5 years. During this period 42 branches on three trees were cleft-grafted, all but five with two

scions each. Seventy-one out of 79 scions, or 90 percent, survived. The same kind of wax has been applied, but, owing to the greater surface needing wax, some pulling away of the wax occasionally occurs; consequently, it becomes necessary to check the grafts once or twice during the growing season and to rewax any bit of exposed surface. The third season after cleft-grafting, some fruit is usually available for observation.

While not in the same category as the top-working of trees, cleft-grafting of grape vines in the vineyard involves similar methods to attain the same purpose. For instance, in 1950, three varieties of two-year-old phylloxera resistant stock plants were cleft-grafted at the ground level just before growth started in the spring. No wax was used, but soil was mounded and packed over the union and scion. Twelve percent of the scions survived.

It was surmised that the mound of heavy, sandy clay soil, characteristic of the Piedmont, did not permit sufficient aeration of the graft union nor the rapid escape of sap from the area surrounding the graft, resulting in killing the scion buds. Consequently, the grafting the following season was repeated on the same stocks, but sand was placed over the graft to the top of the scion and the soil packed over it. Eighty-six percent of the scions survived, some of which produced small bunches of fruit the same season. Usually, grafted grapes produce fruit the season following grafting.

Thus, cleft-grafting grapes and top-working fruit trees permit the use of established stocks to hasten the production of fruit selections and varieties.

Removal of Grape Seed With Waring Blendor and Effect on Germination

(H. J. Sefick and A. M. Musser)

One of the problems which has caused some concern in the bunch grape breeding project has been poor germination of the seed. While investigating the probable causes, it was found that extraction of the seed from the berries with a Waring Blendor was faster and more convenient than removal of the seed by mouth. The blender slightly scarified the seed when operating at 10,000 revolutions per minute, and it seemed likely that germination might be improved.

To test germination, in 1948, one-half of each of five flats was planted with seed removed by mouth, and the other half with seed removed with the blender. The seed used came from open-pollinated fruit of a Clemson selection. There was no significant difference between the two lots; 55.3 percent of the nonscarified seed and 53.3 percent of the scarified (extracted with blender) seed germinated.

To further test germination, the method of handling seed after harvest and seed treatment was investigated. In 1950, the fruits from various crosses were placed in a household refrigerator as soon as harvested. All the seeds were extracted within a 48-hour period. One half of the seeds of each lot from six different crosses was held dry and the other half was held moist by keeping them covered with moist sphagnum moss at room temperature. After 30 days of this treatment they were buried outdoors for after-ripening. The various crosses were enclosed in wire-cloth screen envelopes.

In the spring of 1951 a total of 1,920 seeds was planted in a split-plot design in which the varieties were randomized in each of four blocks in a greenhouse bench filled with a mixture of 1/3 sand, 1/3 soil, and 1/3 rotted leaf mold. The treatments were the sub-plots. See tables 14 and 15.

Analysis of variance showed there was no significant difference between treatments. However, this was not a good test of the effect of the seed disinfectant because damping off was not a problem as it usually is, only 7 seedlings dying out of the nearly 1,300 that emerged.

The difference in germination of the various crosses was significant. It explains, in part at least, the near and often complete failure to obtain seedlings from certain crosses.

Table 14.—Effect of Treatment on Germination of Grape Seed

Treatment	Mean germination
	Percent
Moist	65.0
Moist - Arasan	67.0
Dry	66.0
Dry - Arasan	71.5
F ratio not significant	

Table 15.—Germination Response of Various Crosses

Crosses	Mean germination
	Percent
Unknown x NY 13920	58.5
Unknown x NY 14795	73.0
Unknown x Seneca	65.5
Athens x NY 14795	86.5
Edna x SC 4125-237	81.5
NY 14795 x NY 13035	39.0
Least significant difference at 5% level	9.5
Least significant difference at 1% level	13.5

FORESTRY AND PLANT DISEASES

The Cabbage, Radish, and Probably Stock-Wilt Fusaria as Races of the Cabbage-Wilt Fungus, *Fusarium conglutinans*

(G. M. Armstrong and J. K. Armstrong)

Annual reports for the past several years have given the results of the investigations of numerous Fusarium wilt diseases of cotton, tobacco, sweet potato, cowpeas, soybean, sesame, and crotalaria, as well as those of legumes, a phase which is not complete. During the year, the work on the wilt diseases of cabbage, radish, and other plants of the mustard family was completed, and a paper was submitted for publication in a scientific journal.

In the Charleston-Beaufort area, wilt of cabbage is found in the fall-grown crop. Radish wilt has not been reported from this area and may never become a serious disease, since the radish crop is grown at times when the soil temperature is cool and unfavorable for the wilt fungus. This fungus has been reported to be so different from the cabbage fungus that a distinct name has been given to it. The same is true for the stock-wilt fungus.

After the South Carolina cabbage-wilt fungus was found to cause wilting of radish, cultures of the radish-wilt *Fusarium* from Wisconsin were obtained. It has not been possible to secure a culture of the fungus causing stock wilt, which has been reported only from California. The fungus isolates from wilted cabbage and radish were used to inoculate plants of a number of varieties of the cabbage tribe (cabbage, cauliflower, broccoli, brussels sprouts, kohlrabi, kale, and collards), stock, and radish to determine their host relationships.

The plants were grown in 2-gallon pots of steamed sand in a greenhouse with the temperature maintained at approximately 83° F. Inoculations were made with fungus isolates derived from single spores. The noninoculated plants of each species or variety which were grown concurrently with the inoculated ones showed no external or internal symptoms of wilt.

In addition to radish, stock, and varieties of the cabbage tribe, wilt-susceptible plants of 18 genera other than those in the mustard family were inoculated with the cabbage and radish organisms. Likewise, one variety of cabbage and one variety of radish were inoculated with 18 different wilt *Fusaria* from other hosts.

The cabbage and radish *Fusaria* produced no wilting of wilt-susceptible plants of 18 genera not in the mustard family. The 18 different wilt *Fusaria* from other hosts failed to produce any symptoms of wilt in the one variety each of cabbage and radish which were inoculated. These cross inoculations indicate that there is no relationship between the cabbage and radish *Fusaria* and any of the 18 other *Fusaria* which were tested, since a common host was not found.

The results of inoculations of members of the cabbage tribe, stock, and radish with isolates of the cabbage-wilt *Fusarium* and the radish-wilt *Fusarium* are shown in table 16. The cabbage *Fusarium* was highly pathogenic to radish, cabbage and some other members of the cabbage tribe, and moderately so to one variety of stock. The radish *Fusarium* was highly pathogenic to radish and one variety of stock, moderately so to a variety of brussels sprouts, and kale, and less so or nonpathogenic to other members of the cabbage tribe.

Since both of these *Fusaria* have a common host in radish, they should be named according to the accepted procedure as pathogenic or physiologic races of the first described cabbage-wilt fungus, *Fusarium conglutinans*. Even though we did not have the stock *Fusarium* for comparison, the fact that the radish and cabbage *Fusaria* caused wilt of at least one variety of stock, suggests that testing of other varieties might show the stock as a common host for all three of these fungi. It is proposed, therefore, that the wilt *Fusaria* from cabbage and radish, and probably the one from stock be designated as physiologic races of *F. conglutinans* and not forms of *F. oxysporum* since there is a common host. The *Fusarium* originally described from cabbage would be race 1; the one with a high degree of pathogenicity chiefly for radish, race 2; and the one from stock, probably race 3.

Table 16.—Results of Inoculations With the Radish- and the Cabbage-Wilt Fusaria

Host[1]	Number of diseased and healthy plants and percent with external symptoms of wilt											
	Radish-wilt Fusarium						Cabbage-wilt Fusarium					
	Percentage of plants with external symptoms	Number of plants					Percentage of plants with external symptoms	Number of plants				
		Severe external	Slight external	Internal only	Healthy	Total inoculated		Severe external	Slight external	Internal only	Healthy	Total inoculated
Brussels Sprouts: Improved Dwarf	19.6	16	4	55	27	102	96.0	24	0	1	0	25
Brussels Sprouts: Long Island Improved	61.3	40	9	27	4	80	96.4	27	0	1	0	28
Kale. Dwarf Siberian	1.0	2	0	118	78	198	55.1	7	20	21	1	49
Kale: Blue Curled Scotch	18.1	10	3	54	5	72	90.9	10	0	0	1	11
Kale: Early Green Curled Scotch	45.0	18	9	17	16	60	100.0	13	0	0	0	13
Stock: Giant Imperial Rose	0	0	0	9	0	9	50.0	4	0	4	0	8
Stock: Double Giant Shasta	90.0	6	3	1	0	10	0	0	0	5	5	10
Cabbage: Copenhagen Market	7.4	4	1	16	47	68	95.3	41	0	1	1	43
Cabbage: Danish Ballhead	0	0	0	8	11	19	100.0	12	0	0	0	12
Cabbage: Early Jersey Wakefield	0	0	0	1	3	4	87.5	7	0	1	0	8
Cabbage: Glory of Enkhuizen	0	0	0	2	16	18	---	--	--	--	--	--
Cabbage: Wisconsin All Season Resistant	0	0	0	0	8	8	30.0	2	1	1	6	10
Cauliflower: Early Snowball	2.6	2	0	58	17	77	88.2	15	0	0	2	17
Collards: Georgia	0	0	0	0	6	6	33.3	4	0	4	4	12
Kohlrabi: Green Vienna	0	0	0	0	7	7	26.7	4	0	3	8	15
Radish: Long White Icicle	97.5	73	6	1	1	81	87.5	95	3	5	9	112
Radish: Early Scarlet Globe	80.0	12	0	0	3	15	85.6	111	2	7	12	132
Radish: Round Black Spanish	---	--	--	--	--	--	72.0	79	6	22	11	118
Radish: French Breakfast	---	--	--	--	--	--	69.0	67	2	10	21	100

[1] Commercial lots of seed were used.

The Nutritional Requirements of Certain Wilt Fungi

(J. K. Armstrong, J. B. Whitney, Jr., and G. M. Armstrong)

In the investigation of a Fusarium wilt disease, one procedure is to grow the fungus in a liquid nutrient solution and to pour the fungus mass around the roots of the plants as the inoculum. However, a sesame-wilt isolate and a cowpea-wilt isolate failed to grow in this standard solution. Since the usual procedure could not be followed for studying these wilt diseases, an effort was made to determine what is needed by the two isolates.

Some fungi do not manufacture all the vitamins necessary for their growth; hence it was suspected that these isolates might be vitamin deficient. Tests soon showed that the cowpea fungus was a biotin-deficient isolate. Slight growth occurred with as little as 1 part biotin to 10 billion parts of solution, moderate growth with 1 part per billion, and good growth with 1 part per 100 million. Maximum growth was made with biotin at a concentration of 1 part in 50 millions of solution. It is interesting to note that of the numerous cowpea-wilt isolates with which experiments have been performed, only this one shows the biotin deficiency.

Tests with various vitamins failed to induce growth in the sesame isolate; so other modifications of the nutrient solution were made. It was discovered that the fungus could not use calcium nitrate alone which is the source of the nitrogen in the standard nutrient solution. It was able to use reduced forms of nitrogen such as glycine, ammonium sulfate, and ammonium nitrate. However, the best growth was obtained with equal parts of ammonium sulfate and calcium nitrate. Of the several sesame isolates on hand, only this one requires the reduced form of nitrogen since the others will grow on the standard nutrient solution with calcium nitrate.

Comparison of Organic and Inorganic Fungicides for Brown Rot Control on Peaches

(H. H. Foster)

Brown rot control experiments were conducted in a commercial peach orchard of the J. H. Hale variety in Spartanburg county in 1951. Ten spray treatments were compared in randomized single tree plots. Applications of conventional or dilute type of sprays were made at approximately 600 pounds pressure. Starting at petal fall nine of the spray treatments received a total of eight fungicide applications. The control treatment consisted of six applications of parathion (insecticide) in which no fungicide was used. Peaches were harvested approximately 2 weeks following the final fungicide application. In certain storage experiments peaches were held at room temperature (approximately 75° to 80° F.) for 5 days after harvest. In other storage experiments peaches were held for 5 days at approximately 45° F., and were then ripened for 3 days at room

temperature. Data were recorded after these 5- or 8-day storage periods by counting the number of peaches showing brown rot symptoms. Table 17 gives the fungicides used, the number of fruits harvested, percent of healthy peaches, and percent of peaches showing brown rot symptoms. Only wettable sulfur (6 lbs. to 100 gal.), Orthocide 406, and manganese ethylene bisdithiocarbamate appeared sufficiently effective for practical brown rot control. Many peaches sprayed with manganese ethylene bisdithiocarbamate showed spray injury in the form of a bronzing or russeting. Peaches sprayed with Orthocide 406 were free from spray injury and usually showed better color than those sprayed with wettable sulfur.

Table 17.—Comparison of Eight Fungicides in Relation to Brown Rot Control[1]

Fungicide used	Number of peaches harvested	Percent healthy[2]	Percent showing brown rot symptoms[2]
Wettable sulfur 6 lbs./100 gal.	296	82.4	4.7
Wettable sulfur 4 lbs./100 gal.	279	83.1	11.4
Dispersible sulfur 50% wettable 3 lbs./100 gal.	296	26.3	68.5
General Chemical 1189 50% wettable 2 lbs./100 gal.	266	71.0	16.1
Rohm & Haas CR-2379 50% wettable 2 lbs./100 gal.	304	51.3	44.7
Rohm & Haas Dithane D-14 1½ qts./100 gal. Ferric sulfate 6/10 lb./100 gal.	296	80.0	15.8
DuPont's manganese ethylene bisdithiocarbamate 1½ lbs./100 gal.	301	88.0	5.6
Orthocide 406 50% wettable 2 lbs./100 gal.	300	94.6	5.0
H T H (calcium hypochlorite) 70% active ½ lb./100 gal.	300	9.6	82.6
Check plot (no fungicide) parathion only	287	16.3	60.6

[1] Parathion, at 1½ lbs./100 gal., was used as the insecticide in all spray treatments except General Chemical 1189. The compound 1189 was used as a combination insecticide-fungicide.
[2] The percentage of healthy and brown-rot-infected fruits does not total 100 percent. The percentage of peaches showing symptoms of **Rhizopus** rot, scab, and certain miscellaneous rots is omitted from this table.

The Peach Leaf Curl Epidemic of 1951

(H. H. Foster and D. H. Petersen)

A leaf curl epidemic, the first since the early 1940's, was observed in the peach areas of northern South Carolina during the 1951 season. Most of the orchards of the Upper Piedmont showed foliage symptoms of the disease caused by the fungus, *Taphrina deformans.* During May some of the severely affected orchards, primarily of the Elberta variety, were nearly defoliated. In those orchards the fruit drop was extremely heavy and frequently the number of peaches that remained on the trees was insufficient to justify continuing the spray program. In orchards showing leaf curl symptoms, young infected twigs were frequently observed, but relatively few infected peaches were seen.

Certain factors favored the development of this epidemic. Cool, wet weather during late March and early April favored the spread and development of the disease. This period was preceded by unseasonally warm weather, and it is believed that bud development had begun before the recommended dormant spray of Bordeaux mixture or liquid lime sulfur was applied. However, in many orchards no dormant spray was used. Another contributing factor may have been the absence of a sulfur spray program in 1950, as a result of a peach crop failure. Additional amounts of a readily available nitrogen fertilizer, when applied during the early spring, appeared to be effective in forcing new foliage growth on trees severely affected by the leaf curl fungus.

Table 18 lists the reaction of 73 peach varieties. The rating used to indicate symptom expression was based on a numerical scale of 0 to 5 in ascending susceptibility. In some peach varieties trees 2 to 3 years old showed less foliage symptoms than trees 5 to 6 years in age. However, in some varieties foliage symptoms appeared to be similar for trees in both age groups. No variety observed was immune to the leaf curl fungus.

Board Foot-Bolt Foot Volume Relationship for White Oak Logs

(N. B. Goebel)

Measuring or scaling logs to determine their board foot volume is common practice when logs are bought and sold. These volumes, expressed in board feet for a log of given diameter and length, are determined directly from a log rule or volume table, such as the Doyle, Scribner, or International.

For the manufacture of lumber, logs are usually cut in lengths of 10 feet and longer in order to produce boards and timbers. However, in the manufacture of wood containers, such as barrels, kegs, and pails (cooperage), the purchase of long logs is not common

Table 18.—Leaf Curl Rating for 73 Peach Varieties[1]

Variety or seedling number	Rating	Variety or seedling number	Rating
Age of trees—5-6 years			
Early Triogem	3	Golden Beauty	1
Early Halehaven	3	Dixired	2
Newday	1	Dixigem	0–1
Early Red Fre*	3	Southern Glow	1
Rosebud	2	Golden Globe	2
Candoka	2	False Sunhigh	2
J. H. Hale	1–2	Sunhigh	2
Sunday Elberta	2–3	July Elberta	3–4
Redskin*	2–4	Early Elberta (Gleason)	1–3
Summer Crest*	1–2	Burbank Elberta	2–3
Early Vedette*	1	Goldeneast	4
Fort Valley 110	2	Belle of Georgia	3–4
Nectar	1–2	Elberta	4–5
Best May	2	Gemmer's Late Elberta	4–5
Raritan Rose*	1–2	Fertile Hale	3–4
Fisher	2	Lizzie	4
Early Fair Beauty	2	Halehaven	1–2
Garden State Nectarine	4	Redhaven	0–1
Starking Delicious	2	Southland*	2
Sullivan Early Elberta	3–5	Fort Valley 993	3
Triogem*	4	Ambergem	1–2
Missouri	1	Fireglow	3
Loring	1	Fairhaven	1–2
Ozark	1	South Haven 20	1
Prairie Rose	2	Redcrest	1
Prairie Dawn	0–?	Halberta	1–2
Prairie Rambler	2–3	Afterglow	4
Davidson Red Leaf	1	Rio Oso Gem	4–5
Halegold	3–4		
Age of trees mostly 2-3 years			
Indian Blood (Cling)	1	Merill Gem	2
Southland*	3–4	Merill June	1
Fay Elberta	1	Raritan Rose*	0–?
Summer Crest*	1	Early Red Fre*	1
Fort Valley 20	1	Jerseyland	2
Early Vedette*	1	Early Jubilee	1
Triogem*	1	Cherryred	1
Fireglow	3	Desirable	1
Fairhaven	1–2	Halberta	1–2
South Haven 20	1	Redskin*	2–4
Redcrest	1	Afterglow	4
		Rio Oso Gem	4–5

* Variety occurring in both age groups of trees.
[1] Rating = 0-5, inclusive.

practice. In addition to requirements for short lengths of 23 and 39 inches, white oak must be absolutely free of defects when used for cooperage. The practice of cutting white oak logs into short lengths, called bolts, followed by splitting into quarter sections, allows a closer inspection for defects, such as worm holes, sap streak, decay, and other defects, commonly found in the white oak.

Accordingly, the volume of these bolts, when based on the cord

measurement taken on the cut face between the two radii of the split section, is determined on the basis of the bolt foot. A split section of a bolt having a cord measurement of 12 inches would contain one bolt foot.

Many woodland owners readily understand the board foot system and figure their labor costs for woods operations on that basis. When confronted with the bolt foot system, they find it difficult to arrive at comparable cost figures simply because there is no ready method to determine them except by experience. What then is the relationship of the board foot volume of a log to its bolt foot volume?

The net volume relationship of the number of board feet per bolt foot for logs of various scaling diameters and lengths is given in table 19. The values shown indicate that the ratio between the volumes is not constant, but increases in value as the diameter and length increase in size.

It is interesting to note, that a rule-of-thumb ratio of 5 to 6 board feet per bolt foot is being used in this section. This ratio does apply to average conditions of log size, but would be a low estimate for better than average size logs, particularly in the sizes which are in constant demand.

Table 19.—Net Volume in Board Feet per Bolt Foot for White Oak Logs, Piedmont Hardwood Forests, South Carolina[1]

Diameter (small end of log inside bark) in inches	Log length in feet			
	6	8	10	12
	Board feet per bolt foot			
14	3.0	4.0	5.0	6.0
15	3.2	4.3	5.3	6.4
16	3.4	4.5	5.7	6.8
17	3.6	4.8	6.0	7.2
18	3.8	5.1	6.4	7.7
19	4.1	5.4	6.8	8.2
20	4.3	5.8	7.2	8.7
21	4.6	6.1	7.7	9.2
22	4.9	6.5	8.1	9.8
23	5.2	6.9	8.6	10.3
24	5.5	7.3	9.1	11.0
25	5.8	7.7	9.7	11.6
26	6.2	8.2	10.2	12.2
27	6.5	8.6	10.8	12.9
28	6.8	9.1	11.4	13.6
29	7.2	9.6	12.0	14.3
30	7.6	10.1	12.6	15.1

[1] Based on measurements from 475 logs. Tabular values computed from regression equation: Board feet per bolt foot = 0.29128 + 0.00109 (diameter squared) x length. Standard error of estimate = ± 0.229. Board foot volumes by Doyle Rule.

Chemical Weed Control Experiments in Corn and Cotton

(W. B. Albert)

The Agricultural Engineering Department, the Agronomy Department, the Edisto Experiment Station, and the Soil Conservation Service have cooperated in these experiments.

The 1951 season was extremely dry at planting time, and seed germination was slow and uneven, resulting in irregular and uneven stands of corn and cotton. Although there was sufficient moisture later in the season for a cotton crop, yields of corn were only ¼ to ½ of what might have been expected under more favorable moisture conditions.

Under these unfavorable seasonal conditions, results from chemical weed control experiments in corn were, at times, at variance with results obtained in previous years. Certain general observations, however, will be presented as being indicative of what occurred under dry seasonal conditions.

Corn Pre-Emergence Experiments

On a "river-bottom" field, pre-emergence applications of 2 pounds per acre of 2,4-D and 4 pounds per acre of Crag Herbicide 1 to plots that received no further cultivation resulted in yields significantly lower than those obtained from plots that received no herbicides, but were cultivated in the usual manner. In contrast, yields in another experiment in the same field, but where moisture conditions were more favorable for seed germination, were not significantly lower following the application of 2 pounds per acre of 2,4-D and 3 pounds per acre of Crag Herbicide 1, as compared to normally cultivated, chemically untreated plots.

On an upland Cecil clay loam soil pre-emergence application of herbicides to plots that were not subsequently cultivated resulted in yields of corn significantly greater than on uncultivated plots to which no herbicides were applied, but yields were significantly lower than on normally cultivated plots that received no herbicides.

At the Edisto Experiment Station, on a Ruston sandy loam soil, all pre-emergence applications of herbicides without subsequent cultivation resulted in corn yields significantly lower than those where normal cultivation was given but herbicides were not applied. It should be added, however, that yields from normally cultivated plots were less than 15 bushels per acre under the extremely dry conditions of the season and that the application of herbicides contributed only to a relatively greater degree of crop failure.

Chemical Weed Control in Cotton

The cotton plantings of April and early May did not produce a stand of plants suitable for experimental purposes because of poor and irregular stands resulting from dry weather. Later plantings on

May 30 and July 24 resulted in stands suitable for studies of pre-emergence and post-emergence herbicides, although yields were not obtained. The following observations were made regarding the effectiveness of certain herbicides for weed control in cotton.

The "dinitro" materials, applied at the rate of 1-1/3 pounds per acre on a 13-inch band of soil over the row immediately after planting appreciably reduced the number of annual grasses and broad-leaved weeds in the row. At this rate of application, there was no significant reduction in the number of young cotton plants. At twice the above rate of application, or 2-2/3 pounds of "dinitro" per acre, significant reduction in numbers of seedling plants of cotton were noted, although a greater degree of weed control was obtained.

Pre-emergence applications of chloro-IPC at the rate of 1-2/3 pounds per acre on a 13-inch band over the cotton row suppressed germination of annual grasses for a period of 4 weeks, as shown in figure 12. Up to the time of fruit bud formation, after which the experiment was discontinued, there was no evidence of injury to cotton plants at rates of 1-2/3 and 3-1/3 pounds per acre. The lower rate was effective in suppressing annual grasses. This new and promising chemical has been tested for only one season.

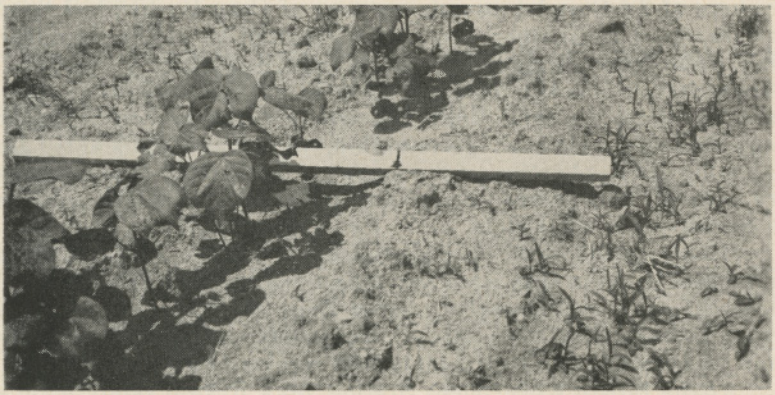

Figure 12.—Weed control in cotton with 1-2/3 pounds per acre of chloro-IPC applied immediately after planting in a 13-inch band over the row. The cotton was planted July 24. On August 10, the row "middles" were cultivated and 5 gallons per acre of Esso No. 38 oil applied to the band. The grass present in the row "middles" had grown since August 10. Photographed on August 22.

Post-emergence applications of a special herbicidal oil (Esso No. 38) at rates of 5 gallons per acre were made to the bands of soil over the cotton rows that had been previously treated with pre-emergence chemicals. When properly used and applied with suitable equipment, young cotton plants tolerated this oil, and it was an effective contact herbicide for young grass and broad-leaved weed plants present in the cotton rows.

At rates tolerated by cotton plants, none of the herbicides tested have shown any promise of controlling infestations of nut grass, Johnson grass, and Bermuda grass.

The principal requirements for a combination of mechanical and chemical methods for weed control in cotton production appear to have been met where cotton can be planted in fields permitting uniform seedbed preparation. There are, however, unsolved problems of herbicidal application techniques where cotton fields are hilly, or full of rocks and clods.

INSECTS AND THEIR CONTROL

Faunal Survey

(M. D. Farrar)

Each year cooperative surveys are made to determine the presence of destructive pests. Records made on these surveys give a clue to the introduction or spread of dangerous species. The Irish potato producing area in the Coastal Plain has been checked for the last 3 years for the possible presence of the golden nematode, a destructive pest of the potato in Europe. To date it has not been found outside of Long Island, New York. All of the South Carolina records were negative. A first record for the imported fire ant, *Solenopsis saevissima* (Forel) was made at Charleston in the summer of 1950. Also the European corn borer, *Pyrausta nubilalis* (Hbn.) was found for the first time at Greer. Two new species of lepidoptera were added to the records and collection. As a service to farmers reports on the relative abundance of common destructive species are released throughout the season. Such information aids farmers in protecting their crops against such crop pests as the plum curculio, the oriental fruit moth, the cotton boll weevil, the bollworm, the tobacco budworm, armyworms, grasshoppers, aphids (plant lice), white grubs, wireworms, the corn billbug, and red spiders.

Cowpea Curculio Control Investigations

(David Dunavan)

Small field plots were used in order to test the effectiveness of several of the newer insecticides in controlling this insect. A few of the older materials were also included for comparison. The materials used were: Aldrin 2.5%, dieldrin 1%, DDT 5%, toxaphene 10%, toxaphene 20%, chlordane 5% plus DDT 5%, cryolite 90% and lindane 3%. All materials were applied as dusts beginning about the time young pods were beginning to develop on the plants. Plots were laid off so that each treatment could be replicated once. In addition, two untreated areas were used as untreated checks.

Effectiveness of treatments was rated on the number of full-grown larvae emerging from 1,000-gram samples of pods picked just as they changed from green to mature stage.

Table 20.—Effectiveness of Dust Insecticide Treatments Against Cowpea Curculio at Clemson, S. C., 1951

Treatment	Larvae per 1,000 grams of peas	Percent control
Lindane 3%	1.5	99.1
Aldrin 2.5%	2	98.8
Dieldrin 1%	2.5	98.5
Toxaphene 10%	8	95.3
Chlordane 5% plus DDT 5%	14	91.9
Cryolite 90%	16	90.6
DDT 5%	40	76.6
Check	171	0

The Regraft or Double-Graft Method of Rearing Queen Bees

(David Dunavan)

This investigation was an attempt to secure conclusive data regarding the possible superiority of this method over the older standard method of producing queen bees.

Basically, the usual commercial production of queen bees consists of manually placing a very young bee larva in a special wax cell acceptable to bees and then inducing these bees to go ahead and develop this larva into a queen. Queen producers or breeders know the process of transferring the young larva from its original position in the hive to the special wax cell referred to above as "grafting."

The regraft or double-graft method consists of removal by the queen breeder of the first larva grafted and the substitution of a fresh larva. This substitution is usually performed about 24 hours after the first larva is placed in the cell. At the time of this substitution the bees have well under way the lavish feeding which produces the new queen. The presumption has been that this substitution may produce a superior queen because of the fact that the second larva is placed directly into a bed of already prepared food and therefore suffers no interruption in its feeding process.

A total of 68 regrafted larvae were compared with approximately the same number of larvae started in the usual manner (single graft). Every effort was made to have conditions identical for both. When the larvae had attained their growth and had transformed to the pupal stage, they were removed from the rearing hives to a laboratory where they could be weighed and measured. First, the cells containing the pupae were measured. Next, the cells were split open and the pupae were removed. Each pupa was then weighed and measured. Table 21 shows the results obtained.

It will be noted that regrafting caused increase in length of cells, length of pupae, and weight of pupae. Due to unavoidable errors in the first two measurements, it is felt that the increase in weight of pupae is the most reliable of the three figures.

Table 21.—Effect of Regrafting on Length of Cells, Length of Pupae, and Weight of Pupae

Treatment	Cell length, mm.			Length of pupa, mm.			Weight of pupa, mg.		
	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
Double graft	28	19	23.27	17	15	16.02	305	240	272.0
Single graft	26	18	20.78	17	15	15.62	290	210	260.5
Increase	2	1	2.49	0	0	.39	15	30	11.5
Percent increase			11.98			2.53			4.4

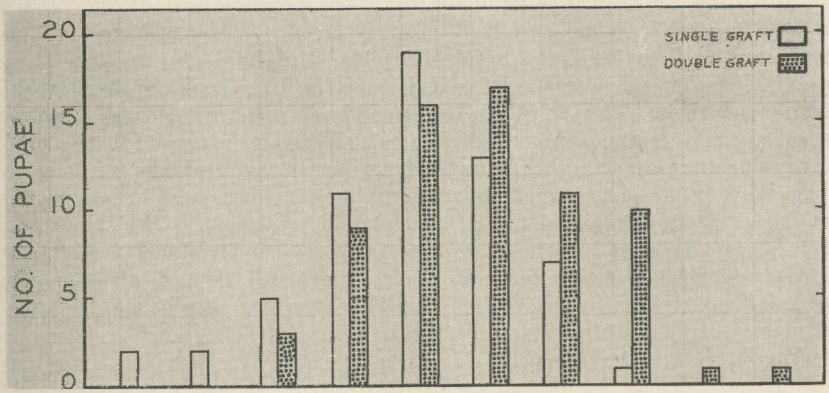

Figure 13.—Effect of regrafting on weight of queen bee pupae. Pupal weights grouped in 10-milligram classes.

The significance of this increase in weight of pupae is shown in graphic form in figure 13. Nearly two-thirds of the single-grafted cells gave pupae weighing less than 270 milligrams. In the regrafted cells nearly two-thirds of the pupae weighed 270 milligrams or more, and none appeared in the lighter weights as was the case with the single-grafted cells.

Honey Bees Increase Yield of Clover Seed

(W. H. Purser)

The yield in seed of reseeding crimson clover has been greatly increased by providing honey bees as pollinators. Clover growing in cages that excluded honey bees produced only 3.5 percent as much seed as was produced from clover in similar cages with honey bees. The seed produced from clover under field conditions was only 68 percent as abundant as seed produced from clover in cages provided

with honey bees. Data on seed yields in 1951 indicated that the field under observation did not have sufficient honey bees working the field to provide adequate pollination. Tests conducted in Alabama indicated that at least two colonies of honey bees per acre were necessary to produce a satisfactory set of seed.

Records made on the most favorable period for producing seed indicate that the bulk of the seed is produced on the early to mid-season blooms. Later blooms produce very little seed.

EPN Versus Parathion for Control of Peach Insects
(J. H. Cochran)

Laboratory and field experiments indicate that EPN (ethyl p-nitrophenyl thionobenzene phosphonate) was equally as effective as, if not slightly superior to, parathion for the control of the three major insect pests of peaches—plum curculio, oriental fruit moth, and borers. However, it appeared to be slightly less effective than parathion for the control of scales and aphids. It is doubtful that either of these pests will build up sufficient populations to cause any damage, if a complete EPN spray schedule is used for the control of plum curculio and oriental fruit moth.

EPN possesses two advantages over parathion: (1) It has better residual properties and will give longer protection to the trees and fruits. (2) It is reported to be less toxic to warm-blooded animals. However, it is a toxic material, and operators should observe the precautions listed on the labels which are very similar to the precautions recommended for parathion.

Cattle Spray Themselves
(W. F. Chamberlain)

Following the Illinois Natural History Survey technique of automatic sprayers, two units were tested at Clemson in 1951. The automatic sprayer unit is a type of chute with a moveable platform. As the cattle move through the chute to either feed or water, they spray themselves by stepping on the platform which is connected with a tiny pump. About 2 cc. of liquid is applied to a cow per day. The cost of the treatment does not exceed one cent per cow per day.

A herd of dairy heifers treated in this manner had only 1 to 2 hornflies feeding on each per day as compared to 500 per cow in an untreated herd nearby. Horseflies were virtually absent from the treated herd, but averaged 2 to 4 per animal in the untreated herd. Several formulations of pyrethrum plus a synergist gave protection from hornfly and the horsefly when used in the automatic sprayer.

Systemic Insecticides Promising
(W. F. Chamberlain)

A new chemical that can be absorbed by the plant and then destroy insects feeding on the plant has been under test by the De-

partment of Entomology at Clemson College. This chemical is called octomethyl pyrophosphoramide (OMPA). When applied to alfalfa, during the spring of 1951, this chemical completely destroyed a pea aphid population. The use of systemic poisons must be restricted to experimental testing until more is known about the toxic properties of the chemical. It has been shown that toxic portions of the chemical are absorbed by the plant and that insects are killed by sucking the juices from the plant. Under growing conditions the plant apparently becomes less toxic as it approaches maturity. Also 1/4 pound of technical parathion applied as a spray destroyed 97.5 percent of the aphids in 24 hours. This chemical does not remain active for the long period of time exhibited by OMPA.

Two Insecticides Control Green June Beetle Larvae

(W. F. Chamberlain)

With the advent of better pastures, larvae of the green June beetle, *Cotinis nitida* (L), have become destructive in these pastures. This native insect was relatively unnoticed until legumes were introduced into pasture mixtures. The adults lay their eggs in heavy pasture sods. The young grubs feed particularly on the roots of the legumes. When abundant the grubs will pulverize the soil to a depth of 2 to 3 inches. A severe loss in stand is evident within a year or two.

Treating infested sods with parathion at 1/2 to 1 pound per acre (technical) applied as a heavy spray has been very effective. Dead grubs appear on the soil surface within 2 to 7 days. Lindane applied at 1/2 to 1 pound per acre also gives good control. Spring and fall applications of the spray have been about equally effective.

ANIMAL HUSBANDRY

Cottonseed Meal, Soybean Meal, and Antibiotics in the Rations of Fattening Swine

(E. G. Godbey and L. V. Starkey)

The objects of this test were: (1) To compare low gossypol cottonseed meals, soybean meal, and fishmeal as protein supplements to corn for hogs fed in dry lot; (2) to compare cottonseed meals made by different methods; (3) to determine the value of materials containing B_{12} and antibiotics when added to rations in which cottonseed meal furnished the protein supplement.

Fall pigs averaging approximately 80 pounds in weight were self-fed in individual pens to a final weight of 225 pounds. The rations were balanced according to the Morrison standard. Ground yellow corn was fed in all of the rations. The supplement used in the

check lot was one-half fishmeal, one-fourth cottonseed meal, and one-fourth alfalfa meal. Cottonseed oil meal or soybean oil meal furnished the protein supplement in other lots. Alfalfa meal was added to each ration.

Four low-gossypol cottonseed meals were used. The first three were designated as meals number 1, 2, or 3. These meals, which were furnished by the Southern Regional Research Laboratory, New Orleans, Louisiana, were made by the screw process method. The difference in chemical analyses that was of particular interest was the percentage of soluble nitrogen. This percentage of soluble nitrogen was 15.9 in meal number 1, 33.9 in meal number 2, and 41.1 in meal number 3. The fourth cottonseed meal used was a special solvent extracted product, which was furnished by Proctor and Gamble, Cincinnati, Ohio. The B_{12} and antibiotic supplements were furnished by Merck and Co., Rahway, New Jersey, and Lederle Laboratories, Pearl River, New York. These supplements were used in such amounts that each of them supplied about 12,500 mcg. of B_{12} per ton of feed. This amount of the supplements also supplied about 15,000 mg. of aureomycin or penicillin, or 30,000 mg. of streptomycin. The effect of the rations on the rate of gain and feed requirement of the hogs is shown in the following table.

Table 22.—Supplements Fed, Average Daily Gains, and Feed Required for 100 Pounds of Gain Made by Fattening Hogs

Lot No.	Supplements fed[1]	Av. daily gain	Feed eaten 100 pounds gain
		Pounds	*Pounds*
1	Fishmeal + alfalfa meal + cottonseed meal	1.88	381.41
2	No. 1 cottonseed meal + alfalfa meal	1.63	406.67
3	No. 2 cottonseed meal + alfalfa meal	1.60	393.14
4	No. 3 cottonseed meal + alfalfa meal	1.43	377.16
5	Buckeye cottonseed meal + alfalfa meal	1.62	387.98
6	No. 2 cottonseed meal + alfalfa meal + aureomycin + B_{12}	1.70	370.04
7	No. 2 cottonseed meal + alfalfa meal + streptomycin + B_{12}	1.67	371.75
8	No. 2 cottonseed meal + alfalfa meal + penicillin + B_{12}	1.97	321.24
9	Soybean meal + alfalfa meal	1.41	380.99

[1] Ground yellow corn was fed in all lots. One percent of ground oyster shell and one-half of one percent of salt were added to each ration.

The hogs which received an animal supplement made faster gains than those fed cottonseed meal or soybean meal. There was no evidence of gossypol poisoning in any of the pigs that were fed cottonseed meal. The use of B_{12} and antibiotics increased the rate of gain and decreased the feed required for 100 pounds of gain. Penicillin was more effective than streptomycin or aureomycin as judged by the rate and cost of gains.

Summer Pastures for Beef Cattle

(E. G. Godbey and L. V. Starkey)

Southern farmers are finding by experience that good summer pastures are the first essential for economical beef cattle production. When properly fertilized, these pastures have a long growing season, withstand extreme temperatures and rainfall, and furnish a palatable, nutritious feed.

There has not been a general agreement as to which of the grasses is most desirable for summer grazing. Many people, especially in the Piedmont section, prefer a permanent pasture grass mixture of Bermuda and Dallis grass with lespedeza and White Dutch clover. Some farmers prefer sericea and kudzu pastures for summer grazing. During the 1951 season a second test was conducted comparing these grasses as pastures for growing and fattening steers.

Duplicate 4-acre plots of permanent pasture, sericea or kudzu, were grazed at the rate of one 550-pound steer to the acre. The grazing started May 1 on the permanent pasture and sericea lots and on May 15 on the kudzu lots. The excessive drought in the early fall made it necessary to close the test on October 2.

The results secured during the 1951 grazing season were approximately the same as those secured in 1950. The average gain produced per acre for the 2 years was 220 pounds for the steers on Bermuda, 204 pounds on sericea, and 199 pounds for those on kudzu.

If the steers had been bought and sold for $25.00 per 100 pounds, the income per acre, above fertilizer costs, would have been $39.70 for Bermuda, $34.70 for sericea, and $33.45 for kudzu.

Purebred Versus Crossbred Calves

(E. G. Godbey and L. V. Starkey)

Fat calf production is one of the most popular and profitable forms of commercial beef cattle raising in South Carolina. The value of crossbreeding in the production of these calves has not been thoroughly demonstrated. In most cases, crossing the British breeds, or using a Brahman bull on the British-breed cows has produced calves that were heavier than the purebreds. The breeds that can be most profitably used in making these crosses have not been determined. Tests at the Coast Experiment Station have shown that crossbred calves were heavier than purebreds at birth and at weaning. The differences in weaning weights were not significant when calves sired by Hereford and Brahman bulls were compared.

The first test at the College Station was completed in 1951. Thirty-eight calves were produced by purebred Hereford cows that

had been bred to Hereford, Angus, or Brahman bulls. The purebred Hereford calves weighed 449.57 pounds at weaning (7 months), as compared to 481 pounds for the Brahman-Hereford calves and 496.57 pounds for the calves sired by the Angus bull. The calves sired by the Brahman actually sold for $11.31 more per head than the purebreds. The calves sired by the Angus bull were worth $16.92 more than the purebreds. The greatest difference was between the crossbreds and the purebreds. The difference in value per head was only $5.61 when the calves from the crossbred groups were compared.

Bovine Serum Solids in the Control of White Scours in Calves

(G. W. Anderson)

White scours of newborn calves is a major hazard in the development of replacement stock in the dairy cattle industries. Many compounds, "sulfa" drugs, and antibiotics have been used to control white scours. Some of the compounds used have been quite successful, others have been valueless, but all the compounds used injure the calf to some extent. This fact prompted the development of normal bovine serum solids as a treatment for white scours.

In summary:

1. Bacteria and virus-free bovine serum solids contain antibodies which protect the calf against the bacteria causing white scours.

2. Bovine serum solids do not contain substances foreign to the body of the calf.

3. Bovine serum solids were not harmful when administered to 57 healthy calves.

4. Fifteen calves with white scours received bovine serum solids and recovered in 24 to 48 hours.

DAIRYING

Topseeding Bermuda Grass with Perennial Rye Grass and Reseeding Crimson Clover

(W. A. King and J. P. LaMaster)

One of the best producing pastures at Clemson College for milking cows has been Bermuda grass topseeded each fall with annual rye grass and crimson clover. This experience suggested the use of perennial rye grass and reseeding crimson clover on Bermuda grass pastures. Twenty acres were planted in October by a cultipacker seeder with 30 pounds of perennial rye and 20 pounds of reseeding crimson clover per acre. Prior to seeding, the Bermuda grass pasture was disked thoroughly and 2 tons of limestone, 1,000 pounds of basic slag, 600 pounds of superphosphate, and 500 pounds of 4-10-6 ferti-

lizer were applied per acre. One year later an application of 600 pounds per acre of a 3-12-12 mixture was made.

Dairy heifers grazed this pasture for 215 days the first season. Concentrates and hay were fed as supplements during certain periods. The live-weight gains averaged 1.44 pounds daily. The carrying capacity of the pasture totaled 261 heifer days per acre. During the second year the pasture was grazed for 225 days, averaging 171 heifer days per acre. Some concentrate was fed at certain periods to supplement the pasture. The live weight gains averaged 1.09 pounds daily.

The yield of the Bermuda grass-rye grass-crimson clover pasture was 1,850 pounds of total digestible nutrients per acre the first year and 1,651 pounds the second year. The average was 1,750 pounds of total digestible nutrients per acre, which is equivalent to 1.74 tons of alfalfa hay per acre.

At the end of the second year all the reseeding crimson clover and a large percentage of the perennial rye grass had disappeared, partly due to the Bermuda grass crowding out the rye grass and crimson clover.

Cottonseed Meals Tested for Palatability

(W. A. King)

Most cottonseed meal is processed by the hydraulic method. Other manufacturing procedures, such as the expeller and solvent processes, are beginning to be used more widely. The solvent method removes the fat more completely and produces a cottonseed meal which contains approximately 1 percent fat as compared with 4.5 to 7.0 percent fat in expeller and hydraulic processed cottonseed meals. An experiment was undertaken to determine the palatability of representative samples of cottonseed meal produced commercially by the hydraulic, the expeller, and the solvent processes.

Each of the three cottonseed meals was mixed with other concentrates to make a mixture containing approximately 16 percent crude protein. The general formula for the mixtures was 49 percent ground shelled corn, 25 percent ground oats, 25 percent cottonseed meal, and 1 percent salt. Ten cows producing over 20 pounds of milk daily were selected and placed in two groups of five each. The mangers for the experimental cows were divided into two parts with a partition 10 inches in height. During a 9-day preliminary period, the concentrate containing the hydraulic meal was fed to all cows. One-half of their usual allotment of concentrate was placed on each side of the partition. Following the preliminary period, each group of cows was fed two of the concentrate mixtures for an experimental period of 10 days. The cows were fed their usual quantity of concentrate from two sources as follows: Group I—one-half hydraulic

mixture and one-half expeller mixture; Group II—one-half hydraulic mixture and one-half solvent mixture. Each mixture was fed in a different side of the manger at each feeding. This was done to overcome any eating habits of individual cows.

The cows were observed throughout each feeding for any evidence of preference and time required to consume the feed. The results of the experiment showed that the meals prepared by the hydraulic, expeller, and solvent processes were equally palatable.

Evaluation of Winter Pastures for Dairy Cattle

(W. A. King and J. P. LaMaster)

The best method for evaluating the returns from pastures is the determination of the nutrients that the animals obtain from grazing. A milking cow must be supplied with sufficient nutrients to satisfy her requirements. The returns from pasture are based on the total digestible nutrients (TDN) required by the cow for body maintenance, milk production, and live-weight changes, less the amount of total digestible nutrients obtained from feed received in the barn. The yields obtained from grazing are measured in pounds of total digestible nutrients produced per acre and can be converted to alfalfa hay equivalent per acre. The latter is the quantity of hay that would be required if the pasture had not been available.

A preliminary report of the results of grazing various winter pasture crops is presented in the table. The best winter pasture combination for milking cows has been rye grass and crimson clover.

Table 23.—Preliminary Report of Results of Grazing Experiments With Dairy Catt Expressed on Acre Basis

Winter pasture	Type of animal	No. of experiments	Av. no. days grazed	TDN obtained	Alfalfa hay equivale
Rye grass-crimson clover	Milk cows	3	167	3,000	2.98
Fescue (75%)-Ladino clover (25%)	Milk cows and dry cows	2	216	1,844	1.83
Fescue (25%)-Ladino clover (75%)	Milk cows	1	231	2,599	2.58
Crimson clover	Heifers	2	91	1,164	1.16

The yield of this combination averaged 167 days of grazing and 3,000 pounds total digestible nutrients, or 2.98 tons of alfalfa hay equivalent per acre. The grazing of rye grass and crimson clover began each year in December and continued into May. The fertilizer used included a basic treatment of 2 tons of lime, 8 tons of manure, and 900 pounds of 20 percent superphosphate applied prior to the 3-year experiment. Annual applications of 600 pounds of 4-10-6 fertilizer per acre and additional nitrogen averaging 53 pounds per

acre were made. To date, a winter pasture of rye grass and crimson clover has proved better for milking cows at Clemson College than a winter pasture of fescue and Ladino clover. In addition the land is available for Sudan grass or millet pasture during the summer.

Fescue and Ladino clover pastures have varied in production. The results of two years of experiments with a mixture of 75 percent fescue and 25 percent Ladino clover averaged 1,844 pounds total digestible nutrients, or 1.83 tons of alfalfa hay equivalent per acre, obtained over 216 days of grazing. This pasture was treated with 2 tons of lime, 1 ton of basic slag, and 10 tons of manure per acre as a basic treatment. During the first year 640 pounds of a 4-10-6 mixture per acre was applied in September and 640 pounds 0-12-12 in March. In addition, 20 pounds of nitrogen per acre was applied in December, in February, and again in May. During the second year an application of 640 pounds of 3-12-12 per acre was made in August plus 100 pounds of nitrogen distributed in four different applications through the fall, winter, and spring.

A grazing experiment with a mixture of 75 percent Ladino clover and 25 percent fescue has been more encouraging. In 231 days of grazing, the pasture yielded 2,599 pounds total digestible nutrients, or 2.58 tons of alfalfa hay equivalent per acre. These results showed the yield of the pasture with 75 percent Ladino clover and 25 percent fescue to be 53 percent better than the mixture of 75 percent fescue and 25 percent Ladino clover. Bloat has not been a problem. Basic treatment prior to seeding consisted of 11 tons of manure, 2 tons of lime, and 900 pounds of 20 percent superphosphate per acre. In addition 600 pounds of 3-12-12 was applied per acre at the time of seeding with another 600 pounds in May. Because of the dry fall the pasture did not become established until the spring after seeding. Experimental grazing began on August 2. A total of 78 pounds of nitrogen per acre was added in the several different applications made in the fall and late winter.

Reseeding crimson clover when grazed by heifers in two experiments has produced 1,164 pounds of total digestible nutrients, or 1.16 tons of alfalfa hay equivalent per acre. The heifers were on the pastures for 91 days beginning the first of March. Average liveweight gains ranged from 1.22 to 2.35 pounds daily.

Several of the above pasture combinations are still being studied; therefore, this report should be considered as preliminary and subject to change with additional research. The results given here are those found with dairy animals. Beef cattle may give different values with the same pasture.

Brown Swiss Cows Have Long Gestation Periods
(Wayne T. O'Dell)

A study of the gestation periods of Brown Swiss cows in the Clemson herd shows that 53 male calves were carried by their dams

an average of 290.0 days, and 48 female calves were carried an average of 285.2 days. The difference of 4.8 days was significant when these data were analyzed statistically. The 101 male and female calves were carried an average of 287.8 days. The day after service was counted as the first day of the gestation period. Only normal gestation periods were included in this study.

A majority of the calves were sired by Lee's Hill Lucky Strike or Elmhurst Lady's Dan. The average number of days that calves of both sexes, sired by these bulls, were carried by their dams is given in table 24.

Table 24.—Length of Time Brown Swiss Calves by Two Sires Were Carried in Dam

Name of sire	Males		Females	
	Number of calves	Average days carried in dam	Number of calves	Average days carried in dam
Lee's Hill Lucky Strike	27	292.2	16	290.6
Elmhurst Lady's Dan	20	287.7	22	281.9

The difference of 4.5 days between the two groups of male calves was significant, and the difference of 8.7 days between the two groups of female calves was highly significant.

The differences in the length of time carried in dam between calves sired by the two bulls indicate that the inheritance of the calf determines to some extent how long it will be carried by its dam. The data also indicate that there are differences between animals in the same breed for inheritance of the length of gestation.

For many years the gestation period of the dairy cow has been assumed to be 283 days. The American Dairy Science Association has recently recommended that new average gestation periods be shown in gestation tables for all breeds of dairy cattle, based on more complete data. The gestation periods recommended for these tables are as follows:

Breed	Days
Ayrshire	278.7
Holstein	278.9
Jersey	279.3
Guernsey	284.0
Brown Swiss	290.8

It was also recommended that these gestation periods be shown as two days less for all first-calf heifers in the respective breeds.

The average gestation period of 287.8 days for 101 male and female Brown Swiss calves born in the Clemson herd is three days less than the 290.8 days shown in the recommendations. The difference is largely due to the relatively short length of time the female calves sired by Elmhurst Lady's Dan were carried by their dams.

Official Production Testing of Dairy Cattle

(Calhoun H. Strickland)

The Clemson College Dairy Department provides supervision for the official production testing of registered dairy cattle in the State of South Carolina. During the year ending June 30, 1951, 81 herds of registered dairy cattle participated in either an advanced registry or a herd improvement registry type testing program.

Three men are employed full time and five men part time to visit farms of breeders who desire to have their herds tested. These test supervisors made 16,800 butterfat test reports on individual cows during this fiscal year. These test reports are checked, verified, posted, and forwarded to the breed association concerned to become official reports. The breeders pay all expenses connected with this work except the salary of the State Superintendent of Advanced Registry Testing, who is paid from state appropriation.

A dairy honor roll, published monthly, lists every cow on Advanced Registry and Herd Improvement Registry test in South Carolina which during her test period (except the first month) produces 55 pounds of butterfat on two times per day milking or 66 pounds on three times per day milking for the month. The completed record for each cow is reported.

The honor roll this year contained 1,751 monthly records. Of these, 29 were made by Brown Swiss, 961 by Guernseys, 95 by Holsteins, and 666 by Jerseys.

A total of 531 cows completed official records during this fiscal year. The averages of the completed records by breeds, irrespective of age and classification, are as follows:

	Pounds Milk	Pounds Fat	Percent Butterfat
Holsteins	12,034	410	3.41
Brown Swiss	9.409	390	4.15
Guernseys	9,369	469	5.01
Jerseys (HIR records not included)	7,521	381	5.06

The highest Brown Swiss record based on the fat production factor was 13,824 pounds of milk, 4.10 percent butterfat, 567 pounds of butterfat made by Clemson Dan Robitine on Herd Improvement Registry in 305 days as a Senior 3-year-old on two times per day milking. This cow is sired by Elmhurst Lady's Dan. Clemson Dan Robitine is owned by The Clemson Agricultural College, Clemson, S. C.

Coker Maxim's Ada, owned by Coker's Pedigreed Seed Company, made the highest Guernsey record. She produced 13,151 pounds of milk, 5.13 percent butterfat, 675 pounds of butterfat in 305 days as a Junior 2-year-old on three times per day milking. Her sire is Clearspring's Prince Foremost.

Clemson Homestead Rade owned by Clemson College was the

highest producing Holstein. She was tested in Herd Improvement Registry on two times per day milking and was 4 years 11 months old when the record started. Her production record was 16,862 pounds of milk, 3.71 percent butterfat, and 626 pounds of butterfat. Carnation Homestead Major is her sire.

Combine Design Lady, owned by Paul S. Lofton, made the highest Jersey 2x 305 mature equivalent fat record during the year. She was on Herd Improvement Registry two times per day milking and was 1 year 11 months old when the record started. She produced 8,960 pounds of milk and 549 pounds of butterfat giving her 747 pounds of butterfat on a mature equivalent basis. Mr. Lofton received an award from the South Carolina Jersey Cattle Club at the annual meeting held in Spartanburg.

POULTRY

Antibiotics in Chick and Turkey Starting Rations Increase Gains

(C. L. Morgan and Charles P. Willimon)

Experiments to determine the effect of adding antibiotics to both chick and turkey starting rations have been conducted. The antibiotics used in these experiments were streptomycin, penicillin, and aureomycin in combination with vitamin B_{12}.[1] A standard animal protein control ration supplemented with adequate amounts of minerals and vitamins was used with both chicks and poults. In the trial with chicks an all vegetable protein diet was also used to which additions of both vitamin B_{12} and vitamin B_{12} in combination with antibiotics were made. The results of adding antibiotics to chick starting rations are shown in table 25.

The addition of vitamin B_{12} to the starting ration containing animal protein did not affect rate of gain of the chicks or feed efficiency. By the addition of antibiotic supplements the rate of gain of the chicks was increased during the early weeks of growth, but at the end of 10 weeks gains in weight were found to be significant only for the males. With the antibiotics as supplements for the vegetable protein ration, there was little difference in rates of gains of the chicks from the use of these supplements over supplementation with vitamin B_{12} alone, except in the case of streptomycin. The greatest differences in gains between the control ration and those supplemented with antibiotics at 10 weeks was approximately 10 percent which was statistically significant only for males.

Similar studies were made with turkey poults as with chicks on the addition of vitamin B_{12} and antibiotics to animal protein starting rations. The results of adding vitamin B_{12} and antibiotics to turkey starting rations are shown in table 26.

[1] In conducting these tests the authors are indebted for the supplements used to Merck and Company for vitamin B_{12}, penicillin, and streptomycin and to Lederle Laboratories for aureomycin.

Table 25.—The Effect of Adding Antibiotics to Chick Starting Rations (White Plymouth Rocks)

Supplements	Average weight in grams (both sexes)					Pound feed per pound gain
	2 wks.	4 wks.	6 wks.	8 wks.	10 wks.	
Animal Protein Rations						
None (Control)	118.9	253.7	441.9	714.6	968.6	2.50
Vitamin B_{12} only	122.8	252.9	435.3	709.3	974.1	2.51
Vitamin B_{12} + streptomycin	147.4	309.7	515.4	811.6	[1]1046.0	2.43
Vitamin B_{12} + penicillin	142.5	287.4	488.8	791.1	[1]1064.0	2.64
Vitamin B_{12} + aureomycin	137.5	296.2	496.3	775.6	[1]1042.0	2.40
Vegetable Protein Rations						
Vitamin B_{12} only	116.8	250.6	430.1	693.7	956.9	2.71
Vitamin B_{12} + streptomycin	133.9	280.0	477.6	764.2	1018.4	2.53
Vitamin B_{12} + penicillin	126.8	265.9	443.8	729.6	945.2	2.73
Vitamin B_{12} + aureomycin	128.7	279.1	471.5	728.3	974.0	2.65

[1] Significant difference males only over controls.
Other groups no analysis.

Table 26.—The Effects of Adding Antibiotics to Turkey Starting Rations (Small Type Whites)

Supplements	Average weight in pounds (both sexes)				Pounds feed per pound gain	Percent mortality
	4 wks.	8 wks.	12 wks.	16 wks.		
Animal Protein Rations						
None (Control)	0.71	1.90	4.24	6.77	3.60	6.8
Vitamin B_{12} only	0.70	1.87	4.44	[1]7.12	3.73	10.3
Vitamin B_{12} + streptomycin	0.89	2.32	5.02	[2]7.38	3.48	7.1
Vitamin B_{12} + penicillin	0.94	2.13	4.57	[1]6.97	3.60	10.3
Vitamin B_{12} + aureomycin	0.83	2.12	4.43	[3]6.90	3.54	0

[1] Significant difference females only over controls.
[2] Significant difference both sexes over controls.
[3] No significant difference either sex over controls.

With turkey poults at 16 weeks of age there was a significant increase in gain in weight of both sexes for the birds on the ration supplemented with streptomycin. With vitamin B_{12} only and with vitamin B_{12} plus penicillin, increased gains were significant only in the case of females on these rations. The addition of aureomycin to the control ration used in these trials produced no significant increase in gains of the poults at the end of 16 weeks' feeding. With the poults in this feeding trial, a nonidentified disease trouble was experienced during the brooding period. It is of interest to note that there were no death losses in the group receiving aureomycin.

The results from the use of antibiotics with chicks and poults showed some advantage from their use as supplements to animal protein rations. In these trials the addition of streptomycin gave

slightly better results than the use of penicillin or aureomycin. The increases in gains reported in these trials are not as great as the maximum reported by certain other workers on the use of antibiotics. With the vegetable protein rations, supplementation with antibiotics, except streptomycin, gave no increase in gains over vitamin B_{12} alone. The greatest gains were obtained during the earlier weeks of growth. The lower mortality of the turkey poults on the aureomycin supplemented diet is of interest and should be verified through further trials.

Artificial Lights Increase Egg Production of Turkeys

(C. L. Morgan and James B. Cooper)

Studies on the use of protamone (iodinated casein), an artificial thyroid hormone, in relation to artificial lighting for the stimulation of egg production of turkeys have been under way. The use of artificial lights as a means of increasing sexual activity of turkeys, both toms and hens, is a common practice of turkey breeders. The feeding of iodinated casein has also been found to give some increase in turkey egg production, particularly with stock unselected for egg production. Turkey breeding hens of the Beltsville Small Type White variety were used to determine the effects of the addition of 15 grams of protamone per 100 pounds of ration, both with and without artificial lighting, during the breeding season extending from January through May. The results of these trials are shown in table 27.

Table 27.—Relationship of Artificial Lighting and Protamone to Egg Production of Turkey Breeders (Beltsville Small White)

Lighting and ration supplement	Number hens	Number days	Percent egg production	Pounds feed consumed per egg	Percent fertility	Percent hatchability
No Lights						
No supplement	15	132	19.0	1.74	94.3	49.10
Protamone added	15	132	21.7	1.52	94.7	78.65
With Artificial Lights						
No supplement	15	132	52.3	0.80	92.9	73.08
Protamone added	15	132	50.8	0.72	95.2	77.61

With the use of artificial lights egg production of turkey breeding hens was more than doubled during the hatching season both with and without the addition of protamone to the ration. Without artificial lighting slightly greater egg production was obtained by the addition of 15 grams of protamone per 100 pounds of ration, but with artificial lighting more eggs were produced on the check ration without the addition of protamone. The variation in egg production as noted in this test on the use of protamone is generally characteristic of the results on egg production obtained in previous trials. The

fertility of eggs in all pens was high with only slight variations between pens. The hatchability of fertile eggs was satisfactory in all pens except for the pen without lights or protamone. The hatchability results in this pen are attributed to the extremely low hatchability of certain hens rather than to the lack of artificial lights or protamone.

A marked increase in egg production of turkey breeding hens through the use of artificial lights is shown by the results of this test, which is characteristic of similar tests in previous years. While the use of protamone as a means of increasing egg production in turkeys is variable and of doubtful value, the use of artificial lights in increasing egg production is of marked value.

CHEMISTRY

(J. H. Mitchell and D. B. Roderick)

The Chemistry Department published a bulletin on the "Cobalt Content of Pasture Grasses and Feeds Grown in South Carolina." Cobalt is one of the essential minor elements needed for cattle to prevent certain diseases or malnutritional conditions. While there were some indications of rather low cobalt content, in the main, the amount present would seem to be sufficient to maintain healthy animals.

In cooperation with the Dairy Department a study was made of the effect of winter grazing of rye grass and crimson clover, versus barn feeding, on the vitamin A and carotene in milk. The pasture grasses were analyzed for carotene, feed analysis, calcium, and phosphorus. The carotene content of the pasture grass ranged from 109 to 716 ppm of the dry matter and averaged 413 ppm for the three years. The milk contained on the average 97 percent more vitamin A potency than the milk produced by control cows from good quality lespedeza hay and corn silage.

A project entitled "Comparative Mineral Composition and Vitamin Content of Vegetables and Feeds Grown Under Various Environmental Conditions" was completed and a final report made.

A new project was begun, entitled "The Relation Between the Amounts of Zinc and Copper in the Soil and the Amounts in Peach Trees, Pecan Trees, Pasture Grasses and Other Forage Plants." In connection with this project, a great many samples have been collected and analyzed for copper and zinc.

During the year 240 samples were received and analyzed, requiring approximately 500 individual determinations. These samples were collected in connection with the various projects of this department.

Improvement of Corn Meal

(E. J. Lease)

Farmers are becoming less interested in taking their corn to a nearby mill and waiting for it to be ground on a toll basis. Many rural housewives now find it more convenient to buy their corn meal and grits along with the other groceries. This trend together with modern roads and transportation is changing the milling industry of the state so that a comparatively small number of mills are grinding the bulk of the corn for human food. The larger and more progressive mills enrich, fumigate, and use cleaning, sifting, and automatic machinery to a greater extent than the smaller mills.

This department of the Experiment Station compounds the vitamin-mineral mixture used in the enrichment of corn meal and distributes it to corn millers on a nonprofit basis. Millers use this service and also the service of providing information and equipment with which to carry on the enrichment process in their mill. Improvements in the design of the equipment and in the formula of the enrichment mixture were made during the past year.

Samples of hybrid corn were analyzed for vitamin and mineral content. Results indicated that the range of variation is not great enough to alter the standard procedure of adding 2 ounces of the vitamin-mineral mixture per bushel of corn meal. It was found that the riboflavin content of whole ground corn was lower than any other ingredient in comparison to the enrichment standard. When corn from certain hybrids was ground into meal and tested in standard recipes, good baking qualities were evident; however, in some cases it was necessary to vary the amount of water or milk added to get best results.

It was found that adequate machinery to clean the shelled corn before grinding it into human food was not being used and that the commercial models were unsuitable for the smaller mills. Tests were continued on corn cleaners of various types. The model developed by this department was improved. Many corn millers in the state were given help on problems of corn cleaning in their mills. Special castings, parts, and corn cleaners were distributed on a cost basis to millers who were trying to learn how to improve the quality of their meal.

Fading of Dried Red Pepper

(Jane G. Lease and E. J. Lease)

The problem of loss of color from various kinds of pepper (*Capsicum annum*) after drying was investigated with the view to finding a quick and simple test as to which peppers would discolor and which

would not discolor. Cayennes, paprikas, and Louisiana Sports were used. The beta-carotene was determined, as well as the total color of a hexane extract of each kind of pepper which was compared to dichromate in an Evelyn photocolorimeter. The paprikas and a seedless cayenne (sterile plants) had the strongest original total color, while Cayenne strain No. 69A, a field mixture of this pepper, and Louisiana Sports were much less intense. The amount of beta-carotene or of free xanthophylls found did not have any constant relation to the amount of total color; those having the most intense color had the most total amount of esterfied xanthophylls, though here, too, this did not follow the color proportionally when the percentage of color due to each of these three factors was considered.

On being allowed to stand in glass bottles at room temperature out of the sunlight, the 1950 crop of peppers lost color much more slowly than the 1951 crop of the same varieties of pepper.

There was no correlation between the total amount of color and the ability to withstand color loss on aging when the aged pepper was compared with the fresh bright pepper as to percentage of color retained. In both years, Louisiana Sports kept its color much better than the other kinds of pepper; Cayenne strain No. 69A and the field mixture of this were poorer in general but much better than the paprikas.

Various tests were made on the ground dry pepper and the loss of color followed as compared to that on aging. On heating at 70° C. for several days, no correlation with the process of aging, total color, or between the same kinds of pepper from two succeeding years was noted. When hexane extracts of these peppers were shaken with rancid lard at 32° C., the greater the original total color, the slower the rate of color destruction. When hexane extracts were exposed to ultra violet light or bright sunlight, there was no correlation between the destruction of color by this means and that by rancid lard, by heating, or by the aging of the peppers. The moisture content showed no correlation with the rate of destruction on aging.

There was no striking difference between the beta-carotene content, the non-saponifiable hexane soluble content, the free xanthophyll- or the esterified xanthophyll-content by which a pepper which would withstand the effects of aging well could be differentiated from those which lost color rapidly. This failure to find any one external factor which predominated in causing loss of color on aging is not surprising when it was found that the same variety of peppers varied in their resistance according to the season in which they were grown, their treatment before picking, and the container in which they were aged—can, bottle or bag.

It seems likely that the pigment may be sensitized by the attack of any one of several factors and, after this initial sensitization, the other factors are able to cause further destruction. The lag period

before any destruction is evident, which has been found with different kinds of pepper, or with different years, or with different field treatment, etc., may be due to some protective substance in the pepper, or to a low content of those which would sensitize the pigment, whether in combination with it or extraneous to it.

The investigation of which pigments were left when the pepper was bleached was complicated by the fact that the remaining pigments were very unstable to any kind of treatments, e. g., being much more quickly decomposed than the extracts from bright peppers, under ultra violet light, or treatment with rancid lard, and tending to disappear on the chromatographic column. In general, it may be said that most of the carotenes had disappeared and the residual color was due to small amounts of esterified xanthophylls, especially a red one, probably a capsanthin ester.

COAST EXPERIMENT STATION

(E. D. Kyzer, Superintendent)

During the past year the Coast Experiment Station has continued the beef cattle crossbreeding experiment and the development of permanent summer and winter pastures. The beef cattle crossbreeding experiment has been in progress for four years. This year, 63 registered Angus brood cows and three bulls were used in the study. The remaining 15 brood cows of the station herd and one bull were used to produce replacements for future experimental work; hence the entire brood cow herd and a battery of four bulls have been used in the research program. For this program, no females have ever been purchased but have been produced here. Yearling replacement heifers have been used in winter grazing tests.

In addition to the above activities, this station has cooperated in the State corn breeding program in the control of corn insects, and with the Agricultural Engineering and Agronomy Departments of the South Carolina Experiment Station. Some of the results of these cooperative experiments are reported by these departments.

Winter Pastures

The initial planting of tall fescue and Ladino clover was made in 1947. Since then, plantings have been made as labor and finances permitted. At the close of this year, this winter pasture mixture is making satisfactory growth on 63 acres. Of the total plantings, approximately 50 acres is well established and is being grazed this winter. Some observations that have been made in the development and use of these several pastures are:

(1) Fescue requires moist soil of medium to high fertility and is making the best progress on land previously cultivated, which,

because of poor drainage for summer row crops is now devoted to winter pasture. For desired carrying capacity, plant food, particularly nitrogen, must be added several times during a year.

(2) The cut-over flat woods lands of low fertility, as found in the lower coastal plains of the state, need more than the initial application of complete fertilizer. The 1951 planting made here was on cut-over Coxville soil, prepared in late winter and fallowed during the summer prior to seeding this fall. The excellent stand and growth obtained indicates that summer fallowing prior to fall seeding is desirable and profitable. This method gives a much better seedbed and reduces the amount of native grasses and weeds that usually infest pastures.

(3) Fescue without an appreciable amount of clover appears to be little more than a maintenance ration. With enough clover, substantial gains are made—sometimes too much for brood cows carrying calves for spring delivery.

(4) Fescue seems to become tough and unpalatable after sods have been established for several years. Well-fed cattle or those on abundant pasture may deplete the clover stands by overgrazing and trampling if fescue is not so palatable.

(5) Under the abnormal seasonal conditions during the past two falls and winters the per acre carrying capacity has been disappointing. Under these conditions pasture clippings from excess spring and summer growth cured as hay and other domestic hay may have to be used many times to supplement winter grazing.

Wintering Yearling Angus Heifers on Tall Fescue and Ladino Clover

Ten yearling Angus heifers averaging 816 pounds in weight were put on 19 acres of fescue containing a medium stand of Ladino clover on January 30 and allowed to remain on the area until April 26, a period of 86 days. The area was cross-fenced to permit alternate grazing and top dressing of the areas. No shelter or supplementary feed was furnished. The average final weight of the heifers was 919 pounds, the total gain per head 103 pounds, and the average daily gain 1.20 pounds. Since no supplementary feed was supplied, a per acre gain of 54 pounds was credited to the grazing furnished during the 86-day period. During the summer, these areas were periodically grazed by brood cows that were nursing calves. It was not possible to record accurately the gains made by this group of cattle; however, it is logical to credit additional gains to the areas. From the recorded data, a rather low per acre carrying capacity is indicated. In view of this fact, it should be noted that an exceptionally dry fall and an abnormal hard freeze occurred in late fall, both of which seriously retarded and damaged the fescue and even more seriously damaged the Ladino clover.

Corn Variety Test

(Alfred Manwiller, Lewis Reep, E. D. Kyzer)

Notwithstanding the trend of the beef cattlemen and dairymen towards grassland farming, corn still remains a most important factor in producing dairy products and animals primarily intended for meat. Stored corn-legume silage and ear corn together with hay from grassland farming acres are comfortable insurance against the loss of livestock profits during abnormal seasonal conditions. Experiments, contests, and demonstrations have shown that with adapted high-yielding seed, adequate plant food, and proper cultural practices satisfactory and profitable yields of corn can be produced in South Carolina where the soil type is adapted and the rainfall sufficient. Recent tests here have shown that adapted hybrids often yield as much as 38 percent more corn than some standard open-pollinated varieties, thus showing the importance of adapted high-yielding seed. The climatic conditions, insect population, and the prevalence of plant diseases make the requirements for adaptation to the lower coastal plains of the state somewhat more rigid than in other areas. In order to answer yield and adaption questions, the Coast Station annually conducts a variety test which includes hybrids and standard open-pollinated varieties that have shown promise. In addition to yields, data as to storm, insect, and disease resistance are recorded. The adaptability to machine picking as indicated by lodging, size, and placement of ear is also noted. Table 28 includes 1951 results and averages for the past four years.

Table 28.—Comparative Yields and Storm and Weevil Resistance as Shown in Corn Variety Tests, Coast Station, 1951

Variety	Yield in bushels per acre					Resistance to	
	1948	1949	1950	1951	Average	Lodging	Weevils
Yellow							
Dixie 18	73.8	84.6	69.0	61.0	72.1	Good	Good
N. C. 27	69.6	76.1	55.0	51.0	62.9	Very poor	Medium
Funk's 714a	---	---	62.0	63.0	62.5	Medium	Medium
Wood's 211	---	---	59.0	56.0	57.5	Poor	Medium
Dixie 82	---	---	---	62.0	---	Poor	Medium
White							
Dixie 17	79.2	85.8	70.0	69.0	76.0	Very poor	Poor
Coker's 811	---	---	76.0	63.0	69.5	Excellent	Medium
Wood's 361	---	76.3	---	60.0	68.1	Poor	Medium
Douthit's Prolific[1]	53.6	63.8	56.0	44.0	54.3	Medium	Good
Latham's Double[1]	50.0	58.5	53.0	49.0	52.6	Medium	Good
Funk's 791	---	---	---	64.0	---	Poor	Medium
Georgia 281	---	---	---	49.0	---	Good	Good

[1] Open-pollinated varieties.

Crossbreds Versus Purebreds in the Production of Baby Beef

Breed associations and their members sometimes make apparently exaggerated claims for their particular breed of cattle as

purebreds or for the hybrid vigor transmitted when crossed with other breeds. In order to supply information to commercial cattlemen who sell their cattle on grade and by the pound, a crossbreeding study was begun with the 1947 breeding season. At that time, the project was outlined to compare Brahman-Angus crossbreds with purebred Angus, using the Angus brood cows of this Station as dams. With the 1949 breeding season, the outline was amended to include the Hereford-Angus cross, using a Hereford bull on Angus cows that were comparable to the cows of the other two groups. Since then, the study has been continued on that basis. The brood cows have been bred to the bulls of each breed in rotation. This has been done in order to compensate for the individual variation, particularly the milk production of the cows. Where possible, all cows have been continued in the program until at least one calf sired by a bull of each breed has been produced. Annual pasture rotation of the groups has been practiced. All calves have been allowed to run with their dams on adequate pasture and have been full creep-fed a ration of 4 parts by weight of ground snapped ear corn, 2 parts ground oats, and 1 part 36 percent cottonseed meal. Birth weights and final weights at 210 days have been recorded. At this age the calves were graded on foot, slaughtered by a local plant of Kingan Packing Company, and carcass grades and dressing percent were determined. Upon completion of this year's work, a total of 70 purebred Angus calves, 61 Brahman-Angus, and 35 Hereford-Angus calves had completed the test. The average birth weight of these calves was as follows: Purebred Angus 65.5 pounds, Brahman-Angus 80.6 pounds, and Hereford-Angus 69.2 pounds. The final 210-day weight was purebred Angus 464.1 pounds, Brahman-Angus 517.3 pounds, and the Hereford-Angus 537.8 pounds. The sex of the calves of all groups was approximately evenly divided. The feed consumed from the creep by both crossbred groups per 100 pounds gain was much greater than that consumed by the purebred calves; however, in both cases the additional final weight more than compensated for the additional feed consumed. The live and carcass grades were approximately the same for all groups. The dressing percent was significantly higher for both crossbred groups. Since the beginning of this experiment, the number of calves lost at birth due to size and body conformation has been: purebreds, none; Hereford-Angus, none; and Brahman-Angus, two. Both of the calves that were not delivered alive by their dams were large, the larger one weighing 111 pounds.

While the progress of this project has been previously reported, this summary averages the data and brings the progress report up to date.

PEE DEE EXPERIMENT STATION
(E. E. Hall, Superintendent)

Corn Yields Increased by Irrigation
(E. E. Hall and F. M. Harrell)

Corn yields in the state are being increased chiefly by better cultural practices, the use of adapted hybrids, and heavier applications of commercial fertilizer. However, there are years in which moisture is the limiting factor, resulting in greatly reduced yields regardless of how favorable other conditions may be. Since nothing can be done about the weather, irrigation is the nearest approach to the solution. Results for several years show that corn yields can be greatly increased by applying water, mainly during the earing period. At the Pee Dee Station an average increase of 28.8 bushels per acre has been obtained. Yearly and average yields are recorded in table 29.

Figure 14.—Overhead sprinkler irrigation system at Pee Dee Station.

Table 29.—Yearly and Average Yields of Irrigated and Nonirrigated Corn, Pee Dee Station.

Treatment	Corn yields in bushels per acre			
	1949	1951	2-year average	Increase from irrigation
Irrigated	84.7	56.1	70.4	28.8
Not irrigated	57.1	26.2	41.6	---

State Corn Yields Being Increased
(E. E. Hall, F. M. Harrell, and C. B. Smith)

On a large percent of the land planted to corn in South Carolina, yields are too low for profitable production; however, average yields for the state have increased considerably in recent years. This in-

Figure 15.—Irrigating corn at Pee Dee Station with sprinklers on 10-foot risers.

crease is due largely to better cultural practices, planting of adapted hybrids, and a more liberal use of commercial fertilizer, especially nitrogen. For several years at the Pee Dee Station two hybrids and one open-pollinated variety have been fertilized at rates of 15, 55, 95, and 135 pounds of nitrogen per acre with stands of 4,000, 7,000, 10,000 and 13,000 plants per acre. Yield increases from the various rates varied from year to year according to rainfall during the earing period of corn. One year when rainfall was very deficient, there was no increase in yield from rates heavier than 40 pounds of nitrogen. Results for the past year and average results for 4 years are recorded in table 30. It will be noted that, while there was a gradual increase in yield as the nitrogen rate increased, the increase has not been sufficient to offset the cost of nitrogen for the heavier applications.

Soybeans Increasing in Importance

(E. E. Hall, F. M. Harrell, and C. B. Smith)

Soybeans are becoming more and more important in South Carolina agriculture. In 1945 the acreage harvested for seed was 10,000 with a yield of 70,000 bushels valued at $256,000. This compares with 83,000 acres harvested for seed in 1951 with a yield of 1,038,000 bushels valued at $3,114,000. The acreage interplanted with other crops and for hay more than doubles the acreages given above for seed production alone. This rapid increase in soybean production is largely due to labor conditions, the development by plant breeders of high-yielding shatter-resistant varieties of high oil content, and the complete mechanization to which this crop lends itself. Also, satisfactory yields can be obtained by planting stubble land immediately after small grain has been harvested, making it possible to produce two money crops on the same land.

Table 30.—Effect of Spacing and Varying Amounts of Nitrogen on Yield of Three Varieties of Corn, Pee Dee Station, 1951

Spacing	Variety	Nitrogen rate per acre			
		None	40 pounds	80 pounds	120 pounds
		Bushels shelled corn per acre			
11.5 inches	Coker 811	34.2	58.7	77.5	81.7
	N. C. 27	37.4	53.8	59.4	66.6
	Latham's Double	23.4	50.7	58.6	60.5
	Average	31.6	54.4	65.1	69.6
15.0 inches	Coker 811	40.4	58.9	65.7	75.1
	N. C. 27	41.2	55.4	63.3	65.6
	Latham's Double	29.7	41.4	57.4	62.0
	Average	37.1	51.9	62.1	67.5
21.4 inches	Coker 811	37.2	60.5	65.0	73.5
	N. C. 27	39.8	58.1	61.8	61.7
	Latham's Double	26.3	46.4	55.1	68.7
	Average	34.4	55.0	60.6	67.9
37.4 inches	Coker 811	29.7	53.0	59.8	56.4
	N. C. 27	29.2	45.9	48.4	50.1
	Latham's Double	23.0	46.5	47.1	54.0
	Average	27.3	48.4	51.7	53.5

4-Year Average of Three Varieties

Spacing	Nitrogen sidedressing pounds per acre				Number corn plants per acre
	None	40	80	120	
	Bushels shelled corn per acre				
11.5 inches	43.0	61.9	70.7	72.5	13,000
15.0 inches	45.2	61.4	67.5	69.6	10,000
21.4 inches	48.1	60.8	65.5	68.2	7,000
37.4 inches	37.9	48.4	52.7	52.1	4,000

Note:—Six replications—rows 42 inches apart.
Basic fertilizer application—500 pounds per acre of a 3-9-9 mixture applied to all treatments before planting.
Nitrate of soda was the source of nitrogen and was applied when the corn was knee high.

Variety tests are conducted at this Station each year in cooperation with the Bureau of Plant Industry USDA to determine the most satisfactory strains and varieties to grow. Of the varieties tested over a period of years, Roanoke and Volstate have been outstanding for yield and for high oil content. Yield data and other characters of varieties tested this year are recorded in table 31.

Cotton Variety Test

(E. E. Hall and F. M. Harrell)

Cotton, the South's main crop, is receiving serious competition from synthetic fibers. Cotton breeders are exerting every effort to meet this competition by developing varieties that produce staple with superior spinning qualities. Spinners and breeders are cooperating in this undertaking, and much progress has already been

Table 32.—Cotton Variety Test, Pee Dee Station, 1951
(VARIETIES LISTED IN ORDER OF MONEY VALUES PER ACRE)

Variety	Pounds of seed cotton per acre	Lint					Seed		Value per acre of lint and seed	Bolls per pound
		Per-cent	Pounds per acre	Length	Price	Value per acre	Pounds per acre	Value per acre		
Empire P-48	2,064	36.7	757	1-1/32	$38.45	$291.07	1,307	$47.71	$338.78	58
Coker 100 Wilt 50-93	2,006	37.2	746	1-1/32	38.45	286.84	1,260	45.99	332.83	68
Coker 100 Wilt 50-68	2,064	35.8	739	1-1/32	38.45	284.15	1,325	48.36	332.51	65
Empire P-47	2,035	36.4	741	1-1/32	38.45	284.91	1,294	47.23	332.14	57
Coker 100 Wilt 50-81	2,026	36.5	739	1-1/32	38.45	284.15	1,287	46.98	331.13	68
Coker M-15	2,026	36.3	735	1-1/32	38.45	282.61	1,291	47.12	329.73	66
Coker 100 Wilt 50-31	1,997	36.1	721	1-1/16	38.80	279.75	1,276	46.57	326.32	63
Coker 100 Wilt 1951	2,006	35.8	718	1-1/16	38.80	278.66	1,288	47.01	325.67	71
Coker 100 Wilt 50-39	1,968	36.2	712	1-1/32	38.45	273.76	1,256	45.84	319.60	62
Hybrid 81 (Ala)	1,987	35.7	709	1-1/32	38.45	272.61	1,278	46.65	319.26	73
Empire W. R.	1,920	37.0	710	1-1/32	38.45	273.00	1,210	44.17	317.17	59
D & P. L.—Fox	1,968	35.7	703	1-1/32	38.45	270.30	1,265	46.17	316.47	74
Coker 100 Wilt 50-3	1,987	35.2	699	1-1/32	38.45	268.77	1,288	47.01	315.78	68
Coker 100 Wilt 50-33	1,997	34.7	693	1-1/32	38.45	266.46	1,304	47.60	314.06	70
Stoneville 2B	1,920	36.2	695	1-1/32	38.45	267.23	1,224	44.71	311.94	64
Coker M-10	1,939	35.7	692	1-1/32	38.45	266.07	1,247	45.52	311.59	65
EH 808 (Sta)	1,680	33.4	561	1-7/32	47.80	268.16	1,119	40.84	309.00	71
Early Fluff (Tifton)	1,939	34.9	677	1-1/32	38.45	260.31	1,262	46.06	306.37	66
Coker 100 Wilt 1952	1,901	35.0	665	1-1/16	38.80	254.21	1,236	45.11	299.32	71
Coker 100 Wilt 50-4159	1,882	35.2	662	1-1/32	38.45	254.54	1,220	44.53	299.07	66
Coker Hybrid Wilt	1,843	35.6	656	1-1/32	38.45	252.23	1,187	43.33	295.56	73
Plains (Ala)	1,747	37.1	648	1-1/32	38.45	249.16	1,099	40.11	289.27	62
Coker 100 Wilt B1-50-1017	1,728	36.7	634	1-1/16	38.80	245.99	1,094	39.93	285.92	68
Delfos 9169	1,786	35.3	630	1-1/32	38.45	242.24	1,156	42.19	284.43	61
D & P. L. 8389A	1,670	38.2	638	1-1/32	38.45	245.31	1,032	37.67	282.98	68
Stoneville 2B-2492	1,766	35.3	623	1-1/32	38.45	239.54	1,143	41.72	281.26	62
Hybrid 56 (Ala)	1,766	35.2	622	1-1/32	38.45	239.16	1,144	41.76	280.92	69
Bobshaw 1A	1,699	36.7	624	1-1/32	38.45	239.93	1,075	39.24	279.17	72
Coker 100 B1-50-1516	1,670	36.5	610	1-1/16	38.80	236.68	1,060	38.69	275.37	68
Coker 100 Wilt 50-53	1,709	35.3	603	1-1/16	38.80	233.96	1,106	40.37	274.33	65
Deltapine 15	1,603	37.2	596	1-1/16	38.80	231.25	1,007	36.76	268.01	69
Sealand 542	1,488	32.4	482	1-7/32	47.80	230.40	1,006	36.72	267.12	70
EH 806 (Sta)	1,430	33.7	482	1-7/32	47.80	230.40	948	34.60	265.00	71

Note: Lint percentage is the average of eight representative samples of each variety ginned on a ten-saw gin.
Staple values are based on average at ten spot markets middling basis 15/16 at 37.08 cents as of Oct. 25, 1951.
Seed valued at $73.00 per ton.
Staple length is the average of eight samples graded and stapled by the South Carolina Department of Agriculture.
Each variety was replicated seven times in 4-row plots and yield records were obtained from two inside rows of each plot.

Cotton Yields Increased by Treating Soil for Nematodes

(E. E. Hall and F. M. Harrell)

Nematode injury to tobacco and to several vegetable crops is plainly visible on heavily infested soil. With other crops, such as cotton and corn, yields can be considerably reduced without any visible effect on growth. Two soil fumigants, Dowfume and DD, have proved effective in controlling nematodes and in increasing cotton yields for the past two years. They were applied at the rate of 10 gallons per acre in a single stream in the bottom of middlebuster furrow and were covered immediately with two furrows to form the planting bed. The area treated with Dowfume has given an average increase of 252 pounds of seed cotton per acre over the untreated areas, and the area treated with DD gave an average increase of 283 pounds over the untreated areas.

Yearly and average yields are recorded in table 33.

Table 32.—Cotton Variety Test, Pee Dee Station, 1951
(VARIETIES LISTED IN ORDER OF MONEY VALUES PER ACRE)

Variety	Pounds of seed cotton per acre	Lint					Seed		Value per acre of lint and seed	Bolls per pound
		Per-cent	Pounds per acre	Length	Price	Value per acre	Pounds per acre	Value per acre		
Empire P-48	2,064	36.7	757	1-1/32	$38.45	$291.07	1,307	$47.71	$338.78	58
Coker 100 Wilt 50-93	2,006	37.2	746	1-1/32	38.45	286.84	1,260	45.99	332.83	68
Coker 100 Wilt 50-68	2,064	35.8	739	1-1/32	38.45	284.15	1,325	48.36	332.51	65
Empire P-47	2,035	36.4	741	1-1/32	38.45	284.91	1,294	47.23	332.14	57
Coker 100 Wilt 50-81	2,026	36.5	739	1-1/32	38.45	284.15	1,287	46.98	331.13	68
Coker M-15	2,026	36.3	735	1-1/32	38.45	282.61	1,291	47.12	329.73	66
Coker 100 Wilt 50-31	1,997	36.1	721	1-1/16	38.80	279.75	1,276	46.57	326.32	63
Coker 100 Wilt 1951	2,006	35.8	718	1-1/16	38.80	278.66	1,288	47.01	325.67	71
Coker 100 Wilt 50-39	1,968	36.2	712	1-1/32	38.45	273.76	1,256	45.84	319.60	62
Hybrid 81 (Ala)	1,987	35.7	709	1-1/32	38.45	272.61	1,278	46.65	319.26	73
Empire W. R.	1,920	37.0	710	1-1/32	38.45	273.00	1,210	44.17	317.17	59
D & P. L.—Fox	1,968	35.7	703	1-1/32	38.45	270.30	1,265	46.17	316.47	74
Coker 100 Wilt 50-3	1,987	35.2	699	1-1/32	38.45	268.77	1,288	47.01	315.78	68
Coker 100 Wilt 50-33	1,997	34.7	693	1-1/32	38.45	266.46	1,304	47.60	314.06	70
Stoneville 2B	1,920	36.2	695	1-1/32	38.45	267.23	1,224	44.71	311.94	64
Coker M-10	1,939	35.7	692	1-1/32	38.45	266.07	1,247	45.52	311.59	65
EH 808 (Sta)	1,680	33.4	561	1-7/32	47.80	268.16	1,119	40.84	309.00	71
Early Fluff (Tifton)	1,939	34.9	677	1-1/32	38.45	260.31	1,262	46.06	306.37	66
Coker 100 Wilt 1952	1,901	35.0	665	1-1/16	38.80	254.21	1,236	45.11	299.32	71
Coker 100 Wilt 50-4159	1,882	35.2	662	1-1/32	38.45	254.54	1,220	44.53	299.07	66
Coker Hybrid Wilt	1,843	35.6	656	1-1/32	38.45	252.23	1,187	43.33	295.56	73
Plains (Ala)	1,747	37.1	648	1-1/32	38.45	249.16	1,099	40.11	289.27	62
Coker 100 Wilt B1-50-1017	1,728	36.7	634	1-1/16	38.80	245.99	1,094	39.93	285.92	68
Delfos 9169	1,786	35.3	630	1-1/32	38.45	242.24	1,156	42.19	284.43	61
D & P. L. 8389A	1,670	38.2	638	1-1/32	38.45	245.31	1,032	37.67	282.98	68
Stoneville 2B-2492	1,766	35.3	623	1-1/32	38.45	239.54	1,143	41.72	281.26	62
Hybrid 56 (Ala)	1,766	35.2	622	1-1/32	38.45	239.16	1,144	41.76	280.92	69
Bobshaw 1A	1,699	36.7	624	1-1/32	38.45	239.93	1,075	39.24	279.17	72
Coker 100 B1-50-1516	1,670	36.5	610	1-1/16	38.80	236.68	1,060	38.69	275.37	68
Coker 100 Wilt 50-53	1,709	35.3	603	1-1/16	38.80	233.96	1,106	40.37	274.33	65
Deltapine 15	1,603	37.2	596	1-1/16	38.80	231.25	1,007	36.76	268.01	69
Sealand 542	1,488	32.4	482	1-7/32	47.80	230.40	1,006	36.72	267.12	70
EH 806 (Sta)	1,430	33.7	482	1-7/32	47.80	230.40	948	34.60	265.00	71

Note: Lint percentage is the average of eight representative samples of each variety ginned on a ten-saw gin.
Staple values are based on average at ten spot markets middling basis 15/16 at 37.08 cents as of Oct. 25, 1951.
Seed valued at $73.00 per ton.
Staple length is the average of eight samples graded and stapled by the South Carolina Department of Agriculture.
Each variety was replicated seven times in 4-row plots and yield records were obtained from two inside rows of each plot.

Cotton Yields Increased by Treating Soil for Nematodes

(E. E. Hall and F. M. Harrell)

Nematode injury to tobacco and to several vegetable crops is plainly visible on heavily infested soil. With other crops, such as cotton and corn, yields can be considerably reduced without any visible effect on growth. Two soil fumigants, Dowfume and DD, have proved effective in controlling nematodes and in increasing cotton yields for the past two years. They were applied at the rate of 10 gallons per acre in a single stream in the bottom of middlebuster furrow and were covered immediately with two furrows to form the planting bed. The area treated with Dowfume has given an average increase of 252 pounds of seed cotton per acre over the untreated areas, and the area treated with DD gave an average increase of 283 pounds over the untreated areas.

Yearly and average yields are recorded in table 33.

Table 33.—Effect of Soil Treatment for Nematodes on Cotton Yields

Treatment	Seed cotton per acre		2-year average	Pounds increase from treatment
	1950	1951		
Not treated	1,517	2,342	1,929	
Dowfume	1,784	2,578	2,181	252
DD	1,809	2,616	2,212	283

Cotton Breeding and Improvement

(W. H. Jenkins, D. C. Harrell, and E. E. Hall)

Two New Long Staple Upland Cottons. Two long-staple upland cottons have been developed at the Pee Dee Station in recent years. The first was Sealand 542, a hybrid developed from a backcross between Bleak Hall Sea Island and Coker-Wilds. This cotton is being successfully grown in Florida with good yields, and a ready market is found at as high as 72 cents per pound. There is also some interest in this cotton in Texas and Georgia. A few years ago a small amount was produced in Chesterfield County. However, interest has waned since there was little demand for the cotton at a satisfactory price because it was saw ginned rather than roller ginned. Sealand is a long fine cotton which spinning tests have shown must be roller ginned to prevent an undue number of neps in the yarn. To bring premium prices and go into high-priced goods, it must be handled and processed in the same manner as Sea Island and Egyptian cottons.

The more recently developed EH Long Staple, a cross between Tidewater Acala and Coker-Wilds, is 10-25 percent more productive than Sealand, has a better boll, and is easier to pick; has stronger, coarser fiber, but is about 1/8 of an inch shorter. In 1951, 13 bales were produced on 10.5 acres at the Station, and a farmer near Florence made 12 bales on 10 acres. It has done well in Georgia and Florida, and in some variety tests it has compared favorably with some short staple cottons. EH compares favorably with Sealand in spinning performance and outspins the short cottons. The principal handicap in the production of EH in South Carolina is the lack of roller ginning facilities to handle the crop. It should be picked promptly and carefully to insure premium prices.

New Breeding Developments. Since the development of the two new long-staple upland cottons, a new approach has been made to incorporate extremely high-spinning performance into both short- and long-staple cottons. Competition from synthetic fibers and several high-quality foreign cottons has increased the importance of this work. On the basis of four years' work on the new program encouraging progress has been made. Breeding lines are now available which are almost twice as strong as standard commercial varieties. But these lines are strictly in the experimental stage and do not have

the yielding potential of commercial types. The process of transferring extremely high-spinning performance from noncommercial synthetic types with high-fiber quality to productive short-and long-staple cottons is slow and tedious and is a step by step process. The two types are first crossed; then the hybrid is grown and selected for three or four generations. From each generation only the top quality plants are retained. In the fourth generation the plants with the highest fiber quality are then backcrossed with the productive Upland types, and the selecting and screening process for high-fiber quality is followed again to the fourth generation. Consistently following this technique gives evidence that productive types with high fiber quality may be developed.

The noncommercial lines with high-fiber quality which are being used are Hopi Acala from California and the Triple Hybrid from North Carolina. The parent lines on which these cottons are being crossed and backcrossed are EH, Sealand, Coker 100 Wilt, Empire and Early Fluff. These cottons should give yield, boll size, fluff, etc.

In order to speed up the development program, progenies of the best selections are being grown during the winter at one of the Mexican Experiment Stations under an agreement between the Mexican Government, the U. S. Department of Agriculture, the State Experiment Stations, and the National Cotton Council of America. Very good results were obtained from the first season's planting in Mexico; and, though the seed were received a little late for planting in the spring, fair yields were obtained and it was possible to proceed satisfactorily with the summer program.

The next cross was made on the best lines during the summer, and F_1's from the best plants are now growing in Mexico. By growing two generations a year instead of one, it may be possible, at least in the early stages, to speed up the program. By the summer of 1953, it is hoped to have the fourth generation growing at Florence and to determine what progress is being made in combining high-spinning performance with good agronomic characters, such as high yield, good bolls, etc.

South Carolina Hybrid Corn Test Results, 1951

(Alfred Manwiller and Lewis Reep)

Hybrid corn is rapidly replacing the open-pollinated varieties of corn on South Carolina farms. In 1941 only 1 percent of the total corn acreage in the state was planted to hybrids. In 1950 that acreage had increased to 28 percent of the total. Hybrids, along with better cultural methods and more liberal use of fertilizers, have played a major role in increasing the average bushels per acre from 14 bushels in 1941 to 23 bushels per acre in 1950.

The past year will likely be remembered chiefly for the lack of adequate rainfall during the growing season. This lack of rainfall was reflected in relatively low yields for all experiments, and in part explains the erratic relative position of given hybrids in different experiments. Corn is especially vulnerable to dry weather when the silks emerge, and the hybrids tested varied considerably in their respective silking dates.

In judging any hybrid, the demonstration of superior yield is not sufficient. Farmers insist that the grain be of desirable quality and are demanding a stalk and root system of sufficient strength to hold the ear off the ground until harvest time. These requirements imply disease resistance, particularly to stalk and ear rots, and a long tight husk to prevent entrance of the rice weevil in areas where that insect is a pest. Unfortunately, rice weevils were not numerous enough for checking resistance to this pest in any experiments in 1951.

Table 34.—Summary of Coastal Plain Corn Yield Tests, 1951
(Each test replicated 6 times)

Variety	Bushels per acre						Average bushels per acre	Average percent lodging
	Blackville	Summerville	Florence	Loris	Orangeburg	Hartsville		
*Dixie 17	40	69	69	72	71	48	62	31
Dixie 82	38	62	55	72	66	39	55	27
*Coker 811	38	63	57	66	65	37	54	12
Dixie 18	34	61	53	64	71	39	54	22
*Funk's G714a	35	63	52	61	64	45	53	40
*Funk's G791w	28	64	50	62	66	42	52	27
N C 27	37	51	55	61	62	40	51	27
*Wood's S361	31	60	45	53	68	40	50	39
Wood's S211	28	56	46	56	58	36	47	31
*Ga. 281	28	49	46	55	64	35	46	16
*Douthit's P.	33	44	47	43	54	36	43	34
*Latham's D.	24	49	40	39	53	25	38	35
Hackett's Y.	--	--	--	44	46	21	--	--
*Wise Prol.	22	--	--	--	--	--	--	--

*White grain.

Corn Hybrids Recommended for the Coastal Plain Area

Coker 811 and Dixie 18. These two corn hybrids, white and yellow, respectively, are recommended for the Coastal Plains wherever rice weevils are apt to be present. Coker 811 is relatively new and has not been adequately tested against weevils. Insofar as it has been tested, however, it has proved satisfactory in this respect. Dixie 18 has repeatedly demonstrated its ability to withstand heavy weevil infestations.

Both hybrids are outstanding in root and stalk strength with

Coker 811 superior to Dixie 18. Coker 811 is short and carries the ears at a desirable height. Dixie 18 is tall and carries the ears higher than is desirable.

It will be noted in table 34 that two hybrids (Dixie 17 and Dixie 82) exceed Coker 811 and Dixie 18 in average yield. They are both so susceptible to rice weevil damage that they could not possibly be recommended for the Coastal Plains.

Tobacco Insect Studies

Insecticides May Cause an Objectionable Flavor or Odor to Tobacco

(Norman Allen, C. R. Hodge, and J. D. Early)

Several investigators have reported that soil applications of benzene hexachloride caused off-flavor in such food crops as potatoes, carrots, and tomatoes. While it had been suspected that toxaphene applied to the leaves gave cured tobacco an objectionable flavor, there was no proof of this until 1950, when J. M. Lewis, State extension tobacco specialist of South Carolina, obtained such samples from a sales warehouse. The samples were collected on the Hemingway market, where the tobacco had been marked "NK," meaning damaged and with no support price.

In November, 1950, samples of the cured tobacco were submitted to a cigarette manufacturer for taste and odor determinations. The tobacco had been treated with toxaphene or TDE during he growing season. Five applications had been made of these insecticides as dusts or wettable-powder or emulsion sprays.

The tobacco that had been treated with toxaphene as a dust or emulsion was found to have a strong toxaphene odor. The odor was less intense in the tobacco that had been treated with the wettable-powder spray. However, cigarettes made from all these samples were very objectionable to smokers. From these and other studies, it was concluded that from a taste or odor standpoint toxaphene was the most objectionable insecticide yet used on cigarette tobacco.

The tobacco that had been treated with TDE dust or wettable-powder spray did not show an objectionable odor or taste when made into cigarettes and smoked. However, the tobacco that had been treated with an emulsion of TDE was objectionable.

From these experiments it is evident that toxaphene should not be used on cigarette tobacco. Furthermore, until more information is obtained no insecticide in the form of an emulsion should be used on tobacco. Farmers who use such materials may be penalized by a lower sales price.

Parathion Versatile in Grub Control

(C. R. Hodge and Norman Allen)

Parathion in a dust or bait as a control for green June beetle grubs in tobacco plantbeds was suggested for the first time in 1949,

on the basis of preliminary experiments conducted by L. B. Scott, of the Clarksville, Tenn., laboratory of the Bureau of Entomology and Plant Quarantine. Since that time work at the Pee Dee Station has shown that parathion applied by three different methods is effective against these larvae. It may be used as a dust, a drench, or a poisoned bait. A dust containing 1 percent of parathion should be applied by means of a rotary hand duster at the rate of 4 to 5 pounds per 100 square yards of infested soil. A drench containing 1 pound of a 15-percent parathion wettable powder in 100 gallons of water should be poured over 100 square yards of infested area with a sprinkling can. A bait may be prepared by mixing 1 pound of 15-percent parathion wettable powder with 25 pounds of wheat middlings, commonly sold as hog feed, and adding 2 to 2½ gallons of water to make a crumbly mash. This should be sufficient to treat 200 square yards of infested soil. It should be broadcast over the soil, preferably late in the afternoon. The drench method is the most satisfactory as it gives the quickest kill, is easy to mix and to apply, and is not too expensive.

Parathion is an extremely poisonous material. It should be handled with great care, in accordance with the precautions given on the package.

Wild Mustard an Important Host of the Green Peach Aphid
(C. R. Hodge and Norman Allen)

The green peach aphid first appeared as a pest of tobacco in South Carolina in 1946. In 1947 it was recorded practically throughout tobacco-growing areas from Florida to Massachusetts, westward to Tennessee and Kentucky, and northward to Wisconsin and the Province of Ontario, Canada. Since that time it has continued to be a pest in South Carolina.

Besides being a pest of tobacco in plantbeds and in the field, it is also known to feed on a large number of other plants, both wild and cultivated. Some of the host plants are doubtless more important to the survival of the aphid than others, but prior to 1951 no plant other than tobacco was found in South Carolina that could be considered as a major host.

In April of 1951 the aphid was found feeding and breeding on wild mustard growing in grain fields in the counties of Florence, Clarendon, Williamsburg, Marion, and Horry. The fact that this weed is prevalent in grain fields throughout South Carolina may explain why the aphids become established in tobacco fields even though they have been controlled in nearby plantbeds.

Search Continues for a Better Hornworm Insecticide
(Norman Allen, C. R. Hodge, and J. D. Early)

Control of the tobacco hornworm is an ever-present problem with the tobacco farmers of the State. Lead arsenate is an effective

insecticide, but materials that leave less objectionable residues are needed. A large number of new insecticides have been placed on the market in recent years, and practically all persons who are connected with the tobacco industry as well as insecticide manufacturers and distributors have been interested in their effect on the tobacco hornworm.

Insecticides that seem to be promising are tested at the Pee Dee Station every year. When an effective material is found, it is tested as a dust and as wettable-powder and emulsion sprays. A few of these insecticides have been very toxic to hornworms, but some of the most toxic materials have damaged the tobacco plants or given the treated tobacco an undesirable taste and odor.

One of the most promising insecticides tested in recent years is TDE. While this material is not so toxic to hornworms as some other insecticides, work thus far indicates that it is safe to use on tobacco plants either as a dust or as a wettable-powder spray. An emulsion spray should not be used as it may give an objectionable taste or odor to the cured tobacco. This undesirable taste or odor is thought to be due to petroleum distillates that are being used as solvents for the TDE.

The addition of parathion to either a TDE dust or wettable-powder spray makes a better hornworm insecticide, and will also control the green peach aphid.

Black Shank in Tobacco

(Q. L. Holdeman and J. M. Lewis)

Black shank is continuing to spread over the flue-cured tobacco area of South Carolina. If it follows the course of the disease in North Carolina, there will be an accelerated build-up of the disease in 1952 and 1953. It should become general throughout the area by 1958. Black shank is complicating the general disease problem by spreading into areas where Granville wilt, Fusarium wilt, and root knot are problems. The present rate of build-up is indicated in table 35.

Table 35.—Black Shank Infestation by Counties and Farms

Year reported	Number of infested farms by counties						Total	
	Darlington	Dillon	Florence	Horry	Marion	Williamsburg	Counties	Farms
1948	--	1	--	--	--	--	1	1
1949	1	2	--	2	--	--	3	5
1950	2	5	--	4	3	--	4	14
1951	2	10	4	14	6	3	6	39

Due to rotation of crops the disease on some farms is not diagnosed for 2 or 3 years, or until the tobacco is again planted on the area of the original outbreak. This delay in diagnosing the disease aids in the spread of the disease.

The disease may be introduced to new areas in drainage water or in setting water taken from streams that drain infested areas. The disease also can be spread by diseased seedlings and by infested soil clinging to farm machinery. It may be spread by the shoes of men from diseased areas who are pulling plants from healthy plant-beds. It is customary in South Carolina to give away or sell extra tobacco plants and to lend or rent plows, tobacco planters, and other equipment. Farmers should be cautioned by their agricultural agents about these methods of spreading the disease so that they may avoid introducing it on their farms.

Stem Rot of Transplanted Tobacco

(Q. L. Holdeman and T. W. Graham)

The importance of obtaining a good uniform stand of flue-cured tobacco is generally recognized by tobacco farmers. Besides unfavorable weather and soil conditions, other factors such as parasites often cause a poor stand when seedlings are transplanted to the field.

Besides wireworms, three fungi, *Rhizoctonia solani, Phythium aphanidermatum,* and *P. ultimum,* have been found associated with the loss of stand in the field shortly after transplanting. These fungi attack the plant just below the soil level and change the stem into a brown to black soft rot within 7 days after transplanting. The plants reset adjacent to the diseased plants frequently fail to become established.

Plants affected by the fungi can be recognized by the presence of a soft rot just below soil level and by the absence of characteristic tunneling made by wireworms.

Preliminary work has been initiated in hopes of finding a control for stem rot of transplants.

Tobacco Barn Rot

(Q. L. Holdeman)

Occasionally tobacco farmers encounter a watery soft rot of tobacco leaves in their curing barns during the yellowing stages of the curing process. The soft rot may consume the entire leaf and frequently causes the leaf to fall to the floor of the barn.

During the 1950 curing season, a fungus, *Pythium aphanidermatum,* was isolated and by inoculation was found to be capable of causing barn rot.

It is suggested that farmers filling curing barns during humid weather avoid overpacking their barns (i.e., tying too many leaves on a stick or placing sticks too close together) and provide sufficient ventilation to carry off the excess moisture.

Tobacco Blue Mold Control

(Q. L. Holdeman and T. W. Graham)

Each year tests are carried out in order to check on the performance of the fungicides now in use and to find newer and possibly better fungicides. Past research has shown that successful control of tobacco blue mold can be obtained from proper application of three commercial products: Fermate, Parzate, and Dithane Z-78. One new experimental fungicide, presently listed as No. 5379, has shown considerable promise.

In the 1951 plantbed season there was a large increase in the number of farmers using fungicidal dusts for blue mold control. As more and more farmers learn proper control measures, there will be a tendency to reduce the shortage of plants which occurs at planting time. The plant shortage has been partially responsible for the introduction of tobacco pests and soil-borne diseases to new areas and to farms not previously infested.

Occurrence of Manganese Deficiency in Oats and Wheat Increasing

(Q. L. Holdeman, T. W. Graham, and J. F. Bullock)

The value of agricultural lime for the coastal soils of South Carolina has long been recognized. Due to overliming, an increased number of farmers have been encountering a manganese deficiency in oats and wheat, a condition which has been recognized in this state since 1931.

When oats and wheat begin rapid growth in the spring, bright yellow patches of chlorotic plants appear in the field. The leaves are at first bright yellow. Death of small patches of the leaf blade at the base of the leaf soon follows. As the season progresses, the plants either die or they recover their normal green color and show only stunted growth and the dead areas at the bases of the old leaves. Symptoms may be expected to show up in areas that have the pH raised above 6.5. The low manganese content of the coastal soils may be supplemented by utilizing basic slag, except on tobacco soils. If the soils have been limed, manganese sulphate should be used.

Nematode Parasites on Tobacco and Other Crops

(T. W. Graham and Q. L. Holdeman)

Two nematode diseases of tobacco and other crops, root knot caused by *Meloidogyne spp.* and root rot caused by *Pratylenchus spp.*, are now well recognized. Studies herein reported indicate that other root-feeding nematodes, whose habitat, however, is external to the roots, are important parasites in the Coastal Plain area of South Carolina. Tobacco is attacked by two such surface-feeding nematodes, *Tylenchorhynchus claytoni* Steiner and *Helicotylenchus spp.* Cotton is likewise parasitized by two of these surface feeders, the sting nema-

tode, *Belonolaimus gracilis* Steiner and spiral nematodes, *Helicotylenchus spp.* Greenhouse experiments have shown that corn is attacked by *Belonolaimus* and tomato by *Helicotylenchus.*

Root injury caused by these nematodes is as follows: *Meloidogyne* —root swellings; *Pratylenchus*—root decay; *Helicotylenchus*—root decay; *Tylenchorhynchus*—root shriveling. All of these nematodes caused marked retardation of plant growth.

Table 36.—Parasitic Nematodes Found in Soil Collections from Diseased Roots[1]

Crop	Nematodes found
Cotton	*Tylenchorhynchus claytoni, Helicotylenchus spp. Trichodorus spp., Pratylenchus spp., Meloidogyne spp., Belonolaimus gracilis, Tylenchus spp., Criconemoides spp.*
Tobacco	*Meloidogyne spp., Helicotylenchus spp., Pratylenchus spp., Tylenchorhynchus claytoni*
Corn	*Pratylenchus spp., Belonolaimus gracilis, Trichodorus spp., Criconemoides spp.*
Strawberry	*Belonolaimus gracilis, Helicotylenchus spp.*
Cowpeas	*Belonolaimus gracilis, Helicotylenchus spp., Criconemoides spp.*
Peanuts	*Criconemoides spp., Pratylenchus spp.*
Fescue grass	*Trichodorus spp.*
Soybeans	*Belonolaimus gracilis*
Okra	*Meloidogyne spp., Pratylenchus spp.*
Gardenia	*Helicotylenchus spp., Meloidogyne spp.*

[1] In most collections nematode populations were relatively high.

Table 37.—Multiplication of the Sting Nematode (*Belonolaimus gracilis*) in Relation to the Crop Grown

Crop	Variety	Number nematodes[1]	Ratio of increase[2]
Control (soil from field)		4	--
Corn	N. C. 27	35	8 X
Crotalaria striata		2	--
Cotton	Coker 100 W	31	8 X
Cowpeas	Iron	28	7 X
Soybeans	Bansei	34	8 X
Tobacco	Gold Dollar	1	--
Oats	Fulgrain	20	5 X
Rye	Abbruzzi	2	--
Wheat	Coastal	6	1 X
Peanuts	Virginia Bunch	6	1 X
Crowfoot grass	(*Dactyloctenium aegyptium*)	10	2 X

[1] Counts were made from 6 replicate soil samples after crops had grown 30 to 44 days in infested soil. Soil samples were washed and screened using the modified Baermann funnel technique. Nematode populations were counted with a dissecting microscope from uniform samples withdrawn from the funnel into a 90 mm. petri dish.
[2] Relative increase in nematode population at the end of the test after exposure to the crops.

In addition to the above studies, numerous field collections were made from plants and soils during the growing season of 1950 and 1951 where nematode troubles were suspected. Nematodes were recovered from the soil by using the modified Baermann funnel technique.

Briefly, this method consists of washing a sample of soil with thorough agitation so as to free the nematodes from the soil particles. Suspended nematodes and water are then poured on to a 200-mesh screen on which nematodes are caught. Washings from the 200-mesh screen are poured into a glass funnel filled with water and fitted with a coarse muslin filter on which fine soil debris is caught. Nematodes work their way through the muslin and settle to the bottom of the funnel where they are drawn off in a small volume of water. The data in table 36 list soil collections where in most cases relatively large nematode populations were found associated with diseased plants.

Studies have been made of the damage caused by the sting nematode. Large numbers of these nematodes were found in soils from parts of cotton fields where the crop was almost a total loss. This nematode was also found associated with a severe root disease of corn and soybeans. In order to get more information on hosts of the sting nematode, a series of crops were planted in the greenhouse using infested soil from two cotton fields. The relative increase in populations of the sting nematode in these soils and the hosts concerned are presented in table 37. After 30 to 44 days nematode populations were greatly increased on corn, cotton, cowpeas, soybeans, oats, and crowfoot grass (*Dactyloctenium aegyptium* (L) Beauv.). There was no increase on tobacco, rye, or *Crotalaria striata*, and possible small increases on wheat and peanuts. Other tests with tobacco indicate that this crop is not affected by the sting nematode. Further studies are under way to get more information on parasitism and methods for control of these nematodes.

Tobacco Plant Failures
(James F. Bullock)

Tobacco plantbed failures are common on a goodly number of farms nearly every year. These plant failures can be attributed to a number of causes; however, on many of the exposed upland or very sandy beds, excessive drying out of the top layer of soil during and immediately after germination of the seed often results in a very poor stand of plants. Windy weather usually prevails about this time of the year. Repeated trials have shown that firming the soil as soon as the seeds are sown and keeping the soil moist during the time the seed are sprouting and becoming established will result in a good stand of plants. Some seasons it is necessary to water the beds twice daily in order to keep the top soil from becoming too dry and causing the sprouting seed to die. Usually it is not necessary to water the beds for a period longer than a week.

Tobacco Varieties Resistant to Black Shank and Granville Wilt
(James F. Bullock, Z. T. Ford, and J. F. Chaplin)

Scattered outbreaks of black shank over the flue-cured area and also in areas where Granville wilt is already present point to the

necessity of testing the resistant varieties now available. With the possible rapid spread of black shank it is probable that within a relatively short time a major portion of the tobacco planted will have to be of the resistant varieties. Present information indicates that root-knot and root-rot organisms, which are generally present over the South Carolina flue-cured area, are major factors in determining the degree of resistance to black shank or Granville wilt a variety may have.

Table 38.—Quality Evaluation of Black-Shank-Resistant and Granville-Wilt-Resistant Tobacco Varieties on Noninfested Soil

Variety	Acre yield			Acre value			Average value per 100 lbs.		
	1950	1951	Average	1950	1951	Average	1950	1951	Average
Black-Shank-Resistant									
P. D. 181	1514	1639	1576	715.39	624.89	670.14	47.25	38.12	42.52
Vesta 33	1448	1557	1502	664.07	596.24	625.15	45.85	38.28	41.62
Vesta 55	1561	1627	1594	694.55	558.43	626.49	44.47	34.33	39.30
Vesta 46	1579	1483	1531	698.92	471.78	585.36	44.22	31.82	38.23
Vesta 62	1579	1534	1556	707.29	458.63	582.96	44.78	29.90	37.47
Oxford 1	1424	1454	1439	618.24	447.45	532.84	43.39	30.77	37.03
Granville-Wilt-Resistant									
Dixie Bright 27	1437	1435	1436	647.58	508.49	578.03	45.06	35.43	40.25
Golden Wilt	1313	1314	1313	608.34	460.64	534.49	46.31	35.07	40.71
Oxford 26	1059	1034	1046	474.00	370.70	422.35	44.75	35.54	40.38
Combination Resistance to Black Shank and Granville Wilt									
Dixie Bright 101	1370	1392	1381	648.28	538.93	593.60	47.29	38.71	42.98
Dixie Bright 102	1202	1213	1207	530.91	394.41	462.66	44.15	32.52	38.33

For soils infested with only black shank, Pee Dee 181, is the best variety insofar as resistance, yield, and quality are concerned. Dixie Bright 101 has about equal resistance and quality, but is a lower yielder and is very susceptible to root-knot and meadow nematodes. Golden Wilt is the best Granville-wilt-resistant variety. Dixie Bright 27 will yield more but the cured leaf is very starchy and papery. It also lacks silkiness and commands less respect from the buyer. Oxford 26 is very susceptible to root-knot and meadow nematodes. Dixie Bright 101 is the better black-shank-Granville-wilt-resistant variety. None of the above varieties carry complete resistance or immunity; therefore, each of these varieties should be used in conjunction with crop rotation.

Weed, Grass, and Root-Knot Control in Tobacco Seedbeds

(James F. Bullock, Z. T. Ford, and J. F. Chaplin)

Reasonable control of grass and weeds in tobacco beds has been obtained by the following methods: (1) steaming, (2) applying fertilizer-grade cyanamid, uramon, or combinations of the two, (3) applying allyl alcohol, or methyl bromide gas, or other chemicals to the soil before seeding the beds. Root knot in tobacco seedbeds is of major concern in most of the South Carolina flue-cured area.

Tobacco plants affected with root knot in the seedbed and then transplanted to the field will invariably result in a marked reduction in growth, yield, and economic return.

Uramon, or a combination of uramon and cyanamid or methyl bromide, has given some degree of root-knot control in addition to grass and weed control. In addition to the combination treatments of uramon and cyanamid, at the rate of 1 pound and ½ pound respectively per square yard, an application of DD mixture (dichloropropene-dichloropropane) at the rate of 1 gallon per 100 square yards, has given a high degree of root-knot control. Application should be made in September or early October.

Methyl bromide used as a soil fumigant applied under waterproof and gasproof covers (paper or plastic) has given good weed, grass, and root-knot control. These covers have not proved too practical or economical for use with methyl bromide. Pans 9 feet x 11½ feet, made of zinc-coated tin around a light angle-iron frame, have been in use two seasons for retaining the methyl bromide gas. The action of the methyl bromide on the zinc-coated tin has not caused any noticeable deterioration, whereas, black iron pans were severely corroded. If these metal pans can be used for several seasons, the treatment will be much more economical and the effectiveness of the methyl bromide will be increased. Use of methyl bromide with metal pans has given almost perfect weed, grass, and root-knot control. The chief handicap is that the area treated each time is small.

Cotton-Insect Investigations

(L. C. Fife, R. L. Walker, and C. E. Jernigan)

Low Volume of Spray Reduces Cost of Boll Weevil Control.—As the time and labor required to handle excessive amounts of water make spraying expensive, tests were conducted with emulsion sprays of various insecticides to determine the smallest volume of spray per acre required to give adequate control of the boll weevil.

In 1950 and 1951 toxaphene emulsion spray was applied with different sizes of hollow-cone-type nozzles to obtain a range of 1.9 to 11.4 gallons per acre. Comparable dosages of toxaphene were used on all treated plots regardless of the quantity of water applied.

All treatments gave equally effective control of the boll weevil (table 39). In 1950 the gains of seed cotton per acre in the treated over the untreated plots ranged from 704 to 769 pounds, whereas in 1951 they ranged from 151 to 367 pounds.

It is evident from these tests that the time and labor required for spraying operations can be greatly reduced by using nozzles delivering relatively small amounts of spray per acre.

Table 39.—Control of the Boll Weevil with Toxaphene Emulsion Spray Applied at Comparable Dosages in Various Quantities of Water (1 nozzle per row)

Gallons per acre	Dosage, pounds per acre	Average percent of punctured squares	Pounds of seed cotton per acre
1950 (Average of 3 plots, 10 applications between June 6 to August 4)			
2.3	2.3	36	1201
6.1	2.0	31	1234
11.4	1.9	36	1169
Minimum significant difference at 5% level		(1)	(1)
Check, no treatment		63	465
1951 (Average of 4 plots, 11 applications between June 13 to August 8)			
1.9	1.95	28	1906
5.6	1.81	28	1835
10.5	1.76	31	1690
Minimum significant difference at 5% level		(1)	(1)
Check, no treatment		57	1539

1 Not significant according to the F test.

Several Promising New Insecticides Tested.—Aldrin, dieldrin, and heptachlor have been widely tested over a 3-year period and are now recommended for cotton-insect control. DDT has been added to all these materials for an all-purpose insecticide.

Compounds 711 and 269, stereoisomers of aldrin and dieldrin, were tested in 1951 for boll weevil control, and both showed considerable promise. Further tests should be conducted with these pesticides to establish satisfactory dosage levels for various cotton pests.

Applied as a dust, 3 percent of EPN and 4 percent of 4-methylumbelliferone 0, 0-diethyl thiophosphate (Potasan) plus 1 percent of methyl parathion were less effective against the boll weevil than the recommended insecticides.

Four Species of Spider Mites Attack Cotton in South Carolina.—Spider mites often cause serious damage to cotton in South Carolina, especially in hot dry periods during the summer. The two most abundant species are the two-spotted spider mite, *Tetranychus bimaculatus* Harvey, and *Tetranychus desertorum* Banks (= *Septanychus texazona* McG). Two species of less importance include the strawberry spider mite, *Tetranychus atlanticus* McG., and *T. bimaculatus multisetis* McG.

Tobacco Budworm Causes Serious Damage to Cotton.—To determine the importance of various species of bollworms attacking bolls and squares, insects in cotton fields have been collected during June, July, and August for the past 2 years. In 1950, 95.3 percent of the worms collected were tobacco budworms as compared with only 3.4 percent of bollworms. In 1951, 56.3 percent of the worms were tobacco budworms and 36.6 percent were bollworms.

Often the tobacco budworm causes more damage to cotton in South Carolina than the bollworm.

SANDHILL EXPERIMENT STATION

(J. A. Riley, Superintendent)

In general, the operations at this station for the period covered by this report have gone well. Some improvements and repairs have been made to the establishment.

Facilities have been made available for workers located here, those from the college, and those from elsewhere for giving tests to materials and processes where the soil or crops requirements were met by the conditions at this Station. This includes agronomic work in the fertilization of cotton and in the treatment of other crops.

At the end of the growing season of 1950, it was planned that for the period of one year we would discontinue certain fertilizer experiments that had been conducted for many years with cotton. The area of about 35 acres where these tests had been conducted was planted in the spring in crotalaria, which is now making a very good growth.

In the field of horticulture, facilities were furnished for studies in the fertilization of peach trees, and for the establishment of an additional 15 acres of young peach trees. These were kept to a good stand by irrigation during an extreme drought during the spring.

Allied to the horticulture work with peaches were the studies of disease and insect control conducted by pathology and entomology representatives of the college.

Facilities were also furnished for growing 22 acres of sesame in connection with studies being conducted in the breeding and growing of oil-bearing plants.

Two acres of land were used in the growing of corn in connection with the corn hybrid investigations, and 3 acres in connection with investigations in corn insect control.

Cooperation was continued with representatives of the USDA in the growing of certain fruit trees in search of factors of resistance to insect and disease attack, and also in the growing of certain medicinal plants.

About 1,000 pounds of the new Starr pearl millet seed was produced and distributed to several localities in the State.

A field of 8 acres was grown in watermelons on land which had grown kudzu and other crops for several years. Satisfactory yields were made, but no apparent differences developed which could be attributed to any one of the different preceding crops.

Considerable use was made of the irrigation system in the growing of field crops and in the orchard. It was possible with irrigation to produce peaches of normal size, while on areas not irrigated fruit was for the most part inferior and not suitable for competitive marketing.

Provision is being made for needed additional water supply for use in irrigation to in part meet this need.

Average Yields of Seed Cotton from Various Sources of Nitrogen

(W. R. Paden, E. B. Eskew, and N. R. Page)

Nitrogen is recognized as a limiting element of plant growth in most soils of this region. It must be supplied to the soil through the growth of well-inoculated legumes or through the liberal application of commercial fertilizers if profitable crop production is to be assured. Various sources of nitrogen are used to supply this essential nutrient element. The nitrogen contained in these sources may be in either the ammonium or the nitrate form or in a combination of both. The ammonium form tends to leach from the soil less readily than the nitrate form, or at least until nitrification occurs. The nitrate form is immediately available to plants, although information shows that some crops utilize both nitrate and ammonium forms of nitrogen.

There has been a constant demand for information concerning the relative efficiency of sources of nitrogen. An experiment was begun in 1931 on Norfolk sand to compare the response in yields of seed cotton from eight important sources used alone and in combination with other sources. Two sources were used with basic slag. There were 24 check plots using sodium nitrate as the source of nitrogen. These check plots were distributed systematically as every third plot throughout the experiment. The size of each plot was 1/10 acre, and each source or combination was replicated four times with exception of di-ammonium phosphate which was replicated only two times. One-half of each plot was cross-treated with dolomitic limestone at the rate of 1,500 pounds per acre when the experiment was established in 1931. This treatment was repeated in 1935 with a similar application and repeated again in 1945 over the entire area of each plot. The fertilizer was applied at the rate of 1,000 pounds of 5-10-5 per acre with one-half of the nitrogen applied under the crop and the remainder applied as side dressing with exception of calcium cyanamid which was all applied under the crop. The phosphorus was derived from superphosphate with exception of the sources which contained phosphorus in the compound itself or where basic slag was used. The basic slag was applied at the rate of 1,000 pounds per acre. An application of minor element materials composed of Fertilizer Borate, copper sulfate, and manganese sulfate was made at the rates of 5, 25, and 25 pounds per acre, respectively, in 1948, 1949, and 1950. The average yields of seed cotton obtained from the various sources during three successive 5-year periods and one 4-year period and for the combined 19-year period are given in table 40. The response in pounds per acre and in percent over the yields from no nitrogen and from the use of lime are also given in the same table.

Considerable variation is shown in the response from the differ-

ent sources of nitrogen and also from the effect of lime. In general, the acid-forming ammonium forms gave the highest response with lime. The response from no nitrogen on the limed soil was 65 pounds greater than on the unlimed soil, equivalent to an increase of 34.9 percent. The highest yield on the unlimed plots was produced by the ammonium sulfate and basic slag combination treatment which was followed very closely by the combination of 3/5 sodium nitrate and 2/5 ammonium sulfate treatment. The lowest yields were produced by Ammophos and ammonium sulfate. These sources are acid-forming in reaction. Although ammonium sulfate is more strongly acid-forming in reaction than Ammophos itself, the combination with superphosphate supplied some calcium which was completely absent in the case of the Ammophos. Sodium nitrate produced the highest yield on the limed plots, although this is recognized as not a fair comparison due to the greater number of check plots. The second highest yield was produced by the sodium nitrate-ammonium sulfate combination, and the lowest yield was produced by di-ammonium phosphate.

The response from lime in field practice may be expected to follow the results obtained in this experiment. A relatively high percentage of the soils of the state are moderately to strongly acid in reaction. The greater proportion of the nitrogen materials in mixed fertilizers is derived from ammonium forms.

Yields of Seed Cotton from Acid-forming and Nonacid-forming Fertilizers

(W. R. Paden, E. B. Eskew, and N. R. Page)

It is recognized that acid soil conditions are most economically corrected with a broadcast application of lime in sufficient amounts to maintain optimum soil reactions for crop growth. Under the soil conditions of this region, the proportion of soils that have been properly limed and maintained in a properly limed condition is actually very low. The fact that a high proportion of the nitrogen in mixed fertilizers is derived from the ammonium forms requires that fertilizers be nonacid-forming if the most efficient returns in crop response are to be received. The response from sources of phosphorus will partially be determined by whether or not the soils have been maintained at a reaction most favorable for their availability.

An experiment was established on Norfolk sand in 1935 using various sources of phosphorus under acid and neutral fertilizer conditions on unlimed and limed soils. The fertilizer was applied at a rate equivalent to 800 pounds of 5-10-5 per acre with exception of plots which did not receive any phosphorus and the ones which received rock phosphate or basic slag as the source of phosphorus. Basic slag and rock phosphate were applied at the rates of 800 and

Table 40.—Average Yields of Seed Cotton on Norfolk Sand from Various Sources of Nitrogen on Unlimed and Limed Soils, 1931-1950, Sandhill Station. (Basic fertilizer treatment equivalent to 1,000 pounds of 5-10-5 per acre; one-half of the nitrogen applied under the crop and the remainder as side dressing. Fertilizer Borate, copper sulfate, and manganese sulfate were applied with the fertilizer in 1948, 1949 and 1950 at rates of 5, 25, and 25 pounds per acre, respectively. All limed plots received applications of dolomitic limestone at the rate of 1500 pounds per acre in 1931, 1935, and 1945. The unlimed plots also received a 1,500-pound application in 1945.)

Source of nitrogen	Average yields of seed cotton in pounds per acre[1]					Increase over no nitrogen		Increase from lime	
	5 years (1931-35)	5 years (1936-40)	5 years[2] (1942-46)	4 years (1947-50)	Average				
(Unlimed)									
						Pounds	*Percent*	*Pounds*	*Percent*
No nitrogen	289	229	111	98	186				
3/5 sodium nitrate, 2/5 ammonium sulfate	880	734	491	627	686	500	268.8	---	---
Ammonium sulfate and basic slag	825	763	579	558	688	502	269.9	---	---
Sodium nitrate (24 checks)	815	735	518	569	664	478	257.0	---	---
Urea	782	691	525	588	650	464	249.5	---	---
Urea and ammoniated superphosphate[5]	[3]712	727	509	532	601	415	223.1	---	---
Cal-Nitro	679	600	429	500	555	369	198.4	---	---
Ammoniated superphosphate[5]	686	500	370	513	518	332	178.5	---	---
Ammonium sulfate	713	362	192	460	430	244	131.2	---	---
Calcium cyanamid	648	509	304	499	489	303	162.9	---	---
Calcium cyanamid and basic slag	[3]603	658	335	426	485	299	160.8	---	---
Ammophos[5]	608	183	211	397	347	161	86.6	---	---
Di-ammonium phosphate[5]	[3]543	679	369	532	528	342	183.9	---	---
(Limed)									
No nitrogen	[4]403	363	140	99	251	---	---	65	34.9
3/5 sodium nitrate, 2/5 ammonium sulfate	[4]999	856	616	599	764	513	204.4	78	11.4
Ammonium sulfate and basic slag	[4]844	777	548	594	688	437	174.1	—65	—14.8
Sodium nitrate (24 checks)	[4]1,028	893	629	562	776	525	209.2	112	16.9
Urea	[5]888	854	640	621	750	499	198.8	100	15.4
Urea and ammoniated superphosphate[5]	[3]826	890	626	587	717	466	185.7	116	19.3
Cal-Nitro	[4]841	697	478	496	624	373	148.6	69	12.4
Ammoniated superphosphate[5]	[4]901	767	614	546	705	454	180.9	187	36.1
Ammonium sulfate	[4]844	749	504	523	652	401	159.8	222	51.6
Calcium cyanamid	[4]740	621	364	496	548	297	118.3	59	12.1
Calcium cyanamid and basic slag	[3]692	713	354	433	517	266	106.0	32	6.6
Ammophus[6]	[4]875	833	555	459	682	431	171.7	335	96.5
Di-ammonium phosphate[5]	[3]502	653	595	503	583	332	132.3	55	10.4

[1] 1/20-acre plots; 4 replications.
[2] Yields were not taken in 1941 due to adverse season.
[3] Average for only one year; not included until 1935.
[4] Average for only 4 years; not included until 1932.
[5] Side-dressed with Urea.

Table 41.—Average Yields of Seed Cotton on Norfolk Sand from Neutral and Acid Fertilizers Containing Phosphorus from Various Sources on Unlimed and Limed Soils, 1935-1950, Sandhill Station. (Basic fertilizer treatment equivalent to 800 pounds of 5-10-5 per acre with one-half of the nitrogen applied under the crop and derived from ammonium sulfate, unless contained in the material, and the remainder from ammonium sulfate applied as side dressing. Gypsum, where included, was applied at the rate of 250 pounds per acre. Fertilizer Borate, copper sulfate, and manganese sulfate were applied with the fertilizer in 1948, 1949, and 1950 at rates of 5, 25, and 25 pounds per acre, respectively. All limed plots received applications of dolomitic limestone at the rate of 1,500 pounds per acre in 1931, 1935, and 1945. The unlimed plots also received a 1,500-pound application in 1945.)

Source of phosphorus	Condition of fertilizer	Average yields of seed cotton in pounds per acre[1]								Increase or decrease for lime		Yield from neutral fertilizer expressed as percent of yield from acid fertilizer		Percent of no phosphorus	
		5 years (1935-39)		5 years[2] (1940-45)		5 years (1946-50)		15 years (1935-50)							
		Unlimed	Limed	Unlimed	Limed	Unlimed	Limed	Unlimed	Limed	Pounds	Percent	Unlimed	Limed	Unlimed	Limed
No phosphorus	Acid	70	388	96	216	340	277	169	294	125	74	---	---	100	100
	Neutral	307	416	310	300	420	308	346	342	—4	—1	205	116	100	100
Superphosphate	Acid	404	498	296	391	392	379	364	423	59	16	---	---	215	144
	Neutral	471	457	364	378	344	369	393	401	9	2	108	95	114	117
Rock phosphate	Acid	532	528	402	410	504	391	479	443	—36	—8	---	---	283	151
	Neutral	565	398	462	345	432	342	486	362	—124	—26	101	82	140	106
Ammoniated superphosphate	Acid	378	378	320	329	428	388	375	365	—10	—3	---	---	222	124
	Neutral	486	418	423	344	372	367	427	376	—51	—12	114	103	123	110
Basic slag	Acid	631	435	385	317	376	342	464	365	—99	—21	---	---	275	124
	Neutral	604	422	386	274	358	346	449	347	—102	—23	97	95	130	101
Mono-ammonium phosphate	Acid	130	571	94	326	336	352	187	416	229	122	---	---	111	141
	Neutral	358	474	259	277	385	359	334	370	36	11	179	89	97	108
Mono-ammonium phosphate and gypsum	Acid	443	530	288	384	397	423	376	446	70	19	---	---	222	152
	Neutral	494	515	363	397	404	384	420	432	12	3	112	97	121	126
Di-ammonium phosphate	Acid	94	595	101	356	339	356	178	436	258	145	---	---	105	148
	Neutral	317	539	232	324	376	362	309	409	100	32	174	94	89	120
Di-ammonium phosphate and gypsum	Acid	408	497	304	350	419	380	377	409	32	8	---	---	223	139
	Neutral	515	474	377	342	364	377	419	398	—21	—5	111	97	121	116
Average all treatments	Acid	341	491	254	339	391	365	330	400	72	22	---	---	---	---
	Neutral	458	457	353	331	384	357	398	382	—16	—4	121	96	---	---

[1] 1/40-acre plots; 3 replications.
[2] Yields were not taken in 1941 due to adverse season.

1,000 pounds per acre respectively. Where gypsum was used with mono-ammonium phosphate and also di-ammonium phosphate, it was applied at the rate of 250 pounds per acre. One-half of the nitrogen was applied under the crop and was derived from ammonium sulfate, unless nitrogen was contained in the material, and the remainder of this nitrogen was from ammonium sulfate applied as side dressing. Dolomitic limestone was added to the fertilizer mixture to be applied at the rate of 200 pounds per acre. The size of the plots was 1/10 acre. One-half of the plot received the acid-forming fertilizer, and the other half received the nonacid-forming fertilizer. Each of the plots was cross-treated with applications of dolomitic limestone and each source of phosphorus treatment was replicated three times. The average yields of seed cotton are shown in table 41.

A wide variation is shown in the results of the experiment. The most favorable responses from the sources of phosphorus were obtained on the limed soils and when lime was included with the fertilizer to provide a nonacid condition. These results emphasize the importance of calcium in fertilizer mixtures on acid soils although it is recognized that superphosphate contains a high proportion of calcium in the form of gypsum. Slight exceptions noted in the responses are those in the cases of rock phosphate, ammoniated superphosphate, and basic slag. It is generally recognized that the availability of rock phosphate is highest under slightly acid conditions. It may be observed from these results that the highest average yields on the unlimed soil under both acid-forming and nonacid-forming fertilizer conditions were produced from rock phosphate. On the limed soil and under acid-forming fertilizer conditions, the yield was only 3 pounds less than that from mono-ammonium phosphate with gypsum. The highest yield from ammoniated superphosphate was produced under neutral fertilizer and unlimed soil conditions. In the case of basic slag, sufficient lime was contained in the material to develop an alkaline soil reaction after continued use. This alkaline or overlimed condition resulted in a decrease in uptake of potassium as recognized by a deficiency condition in the lower leaves of the cotton plants.

Very striking responses were shown where gypsum was included with mono-ammonium phosphate and di-ammonium phosphate in the acid-forming fertilizers on the unlimed soils as compared with the results where gypsum was not included. These responses indicate the importance of the elements calcium and sulfur to simulate conditions comparable with superphosphate, which commonly contains as much as 50 percent gypsum. The use of ammonium sulfate as the source of nitrogen supplied sulfur which is an important nutrient in the mineral soils of this region. Doubtless this sulfur favored the response from rock phosphate.

Yields of Seed Cotton from Sources of Phosphorus

(W. R. Paden, E. B. Eskew, and N. R. Page)

The results obtained in an experiment established in 1936 to compare responses in yields of seed cotton from certain sources of phosphorus with that from no phosphorus are given in table 42. Fertilizer was applied at the rate of 800 pounds of 5-10-5 per acre with the nitrogen derived from ammonium sulfate. One-half of the nitrogen was applied under the crop and the remainder as side dressing. The response from phosphorus applications over that from no phosphorus ranged in percent from 40.7 which was obtained from colloidal phosphate to 52.5 from basic slag. The average yield obtained where one-half of the phosphorus was derived from basic slag and the remainder from superphosphate was highest, but it should be noted that this test was not included until 1939 or 3 years after the test was actually begun. Comparison of these data with that from the no-phosphorus plots on comparable years actually show a lower percentage response than would otherwise be shown.

Table 42.—Average Yields of Seed Cotton on Norfolk Sand as Affected by Sources of Phosphorus, 1936-1950, Sandhill Station. (Basic fertilizer treatment equivalent to 800 pounds of 5-10-5 per acre. Nitrogen supplied from ammonium sulfate; one-half applied under the crop and remainder as side dressing. Colloidal phosphate and basic slag applied at rates of 800 pounds per acre. Fertilizer borate, copper sulfate, and manganese sulfate were applied with the fertilizer in 1948, 1949, and 1950 at rates of 5, 25, and 25 pounds per acre, respectively. All plots received applications of dolomitic limestone at the rate of 1,500 pounds per acre in 1931, 1935 and 1945.)

Source of phosphorus	Average yield of seed cotton in pounds per acre[1]				Increase over no phosphorus	
	5 years (1936-40)	5 years[2] (1942-46)	4 years (1947-50)	14 years (1936-50)		
					Pounds	*Percent*
No phosphorus	[3]504	506	573	526	---	---
T. V. A. (47%)	699	805	823	772	246	46.8
Colloidal	705	740	785	740	214	40.7
Basic slag	803	803	800	802	276	52.5
½ Basic slag) ½ Superphosphate)	[4]1,204	824	739	862	[5]275	[5]52.3
Superphosphate	734	844	784	788	262	49.8

[1] 1/20-acre plots; 8 replications.
[2] Yields were not taken in 1941 due to adverse season.
[3] Average for only 4 years—not included until 1936.
[4] Average for only 2 years—not included until 1939.
[5] On comparable year basis.

Yields of Seed Cotton as Affected by Rate and Time of Applying Potash

(W. R. Paden, E. B. Eskew, and N. R. Page)

An experiment was established in 1931 to determine the most effective rate and time of applying potash to cotton on limed soil

Table 43.—Average Yields of Seed Cotton on Norfolk Sand as Affected by Rate and Time of Applying Potash, 1931-1950, Sandhill Station. (Basic fertilizer treatment—600 pounds of a 5-10-0 per acre with potash applied as indicated; 15 pounds of nitrogen applied as side dressing. Fertilizer borate, copper sulfate, and manganese sulfate were applied with the fertilizer in 1948, 1949, and 1950 at rates of 5, 25, and 25 pounds per acre, respectively. All plots received 1,500-pound applications of dolomitic limestone at the rate of 1,500 pounds per acre in 1931, 1935, and 1945.)

Pounds of potash per acre	Time of application	Average yields of seed cotton in pounds per acre[1]					Average for each rate	Increase over preceding rate	Increase over no potash		Increase in pounds of seed cotton per pound of potash
		5 years (1931-35)	5 years (1936-40)	5 years[2] (1942-46)	4 years (1947-50)	19 years (1931-50)			*Pounds*	*Percent*	
None		[3]673	439	483	336	480	480	---	---	---	---
15	All before planting	963	838	842	671	837	859	379	379	79.0	25.3
	½ before planting and ½ at chopping	990	940	856	704	881	---	---	---	---	---
30	All before planting	1,189	1,267	1,081	919	1,124	---	---	---	---	---
	½ before planting and ½ at chopping	1,256	1,313	1,206	949	1,193	1,146	287	666	138.8	22.2
	All at chopping	1,233	1,246	1,071	889	1,122	---	---	---	---	---
45	All before planting	1,370	1,380	1,228	1,010	1,259	---	---	---	---	---
	½ before planting and ½ at chopping	1,384	1,418	1,279	1,034	1,291	1,262	116	782	162.9	17.4
	All at chopping	1,359	1,372	1,218	935	1,236	---	---	---	---	---
60	All before planting	1,488	1,542	1,323	1,064	1,370	---	---	---	---	---
	½ before planting and ½ at chopping	1,531	1,567	1,341	1,050	1,390	1,377	115	897	186.9	15.0
	All at chopping	1,510	1,557	1,324	1,030	1,372	---	---	---	---	---

[1] 1/20-acre plots; 3 replications.
[2] Yields were not taken in 1941 due to adverse season.
[3] Average for only 4 years—not included until 1932.

using 15-, 30-, 45-, and 60-pound rates of K_2O per acre as compared with no potash. Each of the rates was applied as follows: All before planting, one-half before planting and remainder at chopping, and all at chopping (with the exception of the 15-pound rate where the application was omitted). The basic fertilizer treatment was 600 pounds of 5-10-0 per acre with the potash applied as indicated. The nitrogen in the mixture was derived from Cal-Nitro or ANL with 15 pounds of nitrogen from the same materials applied as side dressing. The size of each plot was 1/20-acre and each treatment was replicated three times. The highest average yield of seed cotton for the 19-year period as shown in table 43 was 1,390 pounds per acre which was obtained from the 60-pound rate of potash where one-half was applied before planting and the remainder at chopping. The average per-acre yield for each rate of application was 859, 1,146, 1,262, and 1,377 pounds, respectively, with percentage increases over no potash of 79.0, 138.8, 162.9, and 186.9, respectively. The increase in yields of seed cotton per pound of potash applied was 25.3 pounds at the lower rate of 15 pounds per acre with a gradual decline to 15.0 pounds at the higher rate of 60 pounds per acre. It should be observed that sodium nitrate was not used as the source of nitrogen because sodium partially substitutes for potassium at the lower rates of potash application.

Effect of Sodium with Varying Rates of Potash on Yield of Seed Cotton

(W. R. Paden, E. B. Eskew, and N. R. Page)

The capacity of the cotton plant to utilize sodium especially when the content of potash is low has accounted to a large degree for the favorable response from sodium nitrate commonly applied as side dressing. Experimental data have shown that certain mineral elements can partially replace or supplement others in the nutrition of plants.

Results are shown in table 44 of an experiment which was set up at the Sandhill Station in 1931 to obtain information on the response in yields of seed cotton from varying rates of potash under conditions where the source of nitrogen was derived either from sodium nitrate or from calcium nitrate or Cal-Nitro. The fertilizer nutrients were applied at the per acre rate of 45 pounds of N (with 30 applied before planting and the remainder as side dressing) 60 pounds of P_2O_5 and K_2O as indicated. The check plots received 30 pounds of K_2O or 600 pounds of 5-10-5 per acre and were side-dressed with ammonium sulfate as the source of nitrogen.

The average yields for the 18-year period showed an increase from the sodium nitrate plots equivalent to 70.5 percent over that from calcium nitrate where no potash was applied. The response dropped to 14 percent when 60 pounds of potash was applied.

Table 44.—Average Yields of Seed Cotton Grown on Norfolk Sand With and Without Sodium Nitrate in Combination with Indicated Amounts of Potash, 1931-1950, Sandhill Station. (Fertilizer treatment consisted of 45 pounds of N, 60 pounds of P_2O_5, and K_2O as indicated. Fertilizer borate, copper sulfate, and manganese sulfate were applied with the fertilizer in 1948, 1949, and 1950 at rates of 5, 25, and 25 pounds per acre, respectively. All plots received applications of dolomitic limestone at the rate of 1,500 pounds per acre in 1931, 1935, and 1945.)

Source of nitrogen	Pounds of K_2O per acre	Average yields of seed cotton in pounds per acre[1]					Increase for Na with various rates of K_2O		Percent increase based on no potash with calcium nitrate as 100 percent
		5 years (1931-36[2]	5 years (1937-42[2]	5 years (1943-47)	3 years (1948-50)	18 years (1931-50)			
							Pounds	*Percent*	*Percent*
Calcium nitrate	0	389	224	207	200	261	---	---	100
Sodium nitrate	0	612	430	396	273	445	184	70.5	170
Calcium nitrate	15	815	670	680	394	667	---	---	256
Sodium nitrate	15	1,009	878	765	520	823	156	23.4	315
Calcium nitrate	45	1,023	1,163	892	632	960	---	---	368
Sodium nitrate	45	1,203	1,358	977	646	1,090	130	13.5	418
Calcium nitrate	60	1,085	1,318	866	702	1,025	---	---	394
Sodium nitrate	60	1,228	1,537	1,001	738	1,169	144	14.0	448
Calcium nitrate	[3]30	1,009	1,071	977	829	987	---	---	378
Sodium nitrate	[3]30	1,064	1,224	1,053	786	1,059	72	7.3	406

[1] 1/20-acre plots; 4 replications.
[2] Yields were not taken in 1933 nor 1941 due to adverse season.
[3] Check plots side dressed with ammonium sulfate.

Comparative Yields of Seed Cotton from Varying Combinations of Sodium Chloride (Na_2O) and Potassium Chloride (K_2O)

(W. R. Paden, E. B. Eskew, and N. R. Page)

The average yields of seed cotton grown on Norfolk sand as affected by various combinations of sodium chloride (common salt) with that of potassium chloride, (muriate of potash) are given in table 45. Fertilizer was applied at the rate equivalent to 600 pounds of 7.5-10-0 per acre with varying rates of potash applied in combination with varying rates of sodium chloride. One-half of the nitrogen in the mixture was derived from cottonseed meal and the remainder from ammonium sulfate. Nitrogen side dressing was applied at the rate of 15 pounds per acre and was derived from ammonium sulfate. Equal weights of sodium chloride and potassium chloride calculated on the oxide basis of Na_2O and K_2O were used in the combinations. The milliequivalent value of the sodium chloride treatments was approximately 1.51 times that of the corresponding potassium chloride treatments.

The data show constant increases in response from K_2O where Na_2O was included in the combination. An exception is observed where both were omitted entirely from the fertilizer applied under the crop. In this case the crop was side-dressed with sodium nitrate

instead of the ammonium sulfate as was done in all other combinations. This orderly increase in response continued until the rate of K_2O was increased to 30 pounds per acre with the Na_2O decreased to 10 pounds per acre. These results also confirm other data which have shown that sodium contained in the fertilizer materials may be expected to produce increases in yields where low rates of potash are applied and that some combination of sodium and potassium may be as effective as equivalent amounts of potash.

Table 45.—Average Yields of Seed Cotton Grown on Norfolk Sand as Affected by Various Combinations of Sodium Chloride (Na_2O) and Potassium Chloride (K_2O), 1931-1950, Sandhill Station. (Basic fertilizer treatment equivalent to 600 pounds per acre of 7.5-10-0 with 7.5-10-5 on check plots. Fertilizer borate, copper sulfate, and manganese sulfate were applied with the fertilizer in 1948, 1949, and 1950 at rates of 5, 25, and 25 pounds, respectively. All plots received applications of dolomitic limestone at the rate of 1,500 pounds per acre in 1931, 1935, and 1945.)

Combinations (Pounds)		Average yields of seed cotton per acre[1]					Increase due to Na_2O—K_2O combinations	
		5 years (1931-35)	5 years (1936-40)	5 years[2] (1942-46)	4 years (1947-50)	19 years (1931-50)		
Na_2O and K_2O							*Pounds*	*Percent*
None	None	550	301	267	224	341	---	---
[3]--	None	588	604	447	304	495	154	45.2
40	--	637	388	358	302	428	87	25.5
35	5	824	602	457	407	581	240	70.4
30	10	933	664	552	459	662	321	94.1
25	15	913	740	612	495	700	359	105.3
20	20	967	903	732	614	814	473	138.7
15	25	999	930	822	674	866	525	154.0
10	30	1,100	1,081	996	803	1,005	664	194.7
5	35	1,097	1,116	965	763	997	656	192.4
--	40	1,080	1,074	867	684	939	598	175.4
--	30 (cks)	1,038	970	813	664	882	541	158.7
--	[3]25	1,040	978	889	706	913	572	167.7

[1] 1/20-acre plots; 3 replications.
[2] Yields were not taken in 1941 due to adverse season.
[3] Side-dressed with sodium nitrate instead of ammonium sulfate.

Yields of Seed Cotton from Various Sources of Potash Salts With and Without Lime and Magnesium Sulfate

(W. R. Paden, E. B. Eskew, and N. R. Page)

The results of an experiment established in 1931 to compare the response in yields of seed cotton on limed soil from muriate of potash, sulfate of potash, sulfate of potash-magnesia, and manure salts with that of no potash and using also two rates of magnesium sulfate with the sulfate of potash are given in table 46. The rate of fertilizer application before planting was 640 pounds of a 5-10-0 per acre with rates of potash as indicated equivalent to 50 pounds per acre. The nitrogen was derived from Cal-Nitro or ANL and nitrogen side dress-

Table 46.—Average Yields of Seed Cotton on Norfolk Sand from Various Sources of Potash Salts With and Without Lime and Magnesium Sulfate, 1931-1950, Sandhill Station. (Basic fertilizer treatment—640 pounds of a 5-10-0 per acre with source of potash as indicated. Fertilizer borate, copper sulfate, and manganese sulfate were applied with the fertilizer in 1948, 1949, and 1950 at rates of 5, 25, and 25 pounds per acre, respectively. All limed plots received applications of dolomitic limestone at the rate of 1,500 pounds per acre in 1931, 1935, and 1945. The unlimed plots also received a 1,500-pound application in 1945

Source of potash	Rate applied in pounds per acre	Condition of soil	Average yields of seed cotton in pounds per acre[1]					Increase or decrease from lime		Percent of no potash
			5 years (1931-35)	5 years (1936-40)	5 years[2] (1942-46)	4 years (1947-50)	19 years (1931-50)	*Pounds*	*Percent*	
No potash	---	Unlimed	174	66	34	54	83	---	---	100
		Limed	144	81	33	57	80	—3	—3.6	100
Muriate of potash	100	Unlimed	757	731	357	560	604	---	---	728
		Limed	1,040	946	368	620	750	146	24.2	938
Sulfate of potash	100	Unlimed	982	817	414	554	699	---	---	842
		Limed	1,269	1,181	401	577	872	173	24.7	1,090
Sulfate of potash Magnesium sulfate	100 69	Unlimed	1,075	964	535	575	799	---	---	963
		Limed	1,291	1,167	603	604	933	134	16.8	1,166
Sulfate of potash Magnesium sulfate	100 138	Unlimed	1,118	980	593	579	830	---	---	1,000
		Limed	1,357	1,181	703	656	991	161	19.4	1,239
Sulfate of potash-magnesia	192	Unlimed	1,080	947	493	542	777	---	---	936
		Limed	1,265	1,033	447	572	843	66	8.5	1,054
Manure salts	240	Unlimed	818	899	631	656	756	---	---	911
		Limed	1,120	1,082	598	721	889	133	17.6	1,111
Average yield		Unlimed	857	772	436	503	650	---	---	---
		Limed	1,070	953	451	544	765	115	17.7	---
Average increase or decrease from lime			213	181	15	—41	115	---	---	---

[1] 1/20-acre plots; 4 replications.

[2] Yields were not taken in 1941 due to adverse season.

ing applied at the rate of 32 pounds per acre. The size of each plot was 1/20 acre and they were replicated four times.

Very low yields of seed cotton were obtained from the plots which did not receive any potash with a decline in yields on both unlimed and limed plots in later years. The highest average yield was 991 pounds per acre and was obtained from sulfate of potash containing magnesium sulfate applied at the rate of 138 pounds per acre. This response was equivalent to 1,239 percent over no potash for the entire period. The addition of magnesium sulfate, at both the 69- and 138-pound rates with the sulfate of potash, gave high yields on unlimed and limed soils over sulfate of potash used alone, indicating a response from this soluble form of magnesium over the slowly available magnesium in the dolomitic limestone.

The Effect of Residual Potash on Yields of Seed Cotton

(W. R. Paden, E. B. Eskew, and N. R. Page)

An experiment was set up in 1932 to determine the residual effects of potash applied in different amounts as measured in yields of seed cotton. Applications at a rate of none, 100, 200, and 400 pounds of muriate of potash per acre were applied on 1/20-acre plots replicated four times. The results are given in table 47.

A definite response is shown from each rate of application over the lower rate which continues throughout the 18-year period. A gradual reduction in yields from the higher rates is observed in the later years of the experiment, indicating a gradual removal of the element from this soil through crop growth. Under conditions where only the seed cotton is removed from the soil and the vegetative portion of the plant is returned, potash removal is low.

Table 47.—Average Yields of Seed Cotton Grown on Norfolk Sand as Affected by Residual Potash Applied in 1932 at Rates Indicated, 1932-1950, Sandhill Station. (Plots fertilized annually at rate of 45 pounds of N and 60 pounds of P_2O_5. Fertilizer borate, copper sulfate, and manganese sulfate were applied with the fertilizer in 1948, 1949, and 1950 at rates of 5, 25, and 25 pounds per acre, respectively. All plots received applications of dolomitic limestone at the rate of 1,500 pounds per acre in 1931, 1935, and 1945.)

Rate of muriate applied	Average yields of seed cotton in pounds per acre[1]					Increase over preceding increments	Increase over no potash	
	5 years (1932-36)	5 years[2] (1937-42)	5 years (1943-47)	3 years (1948-50)	18 years (1932-50)		*Pounds*	*Percent*
None	671	549	839	508	657	---	---	---
100 lbs.	1,041	769	970	560	865	208	208	31.7
200 lbs.	1,324	918	1,009	599	1,003	138	346	52.7
400 lbs.	1,444	1,134	1,112	652	1,134	131	477	72.6

[1] 1/20-acre plots; 4 replications.
[2] Yields were not taken in 1941 due to adverse season.

TRUCK EXPERIMENT STATION

(W. C. Barnes, Superintendent)

Wade Snap Bean Very Promising

(W. C. Barnes)

Vegetable growers have been asking for a good disease-resistant, round-podded snap bean to replace Tendergreen, which often suffers severely from powdery mildew and mosaic. Such varieties as Logan, Rival, and Topcrop proved highly productive and disease resistant, but the pods wilted and lost color too rapidly in shipment. Tenderlong, Improved Tendergreen, Supergreen, and similar varieties were too susceptible to mosaic. The U. S. Vegetable Breeding Laboratory line B-1515-1-7-1-2, now released as Wade, has been tested

Figure 16.—Wade Snap Bean.

Figure 17.—Wade Snap Bean.

for several seasons. It was 2 to 3 days later than Topcrop and not quite as productive, but was much more productive than Tendergreen as well as resistant to the viruses that cause so many cull pods in this variety. For example, in the 1951 fall test Wade produced only 20 percent more total yield than Tendergreen, but 75 percent more marketable yield because of the high percentage of mosaic distorted pods in Tendergreen. Wade bore its pods on a high bush well off the ground. It produced attractive round pods that were darker green in color than any variety now grown. Both laboratory and shipping tests indicated that it will hold up well in shipment, and it was readily accepted in retail stores. Canning and freezing tests indicated it to be a good processor. Home gardeners should also find this a most desirable variety.

New Green Seed Limas Now Available

(W. C. Barnes)

All of the old standard varieties of lima beans produce seeds that are light green until they approach full table maturity at which time they take on a white cast. Several years ago green cotyledon mutations were found and propagated as new varieties. These were a

great help in processing where uniform color is essential to an attractive pack. Within the past 3 years several new varieties producing green cotyledons and green seed coats have been introduced. These are small pod types similar to the old standard, Henderson's bush. Early Thorogreen, Clark's Bush, and Cangreen are the green cotyledon introductions, while Evergreen, Emerald, and Allgreen are the new introductions having both green cotyledons and green seed coats.

In the 1950 test at Charleston, cold weather prevented proper germination of the large-seeded varieties, Peerless and Fordhook 242. A heat wave at mid-harvest also damaged the crop severely and caused many pods to drop after they were almost grown. Yields of these tests are reported in table 48.

Table 48.—Lima Bean Variety Test 1950-51, Truck Station, 1950-51

Variety	Yield in bushels per acre	
	1950	1951
Henderson's Bush	122	171
Early Thorogreen	113	211
Clark's Bush	121	215
Cangreen	---	182
Evergreen	102	184
Emerald	140	196
Allgreen	---	203
Peerless	63	---
Fordhook 242	0	303
Difference required for significance at 5 percent point		50

It is noted that the productive potentialities of these new varieties are not significantly different from Henderson; therefore, further tests will be necessary to determine which one is best suited for this area. Fordhook 242 is the best large-seeded type for shipping.

Limited fall tests indicate the small-seeded varieties are only fairly reliable producers; whereas, Fordhook 242 is not dependable. If cool weather prevails during flowering, good pod sets may be obtained, but under high temperatures very few pods are set.

Kentucky Wonder 191 Looks Good

(W. C. Barnes)

Several pole bean varieties have been grown the past two seasons and the yields, reported in table 49, indicate they all may be expected to produce satisfactory crops.

Table 49.—Pole Bean Variety Trials, Truck Station, 1950-51

Variety	Yield in bushels per acre	
	1950	1951
Kentucky Wonder 191	288	283
Kentucky Wonder (Rust resistant)	269	219
Kentucky Wonder (Stringless)	---	208
Kentucky Wonder (O. H. B.)	290	291
Green Savage	393	268
Blue Lake	304	255
Canfreezer	305	238
Difference required for significance at 5 percent point	76	14

The various Kentucky Wonder strains probably do not vary greatly in performance or quality. Morse's Pole 191, or Kentucky Wonder 191 (also sold as White Seeded Kentucky Wonder), was perhaps the best all-round bean in the trials. It produced good yields of long, straight, slightly flattened, dark-green pods that had the typical Kentucky Wonder flavor. This variety has become very popular in certain areas as a market and home-garden bean, and it is highly recommended to South Carolina growers. Green Savage is a new bean of Kentucky Wonder type that may prove worthy of attention by local growers. It was not as attractive as the 191 strain.

Blue Lake and Green Savage are round-podded, stringless, high-quality beans for canning and freezing. They did not have the typical Kentucky Wonder flavor desired by many consumers.

Hybrid Summer Squash Tested

(W. C. Barnes)

For several years the best variety of summer squash for production in this state has been Yellow Crookneck. Early Prolific Straightneck produced as well or better, but the fruits are tender and frequently do not ship well. Long Cocozelle was found to be the best variety in this type of squash. The recently introduced Caserta was early and productive, but the fruits were grayish green instead of bright green like Cocozelle and it has not found ready acceptance on the market. Seed of Hybrid Cocozelle and Hybrid Zucchini varieties are now available in small quantities. Preliminary tests indicate all squash varieties vary greatly in relative earliness from year to year. Productivity also varies with the seasons. Perhaps these hybrids are slightly earlier and more productive than Cocozelle; however, tests to date do not indicate sufficient advantage for the hybrids to justify the extra cost of seed. Furthermore, neither has as good fruit type as Long Cocozelle.

Strains of Great Lakes Lettuce Vary Greatly

(W. C. Barnes)

When the Great Lakes variety of head lettuce was introduced it was slightly variable in type. Many seed companies began selecting for improved types, and today the various strains of Great Lakes vary as much as varieties of most crops. Tests of a number of these strains during the past 3 years indicate the best ones for this area are the medium maturity strains from such firms as Ferry-Morse, Associated, Dessert, Pieters-Wheeler, and Woodruff. With the exception of A-36 from Woodruff, late strains have been disappointing. Premier Great Lakes is a strain that matures about 3 days earlier than those mentioned above. It is quite uniform, but the heads are slightly smaller than the regular strains and the wrapper leaves frequently do not fold as tightly around the head as desired. Pennlake is a small head strain that matures 4 to 5 days earlier than the regular strains. Its head type is good, but if growing conditions are adverse, it does not size up too well. Imperial 44 and Imperial 847 have been used as checks in these trials. They produce good heads which are not as firm as Great Lakes and tip burn frequently causes heavy losses in these varieties; whereas, loss from tip burn in Great Lakes is extremely small.

Tests of lettuce strains in the fall indicate the same strains of Great Lakes are best. The Imperials always seed badly. Fall production is hazardous due to weather problems and insect attacks, and growers are not likely to find it profitable.

Ideal Market Pea Variety Not Available

(W. C. Barnes)

The production of English or garden peas has declined drastically in South Carolina during the past few years. Part of this decline may be accredited to each of the following factors: Competition from frozen peas, scarcity of labor for harvesting, and low yields because of poorly adapted varieties. Testing of new varieties and breeding lines has been continued in the hope that something better than Laxton's Progress could be found. Although more productive varieties have been found, as shown in table 50, most of them do not have the large pods necessary for a market pea.

Morse's 55 is more productive if seeded 7 to 10 days earlier than Progress but it is not outstanding, and over a period of years probably would yield very little, if any, more than Progress. Little Marvel has been the most reliable producer of high-quality medium-size peas and is recommended as the best variety for home gardens or local market use. Thomas Laxton is a high-quality variety, but it is much

more subject to cold damage than Progress or Little Marvel. The P-84 breeding line from the U. S. Vegetable Laboratory is one of the highest quality peas ever tested. It has been a consistent yielder, but the pods are a little too small for a market variety. It should find ready acceptance as a freezer or home garden variety when it is introduced. The other varieties are small-podded, late canning or freezing types that produce well some seasons, and perhaps would perform better if seeded earlier than Progress.

Table 50.—Pea Variety Trial, Truck Station, 1949-51

Variety	Yield in bushels per acre			Pod size	Season
	1949	1950	1951		
Laxton's Progress	137	53	151	Large	Early
Morse's 55	---	--	50	Large	Late
Thomas Laxton	105	88	135	Medium large	Early
Little Marvel	183	92	220	Medium	Early
P-84	171	87	184	Medium	Medium
Victory Freezer	145	40	145	Small	Medium late
Darkskin Perfection	131	61	110	Small	Medium late
Wando	85	31	92	Small	Late

Nothing Outstanding Among New Tomato Varieties

(W. M. Epps)

None of the new tomato varieties tested in 1951 proved well adapted for commercial production in South Carolina. Each of them was definitely inferior to Rutgers in one or more respects or at least not superior to Rutgers in any important characteristic. Urbana, a recent introduction from the Illinois Experiment Station, produced a good yield of smooth attractive fruits, but the fruits were too small and the foliage was inadequate to protect the late fruit from sunscald. Several F-2 hybrids were tested, namely Harvest Cross from Joseph Harris Seed Company, Stokescross No. 1, 2, 4, and 5 from Francis Stokes Seed Company, and Sunnybrook from W. Atlee Burpee Seed Company. All of these produced well, but were not superior to Rutgers in productivity and were inferior in the appearance of the fruit. J. Moran, from Ferry Morse Seed Company, produced large but rough fruits. It was much more susceptible to early blight than the other varieties.

Two of the new tomatoes appeared to meet definite home-garden requirements and should be useful in South Carolina for this purpose. Burpee's Big Boy, a true hybrid variety, produced a good yield of very large smooth fruits. The hybrid seed are so expensive that this variety is unsuited for economical commercial production, but it should be well adapted for home-garden use to meet the gardener's demand for a very large fruited tomato. It was much more productive and more attractive than the Ponderosa variety which is currently

filling this demand. Sunray, a new yellow-fruited tomato, is highly resistant to Fusarium wilt. It was late in maturity, but produced a good yield of large golden yellow fruits. This variety should be satisfactory to meet the limited demand for a yellow tomato in those gardens where Fusarium wilt is present.

Melons for the Coastal Area

(W. M. Epps)

The coastal area of South Carolina grows a limited acreage of watermelons and muskmelons almost exclusively for local sale and for home use. Ravages of downy mildew on muskmelons and anthracnose on watermelons make the growth of these crops unprofitable in many years.

Trials with downy-mildew-resistant muskmelons have been conducted for several years with the aim of finding a melon suitable for home and local market use. None of the melons tested to date has proved completely satisfactory. Georgia 47, an advanced breeding line from Georgia, approached most closely the ideal. It was highly resistant to downy and powdery mildew. The flesh was firm, bright orange in color, and of good eating quality. The melons, however, were slightly flattened, rather poorly netted, somewhat smaller than desired and many had a distinct button at the blossom end. Smith's Perfect is a large, late, high-quality melon with rather soft rind and flesh. Its resistance to downy mildew was about equal to that of Georgia 47. The other melons tested were only intermediate in resistance to downy mildew. Rio Sweet, recently introduced by the Texas Station, produced a good yield of soft-fleshed, high-quality melons. The melons cracked and rotted rather badly in wet weather. They also ripened too quickly and often were full ripe when they reached the full slip stage.

Several of the early "ice-box" watermelon varieties have been tested. All these varieties were very susceptible to anthracnose and of only fair quality. They were about 10 to 14 days earlier than Garrison or Congo. The rinds were thin and fragile. New Hampshire Midget produced a large number of oval melons which weighed from 3 to 5 pounds. Colebrook and Honey Cream (yellow-fleshed) produced good yields of round striped melons which weighed 6 to 10 pounds. These two melons were 2 to 5 days later than New Hampshire Midget. Early Bankok was the most productive of the early varieties tested, but its quality was extremely poor.

Congo appeared to be the best adapted of the main season melons. It was resistant to anthracnose. The melons were of good size and good-eating quality. Garrison and Cannon Ball produced large, good-quality melons, but the vines were highly susceptible to attack by anthracnose. Wilt-Resistant Garrison was similar to the

Garrison only in rind color. Its quality was inferior and its type had not yet been fixed. U. S. Regional Vegetable Breeding Laboratory, 48-12, resistant to wilt and anthracnose, was of the Garrison type and was only slightly inferior to the Garrison in eating quality. A sister line, 48-13, had rather poor quality. Scaly Bark, a medium-sized round melon grown locally in the vicinity of Augusta, Georgia, had the best table quality of any of the melons tested, but had a rough, blotched, very fragile rind. It was very susceptible to anthracnose. Ironsides, a long, dark-green melon, was of good quality, but was not resistant to anthracnose and did not appear particularly promising in the coastal area. It was a few days earlier than Congo.

New Cherokee Potato Looks Good

(W. M. Epps)

The potato variety picture in the South Carolina coastal area is changing constantly. Within the past few years the Irish Cobbler variety has disappeared from the market because of its poor appearance and its susceptibility to disease. The Katahdin was used extensively for a few years, but it gave so much trouble in transit that its popularity was brief. Since 1945 the growers have switched rapidly and completely to Sebago. This variety produces only fair yields and is late, but it has considerable resistance to late blight and scab, looks good when washed, holds up well in shipment, and is suitable for the manufacture of potato chips. Except for its late maturity and relatively low yields, it is well adapted to South Carolina conditions.

For the past few years a search has been in progress to discover a variety that possesses all the desirable characteristics of Sebago and in addition, is earlier and more productive. Cherokee appears to meet these requirements. It is 1 to 2 weeks earlier than Sebago and, over a period of 7 years, has produced an average yield of 31 bushels per acre more than Sebago. It is virtually immune to late blight and highly resistant to scab. Samples of Cherokee, run over a commercial washer and drier in 1951, were clean and attractive. They held up as well as Sebago in simulated shipping tests. (Table 51). Chips made from Cherokee were as bright in color as those made from Sebago.

Cherokee was released in 1951 by the Indiana Experiment Station in cooperation with the U. S. Department of Agriculture. Seed stocks are very short for the 1952 crop, but two cars of seed have been obtained for large-scale grower tests in Charleston and Beaufort Counties.

Simulated Shipping Test Used to Determine the Carrying Ability of Potato Varieties

(W. M. Epps)

Many varieties of potatoes, such as Katahdin and Kennebec, darken quickly and break down in transit after being washed and dried. In a potato improvement program it is necessary to determine the ability of new seedlings to hold up in shipment. It is, of course, possible to include test bags in standard truck or car loads going to northern terminal markets, but this type of test is expensive and requires the cooperation of the terminal market produce inspectors as well as the truck drivers or railroad personnel.

At the suggestion of the Handling, Transportation, and Storage Division of the Bureau of Plant Industry, a relatively simple simulated test was initiated in 1950. The freshly harvested potatoes were artificially skinned and bruised. Then they were spread out on the ground in direct sunlight. At 15-minute intervals samples were picked up, bagged, and stored under an open shed. Two days later these samples were graded to determine the amount of browning, scald, and soft rot which had occurred. Results in 1950 indicated that results obtained with this type of test were very similar to results from actual shipping studies.

Results of 1951 tests with three varieties and four unnamed seedlings are presented in table 51.

Table 51.—Results of Simulated Shipping Tests with Potatoes in 1951, Truck Station

Variety	Exposed for 60 minutes[1]			Exposed for 90 minutes[1]		
	Sound	Brown	Scald	Sound	Brown	Scald
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
B76-23	76	24	0	41	34	25
Cherokee	64	27	9	46	33	21
Sebago	34	58	8	23	50	27
B73-3	29	55	16	27	36	37
B73-10	23	55	22	31	26	43
Kennebec	13	58	29	10	45	45
B69-16	21	35	44	16	19	65

[1] Temperature 85-88° F.; Relative humidity 34-38%; Wind 2-3 miles per hour; Time 1:09—2:39 P. M., May 30, 1951; Clouds—none.

With longer exposures the skinned areas of all varieties scalded. This rate of scalding of various varieties was not directly associated with the maturity of the tubers. Cherokee was the earliest and most mature; Sebago and Kennebec were the latest and least mature of the varieties tested. The seedling B76-23, which held up well in these tests, cracked so badly during harvest that a high percentage of the tubers had to be discarded.

Yellows-Resistant Glory Cabbage Now Available
(W. C. Barnes)

Yellows causes some loss in the coastal South Carolina cabbage crop each fall. Some fields are so badly infested that cabbage production has been discontinued on them. Although Marion Market is resistant, its popularity has declined rapidly because of difficulties in obtaining stands. Ferry-Morse Seed Company has just released a new variety, Resistant Glory. The Truck Station has been testing this cabbage for 3 years and finds that it resembles the old strain of Glory so closely the two are almost indistinguishable. It produces the same yield as Glory, matures at the same time, and is just as susceptible to cold and mildew in the heading stage. Spring crop tests show that it produces just as many premature seeders and is no better adapted to this season than the old strain of Glory. Resistant Glory is highly recommended to those growers having trouble with yellows, and it is probably only a matter of time until it will replace the old strain entirely.

Cabbage Breeding Project Making Progress
(W. C. Barnes)

The cabbage breeding project to develop an early, round-headed type for the spring crop is progressing satisfactorily. Crosses between Round Dutch and a round-headed Wakefield selection have produced some promising lines. Some of these are as early as Round Dutch and

Figure 18.—Cold and downy mildew damage to Glory Cabbage (left) and resistant cabbage x collard selection (right).

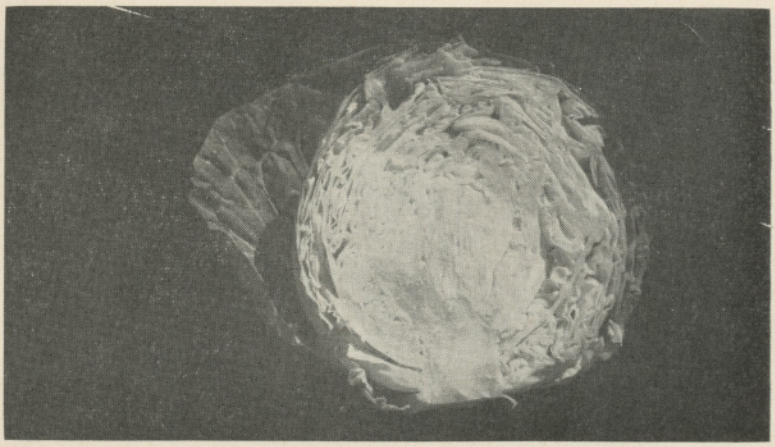

Figure 19.—Interior of head of cabbage x collard selection showing short core and excellent solidity.

produce larger heads that appear to be slightly more resistant to downy mildew. Fair tests on premature seeding indicate these lines are satisfactory, but a prolonged cold winter is needed to obtain a better test on this factor.

Progress is also being made in the development of a late, cold tolerant winter cabbage from a cross of cabbage on heading collard. Most cabbages were rendered unmarketable by the severe freeze of November, 1950, whereas selections out of this cabbage-collard cross came through with little or no damage to the heads. Some selections also appear to have considerable resistance to downy mildew which is frequently serious on most fall crop varieties. Another cold period in 1951 and a very severe epidemic of mildew again proved these cabbage-collard selections to have good resistance both to cold damage and to downy mildew.

A few of the more advanced lines of both of the above crosses are sufficiently uniform to begin increasing seed for preliminary production trials.

Cucumber Breeding Project Enlarged to Include Resistance to Anthracnose and Mosaic

(W. C. Barnes)

Anthracnose is present in all fall cucumber plantings and sometimes causes considerable loss. Within the past year hundreds of breeding lines, varieties, and foreign introductions have been tested for resistance to this disease. The only items showing any marked resistance were a few introductions from Turkey and India. Fortunately, most of these also have considerable resistance to downy

Figure 20.—Results of inoculating cucumber seedlings with anthracnose. Left—resistant PI number 175120—Center—A. & C.—Right—Marketer.

mildew; however, they are very late and produce black-spined, poorly shaped fruit. Crosses between these and some of the Truck Station's best mildew-resistant lines show promise of producing desirable fruit types with resistance to both diseases.

Mosaic-infested plants are only occasionally found in this state; however, the disease appears to be on the increase in this and other southern states. Some very poor fruit-type varieties from Puerto Rico that carry resistance to mildew and mosaic have been crossed with the good fruit-type mildew-resistant lines bred by this Station. It is planned to combine resistance to all three diseases by making crosses between the anthracnose-mildew resistant lines and the mosaic-mildew resistant ones.

Disease-Resistant Cowpeas Found

(W. M. Epps)

In 1949 a search was initiated for a source of resistance to several of the various diseases which restrict the growth of edible cowpeas in the fall in coastal South Carolina. The two diseases which are usually most serious are powdery mildew and mosaic. Cercospora leaf spot and Fusarium wilt are sometimes serious.

Greenhouse tests in 1950 and 1951 revealed that none of the peas tested were immune either to mosaic or mildew. There was, however, considerable variation in the degree of damage from mosaic suffered by the various varieties in the field. The crowder-type varieties, Brown Sugar Crowder, Red Speckled Crowder, Calhoun Crowder,

and LSPC-1, a Louisiana Experiment Station breeding line of the Crowder type, suffered very little, although mosaic was present. California Blackeye No. 5 and the various cream types from the Texas Experiment Station produced almost no normal pods.

A single plant introduction, P. I. No. 115,681, showed some resistance, but not immunity, to powdery mildew. This pea was classed as *Vigna sesquipedalis.* It was late in maturing and a semi-runner, producing a rather poor yield of purple-striped pods with black seeds.

Wilt resistance has been found in several of the varieties tested, such as Calhoun Crowder and Iron. California Blackeye No. 5 was completely susceptible indicating that both of the cultures in use were Armstrong's Race 2. Further tests with Race 1 must be conducted.

Crosses have been made between P. I. 115,681 and several of the commercial edible-type peas. Outcrosses of this material with Calhoun Crowder will be necessary to incorporate resistance to wilt and with one of the white or cream-colored peas to eliminate the undesirable seed-coat colors found in all the parents used.

Spergon Controls Cabbage Mildew

(W. M. Epps)

Downy mildew often seriously injures the fall cabbage crop in South Carolina. The injury is due to the spotting on the top of the heads and the subsequent poor appearance of the heads. When the disease becomes severe, the tissues break down and soft rot bacteria gain entrance to the head.

For some years Spergon has been used successfully for controlling downy mildew in cabbage seedbeds. Preliminary tests in 1950 indicated that mildew on the heads could be controlled by six applications of a 5-percent Spergon dust at 5-day intervals beginning when the earliest heads begin to form. In 1951 tests were conducted to try to reduce the expense of dusting by reducing the number of applications and by the use of a chemically stabilized Spergon.

This test, the results of which are presented in table 52, indicate that six applications at 5-day intervals were necessary for good disease control. The stabilized Spergon at 7-day intervals over the same period was much less effective. The 10-percent Spergon dust was only very slightly more effective than the 5-percent when both were applied at rates of 20 pounds per acre for six applications.

Table 52.—The Use of Spergon Dust for the Control of Downy Mildew on Cabbage Heads. (Expressed as percent of heads harvested), Truck Station, Fall 1951.

Form of Spergon	Concentration	Interval	Number Applications	Season totals		Nov. 26 only[1]	
				Marketable	Discard	Marketable	Discard
				Percent	*Percent*	*Percent*	*Percent*
Regular	10%	5 days	6	95.8	4.2	92.2	7.8
Regular	5%	5 days	6	94.0	6.0	86.2	13.6
Stabilized	5%	7 days	4	84.4	15.6	66.9	33.1
Regular	10%	5 days	[2]3	77.3	22.7	37.3	62.7
Stabilized	5%	5 days	[2]3	76.9	23.1	42.2	57.6
Regular	5%	5 days	[2]3	72.5	27.5	36.2	63.8
Control				66.2	33.8	30.5	69.5
Least difference required for significance at 5% point					7.64		16.60

[1] Most of the diseased heads were harvested on November 26. Figures based on about 100 heads for November 26 harvest and about 270 heads for season as a whole.
[2] These plots received the first three applications only.

Effect of Cover Crops on Yields of Irish Potatoes

(W. T. Scudder)

A permanent-plot cover-crop experiment was started in 1947 to study the effect of various cover crops on the yield and quality of vegetable crops. Irish potatoes and snap beans have been grown on these plots each spring, followed by cover crops during the remainder of the season. The 1948 and 1949 results of this experiment have been given in a previous annual report.

Five different cover crops, cowpeas, hegari, corn and cowpeas, crotalaria and soybeans, have been planted each year along with check plots where weeds were allowed to grow. Fairly good cover has been obtained with all of these crops, although the stand of crotalaria was not uniform. The hegari, a type of kafir corn, produced a heavy growth and caused some trouble with tillage equipment due to its coarse woody stalks.

The yields of potatoes during 1950 and 1951 are shown in table 53. The 1950 yields were low because the crop was severely injured by a late frost on April 16. There were no significant differences in yields attributable to the cover-crop treatments during either year. Also, an application of 150 pounds of nitrate of soda per acre top-dressed on the growing potato crop failed to produce a significant yield increase over adjacent areas not receiving additional nitrogen. Apparently, the nitrogen in the original 2,000 pounds of 5-10-5 fertilizer applied at planting time was adequate. All of these cover-crops, including the weeds, produced considerable organic matter. The value of this contribution to the soil has not been disputed, although so far this experiment has shown no differences in the relative value of the various cover crops.

Table 53.—Effect of Cover Crops on the Yields of Irish Potatoes, Truck Station, 1950-51.

Cover crop	Yield in bushels per acre					
	1950			1951		
	Not top-dressed	Nitrogen top-dressed	Average	Not top-dressed	Nitrogen top-dressed	Average
Weeds	158	168	163	227	248	238
Cowpeas	155	167	160	257	250	253
Hegari	170	183	177	240	242	242
Corn and peas	163	168	165	247	250	248
Crotalaria	160	155	158	222	225	223
Soybeans	170	157	163	242	213	227
Average	163	167	165	238	238	238

Fertilizer Experiments Fail to Show Value from Heavy Applications

(W. T. Scudder)

A series of fertilizer experiments was conducted during the 1950 and 1951 seasons in an attempt to bring about increased yields of a number of different vegetable crops. The tests involved fertilization rates higher than those currently recommended and split applications with part of the fertilizer applied in the row prior to planting and the remainder applied as side dressing at thinning time. In the side-dressing treatments, a complete 5-10-5 commercial fertilizer was compared with mixtures containing nitrogen plus potash and nitrogen alone. These experiments were conducted with spring and fall cucumbers, lettuce, sweet corn, and fall cabbage.

In this series of experiments, none of the modified fertilization schedules resulted in any measurable increase in yield over that obtained for the use of the recommended quantity of 5-10-5 fertilizer applied under the crop. The small yield differences which have occurred have been inconsistent and not significant. As a result, it appears that the minimum applications of 5-10-5 fertilizer applied in the row before planting are adequate. These rates are as follows:

Sweet corn	750 pounds
Lettuce	1,000 pounds
Spring cucumbers	1,000 pounds
Fall cucumbers	1,000 pounds
Fall cabbage	2,000 pounds

It may be that still further testing will reveal some advantage of splitting the fertilizer applications between planting and thinning time, or of using additional side dressings of nitrogen material. This may be possible with the use of improved equipment which would better place the side-dressing fertilizer. For these experiments, the usual methods employed by local commercial growers were utilized.

More Study of Chemical Weed Killers Needed

(W. T. Scudder)

Weed control in truck crops is a major item of expense. Because of this, experiments were initiated during 1950 to find selective herbicides which would effectively kill the weeds and yet allow the crops to grow unharmed. Several pre-emergence chemical treatments have already shown some promise, but considerable work is still needed before practical methods can be made available to growers. The results obtained with individual treatments have been highly variable, indicating that weather conditions have considerable influence on the effectiveness of the chemicals.

Many crops and chemicals have been under test during the past year. The most promising results were obtained with cabbage, onions, beans, and soybeans. Two chemicals, sodium trichloroacetate and sodium pentachlorophenate, used at the rate of 10 pounds per acre, proved effective for the control of weeds in direct-seeded fall cabbage. When these materials were applied in the form of a water spray on the soil surface immediately after the crop was seeded, they were highly effective in preventing the development of most small weed seedlings until the cabbage plants were nearly 6-weeks-old. Certain weeds of the cabbage family, such as wild mustard, appeared to be tolerant to the chemicals and were therefore not controlled. In most cases, however, these are not serious pests. The amount of injury to the cabbage crop appeared to depend upon the soil temperature and moisture content at the time of application and immediately thereafter. Until more is known about these factors and how they influence the proper time of treatment, definite recommendations cannot be made.

Tomato Fruit Set Hormones of Doubtful Value

(W. T. Scudder)

The use of hormones to improve the set of fruit on tomatoes has proved of practical value in many areas of the North. These materials are used in very low concentrations and sprayed on the blossom clusters just as the first flowers begin to open. The greatest success has been obtained with a 30 parts per million solution of p-chlorophenoxyacetic acid. In Michigan, such treatments have been found to triple the yield of tomatoes from the first few pickings and to increase the total yield for the season by over 25 percent.

The hormone, p-chlorophenoxyacetic acid, was applied to Rutgers tomatoes at Charleston in the spring of 1951. Not only did this chemical fail to increase the early yield of fruit, but it also resulted in a large number of "puffy" fruits. Thirty-five percent of the fruits

were seedless or contained only a very few seeds, and many of them contained hollow spaces and had soft, thin walls.

Under northern conditions, hormone treatment tends to reduce the blossom drop resulting from cold weather; thus a much larger harvest of high-priced, early fruit is obtained. Under South Carolina conditions, however, poor fruit set is more commonly due to excessively high temperatures rather than to low temperatures. Under these conditions the hormone was not only ineffective in increasing fruit set, but also reduced the quality of the crop.

1951 Peach Crop—Good

(W. C. Barnes and W. M. Epps)

The 1951 peach crop at the Truck Station was quite good considering the condition of the trees after the two previous warm winters. The six varieties rated as best and their respective ripening dates were as follows: Dixired (6-2), Dixigem (6-11), Southland (6-20), Halehaven (6-25), Early Elberta (7-3), and Georgia Belle (7-13). These varieties all came through the warm winters in fairly good condition. The following varieties produced only fair quality fruit: Early Rose (6-2), Erly-Red-Fre (6-5) and Fischer (6-15). Golden Jubilee (6-20) produced good quality fruit, but it softened too rapidly at ripening. Golden Globe (6-22) trees have not stood up well, and Sun High (6-28) produced fruits of good flavor that were too susceptible to scab. Elberta (7-17), Shippers Late (7-17) and Lizzie (8-2) trees were not in good condition, and brown rot attacked the fruit so badly that very few sound fruits were harvested. These late varieties are practically always damaged severely by brown rot, presumably because they ripen in the rainy mid-summer season.

Peach production on the coast is very risky, but if those growers desiring to grow this fruit will follow a rigid spray schedule and plant the six varieties recommended above, their chances of success are much greater than if they planted other varieties. These six will usually give a continuous harvest from June 1 to mid-July.

Disease Resistance Needed in Coastal Area Pears

(W. M. Epps and W. C. Barnes)

An epidemic of fire blight and leaf spot on pears in 1951 made it possible to evaluate the resistance of the various varieties to these two diseases. Many of the trees are still quite small and it was not possible to evaluate them properly. Baldwin, which was resistant to both diseases, produced a fair crop of high-quality early pears. Keiffer, also resistant to both diseases, produced a heavy crop of late pears of poor eating quality, but satisfactory for cooking. Waite

was resistant to fire blight and moderately resistant to leaf spot. The few pears produced were of typical pear shape and of excellent quality. Douglas produced a few high-quality pears, but was so highly susceptible to leaf spot that the tree was defoliated before the fruits ripened. Most of the fruits shrivelled on the tree. Pineapple flowered so early that the late frosts destroyed the blossoms. The trees were defoliated by leaf spot early in the fall. Ovid suffered severely and PI 46566 was killed by fire blight. Two small trees of PI 49494 produced heavy crops of early, good-quality, but poorly shaped fruits. They appeared to be highly resistant to both blight and leaf spot.

Grapes Suffer from Cercospora Leaf Spot

(W. M. Epps)

The muscadine grapes at the Truck Station produced a heavy crop of fruit, but the vines were defoliated prematurely by Cercospora leaf spot. (*Cercospora brachypus E. & E.*), and black rot. The unusual severity of the Cercospora leaf spot was possibly associated with the poor condition of the vines. None of the varieties appeared resistant to this disease. It was evident that those vines with a heavy crop suffered more severely than the less heavily fruited vines.

Vegetable-Insect Investigations

(W. J. Reid, Jr., and F. P. Cuthbert, Jr.[1])

Early-Season Use of Parathion and TEPP for Cabbage Aphid Control Might Do More Harm than Good—The cabbage aphid usually occurs each year on winter-spring cabbage in the Coastal Plain area of South Carolina, but only twice (1940 and 1951) in the last 20 years has it been observed to cause widespread damage to this crop. Occasional plants are damaged each year and sometimes entire fields are moderately damaged. In the area mentioned the insect apparently is held in check during most years by natural enemies, particularly by the insects known as ladybird beetles, syrphus flies, and hymenopterous (wasp-like) parasites.

In the past local growers usually have not obtained satisfactory control of the cabbage aphid with nicotine, the most effective aphicide available until recent years. As a result only occasional attempts were made prior to 1950 by commercial cabbage growers to combat the insect with an insecticide. Several of the new materials—BHC, lindane, parathion, and TEPP—were used to a limited extent on cabbage by a few growers in the Charleston area during the 1950 spring season. Parathion and BHC gave the most satisfactory aphid

[1] U. S. Department of Agriculture, Agricultural Research Administration, Bureau of Entomology and Plant Quarantine.

control. Most growers realized, however, that BHC was undesirable because of the danger of its imparting an off-flavor to succeeding vegetable root crops, particularly potatoes.

Growers in the Charleston area began finding the cabbage aphid on cabbage in February 1951. The infestation apparently was no greater than usual, but the finanical investment in the crop was greater, price prospects were good because of the small acreage, and the growers now knew about the newer and more effective insecticides. Consequently, use of these materials, particularly parathion, was begun late in February or early in March and continued through April. Only 1 field on 19 farms under observation did not receive an insecticide. Several growers made 5 applications and 1 made 6.

A 1-percent parathion dust was the chief material applied during the preheading stage of plant growth and in some cases its use continued thereafter. When properly applied, parathion usually gave good but not complete initial kill of the aphids. In practically all cases observed, however, there was a rapid rebound in the infestation, apparently due to destruction of insect enemies of the aphid by the insecticides. Additional applications of an insecticide usually were needed. Severe damage to the crops, as many as 33 percent of the plants being unfit to market, occurred when the insect was not brought under control after the early use of parathion.

BHC dusts of 1- or 1.5-percent gamma content were used in a few instances and gave more lasting protection. TEPP dusts and sprays were used with variable results by several growers during the heading period of plant growth. Good initial kill of aphids usually was obtained when TEPP was properly applied, but a more serious infestation of aphids quickly reappeared in most cases. Attempts by one grower to check a heavy infestation on heading cabbage with a 4-percent nicotine dust were unsuccessful. Previous to this treatment the cabbage had received three applications of parathion. The grower later obtained good kills with a TEPP spray, but too late to save his crop from severe damage.

Only one commercial planting under observation received no insecticide application. Aphids were present in this planting throughout the growth of the crop, but the infestation remained light. Hymenopterous parasites and syrphus flies were abundant at all times and had practically wiped out the aphids by the middle of the harvest period. Less aphid damage occurred in this planting than in most of those receiving insecticides. Similar results were noted in an experimental cabbage planting in which sprays were applied to only the few plants that had developed moderate to heavy aphid infestations by the time the plants began heading.

Past experience and limited observations of untreated cabbage plantings in the spring of 1951 lead us to believe that the early-sea-

son applications of parathion and TEPP that season might have done more harm than good.

Until more is learned about the best use that can be made of parathion and related insecticides for cabbage aphid control, it is suggested that these insecticides not be applied on winter-spring crops of cabbage in coastal South Carolina until it is evident that natural enemies are not holding the aphids in check. Meanwhile, the occasional aphid-infested plants found early in the season should either be pulled up and buried or be treated with nicotine dust or spray on warm days.

Systemic Insecticides Toxic to Cabbage Aphid.—In small-scale tests made on cabbage during the spring of 1951, two of the systemic insecticides, E-1059 and schradan (octamethyl pyrophosphoramide), proved to be rather effective against the cabbage aphid and tended to be superior to TEPP, lindane, parathion, and methyl parathion sprays. Both systemic materials were better than a nicotine sulfate-soap spray. As they are poisonous and are absorbed by plants, they should not be used on vegetables until it is determined how to use them safely.

Effectiveness of Several New Materials Against Cabbage Caterpillars.—DDT usually has given satisfactory control of the more important caterpillar pests of cabbage and related crops. As it is recognized that an even better insecticide for this purpose is possible and also that these caterpillars may develop considerable resistance to DDT, studies of newer materials are being continued. In a field-plot experiment conducted during May, 1951, various insecticides were applied only once because of the moderate infestations of the two species present. Several of the materials proved as effective as DDT against both species (table 54). Parathion and methyl parathion gave good initial kills, but did not provide so lasting protection as did certain other materials. The results might have been different had the cabbage looper been normally abundant or had any of the other more resistant species of caterpillars been present. For example, previous tests showed that the cabbage looper is quite resistant to methoxychlor.

In another test a 1-percent dust of a stereoisomer of dieldrin (endrin) proved as toxic to the imported cabbageworm and to larvae of the diamondback moth as did a 3-percent DDT dust.

In a third test allethrin, the new synthetic pyrethrum-like insecticide, showed a moderate degree of toxicity to the two insects just mentioned when used as 1- and 2-percent dusts and as a 0.016-percent spray. As is true of pyrethrum, allethrin evidently is not so effective against these species as rotenone-containing insecticides. Piperonyl butoxide and a related compound were of significant value against one or both of the two species of caterpillars when used separately at 1-percent strength in 0.5-percent allethrin dusts.

Is the Cabbage Looper Becoming Resistant to DDT?—In spite of its scarcity during the spring of 1951, the cabbage looper became abundant on cabbage and related crops in the fall of that year in the Charleston area. Many local growers had much more difficulty than heretofore in checking this insect with DDT. For the first time in our experience, a DDT dust proved inferior to comparable toxaphene and TDE dusts against the cabbage looper in a small-scale field-plot experiment conducted in October and November of 1951. The single application of each of these three materials, however, gave a rather high degree of control under the existing conditions. These 1951 experiences suggest that the cabbage looper may be developing greater resistance to DDT as a result of the general use of that material on cole crops in the Charleston area during the last 5 years. As several growers are known to have obtained satisfactory control of the looper with DDT during the fall of 1951, and as weather conditions were rather unfavorable for the application of insecticides that season, it does not appear that the loopers have attained a great degree of resistance thus far.

Table 54.—Comparison of Insecticide Dusts (unless otherwise indicated) in Control of Certain Caterpillars on Cabbage, Charleston, S. C., Spring of 1951

Insecticide	Dosage (pounds per acre)	Surviving insects per 100 plants				Worm-damaged plants at harvest	
		Imported cabbageworm		Diamondback moth			
		1-6 days after treatment	12-13 days after treatment	1-6 days after treatment	12-13 days after treatment	Number	Percent of total
Methoxychlor, 10%	30	3	10	7	5	1	0.7
CS-708, 3%	23	5	0	14	0	2	1.5
Lindane, 1%	27	7	35	15	0	4	3.0
DDT, 3%	23	8	15	24	5	5	3.7
Q-137, 5%	27	11	15	12	0	5	3.8
Dieldrin, 2.5%	32	10	20	35	5	6	4.5
Parathion, 1%	23	5	50	0	0	10	7.4
Aldrin, 2.5%	27	23	50	43	25	20	15.1
Methyl parathion emulsion spray (1-1,000 dilution of a 33.4% concentrate)	100 (gal.)	0	45	1	30	22	16.4
4-Methyl-umbelliferone O, O-diethyl thiophosphate, 2%[1]	23	13	75	66	80	28	21.5
Untreated		68	245	131	185	100	80.6
Difference required for significance at 5-percent level		15	47	34	50	8.8	

[1] Sold under the name Potasan.

Lindane Continues to Give Outstanding Insect Control on Cucumbers and Squash.—Lindane again proved effective in the fall of 1951 against all the important insect pests appearing on commercial and experimental plantings of cucumbers and squash in the Charleston area. In an experimental cucumber planting one or two applications of a 1-percent lindane dust or of a spray containing 1 pound of a 25-percent lindane wettable powder to each 100 gallons of water gave adequate protection of young plants against cucumber beetles. Two later applications, one about a week before the first pistillate (female) flowers appeared and the other just as the first

fruits showed up, gave adequate protection against the melon aphid and almost complete protection of the fruits against the pickleworm through the seventh of 12 harvestings. There were indications that one or two additional applications of a 0.25- to 0.5-percent lindane dust would have provided the needed continued protection against the pickleworm. In this planting applications of the fungicide zineb at approximately weekly intervals gave partial but not adequate protection against the pickleworm. Considerable evidence was obtained from commercial and experimental plantings that reduced amounts of lindane (dusts of 0.5- to 0.75-percent lindane content, or a spray containing one-half pound of a 25-percent wettable powder per 100 gallons of water) will give adequate control of all the insects mentioned when applied weekly and accompanied by similar use of recommended dosages of zineb.

With the cooperation of experienced judges,[2] it was found that eight applications of lindane (totaling about 1.25 pounds of actual lindane per acre) on a 1950 fall planting of cucumbers caused potatoes grown in the same field during the following spring to have a slight off-flavor or off-odor in the opinion of persons sensitive to this insecticide. The off-flavor was most pronounced in Irish Cobbler and Pontiac varieties, and there was a trend in the same direction in the case of the Bliss Triumph variety. No off-flavor was noted in the Cherokee and Sebago potatoes. The off-flavor also was noted in the Irish Cobbler variety after 3 months' storage, and palatability scores indicated the same for the Pontiac and Bliss Triumph varieties. Previous studies have shown that use of a 1-percent lindane dust until the day of harvest may cause a slight off-flavor to cucumbers. Unfortunately, pickleworms are most injurious during the fruiting period. Lower dosages of lindane should reduce these hazards. Lindane has been used extensively on cucumbers in the Charleston area in recent years, and no consumer complaints of off-flavor or off-odor have come to our attention.

Other materials that proved promising for pickleworm and melon aphid control on cucumbers in preliminary tests in 1951 were aldrin and dieldrin (as 2.5-percent dusts) and a dust containing 1 percent of endrin, a stereoisomer of dieldrin. Cryolite, purified DDT (103° C. setting point), and parathion gave a lower control of pickleworms. Cryolite apparently increased the melon aphid population, whereas parathion was effective against this aphid. Methoxychlor, heptachlor, zineb, and nicotine were relatively ineffective against the pickleworm.

Continued attempts to secure adequate control of the pickle-

---

[2] Palatability tests were made by the Bureau of Human Nutrition and Home Economics, U. S. Department of Agriculture, and L. O. Van Blaricom and associates, of The Clemson Agricultural College of South Carolina.

worm on fruiting cucumbers with sabadilla, rotenone, pyrethrum, and allethrin were unsuccessful, even though treatments with these materials were preceded by lindane and accompanied by zineb.

EDISTO EXPERIMENT STATION

(W. B. Rogers, Superintendent)

Mechanical Weed Control in Cotton

(M. R. Powers and W. A. Balk)

Significant differences were noted between different mechanical tools used for weed control in cotton at the Edisto Station. Six different implements were used in the 1951 test. All implements except two were regular production tools. The two non-production implements used were rotary hoes built in the station shop. They were an angle rotary hoe and an off-set tooth rotary hoe. The angle hoe was constructed to operate at a 30° angle to the direction of travel. The off-set hoe was built with staggered teeth in place of in-line teeth. The percent of grass destroyed by each of the six implements is shown in table 55.

Table 55.—Percent of Grass Destroyed by Each of Six Implements Used to Cultivate Cotton, Edisto Station, 1951

Implements	Percent grass destroyed[1]
Angle rotary hoe (Experimental)	78.1
High speed sweeps	64.7
Conventional sweeps	55.7
Gang-type rotary hoe	33.3
Row-type rotary hoe	15.1
Off-set rotary hoe	[2]-6.0

[1] Weed counts were taken immediately before and 1 week after the implements were used.
[2] Population of grass was greater 1 week after cultivation than immediately before.

Pre-Harvest Loss In Cotton

(M. R. Powers and W. A. Balk)

Most mechanical cotton harvesters cannot begin picking until at least 65 percent of the cotton is open. If used prior to that time, they will knock green bolls off the plants to the extent of lowering the yield. Some varieties of cotton drop a portion of the early opened cotton before all the green bolls are open and in some cases before 65 percent are open. This condition makes it impossible for the mechanical harvester to pick all the cotton produced by the plant. Tests have been conducted at the Edisto Station to determine their picking efficiencies on the different varieties. It should be noted from table 56 that one of these varieties has a high enough yield and picking efficiency to off-set the pre-harvest loss.

Table 56.—Yield, Picker Efficiency, and Pre-Harvest Loss from Seven Cotton Varieties, Edisto Station, 1951

Variety	Yield per acre	Pre-harvest loss	Picker efficiency	
			International	Allis-Chalmers
	Pounds seed cotton	*Percent*	*Percent*	*Percent*
Empire	1,899	1.75	93.9	90.9
Stoneville 2B	1,650	2.19	94.4	89.5
Bobshaw 1A	1,646	3.07	93.2	92.1
Coker 100	2,085	4.29	95.2	93.1
Pandora	1,903	4.91	93.3	90.9
Fox	1,804	6.82	93.8	91.1
Early Fluff	1,952	9.11	93.7	90.9

Defoliation

(M. R. Powers and W. A. Balk)

Defoliation still remains a major problem in any cotton mechanization program in the Southeast. The plants often put on a second growth of leaves thereby reducing the period during which the mechanical harvester can pick the cotton efficiently. The ideal defoliant would be a material which would remove all the leaves and prevent the plant from growing any further. If this were possible, the mechanical harvester could be used effectively for two pickings instead of the usual one. The result would be higher picking efficiency and better grades. In an effort to find such a material the Edisto Station worked very closely with representatives of the Pennsylvania Salt Company, The Mathison Chemical Company, the Pacific Coast Borax Company, and the American Cyanamid Company. Tests were made using various chemicals at different rates, combinations, and times of application, but none of the materials used proved to be more effective than Aero Cyanamid Special Grade. Next year this work will be continued with these companies and with others if they are interested.

Chemical Weed Control in Cotton

(M. R. Powers and W. A. Balk)

Various formulations of herbicides that have become available during the past two years show great promise in the control of grasses without serious damage to the cotton plant. During the past year several experiments have been conducted on the use of herbicides for the control of weeds in cotton. Experiments were also conducted to determine the best and most practical method for applying these chemicals with tractor equipment.

The two chemicals which gave the best weed control without

injury to plants in pre-emergence applications were dinitro and chloro-IPC. Both of the chemicals were applied in band treatment.

The only chemical used for post-emergence grass control was ESSO Weed Killer 38.

Special equipment required for planting was constructed in the station shop. The major change made in conventional equipment was use of a wide planter press wheel. This wheel provided a wide smooth surface for the uniform application of pre-emergence chemicals. Other special equipment used included parallel action shoes for the application of post-emergence oils. These shoes allowed the oil spray pattern to remain at the same height above and parallel to the seed-bed at all times. In this manner it was possible to spray around the base of young cotton plants without spraying the leaves.

Significant differences in weed control by certain chemicals are shown in table 57.

Table 57.—A Comparison of Different Pre-Emergence Weed Killers and Their Effect on Cotton Plants, Edisto Station, 1951

Treatment	Average weed count five replicates	Injury to cotton
2.2 lb. Chloro-IPC	46	None
2 lb. Dinitro	202	Slight
1.31 lb. Dinitro	325	None
6.6 PS 745	445	None
Check	561	

Effect of Chemical Weed Control on Sweet Potato Yields

(M. R. Powers and W. A. Balk)

A test was conducted at the Edisto Experiment Station in 1951 to determine the effect of 3-chloro-IPC on sweet potato yields. Sweet potato vine cuttings were transplanted July 16 in the usual manner on a high wide bed. The chemical (3-chloro-IPC) was applied both before and after transplanting at a rate of 2.5 pounds per acre in a 21-inch band.

Plants were transplanted both by hand and by machine to determine if there was any difference between methods of transplanting as related to the chemical. The plots which received chemical treatment did not receive any cultivation except in row middles where the chemical was not applied. Cultivation was discontinued in the middles when the vines reached the point where they would interfere with the cultivator. The untreated or check plots received cultivation and hand hoeing in the conventional manner. All treated plots were replicated five times, and the check plot replicated four times.

In this experiment sweet potatoes were harvested in November after frost had killed the vines. Results from this test indicate that 3-chloro-IPC cannot be used before transplanting without serious damage to plant growth. Where treatment was applied after transplanting, the cuttings grew off almost as rapidly as the untreated plants, and weed growth was retarded sufficiently to allow plant growth without competition from grass. In the test transplanting was done during a dry period which continued for 10 days. Further tests will be necessary before 3-chloro-IPC can be recommended for weed and grass control in sweet potatoes. Results from this test are outlined in table 58.

Table 58.—The Effect of 3-Chloro-IPC as a Weed Killer on Sweet Potato Yields, Edisto Station, 1951

Treatment	Average yield in pounds per plot
Chemical applied after hand transplanting	249
Chemical applied before hand transplanting	96
Chemical applied after machine transplanting	237
Chemical applied before machine transplanting	68
Check (transplanted by machine)	268

Seedbed Preparation and Its Effect Upon Yield of Seed Cotton

(V. K. Quattlebaum)

Many tillage machines or combinations of machines, may be used to vary the condition of the seedbed. The preparation of the plant seedbed of a soil influences the ability or inability of a certain crop to withstand drought conditions.

Preliminary studies of various methods of preparing the soil for planting showed highly significant differences in yield of seed cotton between subsoil and nonsubsoil treatments. As shown in table 59, all of the tillage machines gave higher yields when the subsoiler was used in conjunction with these machines.

Table 59.—Results of a Preliminary Study to Determine the Effects of Seedbed Preparation Upon Yield of Seed Cotton, Edisto Station, 1951

Treatment	Mean yield (Lb. seed cotton)	
	Per plot	Per acre
(1) Subsoil, disk tiller, and disk harrow	39.25	1709.1
(2) Subsoil, moldboard plow, and disk harrow	39.00	1700.4
(3) Moldboard with 6-inch subsoil shoe, and disk harrow	37.50	1635.0
(4) Moldboard plow, disk harrow	34.75	1515.1
(5) Subsoil, disk harrow	34.25	1449.7
(6) Disk tiller, disk harrow	31.00	1351.6
(7) Deep harrow	25.25	1275.3
(8) Graham Hoehme, disk harrow	27.00	1177.2
L.S.D. (.05)	6.40	279.4
L.S.D. (.01)	7.75	294.7

Anhydrous Ammonia Compares Favorably with Other Sources of Nitrogen As a Cotton Side-Dressing Material

(J. J. Wolfe and J. H. Hoyert)

Anhydrous ammonia is the cheapest source of nitrogen available for crop production. This form of nitrogen has been widely used in areas of Mississippi, Louisiana, and neighboring states because of its low cost and the relative ease with which it is applied. In this experiment the effectiveness of anhydrous ammonia was compared to the more common forms of nitrogen under the conditions of climate and soil of this region.

This test was conducted in 1949 and again in 1951. Five sources of nitrogenous fertilizer material were employed with each source being applied at three levels. These sources were anhydrous ammonia, nitrate of soda, Cal-Nitro, ammonium sulfate, and uramon. The materials were applied at levels of 16, 32, and 48 pounds of nitrogen per acre, respectively. In addition, control plots with no nitrogen side dressing were included. All of the plots received 600 pounds per acre of 4-10-6 fertilizer prior to planting.

Statistical treatment of the harvest data indicated no significant differences between yields from the five sources of nitrogenous side-dressing materials. Neither was there a significant difference in yield between the plots treated with 16 pounds, 32 pounds, or 48 pounds of nitrogen per acre. All five sources of nitrogen at each of the three levels gave appreciable yield increases over the yields of the plots which had no nitrogen side-dressing applications. In table 60 the yields from the nitrogen treatments employed are given.

Table 60.—Yields of Seed Cotton from Five Sources of Nitrogen Each at Three Levels at the Edisto Experiment Station in 1949 and 1951[1]

Source of nitrogen[2]	Crop year							
	1949				1951			
	Levels of nitrogen applied				Levels of nitrogen applied			
	16 lbs. per acre	32 lbs. per acre	48 lbs. per acre	Average for 3 levels	16 lbs. per acre	32 lbs. per acre	48 lbs. per acre	Average for 3 levels
	Yields of seed cotton in pounds per acre							
Anhydrous ammonia	[3]1,328	1,322	1,334	1,328	1,071	1,382	1,248	1,234
Nitrate of soda	1,364	1,372	1,366	1,367	1,369	1,113	1,443	1,308
Cal-Nitro	1,228	1,344	1,582	1,385	1,191	915	1,234	1,113
Ammonium sulfate	1,536	1,380	1,388	1,435	1,231	1,296	1,146	1,224
Uramon	1,398	1,392	1,394	1,395	1,254	1,385	1,384	1,341

[1] Each value is an average of 0.025 acre plots replicated four times.
[2] Control plots with no nitrogen applications averaged 1,212 pounds per acre for eight plots in 1949 and 929 pounds per acre in 1951.
[3] No significant differences between sources or levels.

Cotton Variety Test

(J. J. Wolfe)

Cotton variety tests are conducted to give some idea of the performance of the different varieties of cotton now available to the farmer as well as to compare them with new varieties, strains, and selections. To be profitable cotton varieties must be adapted to the methods of production used in a rapidly changing system of farming. In addition to a high yield, early maturity, high percent of lint to seed, strength and length of fiber, the ability of the cotton to remain on the plant in the field without loss of quality due to weather, disease, insects, and mechanical operations is becoming more important.

In the 1951 test randomized two-row plots of 1/80 acre were replicated eight times. Samples picked from four plots of each variety were ginned on a small gin, and grade, staple, percent of lint and bolls per pound were determined from these samples. Samples were graded and stapled by the South Carolina Department of Agriculture.

Cotton was planted in April; 800 pounds of 4-10-6 fertilizer was applied per acre before planting. One hundred and fifty pounds of nitrate of soda was applied after chopping.

The results of the 1951 cotton variety test are shown in table 61.

Cotton Insect Control

(J. G. Watts)

Cotton insects in general did less damage in South Carolina in 1951 than in any of the past several years. The winter survival of boll weevils was about normal but low rainfall adversely affected their emergence from hibernation. Low rainfall and moderately high temperature throughout the growing season limited the usual population increase. In the Piedmont thrips restricted the early development of seedling cotton to some extent, but probably less than in 1950. Somewhat out of the ordinary was the occurrence in some areas of a damaging infestation of red spiders during the dry early summer months. There was the usual late season spider increase, which is estimated to have caused little or no reduction in yield. Another unusual development was the exceptionally early occurrence of the bollworm in some areas just as the cotton was beginning to fruit. Late summer infestations did considerable damage where insecticide applications were not properly timed.

Insecticide Tests.—There was no significant difference in the effectiveness of eight dust formulations in controlling a relatively light boll-weevil infestation and a very light bollworm infestation

Table 61.—Cotton Variety Test, Edisto Station, 1951

Variety	Pounds seed cotton per acre	Yield per acre in pounds			Average grade	Average staple length in 1/32 inch	Bolls per pound	Percent yield first picking
		Lint	Seed	Percent lint				
Coker 100 Wilt 1952 BRS	2,021	701	1,320	34.70	SM	35	63	86
Bobshaw IA	2,020	730	1,290	36.14	M	33	82	90
Coker 100 Wilt 50-140	1,950	680	1,270	34.85	M	35	72	88
Coker 100 Wilt 50-139	1,925	674	1,251	35.02	SM	34	77	87
Coker 100 Wilt 49-160	1,889	670	1,219	35.46	SM	34	68	91
Pandora	1,884	657	1,227	34.86	SM	33	63	87
Coker 100 Wilt 50-179	1,877	652	1,225	34.76	SM	34	74	89
Deltapine 15	1,853	665	1,188	35.91	SM	34	71	90
Coker 100 Wilt 49-194	1,845	649	1,197	35.17	SM	34	70	84
Coker 100 Wilt 49-14	1,825	622	1,203	34.06	M	35	69	90
Empire P-473	1,823	648	1,175	35.53	M	33	63	94
Delfos	1,814	638	1,176	35.15	SM	35	60	88
Coker 100 Wilt 50-83	1,805	628	1,177	34.77	SM	33	71	89
Stonewilt	1,799	627	1,172	34.88	M	34	65	88
Empire P-482	1,785	641	1,144	35.92	SM	33	56	90
Stoneville 2B-2492	1,724	606	1,118	35.17	M	34	67	88
Fox	1,702	656	1,046	38.54	SM	34	63	87
Coker 100 Wilt 50-178	1,688	595	1,093	35.26	SM	34	66	87
Coker 100 Wilt 50-172	1,668	550	1,118	32.95	SM	35	65	90
Coker 100 Wilt 50-82	1,657	595	1,062	35.92	SM	35	63	86
Coker 100 Wilt 49-127	1,644	563	1,081	34.26	M	35	74	90
Empire W. R.	1,590	580	1,010	36.45	M	33	63	94
Early Fluff	1,580	551	1,029	34.85	SM	34	66	88
Coker 100 Wilt 1951 BRS	1,561	549	1,012	35.16	SM	35	63	88
Coker 100 Wilt 50-171	1,561	531	1,030	34.02	SM	34	63	89
Coker 100 Wilt 49-184	1,560	528	1,032	33.85	M	33	67	86
Coker 100 Wilt 49-134	1,560	559	1,001	35.82	M	35	67	87
Coker C-M-15	1,553	549	1,004	35.33	SM	34	69	91
Coker 100 Wilt 49-196	1,535	525	1,010	34.22	SM	34	67	87
Coker 100 Wilt 50-68	1,470	500	970	34.01	SM	34	77	83
Coker C-M-10	1,456	507	949	34.82	M	33	63	89
White Gold	1,417	492	925	34.69	SM	34	67	87
Coker 100 Wilt 50-146	1,189	409	780	34.37	SM	34	67	84

Note:

1. Grade, staple, percent of lints, and number of bolls per pound were obtained from four samples picked from each variety and ginned on a small gin.
2. Samples were graded and stapled by the South Carolina Department of Agriculture.
3. Planting date: April 17, 1950.
4. Fertilizer: 800 pounds per acre of 4-10-6 and 150 pounds of nitrate of soda.

(table 62). Although there was a difference of 354 pounds of seed cotton between the highest and lowest yielding treatment, the variation between replicates was such that this difference was not statistically significant. Heptachlor dust was used only at the 5.0 percent concentration, but tests at other locations indicate that it is effective for boll-weevil control at 2.5 percent. The yields from the three EPN (ethyl P-Nitrophenyl thionobenzenephosphonate) treatments ranked along with those from the recommended cotton insecticides; but, at other locations where the weevil infestation was higher, it is reported that EPN did not perform as favorably as in this test.

Five spray formulations performed about equally well from the standpoint of weevil control and yield (table 63). Here again the weevil population was relatively light and the bollworm population was very light.

Hand Sprayer.—The small cotton farmer long has been faced with the problem of purchasing equipment for applying insecticides. The conventional tractor and animal-drawn sprayers and dusters are priced beyond the reach of many 5- to 10-acre cotton farmers. The conventional hand duster has not filled the need of this group, perhaps largely because of the physical burden of prolonged operation of a hand duster. A 3- or 4-gallon hand sprayer with a low-gallonage nozzle seems to overcome, to a considerable extent, several of the disadvantages of the hand duster. Therefore, an experiment was set up in which a hand sprayer was compared with both a tractor sprayer and a tractor duster as a means of applying insecticides to cotton. The hand sprayer was equipped with oil-resisting neoprene hose, a pressure gauge, and a No. 1 nozzle which delivered about 1 gallon of liquid per acre at normal walking speed. Only 1 gallon of liquid was placed in the 3-gallon tank, the remaining space being left to build up a head of air pressure. In this way an acre of cotton could be sprayed while pumping up the tank once or twice, at most. Air pressure was maintained at between 40 and 60 psi. The yield from cotton where the insecticide was applied with hand sprayer compared very favorably with that where a tractor sprayer was used (table 64). The hand or tractor sprayer did not produce a significantly better yield than where dust was applied with a tractor duster.

Smoke Generator.—A type of smoke generator was supplied by the Coy Gin Company, Coy, Arkansas, for experimentation in controlling cotton insects. The generating device is similar in appearance to a muffler and exhaust pipe and attaches to the tractor manifold. The chemical mixture prepared for use in the generator was supplied by the same company and was composed of 10 percent guaicol-pyrol, 30 percent petroleum lubricant, and 60 percent sulfur.

The exhaust heat from the tractor vaporizes this mixture which escapes as a dense smoke through a branching exhaust pipe. In the experiment one treatment consisted of daytime applications without regard for wind and another consisted of nighttime applications under conditions suitable for dusting. These treatments did not produce yields which compared favorably with recommended cotton insect control procedures (table 62).

Large-Scale Spraying and Dusting.—Four dusts and one spray material were compared on a demonstrational field basis. There was remarkably little difference in yield of seed cotton in the different treatments as shown in the tabulation below.

Treatment	Form	Acres Treated	Yield Per Acre
			Lb. Seed Cotton
Heptachlor 5% - DDT 5%	dust	34	1,134
Dieldrin 1.5%	dust	43	1,119
Toxaphene	spray	11	1,075
Aldrin 2.5% - DDT 5%	dust	40	1,062
Toxaphene 20%	dust	32	1,061

These small differences tend to verify the non-significant differences from small plot experiments reported above.

Table 62.—Effectiveness of Eight Dust Formulations in Controlling the Boll Weevil and Bollworm[1]

Treatment	Boll weevil	Bollworm	Yield
	Percent infestation	*Percent infestation*	*Pounds seed cotton*
Heptachlor 5% - DDT 5%	6	0.2	2,016
EPN 3% - DDT 5%	7	0.2	1,968
Dieldrin 1.5%	7	0.4	1,885
Toxaphene 20%	5	0.2	1,883
EPN 3%	5	0.3	1,830
EPN 3% - Dilan 10%	8	0.4	1,766
Aldrin 2.5% - DDT 5%	7	0.6	1,739
BHC 3 % - DDT 5%	6	1.4	1,662
Untreated adjoining field	41	---	718

[1] Seven applications of dust were made at an average of 10 pounds per acre application.

Table 63.—Effectiveness of Spray Formulations in Controlling the Boll Weevil and Bollworm

Treatment	Average pounds per application	Percent infestation		Yield
		Boll weevil	Bollworm	
Heptachlor	0.5	8	1.2	2,021
DDT	0.5	--	--	---
Toxaphene	2.0	7	0.3	2,008
Dieldrin	0.15	6	0.5	1,931
BHC	0.3	8	1.1	1,915
DDT	0.5	--	--	---
Aldrin	0.25	9	0.8	1,851
DDT	0.5	--	--	---
Untreated adjoining field		41	--	718

Table 64.—Boll Weevil Infestation Counts and Yield of Seed Cotton from Plots Receiving Different Treatments[1]

Treatment	Average pounds per acre application	Percent weevil infestation	Pounds seed cotton per acre
Toxaphene emulsion spray, 6-row tractor rig	1.33	18	1,434
Toxaphene emulsion spray, 1-row hand sprayer	1.33	18	1,473
Toxaphene, 20% dust 6-row tractor rig	2.00	15	1,262
Smoke treatment, daytime application	([2])	24	1,007
Smoke treatment, daytime application	([2])	24	974
Untreated adjoining field	0	41	718
L. S. D. .05	---	--	309

[1] Seven applications all treatments.
[2] Estimated rate: Smoke from one gallon on 10 to 15 acres.

Cucumber Variety Test, Edisto Station, 1951

(D. W. Newsom)

The yield, percent No. 1's, and relative earliness of nine new and old varieties of cucumbers tested at the Edisto Station in 1951 are shown in table 65. Of the nine varieties tested, SC 10-3 showed most promise for the Blackville area. It was exceeded in yield only by Marketer which is too late for the spring crop in this area. SC 10-3 produced 26.1 percent of its total marketable yield before June 13 as compared to 2.5 percent for Marketer. It also ranked second in the percentage of No. 1 cucumbers produced.

Table 65.—Cucumber Variety Test, Edisto Station, 1951

Variety	Yield in bushels per acre			
	Total marketable	No. 1's	Percent No. 1's	Percent of total marketable picked before June 13
Marketer	282.32	207.30	72.0	2.5
SC 10-3	261.25	197.50	73.9	26.1
SC 10-1	229.19	183.80	77.4	20.5
Palmetto	228.70	160.50	67.6	15.4
Santee-5	228.70	143.00	61.4	19.2
Santee Regular	227.76	161.28	67.2	18.5
A & C	193.75	124.80	62.1	12.5
SC 11	186.96	127.40	66.5	24.2
Cubit	185.81	114.10	56.5	22.4
L.S.D. at 5 percent point				37.96

Watermelon Variety Test

(D. W. Newsom)

Of 10 varieties and strains of watermelons tested in 1951 at the Edisto Station, 48-12 was of particular interest. This melon was developed by C. F. Andrus at the Charleston Breeding Laboratory and seed have been distributed to seed companies for release. Seed should be available to growers for the 1953 season.

48-12 is a Garrison-type melon, but has a deeper base color than Garrison. It is of excellent quality and is considerably earlier than Garrison. The fruit are comparable in size to Garrison and the rind is somewhat tougher.

The New Hampshire midget variety, an icebox-type melon was also in the trials this year. It is a very early small melon, and the fruit ranges in size from 2 to 5 pounds. It has good quality and may be of interest to home gardeners.

Sweet Potato Yield Test

(M. B. Hughes)

In 1951 a replicated yield test was conducted for the purpose of comparing the standard Unit 1 Porto Rico sweet potato with seven new types. Four of these new sweet potatoes have already been introduced as varieties; the other three are still under test. The test consisted of four replications, two 25-foot rows per replication, with plants spaced one foot apart in the row. Sprouts were set on May 29 and harvested November 9. Results of the test are shown in table 66.

Table 66.—The Yield in Bushels Per Acre of Eight Sweet Potato Varieties, Edisto Station, 1951

Variety name or number	Yields in bushels per acre		
	No. 1	No. 2	Total marketable
Heartogold (Louisiana Experiment Station)	126	166	292
Georgia Bunch (Georgia Experiment Station)	81	154	235
B 5941 (U. S. Dept. of Agriculture)	100	129	229
Goldrush (Louisiana Experiment Station)	84	140	224
L 240 (Louisiana Experiment Station)	94	109	203
Allgold (Oklahoma Experiment Station)	71	131	202
B 5999 (U. S. Dept. of Agriculture)	116	71	187
Unit 1 Porto Rico[1]	61	99	160

[1] Despite the long growing season, the extremely late planting date for sprouts as well as the extremely severe drought appeared to handicap the Porto Rico variety more than most of the others. The fact that this variety is a very heavy vine grower and was prevented by adverse conditions from producing its usual luxuriant vine growth probably accounts for its relatively low yield.

Heartogold is a light-skinned variety, which cans well. It is grown in North Louisiana for home use, but is not commercially acceptable because of the light-skin color.

Georgia Bunch was a selection from Porto Rico made by a Georgia farmer, and it is similar to Unit 1 Porto Rico except for short vines. All sources of it thus far examined have been rather heavily infected with the internal cork disease. Buyers of seed are cautioned to examine the roots for this disease before purchasing.

B 5941 is a very promising copper-skinned variety, but is highly susceptible to stem rot (Fusarium wilt).

Goldrush is a semi-bunch type which is highly resistant to stem rot or wilt. It is rather susceptible to internal cork, however, and is recommended only for use in fields suspected of harboring the wilt organism.

L 240 is a copper-skinned type which is said to be exceptionally early in Louisiana, but has not appeared to be early in South Carolina.

Allgold is an excellent canning type, lighter in skin color than Porto Rico and often ill-shaped under Carolina conditions. It is quite susceptible to nematode damage.

B 5999 is a red-skinned variety which is of excellent table quality but quite susceptible to stem rot.

In general, none of the above varieties has been tested for a sufficient period to justify its being recommended. It would be advisable for the producer to continue to grow the Unit 1 Porto Rico until more conclusive tests on the new varieties have been completed. The practice of purchasing seed of new varieties at fancy prices on the basis of extravagant claims in newspapers and magazines is not warranted on the basis of information available at present.

High Storage Temperatures Increase Severity of Internal Cork in Sweet Potatoes[1]

(Robert Aycock and M. B. Hughes)

Results of sweet potato storage tests conducted in 1950-1951 showed that temperature has an important bearing on the development of internal cork symptoms.

Three half-bushel samples of cured Porto Rico roots were stored for approximately 5 months at each of the following temperatures: 50, 55, 60, 70, and 85° F. After this period the roots were sliced and examined for internal cork lesions. No differences in the severity of symptoms were noted at the lower temperatures (table 67) but a progressive increase in symptom expression was noted at 70° and 85° F. Moreover, many of the roots stored at 50°, 55°, and 60° F. contained small lesions only, which were not particularly objectionable, while most of those stored at the higher temperatures were rendered inedible by the development of large corky areas having a diameter of 1 inch or more.

These results indicate that growers may expect the disease to be much more severe in mild winters. Under these conditions some degree of control can be obtained by paying particular attention to storage-house ventilation. In larger houses, the installation of fans may prove profitable. It will still be necessary, however, to use seed stocks having a low level of internal cork, since considerable corky spotting may develop in infected Porto Rico roots prior to harvest.

Table 67.—The Incidence and Severity of Internal Cork in Porto Rico Sweet Potatoes Stored for Five Months at Various Temperatures, Edisto Station, 1951

Temperature (Degrees F.)	Total roots examined	Percent corky roots	Mean slice rating[1]
At harvest	196	43.9	--
50	185	43.3	.06
55	183	45.8	.07
60	189	47.9	.10
70	188	87.1	.87
85	195	88.7	1.42
LSD (.05)	---	---	.14
LSD (.01)	---	---	.19

[1] Mean slice ratings obtained at harvest were not included in the statistical analysis.

---

[1] These studies were conducted in cooperation with Drs. J. S. Cooley and Wilson Smith of the Division of Handling, Transportation and Storage, U. S. Department of Agriculture, Beltsville, Maryland.

Watermelons Resistant to Fusarium Wilt

(Robert Aycock)

In 1951 a number of watermelon breeding lines and varieties were tested for their resistance to Fusarium wilt. Seed of each variety were planted in a four-replicate, randomized block experiment on land which had been cropped continuously to watermelons for 3 years. The soil was heavily and uniformly infested with the wilt fungus. Each plot consisted of two rows, 50 feet long with five hills per row. The usual cultural practices were followed and all hills were thinned to one plant.

In table 68 are shown some of the yield and disease data obtained. Two lines, 48-12 and 48-13, showed a high degree of wilt-resistance which was reflected both by the number of surviving plants and the yield of melons. Black Diamond, which is widely grown commercially, yielded no marketable fruit and Garrison produced none which weighed 30 pounds or more.

The two lines, W319 and W290, performed well, but neither they nor the wilt-resistant variety, Blacklee, exhibited the resistance shown by 48-12 and 48-13.

In taste preference tests melons of 48-12 consistently ranked very high, while those of 48-13 were found to be low in quality.

Table 68.—Performance of Certain Watermelon Varieties and Breeding Lines on Land Heavily Infested with the Fusarium Wilt Fungus, Edisto Station, 1951

Variety or line	Mean number plants per acre surviving at harvest	Yield per acre		Average weight of melons 15 pounds and over
		No. melons 15 pounds and over	No. melons 30 pounds and over	
48-12[1]	392	403	163	27.8
48-13[1]	381	381	152	27.8
W319[1]	283	316	87	24.8
W290[1]	305	250	76	25.4
Blacklee	250	109	11	23.6
48-11g[1]	130	54	22	29.8
Congo	98	120	33	26.6
Garrison	98	54	0	25.6
Black Diamond	22	0	0	---
LSD (.05)	72	114	84	---
LSD (.01)	98	155	115	---

[1] Lines developed by Dr. C. F. Andrus, U. S. Regional Vegetable Breeding Laboratory, Charleston, S. C.

PUBLICATIONS

(S. C. Stribling)

The demand for publications of the South Carolina Experiment Station continues strong and comes from a wide range of inquirers, many of whom are interested in the practical application of the technical results of research work. Station publications distributed during the fiscal year totalled about 40,000.

Distribution of publications is effected through (a) classified mailing list which contains 12 subject matter classifications with a total of about 6,000 addresses, (b) county farm agents and other agricultural leaders, (c) individual requests from South Carolina, other states in this country, and from a number of foreign countries.

Bulletins, Circulars, and Reports

During the fiscal year 14 publications were issued as follows:

Bulletin 388, *Cotton Buying Procedures and Practices of South Carolina Cotton Mills.* J. Ritchie Smith and W. T. Ferrier.

Bulletin 389, *Inspection and Analysis of Commercial Fertilizers.* B. D. Cloaninger.

Bulletin 390, *Nematode Root Rot of Tobacco and Other Plants.* T. W. Graham.

Bulletin 391, *Cobalt Content of Pasture Plants and Feeding Materials.* J. H. Mitchell.

Bulletin 392, *Commercial Chick Hatcheries in South Carolina—Egg Supply, Prices, and Practices.* Gale H. Lyon.

Bulletin 393, *The Commercial Peach Industry in South Carolina.* T. L. Senn and J. Sam Taylor.

Bulletin 394, *The Supply and Utilization of Milk in the Three Principal South Carolina Milk Markets—Charleston, Columbia, and Greenville.* James F. Miles.

Bulletin 395, *Milk Prices and Pricing Practices in the Charleston, Columbia, and Greenville Markets.* James F. Miles.

Bulletin 396, *Marketing South Carolina Watermelons.* W. T. Ferrier

Circular 78, *Producing Better Corn Meal and Grits in South Carolina.* E. J. Lease, M. D. Farrar, and L. W. Johnson.

Circular 79, *South Carolina Livestock, Dairy, and Poultry Statistics.*

Circular 80, *Chemical Weed Control in Corn and Cotton by Pre-Emergence and Post-Emergence Applications of Herbicides.* W. B. Albert.

Miscellaneous Circular, *Cotton Insect Calendar for South Carolina.* J. G. Watts.

Sixty-Second Annual Report of the South Carolina Experiment Station for the year ended June 30, 1949.

Technical Contributions

During the year seven technical contributions have been published in scientific journals by members of the station staff, as follows:

No. 171, "Some Factors Related to the Expression of Resistance of Cucumbers to Downy Mildew." W. C. Barnes and W. M. Epps. *Proceedings of the American Society for Horticulture Science,* 56: 377-380, December 1950.

No. 175, "Effect of Sulfamerazine on Pullorum Reactors." J. B. Cooper, C. L. Morgan, G. W. Anderson, and J. C. Jones. *Poultry Science,* XXV (2): 249-254, March 1951.

No. 178, "Insecticides in Fertilizer." M. D. Farrar. *Official Publication No. 4, Association of American Fertilizer Control Officials,* pages 58-64, November 1950.

No. 179, "Soil Insect Control in Southeast by Mixtures of Pesticides and Fertilizers." J. G. Watts. *Agricultural Chemicals,* VI (4): 36-38, 115-116, April 1951.

No. 180, "Several Types of Sterility in *Capsicium Frutescens.*" J. A. Martin and J. H. Crawford. *Proceedings of the American Society for Horticultural Science,* 57: 335-338, June 1951.

No. 181, "Control of the Pecan Nut Casebearer with Organic Insecticides." J. H. Cochran. *Proceedings of the 44th Annual Convention Southeastern Pecan Growers Association,* pages 72-73, February 1951.

No. 187, "The Future for the Corn Meal Industry in the Southeast." E. J. Lease. *American Miller and Processor,* pages 72, 116, January 1951.

Additional Contributions

Additional unnumbered contributions made by staff members and published during the fiscal year:

"Machinery for Utilizing Crop Residues for Mulches." G. B. Nutt. *Agricultural Engineering,* 31(8):391-392, August 1950.

"Mechanization of Southeast Agriculture." G. B. Nutt. *Agricultural Engineering,* 31(9):443-444, September 1950.

"Pre-Emergence Treatments of Corn and Cotton in South Carolina." W. B. Albert. *Proceedings Southern Weed Conference.* 4: 79-84, February 1951.

"The Southern Farm Family in an Era of Change—Economic Aspects." G. H. Aull. *Southern Economic Journal,* XVII(1):44-49, July 1950.

"Economic Prospects of the South." G. H. Aull. *Journal of Farm Economics,* XXXII(4):709-720, November 1950.

"The Inhibition of Cholinestrose in the American Roach by Organic Insecticides and Related Phosphorus-Containing Compounds." W. F. Chamberlain and W. M. Hoskins. *Journal of Economic Entomology,* 44(2):177-191, April 1951.

"Review of Pasture Programs in the South." J. P. LaMaster. *Proceedings of Association of Southern Agricultural Workers,* 48:90-91, February 1951.

"The Storage of Egg Yolk-Sodium Citrate Semen Diluter." V. Hurst. *Journal Dairy Science,* 34:490, June 1951.

"Nutritive Value of Cottonseed Meals for Dairy Cattle." W. A. King and D. B. Roderick. *Journal Dairy Science,* 34:509, June 1951.

"Horns Are Out of Style." J. P. LaMaster. *Progressive Farmer,* 66:44, May 1951.

"Sesame Research." J. A. Martin. *The Cotton Gin and Oil Mill Press,* 52(2):6-9,42, January 20, 1951.

"Aromatic Tobacco—Healthy New Immigrant." J. A. Martin. *Crops and Soils,* 3(5):12-15, February 1951.

"Sesame! Ancient Crop May Be Door to New Southland Wealth." J. A. Martin. *Southern Seedsman,* 13(10):14-15, 54, October 1950.

"Nutgrass Can Be Killed with Chloropicrin." J. A. Martin. *Southern Seedsman,* 14(4):28-29, 58, April 1951.

"If the Crop's Disappointing, Don't Blame the Seed." W. C. Barnes. *Southern Seedsman,* 14(4):25, 60, April 1951.

"For an Early Spring Crop Santee Yields 2-3 Times More." W. C. Barnes. *Southern Seedsman,* 14(1): 28-29, 59, January 1951.

"Pointed End Cucumbers Get Nod from Clemson College Station." W. C. Barnes. *Market Growers Journal,* 80(4) 28, April 1951.

"Investigations on a Mosaic of Cantaloupe in South Carolina." Robert Aycock. *Phytopathology,* 41: 2, 1951.

"Notes on the Incidence of the Diseases of Cotton in South Carolina in 1950. Robert Aycock and C. H. Arndt. *Plant Disease Reporter,* 35: 204-206, 1951.

Publicity Work

(S. C. Stribling)

During the year 40 news letters were sent to the regular news letter mailing list which includes daily and weekly newspapers of the state, Extension Service, Experiment Station, and other agricultural agency workers, agricultural magazines, and others who have requested that they receive these letters. The letters contained information and instructional material from research workers, announcements of new publications and information regarding their contents, and other appropriate material. In addition, many of the news letters prepared by extension workers presented facts and ideas based on research work of the station with proper credit shown.

Additional information on station activities was given in live radio programs and transcriptions sent radio stations of the state in cooperation with the Extension Service. Also from time to time extension information specialists and county workers in their weekly news columns called attention to research projects and results.