Sixtieth Annual Report

Of The

South Carolina Experiment Station

Of

Clemson Agricultural College

H. P. COOPER, Director

FOR THE YEAR ENDED JUNE 30, 1947

Clemson, S. C. September, 1948

Sixtieth Annual Report

Of The

South Carolina Experiment Station

Of

Clemson Agricultural College

H. P. COOPER, Director

FOR THE YEAR ENDED JUNE 30, 1947

Clemson, S. C. September, 1948

AGRICULTURAL EXPERIMENT STATION STAFF

BOARD OF CONTROL

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

R. F. Poole, Ph.D.—President
R. A. McGinty, M.A.—Vice-Director
H. P. Cooper, Ph.D.—Director

AGRICULTURAL ECONOMICS

G. H. Aull, Ph.D—Agricultural Economist
W. T. Ferrier, Ph.D.—Agri. Economist
J. M. Stepp, Ph.D.—Agri. Economist
W. E. A. Husmann, Ph.D.—Agri. Economist
J. F. Miles, M.S.—Assoc. Agri. Economist
W. H. Peterson, Ph.D.—Agri, Economist
L. D. Malphrus, M.S.—Asst. Agri. Economist
D. E. Crawford, B.S.—Asst. Agri. Economist
V. A. Boyd, M.S.—Asst. Rural Sociologist
C. P. Butler,* M.S.—Agricultural Economist

AGRONOMY

H. P. Cooper, Ph.D.—Agronomist
W. R. Paden, Ph.D.—Agronomist
C. E. Hutton, Ph.D.—Assoc. Agronomist
N. R. Page, M.S.—Associate Agronomist
E. B. Eskew, B.S.—Assistant Agronomist
T. C. Peele,* Ph.D.—Soil Technologist
O. W. Beale,* M.S.—Soil Scientist
E. H. Stewart,* M. S.—Asst. Soil Scientist

AGRICULTURAL ENGINEERING

G. B. Nutt, M.S.—Agri. Engineer
G. H. Dunkleberg, M.S.—Assoc. Agri. Engineer
J. S. Evans, B.S.—Asst. Agri. Engineer
L. A. McInnis, B.S.—Asst. Agri. Engineer
J. K. Park,* M.S.—Agricultural Engineer

ANIMAL HUSBANDRY

L. V. Starkey, M.S.—Animal Husbandman
E. G. Godbey, B.S.—Assoc. Animal Husbandman
G. W. Anderson, D.V.M.,M.S.—Associate Animal Pathologist
J. C. Jones, B.S.—Asst. in Animal Pathology

BOTANY AND BACTERIOLOGY

G. M. Armstrong, Ph.D.—Botanist and Plant Pathologist
C. H. Arndt, Ph.D.—Assoc. Botanist and Plant Pathologist
W. B. Albert, Ph.D.—Assoc. Plant Physiologist
H. H. Foster, Ph.D.—Assoc. Plant Pathologist
N. B. Goebel, M.S.—Assoc. Forester
C. C. Bennett, B.S.—Asst. Botanist

CHEMISTRY

J. H. Mitchell, M.S.—Chemist
E. J. Lease, Ph.D.—Nutritionist
D. B. Roderick, B.A.—Assistant Chemist
H. M. Smith, B.S.—Asst. Chemist

DAIRY

J. P. LaMaster, M.S.—Dairyman
Victor Hurst, Ph.D.—Assoc. in Dairying
G. W. Brandt, M.S.—Assoc. Dairy Husbandman
G. M. Barnett, B.S.—Assoc. Dairyman
C. C. Brannon, B.S.—Assoc. Dairyman
W. T. O'Dell, B.S.—Asst. in Dairying
J. F. Causey, B.S.—Asst. in Dairying

ENTOMOLOGY

J. A. Berly, B.S.—Acting Entomologist
J. H. Cochran, Ph.D.—Assoc. Entomologist
David Dunavan, M.S.—Associate Entomologist
W. H. Purser, M.S.—Asst. Bee Specialist

HOME ECONOMICS

Ada M. Moser, M.S.—Home Economist
Elizabeth S. Watson, M.A.—Asst. Home Economist
Florence E. Roach, B.A.—Asst. in Home Economics

HORTICULTURE

A M. Musser, B.S.—Horticultrist
O. B. Garrison, Ph.D.—Horticulturist
H. J. Sefick, M.S.—Assoc. Horticulturist
L. O. Van Blaricom, M.S.—Assoc. in Hort. Manufactures
J. A. Martin, B.S.—Assoc. Horticulturist
R. J. Higdon, B.S.—Asst. Horticulturist
J. T. Bregger,* M.S.—Senior Soil Conservationist

FARMS

C. S. Patrick, B.S.—Head, Farms Dept.

POULTRY

C. L. Morgan, M.S.—Poultryman
J. B. Cooper, M.S.—Assoc. Poultry Husbandman
M. A. Boone, M.S.—Asst. Poultry Husbandman

PUBLICATIONS

S. C. Stribling, B.S.—Agricultural Editor
H. M. Simons, Jr., B.S.—Asst. Agri. Editor
Doris A. Timmerman, B.A.—Asst. Editor

VETERINARY

R. O. Feeley, D.V.S.—Veterinarian

COAST STATION, Summerville, S. C.

E. D. Kyzer, B.S.—Superintendent
T. M. Clyburn, B.S.—Assoc. Animal Husbandman

PEE DEE STATION, Florence, S. C.

E. E. Hall, M.S.—Superintendent
Alfred Manwiller, Ph.D.—Assoc. Plant Breeder
W. A. Mappus, M.S.—Assoc. Agronomist
J. F. Chaplin, B.S.—Asst. Agronomist
F. M. Harrell—Research Assistant
F. F. Bondy,* B.S.—Entomologist
L. C. Fife,* M.S.—Entomologist
Norman Allen,* M.S.—Entomologist
R. L. Walker,* B.S.—Asst. Entomologist
W. H. Jenkins,* B.S.—Agronomist
J. F. Bullock,* M.S.—Agronomist
D. C. Harrell,* B.S.—Assoc. Agronomist
Z. T. Ford,* B.S.—Agent
T. W. Graham,* Ph.D.—Agent
A. R. McPherson, B.S.—Agent
W. H. Rolfe,* B.S.—Agent
W. E. Vaught,* B.S.—Agent
W. D. Yeargin,* B.S.—Agent

SANDHILL STATION, R. 5, Columbia, S. C.

J. A. Riley, M.S.—Superintendent
W. A. Balk,* B.S.—Agent

TRUCK STATION

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

W. C. Barnes, Ph.D.—Superintendent
W. M. Epps, Ph.D—Superintendent
W. J. Reid, Jr.,* B.S.—Entomologist

EDISTO STATION, Blackville, S. C.

W. B. Rogers, B.S.—Superintendent
J. G. Watts, M.S.—Assoc. Entomologist
Morris B. Hughes, Ph.D.—Assoc. Horticulturist
J. H. Horton,** B.S.—Asst. Agronomist
J. J. Wolfe, B.S.—Asst. Agronomist
M. R. Powers, B.S.—Assoc. Agri. Engineer
J. D. McCown*—Agent
V. K. Quattlebaum, B.S.—Asst. Agri. Engineer

CROP PEST COMMISSION AND SEED CERTIFICATION

G. M. Armstrong, Ph.D.—State Pathologist
J. A. Berly, B.S.—Acting State Entomologist
R. H. Garrison, B.S.—Asooc. Plant Breeder, in charge Seed Certification
G. M. Anderson, B.S.—Asst. State Pathologist

FERTILIZER INSPECTION AND ANALYSIS

B. D. Cloaninger, B.S.—Head of Department
H. J. Webb, Ph.D.—Chief Chemist & Toxicologist
J. T. Foy, B.S.—Chemist
Maurice M. Phillippe,** M.S.—Asst. Chemist
E. E. Leslie, B.S.—Asst. Chemist

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

Letters of Transmittal

Clemson, S. C.
November 1, 1948

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

I have the honor to submit herewith the Sixtieth Annual Report of the South Carolina Experiment Station for the fiscal year ended June 30, 1947.

Yours very truly,
H. P. COOPER, *Director*
S. C. Experiment Station

Clemson, S. C.
November 1, 1948

HON. W. W. BRADLEY, *President, Board of Trustees,*
The Clemson Agricultural College,
Dear Sir:

I beg leave to submit herewith the Sixtieth Annual Report of the South Carolina Experiment Station.

Yours very truly,
R. F. POOLE, *President*
The Clemson Agricultural College

Clemson, S. C.
November 1, 1948

HON. J. STROM THURMOND,
Governor of South Carolina,
Sir:

I have the honor to submit herewith the Sixtieth 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,
W. W. BRADLEY,
President, Board of Trustees
The Clemson Agricultural College

TABLE OF CONTENTS

Table of Contents (Continued)

Table of Contents (Continued)

The

Sixtieth Annual Report

of the

SOUTH CAROLINA EXPERIMENT STATION

INTRODUCTION

The recent increases in the resources for agricultural research have resulted in a marked expansion of the work of the agricultural experiment stations. Special emphasis is being placed upon cooperative research projects. All research agencies are focusing their activities on problems which have been given a high priority in the list of subjects to be investigated. Many of the subjects under investigation are of regional interest while others are national in scope.

During the war period one of the principal problems was total production, as there was a demand for practically all agricultural products at profitable prices. It now seems that the period of food shortages is passing and that it will be desirable in the near future to improve the quality of food products. The change from a seller's to a buyer's market will stimulate more interest in grading, processing, packaging, transportation, and marketing of farm products. Many marketing problems are under investigation, which should contribute to significant improvements in marketing facilities.

One of the problems of primary interest at this time is a more effective soil conservation and utilization program. The relation of soil fertility to quantity and quality of plant products produced and to the nutrition of animals and man is of interest to all people. The relation of the quantity and quality of food to the nutritional, health and efficiency status of groups with different dietary patterns is also in need of further investigation. Apparently the dietary habits of people have a very significant effect upon their general health and efficiency.

There is great need for the breeders to develop new varieties or strains of plants better adapted to our climatic and soil conditions and improved animals capable of efficiently utilizing the staple food crops best adapted to the region. It is probable that there will be special interest in improving feeding and management practices for animals which utilize relatively large quantities of grain feed.

The recently improved practices now followed in the production of forage and other feed crops can be an important factor in expand-

ing livestock enterprises requiring good pastures and other high quality forage products. The increase in the use of lime under the soil conservation program has greatly expanded the production of high quality forage crops. Recent investigations on the high nitrogen fertilization of corn have produced very striking increases in corn yields. The extensive use of a high nitrogen fertilizer for corn and other feed crops could do much to provide a cheaper source of animal feed which could result in a significant increase in our livestock enterprises.

The possibility of surpluses in a number of staple food products suggests the desirability of making a comprehensive study of the economic status of the different farm products and the development of long-time agricultural programs which will be of the greatest interest to both the producer and consumer.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

There is a familiar adage to the effect that "hindsight is better than foresight." Farmers generally illustrate its meaning by reference to such contrasting periods as that from 1919 to 1921, or from 1929 to 1932. As applied to the current economic situation, it is to be hoped that foresight during 1949 may prove superior to that during 1919 and 1929, in which case it should at least approach in merit the hindsight of 1952.

There is ample evidence to suggest that farmers are practicing today a high level of economic activity but some of the signs are not as encouraging as they could be. For example, although farmers reduced their mortgage indebtedness during World War II (whereas they increased it during World War I) recent figures indicate that this trend has been halted and that long term farm indebtedness is once again on the increase. If this trend continues and if 1951 should prove to be a year of low prices, farmers may again experience a painful reminder of the fact that "hindsight is better than foresight." While the current outlook is quite favorable and long term national prosperity is within the realm of possibility, farmers would do well, insofar as they can, to avoid long term indebtedness and to invest any surplus funds in government bonds or other solid securities pending a decrease in present high prices.

This department continues to conduct research into the various economic and social problems affecting the lives of rural people in South Carolina. Currently a number of projects are active, representing research in marketing, land utilization, mechanization of farms, custom use of farm equipment and facilities, potentialities of demand and supply in local areas, price spreads and price determinants.

Completed Studies

At the time this report is written this department is preparing manuscripts covering four completed studies which will be published as bulletins. These studies relate to farm power utilization and cost, land use and soil conservation, economic aspects of rural industrialization, and farm land ownership and use. The bulletins when printed will be available to those interested.

Supply and Demand for Feed Grains

(L. D. Malphrus)

This study is being made in cooperation with the Extension Service and interested farmers, business men and manufacturers in Anderson and adjacent counties. Production figures are being obtained directly from farmers and checked against data from the Census for earlier years. Price data are obtained from farmers, grain buyers, and feed manufacturers, and will be compared with historical

Table 1.—Estimated Consumption of Corn, Wheat, Oats and Barley in Anderson County by Class of Consumers, 1945

Class	Number*	Estimated per capita grain consumption	Estimated consumption of specified grains			
			Corn	Wheat	Oats	Barley
		Pounds	Bushels	Bushels	Bushels	Bushels
All mules and mule colts	7,513	1,500	68,422	----	232,434	----
All horses, colts and ponies	799	1,500	7,276	----	24,718	----
Cows milked	8,599	1,000	38,388	----	134,359	44,786
Cows and heifers two years old and over not milked	1,899	200	2,306	----	7,833	----
All cattle except cows and heifers two years old	8,272	300	14,624	----	26,367	17,061
Cattle and calves sold alive	2,984	350	8,392	----	16,319	1,088
Cattle and calves butchered on farm	536	250	814	----	2,764	----
All hogs and pigs except sows and gilts	10,443	300	49,231	----	6,266	----
Sows and gilts for spring farrow	590	1,400	8,408	1,377	8,518	----
Hogs and pigs sold alive	3,982	250	13,332	2,489	3,111	----
Hogs and pigs butchered on farm	10,533	700	105,520	12,288	23,041	----
Chickens on hand	204,436	55	100,393	37,480	87,822	11,712
Chickens raised including broilers and fryers	521,455	15	89,392	7,822	73,330	----
Turkeys raised	3,872	55	1,866	710	1,996	----
Total, livestock	----	----	508,374	62,166	648,876	74,647
Human population	77,000**	160	72,600	133,467	7,700	----
Seed	----	----	7,423	36,852	85,146	7,658
Grand total	----	----	588,397	232,485	741,724	82,305
Production*	----	----	600,154	359,271	953,151	100,002
Surplus, or production over consumption	----	----	11,757	126,786	211,427	17,697

* 1945 Census of Agriculture.

** This estimate is derived from **Estimated Civilian Population, 1943,** by the Bureau of Census, Dept. of Commerce.

price data published by the Bureau of Agricultural Economics of the U. S. Department of Agriculture. Per capita consumption figures for livestock were derived from data on feeding recommendations and practices. These data were adjusted to local conditions and applied to the numbers of the different classes of livestock after consultation with Experiment Station and Extension Service specialists and committees of farmers working in cooperation with the county agent. These farmer committees also reviewed and approved the resulting figures as being the best estimates of total livestock requirements in the area. Nutritionists assisted in working out the estimated amounts of grain required for human consumption in the county.

Assuming that all grain and grain by-products consumed as food and feed come from corn, wheat, oats and barley, the accompanying table shows the number of bushels of each required to provide food and feed for the given number of people and livestock. Using the number of consumers and the estimated consumption, the table shows that Anderson County produces a surplus of corn, wheat, oats and barley. Nevertheless, large quantities of feed are known to be imported annually. The county might well consider whether it is sound economic policy to continue to export whole grains and import feeds.

Along with price information, a record is being obtained of seasonal sales of grain by farmers in Anderson County. Data from

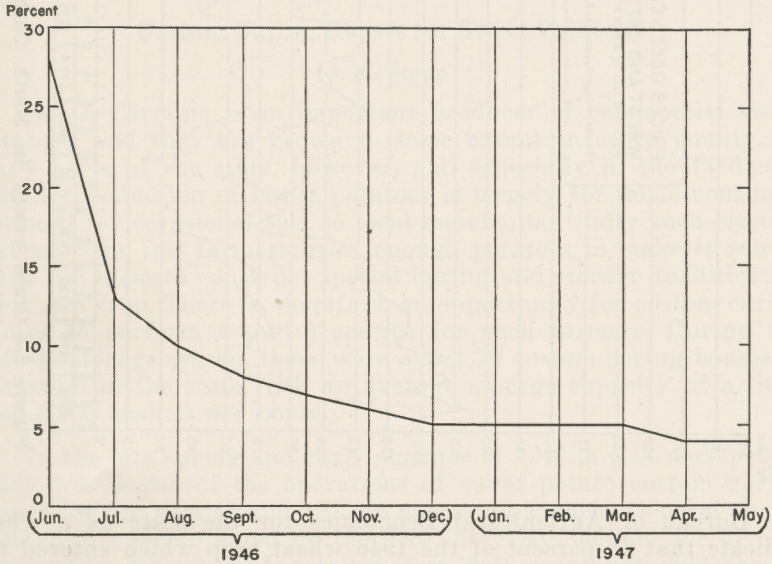

Figure 1.—Wheat: Monthly sales by farmers as a percentage of total wheat sales South Carolina, 1946-47.

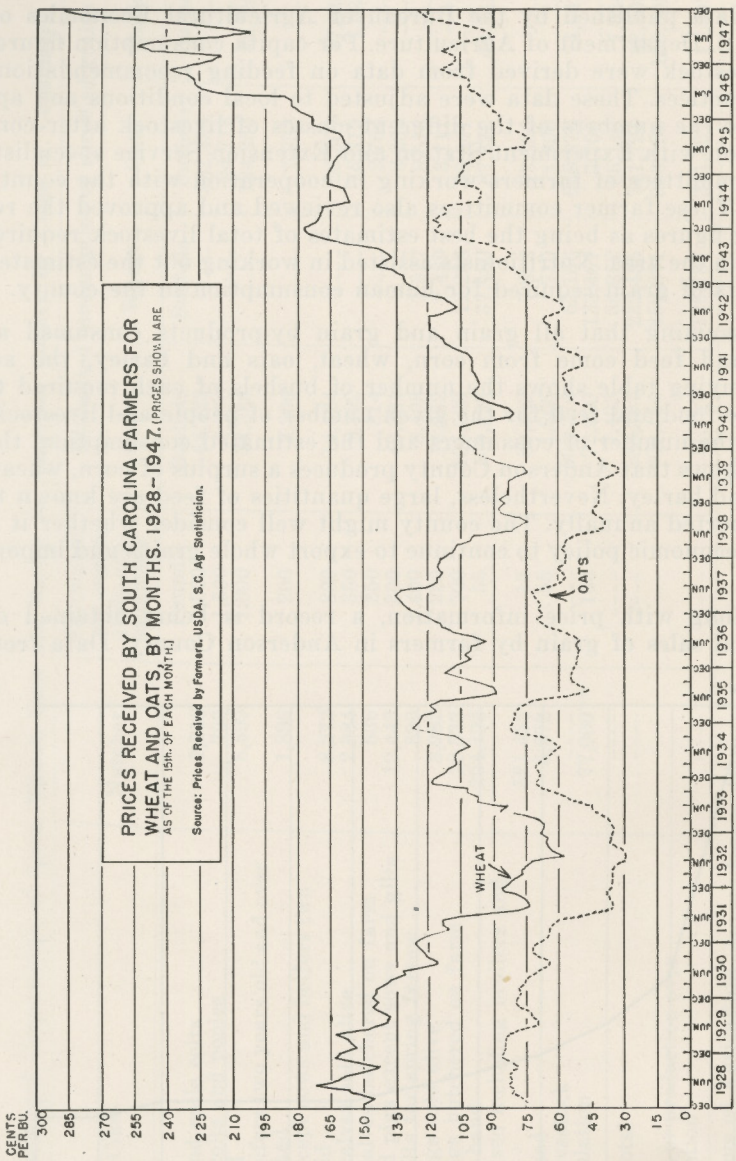

Figure 2.—Grain prices in South Carolina are generally lowest during or soon after harvest season.

the Bureau of Agricultural Economics for the state as a whole indicate that 28 percent of the 1946 wheat crop which entered the market was sold during June, and 41 percent during June and July. During that year, two-thirds of the South Carolina crop not kept for

farm and home use was sold within four months after harvest. The marketing season for oats and barley is closely related to that for wheat.

Figures reported by the agricultural statistician for South Carolina have been used to chart monthly price changes in selected grains over a period of years. While these data are for the state as a whole, the general relationships are believed to be about the same for all areas. One interesting thing about the figures is that they show corn prices during any one year of the 20 year period, 1928-1947, were lowest 12 times in January, 7 times in December and once in October. Likewise, the annual peak price for corn occurred 5 times in August and 4 times in September. Other peak prices occurred in other months throughout the year.

High and low prices for wheat and oats occur somewhat more erratically than in the case of corn. However, during the 20 years, 1928-1947, wheat prices on a calendar year basis reached their peak six times in January, and four times in November, and six times in December. Low prices occurred 8 times in July, 4 times in August, and 3 times in June.

Highest monthly prices for oats occurred generally during the months of November, December and January, while as a rule the lowest prices during any one year were obtained during July and August. There were, of course, exceptions.

Custom Curing Houses for Sweet Potatoes

(J. M. Stepp)

South Carolina is an important producer of commercial sweet potatoes, and they are grown to some extent in every county. In many parts of the state, however, and especially in the Piedmont section, production of sweet potatoes is largely for home consumption and for occasional sale to local merchants. Under such circumstances, very few farmers grow enough potatoes to make it worthwhile for them to construct special curing and storage facilities for their own crop. There is, therefore, an opportunity for custom curing houses to perform a useful service for such farmers. During the 1945-46 storage season, there were about 75 custom curing houses in operation in the state with an average storage capacity of a little over 5,000 bushels per house.

In the late spring and early summer of 1946, a cost and income study was begun of the operations of sweet potato custom curing houses for the 1944-45 and 1945-46 operating seasons. General operations data were obtained by the field interview method for 61 custom curing houses, and detailed cost data were obtained for 33 houses.

Nearly half of the curing houses studied were built since 1939, and seven-eighths of them were built since 1934. This indicates that the custom curing and storing of sweet potatoes is a relatively new activity, and that it is increasing in importance. Over half of the curing houses studied were publicly owned and were operated in connection with public schools. For both of the years covered by the study, most of the 61 curing houses operated at much less than their full capacities. An average of the records of these houses showed that only 59 percent of them were operated at full capacity in 1944-45, and only 48 percent were fully utilized in 1945-46.

The 33 cost and income records do not indicate that the operation of custom sweet potato curing houses was a profitable activity either in 1944-45 or in 1945-46. The following table shows the return to capital and management "before taxes." Taxes were not included as a cost because two-thirds of the cost records were for publicly-owned curing houses upon which no taxes were paid.

Table 2.—Return to Capital and Management From the Operation of 33 Sweet Potato Custom Curing Houses 1944-45 and 1945-46.

Net return*	1944-45			1945-46		
	Number houses	Net return*		Number houses	Net return*	
		Total	Per house		Total	Per house
$ 0 to $ 99	7	$ 340	$ 48.57	8	$ 315	$ 39.38
$100 to $199	8	1349	168.63	11	1645	167.27
$200 to $299	8	1930	241.25	3	760	253.33
$300 to $399	3	1047	349.00	2	639	319.50
$400 and over	5	3446	689.20	3	1731	577.00
Net loss	2	—127	—63.50	6	—384	—64.00
Total	33	$7985	$241.97	33	$4706	$142.61

* This is net return to capital and management "before taxes." Two-thirds of the 33 curing houses were publicly owned and paid no taxes, and in order to make the records comparable taxes were omitted from the cost calculations for all of the curing houses.

There is no objective method of ascertaining what should be considered a fair rate of compensation for managing a sweet potato curing house. Surely, however, $300.00 per house is a very conservative figure. A return to capital of $100.00 per year also appears to be a very conservative figure. Even these very modest standards were met by less than one-sixth of the curing houses in 1944-45, and by only one-eleventh of them in 1945-46. It appears that the operation of these curing houses was not on a sound economic basis during the two years covered by this study.

AGRICULTURAL ENGINEERING

Mulch Farming

(G. B. Nutt and T. C. Peele)

Experiments conducted at Clemson have shown conclusively that organic residues retained on the surface of the soil during the growth of row crops are much more effective in reducing runoff and erosion than organic matter plowed under before the row crops are planted.

Corn experiments on Cecil sandy loam have included the use of winter and summer cover crops as sources of mulch material. Where crimson clover or a mixture of vetch and rye is used as a winter cover crop, the preparation of the land for corn is started about the first of April and the corn is planted about two weeks to a month later, depending upon weather conditions. By April the cover crops usually have made much growth and must be thoroughly killed before the corn is planted to avoid insect damage to the corn and competition for soil moisture.

Tillage Methods

The three tillage methods used in the tests with row crops were the mulch disk method, the mulch balk method, and the conventional method of plowing and clean cultivation.

1. **Mulch Disk Method.**—The growing winter cover crop or the dead residue from the preceding summer cover crop is disked with a heavily weighted harrow having scalloped disks. This is pulled slowly to avoid covering any more plant material than necessary. With heavy residue on hard, dry, clay soil, the disks can be operated at full angle and moderate speed without incorporating an excessive amount of plant residue into the soil. On sandy soils the harrow should be pulled more slowly and the disks set at about two-thirds of full angle. The object of the disking operation is to loosen the soil to a depth of 2 to 4 inches, cut the residue on the soil surface, and kill any plant growth.

The second operation consists of ripping the soil at 3½ foot intervals using middlebusters with moldboards removed, preceded by rolling coulters and followed by disk hillers set to push the plant litter out of the furrows without pushing any more soil into the areas between the furrows than necessary. The disk hillers are set to run very shallow. The object of this operation is to prepare a loose, clean seedbed with moderately deep furrows for planting corn.

The third operation consists of planting the corn and applying fertilizer in the drill, using standard planting equipment on a two-row tractor planter.

Cultivation of the corn is done with standard tractor cultivating equipment, using small conventional sweeps set to run rather flat.

2. **Mulch Balk Method**.—As the initial operation, planting furrows are prepared with the middlebuster unit, leaving an undisturbed balk about 20 inches wide between the rows. The balk is then plowed with a 24 inch sweep to kill the cover crop and loosen the soil. The corn is planted about 2 weeks later, using a standard two-row tractor planter. Conventional tractor equipment is used for cultivating the corn.

3. **Conventional Clean-tillage Method**.—The crop residue is plowed under with a disk plow and the soil disked thoroughly with a disk harrow. Planting furrows are formed, fertilizer applied, and the crop planted in one operation. Cultivation is done with small sweeps.

Corn Following Winter Cover Crops

Three tillage methods with corn on Cecil sandy loam have been compared during a 5 year period, where the crop was grown each year following vetch and rye or crimson clover. Plots 1/15 acre in size with five replicates of each tillage method where corn followed vetch and rye and three replicates where corn followed crimson clover were devoted to the experiment. Runoff and erosion measurements were made on two plots of each tillage method where corn followed vetch and rye, and on two plots where corn was grown each year with no cover crop.

The effects of the tillage methods on runoff and erosion during the corn growing seasons are shown in Tables 3 and 4. The mulch

Table 3.—Runoff From Corn Plots Where Different Tillage Methods Were Used. Clemson, 1947.

Tillage method	Preceding cover crop	Runoff during corn growing season, percent*					
		1943	1944	1945	1946	1947	Av.
Mulch, balk	vetch & rye	12.42	0.42	1.65	2.51	0.55	4.38
Mulch, disk	vetch & rye	18.97	2.38	1.77	4.74	0.80	7.22
Plowed	vetch & rye	19.71	6.42	9.55	16.08	2.50	12.53
Plowed	none	25.62	15.96	34.65	41.63	10.55	30.48

* The percent runoff is based on the total rainfall during the storms which produced runoff.

Table 4.—Soil Loss From Corn Plots Where Different Tillage Methods Were Used. Clemson, 1947.

Tillage method	Preceding cover crop	Soil loss during corn growing season, lbs./acre					
		1943	1944	1945	1946	1947	Av.
Mulch, balk	vetch & rye	1550	45	112	245	none	390
Mulch, disk	vetch & rye	5484	377	242	337	none	1288
Plowed	vetch & rye	9802	488	357	1266	none	2382
Plowed	none	7915	6006	5777	5100	264	5012

methods were quite effective in reducing runoff and erosion as compared with the conventional method of plowing under the cover crop. The average erosion from the mulch-balk tillage plots was about 1/6 of that on the plots where a cover crop was plowed under, and 1/13 of that where no cover crop preceded the corn.

The corn yield data in Table 5 show that the mulch methods

Table 5.—Effects of Cultural Treatments on Yields of Corn Following Winter Cover Crops.

Tillage method	Preceding cover crop	Yield of corn in bushels per acre					
		1943	1944	1945	1946	1947	Av.
Mulch, balk method	vetch & rye	26	24	65*	71	22	42
Mulch, disk method	vetch & rye	30	22	80	64	21	43
Plowed, clean cultivation	vetch & rye	32	19	76	60	21	42
Mulch, balk method	crimson clover	28	22	64*	61	21	39
Mulch, disk method	crimson clover	33	20	83	57	23	43
Plowed, clean cultivation	crimson clover	36	17	82	59	19	43
Plowed, clean cultivation	none	40	22	62	54	24	36

* Bud worm infestation depleted stands on these plots.

resulted in yields equal to those secured under conventional tillage practices. The higher yields from all treatments in 1945 and 1946 as compared with preceding years were due mainly to increased fertilization and the use of hybrid seed, while the low yields in 1947 resulted from lack of adequate moisture in July and August. The total rainfall for these two months was the lowest recorded at Clemson in the past 55 years. The yield from the mulch balk method in 1945 was reduced by worm injury. The cover crop in the balks was not killed until planting time of that year. In subsequent years, the cover crop was killed at least two weeks before the corn was planted and no worm damage occurred.

Corn Following Summer Cover Crops

Summer cover crops, such as Kobe lespedeza and Crotalaria spectabilis, provide a good source of mulch for row crops the following year. Kobe lespedeza is planted in oats and matures after the oats are combined. Crotalaria is usually broadcast in corn at the last cultivation the first year and will reseed itself thereafter where corn is grown each year on the same land. These crops provide a source of dead residue in the spring that presents fewer tillage problems than living cover crops such as vetch and rye. The soil remains loose and mellow under the dead residues, while it tends to become dry and hard very quickly under growing cover crops. Where such crops are growing there is frequently a period of less than three days during which Cecil soil is in a suitable condition for plowing after a heavy rain.

Mulch farming methods with corn following Kobe lespedeza and Crotalaria spectabilis in 1945, 1946, and 1947 produced yields equal to but no better than conventional methods as shown by the data in Table 6.

Table 6.—Effects of Tillage Methods on Yields of Corn Following Summer Cover Crops.

Tillage method	Cover crop	No. of replicates	Corn yield in bu. per acre			
			1945	1946	1947	Av.
Mulch*	Crotalaria spectabilis	4	72.2	68.8	27.9	56.3
Plowed, clean cultivation	Crotalaria spectabilis	4	72.3	68.5	26.3	55.7
Mulch*	Kobe lespedeza	2	53.9	54.6	16.5	41.7
Plowed, clean cultivation	Kobe lespedeza	2	54.7	54.6	20.6	43.3

* The mulch balk method was used in 1945 and the mulch disk method in 1946 and 1947.

The tests with corn following crotalaria and Kobe lespedeza were conducted in separate fields, with the crotalaria test located on more fertile soil. For that reason, conclusions regarding the comparative influence of these cover crops on corn yields should not be drawn from the data in Table 6.

New Machinery Developments

One of the principal reasons for low yields of corn on clay soils in the Piedmont is the difficulty of securing adequate stands, whether conventional plowing methods or mulch tillage practices are used. The clay soil forms clods when the soil is being prepared for planting and the clods prevent the soil from settling closely enough around the corn grains to provide good conditions for germination until one or more rains occur. Then the soil forms a crust which may be so compact that the corn shoot cannot penetrate it. Some corn grains may germinate soon after planting and others three weeks to a month later. When this occurs, the later germinating seedlings have litle chance of producing ears due to competition from corn plants which started earlier as well as from grasses and weeds.

Equipment for breaking the clods in the planting furrow has been constructed by adding spike-toothed wheels to the rear of a two-row furrow opener used in preparing planting furrows when the mulch tillage methods are used in growing corn. This attachment is shown in Figure 3.

Several types of wheels for breaking clods have been constructed and will be tested next season.

Figure 3.—Spike-toothed attachment for breaking clods in planting furrows.

Yield of Corn as Influenced by Spacing, Fertilization, Irrigation and Rainfall, Clemson, 1946-47.

(J. B. Richardson and O. W. Beale)

An investigation of the effect of supplemental irrigation on corn yields in the Piedmont was initiated in 1946 and continued in 1947 on approximately two acres of Hiawassee sandy loam soil. Following the corn in 1946, a winter cover crop of vetch and rye was planted, but heavy rainfall in the spring of 1947 delayed the plowing-under of the cover crop until April 22. On April 23, applications of 1000 pounds per acre of 20% cyanamide and 1400 pounds per acre of 4-10-6 fertilizer were broadcast over the plots. An additional 700 pounds per acre of 4-10-6 fertilizer were applied in the drill at the time of planting.

On May 23, the corn was planted 13 inches apart in the drill, and rows were spaced at 42 inch intervals. The study included plots designed to determine the effect of the density of plant population on yields. In these plots the rows were only 21 inches apart, resulting in double the number of plants per acre.

Although rainfall was rather light during May, germination was good and the corn grew rapidly. Cultivation was completed on June 27, at which time 250 pounds of muriate of potash per acre were applied.

A portable irrigation outfit equipped with No. 40 sprinklers, fitted with 1/8" x 3/16" nozzles, was used. The sprinklers were mounted on 12 foot risers spaced at 40 foot intervals along the distribution lines. Each sprinkler delivered approximately 10 gallons of water per minute when operated at 45 pounds pressure. An area of one acre required 18 sprinklers to deliver 0.40 of an inch of water per hour, which is the approximate infiltration rate of Hiawassee sandy loam soil. During each irrigation, 1.0 to 1.5 inches of water per acre were applied. Catchment basins placed within the circle of water thrown by one sprinkler indicated that distribution of the water was not uniform. Soil moisture determinations also showed that the soil was not wetted to the same depth in all parts of the area.

Gypsum electrical resistance blocks were installed at depths of 8, 18, and 24 inches in the soil to determine the moisture changes in the irrigated and non-irrigated sections. The rainfall, amount of irrigation water used, and the soil moisture available during the summer months at the 8 inch depth in the irrigated and non-irrigated sections are shown graphically in Figure 4.

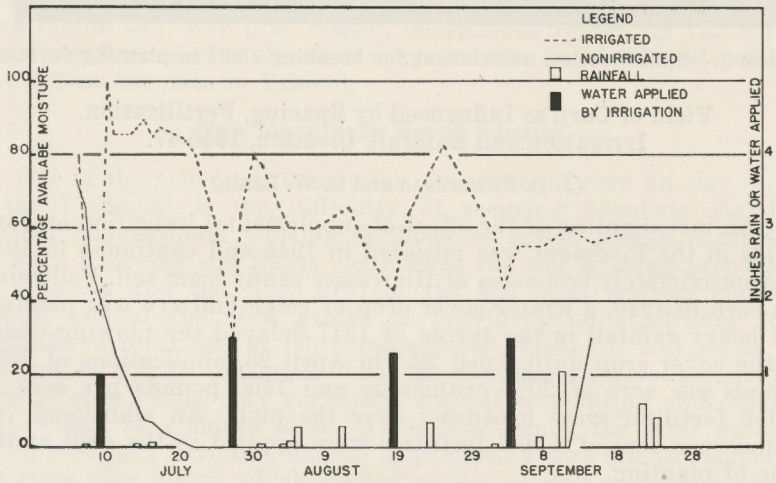

Figure 4.—Irrigation of corn: Available moisture in irrigated and non-irrigated areas at 8" depth.

During the growing season of 1946 only two irrigations were necessary to maintain an adequate supply of water, while during 1947 four applications were needed. The soil moisture of the non-irrigated section was at the wilting percentage on July 21 to a depth of 24 inches, and the leaves of the corn plants were rolled or curled, with considerable yellowing by July 31. There was no available water in the soil of the non-irrigated area at the 24 inch depth until

the rain of September 11, when 30 per cent was recorded at the 8 inch depth.

The rainfall during July was only about 1/16 of normal and about 1/4 of normal during August. This necessitated frequent irrigations to maintain sufficient moisture for normal plant growth. The percentage of lodging in the irrigated corn was high and the yield was lower than expected. The yields were probably affected by the lodging, since much occurred before the ears matured. The yields of corn and silage for 1946 and 1947 are shown in Table 7. In 1947 the yields of corn were increased more than five times, and the silage yields were more than doubled by irrigation. Figure 5 is a striking

Figure 5.—Yields of corn from 1/50 acre plots; irrigated, left, and non-irrigated, right.

comparison of quality and quantity of corn harvested from 1/50 acre plots of irrigated and non-irrigated corn.

Irrigation Requirements of South Carolina Soils

(T. C. Peele)*

When an engineer is called upon to design an irrigation system, one of the first things he needs to know is the quantity of water required for wetting the soil to the desired depth. If the soil will retain only two inches of water in the zone that is to be wetted, it is obviously a waste of the farmers' money to design the system to apply three inches of water. The available water that different soils can hold varies considerably more than this amount, so it is evident that

*Project Supervisor, Soil Conservation Service Research, Clemson, S. C.

Table 7.—Results of Corn Irrigation, Clemson, 1946-1947.

Year	Treatment	No. of Plants per Acre	Water-Soluble Nutrients applied (lbs. per acre)			Inches of Water			Actual Yield	
			N_2	P_2O_5	K_2O	Rainfall	Arti-ficial	Total	Silage (T/acre)	Grain (Bu./acre)
1946	Irrigated	16,594	284	210	126	13.5	3.0	16.5	37	137
		8,297							31	138
	Non-Irrigated	16,594					----	13.5	23	109
		8,297							23	116
1947	Irrigated	21,458	284	210	264	3.5	5.3	8.8	37	83
		10,729							35	110
	Non-irrigated	21,458					----	3.5	16	14
		10,729							16	22

the efficient design of irrigation systems demands some information on the quantity of water that a given soil can retain in a form available for plant use. Such information has been obtained for many of the western soils from areas where irrigation is widely practiced but is practically non-existent on eastern and southern soils.

The available water holding capacity of a soil is the moisture range between the permanent wilting point and the field capacity. The wilting point can be ascertained by growing plants in pots and determining the moisture content of the soil at which permanent wilting occurs or by extracting the water from a soil in a pressure filter apparatus at 15 atmospheres pressure, measuring the percentage of water retained, and converting this value to the wilting point by means of a regression equation. Field capactiy is the moisture content of a well drained soil one or two days after it has been thoroughly wet by rain. It is the point at which the excess water has drained out of the soil. This value can be determined in the laboratory from the moisture equivalent of the soil and a regression equation. Laboratory determinations of wilting point and field capacity permit determination of available water holding capacity on a percentage basis. Irrigation engineers need this information on a volume basis (surface inches or cubic feet per acre). Volume-weight measurements of the soil using undisturbed soil cores are needed for converting the percentage values to a volume basis. The soil samples of all soils on which data are reported in Tables 8 and 9 were collected and their volume-weights determined by F. F. Lesesne and R. L. Carter in connection with the permeability survey in South Carolina.

The available water holding capacity can be used as an index of the drouthiness of soils and serve as a basis for predicting the suitability of a soil for growing different kinds of plants having

Table 8.—Surface Inches of Water Required to Raise the Soil Moisture Content From the Wilting Point to the Field Capacity.

Soil type	Available water holding capacity in terms of surface inches of water.		
	0-12" depth	0-24" depth	0-36" depth
Bladen loam	2.16	4.32	6.48
Weston fine sandy loam	1.32	3.36	5.40
Wando fine sand	0.84	1.68	2.52
Edisto fine sandy loam	0.96	2.16	3.72
Hyde clay loam	2.16	4.20	6.24
Coxville fine sandy loam	1.98	3.99	6.03
Dunbar fine sandy loam	1.61	3.02	4.44
Coxville very fine sandy loam	1.81	3.31	4.74
Norfolk fine sandy loam	1.00	2.31	3.71
Lloyd sandy loam	1.34	2.64	3.84
Cecil sandy loam	1.14	2.44	3.78

Table 9.—Available Water Holding Capacity of Each Horizon of Different Soil Types.

Soil series	Texture (from mech. analysis)	Horizon	Depth inches	Mechanical analysis			Available water holding capacity
				sand %	silt %	clay %	per inch depth inches
Bladen	sandy loam	A	0-9	70.3	23.7	6.0	.180
	clay	B	9-36	34.7	14.4	50.9	.180
Weston	loamy sand	A_1	0-6	88.6	6.0	5.4	.106
	loamy sand	A_2	6-13	88.4	5.9	5.7	.113
	sandy clay loam	B_1	13-19	67.3	5.4	27.3	.170
	sandy clay loam	B_2	19-36	66.6	3.1	30.3	.170
Wando	loamy sand	A_1	0-12	89.8	3.4	6.8	.078
	sand	A_2	12-48	92.0	3.6	4.4	.077
Edisto	sand	A	0-18	90.7	6.1	3.2	.080
	sandy loam	B_1	18-24	79.8	5.5	14.7	.120
	sandy loam	B_2	24-36	70.5	9.8	19.7	.130
Hyde	clay loam	A	0-12	43.6	27.4	29.0	.180
	sandy clay	B	12-36	40.8	18.7	40.5	.170
Coxville	loamy sand	A	0-6	82.7	14.3	3.0	.160
	sandy loam	B_1	6-15	79.3	13.8	6.9	.160
	sandy clay loam	B_2	15-36	54.6	13.9	31.5	.170
Dunbar	sandy loam	A	0-5	79.0	15.2	5.8	.148
	sandy loam	B_1	5-12	65.2	15.7	19.1	.124
	sandy loam	B_2	12-36	60.8	13.5	25.7	.118
Coxville	sandy loam	A	0-9	57.9	31.5	10.6	.178
	clay loam	B_1	9-18	43.3	29.4	27.3	.131
	clay loam	B_2	18+	39.8	21.2	39.0	.119
Norfolk	loamy sand	A_1	0-8	89.4	8.3	2.3	.074
	loamy sand	A_2	8-18	85.2	11.0	3.8	.101
	sandy loam	B_1	18-30	67.9	9.0	23.1	.118
	sandy clay loam	B_2	30-36	63.5	7.5	29.0	.115
Cecil	loamy sand	A_1	0-10	85.5	8.7	5.6	.094
	sandy loam	A_2	10-19	73.0	12.4	14.6	.101
	sandy clay loam	B_1	19-28	60.7	11.7	27.6	.118
	sandy clay loam	B_2	28+	53.4	9.7	36.9	.109

varying moisture requirements.

The available water holding capacities of different soil types are shown in Table 8 by depths of 1, 2, and 3 feet and in Table 9 by soil horizons.

HOME ECONOMICS

Food Habits and Preferences

(Ada M. Moser)

The reports of two related studies are being prepared for publication. One phase of a study among 400 older men in a Piedmont and a Coastal Plains County* involved the collection of menus for the preceding day's meals and meals preferred for a mid-week working day and for Sunday. The other study was made among rural elementary school children who took group tests designed to show some of their ideas about foods and their attitudes toward individual foods. To learn what kind of meals were regarded as "good" and what foods would be included in them was the object of one part of the test; conversely, an effort was made to find what the children thought "poor" meals were like.

Good Meals, Poor Meals, and Actual Meals.

Breakfast

Evidently the children regarded bread, meat, and grits as foods to be taken for granted in almost any breakfast. When the kind of bread was specified, biscuit and toast were the most frequently named in good breakfasts. Cornbread, very seldom listed for good breakfasts, was the bread most often specified in poor breakfasts. Eggs seemed to be regarded as preeminently suitable for breakfast, for they appeared in two-thirds of all good breakfasts and in one-sixth of all poor breakfasts, but very seldom at other meals. Milk, which was thought of usually as "good for you," appeared frequently in good breakfasts, seldom in poor ones. Coffee, clearly regarded as not good for children, was the leading beverage listed in poor breakfasts. The strong influence of the welfare and health idea is evident here. The conflict between liking or custom and ideas of health shows clearly in the treatment of milk and coffee (or tea) throughout the various portions of the test.

The picture of good breakfasts presented by the children was confirmed by the men who were interviewed, except that milk was not often listed. Since, in general, people like what they eat, it is not surprising to find that the rural men who gave menus for the "previous day" had biscuits or toast for breakfast more frequently than any other form of bread; one-sixth of the Lowcountry rural

*In cooperation with the Food and Container Institute for the Armed Forces.

Negro men ate cornbread or hoecake, however. White men had eggs and/or meat, Negroes meat or fish. The men of both groups drank coffee and more than half of them had grits for breakfast.

Fruit and cereals other than grits were mentioned by only a small percentage of any group. Sirup was listed more frequently by Piedmont children and men than by Coastal Plains groups.

Dinner

Of the major food groups represented in the children's "good" dinners, vegetables ranked first and breads second. With Coastal Plains children, rice came next in frequency. Milk, sweets and desserts, meat and poultry ranked high.

In poor dinners, vegetables and breads still headed the list but milk was now far down and coffee or tea had taken its place; poultry had almost disappeared and meats were listed less frequently.

In Table 10 food items are classified by frequency of mention.

The high frequency of rice in Coastal Plains dinners, both good and poor, indicates its important place in the daily food supply of rural families in the Lowcountry. Piedmont children listed it very infrequently. Relatively high frequency in both good and poor meals may be taken as an indication that a food has an almost indispensable place in the dietary. High frequency only in poor meals indicates the food is disliked, as in the case of carrots, or thought to be not good for one, as in the case of coffee or tea.

Dinners eaten by older men showed many of the same differences between Piedmont and Lowcountry as had the children's "good" dinners. More than two-thirds of the Piedmont men had cornbread for dinner and about one-third of the Coastal Plains men. A higher proportion of the latter had biscuits. Three-fourths of the Coastal Plains men ate rice for dinner but only 13 percent of the Piedmont men did so. One or more vegetables was the most frequent feature of the men's dinners. Over half the Piedmont men but only 16 percent of the Coastal Plains men drank sweet milk or buttermilk for dinner. Apparently the men of the Coastal Plains group were not so conscious of the "good for you" idea as were the school children of that section of the state.

Supper

Children listed milk and bread for good suppers more frequently than any other types of foods. Piedmont children specified cornbread much more often than did Coastal Plains children, but the latter listed grits and rice more frequently. Eggs again made their appearance, but less frequently than in breakfast menus. Vegetables and meats were not as prominent in supper as in dinner menus which children rated good.

Poor suppers contained relatively little milk, but more coffee and tea, and they were, in general, very simple and plain.

Table 10.—Foods Most Frequently Listed for Good and Poor Dinners by Rural Elementary School Children in Two Sections of South Carolina.*

Frequency	Piedmont				Coastal Plains			
	White		Negro		White		Negro	
	Farm	Nonfarm	Farm	Nonfarm	Farm	Nonfarm	Farm	Nonfarm
Good Dinners								
50% or over		Milk (51%)	----	----	Milk (65%)	Milk (71%) Rice (55%)	Rice (70%)	Rice (63%)
40-49%	Milk Beans	Beans	----	Milk	Rice	----	----	Milk
30-39%	Potatoes	Potatoes	Milk Cabbage	Beans	"Bread"	"Bread"	Milk	----
20-29%	Cake "Bread"	Cake "Bread" Chicken	Cake Beans Chicken Pie Potatoes	Cabbage Potatoes "Bread"	Chicken Beans Cake Tea Potatoes Cabbage	"Meat" Chicken Potatoes "Vegetables"	Cabbage "Bread" Cake	Chicken Potatoes
10-19%	Tomatoes Chicken Tea Cabbage Peas "Vegetables" Biscuit Cornbread Soup Ice Cream Pie	Tomatoes Cabbage Ice Cream Cornbread Tea "Vegetables" Soup Biscuit "Meat" "Fruit" Peas	"Bread" Cornbread Tomatoes Soup Tea Ice Cream	Cornbread Chicken Soup Cake Pie Tomatoes "Meat" "Fruit"	"Meat" "Vegetables" Cornbread Tomatoes Biscuit Ice Cream Peas "Fruit" Pie	Beans Cake Tea Tomatoes Cornbread Cabbage "Fruit" Pie Peas	Potatoes Cornbread Tea Biscuit Beans "Vegetables" "Meat" Peas	Cabbage "Bread" Cake "Vegetables" Beans "Meat" Tomatoes Cornbread
Poor Dinners								
30-49%	----	----	----	----	Tea	Tea	Rice	Rice
20-29%	Carrots	Tea	----	Tea	Rice Coffee	Rice "Bread" Coffee	----	----
10-19%	Beans Coffee Tea Milk Peas Cabbage Potatoes Cornbread	Coffee Carrots Beans Cabbage "Bread" Cake Potatoes Cornbread	Beans Cornbread Peas Cabbage Tea Milk Eggs Pie Grits	Eggs Cornbread Milk "Bread" Beans Potatoes Peas	"Bread" Cornbread Milk "Meat" Grits Beans Cabbage Carrots Peas	"Meat" Cake Cornbread Potatoes Beans	Cornbread Grits "Bread" Peas "Meat" Milk Coffee Cabbage Tea Eggs Potatoes	Grits Tea "Bread" Cornbread Milk "Meat" Peas Coffee Beans Eggs Cake Cabbage

* Words in quotations marks are terms actually listed and not names of food groups; other items include all forms and varieties listed in the replies, e.g. "beans,"green beans, dried beans, etc.

Suppers eaten by the rural men interviewed pointed up some of the differences between Piedmont and Lowcountry food habits. Cornbread and milk were more frequent in Piedmont suppers and grits and rice in Lowcountry suppers. In both sections vegetables and desserts left over from dinner were often eaten for supper.

Housing Needs and Preferences*

(Ada M. Moser and Elizabeth S. Watson)

There is a recognized need for information on the housing needs and preferences of rural families as a basis for planning houses and built-in features which will conserve the time and energy of the homemaker and meet the living needs of rural families in the South. This Station participated in a pilot study in York County for the purpose of testing a schedule being prepared for use in regional cooperative studies of rural housing problems. Analysis of schedules obtained from 121 white owner families has been partially completed. Certain preferences expressed by the homemakers are summarized briefly here. However, since this was merely a pretest of a schedule later revised, these findings should not be regarded as conclusive.

There was a decided preference for one-story houses, basements, and screened porches. Of the 121 persons interviewed, ninety-seven homemakers, or 80 percent, wanted a one-story house; of this number, 75 now live in one-story houses. Seventeen preferred a two-story house and seven a one and one-half story house. Only 32 wanted an attic, but 109 desired a basement. Leading uses suggested for a basement were: canned food storage, 79; laundry, 50; general storage, 33; root vegetable storage, 29; heating, 25. Most of the 121 wanted a front porch and 83 of them wanted it screened. Of the 22 homemakers who preferred a house of more than one story, 20 wanted a bathroom on the first floor and all wanted from one to three bedrooms on the first floor.

The 31 cooperators now living in houses of four rooms or less were asked what kind of room they would add first to their present homes. Thirteen would add a bedroom, nine a dining room, seven a living room, one a kitchen, and one a guest room. Among the 19 who had only one bedroom or none, a bedroom or living room was first choice. The nine whose first choice was a dining room had two bedrooms in their present houses. If a second room were to be added, a bedroom was most often desired, with a dining room next in frequency. Five had no opinion as to addition of a second room.

Since closets and other storage facilities were inadequate in a large proportion of these homes, information was secured on possessions to be stored so that planning may be done on the basis of actual need for various kinds of storage facilities.

---

*In cooperation with the Bureau of Human Nutrition and Home Economics, Agricultural Research Administration, U. S. Department of Agriculture.

FIELD CROPS AND FERTILIZERS

Crop Variety Trials

(W. R. Paden and E. B. Eskew)

Improvement in crop production practices includes the development of adapted varieties and varietal strains having high yields, insect and disease resistance and various other desirable characteristics. Before varieties can be safely recommended, they must be tested under various conditions over the state. There is much demand for this type of information by farmers and also by seedsmen who are anxious to handle only the best adapted varieties. An effort is made to provide reliable information concerning the adaptability and productivity of the most promising varieties by testing them under favorable soil fertility conditions and cultural practices. These variety tests are conducted at Clemson and also at the branch stations each year. Careful field plot technique is practiced in all cases.

Cotton

The cotton variety test was conducted on Lloyd's sandy loam soil. Fertilizer was applied in the row at the rate of 450 pounds of 4-10-6 per acre, and the cotton was side-dressed with 200 pounds per acre of sodium nitrate. Fifteen varieties and varietal strains were included in the test, and each was planted in 1/100 acre plots and replicated five times. The yields in pounds per acre of seed cotton and lint cotton, together with the percentages of lint, numbers of bolls required per pound of seed cotton, and lengths of staple are given in Table 11. The poor seasonal conditions account for the low yields obtained.

The highest yields were produced by two of Marett's Wilt Resistant strains, C-4-826-10-3 and #1-21-23, followed by Empire P-43. The new Sealand 542 variety which has extra staple length (1-5/16 inches) and has been bred for upland conditions, produced a very low yield and low percentage of lint under these conditions. Under more favorable conditions this variety would doubtless have produced more pounds per acre of this valuable staple.

Corn

Two corn variety tests were conducted at Clemson, one on Cecil sandy loam and the other on Congaree silty clay loam, representing productive upland and bottomland soil types, respectively. Fertilizer was applied in the row at the rate of 450 pounds of 4-10-6 per acre, and the corn was side-dressed when knee-high with 400 pounds per acre of nitrate of soda. Each variety was replicated six times in 1/100 acre plots under random distribution over the fields. Observa-

Table 11.—Cotton Variety Test, Clemson, 1947

Variety	Yield in Pounds Per Acre		Percent Lint	No. Bolls Per Pound	Length of Staple*
	Seed Cotton	Lint			
Marett's Wilt Resistant C4-826-10-3	1202	430	35.8	81	1-3/32
Marett's Wilt Resistant E1-21-2-3	1192	427	35.8	70	1-3/32
Empire P-43	1162	445	38.3	59	1-1/16
Coker's 100 Wilt Resistant 44-113	1146	411	35.9	72	1-3/32
Coker's 100 Wilt Resistant 45-445	1118	413	36.9	76	1-1/16
Marett's White Gold Wilt	1110	395	35.6	78	1-3/32
Coker's 100 Wilt Resistant	1078	387	35.9	74	1-3/32
Coker's 100 Wilt Resistant 45-23	986	364	36.9	79	1-3/32
Coker's 100 Staple 46-34	982	360	36.7	80	1-3/32
Stoneville 2B	956	337	35.3	72	1-1/16
Coker's 100 Staple	950	347	36.5	79	1-3/32
Marett's White Gold 2-3-18	890	317	35.6	70	1-1/32
Deltapineland #15	878	327	37.3	84	1-1/16
Bobshaw	848	295	34.8	81	1-1/16
Sealand 542	604	177	29.3	75	1-5/16

Difference necessary for significance at 5% level, 126 lbs. seed cotton.

*Length of staple was determined by the State Department of Agriculture, Columbia, South Carolina.

tions were made before harvest on the length and tightness of husk, and also on the amount of root lodging and stalk breakage. The weights of ear corn harvested in the field from the individual plots were calculated as bushels per acre after determining shelling percentages of the various varieties. Statistical analyses were made to determine the number of bushels that the yield of any variety must differ from that of another variety to be significantly different from it at the 5% (odds 19:1) level. The yields are given in Table 12.

The seasonal conditions were very unfavorable for corn on upland soil. The varieties were planted on May 2 on the upland soil, and May 13 on the bottomland due to the cold and late spring. The unfavorable spring was followed by a severe drouth which extended throughout the season. It is recognized that such conditions affect adversely the open-pollinated varieties, which require longer growing seasons and more favorable moisture relationships than do certain hybrids. It may be observed that the hybrids included in these tests almost without exception outyielded the open-pollinated varieties.

The highest yield on the Cecil sandy loam soil was 49.4 bushels per acre and was produced by Broadbent 307, a white hybrid. This yield was followed by those from three other varieties: Woods V-120,

Table 12.—Corn Variety Test on Congaree Silty Clay Loam Soil, Clemson, 1947.

VARIETY	SOURCE	Yield in Bu./Acre	Husk Coverage **	Lodging ***
Dixie #17 (W)	Tennessee Exp. Station	97.1	3	3
Broadbent #305 (W)	Broadbent Hybrids	96.6	4	4
Wood's V-120 (W)	T. W. Wood and Sons	91.0	4	1
Hoosier Crost #708 (W)	Edward J. Funk and Sons	85.0	5	1
Dixie #11 (W)	Mississipi Exp. Station	82.3	2	3
Wood's S-210 (Y)	T. W. Wood and Sons	82.2	4	2
Tennessee #10 (W)	Tennessee Exp. Station	79.9	4	4
N. C. T-23 (Y)	North Carolina Exp. Station	79.8	4	4
Hoosier Crost #707 (W)	Edward J. Funk and Sons	79.5	5	2
Hoosier Crost #1010 (Y)	Edward J. Funk and Sons	79.1	4	3
Wood's V-50 (Y)	T. W. Wood and Sons	78.2	5	4
Funk's G-717 (Y)	Funk Bros. Seed Company	78.1	3	3
N. C. T-20 (W)	North Carolina Exp. Station	77.2	4	3
Broadbent #307 (W)	Broadbent Hybrids	76.9	3	3
Wood's S-315 (W)	T. W. Wood and Sons	76.2	2	5
N. C. 26 (Y)	North Carolina Exp. Station	76.0	3	2
Wood's V-125 (W)	T. W. Wood and Sons	74.6	4	1
N. C. 27 (Y)	North Carolina Exp. Station	74.1	2	2
Pfister Hybrid #4015 (Y)	Pfister Assoc. Growers, Inc.	73.3	4	2
Dixie #44 (Y)	Tennessee Exp. Station	73.2	4	2
Wood's V-60 (Y)	T. W. Wood and Sons	72.9	4	3
Pfister Hybrid #4100 (W)	Pfister Assoc. Growers, Inc.	72.8	4	2
Wood's V-45 (Y)	T. W. Wood and Sons	71.8	4	3
N. C. 1032 (Y)	North Carolina Exp. Station	71.1	4	2
Banner B-63 (Y)	Schumacher Seed Company	70.2	5	1
Funk's G-790 (W)	Funk Bros. Seed Company	68.8	2	4
N. C. 1111 (W)	North Carolina Exp. Station	68.6	2	3
K-374 (Y)	Kelly Seed Company	66.9	5	1
Hoosier Crost 1005A (Y)	Edward J. Funk and Sons	65.6	5	3
Banner B-10 (W)	Schumacher Seed Company	64.9	4	2
Hasting's Yellow Prolific*	H. G. Hastings Seed Company	61.8	2	4
Wood's Golden Prolific (Y)*	T. W. Wood and Sons	60.8	2	4
Louisiana #502 (W)	Louisiana Exp. Station	60.6	2	2
Funk's G-714 (Y)	Funk Bros. Seed Company	59.8	3	3
Lohman's Yellow*	S. C. Agri. Exp. Station	59.3	2	2
Wood's Jarvis Prolific (Y)*	T. W. Wood and Sons	58.3	3	3
Wood's S-350 (W)	T. W. Wood and Sons	58.1	2	3
Hasting's Prolific White*	H. G. Hastings Seed Company	56.6	2	4
Douthit's Prolific White*	J. B. Douthit	54.3	1	2
Douthit's Yellow*	J. B. Douthit	53.9	1	4
Wood's S-240 (Y)	T. W. Wood and Sons	52.8	1	3
Keystone #222 (Y)	Corneli Seed Company	52.0	4	3
Wood's Indian Chief (Y)*	T. W. Wood and Sons	48.8	3	4
Wood's Dixie (W)*	T. W. Wood and Sons	48.0	2	2
Florida W-1 (W)	Florida Exp. Station	47.4	1	3
Latham's Double (W)*	F. P. Latham	44.8	2	3
State Hospital (W)*	S. C. State Hospital	36.1	2	2
Broadbent #307 (W)	Broadbent Hybrids	49.4	3	4

(W) and (Y) following variety name denotes color of grain.

* Denotes open-pollinated variety.

** Judged on length and tightness of husk: 1 = very good; 2 = good; 3 = fair; 4 = poor; 5 = very poor.

*** Judged on approximate amount of root lodging and stalk breakage: 1 = 0-5%; 2 = 6-10%; 3 = 11-20%; 4 = 21-40%; 5 = 41% and above.

Table 12. (Continued)—Corn Variety Test on Cecil Sandy Loam, Clemson, 1947

Wood's V-120 (W)	T. W. Wood and Sons	41.9	3	2
Hoosier Crost #708 (W)	Edward J. Funk and Sons	40.7	4	2
Broadbent #305 (W)	Broadbent Hybrids	40.4	4	4
Wood's V-125 (W)	T. W. Wood and Sons	39.1	3	3
Pfister Hybrid #4100 (W)	Pfister Assoc. Growers, Inc.	38.3	3	3
Tennessee #10 (W)	Tennessee Exp. Station	38.1	3	4
Banner B-10 (W)	Schumacher Seed Company	37.8	4	3
K-374 (Y)	Kelly Seed Company	37.7	5	5
Wood's V-50 (Y)	T. W. Wood and Sons	35.6	3	3
Dixie #17 (W)	Tennessee Exp. Station	35.4	3	4
N. C. 1032 (Y)	North Carolina Exp. Station	35.0	3	2
Wood's V-45 (Y)	T. W. Wood and Sons	34.3	3	2
Banner B-63 (Y)	Schumacher Seed Company	33.9	4	2
Hoosier Crost #707 (W)	Edward J. Funk and Sons	33.7	4	4
Hoosier Crost #1010 (Y)	Edward J. Funk and Sons	33.0	5	5
Funk's G-717 (Y)	Funk Bros. Seed Company	32.2	3	3
Dixie #44 (Y)	Tennessee Exp. Station	31.9	3	3
Wood's S-210 (Y)	T. W. Wood and Sons	31.6	3	3
Pfister Hybrid #4015 (Y)	Pfister Assoc. Growers, Inc.	30.6	4	2
Hoosier Crost #1005A (Y)	Edward J. Funk and Sons	29.8	4	4
N. C. 1111 (W)	North Carolina Exp. Station	29.0	3	4
N. C. T-20 (W)	North Carolina Exp. Station	28.6	3	3
N. C. T-23 (Y)	North Carolina Exp. Station	28.1	3	4
N. C. 26 (Y)	North Carolina Exp. Station	27.4	2	3
Wood's V-60 (Y)	T. W. Wood and Sons	26.0	3	4
Dixie #11 (W)	Mississippi Exp. Station	24.7	2	2
N. C. 27 (Y)	North Carolina Exp. Station	23.8	1	1
Funk's G-714 (Y)	Funk Bros. Seed Company	23.7	2	3
Keystone #222 (Y)	Corneli Seed Company	23.5	4	4
Wood's S-315 (W)	T. W. Wood and Sons	20.9	2	4
Wood's Jarvis Prolific (Y)*	T. W. Wood and Sons	19.6	3	3
Wood's Indian Chief (Y)*	T. W. Wood and Sons	19.0	3	3
Douthit's White*	J. B. Douthit	17.0	1	2
Wood's S-350 (W)	T. W. Wood and Sons	15.1	2	2
Wood's S-240 (Y)	T. W. Wood and Sons	13.7	1	4
Douthit's Yellow*	J. B. Douthit	12.7	2	3
Louisiana #502 (W)	Louisiana Exp. Station	11.8	2	2
Wood's Golden Prolific (Y)*	T. W. Wood and Sons	9.8	2	3
Funk's G-790 (W)	Funk Bros. Seed Company	8.8	2	3
Hasting's Prolific White*	H. G. Hastings Seed Co.	8.6	2	4
Hasting's Yellow Prolific*	H. G. Hastings Seed Co.	8.5	2	3
Latham's Double (W)*	F. P. Latham	6.8	2	2
Florida W-1 (W)	Florida Exp. Station	6.1	1	2
State Hospital (W)*	S. C. State Hospital	6.0	2	3
Wood's Dixie (W)*	T. W. Wood and Sons	4.5	2	2

Difference necessary for significance at 5% level, 6.2 bushels.

(W) and (Y) following variety name denotes color of grain.

* Denotes open-pollinated variety.

** Judged on length and tightness of husk: 1 = very good; 2 = good; 3 = fair; 4 = poor; 5 = very poor.

*** Judged on approximate amount of root lodging and stalk breakage: 1 = 0-5%; 2 = 6-10%; 3 = 11-20%; 4 = 21-40%; 5 = 41% and above.

Hoosier Crost 708W and Broadbent 305W. On the Congaree silty clay loam soil the highest yield was 97.1 bushels per acre, and this was produced by Dixie 17, a white hybrid, originated at the Tennessee and Mississippi Agricultural Experiment Stations. The yield from this variety was followed closely by that of Broadbent 305, with 96.6 bushels per acre. In judging the adaptability of varieties to the areas, consideration must be given not only to the yield but also to insect resistance as indicated by length tightness of husk. It may be observed that the open-pollinated varieties included in the tests had good husk coverage, while many of the hybrids did not. The amount of lodging in open-pollinated varieties and hybrids was variable.

Small Grains

The small grain variety test was planted on Cecil sandy loam soil on October 19, 1946, in rod-length rows, replicated ten times under random distribution. Fertilizer was applied at the time of seeding at the rate of 400 pounds of 4-10-6 per acre, and the grain was side-dressed the first of March with 100 pounds of nitrate of soda.

Oats.—Fifteen varieties and varietal strains of oats were included in the test. The yields are given in Table 13. The four leading varieties were: Tennessee (090 X Bond), Wood's Stanton, Coker's Stanton and N. C. State Lemont. The yields produced by these varieties were followed very closely by those of Marett's Fulghum, St. 2, Marett's Anderson, and Forkedeer.

Table 13.—Oat Variety Test, Clemson, 1947

Variety	Source	Yield in Bu./Acre
Tennessee, (090 X Bond)	University of Tennessee	95.5
Wood's Stanton	T. W. Wood and Sons	95.5
Coker's Stanton	Coker's Pedigreed Seed Company	95.0
N. C. State Lemont	N. C. State College	94.9
Marett's Fulghum, St. 2	Marett's Farm and Seed Company	93.2
Marett's Anderson	Marett's Farm and Seed Company	91.2
Forkedeer	University of Tennessee	90.8
Coker's Fulgrain	Coker's Pedigreed Seed Company	88.5
Wood's Fulgrain, St. 6	T. W. Wood and Sons	88.1
N. C. State Letoria	N. C. State College	86.9
Marett's Winter Resistant, St. 6	Marett's Farm and Seed Company	86.9
Wood's Letoria	T. W. Wood and Sons	80.4
Marett's Carolina Red, St. 1	Marett's Farm and Seed Company	73.3
Coker's Victorgrain	Coker's Pedigreed Seed Company	69.6
Clemson Fulghum	S. C. Experiment Station	68.2

Difference necessary for significance at 5% level, 8.6 bushels.

Wheat.—Nine varieties and varietal strains of wheat were included in the test, as shown in Table 14, with the highest yield, 46.9 bushels per acre, produced by Coker's Hardired variety.

Table 14.—Wheat Variety Test, Clemson, 1947

Variety	Source	Yield in Bu./Acre
Coker's Hardired	Coker's Pedigreed Seed Company	46.9
Marett's Sanett, St. 2	Marett's Farm and Seed Company	43.0
Wood's Hardired	T. W. Wood and Sons	41.0
Clemson Bluestem	S. C. Experiment Station	37.8
Marett's Sanett, 41-950	Marett's Farm and Seed Company	37.3
Marett's Sanett, M764-5	Marett's Farm and Seed Company	26.3
Wood's Redhart	T. W. Wood and Sons	25.0
Coker's Redhart	Coker's Pedigreed Seed Company	23.5
Coker's Hybrid, B1. 45-21	Coker's Pedigreed Seed Company	11.0

Difference necessary for significance at 5% level, 3.0 bushels.

Barley.—The yields of fifteen varieties and varietal strains of barley are given in Table 15. The highest yield, 65.7 bushels per acre, was produced by Tennessee, M. B. x S. A. strain. This yield was followed closely by Strain 2 and Strain 1 of Marrett's Calhoun, and Wood's Wong, with yields of 62.5, 62.1 and 61.0 bushels per acre, respectively.

Table 15.—Barley Variety Test, Clemson, 1947

Variety	Source	Yield in Bu./Acre
Tennessee, M.B. x S.A.	University of Tennessee	65.7
Marett's Calhoun, St. 2	Marett's Farm and Seed Company	62.5
Marett's Calhoun, St. 1	Marett's Farm and Seed Company	62.1
Wood's Wong	T. W. Wood and Sons	61.0
Marett's Sunrise, St. 3	Marett's Farm and Seed Company	56.2
Marett's Sunrise, St. 58-79-12	Marett's Farm and Seed Company	55.8
Marett's Awnless, St. 4	Marett's Farm and Seed Company	54.3
N. C. State Sunrise	N. C. State College	53.4
Wood's Beardless Winter Res.	T. W. Wood and Sons	50.4
Clemson Awnless	S. C. Experiment Station	49.6
Jackson #1	University of Tennessee	49.2
Clemson Hooded	S. C. Experiment Station	47.6
N. C. State Hooded #26	N. C. State College	47.5
Marett's Hooded, St. 4	Marett's Farm and Seed Company	47.5
Marett's Hooded, St. 5	Marett's Farm and Seed Company	46.1

Difference necessary for significance at 5% level, 7.7 bushels.

Soybeans

Thirteen varieties of soybeans were planted in rod-long rows and replicated four times on Cecil sandy loam soil on three different dates at two-week intervals beginning May 22. Fertilizer was applied

in the row at the rate of 400 pounds of 4-10-6 per acre. Each variety was harvested when mature and threshed with a small nursery thresher. The yields in bushels per acre are given in Table 16.

Table 16.—Yields of Soybean Varieties Planted at Different Dates, Clemson, 1947

Variety	Yield in bushels per acre at dates planted		
	May 22	June 5	June 19
Roanoke	22.1	22.0	18.8
N44-774	19.9	19.9	18.9
Ogden	19.8	21.4	19.3
N45-3563	19.7	18.2	16.1
Volstate	19.1	17.5	19.9
N44-92	17.2	20.0	18.1
N42-26	17.1	18.0	19.4
CNS	16.4	17.6	14.9
N44-937	15.6	19.1	19.3
Nanksoy	15.5	16.5	14.9
Palmetto	14.8	17.7	16.2
Burdette #20	14.8	19.0	14.9
F. C. 3096-W	14.1	12.7	13.7
Mean	17.4	18.4	17.3
Difference necesary for significance at 5% level	1.73	3.62	2.92

The second date of planting, June 5, produced the highest average yield of all varieties, 18.4 bushels, as compared with 17.4 bushels from the earlier planting on May 22, and 17.3 bushels on the later planting, June 19. There was not much difference between the varieties in their response to date of planting with the exception of Burdette #20, which produced its highest yield when planted at the second date. Previous tests have shown that Roanoke, Ogden, Volstate and CNS varieties are well adapted and productive in this area.

Response of Alfalfa to Phosphorus, Lime, and Subsoil Treatment

(Mack Drake and W. R. Paden)

Alfalfa, a deep-rooted, drought-resistant perennial legume capable of producing three or more tons of hay per acre each year, is a resurgent crop in the southeastern states. Many difficulties have been experienced by farmers attempting to produce this valuable forage crop. With the demand for livestock feed, and aided by recent information about its fertilizer requirements, farmers are again sowing alfalfa.

Additional information is needed concerning the fertility and management practices required to establish and maintain good stands and high yields of alfalfa. In an effort to provide such information, two field experiments were established with Kansas Com-

mon alfalfa on a well-prepared, firm seedbed of Cecil clay loam in the fall of 1946. This soil was in a low state of fertility. In the first experiment a basic treatment of two tons of dolomitic limestone and 1000 pounds of 4-10-12 fertilizer were disked into the top three inches of soil.

The data obtained in 1947 indicated that if high hay yields are to be obtained the first year on this soil, large applications of phosphate before planting are required as indicated in Table 17 and Figure 6.

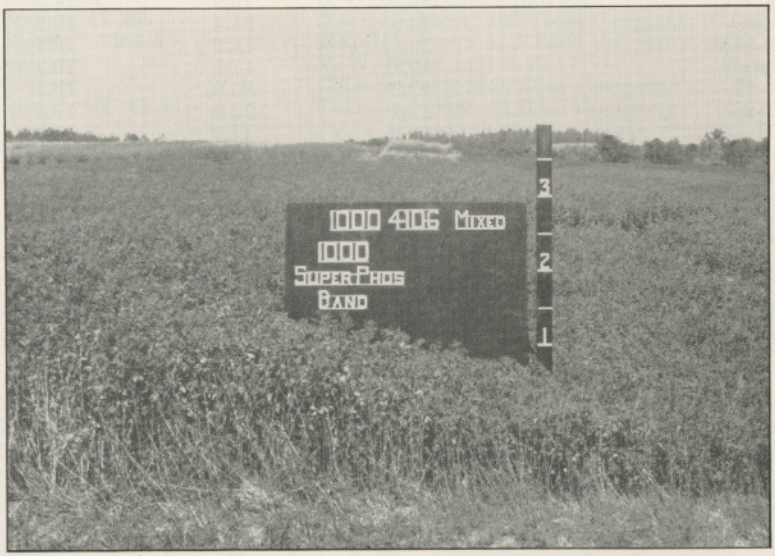

Figure 6.—First cutting of first year's crop of alfalfa hay—Plot on right received 1000 pounds 4-10-6 plus 100 lbs. 60% K.C.L. mixed in surface 3 inches; plot on left received in addition, 1000 pounds superphosphate (18% P_2O_5) in bands 3 inches deep.

The subsoil treatment where neither superphosphate nor dolomite were applied to the subsoil produced smaller yields of both cuttings than the other treatments. Subsoil placement of superphosphate and dolomite produced small yield increases over the check treatment. Root and nodule development were increased in the zone of the phosphate and dolomite bands. This suggests that deep placement of dolomite or dolomite and phosphorus should be practiced if this land is subsoiled. It is planned to continue this experiment for several years and to study the yield response, root development, and phosphorus, calcium and magnesium utilization as influenced by rate and placement of superphosphate and dolomite.

Table 17.—Relation of Alfalfa Yield and Phosphorus Content to Quantity of Applied Phosphorus on Cecil Clay Loam, Clemson, 1947

Treatment No.	P_2O_5 Applied	First Cutting			Second Cutting			Total Lbs. Hay	Total Lbs. P_2O_5
		Lbs. dry Hay	% P_2O_5	Lbs. P_2O_5	Lbs. dry Hay	% P_2O_5	Lbs. P_2O_5		
1	100	2572*	.418	10.73	2027	.746	15.12	4599	25.85
2	280	3088	.598	18.44	2221	.765	17.00	5309	35.44
3	280	3139	.591	18.48	2486	.790	19.62	5625	38.10
4	460	3318	.715	23.72	2606	.792	20.64	5924	44.36
5 (check)	100	2724			2161				

* Differences necessary for significance at 5% level: first cutting 323 lbs.; second cutting 298 lbs./acre.

Treatments:

1. Two tons of dolomite and 1,000 lbs. of 4-10-12 were disked into the surface 3 inches of soil. Subsoil rows 12 inches apart and 12 inches deep.
2. Same as No. 1 plus 1000 lbs. superphosphate (18% P_2O_5) applied with a grain drill in bands 7" apart and 3" deep.
3. Same as No. 2 plus 2,000 lbs. dolomitic limestone applied with a subsoiler in bands 12" apart and 9-12" deep.
4. Same as No. 3 plus 1,000 lbs. superphosphate (18% P_2O_5) applied with a subsoiler in bands 12" apart and 9-12" deep.
5. Same as No. 1 but with subsoil treatment.

(Area harvested 6 x 30 ft. from plots 9 x 36 ft.—4 replications).

In the second experiment two and one-half tons of dolomite, and 400 pounds of 4-10-6 fertilizer (in bands) were applied per acre before planting. This treatment is considered a minimum requirement for establishing alfalfa stands on Cecil clay loam soil. The first and second cuttings yielded only 2,630 pounds per acre of alfalfa hay, compared with 3,610 pounds per acre when 1000 pounds of superphosphate (18% P_2O_5), in addition to the dolomite and 400 pounds of 4-10-6, was applied before planting. When the 1,000 pounds application of the superphosphate was delayed until after the first cutting of hay, the second cutting yielded nearly as much and contained as much phosphorus as the second cutting of hay produced on plots which received the 1,000 pound application of superphosphate before planting.

Equipment Used in Experiments.—An International Harvester Company No. 46 plow-sole fertilizer distributor mounted on an Oliver subsoil plow as shown in Figure 7 was used to place the superphosphate and dolomitic limestone in bands 12 inches deep and 12 inches apart in the acid subsoil.

Figure 7.—Placing fertilizer in subsoil and opening a trench for setting kudzu plants.

This subsoil fertilizer distributor also was used effectively to place fertilizer in the subsoil (12-15" deep) and simultaneously prepare a trench for setting kudzu crowns. This equipment makes it possible to set kudzu earlier in the spring when the soil is too wet to

lay off rows with a turning plow. Placing the fertilizer in the subsoil also reduces stimulation of weed growth.

Influence of Large Applications of Nitrogen and Different Spacings on the Yield of Corn

(E. B. Eskew)

Experiments were conducted on two soil types to determine the influence of varying amounts of nitrogen, supplied in side-dressings of sodium nitrate, on the yields of three varieties of corn planted at four different spacings. The soil types were Lloyds sandy loam, a productive upland soil but one on which plants are likely to suffer during dry weather, and Congaree silty clay loam, a productive bottomland soil which has a high moisture-holding capacity which makes it one of the best corn soils of the upper part of the state. A basic fertilizer application of 500 pounds of 3-9-9 per acre was used. Sodium nitrate was applied at three rates: 250, 500, and 750 pounds per acre, as a side-dressing. One plot, used as the check, did not receive any side-dressing. Each treatment was replicated five times. The three varieties of corn were planted in adjoining rows on each plot using a split-plot design. The varieties were Douthit's White Prolific, an open-pollinated variety, N. C. 27, a yellow hybrid, and Tennessee 10, a white hybrid. A liberal amount of seed was used and the plants thinned to 37.4 inches, 21.4 inches, 15.0 inches and 11.5 inches apart in the row. These spacings give 4,000, 7,000, 10,000, and 13,000 plants per acre when the rows are 42 inches apart, as was the case in this experiment. Plots of corn grown at each of these spacings were each side-dressed with sodium nitrate at one of the four rates. The results are given in Table 18.

Differences in yields resulting from the different treatments and spacings were not great because of the adverse seasonal conditions which prevailed.

The average yields of the three varieties when the figures for all plots on the Lloyds sandy loam soil were combined were 29.5, 40.5 and 39.7 bushels per acre, and on the Congaree silty clay loam soil 41.3, 62.3, and 65.0 bushels, respectively. The yields were greater on the Congaree silty loam by an average of 19.4 bushels per acre. The hybrids outyielded the open-pollinated variety on both soil types.

There was a tendency for the corn spaced 15 inches apart in the row to produce larger yields than that spaced at other distances, especially where the larger amounts of nitrogen were applied. There was also a tendency for Douthit's White Prolific to yield best when side-dressed with 250 pounds and for the hybrid varieties to yield best when side-dressed with 500 pounds per acre of nitrate of soda. In view of the conditions under which the experiment was carried

Table 18.—The Influence of Side Applications of Nitrate of Soda in Addition to a Preplanting Application of 500 Pounds Per Acre of 3-9-9 Fertilizer on Yields of Three Varieties of Corn at Four Different Rates of Planting* on Two Soil Types, 1947

	Douthit's White Prolific				N. C. 27				Tennessee 10				Average			
	Spacing in inches				Spacing in inches				Spacing in inches				Spacing in inches			
Sodium Nitrate Lbs. per Acre	37.4	21.4	15.0	11.5	37.4	21.4	15.0	11.5	37.4	21.4	15.0	11.5	37.4	21.4	15.0	11.5
Lloyds sandy loam soil																
0	30.3	19.4	23.5	18.3	34.7	32.6	29.3	31.0	25.4	28.5	28.6	31.6	30.1	26.8	27.1	27.0
250	36.2	30.3	32.1	32.1	29.7	36.3	43.7	44.1	38.9	33.7	42.4	40.6	34.9	33.4	40.4	38.9
500	33.9	34.3	30.5	25.8	39.3	41.9	46.8	43.7	42.8	45.2	49.0	41.0	38.7	40.5	42.1	36.8
750	33.9	30.9	32.3	27.4	45.2	44.4	52.0	44.0	40.4	42.0	54.9	50.1	39.8	39.1	46.4	40.5
Average	33.6	28.7	29.6	25.9	37.2	38.8	42.9	40.7	36.9	37.3	43.7	40.8	35.9	34.9	39.0	35.8
Average of all treatments and spacings	29.5				40.5				39.7				36.4			
Congaree silty clay loam soil																
0	37.1	35.7	40.8	33.4	52.1	53.0	55.5	62.6	54.5	53.2	59.4	57.9	47.9	47.3	51.9	51.3
250	42.1	45.9	44.3	43.1	57.1	60.9	64.4	66.8	58.7	70.8	70.1	74.7	52.9	59.2	59.6	61.5
500	37.7	43.4	43.2	39.9	51.4	66.3	68.1	71.6	54.7	65.0	71.5	70.0	47.9	58.2	60.9	60.5
750	37.6	44.8	44.6	42.6	53.1	71.7	70.1	71.5	57.7	70.6	75.0	76.9	49.5	62.4	64.9	63.7
Average	38.6	42.5	44.5	39.8	53.4	63.0	64.5	68.1	56.4	64.9	69.0	69.9	49.6	56.8	59.3	59.3
Average of all treatments and spacings	41.3				62.3				65.0				56.2			

L.S.D. between varieties within treatments (5%): Lloyds sandy loam, 2.0 bu.; Congaree silty clay loam, 2.2 bu.
L.S.D. between treatments (5%): Lloyds sandy loam, 10.4 bu.; Congaree silty clay loam, 8.9 bu.
Coefficient of variation: Lloyds sandy loam, 17.0%; Congaree silty clay loam, 12.0%.
*Distance between rows was 42 inches. Plants in the row spaced 37.4, 21.4, 15.0 and 11.5 inches apart give 4,000, 7,000, 10,000 and 13,000 plots per acre, respectively.

on, the latter result indicates that the hybrid varieties are probably better able to withstand unfavorable soil moisture conditions and utilize the available plant nutrients more effectively than Douthit's White Prolific.

With more favorable conditions, the yields of all three varieties at the different spacings and side-dressed with varying amounts of nitrate of soda would doubtless have been considerably higher.

PLANT PHYSIOLOGY AND PLANT DISEASES

Mineral Nutrition and Wilt Resistance in Cotton

(W. B. Albert)

Two series of plants of Rowden, a wilt-susceptible variety of cotton, were grown in culture solutions in the greenhouse. Each series included high and low levels of nitrogen, potassium and magnesium nutrition. The two series were identical but were grown consecutively. Except for sulphates, the solutions were comparable with respect to concentrations of ions other than those under study. The initial pH of the solutions varied between 6.7 and 6.9 and in all cases the nitrogen was derived from calcium nitrate. At the high level of nutrition in both series the solutions contained nitrogen, potassium and magnesium in concentrations sufficient to promote rapid and vigorous plant growth. At the low level, the nitrogen and potassium were 1/10 and the magnesium 1/32 of the concentrations of these ions at the high level of nutrition. The well established seedling plants were inoculated by a 10 minute immersion of the roots in a mycelial suspension of *Fusarium vasinfectum.*

Although the second series of plants was more severely affected by wilt, the following significant differences applicable to both series were noted:

1. For the first three weeks after inoculation the plants grown in low potassium solutions showed less resistance to wilt than plants grown in high potassium solutions. This was not true for plants grown in low nitrogen and high magnesium solutions. No significant differences were noted in this comparison.

2. Plants grown under high levels of nitrogen, potassium and magnesium nutrition were more resistant to wilt than those grown at a high nitrogen level with either potassium or magnesium, or both, at a low nutritional level.

3. There were no marked differences in wilt resistance between plants grown in a solution containing high levels of nitrogen, potassium and magnesium and plants grown in a solution where these elements were at a low level, indicating that nutritional balance had greater influence on wilt resistance than the absolute concentrations of these three elements.

Biological Races of Fusarium Wilt of Cowpeas and Soybeans

(G. M. Armstrong, J. K. Armstrong* and C. C. Bennett)

In observing the Fusarium wilt of cowpeas in several experimental plots, it was noted that some varieties which showed practically no wilting at one location were killed almost completely at others. For example, the nematode resistant Florida Conch showed very little wilt in plots at Clemson but was killed in plots at the Edisto Experiment Station, at Blackville. The behavior of this and other varieties led to the assumption that different biological races of the cowpea-wilt Fusarium probably existed. Numerous collections of wilting cowpeas were made from widely different localities and the wilt-organisms isolated in cultures. Soybeans were also included since there were indications that the wilts of these two crops might be related.

Eleven varieties of cowpeas were grown in the greenhouse and the plants of each were inoculated with a single-spored isolate of each of 13 cowpea-wilt cultures and 3 soybean-wilt cultures. The tests have shown that there are biological races among these isolates; i.e., certain varieties of cowpeas or soybeans are resistant to some of them but not to others.

One race, No. 1, represented by only 3 cowpea-wilt isolates and 1 soybean-wilt isolate caused wilt of the Lady, Florida Conch (nematode resistant) and Brown Sugar Crowder varieties of cowpeas, and Yelredo soybean. Another race, No. 2, appeared to be more common, since it was represented by 10 cowpea-wilt isolates, 6 of them from different locations in South Carolina, 2 from North Carolina, and 2 recovered from infested seed which were grown in other states. This race caused wilt of the Chinese Red, Calva 7 and California Blackeye 5 varieties of cowpeas, and in more limited tests, of the Clay and Whippoorwill varieties. Six of these isolates were tested on Yelredo soybeans but no wilting was noted; thus, cowpea-wilt cultures differed in their ability to cause soybean wilt. Some varieties of cowpeas exhibited an intermediate type of reaction to the isolates and therefore were unsuitable for separating the races distinctly. The lots of Dixie Queen and nematode-resistant Florida Conch varieties used in this experiment, were of this type. Brabham was resistant to both races, being very resistant to No. 2 and only slightly susceptible to No. 1 under conditions of heavy inoculation. Under field conditions this variety probably would not exhibit appreciable symptoms of wilt. It is likely that very few plants would be killed, although some leaf-shedding might occur. Figure 8 shows the reaction of 3 varieties of cowpeas to race No. 1. Lady, in the center pot, was killed in about 2 weeks, California Blackeye 5 with the dense foliage did

*Agent, U. S. Department of Agriculture.

Figure 8.—Reaction of 3 varieties of cowpeas to race No. 1 of the wilt Fusarium. Left, Brabham with lower leaves shed and dark streaks in some stems; center, Lady dead; right, California Blackeye 5, no injury.

not show symptoms of wilt, while Brabham shed a number of lower leaves but was not otherwise seriously affected. As noted above, one soybean-wilt isolate in race No. 1 caused wilt of Yelredo soybean and several varieties of cowpeas.

Two other soybean-wilt isolates tested on various varieties of cowpeas did not produce wilting. Both of these isolates, however, caused wilt of cotton, thus placing them in a different race from the two races described above which do not cause wilt of cotton.

Yelnando soybean, the new shatter-proof variety which is being grown in the state, appeared to be resistant to races 1 and 2 of the wilt fungus. Further study of this variety is in progress.

Some wilt isolates within a race appear to be more pathogenic than others. One isolate, for example, may kill all the plants of a variety very quickly, perhaps within 2 weeks after inoculation, while another will take several weeks to kill most of the plants and a few

plants will only shed leaves, be stunted in growth and show a decided darkening of the internal portions of the stem.

It was difficult to get lots of seed which were free of the wilt fungus and a great deal of seed testing had to be done before healthy plants could be produced. It was also important to use the same lots of seed throughout these experiments, since varieties are not clearly defined in all cases.

The existence of biological races of the wilt fungus of cowpeas and soybeans is important, particularly to breeders of wilt-resistant varieties, since it will be necessary to test new varieties against more than one wilt organism.

Studies of the Effects of Two Herbicides on Certain Grasses

(W. B. Albert)

In recent years many species of weeds have been successfully controlled with sprays containing 2, 4 dichlorophenoxyacetic acid (2, 4-D) or one of its various analogues. The control of grasses with this chemical has not been particularly successful. More recently, it has been reported that quack grass, a troublesome weed in some of the northern states, was controlled by soil applications of isopropyl-N-phenyl carbamate (IPC) and that this chemical was relatively harmless to broad-leaved plants.

These reports suggested the trials described below to determine the efficacy of soil applications of these two herbicides in controlling nut grass, Johnson grass and Bermuda grass.

Greenhouse flats of approximately 0.6 cu. ft. capacity were used in the experiments. The soil used was a clay-loam and was treated with the sodium salt of 2, 4-D and with IPC at rates of 4 and 8 pounds per acre. The flats were planted with 50 rhizomes of Johnson grass or 50 "nutlets" of nut grass or with Bermuda grass rhizomes. In one series of treatments, the flats were partly filled with untreated soil in which the grasses were planted. The herbicides were then mixed with a separate lot of soil which was added as a top layer ½ inch deep to the soil in the flats. In another series the herbicides were well mixed with all the soil in the flats instead of the top ½ inch, and comparable plantings of Johnson and Bermuda grass rhizomes and nut grass "nutlets" were made. The flats were watered sufficiently to insure good growth.

Figures 9, 10, and 11 show the appearance 63 days after planting, of the flats in which the sodium salt of 2, 4-D was mixed with the entire mass of soil in the flats.

In Figure 9, a flat of nut grass treated at the rate of 4 pounds per acre is shown in comparison with an untreated flat. Inhibition of growth, except for one stunted chlorotic sprout, was complete.

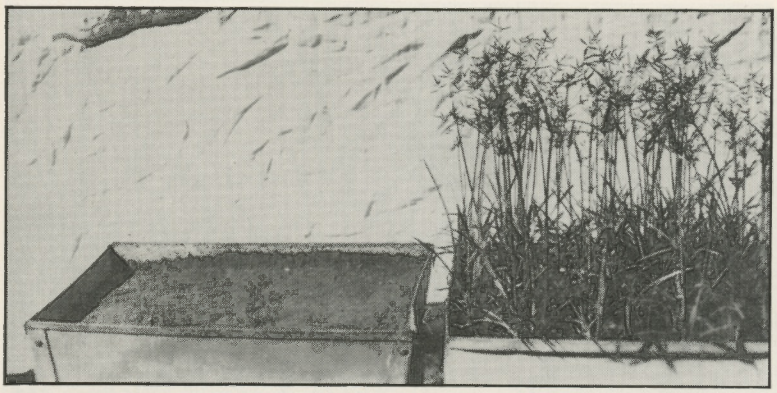

Figure 9.—Left: Flat of nut grass treated with the sodium salt of 2, 4-D at the rate of 4 lbs. per acre. Note single, stunted sprout near lower left corner. Right: Untreated flat. Planted Aug. 20. Photographed Oct. 22, 1947.

Figure 10 shows a comparable flat of Johnson grass treated at the rate of 4 pounds per acre and an untreated flat. Stunting and retardation of growth was marked, but since the rhizomes were not killed it is probable that in time the Johnson grass would have re-established itself.

A single stunted, chlorotic sprout of Johnson grass in a flat, the soil of which was treated with 8 pounds per acre of the sodium salt of 2, 4-D, is shown in Figure 11.

In the flats planted to Bermuda grass, retardation of growth under comparable treatments was less than occurred with nut grass and Johnson grass, although growth was noticeably decreased.

There was not the slightest evidence of damage to any of the three grasses tested when the soil was treated with IPC. The IPC was added in propylene glycol-ethyl alcohol solution and also in an oil-water emulsion. These results do not preclude the possibility that in other solvents IPC might be more or less effective against these grasses.

Flats of soil treated with 2, 4-D (sodium salt) at the rate of 8 pounds per acre were planted to cotton and snap beans 71 days after treatment. There was no evidence of damage to these plants which are relatively sensitive to 2, 4-D. Apparently the toxicity of 2, 4-D in the soil is relatively transient.

In general, the results of these experiments were as follows:

1. The sodium salt of 2, 4-D applied to the soil at the rate of 4 pounds per acre was approximately as damaging to nut grass as was

Figure 10.—Left: Flat of Johnson grass treated with the sodium salt of 2, 4-D at the rate of 4 lbs. per acre. Right: Untreated plot. Planted Aug. 20. Photographed Oct. 22, 1947.

an 8 pound per acre application to Johnson grass. Bermuda grass, although markedly injured by an 8 pound per acre applications was not as severely damaged as nut and Johnson grasses.

2. Applications of the sodium salt of 2, 4-D mixed with the surface layer of soil were not nearly as effective as when it was mixed with the entire mass of soil. For example, 4 pounds per acre mixed with all the soil was more effective against nut and Johnson grass than 8 pounds per acre mixed with only the top layer of soil.

The application of 2, 4-D must be studied under field conditions where thorough mixing of the herbicide with the soil, soil moisture, and other factors are not under control, before specific recommendations can be made for its use in controlling nut and Johnson grass.

Internal Breakdown in Sweet Potatoes

(W. B. Albert, C. J. Nusbaum and G. H. Dunkelberg)

During the past year, studies have been continued on the development of internal breakdown in Porto Rico sweet potatoes as related to exposure of cured and stored potatoes to selected temperatures for various periods of time. In addition, sweet potatoes were exposed immediately after harvesting to several

Figure 11.—Left: Flat of Johnson grass treated with the sodium salt of 2, 4-D at the rate of 8 lbs. per acre. Right: Untreated flat. Planted Aug. 20. Photographed Oct. 22, 1947.

temperatures for varying lengths of time and then cured and stored in the usual manner.

Examinations of lots of 10 potatoes were made at intervals of about 4 weeks. In the spring, 10 potatoes from each treated lot were bedded in the usual manner for observations on sprout production.

The following conclusions can be drawn from the experiments:

1. Cured sweet potatoes removed from storage and exposed to temperatures of 50° F. or lower for periods of time varying from 12 hours to 20 days and then replaced in storage, showed evidence of internal breakdown 4 to 6 weeks after exposure, provided the time of exposure had been 15 days or longer. Internal breakdown increased as the period following treatment lengthened. Twelve to fourteen weeks after exposure the potatoes showed severe damage. Even those exposed as little as 3 days showed internal breakdown to a degree related to the length of time elapsing after exposure.

2. Sweet potatoes severely damaged from internal breakdown, and having little value as food could be used for sprout production.

3. Sweet potatoes taken from the field and exposed for periods up to 4 days to temperatures of 32° to 55° F. and then cured and

stored did not develop internal breakdown to the degree that occurred with potatoes which were cured, stored for a time, and then chilled.

4. If stored sweet potatoes are exposed to low temperatures, losses from internal breakdown can be minimized by using them within 4 to 6 weeks after such exposure.

Control of the Root-Knot Nematode by Soil Fumigation

(G. M. Armstrong and C. C. Bennett)

Previous reports have shown that the root-knot nematode on tomatoes can be controlled by the use of the soil fumigant D-D, when it is injected into the soil at definite intervals or dripped in a furrow and covered immediately. Numerous requests concerning another soil fumigant, Dow W-40, led to its inclusion in the experiments of 1947. Plots were laid out adjacent to those of 1946 and the two materials, D-D and Dow W-40, were compared.

The fumigants were applied in a furrow 7 inches deep. A Planet Jr. planter modified as described in the 59th Annual Report of this station was used to apply the fumigants by the drip method. The furrows were 3 feet apart and the plots were 6 feet by 6 feet with 3-foot alleys. The fumigants were applied April 22, when the soil was slightly too moist to be considered ideal. The Dow W-40 was applied at two rates, 20 gallons and 30 gallons per acre, and the D-D at the rate of 200 pounds per acre, equivalent to approximately 20 gallons per acre. Soil was turned into the treated furrows from both sides, thus forming ridges which were left undisturbed for 3 weeks, or until the plants were set. When the tomato (Pan America) and Turkish tobacco (Smyrna) plants were set, the ridges were leveled so that the plants were placed almost at the general soil level.

There were 6 replications of the tomato plots and 3 of the tobacco plots. Table 19 shows the yield in pounds of tomatoes from

Table 19.—Yield of Tomatoes on Soil Treated with D-D and Dow W-40 for the Control of the Root-Knot Nematode.

Rate of application	D-D 200 lbs. per acre	Dow W-40 20 gallons per acre	Dow W-40 30 gallons per acre	Check (no treatment)
Yield in pounds (6 plots per treatment)	130	106	113	108
Disease index* (severity of galls on roots)	2.8	6.1	5.1	6.3

* 0 = no galls; 10 = all roots severely galled.
The smaller the number, the better the control.

6 plots and also a disease index which was calculated on the basis of the severity of gall formation on the roots when they were dug in late September. The control of the nematode by D-D appeared to be much better when the disease index (severity of root galls) was taken as the criterion than when measured by the yield of tomatoes. If the relative freedom from root galls was reflected in yields, the treated plots could be expected to yield 2.25 (6.3 + 2.8) times as many tomatoes as the check plots. However, the actual yield of the treated plots was only 20% greater than that of the untreated plots.

This result was apparently due to early blight which caused rather serious injury, even though the plants were sprayed every week with a fixed copper. The first year the test was conducted, when there was practically no damage from leaf diseases, a treated plot gave 2.3 times the yield of the check plot.

Tests in previous years have shown that heavier rates of application of D-D will give more thorough control of the nematode on tomatoes, but it appears that a rate of about 200 pounds per acre is most economical for satisfactory commercial control.

Dow W-40 gave practically no control of the nematode as judged by either the disease index or yields. This was surprising since experiments conducted in other states have shown relatively good control of the root-knot nematode by this fumigant. A recent paper in the journal, **Phytopathology**, indicates that this material does not diffuse downward in the soil as does D-D. This may offer a partial explanation of the results obtained in this experiment. The fumigants were placed about 7 inches deep in the soil, but the tomatoes were set a few inches deeper and the lower roots may have been subjected to many nematodes. Under the conditions of this experiment it is clear that Dow W-40 gave little control of the nematode.

The tobacco in the experiment was not harvested as in commercial practice but was left until October 3. The plants were then over 6 feet tall. No differences were noted between the plants on the various plots at any time during the season. Examination of the roots indicated that in both size and number of galls, the root-knot damage was considerably less than in the case of tomatoes. A different system of rating the damage was devised resulting in a different disease index. The disease indices in Table 20 show the relative degree of disease control with tobacco, but these indices cannot be compared directly with those given for the tomato.

It will be noted that Dow W-40 did not give appreciable control of the nematode on tobacco at either of the two rates of application, whereas the control by D-D was relatively good.

Table 20.—Control of the Root-Knot Nematode on Turkish Tobacco Grown on Soil Treated with D-D and Dow W-40.

Rate of application	D-D 200 lbs. per acre	Dow W-40 20 gallons per acre	Dow W-40 30 gallons per acre	Check (no treatment)
Disease Index* (Severity of galls on roots)	.88	1.8	1.9	2.0

* 0 = no galls; 3 = all roots severely galled.
The smaller the number, the better the control.

Observations on Ice Damage to Slash Pine

(N. B. Goebel)

Snow and ice cause considerable damage to trees and other forest growth. This damage usually consists of broken limbs and stems, although uprooting and bending are not uncommon. The degree of injury depends upon the ability of the tree to withstand the additional weight of the snow and ice, and is influenced by such factors as species, density of the crown canopy, and the form and shape of the stem and crown.

On December 24-25, 1945, a severe ice storm occurred in the vicinity of Clemson causing considerable damage to both forest and shade trees. It is estimated that approximately 90 per cent of the 2.41 inches of rainfall recorded for the 48 hour period formed as glaze ice, since the temperatures varied from 26-32° F. during that period.

In order to determine the nature and extent of the damage caused by this ice storm, an examination was made in February 1946 of all trees on two plots, located in a 23-year old slash pine (*Pinus Carabaea Morelet*) plantation, where it was apparent that damage had occurred. Inspection of five other slash pine plantations varying in age from 8 to 11 years disclosed no apparent damage either from breakage or uprooting. Since these five plantations were within the storm area, and less than one mile from the older plantation, it was thought that some damage would be inevitable. Obviously, the amount of ice deposited on the trees was not enough to cause damage. It was noted that each plantation was adjacent to a mature stand of trees, and it is probable that these afforded some protection, especially where the direction of the storm was such that it could not strike the young plantings directly.

The slash pine plantation in which the plots studied are located was established in 1945 on abandoned agricultural land within the Clemson Land Use Area.

The plantation comprises an area of 1/2 acre in which plots A and B are located. Plot A, consisting of 1/4 acre, was plowed prior to planting, and the tree seeds were broadcast at a rate of two

pounds per acre. Plot B comprises 0.1 acre and was planted with one year old seedlings, the spacing being 8 x 8 feet.

A survey of the plots made in February, 1946, disclosed the fact that 98 per cent of the damage occurring on these plots resulted from broken tops, while the remaining 2 per cent was in the form of leaning and uprooted trees. The average diameter of the stem at the point of breakage was 3.4 inches, while the average length of the broken top was 8.6 feet. The trees which were damaged on these plots gave no evidence that breakage was confined to any particular crown class. There were no significant differences between the numbers of damaged trees of various heights and diameters nor any correlation of these measurements with the number of trees damaged. Since slash pine, under ordinary conditions develops a well defined deep root system, bending and uprooting of trees is not too common, although this type of damage does occur.

A summary of the damage which occurred on the plots is given in Table 21.

Table 21.—Summary of Damage Which Occurred in December, 1945

Item	Plot A	Plot B
Trees per plot	63	48
Diameter range, inches	5-12	4-11
Trees uprooted	1	2
Trees badly bent	1	--
Trees with broken tops	29	23
8.5" d.b.h.* and under	15	16
8.6" d.b.h. and over	14	7

* Diameter at breast height.

The results as presented in the above Table show that 49 per cent of the trees in Plot A were damaged, while in Plot B 52 per cent were damaged. Since broken tops and uprooting are forms of damage from which there can be no recovery, subsequent ice storms such as occurred could not be repeated many times during the life of the stand. Loss of the terminal leader in trees of sapling and pole size prevents these trees from producing normal tapered stems, because further elongation of the shoot is impossible. Height growth is expressed later only when a lateral branch assumes the position of a terminal shoot or there is development of a lateral bud into a terminal leader. The breakage of the growing stems of too many trees in the stand would seriously interfere with any successful management program.

Immediate economic loss would result because the broken tops are too small for any use other than fuelwood. However, it is believed that the greater loss is that which will result from the effect upon the future development of the plantation. The understocked

stands resulting from periodic removal of damaged trees, the irregular spacing of trees in the residual stand, and the breakdown of the normal silvicultural treatment of the area will directly affect the program of management. Since the final yield at sawlog maturity (50-60 years) will determine the feasibility of growing this tree crop, and since storms of similar intensity are likely to occur once every 10-15 years, the planting of slash pine in the Piedmont cannot be undertaken without financial risk. Loblolly pine (*Pinus taeda L.*) which is native to the section, can be planted with the assurance that the risk involved, under similar conditions, is much less than if slash pine is grown. The probable reason for the greater damage to slash pine than to the native species is that the slash pine needles are longer, more dense and slightly more persistent, thus tending to accumulate and hold a greater concentration of ice.

Diseases of Small Grains

(C. H. Arndt)

Concurrently with the increase in the importance of small grains in the agricultural economy of this state, there has been an increase in the reports of losses from diseases. It is uncertain whether these losses represent an actual increase in recent years or if they are only apparent because of increased efforts to obtain high yields. In oats there has been an actual increase in disease as the result of the widespread use of high yielding varieties that are very susceptible to injury by *Helminthosporium victoriae,* a pathogen that has appeared within the past few years. There were numerous reports of injury by parasitic diseases to small grains during the winter of 1946-47, and in some areas yields were unusually low. An examination of plants showed that the anthracnose fungus and several species of Helminthosporium which cause diseases of small grains were widely distributed in the state. In many instances, however, it was uncertain whether these fungi or environmental conditions were responsible for the low yields. Since there is little exact information on the relative importance of the several fungi that cause the root- and stalk-rots of small grains in this state, a study was initiated to supply this information. Experiments also will be made to ascertain whether these diseases had their origin in the survival of the pathogens in the field or in their dissemination with seed.

Through the cooperation of county agents, a total of 59 samples of grain were obtained from the counties in which low yields or losses from fungus diseases had been reported. These samples were germinated in sand culture to ascertain their viability and on tested sterile media to determine the infesting fungi. The 27 oats samples were generally of low viability; the percentage of viable oats seed was less than 50 percent in about half of the samples and less than 20 percent for six of them. The viability of the wheat samples was

much greater, averaging 82 percent and the viability of only 2 samples was less than 70 percent. The viability of the 6 barley samples was comparable to that of the wheat samples. The one rye sample tested contained seeds with a viability of 66 percent.

The fungi obtained from the seed samples varied in much the same manner as the viability of the seed: the higher the viability of the seed, the smaller the number of seeds infested and the fewer kinds of fungi found on them; while in seeds with lower viability, the fungi were more prevalent. According to present information, species of Helminthosporium are the most destructive of the fungi obtained. No attempt was made to distinguish between species of this fungus, except to verify the presence on several samples of *H. victoriae*. Helminthosporium species were found on 13 percent of all oats seeds examined, were absent from only 3 samples; and were present on more than 20 percent of the seeds of six samples. In contrast to the oats samples, Helminthosporium species were present on only 2 percent of the wheat and barley seeds; only one sample showed more than 15 percent infested seeds; and 15 of the 25 samples showed no infestation by these fungi. In the case of the sample of rye 21 percent of the seeds were infested with Helminthosporium.

About 12 percent of all seeds examined were infested by *Fusarium moniliforme*, an important parasite of the corn plant. One third of the oats samples tested had more than 25 percent of their seeds infested with this fungus. Another parasite of the corn plant, *Cephalosporium acremonium* was found on 2 percent of the seeds. The most prevalent fungi on the seeds were two species of Alternaria. These fungi were present on 48 percent of the oats seeds, 35 percent of wheat seeds, and 42 percent of the barley seeds. They were found on the seeds of all but 3 samples. The higher infestations by these fungi were associated with a blackish discoloration and low viability of the seeds. The latter lots were frequently also infested by species of Rhizopus, Mucor, Penicillium, and other saprophytes. None of this group are virulent parasites when conditions are favorable for the rapid growth of cereals. Their presence is usually indicative of exposure of the seed to prolonged rainfall after maturity or to high moisture content of the seed when stored. Both of these factors affected yields and quality of grain adversely in 1947. They emphasize the need for drying equipment of large capacity for the rapid drying of cereals and seed cotton so that the seed crop may be harvested without undue exposure to high humidity when rainfall at maturity delays drying in the field.

The effect of the Helminthosporium species, *F. moniliforme*, and *C. acremonium*, on yields of grain in this state is uncertain. Since knowledge of their effects as parasites is based largely on environmental conditions different from those in this state, their economic importance in South Carolina is not known. There is a similar lack

of definite information about the Alternaria species. To obtain information on these potentially serious fungus parasites, samples of typical lots of grain seeds both fungicide-treated and untreated, have been planted in fields in which cereals were grown the previous season and in fields where cereals have not been grown recently. It is expected that these plantings will answer the question as to whether these parasites survive from crop to crop on the seed or on plant residues in the field. The answer will determine the proper control measures that should be used.

HORTICULTURE

Varieties of Peaches for Processing

(L. O. Van Blaricom and A. M. Musser)

Many varieties of peaches have been tested during six seasons to determine their adaptability to canning and freezing. The two lists of varieties shown below are grouped according to their suitability for these purposes as determined at the Horticultural Products Research Laboratory. Most of the varieties have been tested for two or more years, although several have been included in the test for only one season. All have been judged for their ease

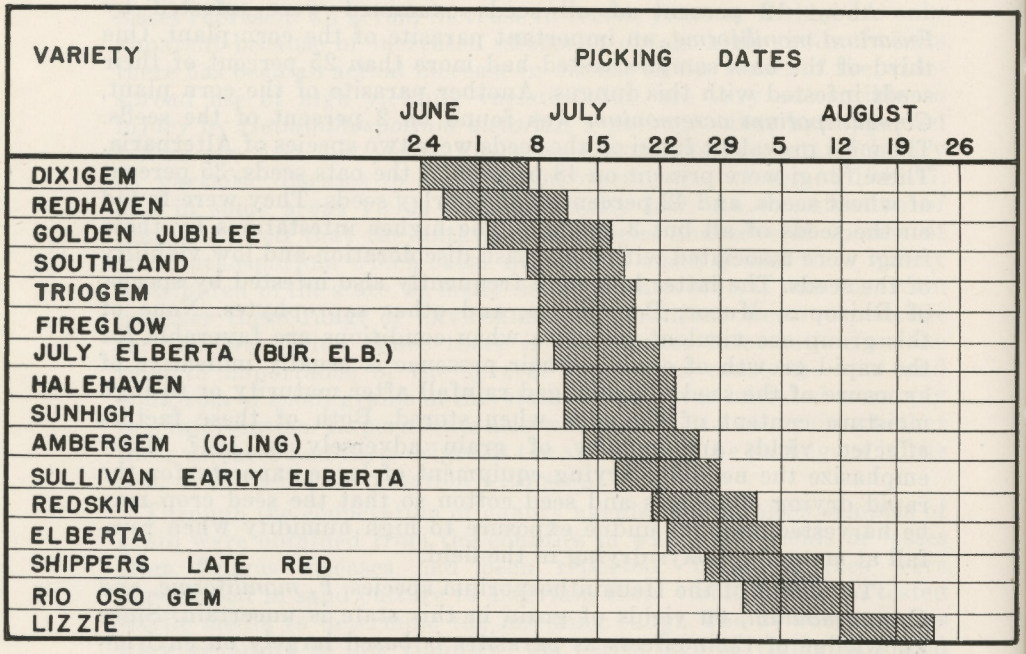

Figure 12.—Dates of harvest of some good varieties of yellow fleshed, freestone peaches suitable for processing.

of pitting, ability to stand up under lye peeling and washing, and their general ripening characteristics. In addition, the canned samples were judged for color, flavor, texture and general appearance; the frozen samples were graded for color, texture, flavor, general appearance and susceptibility to browning.

Peaches for processing vary a great deal with the season; on how they have ripened, whether the season has been dry, whether they have had adequate fertilizer, have been properly sprayed, and other factors. Consequently, considerable variation has been found in a particular variety during different seasons. For example, Elberta, which has been rated as average for canning, can, under favorable conditions, be better than Sunhigh which has been rated as above average.

The varieties listed as average or above average should be suitable for processing, while the ones listed below average should in general not be considered desirable.

Sixteen varieties of peaches are listed in Figure 12 as suitable for processing. Some of these varieties, such as Lizzie, are not of very good quality. However, of the later ripening peaches, Lizzie is the best variety which has been tested at Clemson.

Freestone Peaches Suitable for Canning

Above Average

Early Elberta (Gleason)	Rio Oso Gem
Fireglow	Shipper's Late Red
July Elberta (Bur. Elberta)	Sunhigh

Average

Belle of Georgia	Halegold
Dixigem	Halehaven
Early Hiley (White)	Ideal
Eclipse	Lizzie
Elberta	Redhaven
Fay Elberta (Gold Medal)	South Haven
Gage Elberta	Sunday Elberta
Gemmers Late Elberta	Sunbeam
Globe Haven	Triogem
Golden Globe	Valiant
Golden Jubilee	Vedette
Goldeneast	

Below Average

Afterglow	Marigold
Early Halehaven	Massasoit
Fair Beauty	Midway
Fischer	Mundell Seedling
Flaming Gold	Pickett's Favorite
Giant Freestone	Redelberta

Golddrop
Hardy Berta
Kalhaven
Red Rose
Salberta
White Hale

Clingstone Peaches Suitable for Canning

Above Average

Ambergem

Average

Frank
Golden Elberta

Freestone Peaches Suitable for Freezing

Above Average

(Susceptible to browning)

Fireglow
July Elberta (Bur. Elberta)
Shippers Late Red
Sunhigh

Above Average

(Non-browning)

Dixigem
Redhaven
Redskin
Southland
Sunbeam
Triogem

Average

Elberta
Golden Jubilee
Gemmer's Late Elberta
Globe Haven
Goldeneast
Halegold
Halehaven
Ideal
Kalhaven
Primrose
Red Rose (White)
Rio Oso Gem
Sullivan Early Elberta
Sunday Elberta
Valiant
Vedette
Welcome

Poor

Afterglow
Augbert
Giant Freestone
Hardee
Hardy Berta
Lizzie
Midway
Mundell Seedling
Pickett's Favorite
Penryn

Description of Some of Best Varieties For Processing

Dixigem is a high quality freestone peach which ripens early. It is small, has a light yellow color and occasionally the pits tend to cling. However, when ripe, it is excellent for both canning and freezing. It is practically non-browning.

Redhaven is small in size unless heavily thinned. It has an excellent yellow color, firm flesh, and like Dixigem occasionally tends to cling. This variety is suitable for both commercial canning and freezing. It is particularly well adapted for home canning and freezing, is practically non-browning, and needs no treatment whatever for freezing.

Golden Jubilee is rather soft and breaks up easily during processing. Its color is light yellow and the flavor excellent and distinctive. The flesh is comparatively slow to turn brown and although other varieties are better for freezing preservation, this variety is well adapted for this purpose. Usually it pits quite easily.

Southland is a yellow-fleshed freestone of high quality. It is practically non-browning and seems quite well suited for freezing, but has not been available at Clemson in sufficient quantities for canning.

Triogem usually sizes well, has a light but uniform yellow flesh color. Although this variety occasionally tends to cling, it is excellent for both canning and freezing.

Fireglow is a high quality yellow-fleshed freestone, sizes well with a good crop on the tree. Color and flavor of this variety are good to excellent and pitting and peeling wastes are usually small. It is particularly well suited for canning.

July Elberta is sometimes called Stark's or Burbank's July Elberta, or by other names in various parts of the country. It is a medium-sized freestone peach with fairly good yellow flesh color and excellent quality. A good canning variety and also good for freezing, but will occasionally turn quite brown unless treated to prevent it.

Halehaven is a well-known variety grown in South Carolina. The fruit ripens uniformly and the flesh is yellow throughout while still firm. This variety is somewhat stringy but is well suited for both canning and freezing.

Ambergem is a large, firm yellow-fleshed clingstone peach and makes an excellent canned product. It is by far the best clingstone variety tried at Clemson.

Sunhigh is one of the best freestones tried for canning. It has good yellow color and shape, excellent quality, and pitting and peeling wastes are usually low.

Sullivan Early Elberta is very similar to Elberta except that it ripens a week earlier. Pits are slightly larger than Elberta.

Elberta is the most important commercial variety in South Carolina. It grows to large size, and produces a good quality canned peach if handled in the right manner. The color of the flesh is not uniformly yellow until it reaches the soft-ripe state. If canned too early, the peaches are hard and show a very undesirable green. However, the Elberta makes a product of very good quality when canned at the right stage of maturity. The flavor and texture of the well-ripened peach are good. Elberta browns badly when frozen and should be treated to prevent this discoloration.

Shipper's Late Red is a large yellow freestone practically identical with J. H. Hale. Flesh is firm and the pit cavity has a brilliant red color. This pit color is particularly attractive in the frozen product, but when the fruit is canned the color occasionally turns an undesirable brown.

Rio Oso Gem is another Hale-type peach with firm yellow flesh. This variety also has a very red pit cavity which occasionally turns brown when canned, but the peaches are quite attractive when the fruit is frozen.

Lizzie is not a very good processing peach but is one of the best of its season. Its processing characteristics are very similar to Elberta, although it is not quite as high in quality. It is generally low in acid.

Suitability of Strawberry Varieties For Freezing Preservation

(L. O. Van Blaricom)

Sixteen varieties of strawberries were tested in 1946 and 13 in 1947 for their suitability for freezing preservation. The berries were sliced and mixed with cane sugar in the ratio of one part of sugar to five parts of sliced berries. They were then placed in pint "Searchlight" containers to be frozen and stored at 0° F. After eight months storage, a judging panel scored the berries for color, flavor, texture, and general appearance.

Results of the freezing tests indicate that the following varieties were above average and suitable for freezing preservation in South Carolina:

Blakemore	Tennessee Supreme
Massey	Tennessee Shipper
Sparkle	Tennessee Beauty

All the varieties in the first group have good to excellent red color, and the cores of the berries are red. Blakemore is a well-known variety which has good color, flavor, shape, and stands processing well. Its season of ripening is short, but otherwise it is an excellent berry.

Massey is an excellent all-around berry and has very good color. The seeds are small although fairly prominent. The berry is fairly large, stands up well under washing and preparation, and makes an excellent frozen product.

The core of Sparkle often pulls out when removing the stem and cap. In addition, this variety does not stand up very well during washing and preparation. The seeds are large and not very attractive. However, the berry has excellent color and flavor and is otherwise well suited to freezing preservation.

All three of the Tennessee berries have excellent color and seem to be well adapted to freezing preservation.

The following varieties were judged to be inferior to those listed above. The fact that they are listed as inferior does not mean that they cannot be successfully frozen, but rather that they are not as well suited to freezing preservation as the varieties described above.

Big Joe	Louisiana strain No. L-11
Chesapeake	Louisiana strain No. L-29
Klonmore	Louisiana strain No. L-30
Maytime	Louisiana strain No. L-37
Temple	Louisiana strain No. L-39
U.S.D.A. 2183	

Effect of Syrup Density on The Flavor of Canned Peaches

(L. O. Van Blaricom)

Since 1941, the Horticultural Products Research Laboratory has made experimental canned packs of a large number of peach varieties.

In judging the canned samples, a score of 25 percent has been allowed for the factor of flavor. However, the judging has never been entirely satisfactory, since the factor of sweetness has influenced considerably the scoring of flavor.

Figure 13 shows the syrup concentration in degrees Brix (equivalent to percent sugar) plotted against the flavor rating of 38 varieties of peaches. Each point in the chart represents the average rating of one variety by 12 individuals. The position of the line was determined by the least-squares method of calculating a straight line trend. As the sugar content became greater, the flavor rating was higher.

Since the data in Figure 13 consisted of the scores of 38 different varieties which varied greatly in their fruit characters, it was decided to make a control test of flavor as influenced by syrup density in order to evaluate more accurately the extent of this influence. Samples of Elberta peaches were used with all factors uniform except the density of the syrup used. The sugar contents of the syrups used in the test were 0, 10, 25, 40, and 55 percent. At

Correlation of Flavor Rating and Syrup Density in 38 Varieties of Canned Freestone Peaches

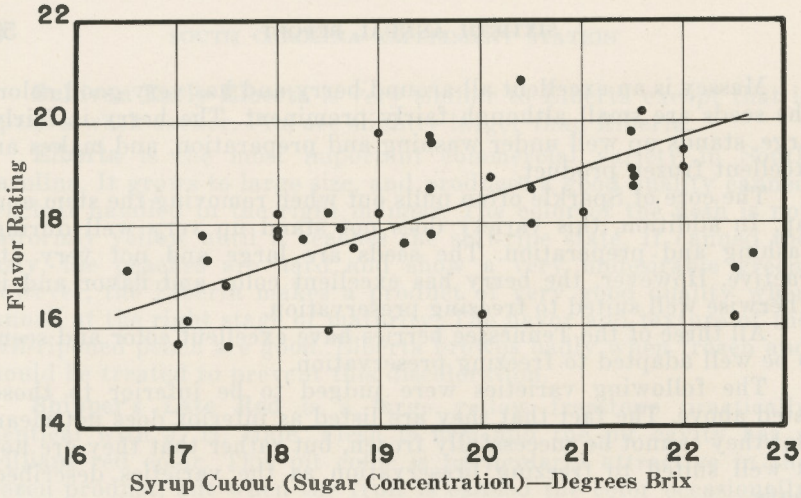

Figure 13.—Each point represents the average flavor rating of one variety by 12 individuals.

the time the samples were judged, the "cutout" density of the syrup in the various samples was determined. Cut-out density is the percentage of sugar in the syrup which has been somewhat diluted during processing by the natural juice of the product being canned. The range of the cut-out densities was from approximately 6 to 30 percent as indicated in Figure 14. Twenty students were used to

Correlation of Flavor Rating and Syrup Density in Canned Elberta Peaches

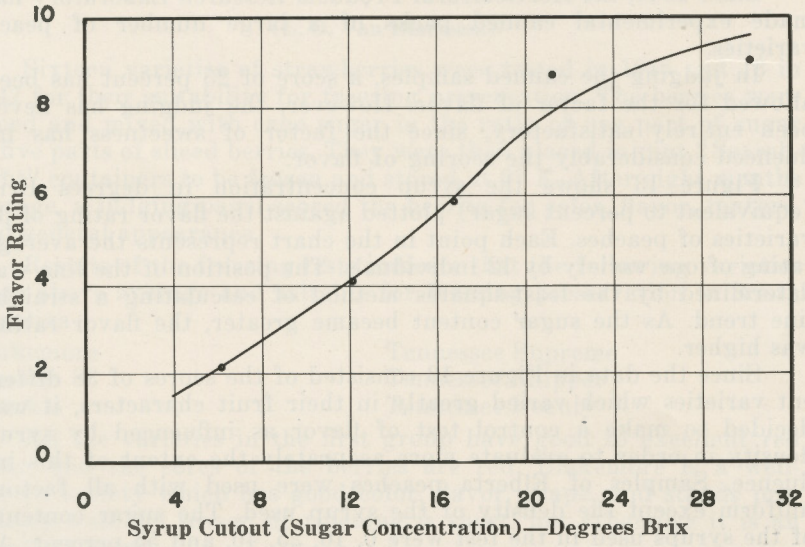

Figure 14.—Each point on the curve represents the average flavor rating by 20 individuals of a sample in syrup having the sugar content indicated.

judge the samples with the caution that they consider flavor only. Before they had finished judging, the students realized that there were large differences in sweetness, but they were cautioned to grade on flavor only. However, as shown in Figure 14, there was again a decided increase in the flavor rating with the increase in sugar content. There are probably two reasons for this. First, high concentrations of sugar preserve the flavor better than lower concentrations, and second, but probably more important, higher sugar content influences the taster to give a higher flavor rating because of the greater sweetness rather than because of improved flavor.

The graphs indicate that if different lots of canned peaches or other fruits are to be judged for flavor, the sugar content of the samples must be uniform.

Pruning Bunch Grapes For Early Bearing

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

The cultural practices associated with early bearing of fruit plants are of continual interest to the fruit grower. For many years, bunch grapes have been successfully produced at Clemson, and early bearing has been partly responsible for this success. A method of pruning and training the young vines which takes advantage of the long growing season of this part of the United States and brings the vines into production early is as follows:

On setting the vines in late fall or early spring, they are pruned to four buds. Shortly after growth starts, all but two shoots are removed and these are trained to a 5-6 foot stake. By the end of the first season, a "Y" type of vine has been developed which is pruned

Table 22.—Yield of Bunch Grapes, 1947

Variety	Number of Vines	Total Yield (Pounds)	Average Yield Per Vine* (Pounds)	Average Yield Per Acre (Pounds)
Portland	44	421.34	9.58	5211.52
Fredonia	57	406.44	7.13	3878.72

* Highest yield per vine:
Portland—19.14 pounds.
Fredonia—15.58 pounds.

and trained to the "Four-cane Kniffin" system. Usually, depending upon individual vine vigor, two strong canes and one or two short canes or spurs are left for fruiting.

One year old, vigorous Portland and Fredonia grape vines were set out in February, 1946, and spaced at 8-foot intervals in three rows 10 feet apart on the contour. The soil, a Madison gravelly sandy clay loam, is quite fertile and well drained. The vines received 1/2 pound each of 5-10-5 fertilizer the first season and one pound the second

season just after growth started in the spring. They were sprayed with Bordeaux mixture once in 1946, and the following year were sprayed with Bordeaux mixture once and with a fixed copper spray twice. The vines and fruit were free of disease and insect pests. The following table shows the yields from these vines in 1947.

New Vegetable Varieties Adapted To The Piedmont Section Of South Carolina

(O. B. Garrison)

Cooperative vegetable trials have been in progress in the Southeast for several years and several varieties have performed

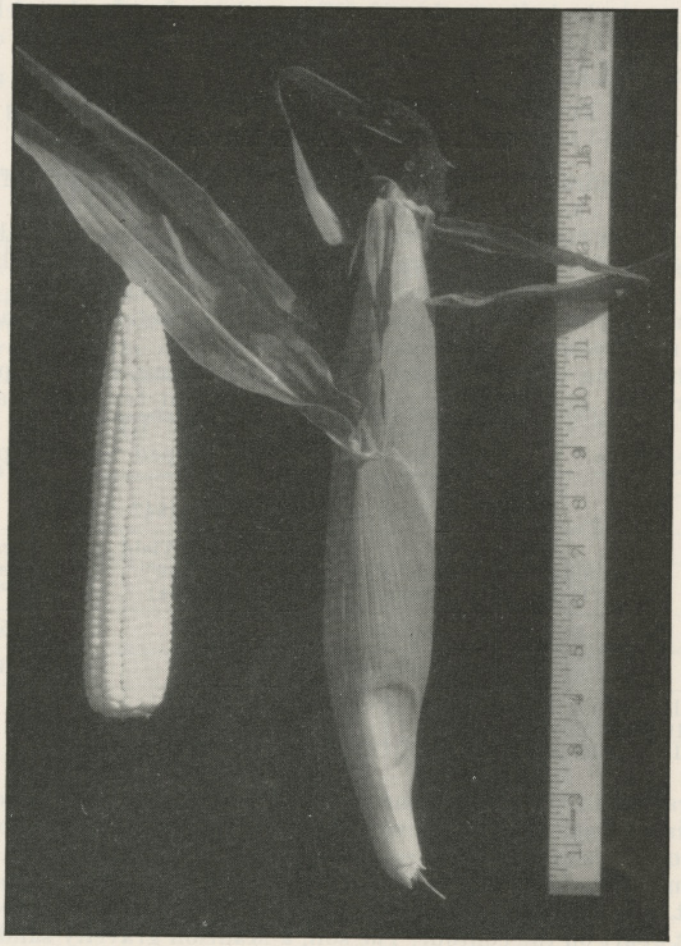

Figure 15.—Typical ears of Aristogold Bantam Evergreen, a medium-size, high quality variety of sweet corn.

satisfactorily in these trials at Clemson.

Snap Beans: Logan, a new variety of the Tendergreen type, has been particularly productive under adverse conditions. The variety sets pods early and under relatively high temperatures. It is highly resistant to common bean mosaic and powdery mildew. These characteristics, plus its high quality, make it adapted to production in home gardens, market gardens, and for processing. Cherokee is a new wax type which is much more productive than previously grown wax beans.

Lima Beans: Peerless is a new variety which is showing par-

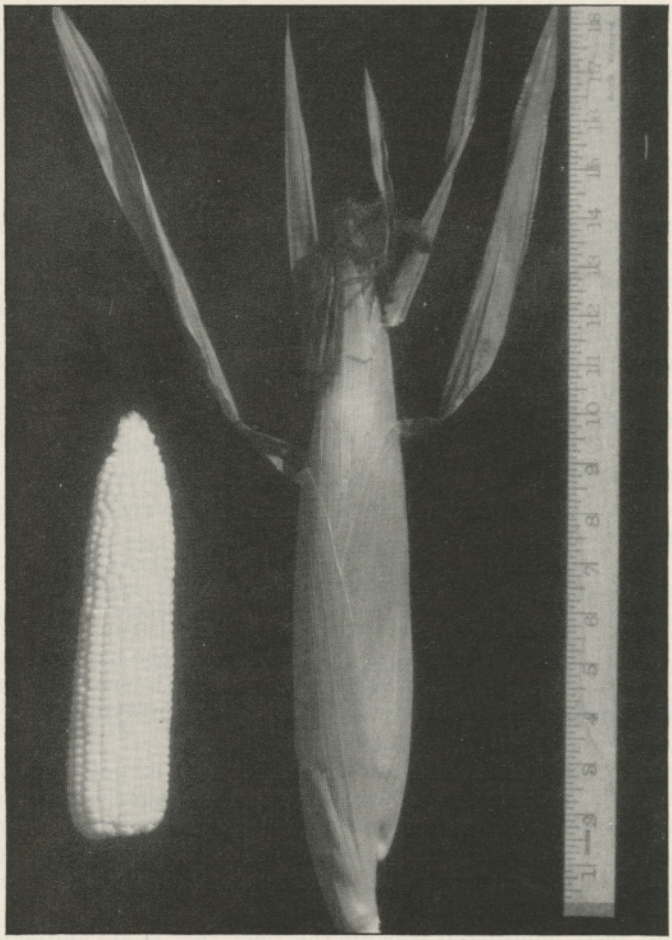

Figure 16.—Typical ears of Golden Grain, a large-size type of sweet corn.

ticular promise. The yield is equal to and often exceeds that of Henderson, which is commonly grown. The pods resemble those of the Fordhook variety. The seed are somewhat smaller than Fordhook but are thicker and more uniformly green colored. It is adapted to machine shelling, and is suitable for production in the home garden, market garden and for processing.

Sweet Corn: The variety Oto (yellow) produces a high yield of good quality ears and appears to suffer relatively little injury from the corn earworm. The small cob is particularly advantageous when the corn is frozen. Aristogold Bantam Evergreen (yellow) produces a high yield of medium-sized, high quality ears. Golden Grain (yellow) produces a satisfactory yield of high quality ears which are almost as large as those of the commonly grown field corn varieties. A 2-3 percent DDT dust applied to the silks of these sweet corn varieties reduces earworm injury under some conditions.

Breeding of Pungent Peppers

(J. A. Martin)

The pepper breeding program has progressed steadily since its initiation in the late summer of 1942. A preliminary report was published in the Fifty-Sixth Annual Report of this station concerning pepper problems and the objectives of the program. As set forth in that report, the main objective is to develop a desirable variety of Cayenne pepper adapted to South Carolina conditions by breeding and selection with emphasis on the following characters:

(1) Productivity
(2) Pungency
(3) Pickability
(4) Color Retention
(5) Pod Characters
(6) Disease Resistance

A discussion of these characters and of observations regarding them are presented below.

Productivity

A large yield is a requisite for profitable returns to the pepper grower. In the past it has been observed that the yield of pepper often has been very low due to sterility, diseases, nematodes, insects, variability in pod shape and size, plant type, unfavorable weather at harvest, etc.

Sterility has been found to reduce the yield of peppers as much as 20 percent. It is due to genetic factors and is inherited as a simple recessive character. Therefore, the sterility problem was solved by eliminating the heterozygous plants which were responsible for this character. Sterile plants do not produce normal pods or seed and therefore cannot reproduce.

Yield tests conducted during the past two years indicate that the most promising inbred strains are capable of producing 2000 to

3000 pounds of dried pepper per acre, a marked improvement over the usual commercial yield.

Pungency

Pungency is due to a complex chemical compound known as capsaicin which is present in minute quantities in the placenta and walls of the pods of pungent pepper. Capsaicin has been found to be very stable for long periods of storage, very little or none being lost.

The variability in the pungency of the original selections (made in 1942) determined according to the methods of Ting and Barrons* and Van Blaricom and Martin** was found to be very great. The degree of pungency of a given sample is found by adding a few drops of vanadium oxytrichloride to an ether extract of the sample which causes a color ranging from yellow to dark green to appear. The exact color depends upon whether the amount of capsaicin present is low or high.

Table 23 is presented to show the variability in pungency over a 4-year period of an inbred line in which selfed seed was obtained each year from plants having the highest degree of pungency. It is interesting to note that in the S_1 generation, which originated from a highly pungent individual plant, the degree of pungency ranged from 5 to 10, while in succeeding years the variability in this character decreased very rapidly due to inbreeding.

Environmental conditions cause little or no variation in capsaicin content according to chemical tests of samples from 25 individual pepper plants of four varieties grown at Clemson, Florence, Charleston, Blackville, and Highlands, N. C.

* S. V. Ting and Keith C. Barrons.—A Chemical Test For Pungency in Peppers. Proc. Amer. Soc. Hort. Sci. 40: 504-508, 1942.

** L. O. Van Blaricom and J. A. Martin.—Permanent Standards for Chemical Tests For Pungency in Peppers. Proc. Amer. Soc. Hort. Sci. 50: 1948.

Table 23.—Distribution of Successive Generations of Inbred Pepper Plants According to the Pungency of Their Pods. Each Year the Plants Grown Were the Progeny of Selfed Plants of the Preceding Year Which Produced Pods Having a Pungency of 10.

Generation	Degrees of Pungency*						
	5	6	7	8	9	10	Mean
s1	3	3	3	1	3	4	7.6 ± .29
s2	1	0	3	6	9	5	8.5 ± .15
s3	0	0	0	1	3	12	9.7 ± .09
s4	2	1	2	2	15	251	9.9 ± .02

* Pungency is determined according to a scale of 0 to 10 where 0 = no pungency and 10 = very pungent (hot).

Pickability: There was much variation in the ease with which the pepper pods could be picked. It was observed at the beginning of the work that pods of certain individual plants were difficult to pick, in that the calyx adhered to the pod when it was removed from the plant. On the other hand, pods of some plants separated readily from the calyces and could be picked with marked ease. Thus the extra operation required to remove the calyces from the pods was unnecessary in the latter instance. Selection for ease of picking has been emphasized all along and has resulted in several strains which are homozygous for this character.

Color Retention: In the early stages of the pepper breeding program, it was observed that the pods from many of the strains lost much or all of their red color shortly after drying or grinding, resulting in an unsatisfactory product from a marketing standpoint. At first, the loss of color was believed due to improper drying procedures. To determine whether this might be the cause, Van Blaricom and Martin in 1943 studied the effect of predrying treatments and varying storage conditions upon the retention of color of Cayenne pepper, but no significant differences were observed. However, the results of the tests indicated that other factors (genetics, nutrient supply, etc.) should be investigated in an effort to determine the cause of the loss of color.

Over a period of five years, it was noticed that the dried or ground pods of certain individual plants possessed the remarkable ability to retain their red color when stored at room temperatures. In fact, a few of the original samples still retain their bright red color. The factors responsible for pungency are apparently not correlated with color retention.

Pod Characters: Desirable pod characters which have been fixed in one strain of cayenne pepper are thin pericarp wall, for more rapid and uniform drying, smooth pod surface, for freedom from soil particles, and long, slender pods for ease of picking and handling.

Pest Resistance

Nematodes: The presence of root-knot nematodes causes considerable reduction in yield. In 1943, resistance to nematodes was suggested by the fact that a few vigorous plants were found scattered over the entire acreage. Upon examining the roots of the plants, it was noted that many of them were absolutely free from galls. On the other hand, the weaker plants were badly infested with nematodes. After several years of inbreeding and reselecting for nematode resistance, a test was conducted in the greenhouse for ascertaining the degree of nematode resistance possessed by some of the selections. For the test, ten plants each of 66 strains of pepper

including California Wonder and Penn Wonder were used. The plants were grown in sandy loam soil which was known to be heavily infested with root-knot nematodes.

Plants of the different strains, 6 to 8 inches high, were planted four by four inches in the greenhouse bench on May 1, 1947. Ratings for nematode resistance were determined 75 days after planting. Each plant was dug with as many roots as possible and rated, as shown in Table 24 and Figure 17. Conditions for optimum growth of plants and for nematode activity were maintained throughout the test.

Table 24.—Susceptibility and Resistance of Cayenne Pepper to Root-Knot Nematode

Number of Strains of Pepper	Susceptibility or Resistance to Nematodes	Remarks
8	Very Susceptible	Numerous enlarged galls on all roots
8	Susceptible	Many small galls
7	Resistant	Only a few roots affected with galls
22	Highly Resistant	No galls
21	Segregating for this character	No. of galls variable

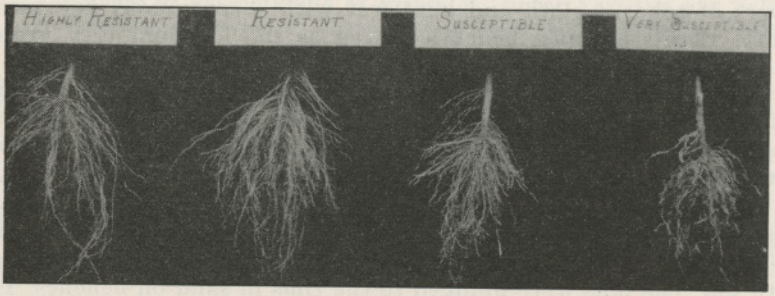

Figure 17.—Representative roots of pepper plants showing different degrees of resistance to nematodes 75 days after planting.

It is interesting to note in Table 24 that a large number of the strains of pepper possessed a high degree of resistance or tolerance to nematodes. Differences in resistance are probably due to hereditary factors. Tests are under way to determine the inheritance of nematode resistance in peppers.

Bacterial Spot Resistance In Peppers

(J. A. Martin)

The yield of Cayenne pepper in the Pee Dee area of South Carolina is often severely reduced by bacterial spot, *Xanthomonas vesi-*

catoria, (Doidge) Dowson. Higgins (1)* and Weber (5) have reported that the disease is also destructive in Georgia and Florida, respectively. This disease is most prevalent during prolonged rainy seasons with high temperatures. All aerial parts of the plants are affected. As a result, complete defoliation has been observed in the case of several varieties in the field. The disease, in addition to reducing the yield, lowers the market value of the pods since they lose their desirable red color. The lesions on the pods are also avenues for entrance of secondary organisms.

Field observations during the past four years have indicated that several varieties and selections of Cayenne pepper were somewhat resistant to bacterial spot. To ascertain more definitely the relative resistance of various lines, plants were artifically inoculated under greenhouse conditions during the spring of 1946.

Methods

Varieties of peppers studied were as follows: Cayenne (six selections) Yatsuffa (two selections), Louisiana Sports, Santanka, Truhart Pimento. Inoculated and uninoculated plants were subjected, in a greenhouse, to (1) relatively high humidity and (2) relatively low humidity. Approximately 100 percent relative humidity was provided inside a chamber which was made of two layers of tobacco cloth and kept wet with a continuous fine water spray. Plants on open benches served as the low humidity group. The temperature was held above 27° C. during the day and 18° C. at night throughout the experiment, and other environmental conditions favorable for vigorous growth of the plants were maintained. The light intensity was slightly lower in the high humidity chamber than on the open benches, but this difference was not recorded.

Thirteen vigorous plants of each of the 11 varieties were grown under each of the two experimental conditions. Each plant was about 9 centimeters tall and was placed in a 15 centimeter clay pot filled with soil. The pots were plunged to the rims in sand on benches. Ten plants of each variety were inoculated, and 3 plants were left uninoculated as checks. Inoculation was accomplished by spraying the plants with a water suspension of the bacterium, *Xanthomonas vesicatoria,* while the check plants were sprayed with water only. After inoculation, all plants were arranged at random on the benches.

The method used was a modification of that devised by Knight and Clouston (2, 3) and Weindling (4) for testing resistance of cotton seedlings to *Xanthomonas* malvacearum (E. F. Sm) Dowson. A suspension containing approximately 1,000,000 bacteria per cc. was prepared from seven-day old Petri dish (potato dextrose agar) cultures of the bacterium. The bacteria from one culture were sufficient for 12 liters of suspension which was enough to spray 30 pepper

* Figures in parentheses refer to literature cited, page 71.

plants 12 weeks of age. Inoculations were made at noon on May 9, 1946 when the stomata on the underside of the leaves were open. The suspension was sprayed with considerable force against the underside of the leaves to simulate the effects of a downpour of rain. One application was adequate for severe infection of susceptible plants.

Observations

Inoculated plants held under high humidity conditions showed the first symptoms of infection 3 days after inoculation. By the fifth day differences in resistance of plants were evident. Final observations were taken 11 days after inoculation. Plants kept on the open greenhouse bench, where the humidity conditions were relatively low, showed a minimum of infection. Uninoculated plants remained free of infection throughout the experiment.

Results

The relative resistance to the disease of inoculated plants of several varieties and selections grown under high humidity conditions is indicated in Table 25. The data (Table 25) show that selec-

Table 25.—Resistance or Susceptibility of Plants of Pepper Varieties and Selections to Xanthomonas vesicatoria When Grown Under High Humidity Following Inoculation.

Selection or Variety No.	Type of Pepper	Degree of Pungency	Resistance or susceptibility to Xanthomonas vesicatoria
4a-2-1	Santanka	Hot	**Highly Resistant** — no infection or only occasional lesions on youngest leaves.
4566*	Cayenne	Very Hot	
4530P2	Cayenne	Very Hot	**Moderately Resistant** — young leaves spotted, lower or older leaves with few if any lesions. Lesions dry and indistinct.
4512P2	Cayenne	Very Hot	
4537P1	Cayenne	Very Hot	**Moderately Susceptible** — young leaves heavily infected, lower or older leaves spotted. Lesions distinct, "water soaked," with little coalescence. Severe defoliation.
4509P4	Cayenne	Hot	
Truhart Pimento	Pimento	Sweet	**Highly Susceptible** — all leaves heavily infected with terminal leaves dead or dying. Lesions large, "juicy," coalesced. Severe defoliation.
Louisiana Sports	Honka	Very Hot	
12b-1-1	Yatsuffa	Hot	
9b-1-3	Yatsuffa	Hot	
4556P6	Cayenne	Mild	

*Hybrid obtained by crossing 4530P3 x 4537P1

tions 4a-2-1, 4566, 4530P3 and 4512P2 are highly resistant. During the past four years these varieties have performed well in the pepper-growing area. Even before the test was initiated they were thought to have some resistance to the organism. Selections numbered 4537P1, 4509P4, 12B-1-1, 9b-1-3 and 4556P6, which are classified as moderately susceptible to very susceptible, do not possess sufficient resistance to perform well under average seasonal conditions. The Truhart Pimento and Louisiana Sports, which were known to be susceptible to bacterial spot, were included in the test as a means of comparison with other varieties and their susceptibility was confirmed.

Figures 18 and 19 are presented to show the resistance of one strain and the susceptibility of another to the disease.

It will be noted that the hot and very hot varieties vary considerably in their resistance to the disease. These observations as to the resistance or susceptibility of the different varieties of pepper following artificial inoculation with bacterial spot in the greenhouse confirm observations of the behavior of these varieties and strains when subjected to natural infection in the field. Strains 4a-2-1, 4566, 4530P3, and 4512P2 have been selected for further study because of their resistance to bacterial spot under conditions of natural and artificial infection. No. 4566, which was produced by crossing 4530P3 x 4537P1, possesses a greater degree of resistance to the bacterial spot organism than either of its parents.

In breeding for bacterial spot resistance, systematic progress can be facilitated by artificial inoculation. By providing conditions

Figure 18.—This strain is highly resistant to bacterial leaf spot. The two plants on the left were not inoculated. The two plants on right were inoculated with the bacterium.

Figure 19.—This strain is highly susceptible to the bacterial leaf spot. The two plants on the left were not inoculated. The two plants on the right were inoculated with the bacterium.

for testing the breeding stocks, plants may be selected with reasonable certainty of their resistance to the organism.

Studies of the genetic factors involved in resistance to the disease will be initiated later.

Summary

Eleven varieties of peppers were artifically inoculated on May 9, 1946 with the bacterium, *Xanthomonas vesicatoria,* and grown under relatively low and high humidity conditions in the greenhouse. The method of inoculation used was highly satisfactory in ascertaining the degree of resistance or susceptibility to the bacterial spot disease. For example, Truhart Pimento and Louisiana Sports Peppers, which are commercial varieties, were found to be highly susceptible to the bacterial spot disease. Cayenne varieties 4537P1 and 4509P4 are moderately susceptible. Santanka (4a-2-1) and Cayenne (4566) are highly resistant and Cayenne (4530P2) and (4512P2) are moderately resistant to the disease.

Literature Cited

(1) Higgins, B. B. Important Diseases of Pepper in Georgia. Georgia Experiment Station Bulletin 186, December, 1934.
(2) Knight, R. L. and Clouston, T. W. The Genetics of Blackarm Resistance: 1 Factors B_1 and B_2. Journal Genetics, 38: 133-159, 1939.
(3) ———— The Genetics of Blackarm Resistance: II Classification on Their Resistance of Cotton Types and Strains. Journal Genetics, 41: 391-398, 1941.
(4) Weindling, Richard. A Technique for Testing Resistance of Cotton Seedlings to Angular Leaf Spot Bacterium. Phytopathology, 34: 235-239, 1944.

(5) Weber, George F. Bacterial Spot of Peppers. Florida Agricultural Experiment Station Press Bulletin 549, June 1940.

Permanent Standards For Chemical Tests For Pungency In Peppers

(L. O. Van Blaricom and J. A. Martin)

The procedures of Fodor (1)* and Tice (2) for testing the pungency or capsaicin content of peppers have been modified by Ting and Barrons (3). This modified procedure employs color standards using Napthol Yellow and Malachite Green. The authors found two serious faults with these standards. First, various lots of the dyes varied so much that it was impossible to duplicate a set of colors from different lots of dye. Second, the solutions were not stable and would change color in a few hours. This necessitated making up standards frequently, and unless the same lots of dye were used each time, the standards could not be duplicated.

After several preliminary trials, the permanent standards described below, using potassium dichromate and copper nitrate, were found to produce approximately the correct colors. A set of these standards was reproduced and matched perfectly after two years.

The potassium dichromate can be obtained in a stable pure form. The copper nitrate is unstable and deliquescent. However, $Cu(NO_3)_2 . 3H_2O$ meeting A. C. S. standards and dried 24 hours at 30° C. was found to be satisfactory, and reproducible colors could be made. If the copper nitrate solution is cloudy, one or two drops of nitric acid will clear it up.

Directions For Making Modified Color Standards

Solution 1. Dissolve 50 grams $Cu NO_3 . 3H_2O$ in 50 c.c. water.
Solution 2. Dissolve 1 gram $K_2Cr_2O_7$ in 100 c.c. water.
Make up color standards by adding solution 1 to solution 2 in the proportions shown.

Color Standard Number	Solution 1 (cc)	Solution 2 (cc)	Comparison with Organoleptic Tests
1	.5	15.5	Sweet
2	.75	15.25	Slightly mild
3	1	15	Mild
4	1.5	14.5	Slightly hot
5	2	14	Hot
6	3	13	Hot
7	4	12	Very hot
8	6	10	Very hot
9	10	6	Extremely hot
10	—Special—dissolve 10 gms. $Cu(NO_3)_2 . 3H_2O$ in ten cc of Solution 1.		Extremely hot

* Numbers in parentheses refer to literature cited page 73.

Literature Cited

(1) Fodor, K. von. New Reaction For Capsaicin. Z. Untersuch Lebensm. 61: 94-100. 1931. Chem. Abs. 25: 4356. 1931.
(2) Tice, Linwood F. A Simplified and More Efficient Method For the Extraction of Capsaicin Together With the Colorimetric Method For Its Quantitative Determination in Capsaicin Fruit and Oleoresin. Amer. Jour. Pharm. 105: 320-325, 1933.
(3) Ting, S. V. and Barrons, K. C. A Chemical Test For Pungency in Peppers. Amer. Soc. Hort. Sci. 40: 504-8, 1942.

Experiments With Sesame (Sesamum Indicum L.)

(J. A. Martin)

Experimental work with sesame has been under way at Clemson since 1943 to determine its cultural and harvesting requirements and whether or not it is adapted to extensive production in South Carolina. Sesame seeds (commonly called "benne") are used in the confectionery and bakery industries, and when crushed yield an edible oil. The plant characters necessary for economic and profitable pro-

Figure 20.—A field of Sesame at the peak of the flowering stage.

Table 26.—Important Characters of Sesame Indicating Desirable and Undesirable Types

Characters of Sesame	Desirable	Undesirable
Number of capsules per leaf axil	3	1
Number of seed rows per capsule	8	4
Color of seed	White	Black
Shape of seed	Roundish-plump	Long, flat
Type of plant	Single stalk	Branching
Color of leaves and stalk at maturity	Yellow	Green
Time of maturity	Early (100 days)	Late (140 days)
Type of capsule	Indehiscent	Dehiscent

Figure 21.—A typical Sesame Plant at the end of the flowering stage.

duction are high yield, high oil content, non-shattering capsules, disease and insect resistance, adaptation to a wide range of soil types, and to mechanical harvesting. The main disadvantages of the present varieties of sesame are their seed shattering and uneven ripening characteristics. A few varieties have recently been obtained which do not shatter when mature. The breeding work now

Table 27.—Yield Tests of Sixteen Varieties of Sesame at Clemson, Florence and Blackville, 1947.

Clemson		Florence		Blackville		Mean for All Locations	
Variety Number	Yield Lbs. per Acre	Variety Number	Yield Lbs. per Acre	Variety Number	Yield Lbs. per Acre	Variety Number	Yield Lbs. per Acre
F-20	466	F-21	774	F-20	921	F-20	680
F-26	413	F-12	736	F-12	890	F-21	637
F-22	381	F-22	676	F-19	814	F-12	618
F-15	373	F-3	656	F-21	782	F-22	609
F-21	356	F-20	653	F-22	770	F-19	575
F-23	333	F-4	623	F-24	751	F-26	542
F-19	323	F-19	587	F-3	715	F-24	533
F-17	301	F-14	586	C-13	701	F-3	520
F-24	282	F-24	565	C-10	667	F-14	499
F-14	250	F-26	552	F-14	661	F-23	491
C-10	235	F-23	550	F-26	661	F-15	490
F-12	229	C-13	544	F-15	629	C-13	479
F-18	196	F-15	467	F-23	589	F-4	435
C-13	191	F-17	451	F-4	554	C-10	425
F-3	188	F-18	436	F-17	301	F-17	423
F-4	127	C-10	373	F-18	298	F-18	310
L.S.D.,1%,	126		199		273		207
L.S.D., 5%,	94		149		204		154

in progress is aimed at the development of high-yielding and non-shattering types with a high oil content and adapted to mechanized production, especially the harvesting of the seed with a grain combine. The present breeding collection consists of approximately 300 varieties and strains of sesame from several countries.

Some of the information obtained thus far is presented below.

Varietal Trials: During the 1947 season, 175 varieties and strains of sesame were grown in order to observe and record the various genetic characters of each variety. Observations indicate that only a few varieties and strains possess desired characters. In Table 26 are shown some of the desirable and undesirable characters of sesame.

Some promising semi-indehiscent types have been selected for future breeding work. Seeds of several indehiscent types of sesame have recently been obtained from various sources and plants from these are now being utilized in the hybridization program.

Yield Tests: Sesame yield tests were conducted at Clemson, Blackville, Florence, and Charleston during the growing season of 1947. The tests included 16 varieties, with each variety replicated four times at each location. A commercial fertilizer (4-10-6) was applied in the drill shortly before planting at the rate of 800 pounds

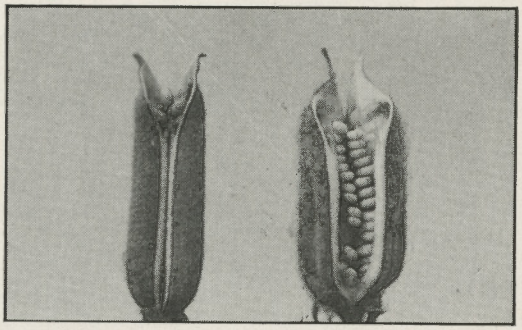

Figure 22.—Actual size of capsules, showing semi-indehiscent type on left and dehiscent type on right.

per acre. Rows were 32 feet long and 3 feet apart. All plantings were made during the latter part of April and the crop was harvested late in August. Excessive rainfall and the presence of diseases caused a complete loss of the crop at Charleston. However, the results of the tests at the other locations are interesting and are summarized in Table 27.

The data indicate that sesame can be grown successfully in various parts of South Carolina. There is a highly significant difference between the relatively low yield at Clemson and the yield

at the other locations. There was only a slight difference between yields at Blackville and Florence. The differences in yield seem to be due largely to the amount of rainfall during the growing season. At Clemson, the rainfall for May, June, July, and August was slightly over six inches. At Blackville and Florence, the rainfall was 25 and 17 inches, respectively, for the same period.

Spacing Tests: A test was conducted at Clemson during the 1947 season in which the rows were spaced 18, 24, 30, 36, and 42 inches apart, and with each spacing replicated five times. Distances between plants in the rows varied as indicated below. Twenty-five plots (27 by 32 feet) arranged in lattice square designs were devoted to the test. Clemson strain #10 was used in the experiment and production procedures other than spacing were comparable for all plots. The seed was planted June 3 and the crop harvested September 16, 1947. Results of the test are summarized in Table 28. The data indicate that the differences in yields from the 18, 24, 30 and 36 inch spacing were not significant, but that there was a highly significant difference between the yield from the 42 inch spacing and those from the other spacings.

Table 28.—Effect of Width of Rows and Number of Plants Per Row on Yield of Sesame Seed.

Row Spacing	Average Number of Plants In Rows 32 Feet Long	Mean Yield In Pounds Per Acre*
18 inches	31	391
24 inches	34	410
30 inches	33	398
36 inches	37	369
42 inches	39	271

* Difference necessary for significance at the 5 percent level, 63 pounds; at the 1 percent level, 87 pounds.

Harvesting: A satisfactory solution to the problem of harvesting sesame mechanically has not yet been found. So far, the following methods have been used to harvest this crop:

(1) Stalks have been cut with corn knives and tied in bundles as lowermost capsules mature. Bundles allowed to dry in a barn loft for ten days or until the seed are ready for threshing.

(2) Harvested as above except the bundles of sesame are allowed to dry in shocks in the field (Figure 23) and threshed when dried. This process usually requires about ten days.

(3) Sesame seed sown broadcast or drilled in 18 inch rows and combined at maturity.

The results of the harvesting studies strongly indicate that hand labor required for harvesting is too expensive for profitable produc-

Figure 23.—Bundles of Sesame in shocks for drying.

tion. In order for sesame to be grown economically, it is essential that non-shattering varieties be developed for mechanized harvesting.

Chemical Composition of Sesame Seed: Oil content of the seed varies from 34 to 56 percent according to analyses made by the Department of Chemistry Research. Analyses of two sesame varieties are summarized in Table 29.

Table 29.—Chemical Composition of Sesame Seed, 1947.

	Strain No. 4519	Strain No. 4520
Moisture at 100° C.	2.98%	2.29%
Ash	6.14%	5.70%
Fat and Oil	43.92%	46.86%
Crude Protein	24.50%	22.81%
Crude Fibre	9.70%	12.05%
Nitrogen-Free Extract	12.76%	10.29%
	100.00%	100.00%

After removing the oil from the seed, a valuable and nutritive residue, sesame meal, remains. This meal contains approximately 45 percent protein, a very high percentage of which is digestible.

The Chinese Chestnut

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

The Chinese chestnut (Castanea mollissima) has been planted in trial plots in various parts of the United States because of its resistance to chestnut blight, a disease which has practically destroyed all the stands of native chestnut trees (Castanea dentata) throughout the country. In 1939-40, several Chinese chestnut seedlings, obtained through the courtesy of the U. S. Department of Agriculture, were set out at Clemson. The trees have been growing in a sandy clay soil in a sheep pasture, without care or fertilization, and range in height from six to fifteen feet.

The quantity of nuts gathered in 1947 varied from a few to slightly over three quarts per tree. Four of the trees were barren. The nuts varied in size, color and quality, some probably being as sweet as native chestnuts and others being starchy in flavor. The color of the nuts from different trees varied from a bright light brown to a dull dark brown. Differences in time of harvest and size of nuts as determined by number of nuts per pound are shown in Table 30.

Table 30.—Chinese Chestnut — 1947 Harvest

Tree Number*	Number Nuts Per Pound	Date of Harvest
1	35	Sept. 15
2	40	Sept. 22
3	56	Sept. 22
4	34	Sept. 22
5	47	Sept. 29
6	30	Sept. 29
7	28	Oct. 6
8	33	Oct. 6

* Trees bearing less than one pound not included.

Whether the Chinese chestnut will prove suitable for orchard cultivation and/or timber is a point for speculation. Apparently, strains suitable for both purposes exist. One South Carolina grower has about an acre of trees twenty-three years old on rough, rocky land difficult to cultivate which produce as much as a bushel of nuts per tree. None of the trees is over twenty feet high.

INSECTS AND THEIR CONTROL

Oriental Fruit Moth

(O. L. Cartwright)

Preliminary field trials of some of the newer organic insecticides for the control of the Oriental fruit moth were started during 1947. The season's studies included one and two sprayings, with three dif-

ferent insecticides of four varieties of peaches in randomized plots in the Clemson College variety orchard. The first spray was applied on May 28, approximately six weeks before harvest; and the second received an additional application on June 18, approximately four weeks before picking. The variety Rio Oso Gem, because of its much later ripening received sprays approximately eight and twelve weeks before harvest. Spray materials used were 5 percent methoxy-DDT, 5 percent Rhothane, and 5 percent DDT. They were applied with a four-nozzle broom at 300-400 pounds pressure.

In taking infestation counts, all fruits obtained at the first picking were cut open; in later pickings only peaches showing external evidence of infestation were cut. Curculio damage was quite high in the earlier varieties but low in Rio Oso Gem. Oriental fruit moth infestation was moderate in the earlier varieties but high in Rio Oso Gem. Data on Sunbeam, the earliest variety, was incomplete and had to be discarded because the pickers mixed the first picking with fruit from the remainder of the orchard. Data for the other varieties are shown in Table 31. Results obtained in this first season's preliminary tests were inconclusive. None of the treatments gave results significantly better than the check.

Table 31.—Number and Percentage of Peaches Damaged by Oriental Fruit Moth in Plots Sprayed Once and Twice with Different Insecticides

Insecticide	Approximate Days From Last Spray To Harvest*	Variety					
		Fireglow		Sunhigh		Rio Oso Gem	
		Damaged Fruit Per Tree					
		No.	Percent	No.	Percent	No.	Percent
5% Methoxy-DDT	54	14	3.28	5	1.60	63	6.82
	34	19	3.43	19	3.43	22	4.20
5% Rhothane	48	8	1.45	8	1.45	32	6.63
	34	7	3.21	8	1.21	21	4.06
5% DDT	86	24	7.05	14	4.29	85	18.84
	66	0	---	13	2.00	45	5.50
Check		14	5.09	28	6.34	49	5.30

* Upper figures in each case indicate results from one application of the insecticide while the lower figures are for two applications.

The Corn Earworm

(O. L. Cartwright)

Studies of the insecticide control of the corn earworm during the 1947 season included three series of tests: one each on sweet corn, field corn, and tomatoes. When the insect attacks tomatoes, it is known as the tomato fruitworm.

The Clemson tomato fruitworm plots suffered severely from blossom end rot due to adverse growing conditions and were only lightly damaged by worms, the maximum amount of wormy fruit being only 5.82 percent in the check plots. The insecticides tried gave about equal control and reduced the wormy fruits approximately 50 percent as compared with the check. Three applications of insecticides were made at fifteen day intervals. Table 32 presents a summary of the data obtained.

Table 32.—Tomato Fruit Worm Control.

Insecticide	Percent Wormy Fruit	Percent Rotten Fruit
2% Rhothane Spray	1.84	35.10
5% DDT Dust	1.98	31.68
5% Dowklor (Chlordane)	2.21	41.82
5% Rhothane Dust	2.36	24.64
5% Methoxy-DDT	2.87	32.37
Check	5.82	52.73

Methods for control of the corn earworm in sweet corn included two applications at an interval of four days of four different materials in small duplicated plots of Oto corn, the first application being made when the silks began to wilt and turn brown. Oil was applied, 1/2 cc. per ear, by use of a small hand applicator. Dusts were blown into the silks by means of hand dusters. A summary of the data obtained is shown in Table 33. Ears in which worms were found in the silk at the tip of the ear but which had not eaten into the ear are listed in the column headed "Infested but not damaged."

Table 33.—Control of Earworm in Sweet Corn.

Treatment	Nunber uninfested ears	Number ears infested but not damaged	Number damaged ears	Undamaged ears Percent	Damaged ears Percent
½ cc. Oil per ear	41	15	0	100	0
5% DDT Dust	45	11	20	73.7	26.3
5% Rhothane Dust	23	6	26	52.7	47.3
5% Methoxy DDT Dust	12	10	44	33.3	66.7
Check	6	2	62	11.4	88.6

In insecticide tests against the earworm in field corn on duplicated plots, nine different sprays and dusts were applied twice, the first application when the first silks turned brown and the second a week later, the entire plot being treated each time with rotary hand dusters or compressed air sprayers. The plots were harvested and examined when the general crop was harvested. Ears were listed as undamaged if the earworm failed to reach the grains of the ear, and as damaged if the tip grains were eaten. Table 34 presents a

summary of the insecticides used and the data recorded. None of the sprays and dusts gave adequate control; however, it is believed unfavorable growing conditions and irregular silking were important factors in producing the results obtained. By using hybrid corn with a more uniform silking date and by better timing of the insecticide applications, much more favorable results should be obtained.

Table 34.—Earworm Control in Field Corn

Insecticide	Number Undamaged Ears	Number Damaged Ears
5% DDT Spray	21	136
2% DDT Spray	6	121
5% Rhothane Spray	5	148
5% Chlordane Spray	0	139
20% Toxaphene Dust	3	130
5% Rhothane Dust	0	110
5% DDT Dust	2	131
5% Chlordane Dust	1	133
5% Gametox Dust	2	123
Check	2	122

Sweet Potato Weevil

(O. L. Cartwright)

The sweet potato weevil, a very destructive tropical insect infesting wild host plants and sweet potatoes from eastern Texas along the Gulf Coast to Florida and Georgia, was first found in South Carolina on the Isle of Palms, in December, 1944. Surveys made since by the Crop Pest Commission and the U. S. Bureau of Entomology and Plant Quarantine have revealed this pest in seaside morning glory, *Ipomoea litteralis* and local sweet potatoes on James, John's, Folly and Sullivan's Islands, and parts of the mainland near Charleston, Mt. Pleasant, and McClellanville. During 1947, the weevil was found by the same workers in another morning glory, *Ipomoea pes-capra* (L.), also on the Isle of Palms.

In September, 1947, this station started work on a project having the following objectives: (1) To determine the life history of the sweet potato weevil under conditions existing in this state; (2) to devise effective control measures for this pest in sweet potatoes and wild host plants; (3) to devise effective methods for the eradication of wild host plants.

To test the effectiveness of several herbicides and plant poisons against the seaside morning glory, field plots were established on the Isle of Palms and the first sprays applied September 10. The following materials were used:

Ammonium sulfamate (Du Pont Ammate), 3 pounds to 3 gallons water.

Atlacide, 4-1/2 pounds to 3 gallons water.

Esteron 44 (isopryopyl ester 2, 4-D), 1 pint to 50 gallons water.

2, 4-Dow powder (2, 4 Dichlorophenoy acetic acid) 1 pound to 50 gallons water.

2, 4 Dow liquid 40 percent (2, 4 Dichlorophenoy acetic acid) 3 pints to 50 gallons water.

Examination of the plots two weeks later showed that the growth of the vines was killed by all materials used except Ammate. A few scattered leaves were still green on the "2, 4 Dow powder" plot but it was thought these were likely missed when the spray was applied. Before the plots were visited again the plants were destroyed by unusually high tides caused by the hurricane of September 24, and it was not determined if the underground roots and stems were killed by the various treatments. These tests will be continued during 1948.

Red Spider on Peaches

(O. L. Cartwright)

During the latter part of May, 1947, a very severe outbreak of red spider occurred in sections of the Clemson College variety peach orchard. The infestation apparently built up in weeds and other ground cover in the orchards and spread into the trees, the lower limbs in every case being severely infested before the mites were noticeable in the center and tops. When the orchard was first examined on May 26, samples of twenty leaves taken from each of six scattered trees revealed an average infestation of 61.7 mites per leaf.

Three different insecticides were applied the same morning, application being made at 300-400 pounds pressure with a four-nozzle broom. The same materials were used in a second application seven days later. These materials were hexaethyltetraphosphate (1/4 pint to 50 gallons water), tetraethylpyrophosphate (1/8 pint plus 2/3 cup Du Pont spreader-sticker to 50 gallons water), and DN1-11 (at 1-1/4 pounds per 50 gallons water). Spreader-sticker unintentionally omitted from the first application of hexaethyltetraphosphate was added in the second application. None of the materials injured the foliage even though temperatures of 86 and 89° F. were recorded on the days applications were made. Table 35 shows average leaf counts of mites on the selected trees before and after the sprays were applied. All sprays gave an excellent reduction in the mite infestation; however, in all cases except that of DN1-11, the mite population immediately recovered and increased rapidly. The DN1-11 had a residual effect, further decreasing the mite count even a week after the application.

Table 35.—The Effect of Various Organic Insecticides in Controlling Red Spider Mites on Peach Trees.

Date Inspected	Average Number of Mites Per Leaf					
	Tree No. 1 HETP*	Tree No. 2 HETP	Tree No. 3 TEPP	Tree No. 4 TEPP	Tree No. 5 DN1-11	Tree No. 6 DN1-11
May 26	73.7	38.3	50.8	30.2	80.1	52.6
Spray Applied**	---	---	---	---	---	---
May 27	9.2	3.4	18.3	9.9	8.7	9.2
June 30	17.3	24.0	64.5	34.3	2.0	8.7
July 3	46.9	34.1	96.5	73.2	0.5	4.2
Spray Applied	---	---	---	---	---	---
July 4	2.4	1.8	4.0	2.2	0.9	3.1
July 9	9.1	6.9	11.7	6.3	0.8	0.3

* Hexaethyltetraphosphate was used on trees 1 and 2, while tetraethylpyrophosphate was used on trees 3 and 4, with DN1-11 being used on trees 5 and 6.

** The sprays were applied immediately after the inspections were made on May 26 and July 3.

Honeybee Improvement

(David Dunavan)

The bees tested for honey production in 1947 were the progeny of queens which were daughters of a queen heading one of the highest producing colonies of the 1946 season. Queens of the 1946 season were in turn daughters of queens heading the highest producing colonies of the 1945 season. The performance of this stock during the 1947 season has been compared with bees from queens secured from several commercial queen breeders. Apparently the effect of the selective breeding program is becoming evident in the increased honey crops produced by colonies headed by these selected queens.

The largest crop of honey produced by any of the colonies on test was 200 pounds. This amount was produced by a colony headed by a queen of the selected stock. The largest crop produced by any of the colonies headed by other queens was 160 pounds. The average production of five colonies headed by queens of the selected stock was 155 pounds as against an average of 137.8 pounds produced by eight hives headed by queens of regular commercial stock.

ANIMAL HUSBANDRY

Methods of Storing Cured Pork

(L. V. Starkey, E. G. Godbey, R. R. Ritchie, and J. H. Mitchell)

Cured smoked hams and bacons were stored at 36° F. and room temperature in cloth sacks, refined cottonseed oil and raw cottonseed oil in order to determine which of the three methods was superior for storing these pork products.

Samples of the meat were cooked and graded by a committee of three at regular eight week intervals during a 48 week storage

period. The meat was graded for aroma, tenderness, juiciness, and flavor, and listed as being desirable, moderately desirable, or slightly desirable.

Free fatty acid determinations were made at the time of each test.

Table 36.—Quality Ratings of Pork Stored Over a 48 Week Period and Examined at Regular Intervals of Eight Weeks. (Each Rating is the Average of the Ratings of Three Individuals).

Covering	Period*	Bacon		Ham	
		Room	36° F.	Room	36° F.
Paper and Cloth Sack	1st	M—**	D—	D	S+
	2nd	D—	D	S+	D—
	3rd	S+	D	D	M
	4th	S+	D	S+	M+
	5th	S—	D	S+	S+
	6th	M—	D	M+	M+
Refined Cottonseed Oil	1st	D—	D	D	D—
	2nd	M+	D	D—	D—
	3rd	D—	D—	M—	D—
	4th	M+	D	M+	D—
	5th	M+	D—	M+	M+
	6th	S+	D	S+	M+
Raw Cottonseed Oil	1st	M	M+	D—	D
	2nd	D—	D—	M—	D
	3rd	M+	D—	M—	D—
	4th	M+	D	M+	M+
	5th	M+	D	D—	M+
	6th	M+	D—	S+	M+

* The examination periods were at regular intervals of eight weeks over the 48 week storage experiment.
** D=Desirable, M=Moderately desirable, S=Slightly desirable.

Bacon Tests

Temperature was an important factor in the keeping quality of bacon. The samples stored at 36° F. graded significantly higher than those at room temperature regardless of the covering. There was no difference between the meats in raw and refined oil at 36° F. or at room temperature.

When the bacon was stored at 36° F. or at room temperature there was no advantage in the use of refined oil. The samples covered with raw oil at room temperature graded significantly higher than those stored in cloth bags.

There was a highly significant negative correlation between the grades and free fatty acid content of the samples.

Ham Tests

Temperature was not an important factor in the storage of the hams used in these tests. There was no significant difference between the grades of hams stored in cloth bags or oil at 36° F. or room temperature. The kind of oil used did not effect the grade of the meat at 36° or room temperature.

There was a highly significant negative correlation between the grades and free fatty acid content of the samples.

Dehydrated Sweet Potatoes for Fattening Swine

(E. G. Godbey, J. H. Mitchell, and L. V. Starkey)

Thirty-nine hogs were fed individually to test the value of dehydrated and blanched dehydrated sweet potatoes for fattening swine.

The results of these feeding tests are shown in Table 37.

Table 37.—Rations, Weights, Daily Gains, and Feed Requirements for Hogs Fed Dehydrated and Blanched Dehydrated Sweet Potatoes

RATION		(Check) Ground Corn and Supplement*	Dehydrated Sweet Potatoes and Supplement	Blanched Dehydrated Sweet Potatoes and Supplement
Number hogs fed		13	13	13
Days on Test		56	68	53
Average Initial Weight (lbs.)		106	106	110
Average Final Weight (lbs.)		199	194	198
Average Daily Gain (lbs.)		1.66	1.29	1.66
Feed Eaten for	Concentrates (lbs.)	300.08	359.91	272.11
100 lbs.	Supplement (lbs.)	43.60	97.63	68.21
Gain	Mineral (lbs.)	5.26	6.47	5.21

* Supplement—
½ fishmeal
¼ cottonseed meal
¼ alfalfa leaf meal

Ordinary dehydrated sweet potatoes were not a satisfactory feed for fattening swine. The hogs fed this ration made slow and expensive gains. However, hogs fed sweet potatoes that were blanched before dehydration made gains equal to those in the check lot and the feed requirements for one hundred pounds of gain were satisfactory.

This experiment indicates that if corn is selling for $90 per ton and supplement for $100 per ton, dehydrated sweet potatoes have a value as feed of $60 per ton and blanched dehydrated sweet potatoes $84 per ton, as compared with corn.

CHEMISTRY

Nutritive Value of Cowpeas

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

Cowpeas are being studied by several southern experiment stations to determine their value in human nutrition and to explore the possibility of developing varieties which have greater nutritive value.

In connection with this project, samples of six varieties grown by the Horticultural Department were collected at three stages of maturity—snap, green shelled, and mature shelled.

The ascorbic acid and carotene content of the snap and green shelled stages of the cowpeas was determined and the results are shown in Table 38. A feed analysis of each of the samples was also made and the data are presented in Table 39.

Table 38.—Ascorbic Acid and Carotene Content of Cowpeas At The Snap and Green-shelled Stages of Maturity.

Variety	Vitamin Content, mgs. per 100 grms. dry sample			
	Snap		Green Shelled	
	Ascorbic Acid	Carotene	Ascorbic Acid	Carotene
Alacrowder	193.77	6.08	49.08	0.442
Cream Long Pod	205.43	9.98	88.67	0.842
Alalong	259.23	7.38	63.75	0.576
Alabunch	199.84	8.32	61.41	0.719
Sugar Crowder	215.74	8.42	61.45	0.453
Grant	263.72	5.89	98.93	0.822
Average	222.78	7.67	70.50	0.642

Enrichment of Corn Products

(E. J. Lease)

Improvement of the nutritive value of corn meal and grits by the enrichment process is being practiced by an ever increasing number of mills. During the past year, 42 additional South Carolina mills began voluntary enrichment of whole corn meal, bringing the total to 240. This department has worked in close cooperation with the Extension Service in taking the program to the people of the state and to the entire South.

The final federal standards for enriched corn meal and enriched grits were promulgated during 1947. These new standards, which are the same as the enriched flour standards, are now in general use. Provisions in the laws of five southern states requiring enrichment of degerminated meal and grits make the state laws automatically conform to the federal standards.

Table 39.—Feed Analysis of Cowpeas at Three Stages of Maturity Expressed as Percent of Dry Sample

Variety	Dry Matter	Ash	Fat & Oil	Crude Protein	Crude Fiber	Starch
SNAP						
Alacrowder	13.80	6.32	2.68	27.51	9.69	25.80
Cream Long Pod	11.93	5.83	2.60	26.06	10.50	15.25
Alalong	12.06	5.75	3.00	21.79	9.04	21.32
Alabunch	12.44	6.48	2.68	24.12	11.33	19.02
Sugar Crowder	12.35	6.99	2.45	23.66	10.43	20.64
Grant	12.64	6.49	1.90	23.24	9.21	21.25
Average	12.54	6.31	2.55	24.40	10.03	20.55
GREEN-SHELLED						
Alacrowder	42.10	4.75	2.10	25.78	4.43	46.50
Cream Long Pod	36.87	4.63	1.89	25.37	4.28	47.84
Alalong	40.30	4.69	1.58	24.09	5.19	47.61
Alabunch	38.85	4.79	2.00	25.67	4.38	47.63
Sugar Crowder	43.54	3.70	2.60	23.82	5.00	42.25
Grant	36.03	4.20	2.42	25.03	4.36	44.68
Average	39.61	4.46	2.09	24.96	4.61	46.08
MATURE-SHELLED						
Alacrowder	88.50	4.60	1.56	28.00	3.72	50.7
Cream Long Pod	89.21	4.52	1.31	27.37	4.46	50.7
Alalong	89.19	4.20	1.94	24.73	3.65	50.2
Alabunch	89.36	4.68	0.99	25.18	4.32	50.1
Sugar Crowder	89.48	4.45	1.40	25.77	4.98	42.5
Grant	89.57	4.58	1.51	25.15	3.62	53.3
Average	89.22	4.50	1.45	26.03	4.12	49.6

A concerted effort has been made to impress upon groups and individuals the value of enrichment of meal and grits. A natural color sound film of 14 minutes running time was produced to aid in the education of the public on this subject. The film has been recognized as an outstanding educational film on nutrition. Twenty-two copies of the film have been purchased by schools and health departments in 14 states, most of which are in the South. The film shows why corn meal and grits should be enriched and graphically illustrates the foods recommended for good diets. It dramatizes the history of the corn enrichment program and illustrates with step-by-step close-ups how to equip a corn mill to enrich meal and grits. The film demonstrates special feeder design for enriching meal and grits in small mills. It shows why grits enrichment can't wash out when grits are washed before cooking, and many other things related to the program and its importance. The film is available for use by interested groups.

DAIRYING

Winter Grazing For Dairy Cattle

(S. P. Marshall, J. P. LaMaster, J. H. Mitchell)

Italian ryegrass and crimson clover provided lactating dairy cows with winter grazing for 161 days between December 2, 1946 and May 12, 1947. There was one day in February when the forage could not be grazed because it was covered with sleet.

In the spring of 1946, an area of 6.5 acres was treated with 4000 pounds of dolomitic limestone, 900 pounds of superphosphate and eight tons of manure per acre. A grazing crop of sweet sudan grass was grown during the summer. On September 19 and 20, 1946, the land was double-cut with a tractor-drawn cutaway harrow, and 600 pounds per acre of a 6-10-4 fertilizer distributed with a drill. Twenty pounds of inoculated crimson clover and thirty pounds of Italian ryegrass seed were mixed and sown at this rate per acre with a cyclone seeder. The area was then cultipacked. Applications of 100 pounds of nitrate of soda per acre were made in March and April, 1947.

Figure 24.—Dairy cattle grazing in February on an experimental winter pasture composed of Italian rye grass and crimson clover.

The Italian ryegrass was eleven inches high and the crimson clover five and a half inches high when grazing was started on December 2. This accumulated reserve of forage, together with that produced during the slower growth period of winter, was adequate

to provide three hours grazing per day for eight cows from December 2nd to April 7th. The number of cows was increased to fourteen and the grazing time increased to six hours per day April 7th. Growth of the forage was so rapid at this time that it was necessary to increase the cows to eighteen on April 16th. Hay feeding was discontinued and the cows grazed continually night and day, except for milking time, from April 16th to May 12th.

The cows in the grazing test received in addition concentrate feed and lespedeza hay from December 2nd to April 7th, but only the concentrate from the latter date to May 12th. A check group of an equal number of comparable cows was barn-fed lespedeza hay, corn silage and the same concentrate. During the 162 days of this test, the cows on winter grazing produced 55,758 pounds of 4 percent fat corrected milk, as compared with 50,170 pounds for the barn-fed group. Winter grazing increased the milk production 11.1 percent on 47.1 percent less nutrients than barn feeding. Feed replaced by the pasture, plus that which would have been required for an additional 11.1 percent more milk on the barn feeding plan, was equivalent, on the total digestible nutrient basis, to 22.06 tons of lespedeza hay. At the prevailing price of $35.00 per ton for lespedeza hay, feed replacement benefits from the pasture amounted to $118.77 per acre. The cost of land preparation, fertilization, and seeding totaled $43.95 per acre.

The Chemistry Department made analyses of pasture clippings collected every two weeks and of composite milk samples taken every four weeks. Food analyses and carotene assays were made of the grass samples, while carotene and vitamin A assays were made of the milk samples.

With the exception of carotene content, the composition of the grass varied very little over the period of the experiment. Its carotene content varied from 13 milligrams per 100 grams of green material in December to 7.3 milligrams in February and 10.6 milligrams in May. The carotene and vitamin A contents of the milk from barn-fed cows and from those having access to the winter pasture are shown in Table 40.

It will be noted that there were increases in the average carotene and vitamin A values of the milk produced by the cows on the experimental pasture of approximately 90 percent and 61 percent, respectively, as compared with the values found at the beginning of the experimental period. These constituents in the milk from the barn-fed cows decreased 12 percent during the same period.

The winter grazing crop saved the cost of harvesting, storing and feeding large amounts of hay and silage. The sod of the Italian ryegrass and crimson clover mixture was so thick that the pasture never became muddy, even during the heaviest rainy periods. The soil was not injured by grazing, and pasture cows were cleaner than

Table 40.—Carotene and Vitamin A Content of 4 Percent Standardized Milk Produced By Guernseys and Holsteins on Barn Feeding and Winter Grazing.

Date	Barn-Fed Group				Winter Grazing Group			
	Guernseys		Holsteins		Guernseys		Holsteins	
	Micro-grams per 100 grams of milk							
	Carotene	Vitamin A	Carotene	Vitamin A	Carotene	Vitamin A	Carotene	Vitamin A
12/1-2/46	53.44	28.19	12.76	18.14	53.41	29.43	12.01	13.11
12/15-16/46	41.22	22.33	12.97	23.35	70.99	32.09	27.00	28.35
1/12-13/47	29.90	13.80	10.81	13.98	93.04	38.15	30.76	37.78
2/9-10/47	39.61	19.80	13.25	15.00	99.60	36.73	34.65	25.99
3/9-10/47	47.19	20.57	12.35	16.56	97.01	36.23	37.31	29.05
4/6-7/47	57.01	22.44	18.33	16.26	96.63	56.07	32.76	27.57
5/3-4/47	41.22	25.19	14.84	13.57	94.30	41.40	33.21	22.44

the check group housed in covered sheds. The milk from the cows on winter grazing showed greatly improved carotene and vitamin A values. These results were obtained by planting early and by controlled grazing to conserve the growth produced before cold weather.

Official Testing of Dairy Cattle

(Wayne T. O'Dell)

Fifty-five owners of registered dairy cattle participated in the official testing program for the year 1946-47 with a total of 762 cows. Three hundred and fifty-six of these cows completed records of 305 or 365 days in length.

The production records of these cows were as follows:

Table 41.—Production Records of Cows on Official Test.

Number of Cows	Breed	Average Production, Pounds	
		Milk	Butterfat
11	Brown Swiss	7,767	825
192	Guernsey	935	466
93	Holstein	11,355	415
60	Jersey	6,994	391

In the accompanying table are shown the records of the individual cows in each of the four breeds which had the highest production records during the year.

POULTRY

Protomone in Turkey Breeding Rations

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

During the past year studies have been conducted on the use of protomone (synthetic thyroxin) in the ration of breeding turkeys. Attempts have been made to determine the best amount of the hormone to use and its effect upon egg production, fertility and hatchability in hens, and on semen production in males. Both first year and second year hens were used in these studies. The males used were first year birds.

The results obtained to date indicate the following:

1. That with second year turkey hens, selected on the basis of high egg production records in their first year of laying, no increase in number of eggs laid may be obtained.

2. That with first year turkey breeders protomone increases egg production, particularly in the latter part of the breeding season.

Table 42.—Individual Brown Swiss, Guernsey, Holstein and Jersey Cows Having the Highest Production Records in South Carolina During the period July 1, 1946 to June 30, 1947

Name of Cow	Breed	Owner	Sire	Class	Age	Days on Test	Times Milked Per Day	PRODUCTION				Butterfat Production Factor
								Milk, Pounds	Fat, Pounds	Fat %	Fat, breed average, same age and class, pounds	
Evergreen Heights Rosalie	Brown Swiss	Clemson Agricultural College	Royal Jane's Ambassador of Vernon	HIR	Jr. 2	305	2	8414	383	4.55	283.3	135.3
Briar's Silver Rosebud	Guernsey	J. B. Guess, Jr. Denmark	Hilltop Butter-fat Briar	AA	6-10	365	3	15061	827	5.49	582.0	142.1
S.C.S.H. Pilot Boast Artis Alberta	Holstein	S. C. State Hospital, Columbia	Winterthur Pilot Posch Seminole	HIR	3-2	365	2	16005	626	3.91	385.9	162.2
Design Favorite Hope	Jersey	W. W. Crim, Moore	Favorite Nicotine Design	HIR	5-5	305	2	11297	678	6.00	421.1	161.0

3. That the optimum levels of this product to use in the ration of breeding turkey hens for maximum egg production is approximately 15 grams per 100 pounds of the ration. This is in general agreement with results obtained with chickens.

4. That fertility is not affected by protomone feeding but a slight reduction in hatchability may result.

5. That semen production in males is not affected at a feeding level of 10 grams of protomone per 100 pounds of diet. This is the only level used to date with male birds.

Studies with this hormone in turkey breeding rations are being continued. It appears that with unselected turkey breeding stock, an increase in egg production and a greater number of poults during the breeding season may be obtained by the use of protomone.

Comparison of Hegari and Yellow Corn in Turkey Growing Rations

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

During the past year a comparison has been made between hegari, a variety of grain sorghum, and yellow corn as components of a turkey growing ration. A standard turkey starting ration containing 24 percent protein and made up of yellow corn, wheat middlings, alfalfa leaf meal, meat scraps, soybean oil meal, dried whey, calcium carbonate, salt, manganese sulphate and a vitamin A and D supplement was fed to a check lot of 55 Small Type White turkey poults from the time they were one day old to 28 weeks of age. To rations fed similar groups of poults, Hegari was substituted for one-half of the yellow corn in one lot and for all of the yellow corn in another lot. After 12 weeks, whole oats were fed to all groups in hoppers free-choice to the end of the test. In all diets the amounts of vitamin A were ample to meet the requirements of the poults. The results of this test are shown in Table 43.

Table 43.—Hegari Versus Yellow Corn in A Turkey Growing Ration.

Ration	Yellow Corn	½ Yellow Corn ½ Hegari	Hegari
No. Poults started	55	55	55
Ave. wt. 28 wks., lbs.			
Males	14.18	14.55	14.41
Females	8.37	8.41	8.27
Pounds mash per pound of gain	4.11	4.17	4.09
Pounds oats per pound of gain	1.47	1.61	1.42
Total pounds feed per pound of gain*	5.58	5.78	5.50
No. poults died	7	9	7
Percent Mortality	12.7	16.4	12.7

* No weight gain during a period of 4 weeks due to an outbreak of Trichomoniasis.

The results show no material difference in weights of birds (males or females) at 28 weeks of age nor in amounts of feed consumed per pound of gain by the various groups. An outbreak of Trichomoniasis increased feed consumption per pound of gain, since during a period of 4 weeks following the attack no gain in weight was recorded. A slight increase in mortality of birds in the group in which Hegari was substituted for one-half of the yellow corn was not associated with the diet. The mortality in the groups receiving all corn and all Hegari was the same.

From this trial, which is in agreement with similar tests made elsewhere comparing yellow corn and grain sorghums in poultry rations, it may be concluded that Hegari can be satisfactorily substituted for yellow corn in turkey growing rations. Since Hegari is lacking in vitamin A it is necessary to provide for this factor in the diet when it is used to replace yellow corn.

Hegari is increasing in acreage in this state. Its use in turkey rations along with locally grown oats should materially decrease the cost of turkey production in South Carolina.

COAST EXPERIMENT STATION

(E. D. Kyzer, Superintendent)

The Pickup Baler Method of Harvesting Lespedeza Hay

(E. D. Kyzer, T. M. Clyburn)

The trend of practices of South Carolina cattlemen is toward the use of winter grazing crops and the elimination of harvested roughages as much as possible in the wintering of beef cattle. This method has its economical advantages. However, over a period of twenty years it has been observed that climatic conditions often prevent the successful production or use of winter grazing crops on certain soil types of the state. On these areas, the economical production and harvesting of hay is sound insurance for the satisfactory wintering of cattle. Consequently, the study of the automatic baler method of harvesting lespedeza hay was continued in 1947.

Approximately 45 acres of Kobe lespedeza, sown in oats at the rate of 35 pounds per acre were used in the study. In harvesting, sufficient acreage for one day's run of the automatic baler was mowed with a tractor mower and windrowed with a tractor side-delivery rake on the following forenoon. The hay was baled when sufficiently dry to allow immediate storage in an open shed without heating.

While climatic conditions in 1947 were not as favorable as in 1946, it was definitely observed that only with practically pure stands of lespedeza producing less than two tons per acre was it safe to bale hay on the day following mowing. When considerable weeds and grass were in the lespedeza and/or the yields were two

tons or more per acre, from two to three days of curing weather following mowing were required. In 1947, a medium amount of rain fell on the hay that had been windrowed, as well as that which remained in the swath. The hay which had previously been windrowed, even though turned with a side-delivery rake, was practically worthless when dry enough to bale. That which remained in the swath during rain produced palatable off-color hay when baled.

Summary:

Since this study was conducted during two years of poor haying conditions it is concluded:

(1) That the pickup baler method is practical for the harvesting of lespedeza hay in coastal South Carolina;

(2) That when pure stands of lespedeza are obtained, and when yields of less than two tons per acre are produced, it is safe to bale the hay on the day following mowing;

(3) That when weeds and grasses are present in the hay and/or the yield is two or more tons per acre, from two to three days of curing weather are required before it can be safely baled;

(4) That after hay has become wet from rain in windrows the baled product will not be satisfactory.

The Use of Brahman Bulls For the Production of Market Calves

(T. M. Clyburn, E. D. Kyzer, L. V. Starkey, and E. G. Godbey)

The growing popularity of Brahman cattle and the claims made by their enthusiastic breeders prompted the Clemson College Animal Husbandry Department to undertake a test to compare the birth weights, rates of growth, weaning weights, live grade, carcass grade, and the dressing percentage of purebred Angus calves versus Angus-Brahman crossbred calves.

Forty purebred Angus cows at this station were selected in 1947 to produce the offspring that will be used in the test. The plan was to breed twenty cows to a Brahman bull and twenty to Angus bulls. After the first calf crop the two groups were to be reversed to eliminate the effects of variations between the mothers of the two groups. All offspring from these two groups will be used in the comparisons. This work is planned to cover a 4-year period.

Observations confirm the opinion of Brahman breeders who contend that the sexual development of Brahman cattle is slow. The bull secured for this work, although three years of age June 15th, failed to breed any cows until late in the season. Rather than disrupt the breeding schedule and have late calves in the Brahman lot, the breeding period was terminated in early August. Due to this fact, the number of crossbred calves for comparison in 1948 will be fewer than desired. However, the 1948 calf crop should provide a suitable number.

Corn Variety Test

(E. D. Kyzer, T. M. Clyburn)

With the increasing interest in livestock farming and the development of satisfactory machinery for planting, cultivating, and harvesting corn, production of this crop is receiving greater attention.

The 1947 variety test conducted at this station included 34 white and yellow open-pollinated and hybrid varieties of corn. The difference of 33.9 bushels per acre between the highest and lowest-yield-

Table 44.—Corn Variety Test, Coast Station, 1947

Varieties	Yield, Bushels Per Acre	Shelling Percentage	Number ears per bushel shelled corn
White Varieties			
Tenn. 5109	95.24	84.65	186.9
Broadbent	91.67	85.32	141.8
N. C. T-20	91.07	84.29	129.6
Broadbent #2	90.18	84.40	148.6
Wood's Hybrid S-360	83.34	83.58	206.4
Wood's Hybrid S-315	82.14	83.64	207.0
Miss. 5111	78.27	84.57	209.5
N. C. 1111	77.98	85.90	147.5
Douthit's White Prolific	77.08	85.77	171.2
Hastings' White Prolific	77.08	84.26	277.6
Louisiana 502	76.19	84.21	228.4
Louisiana 1030	75.00	83.17	160.0
Wood's Hybrid White Prolific S-350	75.00	82.62	162.7
Funk's Hybrid G-790W	74.41	83.33	166.6
Florida W-1	67.26	83.70	234.9
Latham's Double	66.37	82.15	183.8
State Hospital	61.31	81.42	143.3
Yellow Varieties			
Funk's Hybrid G-717	88.69	82.55	191.7
Funk's Hybrid G-714	83.63	80.98	177.0
N. C. 5002	79.46	82.15	221.5
Wood's Hybrid Golden Dent V-60	77.08	83.01	134.9
Wood's Hybrid Golden Prolific S-210	75.89	84.15	192.4
N. C. 1032	75.89	83.34	195.0
Dixie 44	75.59	80.83	153.5
Hastings' Yellow Prolific	74.70	82.61	259.7
Keystone #222	74.41	82.50	142.5
N. C. 26	72.91	85.07	186.5
Wood's Golden Prolific	72.62	83.56	253.4
Wood's Indian Chief	71.73	82.32	197.8
Wood's Hybrid Yellow Flint S-240	71.43	81.08	168.0
N. C. 27	70.83	82.07	152.5
K-374	70.24	79.07	173.7
Wood's Jarvis Prolific	67.86	83.52	153.3
Douthit's Yellow Prolific	66.37	83.83	177.8

All varieties planted May 5th and harvested November 13th.
Fertilized with 400 lb. 4-10-6 at planting and side-dressed with 200 lb. nitrate of soda.
Size of plots 1/100 acre, replicated twice.

ing white varieties showed definitely that an adapted high-yielding variety is of first importance. Varietal characteristics, other than high yield, related to economy of harvesting by hand, adaptation to mechanical pickers, and resistance to insect damage in the field or in storage, are also of considerable economic importance. Data recorded from this test show a highly prolific variety to have produced 3,542 ears per acre more and 18 bushels per acre less than the highest yielding variety. One-third more hand labor was required to harvest a bushel of corn from this lower-yielding variety.

Table 45.—Weevil Damage to Ear Corn at Harvest, Coast Station, 1947

Varieties	Ears with no damage, percent	Ears with indicated degree of weevil damage, percent		
		Light 0-5%	Medium 5-25%	Heavy 25-100%
White Varieties				
Tenn. 5109	3.3	86.7	6.7	3.3
Broadbent	3.3	70.0	23.4	3.3
N. C. T-20	---	90.0	10.0	---
Broadbent #2	---	70.0	13.3	16.7
Wood's Hybrid S-360	13.3	86.7	---	---
Wood's Hybrid S-315	3.3	83.3	13.4	---
Miss. 5111	3.3	90.0	6.7	---
N. C. 1111	16.7	80.0	3.3	---
Douthit's White Prolific	---	100.0	---	---
Hasting's White Prolific	---	96.7	3.3	---
Louisiana 502	---	96.7	3.3	---
Louisiana 1030	10.0	90.0	---	---
Wood's Hybrid White Prolific S-350	---	100.0	---	---
Funk's Hybrid G-790W	10.0	70.0	20.0	---
Florida W-1	6.7	90.0	3.3	---
Latham's Double	3.3	93.4	3.3	---
State Hospital	3.3	93.4	3.3	---
Yellow Varieties				
Funk's Hybrid G-717	---	83.3	16.7	---
Funk's Hybrid G-714	---	83.3	10.0	6.7
N. C. 5002	6.7	86.6	6.7	---
Wood's Hybrid Golden Dent V-60	---	80.0	13.3	6.7
Wood's Hybrid Golden Prolific S-210	---	90.0	10.0	---
N. C. 1032	---	96.7	---	3.3
Dixie #44	---	63.3	23.4	13.3
Hasting's Yellow Prolific	---	93.4	3.3	3.3
Keystone #222	---	83.3	13.4	3.3
N. C. 26	---	86.6	6.7	6.7
Wood's Golden Prolific	6.7	80.0	13.3	---
Wood's Hybrid Yellow Flint S-240	10.0	90.0	---	---
Wood's Indian Chief	---	96.7	3.3	---
N. C. 27	3.3	93.4	3.3	---
K-374	---	16.7	26.6	53.7
Wood's Jarvis Prolific	3.3	90.0	6.7	---
Douthit's Yellow Prolific	3.3	86.7	10.0	---

Note—Weevil damage was determined in accordance with the method approved by the Southern Corn Improvement Conference.

Observations have shown that ears which are exceptionally high on the stalk often do not reach the snapping rolls of the picker, while ears that are too small are caught by the snapping rolls, crushed. and then pass through to the ground with the stalk. Of the two varieties mentioned above, the ear placement of the highly prolific variety was, on the average, 26 inches higher on the stalk than the best yielding variety. With the increased cost of hand labor or the use of mechanical pickers, ear size and placement, as well as high yield and insect resistance are important factors.

Table 46.—Height of Ears and Stalks, Corn Variety Test, Coast Station, 1947

Varieties	Height of Ear, Feet			Height of Stalk, Feet		
	Lowest	Highest	Av.	Lowest	Highest	Av.
White Varieties						
Tenn. 5109	3.2	5.4	4.26	9.1	12.1	10.35
Broadbent	2.0	5.6	4.52	8.3	11.5	10.03
N. C. T-20	3.1	6.0	4.68	8.0	12.5	10.15
Broadbent #2	3.0	6.2	4.35	9.0	11.7	10.12
Wood's Hybrid S-360	3.5	7.2	5.64	9.5	12.5	10.95
Wood's Hybrid S-315	3.1	7.2	5.27	10.2	12.3	11.10
Miss. 5111	3.0	6.1	4.53	8.8	11.7	10.36
N. C. 1111	2.2	5.3	4.20	8.2	12.0	10.13
Douthit's White Prolific	3.2	7.1	5.10	8.5	12.3	10.15
Hasting's White Prolific	3.4	8.0	6.41	8.5	12.8	10.51
Louisiana 502	3.5	7.2	5.33	8.0	12.3	10.51
Louisiana 1030	4.1	7.1	5.79	9.9	12.4	11.28
Wood's Hybrid White Prolific S-350	3.6	6.8	5.06	8.0	12.6	10.47
Funk's Hybrid G-790W	4.0	8.0	5.83	9.0	12.8	11.17
Florida W-1	4.3	8.3	6.11	9.2	13.4	11.88
Latham's Double	3.2	6.2	4.62	8.6	11.8	10.29
State Hospital	3.6	6.5	5.18	9.0	12.4	10.57
Yellow Varieties						
Funk's Hybrid G-717	2.8	5.6	4.16	7.3	10.7	9.29
Funk's Hybrid G-714	3.2	7.0	5.23	8.9	12.7	10.49
N. C. 5002	3.0	5.9	4.94	8.2	11.1	10.10
Wood's Hybrid Golden Dent V-60	2.8	5.9	4.37	7.5	11.5	9.70
Wood's Hybrid Golden Prolific S-210	2.8	6.0	4.09	7.4	11.0	9.31
N. C. 1032	3.0	5.4	4.31	7.0	11.0	9.35
Dixie #44	3.2	5.6	4.12	7.8	12.0	9.32
Hasting's Yellow Prolific	3.4	8.0	5.64	8.5	12.8	10.83
Keystone #222	2.6	5.0	3.87	7.0	11.0	9.31
N. C. 26	2.8	5.0	4.02	8.0	11.3	9.80
Wood's Golden Prolific	3.5	7.5	5.45	8.5	12.6	10.46
Wood's Indian Chief	3.5	6.5	4.91	8.2	11.8	9.97
Wood's Hybrid Yellow Flint S-240	4.0	7.0	6.29	8.2	12.3	11.13
N. C. 27	3.9	5.7	4.72	8.3	12.1	10.22
K-374	1.9	4.6	3.52	7.1	10.2	8.96
Wood's Jarvis Prolific	2.2	6.0	4.27	6.8	12.1	9.56
Douthit's Yellow Prolific	3.5	7.1	5.14	8.4	12.4	10.21

Data covering some of the more important characteristics of the varieties tested are included in the accompanying tables.

Comparison of Corn Silage Varieties

(E. D. Kyzer, T. M. Clyburn)

In addition to the regular field corn variety test, the silage varieties, Pamunkey, Eureka, Red Pop, and Kentucky Yellow Sweepstakes were compared as to silage and shelled corn yields. These varieties were planted two weeks later than the regular field corn varieties; hence, though in adjacent plots and fertilized and cultivated in the same manner, the shelled corn yields are not considered comparable.

The silage yields of these varieties were as follows: Red Pop, 15.65 tons; Eureka, 15.50 tons; Pamunkey, 14.70 tons; and Kentucky Yellow Sweepstakes, 9.35 tons per acre. The yields of shelled corn, harvested at the same time as the regular field varieties, were: Eureka, 52.7 bushels Pamunkey, 50.0 bushels; Kentucky Yellow Sweepstakes, 42.0 bushels; and Red Pop, 41.1 bushels per acre. It is planned to include in the test next year a larger number of silage and field corn varieties.

2, 4-D For Controlling Noxious Weeds in Oats

(T. M. Clyburn, E. D. Kyzer)

It has been observed that lands in the coastal section of the state which are used in a two-year rotation of corn and oats are becoming heavily infested with noxious winter weeds, particularly chick weed, primrose, and corn spurry. Although they cause little or no trouble in cultivated crops, medium to heavy infestations of them apparently reduce the yield of oats considerably.

In order to determine whether 2, 4-D of the strength prescribed by the manufacturers would be effective, this chemical was sprayed on oats containing a very heavy infestation of corn spurry, a light infestation of primrose, and occasional blessed thistle plants. Observations showed that all weeds and also the Kobe lespedeza sown in oats for hay, were completely killed in from ten days to two weeks. There was apparently no injury to the oats. Yield data showed an increase of 34.5% in the yield of grain from the sprayed plots over that of the checks. The increase in the yield of straw was in greater proportion. There was definitely less lodging of the oats in the treated plots.

In the light of this preliminary study, the project will be expanded to include applications at different dates. One application will be made prior to the seeding of lespedeza to prevent its being damaged by the 2, 4-D.

Dynamite Versus Mechanical Methods of Ditching

(E. D. Kyzer)

Adequate drainage is one of the most important factors in crop production on large areas in coastal South Carolina. Agriculture in this area can be materially expended if the land is drained.

Recently a system of drainage canals has been dug at this station with mechanical equipment, consisting of draglines and bulldozers. This method of providing drainage canals proved economical and practical except in low, swampy, and heavily timbered areas. In these areas, the clearing of a necessary 50 to 60 foot right-of-way for the heavy equipment was expensive from both a labor and a timber standpoint. The subsequent operation of heavy equipment on soft ground was likewise more expensive than operation under favorable conditions.

Figure 25.—Cleared right of way before dynamiting.

In the light of these facts, experiments in dynamiting ditches through low, swampy areas were conducted in 1947 in two separate areas. Ditch No. 1 was 270 feet long and ditch No. 2, 233 feet. Both were opened to an average depth of 4 feet with a bottom width of 3 feet, and a top width of ten feet. The total cost of the two ditches was $180.00, 54 percent of which was for dynamite and the remainder for contract labor. The average cost per lineal foot of ditch was 29.6 cents and the average cost per cubic yard of dirt removed and spread was 28.8 cents.

These figures compare favorably with the cost of similar work done by mechanical methods in 1943. The cost of using mechanical methods on similar areas today is likely to be much higher without

Figure 26.—Completed Ditch. (Photos Courtesy of the Soil Conservation service.)

including the additional expense of clearing three times as much right-of-way. In addition, dynamite ditching has the advantage of a simultaneous spreading of the soil thinly over a large area, thus eliminating the usual ponds which form behind the spoil banks of mechanically constructed drainage ditches. In spite of a very heavy summer rainfall, the banks of these dynamited ditches have settled satisfactorily and show little or no erosion.

Pasture Fertilizer Experiments

(H. P. Cooper, W. R. Paden, E. D. Kyzer, T. M. Clyburn)

In the spring of 1945, six 2-acre blocks of old carpet grass sod were treated with either basic slag, superphosphate, or calcium lime plus superphosphate in varying amounts. These 2-acre blocks were cross-divided into smaller plots which were treated with potash in varying amounts from zero to 200 pounds of actual K_2O per acre. One-half of each potash plot was then treated with 20 pounds of borax per acre. Following treatment and scarification with a spring tooth harrow, the entire area was seeded to common lespedeza and white dutch clover.

Observations over the subsequent three-year period show some stimulation of the herbage from applications of basic slag or lime plus superphosphate. The borax has had no noticeable effect. There has been a highly significant increase in the stand and growth of white dutch clover where liberal amounts of potash in combination with lime and superphosphate have been applied. This increase has been in proportion to the amount of potash used. From this and

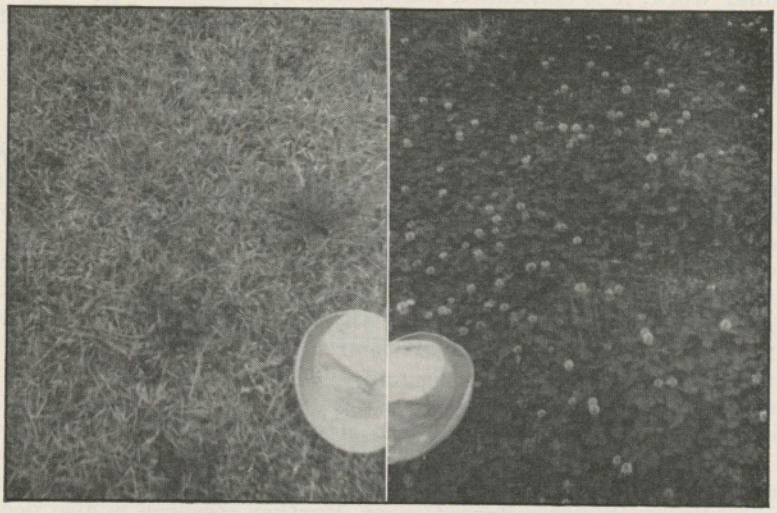

Figure 27 Figure 28

The pasture in Figure 27 received lime and superphosphate only. The pasture in Figure 29 received 100 lbs. of actual potash and that in Figure 28, 200 lbs. of potash in addition to the lime and superphosphate. Note the increased growth of white dutch clover in proportion to the amount of potash applied.

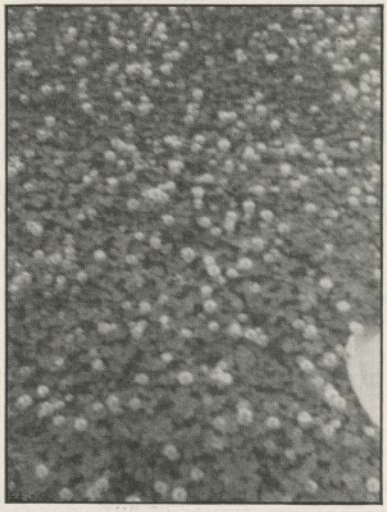

Figure 29

similar work, it is concluded that liberal applications of potash are essential to the satisfactory growth of white dutch clover and similar plants in coastal plains pastures.

PEE DEE EXPERIMENT STATION

(E. E. Hall, Superintendent)

The most outstanding accomplishment at this station in 1947 was the control of all insects injurious to cotton with three new insecticides. They proved far superior to any cotton insecticides ever used here. These insecticides were so outstanding in field tests that several thousand farmers and county agents from practically every county in the state visited the station to observe the results. Of the various cotton insecticides tested, the three most effective were 5 percent DDT, 3 percent gamma benzene hexachloride mixture, 20 percent chloronated camphene, and 10 percent chlordane. Each of these will be available for use by farmers in 1948, and recommendations on how to use them have been published.

While these insecticides are powerful insect killers, much research needs to be done to determine how they affect soils, human beings, livestock and different crops. Further research is also necessary to determine the minimum rates of application, proper intervals between applications, best type of equipment for applying, and the minimum strength for effective control. Investigations along these lines will be conducted in 1948 as far as personnel and funds permit.

This station has been fortunate in maintaining, over a period of years cooperative relations with various bureaus of the U. S. Department of Agriculture, whereby trained personnel are stationed here to conduct research covering a large field at practically no cost to the state. The Bureau of Entomology and Plant Quarantine has several trained entomologists here engaged in control methods and life history studies of the more important insects injurious to the principal field crops grown in the state.

The Tobacco Division of the Bureau of Plant Industry has several capable employees engaged in breeding disease-resistant strains of tobacco, conducting curing, fertilizer, rotation, nutritional, varietal and plant production studies.

The Division of Cotton and Other Fiber Crops of the same Bureau has several trained agronomists engaged in a very comprehensive cotton breeding program.

More detailed reports covering these investigations will be found under appropriate headings on the following pages.

Cotton Variety Test

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

The development, within recent years, of high yielding varieties and strains of cotton having staples of superior spinning quality, has greatly reduced the number of varieties grown in the state. As a

Table 47.—Cotton Variety Test

Table 47.—Cotton Variety Test
Pee Dee Experiment Station—1947
(Varieties Listed in Order of Value Per Acre)

VARIETY	Pounds of Seed Cotton Per Acre	LINT					SEED		Value Per Acre, Lint and Seed	Bolls Per Pound
		Per-centage	Pounds Per Acre	Staple Length, Inches	Price, Cents	Value Per Acre	Pounds Per Acre	Value Per Acre		
Coker 100 Wilt 45-23	2578	40.1	1034	1 5/32	35.90	$371.20	1544	$61.76	$432.96	64
Coker 100 Wilt 46-8578	2540	38.4	975	1 3/16	37.70	367.57	1565	62.60	430.17	59
Coker 100 Wilt 45-445	2602	39.0	1015	1 1/8	34.55	350.68	1587	63.48	414.16	61
Coker 100 Wilt 46-61	2459	38.1	937	1 3/16	37.70	353.24	1522	60.88	414.12	60
Coker 100 Wilt 46-66	2394	39.3	941	1 3/16	37.70	354.75	1453	58.12	412.87	60
Coker 100 Wilt 46-62	2434	38.2	930	1 3/16	37.70	350.61	1504	60.16	410.77	57
Empire P43	2320	40.3	935	1 3/16	37.70	352.49	1385	55.40	407.89	51
Coker 100 Staple 1947 B.F.S.	2300	39.7	913	1 7/32	38.20	348.76	1387	55.48	404.24	62
Coker 100 Wilt 46-59	2368	38.7	916	1 3/16	37.70	345.33	1452	58.08	403.41	58
Coker 100 Wilt 1947 B.F.S.	2368	38.5	912	1 3/16	37.70	343.82	1456	58.24	402.06	58
Coker 100 Wilt 46-736	2324	38.4	892	1 7/32	38.20	340.74	1432	57.28	398.02	57
Coker 100 Staple 46-3-4	2302	38.5	886	1 7/32	38.20	338.45	1416	56.64	395.09	66
Coker 100 Wilt 46-55	2294	39.0	895	1 3/16	37.70	337.41	1399	55.96	393.37	60
Coker 100 Wilt 46-44	2536	39.2	994	1 3/32	32.95	327.52	1542	61.68	389.20	63
Coker 100 Wilt 46-635	2371	38.9	922	1 5/32	35.90	330.99	1449	57.96	388.95	60
Coker 100 Wilt 44-113	2410	38.3	923	1 1/8	34.55	318.89	1487	59.48	378.37	58
Coker Wilds 1946 B.F.S.	2050	33.9	695	1 11/32	46.50	323.17	1355	54.20	377.37	60
Coker 100 Wilt 46-33	2517	38.8	976	1 1/16	31.95	311.83	1541	61.64	373.47	61
Marett's W.R. El-21-2-3	2186	38.7	846	1 3/16	37.70	318.94	1340	53.60	372.54	59
Empire P44	2114	40.0	846	1 3/16	37.70	318.94	1268	50.72	369.66	52
Deltapine No. 15	2126	41.3	878	1 5/32	35.90	315.20	1248	49.92	365.12	65
Marett's White Gold 2-3-18	2198	38.6	848	1 5/32	35.90	304.43	1350	54.00	358.43	57
Marett's W.R.E. 1-21	2155	38.4	827	1 5/32	35.90	296.89	1328	53.12	350.01	62
Delfos 9169	2040	38.4	783	1 3/16	37.70	295.19	1257	50.28	345.47	58
Marett's White Gold 4A	2142	38.8	831	1 1/8	34.55	287.11	1311	52.44	339.55	59
Marett's W.R. C4-8-26-10-3	2195	39.6	869	1 3/32	32.95	286.33	1326	53.04	339.37	63
Coker 100 Wilt 46-52	2209	38.7	855	1 3/32	32.95	281.72	1354	54.16	335.88	60
Marett's White Gold Wilt	2232	39.5	882	1 1/16	31.95	281.79	1350	54.00	335.79	67
Marett's W.R. 4X	2104	39.9	839	1 3/32	32.95	276.45	1265	50.60	327.05	65
Bobshaw No. 1	2090	38.2	798	1 3/32	32.95	262.94	1292	51.68	314.62	61
Sealand 542	1677	32.9	552	1 13/32	47.50	262.20	1125	45.00	307.20	60
Stoneville 2B	1933	38.7	748	1 1/8	34.55	258.43	1185	47.40	305.83	57

Percentage of lint is average of 4 representative samples of each variety ginned on roller gin.
Staple values are based on Augusta spot market, middling basis, 15/16, at 30.70 cents, as of October 1, 1947.
Seed valued at $80.00 per ton.
Staple length is the average of 4 samples graded and stapled by the South Carolina Department of Agriculture.
Each variety was replicated eight times in 4 row plots and yield records were obtained from two inside rows of each plot.

result, the staple of practically all cotton now produced is one inch or longer and possesses spinning qualities that meet the requirements of manufacturers. Frequent requests are received from farmers for advice as to the most profitable varieties for them to plant. In answering such inquiries the Experiment Station furnishes the results obtained from carefully conducted variety tests in which the most recently developed strains are included.

Thirty-two varieties and strains, each replicated eight times in 4 row plots, were included in the 1947 test, the results of which are recorded in Table 47.

The total yield per acre of seed cotton varied from 1,677 pounds for the lowest yielding variety to 2,602 pounds for the highest yielding variety, a difference of 925 pounds; the yield of lint varied from 552 to 1,034 pounds, a difference of 482 pounds per acre. The variation in staple length ranged from 1-1/16 to 1-13/32 inches, and the price ranged from 31.95 to 47.50 cents per pound. Coker 100 Wilt 45-23 had the highest total value per acre, ($432.96) and Stoneville 23 had the lowest value ($305.83). The six strains having the highest value per acre were strains of Coker 100 Wilt, with Empire P43 ranking seventh.

Grain Sorghum Variety Test

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

The grain sorghums continue to increase in popularity as a supplement to corn for feeding livestock. Since they are drouth resistant, they produce feed in seasons too dry for successful corn production. The low-growing, productive varieties can be harvested with an ordinary grain combine, or they can be left in the field to be grazed by hogs and cattle during the winter months. The tall-growing varieties have a tendency to blow down, resulting in much of the grain being weather-damaged.

Eighteen varieties were tested in 1947 in plantings made on two different dates, July 3rd and July 26th. Yields of both plantings are recorded in Table 48. The planting on July 26th was made to determine whether such late seeding would allow sufficient time for the crop to mature before the first killing frost. With the exception of Imperial Kafir all varieties planted on this date were fully mature before they were killed by frost on November 27.

The yields from the early planting varied from 24.0 bushels per acre for Dwarf Shallu to 38.6 bushels per acre for Hegari, while the yields from the late planting varied from 15.9 bushels per acre for Imperial Kafir to 45.4 bushels per acre for Martin's Milo. Thirteen varieties made higher yields in the late planting than in the early planting. These results indicate that if a severe drouth badly injured the corn crop in June and July, there would still be sufficient time

Table 48.—Grain Sorghum Variety Test
Pee Dee Experiment Station, 1947

	VARIETY	Bushels Per Acre, July 3rd Planting	Bushels Per Acre, July 25th Planting
1	Early Hegari T.S. 25248	37.8	39.9
2	Black Hull Kafir T.S. 9195	29.7	31.9
3	Hegari T.S. 7313	38.6	44.0
4	Schrock T.S. 1923	35.3	35.0
5	Hegari H.C. 46-1	31.9	39.0
6	Imperial Kafir 1K-C-46-1	32.3	15.9*
7	Texas D.D. Yellow Milo T.S. 25242	29.3	25.9
8	Caprock S.A. 7000	31.9	31.3
9	Martin S.A. 5330	27.8	40.3
10	Plainsman S.A. 7005	27.1	33.0
11	Dwarf Shallu S.A. 5463-34	24.0	26.3
12	Midland S.A. 5840	30.4	31.2
13	Martin X Combine 7008 X S.A. 5507-10	32.8	35.7
14	D.D. White Sooner S.A. 5155-5	30.9	33.5
15	Plainsman Milo P.C. 46-9	30.2	37.4
16	D.D. 38 Milo M38-8-46-17	38.5	29.7
17	Martin's Milo M.C. 46-19	36.1	45.4
18	Combine Kafir	29.0	37.5
	Average	31.8	34.1

* Late planting of Imperial Kafir did not fully mature before frost.
Early planting harvested Nov. 17, late planting, Dec. 16. Constant heavy rains in Oct. and Nov. resulted in heads of early planted sorghum being damaged by mildew and rot. Some loss of grain from shattering also resulted.
Seed of varieties 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13 and 14 were obtained from R. E. Karper, Lubbock, Texas; that of varieties 5, 6, 15, 16, 17 and 18 from Advance Seed Co., Phoenix, Arizona.

to plant and produce a crop of grain sorghum. The work with grain sorghums is being continued to obtain further information regarding them.

Soybean Variety Test

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

The development by plant breeders of varieties of soybeans that are heavy producers and shatter-resistant has resulted in rapid expansion of the acreage devoted to this crop. It now makes important contributions to the food and feed supply, and is used for various manufacturing purposes. The fact that it is a crop well adapted to mechanized farming has aided in its rapid expansion.

Variety tests have been conducted in many southern states since 1944, with the aim of determining varieties best adapted to different locations. Such a test has been conducted annually at this station for the past four years in cooperation with the Bureau of Plant Industry,

U.S.D.A. Eighteen varieties were included in the 1947 test, which consisted of plantings made on two different dates, May 22, and June 19, with results as recorded in Table 49. Yields varied from

Table 49.—Yields of Soybean Varieties From Early and Late Plantings Pee Dee Experiment Station, 1947

VARIETY	Yield, Bushels Per Acre		PARENTAGE
	Planted May 22	Planted June 19	
N45-3728	35.0	37.7	Palmetto X Ogden
N42-26	33.1	31.4	Selection from Arksoy
N45-1004	32.8	28.4	Volstate X C.N.S.
N44-92	32.0	35.5	Hoberlandet X Ogden
N44-937	31.8	39.9	Palmetto X Ogden
N45-3563	31.5	36.3	Ogden X Missoy
Dortchsoy	31.0	---	
Roanoke	29.1	28.0	
Ogden	28.0	35.0	
Burdette 20	27.3	31.9	Selection from Arksoy
N45-1128	27.3	28.9	Volstate X C.N.S.
Palmetto	24.8	29.5	
Volstate	24.0	26.3	
Nanksoy	23.0	19.9	
FC30967	22.5	25.3	
N44-774	22.5	26.9	Ogden X Missoy
C.N.S.	22.2	22.3	
Dortchsoy #7	21.9	---	Arksoy Selection

21.9 to 35.0 bushels per acre for the early planting and from 22.3 to 37.7 bushels per acre for the late planting. In previous years early plants made the best yields, but seasonal conditions were more favorable for the late planting in 1947. Recent selections and crosses, designated by numbers in the table, outyielded the older varieties, Palmetto, Volstate, and Roanoke.

Annual and average yields for the varieties tested since 1944 are recorded in Table 50. Roanoke, Ogden and Volstate have made

Table 50.—Yields of Commonly Grown Varieties of Soybeans Pee Dee Experiment Station, 1944-1947

VARIETY	Yield, Bushels Per Acre				4 Year Average
	1944	1945	1946	1947	
Roanoke	37.1	27.3	21.5	29.1	28.8
Volstate	34.5	26.5	16.6	24.0	25.4
Ogden	30.5	24.8	26.1	28.0	27.4
C.N.S.	30.4	21.0	17.1	22.2	22.7
Palmetto	29.7	25.1	14.1	24.8	23.4
N42-26	---	28.4	25.1	33.1	28.9
N44-774	---	26.0	23.2	22.5	23.9

Name of Variety or Hybrid	Yield, Bushels Per Acre	Weevil Damage*		Ear-Worm Damage*		% Rotten Ears	Av. No. Ears Per Plant	% Lodged Plants	Grain Color	Source of Seed Stock
		% Ears Infested	Grade	% Ears Infested	Grade					
La. 468	62.4	11	L	23	L	1	1.5	9	White	La. Exp. Station
Dixie 17	55.1	20	L	26	L	2	1.3	4	White	Sou. Corn Improvement Conf.
NC T20	54.8	23	L	39	L	1	1.1	5	White	N. C. Exp. Station
NC 26	52.4	26	L	27	L	1	1.4	7	Yel.	N. C. Exp. Station
PAG 4100	50.7	13	L	41	L	0	1.1	6	Yel.	Pfeister's Ass. Growers
Dixie 11	49.6	3	L	28	L	1	1.4	5	White	Sou. Corn Improvement Conf.
Tex 18	49.2	44	L	36	M	2	1.1	24	Yel.	Tex. Exp. Station
Dixie 44	48.7	59	M	38	L	2	1.0	16	Yel.	Tenn. Exp. Station
Tenn 10	48.6	20	L	44	L	1	1.3	9	White	Tenn. Exp. Station
Funk's G714	48.4	17	L	22	L	2	1.3	12	Yel.	Funk Bros. Seed Co.
Dixie 18	47.7	2	L	20	L	2	1.1	2	Yel.	Sou. Corn Improvement Conf.
NC 27	47.3	7	L	27	L	0	1.2	3	Yel.	N. C. Exp. Station
Broadbent 305	47.2	40	L	39	L	0	1.2	8	White	Broadbent Hyb. Seed Co.
Wood's S210	46.7	19	L	31	L	1	1.2	6	Yel.	T. W. Wood & Sons
Tex 20	46.2	34	M	42	M	3	1.1	18	Yel.	Tex. Exp. Station
PAG 4015	46.2	35	M	38	L	1	1.0	21	Yel.	Pfeister's Ass. Growers
Keystone 222	46.2	22	L	37	M	2	1.0	14	Yel.	Corneli Seed Co.
Wood's S315	45.6	6	L	28	L	1	1.2	16	White	T. W. Wood & Sons
Wood's S360	45.3	2	L	24	L	2	1.3	11	White	T. W. Wood & Sons
x—Wood's G. Prol.	45.2	12	L	27	L	1	1.7	7	Yel.	T. W. Wood & Sons
Broadbent 307	44.5	23	L	32	L	1	1.0	9	White	Broadbent Hyb. Seed Co.
x—Hasting's White	44.5	7	L	37	L	1	1.5	10	White	H. G. Hastings Seed Co.
x—Douthit's White	44.0	1	L	24	L	2	1.1	6	White	J. B. Douthit
NC 1111	42.8	13	L	32	L	4	1.1	6	White	N. C. Exp. Station
Funk's G717	41.4	36	L	39	L	2	1.1	11	Yel.	Funk Bros. Seed Co.
Funk's G790W	40.9	1	L	35	M	3	1.0	2	White	Funk Bros. Seed Co.
x—Pee Dee #5	40.1	2	L	34	L	2	1.0	8	White	Pee Dee Exp. Station
x—Hasting's Yel.	40.1	19	L	35	L	1	1.6	12	Yel.	H. G. Hastings Seed Co.
x—Douthit's Yel.	39.8	3	L	20	L	3	1.1	7	Yel.	J. B. Douthit
La. 1030	39.0	2	L	22	L	1	1.0	2	Mixed	La. Exp. Station
x—Jarvis Prol.	38.7	12	L	30	L	2	1.0	11	Yel.	T. W. Wood & Sons
Wood's S240	37.9	1	L	35	L	2	1.1	5	Yel.	T. W. Wood & Sons
La. 502	37.6	4	L	34	L	2	1.2	11	White	La. Exp. Station
x—Indian Chief	35.8	24	L	32	L	2	1.1	12	Yel.	T. W. Wood & Sons
Kelly K374	35.6	88	M	65	M	1	1.0	14	Yel.	Kelly Seed Co.
x—Latham's Double	33.2	1	L	45	L	2	0.9	5	White	F. P. Latham
Fla. W.1	31.1	0		32	L	1	1.1	4	White	Fla. Exp. Station
L.S.D. at 5% level	8.0									

Planted April 21 in 42 inch rows. Plants were thinned uniformly to 18 inches in the drill. Plots consisted of 2 rows 40 feet long and were replicated 6 times. Yield data represent shelled corn with moisture content of 14%.

*=Degree of injury based on infested ears only.

X=Varieties—All others are hybrids.

L=Less than 5% weevil injury visible on ear. Ear worm penetration 1 inch or less.

M=5 to 25% weevil injury visible on ear. Earworm penetration 1 to 2 inches.

H=Over 25 weevil injury visible on ear. Earworm penetration over 2 inches.

The Southern Corn Improvement Conference includes the State and Federal Corn Breeders of the South. The "Dixie" hybrids have been produced through cooperative efforts of this group.

the highest average yields of 28.8, 27.4 and 25.4 bushels, per acre, respectively. N42-26, a selection of the Arksoy variety, has been outstanding for the three years it has been included in the test.

Corn Variety and Strain Test

(Alfred Manwiller)

Two hundred and fifty commercial and experimental hybrids and varieties were grown in 1947 and data recorded on yield, insect resistance, lodging, disease resistance and general appearance. A summary is given in Table 51 for those hybrids and varieties of which seed is presently available.

Small Grain Variety Trials

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

New varieties and strains of small grain, some of which are very productive and disease resistant, are being developed by plant breeders and seed are being made available to farmers. This station conducts tests annually, in which the latest varieties of wheat, oats and barley are included. Results of these tests are made available to farmers to help them select the most productive varieties for planting.

Wheat

Seventeen varieties and strains of wheat were included in the 1947 tests, results of which are recorded in Table 52. Yields varied

Table 52.—Yields of Varieties of Wheat
Pee Dee Experiment Station, 1947

VARIETY	Yield, Bushels Per Acre
Coker's Hybrid Bl. 46-14	31.8
Coker's Hybrid Bl. 45-24	31.1
Coker's Hybrid Bl. 4612	29.6
Coker's Hybrid Bl. 45-21	29.5
Coker's Hybrid Bl. 46-13	29.4
Coker's Hybrid Bl. 46-15	29.0
Wood's Redhart #46	28.8
Coker's Hybrid Bl. 46-16	28.7
Coker's Hybrid Bl. 46-17	28.1
Marett's Sanett #2	27.6
Coker's Redhart 45-3	27.5
Coker's Redhart 1946	27.4
Marett's Sanett 41-950	26.0
Marett's Sanett M 764-5	23.2
Coker's Hardired 1947	21.9
Wood's Hardired	20.0
Average of 24 checks of Coker's Hardired 1946	20.9

from 20.0 bushels per acre for Wood's Hardired to 31.8 bushels per acre for Coker's Hybrid 46-14. The six highest yielding strains were recently developed by the Coker Pedigreed Seed Co. Hardired strains, maturing later, were severely damaged by mildew.

Barley

Thirteen varieties of barley were included in the 1947 test. Yields varied from 29.9 bushels per acre for Wood's Beardless #12 to 42.1 bushels for Marett's Sunrise 58-79-12. The three highest yielding varieties were Marett's Sunrise 58-79-12, Wood's Wong and Marett's Calhoun No. 1, with yields of 42.1, 41.9 and 40.0 bushels per acre, respectively. Yields of all varieties in the test are recorded in Table 53.

Table 53.—Yields of Varieties of Barley

Pee Dee Experiment Station, 1947

VARIETY	Yield, Bushels Per Acre
Marett's Sunrise 58-79-12	42.1
Wong (Wood)	41.9
Marett's Calhoun #1	40.0
Marett's Calhoun #2	39.5
Jackson #1 (Tenn)	37.7
M.B. X S.A. R3-56 977-8-1 (Tenn)	37.2
Sunrise (N.C.) Average 15 Checks	37.0
Marett's Awnless 15-7	36.2
Marett's Sunrise #3	36.2
Marett's Hooded #5	33.9
Hooded #26 (N.C.)	31.8
Marett's Hooded #4	30.5
Wood's Beardless #12	29.9

Influence of The Rate of Seeding on The Yield of Oats

(E. E. Hall)

The amount of oat seed planted per acre varies more than that of any other grain crop, and has less influence on yield than many other factors, such as time of seeding and fertilization. The rates most commonly used by farmers vary from 2½ bushels to 5 bushels per acre. Six different rates of seeding, varying from ½ to 5 bushels per acre, have been used in yield tests at this station over a ten year period, and yearly as well as average yields from the different rates are recorded in Table 54. The small differences in yield resulting from the different rates of seeding indicate that the use of the larger quantities of seed is unnecessary.

Table 54.—Influence of Rate of Seeding on Yield of Oats
Pee Dee Experiment Station, 1947

Seed Rate Per Acre	Yield, Bushels Threshed Oats Per Acre										10 Yr. Average
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	
½ Bushel	81	50	81	62	76	63	46	79	53	43	63.4
1 Bushel	83	58	81	65	76	70	51	72	51	48	65.5
1½ Bushels	77	61	84	68	78	69	52	70	51	43	65.3
2 Bushels	80	56	82	68	75	63	50	72	51	44	64.1
3 Bushels	79	52	82	59	74	70	52	71	48	49	63.6
5 Bushels	69	55	82	68	68	73	47	65	48	48	62.3

Plow Sole Application of Fertilizer

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

Studies have been made at this station, over a period of years, to determine the most profitable and economical method of applying fertilizer to different crops. With corn, good results have been obtained by applying all of the fertilizer in the bottom of the furrow, or on the plow sole, as the land was prepared for planting. Special machines for applying the fertilizer in this manner require less labor than when later separate applications are made.

Studies of plow sole applications of fertilizer were started at this station in 1944, using 400 pounds per acre of a 10-10-10 fertilizer with the nitrogen from three different sources—cyanamid, uramon and nitrate of soda. All plots received 150 pounds per acre of a 5-10-5 starter fertilizer under the corn before planting in addition to the plow sole applications. Annual and average yields are recorded in Table 55.

Table 55.—Effect of Plow Sole Versus Ordinary Method of Applying Fertilizer on the Yield of Corn

Pee Dee Experiment Station, 1944-47

TREATMENT	Yield, Bushels Per Acre				4 year Average
	1944	1945	1946	1947	
Starter fertilizer only		24.1	25.1	57.7	35.6
Regular fertilizer application (Check)	50.4	44.1	34.9	63.4	48.2
Plow sole application (Nitrate of soda)	54.4	43.6	31.1	64.8	48.5
Plow sole application (Uramon)	55.0	41.3	35.8	66.0	49.5
Plow sole application (Cyanamid)	52.2	35.2	41.5	65.9	48.7

All plots received 150 lbs. per acre of the starter fertilizer (5-10-5) at planting.
The plow sole applications consisted of 400 lbs. of 10-10-10 fertilizer, in which the nitrogen was supplied from the materials indicated.
The check plot where the regular fertilizer application was made received all of the phosphorous and potash and one half of the nitrogen when corn was knee high. Balance of nitrogen was applied at last cultivation.

Only slight differences were found in the yields from plow sole applications and from the regular or split applications. Applying all the fertilizer on the plow sole resulted in saving the additional labor which would have been necessary in making split applications. No significant difference in yield resulted from the use of different sources of nitrogen. Results so far indicate that plow sole application of fertilizer is as effective as split applications in corn production, but further studies will be necessary before definite conclusions can be drawn.

The Effect of Varying Amounts of Fertilizer on the Yield of Cotton

(E. E. Hall)

In order to determine the extent to which cotton yields are influenced by the use of varying amounts of fertilizer, a test was begun

in 1945, in which a 5-10-5 fertilizer was applied at rates of 400, 600, 800, 1000 and 1200 pounds per acre. Results for the three year period, 1945-1947 are recorded in Table 56.

Table 56.—Effect of Varying Amounts of Fertilizer on the Yield of Cotton Pee Dee Experiment Station

TREATMENT	Yield, Pounds Seed Cotton Per Acre			
	1945	1946	1947	Average 3 year
400 lbs. 5-10-5 per acre	1588	1846	1736	1723
600 lbs. 5-10-5 per acre	1734	2076	2096	1969
800 lbs. 5-10-5 per acre	1624	2252	2218	2031
1000 lbs. 5-10-5 per acre	1628	2318	2246	2064
1200 lbs. 5-10-5 per acre	1622	2233	2024	1963

All fertilizer was applied before planting.
No nitrogen was applied as side-dressing.

The greatest increase in yield (246 pounds) occurred when the quantity of fertilizer was increased from 400 pounds to 600 pounds. There was a further gain of 62 pounds per acre when the amount of fertilizer was increased from 600 to 800 pounds per acre. Increased yields from applications greater than 800 pounds have not been profitable. Young plants were stunted by the 1200 pound application, and it was more difficult to obtain and maintain perfect stands.

Cotton Improvement and Breeding

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

The United States imported approximately one hundred thousand bales of long staple cotton (1-3/8 - 1-1/2 inches) in 1947. These imports were necessary in the greatest cotton producing country in the world because the small commercial production of long staple fiber in this country is insufficient for textile mill needs. Some progress has been made at this station in developing superior strains of long staple upland varieties. If the new phases which have been added to the project are successful, varieties comparable to the best foreign cottons may be possible.

A history of the development of Sealand 542 was given in the 1946 Annual Report. This new long staple strain was further increased and tested in 1947. All of the data have not been received from the locations in the United States where it was tried, but the results prior to 1947 have indicated that Sealand 542 was as productive as other commercially grown long staple cottons. The fiber is strong, approximately 1-3/8 to 1-7/16 inches long, and the lint percentage is 33. The commercial growers in North and South Carolina, Georgia and Florida were well pleased with this variety in 1947. The yields were not great because of adverse conditions and insect

damage, but the high grade bales were sold for 47 and 47-1/2 cents per pound, a premium of approximately 17 cents above middling 15/16 inch cotton. Textile mills were interested in the cotton, and 38 out of the 44 bales produced were sold to four mills. Mill tests will be run to determine the spinning value for special goods requiring long, fine, strong fiber. A satisfactory report has already been received from one mill test. Spinning tests will be made at Clemson from cotton samples produced in Florida, Georgia, South Carolina, Arkansas, New Mexico and Arizona. Preliminary fiber tests indicate superiority in strength, length, and fineness of Sealand 542 in comparison with other long staple types and short cottons. All of the Sealand 542 seed available will be used in 1948, and a total of 1000 acres or more will be planted in South Carolina, Georgia and Florida. The South Carolina plantings will be made in areas suited to long staple production.

A farmers' cooperative association has been organized in Berrien County, Georgia, with headquarters at Nashville for the exclusive production of Sealand 542. The objects of the association are to control and maintain the purity of the seed and to increase breeder seed for grower members and for areas in Georgia interested in growing the new variety. There is similar interest in a large area in North Florida and some interest in South Florida. Arrangements have been made with the Berrien Staple Cotton Cooperative and with Florida growers to furnish small lots of foundation seed each year from the breeding blocks at the Pee Dee Station. Under this arrangement selected growers will plant the foundation seed and sell the increase at a reasonable price to other growers. After the third or fourth increase, the seed will go to oil mills. Such a program properly conducted can provide a continuing supply of pure seed. Much of the Sealand 542 in Georgia will be certified under the rules of the Georgia Crop Improvement Association. Many bales of Sealand will carry lint certification tags. The program of furnishing foundation seed to growers in Georgia and Florida is being carried out in cooperation with the state experiment stations and extension services.

Short staple cottons produce about one third more cotton than long staple types and have much fluffier bolls which are easier to pick. High grades are difficult to obtain from the long staple type with the less fluffy boll. Since premiums are based on grade as well as staple, interest in the production of long staple cotton has decreased where low grades have been combined with low yields. Based on annual consumption, there is a potential market in the United States for about a hundred thousand bales of high quality, long staple cotton since this type of cotton is necessary in our national economy.

In order to encourage the production of long staple cotton, a

breeding program is being conducted to develop more productive types with fluffier bolls which compare more favorably with the higher yielding short cottons. Two steps were taken in 1947 in an attempt to obtain such types. First, a detailed survey was made of all hybrid lines in the breeding blocks at this station. Second, new hybrids were made between productive short staple cottons and a new Sealand strain with fiber 1-7/8 inches in length. In the survey a few productive types with fluffy bolls were found. One of the best of these is a hybrid between Tidewater (long staple Acala) and Coker Wilds. This cotton has a high lint percentage, up to 39 percent, with fiber about 1-3/8 inches in length, Pressley strength index of about 8.17, good plant type and production, and fluffy bolls averaging 67 to the pound. This line will be increased and tested in 1948. Another promising hybrid line is a cross between Sealand 542 and a Meade X Wilds cross. The production and plant type are good, the bolls more fluffy than Sealand 542, the fiber as long and the lint percentage higher, up to 36 percent. Still another hybrid of promise is from a cross between Sealand 542 and a massed lot of selected interspecific hybrids. This cross is in the third generation and still segregating. It has a very high lint index for a long staple cotton, 8.25 - 8.50, and a lint percentage of 35-36. The bolls are large and fluff well; the fiber is 1-7/16 to 1-1/2 inches, but requires some improvement in strength.

One of the most exceptional hybrid strains developed at this Station is Sealand 766. This strain is probably the longest upland cotton ever developed, possessing fibers that are extremely fine and long, 1-7/8 inches. The Pressley strength index is about 8.20, and the lint percentage is 30, which is considered good for a cotton with this extreme length and fineness of fiber. Under good conditions yields up to 400 pounds of lint per acre might be expected. This cotton was developed from a complex cross carrying Seabrook and Bleak Hall sea islands and Coker-Wilds. The strain is valuable as breeding material rather than as a commercial variety.

Many crosses have been made between Sealand 766 and Coker 100 Wilt, Empire Wilt, Pandora, Acala 1517 Wilt and Acala X Hopi X Acala. The F_1 generations were productive, with good plant types and large bolls. The staple was 1-7/16 to 1-1/2 inches in length and fairly strong. High yielding segregates or selections will be sought with long, strong fiber. Strength is to be further improved by crossing and backcrossing with some high-strength interspecific hybrid forms. One of the latter forms was derived from a hybrid of Upland X Hopi developed at Shafter, California and the other from a triple hybrid of Asiatic, Wild American and upland cottons developed at Raleigh, North Carolina.

Nicotine Content of Tobacco

(J. F. Bullock and Raymond Wenger)

Studies of the nicotine content of the tobacco grown on the variety-fertilizer plots were made to determine whether varying the rate of fertilizer application affects the nicotine level. Four varieties, Gold Dollar, Yellow Mammoth, 400, and 401, fertilized with 1000, 1400, and 1800 pounds of fertilizer per acre, were included in the studies. Nicotine values for 3 years are shown in Table 57. With a

Table 57.—Effect of Different Rates of Fertilization on the Nicotine Content of Four Varieties of Flue-Cured Tobacco
Pee Dee Experiment Station, 1945-1947

Variety	Pounds of 3-8-6 fertilizer per acre	Percentage of Nicotine*—Water Free Basis			
		1945	1946	1947	Average
Gold Dollar	1000	2.26	1.76	2.89	2.30
	1400	2.48	2.18	2.86	2.51
	1800	2.50	2.07	3.12	2.56
Yellow Mammoth	1000	2.01	1.82	2.70	2.18
	1400	2.41	2.05	2.37	2.28
	1800	2.67	2.14	3.09	2.63
400	1000	1.95	1.96	2.16	2.02
	1400	2.38	2.11	2.77	2.42
	1800	2.90	2.33	2.92	2.72
401	1000	2.00	1.87	2.33	2.07
	1400	2.07	1.96	2.44	2.16
	1800	2.16	2.05	3.06	2.42
Average		2.32	2.02	2.73	2.36

* L.S.D. at 5% level—0.16%
L.S.D. at 1% level—0.21%

single exception, the tobacco receiving 1800 pounds of fertilizer contained the highest percentages of nicotine found. In most cases the use of 1400 pounds of fertilizer resulted in slightly lower percentages of nicotine. Rainfall, both as to amount and distribution, influenced the formation of nicotine. In 1945 and 1946, the well-distributed and fairly heavy rainfall caused some leaching of the fertilizer. In 1947, the rainfall came late in the growing season and was not excessive, enabling the plant to utilize the plant food, and resulting in a higher nicotine content.

Chlorine and Reducing Sugars in Flue-Cured Tobacco

(J. F. Bullock and Raymond Wenger)

Tobacco grown where different amounts of chlorine had been applied in the fertilizer was studied to determine the uptake of this element. In Table 58 the amounts per acre of the different fertilizer

Table 58.—Pounds Per Acre of Fertilizer Constituents Applied to Tobacco Plots Pee Dee Experiment Station, 1947

Plot	Nitrogen	P_2O_5	K_2O	CaO	MgO	SO_3	Cl
1*	30.1	90.0	89.8	155.0	20.5	267.8	3.9
2	30.2	90.0	89.7	155.0	20.5	268.4	23.9
3	30.1	90.0	90.0	155.0	20.5	267.9	42.1
4	30.0	90.0	89.5	155.0	20.5	268.7	61.2
5	30.1	90.0	90.0	295.0	123.8	267.9	42.1
6	30.1	90.0	60.0	133.0	13.7	228.2	40.8
7	30.1	90.0	60.0	293.1	115.9	228.2	40.8

* Control (check) plot.

constituents added on the different plots are set forth. All plots, except the control, received chlorine in muriate of potash. It was known that tobacco would take up chlorine whether it was present in the soil or added in the fertilizer and that combustion of the tobacco might be adversely affected by excessive amounts in the

Table 59.—Chlorine and Reducing Sugars in Flue-Cured Tobacco Grown on Plots Receiving Varying Amounts of Chlorine in the Fertilizer Pee Dee Experiment Station, 1947

TREATMENT				Chlorine in Tobacco, Average of Analyses of Leaves From Four Replicate Plots**	Percentage of Chlorine and Reducing Sugars in Tobacco from Replicate Plots which Yielded Product Having Lowest and Highest Proportions of these Constituents for each Treatment.	
Plot	Chlorine*	Limestone, Approx. Lbs. Per Acre	Fertilizer 1000 Lbs./Acre	Percent	Chlorine, Percent	Reducing Sugars, Percent
1	4 (control)		3-9-9	0.79	0.46 1.01	12.18 7.57
2	20		3-9-9	1.57	1.00 1.74	13.39 9.50
3	40		3-9-9	2.11	1.94 2.42	10.25 9.20
4	60		3-9-9	2.85	2.64 3.33	10.24 7.40
5	40	400	3-9-9	2.06	1.61 2.54	16.56 8.20
6	40		3-9-6	2.09	1.51 2.53	13.51 7.23
7	40	400	3-9-6	2.27	1.86 2.72	11.97 6.58

* Chlorine contained in Muriate of Potash
** L.S.D. at 5% level—0.49
L.S.D. at 1% level— .64

leaf. The amount of chlorine in the leaves from the different fertilizer plots was therefore ascertained. As the amount of chlorine applied was increased up to 60 pounds per acre, the average chlorine content of the tobacco from the four replicates also increased, as shown in Table 59. Changing the basicity of the fertilizer (Plot 5) or the potash content (Plot 6), or both (Plot 7), did not appreciably influence the uptake of chlorine by the tobacco. These results confirm previous work along this line at this station.

When the amounts of chlorine and reducing sugars in the tobacco leaves from the various replicate plots were compared, it was found that they bore an inverse relationship to each other. For example, in the case of Treatment 1 (the control), and all the other treatments, the replicates which produced tobacco having the lower chlorine contents also developed in this same tobacco the higher content of reducing sugar.

Tobacco Blue Mold

(T. W. Graham)

Blue mold in South Carolina during 1947 caused, in general, a two to three weeks delay in transplanting the crop, but did not result in as severe plant losses as in 1945 and 1946. Although blue mold appeared unusually early (March 10), its general spread was very slow due to the lack of plants. Because of damage by February freezes, approximately 95 percent of all tobacco beds were resown in late February and early March. Only those beds in well-protected locations had early stands of plants, but there were enough of these to keep blue mold active. In many communities the disease failed to appear before April 15, but was generally active on untreated beds during the last week in April. Treated beds were producing ample plants at this time, and transplanting from such beds was practically completed by the last of April. Untreated beds were not producing transplants until the second and third week in May, and transplanting from them continued into June.

The recommended Fermate dust treatment for control of blue mold was used far more generally in 1947 than in any previous year. Approximately 200 tons of mixed Fermate dust were bought and used by South Carolina growers in 1947, as compared with about 25 tons in 1946.

Experimental tests of fungicides for control of blue mold were continued in 1947 at this station and in cooperative tests with growers; however, weather conditions were so unfavorable for development of blue mold at these locations that critical evaluation of the materials used could not be made. Detailed results are therefore not presented from the series of 10 different sprays and 7 dust formulations used.

The Meadow Nematode Root Disease of Tobacco

Studies of the root decay disease caused by meadow nematodes *Pratylenchus spp.*, have been a phase of the root disease project at this station. Collections of diseased roots, made during the past six years, and various greenhouse inoculation experiments have shown a consistent association of this nematode with the recognized symptoms of stunting and decayed roots. While the stunting effects of meadow nematode disease are identical with those caused by the root knot nematode* the root symptoms of the former are quite distinct.**

The two diseases are often confused, and much of the damage on tobacco is frequently attributed to root knot when meadow nematodes are actually responsible. In a series of 212 diseased tobacco root collections made during the period 1941 to 1947 inclusive, 59 percent were found to be infested by meadow nematodes alone, and 41 percent by both root knot and meadow nematodes.

Investigations of the relationships between the meadow nematode and its hosts show that a wide range of plants is susceptible. Root collections from other crops growing on tobacco land revealed that cotton and corn are susceptible and are frequently severely damaged. These crops carry the meadow nematode to succeeding crops of cotton, corn and tobacco. Root collections from peanuts, cowpeas, soybeans, crotalaria, sweet potatoes, and tomatoes showed root decay symptoms, and meadow nematodes were found. Among the various susceptible grasses are oats, barley, crabgrass, Bermuda grass, crowfoot grass and broom sedge, root collections of which yielded nematodes. Collections of roots from horseweed, camphor weed, ragweed and button weed were affected with meadow nematodes.

Experimental tests showed that meadow nematodes overwinter in the roots of cotton, tobacco, and crabgrass, and also in soil adjacent to roots of these plants. Other studies of the overwintering habits of this nematode are under way but not yet completed.

Studies of other phases of the biology of this disease are also under way. In this work, a special root culture chamber has been devised and used successfully for growing plants with roots accessible for inoculation and observation.

Control of Green June Beetle Grubs with Soil Fumigants

(Norman Allen and Jack D. Early)

Incidental to studies of the control of grubs of the green June beetle (Figure 30) in tobacco plant beds with poisoned baits,* the Bureau of Entomology and Plant Quarantine, in cooperation with

* **Heterodera marioni** (Cornu) Goodey.

** Descriptions of both of these root diseases were given in the 1943 Annual Report.

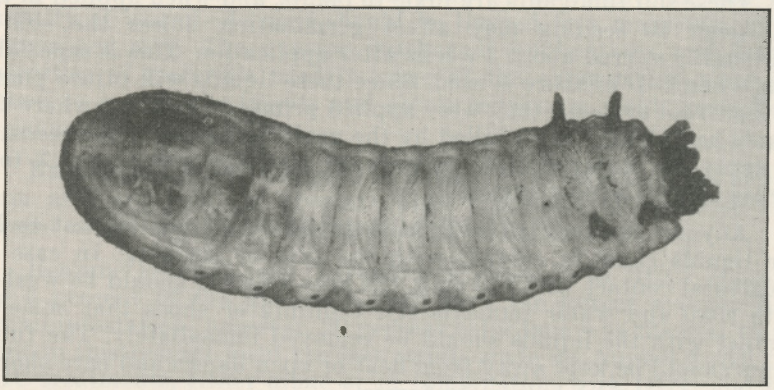

Figure 30.—Green June beetle grub (approximately twice natural size).

this station, tested some of the new soil fumigants. The tests were begun in 1943. The first tests were on a trial basis in small outdoor plots 0.5 square yard in area. The more promising fumigants were later tested on a practical basis in tobacco plant beds.

These were (1) D-D mixture, which is a mixture of 1, 2-dichloropropane and 1, 3-dichloropropylene; (2) ordinary traffic gasoline, found by Scott** to be effective; and (3) a 10 percent (by volume) solution of ethylene dibromide in a standard paint thinner.

The experiments demonstrated that grubs of the green June beetle may be controlled by treating the plant bed soil with any of the three fumigants during the fall prior to seeding, or with D-D mixture or ethylene dibromide in the spring when growing plants are present. The most satisfactory method of application was to pour or drop the liquids into holes 6 inches deep, punched in the soil of the plant bed with a 6-inch screwdriver. In beds of growing plants, only the areas in which the plants had been uprooted by the grubs were treated. These were carefully covered with holes spaced about 8 inches apart. About 1.5 medicine-dropperfuls of D-D mixture or ethylene dibromide solution were applied to the bottom of each hole. In order to retard escape of the fumes, the holes were closed immediately by pressing the soil together at the surface. In the fall when no plants were present, the dosages per 100 square yards required for good control were 3 quarts of D-D mixture, 1 gallon of ethylene dibromide solution or 10 gallons of gasoline.

* Allen, N., and H. N. Pollard, 1941. Control of green June beetle larvae in tobacco plantbeds. S. C. Expt. Sta. Ann. Rpt. 54: 123-127.

** Scott, L. B., and Joe Milam, 1944. Gasoline to control green June beetle larvae in tobacco plant beds. Jour. Econ. Ent. 37(6): 845-846.

These soil fumigants are toxic to plants, and when applied in the fall prior to seeding may affect germination unless the soil is thoroughly stirred about 3 weeks after application. This is especially true when D-D mixture is used. Since these liquids will injure plants or their root systems, they were applied primarily in areas where the plants had already been killed by the grubs. Where it was necessary to apply the material close to growing plants it was placed 3 to 4 inches below the root system.

Anyone handling these fumigants should be careful not to let the liquids come in contact with the skin or clothing. In case of accidental contact with the skin, the area affected should be washed with soap and water immediately. Clothing or shoes that come in contact with the liquids should be removed immediately. The fumigants should be kept away from heat or open flames and care should be taken to avoid inhaling the fumes.

Experiments on The Control of Cotton Insects

(Floyd F. Bondy and C. F. Rainwater)

Experiments at this station in 1947 on the control of cotton insects were conducted along the same lines as in 1946, except that four new synthetic organic poisons were included: benzene hexachloride, chlorinated camphene (67-69 percent chlorine), chlordane, and parathion.

The first three poisons showed much promise, but mixtures containing 2 percent or less of parathion gave little control of the boll weevil. However, good control of the cotton aphid and red spider was obtained with parathion at this strength. This chemical is highly toxic to man and domestic animals, and it cannot be recommended to cotton growers until it is tested further.

Four randomized-block experiments were carried out. In 3 of these, 12 insecticidal treatments were replicated, a replicate of each treatment being located in each of two cotton fileds. In the fourth experiment, 12 treatments were replicated twice in one field. All experiments were conducted in fields as nearly uniform in all rspects as could be found. The plots consisted of 12 rows, 45 feet wide and 100 feet long, or 1/10 acre. The initial boll weevil infestation in each field was high, and conditions were favorable throughout the season for a critical comparison of the various insecticides and formulations being tested. Boll weevil infestations were recorded twice a week, and aphid populations weekly. Yields were determined on all experiments by picking the cotton from 50 linear feet of the six center rows in each plot. In Table 60 is presented a summary of the data obtained in these experiments.

In these experiments 5 to 10 applications of the different insecticides were made. Probably not more than 5 or 6 applications

can profitably be made under ordinary farm conditions and the quantity of insecticide used should be limited to a maximum of 10 pounds per acre. The greater number of applications and larger quantities of materials used in some of the experiments were designed to control the insects and obtain maximum yields regardless of economic considerations.

Experiment 1 was designed to compare the effectiveness of calcium arsenate, calcium arsenate plus 1 percent of nicotine, and several of the new synthetic organic insecticides.

Benzene hexachloride (hereafter referred to as BHC) containing 6 percent of the gamma isomer gave the lowest average boll weevil infestation; however, 20 percent chlordane was the best treatment in this respect until the last count, made on August 8. All the BHC treatments, either alone or in combination with DDT, and the 20 percent chlorinated camphene treatment held the boll weevil infestations to lower levels than did either of the calcium arsenate treatments. The plots treated with 50 percent DDT and 2 percent parathion were the only plots that had higher boll weevil infestations than the plots treated with calcium arsenate. The BHC dusts were prepared from the 50 percent technical material containing 6 percent of the gamma isomer.

Against the cotton aphid, (1) 2 percent parathion, (2) BHC containing 6 and 3 percent of the gamma isomer, and (3) BHC containing 3 percent of the gamma isomer plus 5 percent DDT, were the best treatments. The calcium arsenate-nicotine treatment did not hold the aphids down to the level of the checks, and was inferior for aphid control to all the other treatments, except calcium arsenate alone.

With respect to yields, calcium arsenate alone and the 2 percent parathion treatments were poorest. However, the yields from plots receiving these treatments were significantly better than where no treatment was used.

High yields were obtained where the following treatments were applied: percent DDT plus 1 percent BHC, 5 percent DDT plus 2 percent BHC, 20 percent Chlordane, calcium arsenate plus 1 percent nicotine, 3 percent BHC, 1 percent BHC and 6 percent BHC. There were no significant differences in the yields obtained from plots where these treatments were used. Yields of all plots where insecticides were used were significantly greater than that of the untreated plots.

In experiment 2, calcium arsenate was compared with calcium arsenate plus nicotine or rotenone, BHC, chlorinated camphene, and parathion. Good boll weevil control was secured with all the insecticides except parathion. Aphid control was adequate in all cases ex-

Table 60.—Cotton Insect Investigations
Pee Dee Experiment Station—1947

TREATMENTS	Average percent boll weevil infestation	Maximum number aphids per leaf	Average pounds poison per acre	Yield in pounds of seed cotton per acre	Increase in Yield per acre over check	
					Pounds	Percent
Experiment 1—10 applications insecticide						
Calcium arsenate	27.6	93.4	10.0	2139	899	72.5
Calcium arsenate plus 1% Nicotine (B.L. 14)	28.7	35.9	7.2	2541	1301	104.9
6% gamma benzene hexachloride	14.4	0.3	13.2	2436	1196	96.5
3% gamma benzene hexachloride	18.7	0.9	12.1	2504	1264	101.9
1% gamma benzene hexachloride	24.2	5.4	12.4	2496	1256	101.3
5% DDT plus 3% gamma benzene hexachloride	20.5	1.3	11.1	2215	975	78.6
5% DDT plus 2% gamma benzene hexachloride	21.6	2.5	11.7	2482	1242	100.2
5% DDT plus 1% gamma benzene hexachloride	22.7	5.1	13.3	2618	1378	111.1
50% DDT (alt. appls.)	29.3	9.6	10.7	2200	960	77.4
20% chlorinated camphene	24.6	1.8	14.0	2292	1052	84.8
20% chlordane	16.2	7.0	14.1	2583	1343	108.3
2% parathion	30.4	0.2	16.0	1884	644	51.9
Untreated (Check)	50.3	16.4	---	1240	---	---
Experiment 2—8 applications insecticide						
Calcium arsenate	20.5	59.3	11.5	1551	741	91.5
Calcium arsenate plus 1% Nicotine (B.L.14)	22.9	1.6	11.2	1653	843	104.1
Calcium arsenate plus 1½% Nicotine (B.L. 14) (alt. applications)	18.7	6.3	10.3	1592	782	96.5
Cal. arsenate plus 2% Nicotine (B.L. 40—alt appls)	27.0	2.5	10.7	1627	817	100.9
Calcium arsenate plus 1% Rotenone	28.6	5.5	11.0	1751	941	116.2
6% gamma benzene hexachloride	10.4	0.6	10.1	1658	848	104.7
20% chlorinated camphene	15.3	0.8	14.3	1592	782	96.5
10% chlorinated camphene	30.5	0.5	14.7	1570	760	93.8
10% chlorinated camphene plus 5% DDT	31.0	1.8	12.3	1711	901	111.2
2% parathion	36.9	0.2	17.8	1522	713	88.0
1% parathion	43.6	0.5	16.9	1577	767	94.7
0.5% parathion	45.9	0.6	19.8	1234	424	52.4
Untreated (Check)	59.6	14.9	---	810	---	---

Experiment 3—7 applications insecticide						
Calcium arsenate	15.6	120.4	11.3	1000	303	43.5
Calcium arsenate plus 1% Nicotine (B.L. 14)	16.3	14.3	9.8	1193	496	71.2
20% chlordane	11.3	15.3	16.9	1274	577	82.8
10% chlordane	17.4	15.5	16.1	1193	496	71.2
10% chlordane plus 5% DDT	13.5	84.8	14.9	1226	529	75.9
5% chlordane plus 5% DDT	17.2	63.7	14.1	1167	470	67.4
5% chlorinated camphene plus 5% chlordane	18.8	8.2	14.2	1284	587	84.2
20% chlorinated camphene	16.6	5.3	15.1	1327	630	90.4
3% gamma benzene hexachloride plus 5% DDT	10.9	1.7	13.3	1318	621	89.1
1% parathion	38.6	1.4	14.2	968	271	38.9
50% DDT (alternate applications)	31.8	50.2	8.1	771	74	10.6
10% chlorinated camphene	23.7	7.2	14.3	1382	685	98.3
Untreated (Check)	50.8	8.3	---	697	---	---
Experiment 4—5 applications insecticide						
Calcium arsenate	50.6	31.2	10.8	782	358	84.4
10% chlordane	44.7	1.6	11.1	728	304	71.7
5% gamma benzene hexachloride	30.1	0.1	16.7	764	340	80.2
1% gamma benzene hexachloride	60.2	0.5	12.3	766	342	80.7
3% gamma benzene hexachloride plus 5% DDT	50.5	0.4	19.5	902	478	112.7
10% chlorinated camphene	48.0	0.4	11.8	878	454	107.1
5% parathion	55.7	0.6	14.6	920	496	117.0
3% Parathion	46.6	0.1	17.3	878	454	107.1
1% Parathion plus DDT 5%	48.3	0.2	15.6	862	438	103.3
2% parathion plus DDT 2%	50.7	0.1	12.1	780	356	84.0
10% chlordane plus 5% DDT	44.4	0.3	12.4	948	524	123.6
1% gamma benzene hexachloride plus 5% DDT	51.9	3.7	17.5	752	328	77.4
Untreated (Check)	93.6	19.4	---	424	---	---

cept on the untreated plots and the plots where calcium arsenate alone was used. Large increases in yield resulted from all treatments.

Experiment 3 was designed to compare calcium arsenate and calcium arsenate plus 1 percent nicotine with several organic insecticides and combinations. Good boll weevil control was secured with all the treatments except 1 percent parathion and alternate applications of 50 percent DDT. Aphid control was very good where parathion, benzene hexachloride, and chlorinated camphene were applied and was adequate where chlordane 10 percent and 20 percent and calcium arsenate plus 1 percent of nicotine were used. Calcium arsenate alone, chlordane plus DDT, and 50 percent DDT did not control the aphids. The yields were not as high as in Experiments 1 and 2. All treatments, except 1 percent parathion and 50 percent DDT, resulted in large and significant increases in yield as compared with that of the check plots.

In Experiment 4, several organic insecticides and combinations of these insecticides were compared with calcium arsenate in a field of late-planted cotton. Good control of the boll weevil resulted from all treatments as is indicated by the yield records, although the boll weevil infestation remained relatively high. The untreated plots had an average infestation of nearly 94 percent, and those treated with benzene hexachloride containing 5 percent of the gamma isomer, 30 percent. Very few aphids were present on any of the cotton, and they were not a factor in the final yields. Treated plots yielded less than 1000 pounds of seed cotton per acre, but the yields were significantly greater than that of the untreated plots which produced only 424 pounds per acre. Six treatments produced yields which were more than double that of the check plots.

The most outstanding development of the year in the field of cotton insect control was the discovery that boll weevils can be killed inside cotton squares. The percentages of adult boll weevils that actually died within cotton squares treated with the different insecticides are shown in Table 61. Two hundred fallen punctured

Table 61.—Adult Boll Weevil Mortality Inside Cotton Squares Pee Dee Experiment Station, 1947

TREATMENT	Number of Replications	Average Percentage Adult Mortality
Untreated check	7	5
Calcium arsenate	3	20
Chlordane, 20%	6	92
10%	5	84
10% plus DDT, 5%	8	88
Benzene hexachloride	4	--
Gamma isomer, 5%	2	76
Gamma isomer, 3% plus DDT, 5%	8	50
Chlorinated camphene, 20%	4	36
10%	4	16

squares when that number could be found were collected from each replicate plot receiving the treatments. In some of the later collections, it was impossible to get 200 squares from some of the plots, and in such cases all that were available were taken. The squares were collected in the field after the insecticide treatments had been applied.

Chlordane caused the highest mortality of boll weevils inside the cotton squares, with benzene hexachloride second, and chlorinated camphene third.

Summary of Results

Benzene hexachloride dusts with a gamma isomer content of 1, 3 or 6 percent, and dusts containing a mixture of 5 percent of DDT and 1, 2 or 3 percent of the gamma isomer of BHC gave good to excellent control of the boll weevil and cotton aphid. Benzene hexachloride did not control the bollworm or the red spider. It may actually make conditions favorable for an increase in the number of these insects.

Chlordane in 10 and 20 percent concentrations gave excellent control of the boll weevil and adequate control of the cotton aphid. No control or only fair control of the bollworm and red spider resulted from the use of this insecticide. It may actually cause an increase in these insects. It was not effective against aphids when combined with DDT.

Chlorinated camphene (67 to 69 percent chlorine), in 20 percent concentration, gave excellent control of the boll weevil and adequate control of the cotton aphid and bollworm, but did not control the red spider.

Parathion used at strengths of 1, 2, 3 and 5 percent gave control of the red spider and the cotton aphid, but did not adequately control the boll weevil or the bollworm.

The plots treated with the various insecticides produced significantly greater yields in all except one or two cases than did the untreated plots. In some instances the yields where the insecticides were applied were more than twice those of the check plots.

SANDHILL EXPERIMENT STATION

(J. A. Riley, Superintendent)

The physical plant at this station has been improved by repairing and repainting all buildings and re-roofing the five residences. The interiors of three residences have been refinished. Several worn-out farm machines have been replaced with new ones and several additional pieces of new farm machinery have been added. New office furniture and machines have been obtained to replace worn-out or obsolete items. The Dairy Bureau which had been cooperating

for about twenty years in a dairy project at this station terminated this relationship on June 30, 1947, and transferred its personnel and property elsewhere.

Abundant rainfall through most of the growing season resulted in good production of most crops, though extended rain during the fall months retarded harvesting and some hay was lost.

The old Halehaven peach orchard was used during the past season for the experimental application of several kinds of insecticides in the control of peach curculio. A new planting of 533 young peach trees grown on resistant root-stocks was made in the spring of 1947 for use in a study of the value of minor elements in peach growing. These trees made satisfactory development during the following growing season, except for one variety which seems to be incompatible with the root-stock on which it was budded.

The usual acreage of cotton was planted to provide for the continuation of the fertilizer experiments which have been conducted for many years. Two additional experiments were started during the year, one with cotton as the indicator crop and the other with thirteen different crops as indicators.

Plans were made to plant and cultivate nineteen acres of cotton, using mechanized equipment. The experiment could not be carried out entirely as planned because some of the necessary equipment was not available in time. Part of the cotton, however, was harvested with a stripper type cotton harvester and comparable plots were picked by hand. When the data have been assembled comparison will be made of the quality of machine harvested and hand picked cotton and of the cost and efficiency of machine and hand picking.

TRUCK EXPERIMENT STATION

(W. C. Barnes, Superintendent)

Potato Seedling and Variety Tests

(W. M. Epps and C. N. Clayton*)

In 1943, single tubers of each of 432 new potato seedlings were received for testing from the United States Department of Agriculture. The most promising of these seedlings were selected in 1943, increased in 1944, and tested on a larger scale in 1945 and 1947. Information on resistance to late blight and common scab was obtained in 1945 and data on resistance to scab was recorded in 1947. Other new seedlings and varieties were received for tests during the intervening years. Selections were made for productivity, tuber appearance, disease resistance, vine type, and season of maturity.

In 1947, there were included in the test along with these U.S.D.A. seedlings, the six standard varieties now grown in South Carolina (Pontiac, White Rose, Bliss, Cobbler, Katahdin and

* Formerly Associate Plant Pathologist.

Sebago) and a number of recently released varieties as follows: Teton, Mohawk, and Pawnee, developed by the U.S.D.A. in cooperation with certain state experiment stations; Essex, Ashworth, Placid, Virgil, Chenango, and Empire, selected for blight resistance by the New York Experiment Station; Cayuga and Ontario, selected for scab resistance by the New York Experiment Station and the U.S.D.A.; and four new seedlings (B 76-43, B 61-3, B 354-18, B 70-5) developed by the U.S.D.A.

Several of the new varieties and seedlings have appeared particularly promising. (See Table 62.) A blight and scab resistant

Table 62.—Performance of Standard Commercial Potato Varieties, New Varieties, and Seedlings. Truck Station 1945 and 1947

Variety or Seedling	Maturity	Yield (Bushels per Acre)			Resistance to Disease**		
		1945	1947	1947	Late Blight	Common Scab	
			Test No. 1*	Test No. 2	1945	1945	1947
Pontiac	Midseason	257	444	358	5	5	5
White Rose	Late	271	440	358	5	5	2
Bliss	Early	---	393	348	--	--	4
Cobbler	Early	230	389	387	5	5	4
Katahdin	Midseason	283	351	298	5	5	4
Sebago	Late	281	318	222	4	2	2
Essex	Midseason	---	458	---	10	--	4
Ashworth	Midearly	---	398	---	10	--	3
Teton	Midseason	---	395	360	--	--	4
Placid	Late	---	385	---	10	--	4
Pawnee	Early	---	363	335	--	--	5
Ontario	Late	---	343	---	--	--	2
Mohawk	Midlate	---	338	288	--	--	5
Chenango	Midseason	---	288	---	10	--	5
Virgil	Midlate	---	273	---	10	--	2
Cayuga	Midlate	---	215	---	--	--	0.5
Empire	Late	---	198	---	10	--	5
B 76-43	Midseason	---	515	460	10	--	2
B 73-16	Midseason	365	463	375	5	3.5	4
B 61-3	Midseason	---	460	365	10	--	1
B 354-18	Late	---	460	---	--	--	--
B 70-5	Late	---	453	375	10	--	4
B 69-16	Late	390	448	362	0	4.5	4
B 87-1	Midseason	365	438	383	5	4	5
B 137-5	Midseason	351	435	348	5	4.3	3
X 403-5	Midseason	375	435	320	0	1	1
B 69-11	Midseason	375	397	382	0	3.8	4
B 73-10	Midseason	334	375	358	0	0.8	1
B 73-3	Midseason	307	372	318	0	4.5	4
Least difference required for significance at 5% point		106	52-72	62			

* The figures in the column headed "Test 1" include results from 3 separate tests all made in the same uniform field. Plot size and number of replicates varied because quantity of seed varied. The figures in the adjacent columns are for single tests.

** 0=highly resistant, 5=very susceptible, 10=selected for resistance to late blight by breeder, but no opportunity to test resistance in this experiment.

seedling, B 76-43, ranked first in 1947 in both of the yield trials in which it was included, out-yielding the second variety by 52 and 73 bushels in the two trials, differences great enough to be significant in both cases. Other outstanding seedlings were B 70-5, B 73-16, B 69-16, B 354-18, B 137-5, B 69-11, and B 61-3. Essex and Ashworth, late blight-resistant varieties and Teton, which is ring rot-resistant, were outstanding among the new varieties. Although the yield of B 87-1 was good, its deep eyes and susceptibility to disease eliminated it from further consideration.

Many of the new varieties and seedlings were either inferior to or not markedly superior to the standard commercial varieties now grown. Some were too late, others had a poor vine type or rough tubers, and still others were merely less productive than Katahdin and Cobbler.

The marked superiority of several of these new potatoes over standard varieties, both in productivity and disease resistance, suggests that they may have great promise for South Carolina. Tests are contemplated for the next few years on as large scale as the seed supply will permit with the aim of selecting from these outstanding potatoes those few best suited to local conditions and market requirements.

Cabbage Variety Trials

(W. C. Barnes)

Previous tests have shown that Round Dutch is the only reliable round head variety of cabbage for the spring crop. In 1947, seed of this variety was obtained from the three most commonly patronized sources and cabbage grown from this seed was compared. The results reported in Table 63 indicate that seed from any one of the three sources may be expected to yield as much as that from the others. Although Henderson's strain produced slightly, but not significantly, more than the others, it contained more off-type heads. The difference was probably due to these off-type heads which were larger and later than the true-to-type heads. All other round headed varieties tested produced seed stalks or unmarketable, elongated, puffy heads.

Table 63.—Strain Test of Round Dutch Cabbage in 1947 Spring Crop.

Seed Source	Yield in tons per acre	
	Early planting	Late planting
Peter Henderson Company	10.1	8.7
Associated Seed Growers	9.3	7.5
Ferry-Morse Seed Company	8.9	7.4
Difference required for significance at 5% point	1.6	1.4

Several varieties of cabbage from a number of seed sources were tested in the fall of 1946. The differences in the yield of different strains of a variety were small, hence the yields were combined to give the average yields of the varieties reported in Table 64.

Table 64.—Fall Crop Cabbage Variety Test, 1946.

Variety	Date of First Harvest	No. Seed Sources Tested	Yield in Tons Per Acre
Golden Acre	10-23	1	13.1
Round Dutch	10-28	3	12.9
Glory	11-6	4	17.2
Globe	11-6	1	14.0
Marion Market	11-6	3	12.6
Racine Market	11-6	1	14.0
Hollander	11-13	1	12.2
Red Round Dutch	11-13	1	9.0

Racine Market proved undesirable because of extreme susceptibility to cold and to downy mildew during the heading period. Golden Acre is not adapted to production in this area because of small head size, susceptibility to cold injury, and early maturity. Glory is perhaps the best all-round variety of cabbage for fall, although it has three undesirable features: slight susceptibility to cold injury during the heading stage, susceptibility to yellows, and production of over-sized heads under favorable conditions. Marion Market is a good fall crop variety resistant to yellows and perhaps slightly less susceptible than Glory to cold damage. Stands of this variety are frequently poor because it is more susceptible to heat injury in the seedling stage than most other commonly grown varieties. Globe is a fairly new yellows-resistant variety of the Glory type. It appears to be more resistant to cold and mildew than Glory and the head size is slightly smaller as reflected in somewhat lower yields. This variety is suggested as a replacement for Glory, especially on land where yellows is prevalent.

Heads of Round Dutch are small, and yields are usually lower than those of the varieties mentioned above. Its greatest value for fall planting lies in its early maturity and resistance to cold damage, which permits its use when plantings must be made late in the season.

Hollander is a late maturing, cold-hardy variety that should comprise only a small percentage of the fall crop. Heads of this variety are somewhat small, as reflected in lower yields. It is apparently quite susceptible to Alternaria leaf-spot, and other similar late varieties are being tested with the aim of finding one that may be better adapted.

Cabbage Insect Investigations

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

Studies of cabbage caterpillars and their control have been conducted at the Truck Station in cooperation with the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, since 1932. Control measures developed before June 30, 1944, were summarized in the Fifty-Seventh Annual Report of this station. Since that time the investigations of DDT have progressed to the point that this material can be recommended for the control of caterpillars and certain other insects attacking cabbage and related crops during the early stages of plant growth. Further studies of DDT and of more effective methods of using rotenone and pyrethrum insecticides are under way. In addition, tests have been made of several promising new insecticides to determine their effectiveness against aphids as well as caterpillars. There is a need for more effective methods of preventing aphid injury to cabbage and related crops, particularly during cool, wet, or windy weather.

DDT on Young Cabbage Plants—When properly used, DDT gives good to excellent control of the more important species of caterpillars, or "worms", and of several of the other destructive insect enemies of cabbage. DDT is more generally effective against these pests than any insecticide commonly used in the past on cabbage, including cryolite, lead arsenate, calcium arsenate, and paris green. This evaluation of DDT has been based on small field-plot tests, on comparisons with other materials used on larger plots in commercial plantings, on observations of its use on a total of at least 500 acres of cabbage in commercial plantings in Charleston County during the years 1945-1947, and on commercial plantings of summer-grown cabbage in 1947 in southwestern North Carolina. With very few exceptions, all growers contacted have been highly pleased with DDT. By the fall of 1947 it had almost entirely replaced arsenical and fluorine insecticides for cabbage-caterpillar control in the area mentioned. Thus far, no ill effects from the use of DDT on young cabbage plants have been observed.

When applied every 10 to 14 days, a 3 percent DDT dust or a spray containing 1 pound of wettable 50 percent DDT powder to each 50 gallons of water (plus a nonalkaline wetting agent used as directed by the manufacturer) usually has given satisfactory control of "green" caterpillars. These include the cabbage looper, the imported cabbage worm, and the diamondback moth. These insecticides also will control the cross-striped cabbage worm, cucumber beetles, flea beetles, and larvae of the vegetable weevil.

For the control of the more resistant "brown" caterpillars, including the cabbage webworm, the corn earworm, climbing cutworms, and the fall army worm, a 5 percent DDT dust or a spray

containing 1-1/2 pounds of a wettable 50 percent DDT powder in 50 gallons of water is usually needed. This stronger dust or spray also will provide at least partial protection against the harlequin bug and thrips. The dusts should be applied at the rate of 15 to 25 pounds per acre per application and the sprays at the rate of 50 to 75 gallons. From 25 to 40 pounds of a 3 percent DDT dust can be used instead of a dust of 5 percent strength, if desired. Greater dosages than these may be needed to control large fall army worms, the saltmarsh caterpillar, and the southern cabbage worm.

On spring and early-summer plantings, applications should begin when there is about one caterpillar per plant or when about one-fourth of the plants show recent injury due to insects. These conditions usually have occurred about the second or third week after the weekly mean temperatures reach and remain at or above 60° F. In the case of late-summer and fall plantings the control measures should start when the first true, or crinkly, leaves appear. Applications should be repeated every week during rainy weather, and every 10 to 14 days at other times until the insects are brought under control. Every effort should be made to have cabbage plants free of insects when heading begins. An application of DDT just before this stage of growth is reached, even though insects are not abundant at the time, will reduce, and sometimes eliminate, the need for an insecticide later. Such an application has been found to be especially helpful in spring plantings, since insecticides which are more expensive and often less effective than DDT are usually required to control insects during the heading period of the cabbage.

Deposits of DDT on the lower leaves resulting from periodic use of the material during the early stages of plant growth give considerable protection against soil-inhabiting cutworms. DDT, however, should not be expected to provide adequate control of these insects or of mole crickets on seedlings and recently transplanted cabbage. DDT will not control the aphids that commonly attack cabbage in the South.

Caution Should be Observed in Using DDT Insecticides—DDT is harmful to man and to domestic animals and should be handled and used with care. It should not be applied to those parts of cabbage and related plants that are to be used for food or offered for sale. Studies made during the spring and fall of 1945 indicated that DDT residues on cabbage plants at time of harvest were lower when it was used at various times during the plant-heading period, than were residues of arsenical and fluorine insecticides when used in a similar manner in previous experiments. The DDT residues, however, were sufficiently high to be unsafe from a health standpoint. Under usual conditions of marketing and of home use, DDT insecticides should not be applied to cabbage after the heads begin to form. This ordinarily is about one month before harvest.

Rotenone or Pyrethrum on Heading Cabbage Plants—As previously stated, use of DDT during the preheading stage of cabbage growth will appreciably reduce and sometimes eliminate the need for caterpillar control measures thereafter. The continued protection afforded by early use of DDT is greatest against those species of caterpillars that usually begin feeding on the lower leaves, notably the cabbage looper and climbing cutworms. Effects of DDT on the imported cabbage worm and the diamondback moth are not so lasting.

Dusts or sprays containing rotenone or pyrethrum, or a combination of these materials, will give satisfactory control of the previously named "green" species of caterpillars on heading cabbage, if applied when the insects are small and before they reach protected portions of the plant. Periodic use of rotenone insecticides will protect the plants also against turnip aphids and flea beetles, and will be of considerable value against harlequin bugs. The commonly used strengths of rotenone and pyrethrum insecticides have not proved effective against the "brown" species of caterpillars. Rotenone-containing dusts or sprays usually are most toxic to the imported cabbage worm and the diamondback moth, and those containing pyrethrum are most toxic to the cabbage looper and the cross-striped cabbageworm. A combination of these two materials will be found most satisfactory against mixed populations of these two groups of green caterpillars.

The dusts should contain not less than (1) 1 percent of rotenone, (2) 0.3 percent of pyrethrins, or (3) in the case of the combination dust, 0.5 percent of rotenone plus 0.15 percent of pyrethrins. The addition of about 2 percent of a light grade of highly refined mineral oil of the "straw or "vapor" type and about 10 percent of dusting sulfur has been found to increase the control. The proportion of pyrethrins can be reduced by about one-third if the "impregnated" or "coated" type of this insecticide is being used.

Sprays usually are made from rotenone or pyrethrum extracts, which should be diluted according to directions of the manufacturer. Wettable powders can be used in which case the spray mixture should contain not less than 0.4 percent of rotenone, or 0.006 percent of pyrethrins, or half these percentages of each ingredient when they are used together. Two and one-half pounds of a derris, cube, or timbo root powder (5 percent of rotenone), or 3 pounds of a pyrethrum powder (0.9 percent of pyrethrins), should be used in each 50 gallons of water. The dusts should be applied at the rate of 20 to 30 pounds per acre per application and the sprays at the rate of 75 to 125 gallons. The applications should be repeated at least every 10 days until the insects are checked.

New Developments in Connection with Insecticides for Use on Cabbage—Efforts to find means of improving the effectiveness of DDT, rotenone, and pyrethrum insecticides are continuing.

Dust mixtures containing 0.5 percent or 1 percent of DDT in an "impregnated" form, in which a nonvolatile solvent (a mixture of trimethyl and dimethyl naphthalenes) was used, have proved more effective against several species of caterpillars than comparable dusts prepared in the usual manner. It was also found that similar improvements in DDT dust can be attained by simply adding this nonvolatile solvent to ordinary dust mixtures while they are being prepared by the manufacturer. The same was true, but to a lesser degree, when not more than 2 percent of a light mineral oil was added. In general, however, dusts containing the solvent or the oil did not have good dusting quality.

DDT has been found to be compatible with rotenone-containing powders, and with powdered concentrates containing free nicotine, when used in dust mixtures intended for both caterpillar and aphid control on cabbage. Storage of the DDT-rotenone dust did not appreciably affect its toxicity. DDT-nicotine dusts stored for six months were as effective as freshly mixed dusts against caterpillars, but not against aphids.

Tests of New Insecticides—One or more tests of new insecticides gave the following results:

Benzene hexachloride dusts containing 0.5, 1.0, 2.0, and 3.0 percent of the gamma isomer proved to be about as effective as DDT dusts of similar strength against the various species of caterpillars, with the exception of the cabbage looper. The benzene hexachloride did not give as lasting protection as did DDT, and did not prove quite so toxic to the loopers, especially the large larvae. Benzene hexachloride dusts containing 1 percent or more of the gamma isomer proved toxic to the cabbage aphid and the turnip aphid. Dusts containing 2 and 3 percent of the gamma isomer caused slight to moderate injury of cabbage plants on several occasions, the injury being more severe on the larger plants. The odor of the benzene hexachloride dusts persisted in the field for about a week, but was not detected on the cabbage 15 days after the last application.

Dusts containing 3 and 5 percent of chlorinated camphene or of chlordane, or of TDE (dichloro-diphenyl-dichloroethane) were toxic to one or more of the important species of cabbage caterpillars in spring and fall tests in 1947. In some cases the materials were as effective and lasting as DDT dusts of similar strength. The chlorinated camphene dusts gave indication of some toxicity to the cabbage aphid, but otherwise none of these new materials (chlorinated camphene, chlordane and TDE) were superior to DDT. No plant injury was observed.

Dusts containing 1 percent, 2 percent, 3 percent, and 5 percent of the methoxy analog of DDT were generally inferior to similar DDT dusts against the more important species of caterpillars present on cabbage during the spring of 1946 and the spring and fall of 1947. This material was particularly ineffective against the cabbage looper.

The new insecticide, parathion, (O, O-diethyl O-p-nithrophenol thiophosphate) was very toxic to the turnip aphid in preliminary tests during the fall of 1947. It was used in dusts of 0.5 percent and 1 percent strengths. In a small-scale test the 1 percent dust gave an almost complete kill of the cabbage looper, the imported cabbage-worm, and climbing cutworms on cabbage. There were no indications of injury to cabbage and turnips by these dusts. Parathion is very poisonous to higher animals, however.

In small-scale tests in the spring of 1947, a freshly mixed dust containing 2 percent, by weight, of hexaethyl tetraphosphate and a spray of 1 part, by volume, of this material to 1,600 parts of water showed some toxicity to the cabbage aphid but was not as effective as a 3 percent nicotine dust or a benzene hexachloride dust containing 1 percent of the gamma isomer.

Other than DDT, none of the new insecticides discussed above are recommended for the control of insects attacking cabbage and related crops. Further studies are needed to determine their usefulness and possible danger to health.

Cross-striped Cabbage worm Survey—The cross-striped cabbage worm (*Evergestis rimosalis* (Guen.)). which has not been observed in the commercial cabbage-producing areas in the lower coastal section of South Carolina, was found during a hasty survey made in September, 1946, to be an important pest of cabbage and collards in the Piedmont section of this state and in the mountains of southwestern North Carolina. A light infestation on collards was noted near Florence. The caterpillars were moderately to heavily parasitized by the braconid *Apantales orobenae* Forbes in all localities, particularly at the lower elevations. During August, 1947, the cross-striped cabbage worm again was found injuring cabbage and collards in Chester County, and in southwestern North Carolina.

Small-scale cage and field tests in 1946 and 1947 and control operations of growers in 1947 indicated that dusts containing 3 percent DDT or 0.3 percent of pyrethrins are toxic to this insect.

Palmetto, A New Fall Crop Downy Mildew-Resistant Cucumber Variety

(W. C. Barnes)

The mildew-resistant cucumber breeding line 201A-3-7-2-1-2 mentioned in the 59th Annual Report has been released to the commercial seed trade under the name of Palmetto.

Palmetto vines are not greatly unlike those of Cubit; however, its leaves are deeply lobed in a manner that makes identification simple. The season of maturity is the same as Marketer, which usually is 3 to 5 days later than A and C and Cubit. Fruit shape more nearly approaches that of Cubit than of any other variety; however, the fruit is slightly more pointed at the ends than is typical of Cubit fruits. Typical "fancy" fruits are 8-9 inches in length or about the same as Cubit. Fruit color very closely approximates the excellent color of Cubit and Marketer and is superior to that of A and C. It is usually greatly superior in color to Burpee Hybrid and the Puerto Rico varieties 37, 39, and 40. The seed cavity is small like that of Cubit and the color of the interior flesh is excellent. The flavor of Palmetto is good.

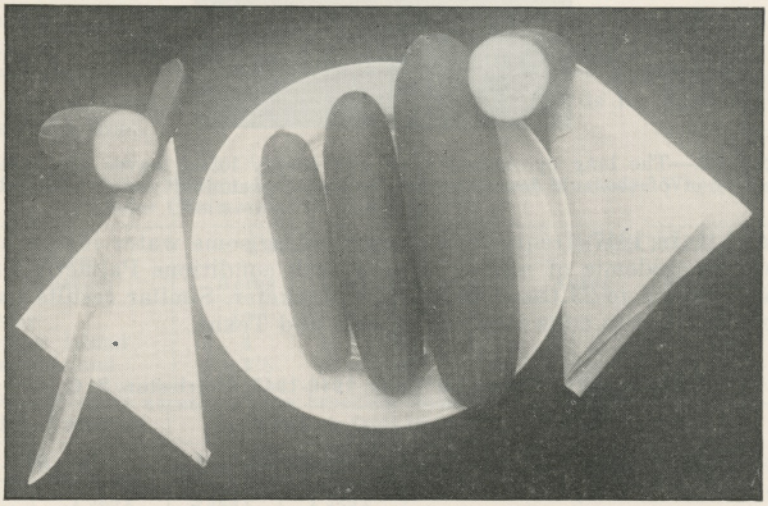

Figure 31.—Typical "jumbo," "fancy," and "pickle" fruits of Palmetto. Note the small seed cavity of the cut fruit.

Several southern state experiment station workers have reported yields of Palmetto in spring crop tests. During the regular harvesting period it produced no more than the varieties normally grown, but if mildew were a factor, it continued in production after other varieties were ruined by the disease. In spite of this, it is doubtful if Palmetto has a place in the spring crop outside of Florida because other states need an early spring variety.

Fall crop tests have shown Palmetto to be outstanding. The results reported in Table 65 show that in a good crop year like 1946, substantial increases in yield may be obtained by using Palmetto instead of the usual commercial varieties such as Marketer and

Figure 32.—The long cylindrical fruit and deeply lobed leaves are typical of the new downy mildew resistant cucumber variety Palmetto.

A and C. In 1947, frequent rains resulted in some water injury and a severe epidemic of mildew. Under such conditions Palmetto produced from 4 to 23 times as much as Marketer. Similar results have been obtained in tests made in Florida and Texas.

Table 65.—Fall Cucumber Tests, 1946-1947, Charleston, S. C.

Variety	Yield in Bushels Per Acre			Percent Defoliation	
	1946	1947		Oct. 20, 1947	
		Test 1	Test 2	Test 1	Test 2
Palmetto	231	135	140	25	25
Burpee Hybrid	279	93	73	60	80
Marketer	138	35	6	95	98
A & C	81	58	3	95	98
Difference required for significance at 5% point	42	34	40		

The chief reason for the differences in performance of the various varieties is evident in the percentage of defoliation by downy mildew reported in Table 63. While Palmetto is not immune to downy mildew, it is so highly resistant that it may be grown without fungicidal treatment in the fall crop where the disease is present during the entire season. It has been reported by various workers to be as resistant to mildew as Puerto Rico 39. Observations at Charles-

ton indicate greater resistance will be evident when this variety is not grown adjacent to susceptible cucurbits. This is due to the fact that resistance is expressed not only as resistance to infection but also as a failure of the fungus to sporulate readily even when the infection is established. These facts are strikingly evident when resistant and susceptible varieties are grown in trials. The resistant plants become infected much more readily than they do when grown in isolated plots.

In the fall of 1947, seed of Palmetto and five other related resistant lines were planted on three farms in coastal South Carolina along with Marketer. The acreages planted and yields reported in Table 66 were obtained from the growers' packing house records. The resistant lines and Marketer were planted in one field and dusted alike with a combination insecticide-fungicide mixture at 5 day intervals as recommended by this station. Yield records of the resistant lines Palmetto, etc., and Marketer were kept separately but no attempt was made to keep separate records for each of the resistant lines.

Table 66.—Total Marketable Yield of Palmetto and Marketer When Grown Under Commercial Conditions.

Farm Location	PALMETTO*		MARKETER	
	Acres	Bu. Per Acre	Acres	Bu. Per Acre
Ritter	17	324	33	36
Yonges Island	4	200	21	50
James Island	4½	182	15½	72

* Part of these acreages were breeding lines similar to Palmetto.

In spite of adverse weather conditions that resulted in poor yields of Marketer, Palmetto and its related lines produced excellent yields. The reason for the latter producing 3 to 9 times as much as Marketer was readily apparent in the rate of defoliation by mildew. For example, in the Ritter planting, Marketer was harvested only twice before it was killed by mildew, whereas Palmetto continued in production from September 22 to November 5.

It is apparent that the introduction of this new cucumber variety will remove the greatest hazard in fall cucumber production in this state. Downy mildew-resistant varieties previously introduced have not been acceptable because of poor fruit shape, color, etc. Limited tests have not revealed any unfavorable market reaction to fruit length, shape, color, or carrying qualities of Palmetto.

A sister line of Palmetto that should be ready for release next year should fill the need for an early resistant variety, suitable for spring planting.

Minor Element Tests

(W. C. Barnes)

Various tests with minor elements have been made in the truck crop area over a period of about twelve years. Early tests showed the need for magnesium and manganese in the soils of the coastal vegetable area. Magnesium has been supplied by the use of basic slag and dolomitic limestone to correct soil acidity and at times by the use of soluble magnesium in the fertilizer. Manganese has been used at intervals in the fertilizer. Since most truck crop soils have been limed, further tests with magnesium have been found unnecessary. In order to test further the need for manganese and certain other minor elements, single row observational tests have been made on a number of farms on various vegetable crops. These tests have not indicated a need for any of the elements tested. At times, response in yield to application of minor elements has been obtained when no visible deficiency symptoms were apparent on the plants in the control plots. In order to investigate this possibility further, experiments using cabbage, tomatoes, Irish potatoes, and lettuce were set up in 1947. Results of the cabbage, tomato and potato tests, reported in Table 67, indicate that these crops failed to respond to applications of boron, copper, zinc, manganese, or Es-Min-El, which is a mixture of a number of essential minor elements. The lettuce crop was ruined by unfavorable weather, but no obvious growth responses were obtained from application of any of the elements tested. A preliminary cabbage test in 1946 likewise resulted in no response in yield to applications of 20 pounds per acre of borax, 100 pounds per acre of manganese sulfate, or 100 pounds per acre of Es-Min-El.

In all of the above tests, the soil had been properly limed for each of the crops grown and basic slag had been applied in previous years. It is therefore concluded that application to the soil of the minor elements included in the test will not be beneficial to these

Table 67.—Response of Cabbage, Tomatoes, and Irish Potatoes to Applications of Certain Minor Elements in the Fertilizer.

Minor Element	Rate per Acre (lbs.)	YIELD PER ACRE		
		Cabbage (tons)	Potatoes (bus.)	Tomatoes (tons)
Zinc Sulfate	100	9.2	365	8.5
Copper Sulfate	100	9.1	396	9.0
Manganese Sulfate	100	8.7	394	9.6
Es-Min-El	100	8.6	392	8.1
Borax	20	6.0*	391	8.3
None (check)	---	8.4	385	9.3
Difference required for significance at 5% point		0.9	Not sig.	Not sig.

* Thru an error, 40 lbs. per acre of Borax was added to the cabbage. This quantity proved toxic thereby stunting early growth and reducing yield.

crops. Since there is a possibility that these minerals may be fixed by the soil, further tests will be made in which the minor elements will be applied directly to the foliage in spray or dust form.

Soil Fumigation

(W. M. Epps)

Experiments were initiated in the spring of 1947 to study the feasibility of controlling the root knot nematode on tomatoes and cucumbers, and of controlling wire worms on potatoes by the use of soil fumigants.

Three separate replicated trials were conducted in 1947, one each on potatoes, tomatoes, and fall cucumbers. The first two were conducted in cooperation with the Shell Chemical Corporation, which supplied the D-D mixture for the work. Innis, Speiden and Co. supplied the ethylene dibromide (Iscobrome D). The results of these tests are combined in Table 68.

Table 68.—The Effect of Soil Fumigation for Nematode and Wire Worm Control on the Yield of Tomatoes, Potatoes, and Fall Cucumbers.

Treatment*	Amount of Fumigant Applied	Potatoes	Tomatoes	Cucumbers	
	Lbs. Per Acre	Bushels Per Acre	Tons Per Acre	Bushels Per Acre	Root Knot Index**
D-D Mixture	100	---	---	106.0	2.48
	200	265	2.89	---	---
	300	275	1.94	---	---
	400	275	2.12	---	---
Ethylene Dibromide	100	---	---	96.8	2.48
	200	290	---	---	---
	300	273	---	---	---
None	---	210	2.24	89.3	3.56
Least difference required for significance at 5% point		95	0.70	n.s.	

* Applied as 2 parallel bands 10 inches apart on the planting bed about 10 days before planting. Seeds planted between the bands.

** Root knot index determined from 50 roots taken at random from each treatment after harvest was completed and graded into classes from 0 (no galls) to 5 (roots killed by root knot), depending on the severity of the disease.

These experiments indicate benefits from the fumigation, but the results were inconclusive. They suggest the desirability of further investigation of the value of soil fumigants.

DDT for Control of Tomato Fruitworm

(W. M. Epps*)

Various investigators have found that DDT is effective in the control of the fruitworm and certain other insect pests of the tomato.

* This trial was conducted with the advice and assistance of W. J. Reid, Jr. of the Bureau of Entomology & Plant Quarantine of the U. S. Dept. of Agriculture.

Other workers, however, have reported that DDT has caused injury to tomatoes, particularly young plants. A 5 percent DDT dust has been used exclusively for fruitworm control at the Truck Station for the last two years with very satisfactory results. It was deemed advisable, therefore, that a thorough study be made of the use of this insecticide on tomatoes.

Dust mixtures containing 5, 10, and 20 percent of technical DDT were compared with a cryolite dust containing 70 percent of sodium fluoaluminate, with a 70 percent calcium arsenate dust, and with a dust containing 5 percent of dichloro-diphenyl-dichloroethane (DDD)*. The 10 and 20 percent strengths of DDT were used so that the plant injury factor could better be studied. Calcium arsenate is usually used undiluted, but a 70 percent strength was used in this test so that a fungicide could be incorporated into the dust. It was later decided to apply the fungicide separately. A flaky talc was used as a diluent in all dust mixtures. The 6 dusts and an untreated control were compared by means of one-row field plots replicated six times in randomized blocks. Each plot contained 10 plants spaced 2 feet apart in 6 foot rows. The Rutgers variety was used in three of the replicates and 119AA, a promising Truck Station breeding line, was used in the other three. The first application was made on May 3 when fruits on the first cluster were set. Two other applications were made at 10 day intervals. Dosages for the three applications ranged from 15-21, 24-30, and 30-40 pounds per acre respectively. Harvests were made at weekly intervals between June 10 and July 2. The fruits were graded into three sizes of sound marketable tomatoes and a cull group. The culls were segregated into fruitworm damaged, sunscalded, rough or "catfaced," and undersized groups. Relevant date are presented in Table 69.

These results indicate that dusts containing 5 percent of DDT or 5 percent of DDD were equally as effective as 70 percent cryolite or 70 percent calcium arsenate dusts for tomato fruitworm control, and that as used, they did not cause serious injury to the tomato plants.

EDISTO EXPERIMENT STATION

(W. B. Rogers, Superintendent)

Research on cotton insect control, sweet potato nutrition, cotton mechanization, cantaloupe and sweet potato breeding and land improvement received major attention at the Edisto Station during the year.

Several new and promising cotton insect control materials were tested on both large and small blocks for the first time in the southern part of the state. This work was watched very closely by

* DDD used was obtained from Rhothane, a Rohm and Haas Company product.

Table 69.—A Comparison of DDT and DDD With Calcium Arsenate and Cryolite For the Control of Tomato Fruitworms.

Insecticide	Insecticide Concentration (Percent)	Total Dosage Per Acre (Pounds)	Yield in Tons Per Acre		
			Marketable (Tons)	Worm-damaged	
				(Tons)	(Percent of Total)
DDT	5	75	11.32	0.154	1.3
DDT	10	78	10.59	0.042	0.4
DDT	20	75	10.07	0.091	0.9
DDD	5	84	10.65	0.197	1.8
Calcium Arsenate	70	87	11.29	0.299	2.6
Cryolite	70	81	9.06	0.215	2.3
None	--	--	9.99	1.101	9.9
Minimum difference required for significance at 5% point			2.25	0.272	

* DDD used was obtained from Rhothane, a Rohm and Haas Company product.

many cotton growers. Two special dusting demonstrations were held, during which several hundred visitors were shown in detail the work being done and results accomplished. In addition, many small groups viewed the work and were impressed with the degree of control obtained.

Nutritional work with sweet potatoes continued to emphasize the importance of borax in the fertilization of this crop. Such studies in past years have resulted in the general use of borax in sweet potato fertilizers in South Carolina. This has undoubtedly contributed to increased yields and improved quality of the crop. Certain results obtained during the year indicate that sulfur may also improve the quality of sweet potatoes. Plans are being made to study this in more detail during 1948.

There has been sustained interest in the cotton mechanization studies now under way, and groups of farmers from throughout the state visited the station to observe the progress being made in this work. It now appears that the major obstacle to complete mechanization of cotton production is the control of weeds and grass prior to the time the plants are eight to ten inches in height. Plans to emphasize weed control studies during this stage of growth are being made.

Breeding work with sweet potatoes and cantaloupes was continued. A promising beginning was made in developing cantaloupe varieties resistant to downy mildew. In the sweet potato breeding work several strains have been developed which appear superior to Porto Rico in flesh color and yield.

Work is under way to reclaim through drainage a tract of land, mostly of the Grady series, which formerly was practically useless. The primary ditches, which have now been completed, will be aug-

mented by secondary ditches and tile lines. Upon completion of the drainage it is proposed to begin work on a system for irrigating this tract. These two operations of drainage and irrigation should bring into a productive state an area of waste land which is representative of many similar areas through the middle and lower coastal plains.

The installation of an experimental sweet potato feed drier at the Edisto Station during the war years was the subject of considerable interest, and inquiries concerning it are still being received. This experimental unit has stimulated the establishment of four commercial driers in the state. Commercial fish scrap driers in the coastal counties are now requesting information concerning the possibility of adapting their equipment to sweet potato drying.

The reports of progress of these and other projects, along with detailed results of some experiments, are reported herein.

Field Crop Variety Trials

(J. H. Horton, Jr.)

New varieties of the various field crops are constantly being developed and introduced by plant breeders. These new varieties are tested each year along with the better adapted old varieties in order that growers may be advised as to their field performance. Results of the 1947 variety trials with the more important field crops are reported below.

Cotton.—Twenty-nine varieties were included in this test and were planted April 18 on Ruston sandy loam. Fertilization consisted of 650 pounds per acre of 4-10-6 under the crop and 150 pounds per acre of nitrate of soda applied as a side-dressing on May 19. The plots were dusted four times with benzene hexachloride-DDT mixture at the rate of 8 pounds per acre to control the boll weevil. The results, which included yield, lint percentage, relative boll size and staple length are listed in Table 70. Several strains of Coker's 100 Wilt, Empire, Marett's White Gold, Wannamaker's Stonewilt and Pandora were the higher yielding varieties. The staple length, lint percentage and boll size of all varieties and strains included were satisfactory for their use in this area.

Corn.—Twenty-three white varieties, 19 hybrids and 4 open-pollinated, and 19 yellow varieties, 14 hybrids and 5 open-pollinated, were included in the test. Seed of the varieties to be tested was planted on April 24. Fertilization consisted of 650 pounds per acre of a 3-9-9 fertilizer applied before planting and side-dressing of 175 pounds per acre of nitrate of soda on May 27. The tests were conducted on two soil types, Blanton sand and Grady sandy loam, to determine the effect of the soil fertility level on the performance of the various varieties. The results, which included yield, shelling percentage, relative lodging and relative weevil infestation are listed

Table 70.—Cotton Variety Trials
Edisto Station, 1947

VARIETY*	Yield in Pounds Per Acre			No. of Bolls Per Lb.	Staple Length, Inches
	Seed Cotton	Lint Cotton	Percent Lint		
Coker's 100 Wilt St. 46-33	2283	856	37.5	71.6	1-1/16
Coker's 100 Wilt St. 46-59	2120	797	37.6	64.5	1-1/16
Coker's 100 Wilt 1947 B.F.S.	2088	781	37.4	64.5	1-3/32
Empire	2045	810	39.6	54.2	1-1/16
Coker's 100 Wilt St. 46-44	2040	785	38.5	71.2	1-1/16
Marett's White Gold 2-3-18	1993	747	37.5	62.7	1-1/16
Wannamaker's Stonewilt St. 7	1980	746	37.7	70.7	1-1/16
Coker's 100 Wilt 46-66	1975	758	38.4	62.4	1-3/32
Pandora	1915	710	37.1	68.2	1-1/16
Marett's W/RE 1-21	1885	711	37.7	69.1	1-1/16
Coker's 100 Wilt 1946 B.F.S.	1863	727	39.0	70.2	1-1/16
Delta and Pineland 15	1855	787	42.4	70.0	1-1/16
Coker's 100 Wilt 46-8578	1845	692	37.5	64.0	1-3/32
Coker's 100 Wilt 45-445	1840	697	37.9	64.9	1-1/16
Marett's W/RC 4-8-26-10-3	1830	701	38.3	67.7	1-1/16
Coker's 100 Wilt 44-113	1808	680	37.6	67.5	1-1/16
Coker's 100 Wilt 46-635	1808	687	38.0	65.5	1-1/32
Delfos 9169	1795	679	37.8	70.0	1-1/16
Stoneville 2 B	1785	682	38.2	68.5	1-1/16
Coker's 100 Wilt 46-62	1785	684	38.3	65.6	1-3/32
Coker's 100 Wilt 46-55	1760	667	37.9	68.3	1-3/32
Marett's 4X	1755	700	39.9	67.9	1-1/16
Marett's White Gold Wilt	1738	674	38.8	73.3	1-1/16
Coker's 100 Wilt 46-52	1705	643	37.7	30.3	1-3/32
Coker's 100 Wilt 46-61	1693	653	38.6	67.8	1-1/16
Coker's 100 Wilt 45-23	1610	646	40.1	72.9	1-1/16
Coker's 100 Wilt 46-736	1558	590	37.9	69.1	1-3/32
Bobshaw	1470	556	37.8	71.6	1-1/16
Sealand 542	978	333	34.1	70.3	1-1/4

Difference necessary for significance between yields at 5% level, 473 pounds.

* Varieties listed in descending order of yield of seed cotton.

in Table 71. Under the conditions of the experiment, a number of the hybrids were significantly better than the popularly grown open-pollinated varieties such as Douthit's Prolific and Hasting's Prolific. Many of the hybrids, however, have loose, short shucks which do not provide much protection against the weevil. This fact limits the use of such hybrids in this state.

Grain Sorghum.—This test, consisting of 11 varieties, was made on Grady sandy loam and was planted July 3. The planting followed cucumbers, which received a heavy application of fertilizer, and it was not necessary to apply any fertilizer to the grain sorghum. Low yields were obtained probably due to the heavy rains which occurred during the growing season, causing excess moisture under the poor drainage conditions prevailing. Yields in bushels per acre and the relative height of each variety are listed in Table 72. Bonita and Early Hegari produced the highest yields per acre.

Table 71.—Corn Variety Trials, Edisto Station, 1947.

Variety	Performance on stated soil type:						Weevil** infestation
	Grady sandy loam			Blanton sand			
	Yield, bushels per acre	Lodging*	Shelling percentage	Yield, bushels per acre	Lodging	Shelling percentage	
White Varieties							
Hybrid							
Tennessee 5109	75.9	L	89.1	36.7	L	68.7	M
Pfister #4100	67.4	M	87.4	32.3	M	76.5	H
Wood's V 120	67.1	L	86.1	18.7	L	65.5	H
North Carolina 1111	---***	--	---	31.0	L	78.9	L
North Carolina T 20	64.5	H	91.0	32.2	L	79.5	H
Tennessee 10	64.0	H	85.8	30.6	M	78.2	M
Wood's V 125	61.0	M	89.4	26.2	M	72.5	H
Wood's S 315	60.7	H	88.3	22.3	M	76.6	L
Broadbent 305 W	60.3	H	88.6	26.4	M	75.8	H
Broadbent 307 W	59.3	H	84.6	26.6	M	76.5	H
Mississippi 5 111	54.2	H	89.6	25.8	L	77.3	L
Wood's 5360	46.6	H	86.4	25.2	L	76.6	M
Louisiana 502	44.5	H	91.6	14.6	L	72.7	L
Louisiana 1030	42.1	M	90.7	13.5	L	66.6	L
Funk's G Hybrid 790W	40.9	M	86.8	21.7	L	72.3	M
Wood's S 350	39.7	H	74.9	19.3	L	72.2	M
Florida W—1	35.1	L	85.0	19.1	L	73.3	L
Latham's Double	32.0	H	88.0	16.5	L	70.4	M
Wood's Dixie	30.4	H	88.6	17.4	L	68.2	L
Open pollinated							
Hasting's Prolific	56.0	H	92.5	21.9	L	70.4	M
Wise	39.3	H	89.4	21.2	L	68.6	L
State Hospital	31.9	M	88.0	24.9	L	70.5	M
Douthit's Prolific	31.2	H	89.8	25.3	L	81.7	L

Yellow Varieties							
Hybrid							
North Carolina 27	86.5	H	84.3	23.4	L	75.8	M
North Carolina 5002	81.0	H	85.2	20.0	L	75.7	L
Funk's G—717	78.6	M	88.3	23.5	M	75.0	M
North Carolina 26	75.0	M	83.8	20.3	L	75.8	H
North Carolina 1032	72.7	L	88.8	20.9	L	79.5	H
Pfister #4015	72.7	M	85.6	16.4	L	71.3	H
Dixie 44	71.3	M	89.5	24.2	L	74.4	H
Kelly K—374	70.3	M	80.9	16.5	M	69.4	H
Wood's S 210	66.8	H	87.8	21.7	L	78.5	H
Illinois 200	66.7	M	83.8	17.2	M	68.3	H
Funk's G-714	66.3	H	85.4	21.6	M	68.0	H
Wood's S 240	65.6	M	87.6	11.8	L	70.4	L
Wood's V 60	62.8	H	91.0	18.2	L	84.5	H
Keystone 222	57.7	H	85.9	18.3	M	74.3	H
Open pollinated							
Hasting's Prolific	73.4	H	92.0	19.5	M	75.2	H
Wood's Indian Chief	56.7	H	86.9	22.0	M	79.8	H
Wood's Golden Prolific	51.8	H	85.4	20.2	L	72.2	H
Douthit's Prolific	51.2	H	91.0	18.5	L	74.0	M
Jarvis' Prolific	48.7	M	87.2	19.6	M	75.8	H

Differences in yields necessary for significance at the 5 percent level: white varieties, on Grady sandy loam and Blanton sand, 15 bushels and 6.9 bushels, respectively; yellow varieties, 15.4 bushels on Grady sandy loam. Differences not significant on Blanton sand.

* L —Less than 20%
M—20%—60%
H—over 60%

** L —Less than 5%
M—5%—30%
H—over 30%

*** —Insufficient seed.

Table 72.—Grain Sorghum Variety Trials, Edisto Station, 1947.

Variety	Yield, bushels per acre	Type of Growth
Bonita B-C-44-2	18.9	Tall
Early Hegari EH-C-44-1	16.1	Tall
#13 Hegari H-R-46-2	14.4	Tall
Martin's Milo M-C-44-11	13.0	Medium
Plainsman Milo P-C-44-11	13.0	Dwarf
Edward's White Combine Milo	13.0	Medium
Double Dwarf Yellow Sooner	11.4	Medium
Double Dwarf 38 Milo	11.1	Dwarf
Caprock S. A. 7000	9.7	Dwarf
Double Dwarf White Sooner	9.6	Medium

Difference necessary for significance between yields at the 5% level, 2.1 bushels.

Oats.—Thirteen varieties were planted October 23 on Ruston sandy loam. Fertilization consisted of 300 pounds per acre of a 3-9-9 mixture applied before planting and a side-dressing of 100 pounds per acre of nitrate of soda given on March 21. The yield of each variety of oats in the test is listed in Table 73. Coker's Victorgrain, Marett's Anderson and Coker's Fulgrain produced higher yields than the other varieties in the test.

Table 73.—Oat Variety Trials, Edisto Station, 1947.

Variety	Source	Yield, bushels per acre
Coker's Victorgrain	Coker's Pedigreed Seed Co.	108.0
Marett's Anderson	Marett's Farm and Seed Co.	106.0
Coker's Fulgrain	Coker's Pedigreed Seed Co.	96.2
Wood's Fulgrain St. 6	T. W. Wood and Sons	95.5
Marett's Carolina Red St. 1	Marett's Farm and Seed Co.	92.2
Coker's Stanton	Coker's Pedigreed Seed Co.	88.4
N. C. State Letoria	N. C. State Expt. Station	83.8
Wood's Stanton	T. W. Wood and Sons	81.7
Wood's Letoria #285	T. W. Wood and Sons	80.7
090 x Bond 140-17-63-75-243	Tenn. Expt. Station	63.9
Marett's Fulghum St. 2	Marett's Farm and Seed Co.	60.0
Marett's Winter Resistant St. 6	Marett's Farm and Seed Co.	47.3
Forkedeer	Tenn. Expt. Station	15.2

Difference necessary for significance between yields at 5% level, 16.5 bushels.

Wheat and Barley.—Eight varieties of wheat and thirteen of barley were tested under the same soil and fertilizer conditions as were the oat varieties. The yields in bushels per acre are listed in Tables 74 and 75, respectively. Several strains of Marett's Sanett and Coker's Hardired wheat and the two strains of Marett's Calhoun barley comprised the higher yielding varieties.

Table 74.—Wheat Variety Trials, Edisto Station, 1947.

Variety	Source	Yield, bushels per acre
Marett's Sanett St. 2	Marett's Farm and Seed Co.	40.7
Marett's Sanett St. 41-950	Marett's Farm and Seed Co.	39.6
Coker's Hardired	Coker's Pedigreed Seed Co.	37.2
Marett's Sanett M764-5	Marett's Farm and Seed Co.	31.4
Wood's Hardired #347	T. W. Wood and Sons	28.7
Coker's Redhart	Coker's Pedigreed Seed Co.	20.5
Coker's Hybrid B1-45-21	Coker's Pedigreed Seed Co.	20.2
Wood's Redhart #46	T. W. Wood and Sons	20.2

Difference necessary for significance between yields at 5% level, 7.1 bushels.

Table 75.—Barley Variety Trials, Edisto Station, 1947.

Variety	Source	Yield, bushels per acre
Marett's Calhoun St. 1	Marett's Farm and Seed Co.	56.5
Marett's Calhoun St. 2	Marett's Farm and Seed Co.	56.0
Jackson #1	Tenn. Expt. Station	50.5
Wood's Beardless Winter #2	T. W. Wood and Sons	48.9
Marett's Hooded St. 4	Marett's Farm and Seed Co.	48.7
N. C. State Sunrise	N. C. State Expt. Station	45.6
Marett's Awnless St. 15-7	Marett's Farm and Seed Co.	45.2
MBxSA B 3-56 977-8-1	Tenn. Expt. Station	43.6
Marett's Sunrise St. 3	Marett's Farm and Seed Co.	42.7
N. C. State Hooded #27	N. C. State Expt. Station	38.4
Marett's Sunrise 58-79-12	Marett's Farm and Seed Co.	35.9
Wood's Wong #169	T. W. Wood and Sons	35.7

Difference necessary for significance between yields at 5% level, 11.4 bushels.

Cotton Mechanization

(M. R. Powers and G. B. Nutt)

Cotton mechanization studies were continued at this station in 1947 to determine: (1) the practicability of producing cotton on a large scale without the use of hand labor, and (2) the effect of flame cultivation, flat sweep cultivation, and rotary hoe cultivation on weed control.

An attempt was made to mechanize completely the production of 100 acres of cotton. Cost records were kept of all operations performed. Individual fields involved in the experiment varied in size from 10 to 25 acres. The soils of some fields were of a light, sandy type while others were fairly stiff, containing considerable clay. About 25 acres were terraced.

The following facts attest the degree of mechanization attained: 50 acres were hoed once in the conventional manner, and at a later date some terrace rows were hoed. Fifty acres were completely mechanized.

A detailed description of the operations performed on the 100 acres follows:

Seedbed Preparation.—All fields were plowed once with a disc tiller during the winter and then disked with a tandem disc harrow just before planting.

Planting and Fertilizing.—The fields were planted and the fertilizer applied with a two-row tractor planter equipped with a fertilizer attachment. Planting started April 7 and was completed 9 days later, except for a 20 acre field which was replanted at a later date. Disk hillers and runners on the planter were set so that the beds would be flat, which is desirable for both flame cultivation and mechanical picking. The rows were 42 inches apart, and a 4-10-6 fertilizer was applied at the rate of 600 pounds per acre. Seed of Coker 100 Wilt-Resistant variety were planted about 1 inch deep, at the rate of 1 bushel per acre. The seed had been machine delinted and treated with 2 percent Ceresan.

Rotary Hoeing.—Cultivation with a four-row rotary hoe was begun April 19, or 12 days after the first planting. This machine was pulled across the rows in some fields and along the rows in others. A tractor operating in third gear was used to pull this machine, and approximately 30 acres were covered in one day. A rotary hoe attachment, fitted between the front sweeps, was used with 8 inch sweeps on the cultivator for the second cultivation. These toothed wheels run directly on the bed when the cotton is young without excessive injury to the plants. They prevent early weed growth and in some cases stimulate plant growth. Ordinarily the rotary hoe may be used two or three times before the plants are large enough for cultivation in the conventional manner.

Thinning and Chopping.—A two-row tractor-drawn cotton chopper was used for thinning and chopping. This operation was started May 9th, but it was necessary to chop only 45 acres, the remaining 55 acres having been sufficiently thinned by the rotary hoe during the first cultivation.

Cultivating with Sweeps.—Cultivation with sweeps on a two-row tractor-mounted cultivator was started April 28. The sweeps were mounted along with the rotary hoe attachment and set very flat in an attempt to keep the beds level for subsequent flame cultivation. The rotary hoe attachment was used for only one cultivation. At the time of cultivation, with a regular sweep, the first week in June, nitrate of soda was applied as a top dressing at the rate of 80 pounds per acre with the tractor fertilizer attachment.

Flame Cultivation.—Flame cultivation was started June 9 with a tractor-mounted four-burner, two-row Sizz-Weeder. This machine was a 1947 model which used butane gas and did not require a continuous spark from the tractor engine to keep the burners operating.

Figure 33.—A four row tractor-drawn Rotary Hoe.

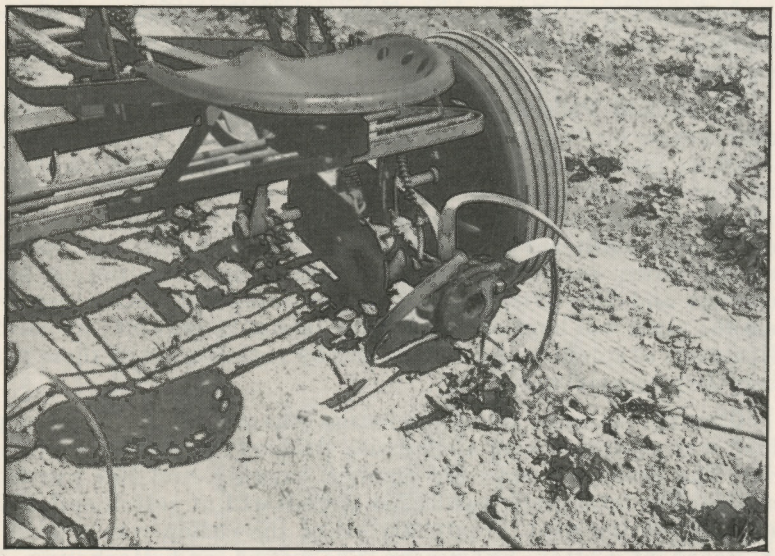

Figure 34.—A two row tractor-drawn Cotton Chopper.

A hand-operated snap-action valve, located near the tractor seat, was used to control the flame while turning at the ends of the rows. A small hole drilled in the valve seat allowed sufficient gas to pass to the burners to keep them burning while turning at the row ends. The burners were adjusted to sweep across the beds at the base of the plants. The flame from one burner was not allowed to oppose the flame from the opposite burner operating on the same row. The Sizz-Weeder was mounted on the rear of a tractor where the rear cultivator sections were normally mounted. The front sections of the cultivator remained on the tractor and front sweeps were mounted to work the row middles. Flames from the burners did not reach far enough to kill small grass growing in the middles.

The principal weeds occuring in the cotton fields were crab grass, Johnson grass, coffee weed, Bermuda grass, Cockle bur, parsley, pigweed, and nut grass. The flame usually killed grass less than 3" high, while larger growth usually survived.

Dusting for Boll Weevil Control.—Dusting for boll-weevil control started June 17 and continued until July 30. All fields were dusted three times and two fields of approximately 50 acres were dusted four times. The dust was applied with an eight row tractor power-take-off duster. The tractor was operated in fourth gear, covering approximately 12 acres an hour.

Defoliation.—Aero defoliant, containing calcium cyanamid as the active ingredient, was applied at the rate of 30 pounds per acre approximately a week before picking began. The defoliant was applied with the same machine and in the same manner as the boll weevil control dust.

Mechanical Picking.—Picking with an IHC high-drum cotton picker began on September 4 and was completed October 13. All fields were picked one time. Picking started in the mornings as soon after servicing as possible, and in some cases before the morning dew had disappeared. Lights were installed on the picker and some picking was continued until after dark. The water for the spindles was cut down considerably when picking moist cotton in early mornings and late afternoons. The percentage of cotton removed from the plant was kept at a high level (about 90 percent) by careful adjustment of spindles and doffers and by replacement of these parts when they became worn.

Ginning.—Almost all of the cotton was ginned at one local gin which was equipped with a six-drum cleaner, extractor feeders and drier. The average charge for ginning, bagging, and ties was $6.50 per bale. The total yield was 30,254 pounds of lint cotton and 45,050 pounds of cotton seed. Practically all of the cotton was graded by the Board of Cotton Examiners, Production and Marketing Administration, U. S. Department of Agriculture. The grades ran from

Table 76.—Costs and Returns From 100 Acres of Cotton Under Mechanized Production, Edisto Station, 1947.

Cost of Production

Operations and other factors	Hours of Operation	Equipment costs			Unit cost	
		Fixed*	Operating	Total	Per acre	Per hour
Plowing	96	$ 65.36	$ 60.44	$ 125.80	$ 1.26	$1.31
Disking along with Planting	35	31.05	22.05	53.10	.53	1.52
Planting and Fertilizing	89	53.31	67.00	120.31	1.20	1.35
Rotary Hoeing	27	31.83	14.10	45.93	.46	1.70
Chopping	28	50.62	20.70	71.32	.71	2.54
Flame Cultivating	128	112.66	65.80	178.46	1.78	1.39
Sweep Cultivating	312	137.61	197.10	334.71	3.35	1.07
Machine Picking	277	1,363.76	254.85	1,618.61	16.19	5.84
Stalk Cutting	32	23.01	19.40	42.41	.42	1.32
Dusting	29	28.82	16.25	45.07	.45	1.55
Defoliating	13	11.98	10.20	22.18	.22	1.70
Misc. Expense**				584.70	5.84	
Cost of Operation	1066	1,910.00	747.89	3,242.60	32.42	
Cost of Materials***				2,261.62	22.62	
Rent****				500.00	5.00	
Total Cost of Production				6,004.22	60.04	

Summary of Costs and Returns

Item	Per 100 Acres	Per Acre	Per Bale
Lint	$ 8,206.39	$ 82.06	$135.64
Seed	2,027.24	20.27	33.50
Total Returns	10,233.63	102.33	169.15
Total Cost	6,004.27	60.04	99.21
Net Returns	4,229.41	42.29	69.90

* Fixed costs were computed from both actual and estimated values and included such items as depreciation, repairs, interest, insurance and taxes.
** Miscellaneous costs include hand hoeing, ginning, hauling.
*** Cost of materials includes seeds, fertilizer, dust, butane gas, and defoliant.
**** Rent costs were computed on the basis of $5.00 per acre.

LM 1 1/16 to SGO 1 1/32. The cotton was sold November 19, 1947 to a local buyer for 27.125 cents per pound. Hand picked cotton (middling) on the same market was selling for 32.625 cents per pound.

Explanation of Table.—A summary of the cost of production on the 100-acre project is shown in Table 76. The fixed, operating and total costs, as well as the unit costs per acre and per hour are listed for each of the mechanized operations. The fixed costs were computed from both actual values (where available) and estimated values and include such items as depreciation, repairs, interest, insurance and taxes. The operating costs include fuel, lubricating oil and labor. It should be pointed out that most of the machines used have a greater capacity than required for the acreage covered in this enterprise, and that lower per acre and per hour costs could be realized by the operation of the machine at full capacity. The total cost of the tractor is not given separately because it was included in the operating costs of other machines.

Summary

1. An attempt was made to mechanize the production of 100 acres of cotton. Fifty acres were completely mechanized, while the remaining 50 acres required a small amount of hand hoeing.
2. The only operations requiring the labor of more than one man were planting and chopping. If a satisfactory tractor-mounted mechanical chopper were available, chopping might become a one-man operation.
3. Two important factors in the success of mechanization were early planting and the use of fields relatively free of weeds.
4. The critical period in the program of mechanization followed in this experiment was the time between seedling emergence and flaming.
5. Flame cultivation usually controlled weeds less than 3 inches in height.
6. The total yield from the 100 acres was 60.5 bales of 500 pounds each.
7. The total cost of producing 100 acres of cotton was $6,004.22, and the gross returns were $10,233.63, making the net returns $4,229.41.

Influence on the Yield of Cotton of Varying Rates of Sodium Nitrate Applied as Side-dressing

(J. H. Horton, Jr.)

A test was conducted on Ruston sandy loam to determine the influence on the yield of cotton of varying amounts of sodium nitrate applied as side-dressings. The plots received a basic treatment of 650 pounds of 4-10-6 fertilizer per acre before planting on April 21. The

side-dressings of sodium nitrate were applied on May 12 at four rates: 100, 200, 300 and 400 pounds per acre. In addition, the 300 and 400 pound applications were divided into two applications each with the second portion applied on June 24. One plot was left untreated to serve as a check. The plots were dusted four times during the season with benzene hexachloride—DDT mixture at the rate of 8 pounds per acre to control the boll weevil. The yields and percentages of the crop harvested at the first picking are reported in Table 77.

Table 77.—Influence of the Rate of Application of Sodium Nitrate, Used as Side-dressing, on the Yield of Cotton. Edisto Station, 1947.*

Rate of application of sodium nitrate, lbs. per acre	Yield of seed cotton, lbs. per acre	Percentage first picking	Increase over no treatment, percent
0	734	77.5	0
100	800	72.5	9.0
200	921	66.6	25.5
300	1143	73.7	55.7
400	1084	60.5	47.7
300**	976	65.8	33.0
400**	1088	60.3	48.2
L.S.D. at odds of 19:1			

* Planted in 42-inch rows on April 21.
Side-dressing applied May 12.
** Split applications: first half applied May 12; second, June 24.

Side-dressing with 300 pounds per acre of sodium nitrate in a single application resulted in a yield of 1143 pounds per acre. This yield was 55.7 percent greater than that from the check treatment and 73.7 percent of it was harvested at the first picking. Yields from other treatments were intermediate between this and the yield of the check treatment. The split-applications did not produce consistent increases over the single applications.

Influence of Side-dressings of Nitrogen Fertilizer and Spacing on the Yield of Three Varieties of Corn

(J. H. Horton, Jr.)

Various experiments have shown that corn responds to heavy applications of nitrogen fertilizer under favorable seasonal conditions. They have also shown that maximum yields can only be obtained through rather close spacing of plants in the rows. An experiment was set up to include three varieties of corn, each of which was grown at four spacings and three levels of nitrogen fertilization. Adequate phosphate and potash were provided in the basic fertilizer except that for two check plots, one of which received no phosphate and one no potash. The soil type was Ruston sandy loam. A split-plot design was used and the plots were planted April 24. Side-dressings

Table 78.—Influence of Amount of Sodium Nitrate Applied as Side-dressing on Yields of Three Varieties of Corn Planted at Various Spacings, Edisto Station, 1947.

Basic Fertilizer Application, Lbs. Per Acre	Side-dressing, Lbs. Per Acre Sodium Nitrate	Yields in Bushels Per Acre from Various Spacings*															
		Douthit's White Prolific				N. C. 27				Tennessee 10				Average, Three Varieties			
		37.4	21.4	15.0	11.5	37.4	21.4	15.0	11.5	37.4	21.4	15.0	11.5	37.4	21.4	15.0	11.5
500 # 0-9-9	0	25	--	--	--	29	--	--	--	19	--	--	--	24	--	--	--
500 # 3-9-9	0	28	31	31	--	39	46	39	--	35	27	24	--	34	35	31	--
500 # 3-9-9	250	35	61	52	63	48	75	58	69	39	74	49	51	41	70	53	61
500 # 3-9-9	500	56	75	78	70	61	87	81	85	39	71	70	70	52	78	76	75
500 # 3-9-9	750	51	67	75	77	54	76	77	78	48	61	68	63	51	68	73	73
500 # 3-0-9	750	--	--	--	74	--	--	--	87	--	--	--	76	--	--	--	79
500 # 3-9-0	750	--	--	--	63	--	--	--	89	--	--	--	75	--	--	--	76

* Distance between rows was 42 inches. Plants in the row were spaced 37.4, 21.4, 15.0 and 11.5 inches apart giving 4,000, 7,000, 10,000 and 13,000 plants per acre, respectively.

of sodium nitrate were applied May 23. Rainfall was above average during the growing season. The yields per acre for each variety, treatment, and spacing are given in Table 78. The comparative yields of one variety grown at different levels of nitrogen fertilization are shown in Figure 35.

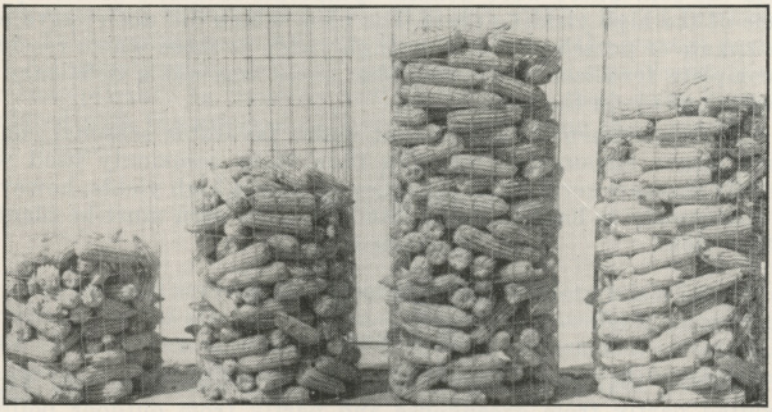

Figure 35.—Comparative yields of N. C. 27 hybrid corn at the 15 inch spacing and four levels of nitrogen side-dressing. Yield of plots receiving side-dressings of nitrate of soda, left to right: 0, 250, 500, and 750 pounds per acre, respectively.

Notable increases in yield were obtained from the plots receiving the larger amounts of nitrogen and planted at the medium spacings. The highest yield, 87 bushels per acre, was obtained from the N. C. 27 variety, a yellow hybrid, which received a side-dressing of 500 pounds per acre of sodium nitrate in addition to the basic fertilizer (500 pounds per acre of 3-9-9) at the 21.4 inch spacing. Douthit's White Prolific yielded 25 bushels per acre when planted 37.4 inches apart in the row without any nitrogen fertilizer (500 pounds per acre of 0-9-9), while N. C. 27 under the same conditions produced 29 bushels, and Tennessee 10, a white hybrid, produced 19 bushels per acre. When 15 pounds of nitrogen per acre was included in the fertilizer (500 pounds per acre of 3-9-9) the yields of the three varieties at the same spacing were increased to 28, 39 and 35 bushels per acre, respectively. Douthit's White Prolific, when fertilized with the basic mixture, produced 31 bushels per acre at the 21.4 inch spacing while N. C. 27 and Tennessee 10 yielded 46 and 27 bushels per acre, respectively. When 250 pounds of sodium nitrate was applied a side-dressing in addition to the basic fertilizer application, the three varieties yielded 61, 75, and 74 bushels per acre at the 21.4 inch spacings. At the 15-inch spacing side-dressing with 500 pounds of nitrate of soda resulted in yields by the three varieties of 78, 81,

and 70 bushels per acre, respectively. Side-dressing at the rate of 750 pounds per acre did not produce consistent increases in yield above those obtained from 500 pounds per acre. It is possible that the increases might have been greater except for the rather heavy rainfall which possibly leached a considerable amount of the nitrate nitrogen from the soil. There were definite symptoms of boron deficiency on some of the high yielding plots. The plots which did not receive any phosphate or potash produced as high yields as those which received a complete fertilizer, indicating that there was not a deficiency of these elements in the soil.

The experiment indicates that under favorable seasonal conditions larger amounts of nitrogen than those commonly used will greatly increase corn yields. In order to obtain high yields, however, it is necessary to have uniform stands and the corn must be planted rather close.

Sweet Potato Breeding

(M. B. Hughes)

During 1947 about 1500 seedlings were grown from seed which resulted partly from greenhouse and partly from outdoor pollinations. Greenhouse breeding is much more efficient since more uniform environmental conditions can be obtained, bringing about more profuse blooming. In addition, the seed is seldom lost.

In the outdoor breeding work, plants are set in early May but do not bloom profusely until mid-August. Weather conditions from that time until frost are often adverse, and a low seed set or none at all may be obtained. There are a number of days when no pollinations can be made. Strong winds and heavy rains whip the plants and many seeds are lost. However, the need for considerable space for the plants restricts the number that can be grown in the greenhouse and some outdoor breeding will be continued.

General procedure in handling seedlings is to germinate the seed in the greenhouse and set the young plants in an irrigated plot when they are six weeks old. After these grow under irrigation for six weeks, five cuttings from each seedling are set in the field. At harvest time notes are taken on internal and external color, shape, yield, etc., and the promising seedlings are retained for further testing.

In the second year the roots of the selected seedlings are bedded and as many plants of each as can be obtained are set in the field. Usually there will be a 30-60 foot single row of each. Observations on vine vigor, disease resistance, table quality, carotene content and yield are made during the second year.

In the third year, data are collected on keeping quality and sprout production. The seedlings are planted in replicated plots to determine yields in comparison with Porto Rico. By the end of the

third season, preliminary appraisal of their commercial possibilities can be made. Those judged of sufficient promise then go into extensive tests before they are released to growers.

About 200 second-year seedlings were tested in 1947. A number appeared to be superior to Porto Rico in flesh color. The best of these were sent to Meridian, Mississippi for carotene analysis. A few of them appeared to be excellent yielders and will be tested further in 1948. Table quality tests will also be made during the storage period.

All promising second-year seedlings have had a preliminary test for susceptibility to fusarium wilt and most of them have been inoculated with the internal cork virus to determine their reaction to that disease.

Cantaloupe Variety Trials

(M. B. Hughes)

For the past several years no cantaloupe variety trials have been carried on at this station. It seemed desirable, therefore, to compare some of the newer varieties with those now grown and to establish standards for the evaluation of varieties in process of development at this station.

Unfortunately, downy mildew and anthracnose were present in epidemic form and none of the varieties performed as well as they should have. Some varieties, particularly susceptible to anthracnose, were very badly damaged. Nevertheless, the test was useful since it revealed the comparative behavior of varieties and strains under unfavorable conditions.

Table 79 gives a summary of the results obtained as to earliness, fruit size and yield. Seed Breeders' strain of Hale's Best was significantly higher in yield than Texas #1 and the new Powdery Mildew Resistant strains 5, 6 and 8. It was also superior in yield to Hale's Jumbo, although the fruits are too small for the truck trade. It was not significantly higher in yield than Purdue 44, Hale's 936 or P.M.R. 45.

The higher percentage of large fruits produced by Hale's Jumbo indicates its superiority as a melon for truckers, while Seed Breeders' strain of Hale's Best or Hale's 936 would be preferred if the melons were to be packed for shipment.

Texas #1 had the highest quality of any variety tested, but its tendency to crack at the blossom end makes it unsuited for commercial production. It is quite resistant to downy mildew and might be planted in small quantities for the home garden. The new variety Crenshaw was completely destroyed by anthracnose, which also badly injured Delicious, Extra Early Sunrise and Golden Gopher. Since these four varieties are susceptible to this disease and are generally unsuited for commercial production, they should not be planted.

Table 79.—Yield, Size and Earliness of Cantaloupe Varieties. Edisto Station, 1947.

Variety*	No. fruits per acre	Percentage of the crop in various size classes**					Earliness: percent of fruits harvested 90 days after planting
		45	36	27	24	18	
Seed Breeders Hale's	8930	26.8	56.9	16.3			17.9
Purdue 44	6970	52.1	41.7	6.2			14.6
Hale's 936	6970	36.4	47.9	14.6	1.0		14.6
Extra Early Hanover (F)	6970	59.4	32.3	8.3			93.7
Powdery M. R. 45	6534	23.3	52.2	24.4			1.1
Texas #1 (A)	5953	43.9	48.8	7.3			3.5
Delicious (A)	5735	21.5	46.8	29.1	2.5		13.9
Powdery M. R. 5	5590	26.0	54.5	18.2	1.3		2.6
Hale's Jumbo (B)	5300	10.9	20.5	57.5	10.9		4.1
Extra Early Sunrise (E)	5082	20.0	40.0	32.8	7.1		20.0
Powdery M. R. 8	4864	34.3	40.3	25.4			3.0
Golden Gopher (D)	4646	10.9	59.4	28.1	1.6		4.7
V-1 (C)	4501	27.4	45.2	27.4			11.3
Powdery M. R. 6	3775	67.3	28.8	3.8			1.9
Golden Champlain (C)	3703	68.6	31.4	---			45.6
Extra Early Osage (D)	3412	12.8	31.9	44.7	10.6		---
Schoon's Hard Shell (B)	2396	---	9.1	51.5	33.3		---
Emerald Gem (A)	2251	61.3	32.2	6.4			22.6
Crenshaw	----						

Difference in yield required for significance: 2,506 fruits.
Yields based on data from 1/290 acre plots replicated four times.
Planting date—April 4.
* Seed obtained from Rocky Ford Seed Breeders Association except where indicateed as follows: A—Associated Seed Growers, Inc.; B—Burrell Seed Growers Co.; C—Ferry-Morse Seed Co.; D—Oscar H. Will and Co.; E—Market Gardener's Seed Store; F—T. W. Wood and Sons.
** Number of Melons per crate.

All varieties except Texas #1 were badly injured by downy mildew and the quality of all other varieties was low. The fact that the new Powdery Mildew Resistant strains 5, 6, and 8 are later than other Hale's Best strains and are as susceptible to downy mildew indicates that no advantage would be gained by using them. Extra Early Hanover and Golden Champlain are low in quality and suitable only as early varieties for the home garden.

Cantaloupe Breeding

(M. B. Hughes and C. J. Nusbaum)

The 1947 season was very favorable for breeding cantaloupes for disease resistance, since both downy mildew and anthracnose were abundant. Susceptible varieties were badly injured and sometimes completely destroyed. Resistant individuals were thus easy to distinguish, which is not the case when diseases are mild and late in appearing.

The F_2 families from crosses of Texas #1 with Seed Breeders' strain of Hale's Best and with V-1 were grown and observed for disease resistance, appearance, quality and freedom from cracking. Texas #1 is quite mildew tolerant and high in quality but produces a large percentage of cracked fruits.

The percentage of cracking in both these F_2 families was much lower than in the mildew-tolerant parent. The appearance, quality and mildew resistance of the Texas-Hale's Best family was distinctly superior to the Texas-V-1 family. The average percentage of soluble solids (mostly sugars) in the juice of the former was 10.8 as compared with 7.0 for commercial strains of Hale's Best grown nearby under the same conditions. Over half the fruits from the Texas-Hale's Best F_2's tested above 11 percent soluble solids and 12 percent of them had 12 percent soluble solids or more. This indicates that continued selection will result in a further improvement in quality, as well as eliminating the tendency to crack and fixing the mildew tolerance.

Neither Texas #1 nor any plant of the F_2 progeny of its crosses with Hale's Best and V-1 has a high degree of mildew resistance under conditions at the Edisto Station. Many of them are, however, resistant enough to develop and ripen a crop while the foliage is still in good condition, thus permitting the fruit to reach its maximum quality. Present commercial varieties in contrast become so badly defoliated before the fruit ripens that they are flat and insipid in flavor, and later fruits fail to net properly.

A high degree of resistance to downy mildew is present in some derivaties of strain 124112 of the Plant Introduction Division, U.S.D.A. Only a few pinpoint lesions were evident on it and the F_1 plants from the cross between it and P.M.R. 45 in the years of severe mildew, 1946 and 1947. This resistance is less when the crop is grown in the fall but it is still very pronounced. Even though both the resistant parent and the F_1's have an objectionable flavor, the high degree of its resistance and its apparent dominance suggests that it will be of considerable value in breeding. Both Honey Dew and Persian, as well as commercial cantaloupe varieties, have been crossed with this highly resistant type in an effort to develop resistant strains.

An F_2 family resulting from the cross of Honey Dew with Extra Early Hackensack was grown with the object of developing an early maturing Honey Dew which would be resistant to anthracnose of the fruit. Susceptibility of the Honey Dew fruits to this disease is a major cause of its failure under the conditions in this area. Thirteen of the 81 fruits tested appeared to be recombinations of the Honey Dew quality with Hackensack earliness. Although a long period of selection will be required to fix earliness, quality, resistance to fruit lesions and Honey Dew type, it is believed that progress is being made toward a Honey Dew which will be suitable for South Carolina conditions.

Constructing Drainage Ditches With Dynamite

(M. R. Powers)

As part of an extensive program of land improvement on a recently acquired farm unit, the Edisto Experiment Station contracted for the construction of three large drainage ditches in 1947. The surveying of the project was conducted by engineers of the local Soil Conservation District. The contractor, using a dragline machine (Figure 36) moved 13,443 cubic yards of earth at a cost of 24 cents

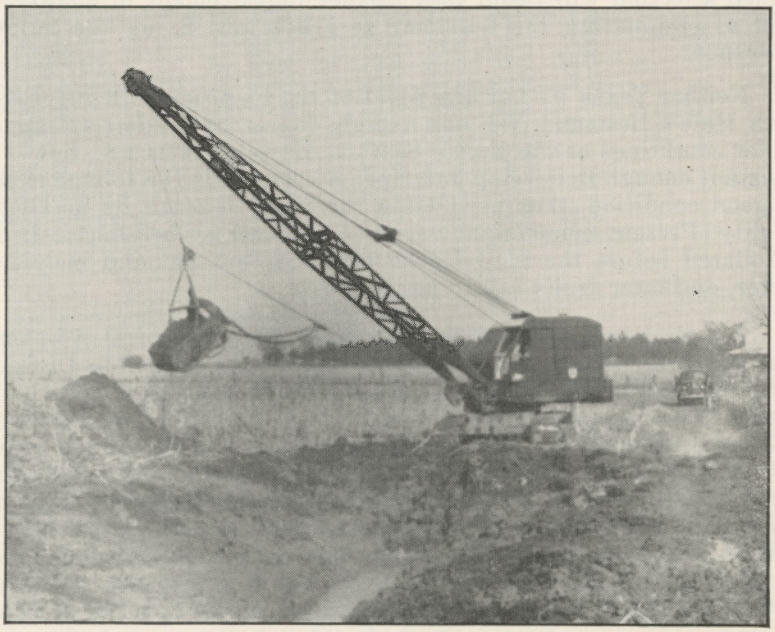

Figure 36.—A dragline, equipped with a 3/4 cubic yard bucket, ditching in an open field.

per cubic yard, bringing the total cost to $3,226.32. The lower ends of these ditches were to be cut through an existing, although inadequate, drainage channel in a densely wooded section, and could not be handled satisfactorily by the dragline machine. Therefore, ditching dynamite, 50 percent strength, in sticks 1-1/4 x 8 inches, was used to open 1,868 feet of the old channel. The sticks were placed with the tops 8 inches below the bottom of the ditch which carried water with an average depth of 12 inches. They were placed 14 inches apart to insure detonation and a ditch of uniform depth. It was arranged to detonate approximately 100 sticks of dynamite at a time using one electric cap. Under no conditions were the charges

allowed to remain under water longer than absolutely necessary and never over night. The detonation chain was broken several times where large roots between the sticks cushioned the shock. When this happened, an additional electric cap was used at the opposite end to complete the blast.

Three men were employed to place the dynamite in the ditch: one with an iron bar 1-1/2 inches in diameter and 4 feet long, made holes 2 feet deep in the bottom of the ditch; another placed the sticks of dynamite near the holes as the bar was being removed, and the third acted as a helper. As soon as the bar was removed, the dynamite sticks were pushed to the proper depth with a wooden rod. By following this procedure it was possible to place the charges at a uniform depth before the running water filled the holes with sand. A tractor battery furnished the current for discharging the electric caps. After blasting, the ditch was 14 inches deeper and 31 inches wider than before. The 1,868 feet of ditching was completed in 8 days at a cost for materials of $224.60 and for labor of $78.40.

A photograph taken immediately after one of the blasts, (Figure 37), shows the nature of the channel and the results obtained.

Figure 37.—Results of dynamite blast in soil containing many tree roots. Sticks were placed 14 inches apart.

Cotton Insect Control

(J. G. Watts)

A large amount of boll weevil injury, and the high price of cotton, contributed to unusual interest in boll weevil control in South Carolina during 1947. Because of the pressing demand for practical information, particular emphasis was given to experiments which would produce results having application under ordinary farm conditions.

Individual fields and large, replicated plots were employed in experiments to obtain the information desired. An attempt was made to conduct the experiments in a manner which would approximate large scale farm operations and at the same time permit statistical analysis of the data. Certain sacrifices had to be made in order to satisfy both demands. Approximately 260 acres of cotton located on two separate farm units were involved in the experiments. The replicated plots, each approximately 0.5 acre in size, occupied about 17 acres. The remainder of the acreage was in fields of various sizes. Further practical significance was given to the experiment by applying all dusts with tractor-mounted dusters. In timing the applications, due consideration was given those risks facing the grower.

The 1947 season was very favorable for boll weevil development. Early spring temperatures were about normal and precipitation was slightly above normal. There was no precipitation during the first 20 days of May, but from that time until harvest there was an excess from the standpoint of cotton production. There was rain on eight days in June, totaling 5.90 inches; on eight days in July, totaling 3.10 inches; and on thirteen days in August, totaling 10.09 inches. When the dry period during the early part of May was broken, weevils began coming out of hibernation in appreciable numbers and by the first week in June they were in cotton fields in abundance. By the second week in June, when squares were large enough to be attacked by the weevil, square infestations ran generally from 15 percent to 30 percent.

Plots and Treatments.—In the plot experiment, five treatments and a check were replicated six times on plots approximately 0.5 acre in size .

In the large scale field comparisons four dust formulations and a check were used.

All dusts were applied to both plots and individual fields with a tractor-mounted duster at the rate of approximately eight pounds per acre. The machines delivered this quantity of dust quite uniformly and excellent coverage was obtained.

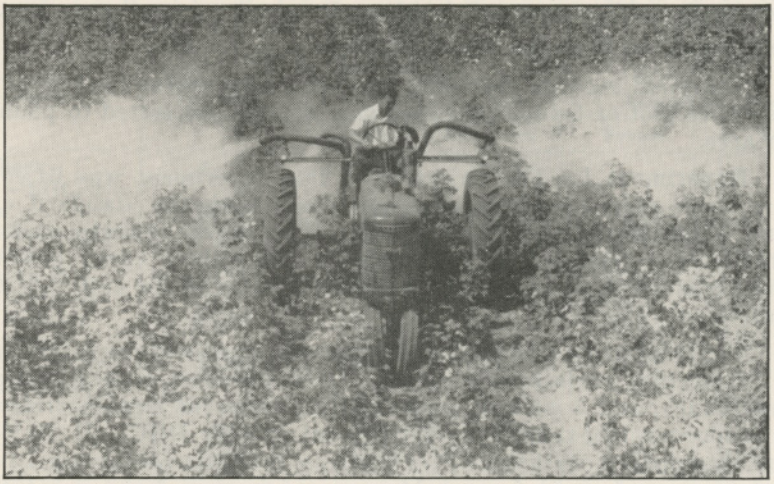

Figure 38.—This tractor-mounted power take-off dusting machine proved highly satisfactory for applying insecticides and defoliants to cotton. It has a short boom and only four outlet nozzles but is provided with a high velocity fan. It is shown above effectively dusting eight rows of cotton without depending upon drift.

A proprietary spray mixture was diluted in accordance with the manufacturers' recommendation and applied with a two-row, horse-drawn traction sprayer at the rate of about 1.25 gallons of the concentrate per acre.

Applications were made with consideration for the percentage of infested squares, weather conditions, and the probability of rain within 24 hours after treatment.

Records.—The boll weevil infestation records were begun the week ending June 14, the week preceding the first application of insecticides, and were continued through the week ending August 2, giving a total of eight consecutive weekly records. The sampling technique consisted of examination of three 100-square samples from among the ten center rows of each plot, and from about equally spaced points with respect to their length. At the point selected for sampling, all squares on consecutive plants were examined until the sample was completed. In the various fields receiving the different treatments, from one to twelve 100-square samples were taken, depending on the size of the field.

Five cotton aphid records were taken on the replicated plots during the weeks ending June 28, July 5, 19, August 2, and 9. The samples consisted of counting the number of aphids on one square

inch of lower leaf surface at the base of the fourth leaf from the top of 100 consecutive plants near the center of the plots. Aphid records were not taken from the various fields.

The yield records represent the total seed cotton picked from the entire plot or field, as the case may be, and converted to pounds per acre.

Experiment 1.—The objective of this experiment was to compare three chlorinated hydrocarbon dusts with the standard calcium arsenate-nicotine dust in controlling cotton insects, and to establish the relative effectiveness of a proprietary spray mixture which was being widely publicized and distributed for cotton insect control.

The treatments consisted of commercial grades of the following: (1) a mixture containing 5 percent DDT (dichloro-diphenyl-Trichloroethane), and 3 percent gamma BHC, (benzene hexachloride or hexachlorocyclohexane), (2) 4.8 percent gamma BHC, (3) 20 percent chloronated champhene,* (4) calcium arsenate containing 1 percent nicotine derived from a 14 percent nicotine dry concentrate, (5) a proprietary boll weevil spray** and, (6) check, or no treatment.

Applications were started on June 20, at which time square infestations averaged about 36 percent. Five applications of poison were made between that date and August 7. Harvest began about August 20.

Results.—Boll Weevil. The DDT-BHC mixture and the 4.8 percent gamma BHC gave equal protection against the boll weevil (Table 80). The 20 percent chlorinated camphene and calcium arsenate plus 1 percent nicotine were approximately equal in protecting squares, but they were each significantly less effective than the two dusts containing BHC. All dust treatments were superior to the proprietary spray mixture. The average infestation where it was applied was not measurably different from that of the untreated check.

Aphids.—The cotton aphid population was light and probably did not affect yield; nevertheless, a significant difference in population density was observed on plots receiving different treatments (Table 80). The DDT-BHC mixture and the 4.8 percent gamma BHC were about equally effective against aphids, and both were superior to chlorinated camphene. The aphid population of the proprietary spray mixture plots and untreated check plots was about equal. There was a significant increase in aphids on the calcium arsenate-nicotine plots over the untreated check.

---

* Supplied by Hercules Powder Co.
** Supplied by A. C. Matthews Co., Columbia, S. C.

Table 80.—Boll Weevil and Cotton Aphid Infestations and Yield of Cotton on Six Blocks of plots Receiving Various Insecticidal Treatments. Edisto Experiment Station, 1947.

Treatment*	Boll Weevil Punctured Squares, Percent	Aphids Per 100 Square Inches, Number	Yield Per Acre, Pounds of seed cotton	Increase over check	
				Pounds	Percent
None (Check)	47.17	54.9	570.2		
DDT 5%—BHC, 3% gamma	30.78	19.9	1,014.5	444.3	77.9
BHC, 4.8% gamma	30.72	23.6	913.1	342.9	60.1
Chlorinated Camphene 20%	36.88	39.6	830.8	260.6	45.7
Calcium Arsenate & 1% Nicotine	38.61	67.9	781.3	211.1	37.0
A Proprietary Boll Weevil Spray	45.81	48.6	634.3	64.1	11.2
Least Significant Difference:					
5% level	4.14	9.99	122.98		
1% level	5.60	13.52	166.38		

* Applied June 20, 28, July 11, 23, August 7 at about 8 pounds per acre. Twelve hours after the applications made on June 28 and August 7, .20 and .22 inches of rainfall, respectively, were recorded.

Boll Worm.—No records were taken on boll worm injury but it was generally unimportant except in plots treated with 4.8 percent gamma BHC, where the worms caused limited damage.

Red Spider.—Red spiders were of no importance in the plots or on surrounding dusted or undusted cotton. One light infestation covering a few hundred plants developed late in the season.

Yields.—The use of the DDT-BHC mixture resulted in yields significantly greater than all other treatments except 4.8 percent gamma BHC. The yield under the latter treatment was significantly better than that where calcium arsenate-nicotine was used, but was not significantly better than that of the untreated check.

Ginning Percentage.—The ginning percentage was determined on samples of seed cotton from all replications of each treatment, but there was no significant difference.

Experiment 2.—The object of this experiment was to make a large scale comparison of the four dust preparations used in Experiment 1. Each dust was applied to two or more fields under conditions which would normally be employed by a grower. The cotton was all of one variety, **Coker-100**, and the fertilization and culture were essentially the same in all fields. On the other hand, there were variations in soil productivity, number of applications of dust, source and degree of infestation, and some variation in planting dates. Therefore, the only justified comparison is between the average yields from the various dust treatments. The boll weevil

was the only insect of importance in any of the fields except in those treated with 4.8 percent gamma BHC where there was somewhat more boll worm damage than elsewhere.

The results of this experiment are given in Table 81. The order of effectiveness of the four dust preparations was the same as in the replicated plot experiment; however, it is felt that the very low yields from the untreated check fields do not represent a true basis for evaluating the benefits of the insecticides. It is believed that local

Figure 39.—A group of county agents and growers attending a discussion of results of cotton insect control experiments at the Edisto Station.

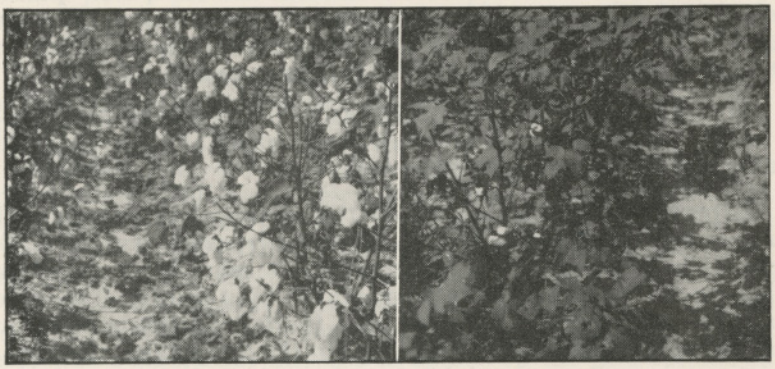

Figure 40.—Comparative fruitfulness of cotton in two adjacent fields in boll weevil control experiment. The one on the left received five applications of 4.8% BHC dust while the one on the right was undusted.

Table 81.—Results of Large-scale Comparisons of Different Insecticides Used Against The Boll Weevil. Edisto Experiment Station, 1947.

Treatment* and Field No.	Number of Applications	Area, Acres	Yield of Seed Cotton, Lbs.			Increase Over Check		Average Percent Punctured Squares
			Total	Per Acre	Weighted Average Per Acre	Pounds Per Acre	Percent	
None (Check)								
6B	0	1.6	362	226				
17	0	2.7	522	193	206			49.8
BHC 3%—DDT 5%								
2	5	14.6	17,195	1,178				
9A	5	6.1	5,086	834				
11	4	26.5	22,880	863				
12	4	31.5	29,011	921	939	733	356	28.3
13	3	5.3	6,269	1,183				
16	4	2.7	881	326				
18	4	4.7	3,702	788				
19	3	4.1	4,606	1,123				
BHC, 4.8%								
6A	5	7.4	6,295	851				
7	5	2.3	1,455	633	867	661	321	24.7
10B	3	24.4	21,826	895				
Toxaphene, 20%								
3	5	6.5	5,146	792				
4	5	15.3	10,007	654				
5	5	16.6	11,684	704	688	482	234	32.5
9B	3	18.0	11,975	665				
Calcium Arsenate with 1% Nicotine								
1	5	3.7	1,743	471				
8	5	3.4	4,156	1,222	640	434	211	39.0
10A	3	11.8	6,196	525				

* All insecticides were applied at the rate of about 8 pounds per acre per application.

variables such as those already mentioned were partly responsible for these low yields. It is quite unlikely that increases over the check as great as those obtained would have resulted had all conditions been uniform except insect control.

Tomato Fruit Worm

(J. G. Watts)

The tomato fruit worm (*Heliothis armigera Hbn.*) might well be classed as the insect causing greater crop loss than any other single species in South Carolina though it is seldom regarded in that light. Besides the damage it causes tomatoes, more than 90 percent of the ears of corn in the eastern half of the state are injured by it. It sometimes causes extensive damage to cotton bolls and apparently is becoming more important in that respect. It is a major pest of tobacco. In 1947 it caused extensive injury to soy bean foliage and pods and to peanut foliage. Behaving as an army worm, it completely destroyed partially-grown grain sorghum in some sections, and it regularly causes important damage to the seed heads of grain sorghum. It is frequently of some importance on garden varieties of beans and peas, and it occurs with regularity on various leguminous crops. In spite of all the damage it causes, the growers of tobacco and greenwrap tomatoes are probably the only farmers in South Carolina who regularly employ measures for its control.

Although extensive damage by the tomato fruit worm occurred on a wide range of crops in 1947, tomatoes at the Edisto Experiment Station were injured less than usual, perhaps largely because the moths were attracted to nearby corn which was at the peak of silking during the time when tomato fruits normally would have been heavily attacked.

In 1947, the field experiments for the control of this insect had two objectives. The first was to compare the effectiveness of nine insecticide dust formulations: 50 percent and 70 percent cryolite, 50 percent and 70 percent calcium arsenate, 10 percent and 20 percent chlorinated camphene (Toxaphene), and 3 percent, 5 percent and 10 percent DDT. The second objective was to compare the effectiveness of five inert materials as diluents in DDT dusts for tomatoes. These were kaolin, talc, pyrophyllite, equal parts of kaolin and talc, and equal parts of kaolin and pyrophyllite.

Three applications of the dusts were made on June 2, 11, and 22 with rotary hand dusters at the rates of 20, 30, and 35 pounds per acre, respectively, on the dates indicated. There were a total of seven pickings of ripe fruits, the first on June 27, and the final one on July 29. Records of infested fruits were taken at each picking, and the results are shown in Table 82.

Table 82.—Effect of Different Insecticide Dusts in Reducing Tomato Fruit Worm Infestation. Edisto Station, 1947.

Treatments*	Percent** Wormy Fruits
Cryolite 50%	6.3
Cryolite 70%	4.7
Calcium arsenate 50%	5.6
Calcium arsenate 70%	4.2
DDT 3%	2.0
DDT 5%	2.5
DDT 10%	2.1
Chlorinated camphene 10%	6.5
Chlorinated camphene 20%	3.7
None—Check	8.8
Difference required for significance at	
odds of 19:1	1.4
odds of 99:1	1.9

* Commercial grades of the insecticides were diluted with kaolin.
** Average of four replications.

Despite the low level of infestation, measurable differences in the percentages of wormy fruits from several of the treatments were found. All treatments were better than the check. The best control was obtained with DDT which is in contrast to the 1946 results (see p. 159, Fifty-Ninth Annual Report, this station), when a presumably inferior batch of DDT failed to give control when used at concentrations of 1.5 percent, 3 percent, and 5 percent.

In 1947, DDT at 3 percent, 5 percent, and 10 percent were equally effective. If the fruit worm population had been greater differences in effectiveness probably would have been demonstrated. A 20 percent chlorinated camphene dust was a little less effective than DDT and was not measurably better than cryolite or calcium arsenate at 70 percent. Chlorinated camphene at 10 percent, and both cryolite and calcium arsenate at 50 percent, were significantly less effective than the higher concentrations of these materials.

The data in Table 83 indicate little preference between talc, kaolin, pyrophyllite or combinations of these materials as diluents of DDT. Talc and pyrophyllite are free-flowing and have somewhat better dusting qualities, but kaolin adheres to foliage a little better. Kaolin also has a slight tendency to cake-up in dust machinery.

Soil Toxicity From Chlorinated Hydrocarbons

(J. G. Watts)

Because of the potential widespread use of chlorinated hydrocarbons on cotton and other crops, it seemed important to initiate an experiment to determine the extent to which they may accumulate in the soil and become toxic to growing plants. Two types of soil was selected on which to make exploratory observations: Grady sandy

Table 83.—Effect of Different Inert Materials Used as Diluents of 5 Percent DDT Applied to Control the Tomato Fruit Worm. Edisto Station, 1947.

Diluents	Percent* Wormy Fruits
Kaolin	2.4
Talc	3.3
Pyrophyllite	1.6
Kaolin and Talc, equal parts	3.6
Kaolin and Pyrophyllite, equal parts	2.6
No treatment—Check	6.5
Difference required for significance	
odds of 19:1	1.6
odds of 99:1	2.3

* Average of four replications.

loam (heavy); and Norfolk sandy loam, deep phase (light). Nineteen crops were seeded on these soils which had been treated the same day with 50 percent DDT, 6 percent gamma BHC, and 36 percent chlorinated camphene each at five different rates. The insecticides were applied by hand in the drill, approximately one inch below the seed.

There was no apparent injury to any of the crops by DDT or chlorinated camphene even from the heavier applications. However, all crops showed light to severe reduction in stand where 2000 pounds per acre of 6 percent gamma BHC were used and all except cowpeas, calico lima beans and Henderson lima beans showed very light to moderate reduction in stand when 400 pounds per acre were applied. Only grain sorghum showed a reduction in stand from 200 pounds per acre. No injury was apparent to any of the crops where 40 and 100 pounds per acre had been applied. In most cases where a reduction in stand occured the seedlings came up to a fairly even stand, but after a few days many of them wilted and died. It is significant that even where the higher rates of application of the insecticides were used some of the plants survived and appeared to mature in a normal manner.

An irregular stand of most crops on the Norfolk sandy loam, made accurate comparisons impossible. However, no injury was apparent to any crop on this soil from any of the applications of DDT or chlorinated camphene, but injury from BHC was relatively more severe than on the heavier Grady sandy loam.

PUBLICATIONS

(S. C. Stribling)

The demand for the 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 totaled about 37,376.

Distribution of publications is through (a) a classified mailing list which now 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 and other states and even from foreign countries.

Bulletins, Circulars, and Reports

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

Bulletin 366, Inspection and Analysis of Commercial Fertilizers. B. D. Cloaninger.

Bulletin 367, Fruit and Vegetable Concentration Markets in North Carolina, South Carolina, Georgia and Alabama. W. T. Ferrier, et al.

Bulletin 368, The Use and Cost of Tractor Power on Small Farms in Anderson County, South Carolina. Charles P. Butler and D. E. Crawford.

Bulletin 369, Inspection and Analysis of Commercial Fertilizers, Season 1946-1947. B. D. Cloaninger.

Fifty-ninth Annual Report of the South Carolina Experiment Station of Clemson Agricultural College for the year ended June 30, 1946.

Technical Contributions

During the year fourteen technical contributions to scientific publications have been published by the members of the station staff, namely:

No. 133, Effect of Several Seed Protectants on Emergence and Stand of Okra. By C. N. Clayton. *Phytopathology,* Vol. 38, No. 2, February, 1948.

No. 134, Development of Downy Mildew Resistance to Cucumber. By W. C. Barnes, C. N. Clayton and J. M. Jenkins, Jr. *Proceedings of the American Society for Horticultural Science,* Vol. 47, 1946.

No. 135, Germination of Sweet Potato Seed as Affected by Different Methods of Scarification. By J. A. Martin. *Proceedings of the American Society for Horticultural Science,* Vol. 47, 1946.

No. 136, The Effects of Certain Nutrition Treatments Upon the Resistance of Cotton to Fusarium Vasinfectum. By W. B. Albert, *Phytopathology,* September, 1946. Vol. 36, No. 7.

No. 137, The Flowering and Fruiting of the Sweet Potato Under Greenhouse Conditions. By J. A. Martin. *Proceedings of the American Society for Horticultural Science*, Vol. 47, 1946.

No. 138, Toxicity of Phenothiazine Derivatives Excreted in the Milk of Dairy Cows Treated with Massive Doses of the Drug. G. H. Wise, C. A. James, III, and G. W. Anderson. *Journal of Dairy Science*, January, 1947, Vol. XXX. No. 1.

No. 139, Some Factors Influencing the Ability of Magnesium in the Soil and the Magnesium Content of Certain Crop Plants. By H. P. Cooper. *Soil Science*, Vol. 63, No. 1, January, 1947.

No. 140 Yields, and Composition of Cotton and Kobe Lespedeza Grown at Different pH Levels. By W. R. Paden and W. H. Garman. *Soil Science Society of America Proceedings*, 1946, Vol. 11.

No. 141, Minor Plant Nutrients. By H. P. Cooper. *Better Crops With Plant Food.* January, 1947.

No. 142, Chemical Composition of the Cotton Plant Grown on Different Soil Types. By H. P. Cooper. *Soil Science Society of America Proceedings*, 1946, Vol. 11.

No. 149, Response of Cotton and Changes in Chemical Properties of Soil from Continuous Use of Various Sources of Nitrogen Fertilizers. By W. R. Paden. *Soil Science Society of America Proceedings*, 1947, Vol. 12.

No. 150, The Relation of the Energy Properties of Soil Nutrients to the Shemical Composition of Crop Plants. By H. P. Cooper. *Soil Science Society of America Proceedings*, 1947, Vol. 12.

Cucumber Breeding Methods. By W. C. Barnes. *Proceedings of the American Society for Horticultural Science.* Vol. 49, 1947.

Publicity Work

(S. C. Stribling and H. M. Simons, Jr.)

During the fiscal year 52 news letters were distributed to the newspapers of the state dealing in various ways with the Experiment Station and its work. These included (a) information and instructional material from research workers, (b) announcements of new publications and information regarding their contents. In addition, many of the news letters prepared by extension workers presented facts and ideas based on research work of the station, and mention of the station was made in many of these news letters.

Feature articles based upon research results as shown in the Annual Report and other publications have been distributed to various daily newspapers of the state and to several farm journals.

Thus through these news letters and feature articles the work of the Experiment Station as a whole has been given general and fairly wide publicity.

FINANCIAL STATEMENT

THE SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION

In Account With

THE UNITED STATES APPROPRIATIONS UNDER THE HATCH, ADAMS, PURNELL AND BANKHEAD-JONES ACTS, 1946-1947

FEDERAL FUNDS

Cr.	Hatch	Adams	Purnell	Bankhead-Jones
To balance from appropriations for 1945-1946	$ 0.00	$ 0.00	$ 0.00	$ 0.00
Receipts from the Treasurer of the United States, as per appropriations for the fiscal year ended June 30, 1947, under Acts of Congress approved March 2, 1887 (Hatch Fund), March 16, 1906 (Adams Fund), February 24, 1925 (Purnell Fund), and June 29, 1935 (Bankhead-Jones Fund)	$15,000.00	$15,000.00	$60,000.00	$64,344.59
Dr.				
Personal services	$11,663.40	$12,661.49	$50,064.01	$52,068.73
Travel expenses	24.25	134.73	977.98	235.38
Freight and express	33.63	4.62	41.18	175.62
Communication service	433.39	82.94	324.81	125.75
Rents and utility services	------	45.48	1,438.95	368.04
Printing and binding	198.39	------	580.81	121.49
Other contractural services	161.39	366.62	502.82	1,252.72
Supplies and materials	1,607.48	868.45	3,463.62	5,499.48
Equipment	878.07	835.67	2,605.82	4,497.38
Lands and structures	------	------	------	------
Totals	$15,000.00	$15,000.00	$60,000.00	$64,344.59

WE, THE UNDERSIGNED, duly appointed auditors of the expenditures from Federal appropriations reported herein, do hereby certify that we have examined the books and accounts of the South Carolina Agricultural Experiment Station for the fiscal year ending June 30, 1947; that we have found the same well kept and classified as above; and that the balances, receipts and disbursements are as follows:

	Hatch Fund	Adams Fund	Purnell Fund	Bankhead-Jones Fund	Total All Funds
Unexpended balance brought forward from previous year	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
Receipts for the year from the Treasurer of the United States	$15,000.00	$15,000.00	$60,000.00	$64,344.59	$154,344.59
Total Federal Funds	$15,000.00	$15,000.00	$60,000.00	$64,344.59	$154,344.59
Disbursements for the year	$15,000.00	$15,000.00	$60,000.00	$64,344.59	$154,344.59

SUPPLEMENTARY STATEMENT, 1946-1947

FUNDS OF THE EXPERIMENT STATION OTHER THAN THOSE FROM FEDERAL SOURCES

SOURCES OF FUNDS

	Balance from previous year	Receipts for 1946-1947	Totals
State appropriations or allotments	$ 0.00	$240,000.00	$240,000.00
Special endowments and grants	0.00	25,540.75	25,540.75
Sales	148,490.25	400,163.75	548,654.00
Totals	$148,490.25	$665,704.50	$814,194.75

CLASSIFICATION OF TOTAL EXPENDITURES FROM SUPPLEMENTARY FUNDS

Personal services	$330,751.47
Travel expenses	11,961.47
Freight and express	6,577.34
Communication service	3,182.28
Rents and utility services	6,927.88
Printing and binding	1,776.99
Other contractural services	36,776.24
Supplies and materials	227,903.34
Equipment	68,973.49
Lands and structures	66,255.63
Unexpended balance	53,108.62
Totals	$814,194.75

Proper vouchers for all the above disbursements are on file and have been examined by us and found correct.

And we further certify that the expenditures have been solely for the purposes set forth in the Acts of Congress approved March 2, 1887, March 16, 1906, February 24, 1925, and June 29, 1935; and in accordance with the terms of said acts, respectively.

Attest: A. J. BROWN,

Custodian of the seal

Signed: J. M. SMITH, State Auditor

als
00.00
40.75
54.00

94.75

51.47
61.47
77.34
82.28
27.88
76.99
76.24
03.34
73.49
55.63
08.62

94.75

nined

s set
y 24,
y.

ditor