SES-Form 17
(Dec. 5, 1955)

North Carolina Agricultural Experiment Station

FINAL REPORT, FEDERAL-GRANT PROJECTS
(Send 3 copies to State Experiment Stations Division, ARS, at time of closing)

1. PROJECT (Fund, number and title):

   H-50 Peanut Breeding and Cultural Investigations.

2. STATION DEPARTMENTS AND COOPERATING AGENCIES (e.g., USDA, TVA, etc.):

   Field Crops, Plant Pathology, U.S. Atomic Energy Commission

3. MAJOR PERSONNEL: W. C. Gregory, Donald A. Emery, (W. E. Cooper), Elizabeth Boardman, Mrs. Dahlia Rembert, and 4 part time seed laboratory technicians.

4. DATE BEGUN: July 1, 1943 DATE COMPLETED: Mar. 1, 1959
   (If discontinued without completion state reasons):

5. ESTIMATED TOTAL COST BY FUNDS (Federal-grant and others): $152,340.90
   (past 5 years only). A.E.C.=$78,687.60; H-50=$58,160.92; ST-H-50=$15,492.38.

6. THE PROBLEM (Briefly restate its nature, importance, and economic significance):

   The Virginia type peanut ranks next to tobacco in cash value in the northern Coastal Plain area of North Carolina and the southeastern counties of Virginia. The annual acreage of peanuts increased from 260,000 to approximately 400,000 acres during the second world war. Unfortunately the quality and yield per acre dropped accordingly. The immediate problem was, therefore, to develop strains of peanuts with greater yielding ability combined with higher quality. Selection within farm stocks had proven effective but inefficient. Attention was turned to methods of increasing genetic variability and techniques for evaluating the selected products in this project.

7. ABSTRACT MAJOR RESULTS AND CONCLUSIONS:

   Yield per acre has been increased on the average 15 percent by varieties resulting from hybridization and selection methods. The use of irradiation has proven an effective tool to increase quantitative genetic variability for selection purposes. It has also made available qualitative mutants which will be invaluable for further genetic studies. The conjunctive use of irradiation and hybridization has been investigated.

(Over)

8. USEFULNESS OF FINDINGS (Present or potential - to other scientists - farmer acceptance - economic value to agriculture - other):
NC 2 was produced by hybridization of a plant selection from a farmer's field with Ga. 207-2. It was released in 1953 and has become the leading peanut variety in North Carolina. It has increased yield approximately 15 percent and its quality justified one to two cents more per pound than farm stock.

NC 4x, released in 1959, is a direct selection from irradiated farm stock. It supplements NC 2 in that it has fewer cracked pods and less kernel damage while it yields nearly as well.

The association of other plant characters with yield have been evaluated as possible indices. The inheritance of several qualitative mutants arising from irradiation was substantiated. The possible influence of mutated modifying genes upon them is presently under study.

9. CITATION OF PUBLICATIONS (Issued and/or in manuscript form):

Gregory, W. C. X-ray breeding of peanuts (Arachis hypogaea L.)
Agron. J. 47: 396-399. 1955

Gregory, W. C. The comparative effects of radiation and hybridization in plant breeding.
Proc. of the Geneva Conf. on the Peaceful Uses of Atomic Energy. 1956.

Gregory, W. C. Induction of useful mutations in the peanut.
Brookhaven Symposia in Biol. No. 9: 177-190. 1956.

Gregory, W. C. Radiosensitivity studies in peanuts (Arachis hypogaea L.)
Proc. of the International Genetics Symp. 243-247. 1956.

Gregory, W. C. Progress in establishing the effectiveness of radiation in breeding peanuts.
Proc. of Ninth Oak Ridge Reg. Symp. "Radiation in Plant Breeding": 36-47.

Gregory, W. C. The use of radiation in peanut breeding.
Crops and Soils. (in press).

Cooper, W. E. and Gregory, W. C. Irradiation induced leafspot mutants in the peanut.
Agron. J. (in preparation).

10. Prepared by_____ Approved_____
(Director)
(Sign original only)

Date_____ Date_____

SES—Form 8
(June 12, 1957)

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 19 59

(Three copies to be given to the SES examiner)

1. PROJECT (Fund, number, and title): HATCH H-50, PEANUT BREEDING AND CULTURAL INVESTIGATIONS.

2. DEPARTMENTS AND COOPERATING AGENCIES: Field Crops, Plant Pathology, U. S. Atomic Energy Commission

3. PERSONNEL: W. C. Gregory, D. A. Emery, (W. E. Cooper), Elizabeth Boardman, Mrs. Dahlia Reubert and 4 part time seed laboratory technicians.

4. RESEARCH ACCOMPLISHMENTS OF THE YEAR (Confidential information should be so marked): An F_5X_5 generation of peanuts was grown in a nursery and yield trial in preparation for testing genetic variation residual in F_3 and F_3X_3 lines in F_6 and F_6X_6 generation. The frequency of mutants with high and suspected low repeatability in the X_2 generation after x-ray treatment was compared with the frequency after treatment with fast neutrons. A study of the effect of background genotype upon mutant expressivity was continued in F_3 populations of combinations of deleterious mutants. Thirteen advanced lines and introductions were recombined by hand crossing in the greenhouse to produce seed for the F_1 generation of the third cycle of recurrent selection. Second cycle F_9 lines, superior x-ray mutants and varieties of the regional test were evaluated. Improvements in disease resistance will be reported by Dr. Cooper.

5. USEFULNESS OF FINDINGS (Benefits to agriculture and the general public and contributions to science): NC 4x, an advanced selection originating from irradiated farm stock was released as a new peanut variety to supplement NC 2. Background effects on qualitative mutants may be estimated metrically within the specific ranges of measurement, for given plant characters, which delimit the particular mutant. Evaluation of the conjunctive use of irradiation and hybridization in the breeding program continues.

6. WORK PLANNED FOR NEXT YEAR: The selection opportunity remaining in high and low yielding F_2 lines in X vs. XO comparisons will be determined. Effects of background genotype will be studied in the presence of the double recessive deleterious mutant loci and wild type loci occurring from the same cross. Re-irradiation experiments will continue. New species are to be introduced and cultured.

7. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

Gregory, W. C. The use of radiation in peanut breeding. Crops and Soils (in press)

Cooper, W. E. and Gregory, W. C. Irradiation induced leaf spot resistant mutants in the peanut (Arachis hypogaea L.) Agron. J. (in preparation)

8. Prepared by_____ Approved_____ (Director).

Date_____ Date_____

SES—Form 8
(June 12, 1957)

North Carolina AGRICULTURAL EXPERIMENT STATION

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 19 58

(Three copies to be given to the SES examiner)

1. PROJECT (Fund, number, and title): Hatch H-50, PEANUT BREEDING AND CULTURAL INVESTIGATIONS.

2. DEPARTMENTS AND COOPERATING AGENCIES: Field Crops, Plant Pathology, U. S. Atomic Energy Commission

3. PERSONNEL: W. C. Gregory, (W. E. Cooper), Elizabeth Boardman, Mrs. Dahlia Reubert, Alma B. Smith, and 4 part-time seed laboratory technicians.

4. RESEARCH ACCOMPLISHMENTS OF THE YEAR (Confidential information should be so marked): Relative effects of radiation upon parents and their F_1 hybrids as measured in F_2 generations were estimated. Significantly higher variances in yield of dry fruits were obtained in the irradiated populations. Comparisons of the yields of selected and of randomly chosen lines from these populations were made. The effect of background genotype upon mutant expressivity and yield performance were studied in F_2 populations of combinations of deleterious X-ray mutants. The effects of irradiation upon restoration of normality in induced mutants were observed in X_3 generation. Second cycle F_8 lines together with certain superior X-ray mutants were further evaluated. Regional variety tests were conducted in cooperation with ARS. The disease work will be reported by Dr. Cooper.

5. USEFULNESS OF FINDINGS (Benefits to agriculture and the general public and contributions to science): Progress has been made in establishing the value of atomic energy in genetic improvement of plants. New varieties of highly productive disease resistant peanuts have been produced. These have not been released.

6. WORK PLANNED FOR NEXT YEAR: Work similar to that described under No. 4 above will be continued throughout the coming year. The radio-sensitivity experiments conducted in 1956 will be resumed.

7. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:
The Genetic Foundations of Mutation Breeding (presented before the Agronomy Society of America, Atlanta, November, 1957).

8. Prepared by _____ Approved _____ (Director).

Date March 7, 1958 Date _____

OES—Form 8
(Nov. 29, 1954)

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 19 57

(Three copies to be given to the OES examiner)

1. PROJECT: (Fund, number, and title): HATCH 50, PEANUT BREEDING AND CULTURAL INVESTIGATIONS.

2. DEPARTMENTS AND COOPERATING AGENCIES: Field Crops, Plant Pathology
U. S. Atomic Energy Commission

3. PERSONNEL: W. C. Gregory, J. M. Mason (resigned), Dahlia Rembert, Elizabeth Boerman, Peter J. Loesch, Eunice Carpenter (retired).

4. PROGRESS OF RESEARCH HIGHLIGHTING PRINCIPAL ACCOMPLISHMENTS OF THE YEAR (Confidential information should be so marked): Twenty-eight second cycle F_7 lines were selected from the 50 lines tested in 1955. In 1955 50 out of 100 lines and in 1956 28 out of 50 lines were selected. Breeders Seed was produced on all 28 lines in 1956 and 4-5 of these will be turned over to Foundation Production in 1957. Ga.119-20 was tested and may be of value in North Carolina. Va. 56 R has also been evaluated and appears to be adapted in the N. E. part of the area. Experiments upon the relative effects of hybridization and radiation upon the total genetic variance and advance due to selection were conducted. Genetic differences in sensitivity to both X-rays and fast neutrons were established. The impact of this fact upon radiation breeding is being evaluated. Twenty-five thousand F_2 plant progenies were produced from crosses among lines screened for resistance to southern stem rot (Sclerotium rolfsii).

5. USEFULNESS OF FINDINGS (when results may justifiably be expressed in terms of public benefits): Over 2,000,000 lbs. of certified seed of NC 2 were produced in 1956. This will plant approximately one third of the total N. C. acreage. It is estimated that 60-80% of the "Virginia Bunch" area will be planted to NC 2 peanuts in 1957.

6. WORK PLANNED FOR NEXT YEAR: Twelve of the 28 2nd cycle lines tested in 1956 will be tested in 1957. The radiation vs. hybridization experiments will be culminated. The study of genetic differences in radiation sensitivity will be placed in cold storage for 1 year. The 25,000 F_2 rows of hybrids among southern stem rot resistant lines will be inoculated and scored.

7. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

1. Induction of Useful Mutations in the Peanut, Brookhaven Symposia in Biology #9 Genetics in Plant Breeding 177-190. 1956.
2. Radiosensitivity Studies in Peanuts (Arachis hypogaea L.). Read before the International Genetics Symposia. Tokyo and Kyoto 1956.
3. Progress in Establishing the Effectiveness of Radiation in Breeding Peanuts. Ridge Regional Symposium. Radiations in Plant Breeding (in Press).

8. Prepared by Approved
(Director).

Date 9-13-57 Date

OES—Form 8
(Nov. 29, 1954)

H - 50

North Carolina AGRICULTURAL EXPERIMENT STATION

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1956

(Three copies to be given to the OES examiner)

1. PROJECT: (Fund, number, and title): B-J, Sec. 5, 10, PEANUT BREEDING AND CULTURAL INVESTIGATIONS

2. DEPARTMENTS AND COOPERATING AGENCIES: Agronomy, Plant Pathology U.S. Atomic Energy Commission

3. PERSONNEL: W. C. Gregory, J. M. Mason, Eunice Carpenter, Dahlia Rembert, Peggy Bowles

4. PROGRESS OF RESEARCH HIGHLIGHTING PRINCIPAL ACCOMPLISHMENTS OF THE YEAR (Confidential information should be so marked):

Fifty lines in F_6 generation were selected from among 100 outstanding second cycle F_4 selections grown in 1954. Twenty-seven of these lines averaged over 30% greater yields than NC-2. Increased leafspot resistance which was particularly effective during the hurricane weather of 1955 accounted partially for this outstanding difference. Several of these lines were of exceptionally high grades. Approximately 1/4 of them will be extended to the "Farm-Level" testing program for final evaluation in 1956 et seq. Simultaneously, "Breeders Seed" increase will be started.

The relative effects of hybridization versus radiation and radiation plus hybridization in genetic variability in fruit yield of peanuts were studied in F_2 and F_2X_2 generations in 1955. It is too early in the experimental program to generalize the results of this experiment.

Nearly 3,000 lines from plant introductions and X_1 mutant strains were grown in a disease nursery and inoculated with southern stem wilt of peanuts (Sclerotium rolfsii). These same lines were grown in nematode infested soil and were evaluated for resistance to infestation. Several lines from both of these studies were selected for further testing in 1956.

5. USEFULNESS OF FINDINGS (when results may justifiably be expressed in terms of public benefits): Certified seed of NC-1 and 2 were produced in sufficient quantity to plant nearly 30,000 acres in 1956. In addition many uncertified sources will provide seed of these varieties. It is estimated that this is enough seed to plant 1/4 of the peanut acreage in 1956. NC-2 continues to return an average of 15-17 per cent more gross income per acre than the old varieties which it is replacing.

6. WORK PLANNED FOR NEXT YEAR: F_3 and F_2X_2 comparisons will be made in the radiations versus hybridization experiments. The relative effects of hard X-rays and fast neutrons on peanuts will be determined. The disease and nematode evaluations will be made on selected varieties and selections from second-cycle breeding lines will be made for initiating the third breeding cycle in this material. Breeder's seed increases will be made.

7. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

"X-Ray Breeding of Peanuts," Agronomy Journal 47: 396-399, 1955.

"The Comparative Effects of Radiation and Hybridization in Plant Breeding." In press - Proceedings of the Conference on the Peaceful Uses of Atomic Energy, Geneva, August, 1955.

8. Prepared by ..... Approved ..... (Director).

Date February 16, 1956 Date .....

OES—Form 8
(June 6, 1950)

H-50

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1955

(Three copies to be given to the OES examiner)

1. PROJECT: (Fund, number, and title): B-J Sec. 5, 10 PEANUT BREEDING AND CULTURAL INVESTIGATIONS

2. DEPARTMENTS AND COOPERATING AGENCIES: Agronomy

3. PERSONNEL: W. C. Gregory, J. M. Bason, Eunice Carpenter, Dahlia Rembert

4. NATURE OF RESEARCH AND PRINCIPAL RESULTS OF THE YEAR (Confidential information should be so marked): From the approximately 4,500 families of the recurrent (second cycle) crosses and selections 100 advanced F_5 lines were tested in 1954. They were arranged as three separate field experiments in a transect across the peanut producing area of northeastern North Carolina and southeastern Virginia. Although seriously damaged by Hurricane Hazel sufficient information was obtained to permit the selection of approximately 50% of these lines for re-evaluation in 1955. Several of these lines appeared to be much superior to NC-2, our best first-cycle selection.

A regional variety trial, in cooperation with U.S.D.A., Virginia, and Georgia, begun in 1954. The best lines from these several research programs were included and tested at two locations in North Carolina.

Preliminary results of varietal mixtures versus the pure strains entering the mixtures showed the varietal mixtures significantly superior to the pure strains.

Following mass inoculation of about 1,000 nursery lines and plant introductions with Sclerotium rolfsii, several outstandingly resistant lines were selected and crossed in all possible combinations inter se and with NC-2 which shows about 50% less infection with this disease than commercial varieties of peanuts.

The prospective new variety mentioned in last year's report was not released because of nematode susceptibility.

5. APPLICATION OF FINDINGS (expressed in terms of measurable public benefits if and when justified):

In twenty-one farm comparisons NC-2 yielded 15% more peanuts per acre worth sixty-six dollars more per acre than the farm varieties with which it was compared. Enough seed of NC-2 have now been produced so that by the spring of 1956 they will be in sufficient supply to meet any demand within the state.

6. WORK PLANNED FOR NEXT YEAR:

The selected F_6 lines will be evaluated in three locations and selections made. The varietal mixtures experiment will be repeated. The F_1 population of Sclerotium rolfsii resistant line combinations will be grown. The varietal collections (ca. 2,500 lines) will be grown in nematode nursery and resistant lines sought.

7. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

X-Ray Breeding of Peanuts (Arachis hypogaea L.) In press
Walton C. Gregory

A Quantitative Genetic Study of Some Character Relationships in the Peanut
R. L. Bernard, W. C. Gregory Manuscript

8. Prepared by _____ Approved _____
(Director).

Date _____ Date _____

OES—Form 8
(June 6, 1950)

North Carolina AGRICULTURAL EXPERIMENT STATION

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1952

(Three copies to be given to the OES examiner)

1. PROJECT: (Fund, number, and title): Bankhead-Jones BJ10-A10
Peanut Breeding and Cultural Investigations

2. DEPARTMENTS AND COOPERATING AGENCIES: N.C. Agri. Exp. Sta.,N.C. Agri. Ext. Service,N.C.Dept. of Agriculture (In coordination with project Sp ni-State of N.C.)

3. PERSONNEL: W.C. Gregory, Joseph Eason,Dahlia Rembert, Eunice Carpenter, R.L. Bernard.

4. NATURE OF RESEARCH AND PRINCIPAL RESULTS OF THE YEAR (Confidential information should be so marked): Eight selections from the twenty three F_6 lines tested in 1950 were tested in 6 replicate trials at 4 locations in 1951. The superior performance of these lines was maintained. The lines were further evaluated in the eight principal peanut producing counties in the state by county agents and tested at the Virginia substation at Holland, Va. where their performance was exceptionally high. Breeders seed of three of these varieties in amounts 250 lbs.,600 lbs.,and 2200 lbs. were produced in 1951 and turned over to Foundation Seed Producers Inc. Jan. 1952. Expected average gains over farm stock peanuts under farm conditions is from 10-20 percent. All possible combinations of six of these lines were tested as F_2 populations at three locations in 1951. Individual plant selections were harvested from all 15 crosses and their 6 parents.

5. APPLICATION OF FINDINGS (expressed in terms of measurable public benefits if and when justified): Foundation Seed production of three outstanding varieties is underway. These peanuts should be in certified seed production in 1953 and in farm production on a small scale in 1954. They are resistant to leaf spot.

6. WORK PLANNED FOR NEXT YEAR: The recombinations of 6 selected lines will be progeny tested as F_3 plants in 1952. There will be 450 lines of 15 crosses. Stringent selection will be exercised among these crosses and lines upon completion of the tests.

7. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR: Gregory,W.C., Smith, Ben W., Yarbrough, J.R., 1951. Morphology, Genetics and Breeding. Ch. III in The Peanut - The Unpredictable Legume. The National Fertilizer Association. Washington, D.C. pp. 28-88.

8. Prepared by ..... Approved.....
(Director).

Date ..... Date.....

OES—Form 8
(June 6, 1950)

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 19 51

(Three copies to be given to the OES examiner)

1. PROJECT: (Fund, number, and title): Bankhead-Jones 10-A10, Peanut Breeding and Cultural Investigations.

2. DEPARTMENTS AND COOPERATING AGENCIES:
Agronomy Department

3. PERSONNEL:
W.C. Gregory, Joseph Eason, Dahlia Rembert, Eunice Carpenter

4. NATURE OF RESEARCH AND PRINCIPAL RESULTS OF THE YEAR (Confidential information should be so marked):
Twenty three F_6 lines selected from an original 3750 F_2 selections were tested in 1950. Seed of all of these lines was increased at the same time. Five of the more outstanding lines were tested in cooperation with county agents in every major peanut growing county in the state. On the basis of a 4 year 12 location average five of the lines have shown gains in production in lbs./A., over select Farm Stock, ranging from 7.50% to 21.43%. In progeny line tests run concurrently with the above the range of the 4 year average has been 9.52% to 35.42%. Six of these lines were crossed in all possible combinations in 1949 and tested in 1950. The F_1 performance was outstanding.

5. APPLICATION OF FINDINGS (expressed in terms of measurable public benefits if and when justified):
The best of these peanuts are now being increased for release to seed producers January 1952. They are higher yielding, highly resistant to leafspot. The quantity of foundation seed estimated to be on hand then - 1500 lbs. of each line.

6. WORK PLANNED FOR NEXT YEAR: The advanced testing program of selected lines will be continued in order to make the final eliminations of lines to choose the ultimate lines for release. The F_2 populations of the F_1 crosses grown in 1950 will be tested and selections made. The work done completes the first cycle of breeding under this project. The new F_1 and F_2 material constitutes the first recurrent cycle.

7. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:
The mss. Morphology, Genetics and Breeding (of peanuts) was completely revised and will appear as chapter III in The Peanut - the Unpredictable Legume, during the Summer of 1951.

8. Prepared by ..... Approved.....
(Director).

Date ..... Date.....

Gregory

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1950
(Three copies to be given to the OES examiner)

1. PROJECT: (Fund, number, and title): BANKHEAD-JONES Agron. BJ10-A10, PEANUT BREEDING AND CULTURAL INVESTIGATIONS.

2. DEPARTMENTS AND COOPERATING AGENCIES: Agronomy Dept.

3. PERSONNEL: W.C. Gregory, Joseph Mason, Dahlia Rembert, Eunice Carpenter.

4. NATURE OF WORK AND PRINCIPAL RESULTS OF THE YEAR (Confidential information should be so marked):

New varieties of peanuts selected from high yielding peanut hybrids have been shown to be superior in yielding power in 50% to 80% of the tests made. These peanuts have fewer damaged seed, are generally later in maturity, and have a fair seed size. They are highly resistant, but not immune to cercospora leaf spot diseases. Tests of these peanuts are being conducted in each of the peanut growing counties of the State in 1950 and foundation seed for several, among which final selections will be made, are being increased in 1950.

These peanuts are in the F_6 generation in 1950. F_1 crosses of six of the better of these lines were made in all possible combinations in 1949, and are being tested in 1950.

The coordination of the work of the breeder, the foundation seed producing agency, the certifying agency and the Extension service has been effectuated preparatory to the release of the best of the new varieties.

5. BENEFITS realized by farmers or the public through application of findings, stated in dollars, bushels, or other values, where possible: None.

The best of these peanuts will be released through the normal channels of foundation and certified seed production in 1952.

6. WORK PLANNED FOR NEXT YEAR: Selections among F_2 plants from the F_1 crosses made in 1949 will be made on a large scale in 1951. Recurrent combinations among selected parental lines not used in 1949 will be made. Testing of F_7 progenies will be carried out over a wide area. Foundation seed among the better selections will be increased.

7. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR: Morphology, Genetics, and Breeding (Peanuts) mss. chapter for book. W.C. Gregory, B.W. Smith, John A. Yarbrough.

8. APPROVED: _____ _____
Project Leader. Director.

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1949.
(Three copies to be given to the OES examiner)

1. PROJECT: (Fund, number, and title): BANKHEAD-JONES BULO-A10, PEANUT BREEDING AND CULTURAL INVESTIGATIONS

2. DEPARTMENTS AND COOPERATING AGENCIES: Agron.

3. PERSONNEL: W. C. Gregory

4. NATURE OF WORK AND PRINCIPAL RESULTS OF THE YEAR (Confidential information should be so marked):

Bulked F_3 progenies from the highest performing 10% of the F_2 trials of the preceding year were tested at two locations (McCullers Branch and the Upper Coastal Plains Branch Stations). The performance of some of these progenies was outstanding. It should be pointed out that this represents the first time that seed supply has allowed tests to be run on a scale sufficient to draw conclusions on the relative merits of the superior selections from the present program. These selections are approaching homozygosity and should their continued performance warrant it several of them should be ready for release by 1952 (F_8). The total land area under experimental and nursery material was about eight acres.

5. BENEFITS realized by farmers or the public through application of findings, stated in dollars, bushels, or other values, where possible:

None

6. WORK PLANNED FOR NEXT YEAR:

Work on the morphology, cytology, species cross-relationships and foreign plant introduction will continue. Second cycle recombination of the superior selections from the present breeding cycle will be made in the summer of 1949. The testing program of advanced selections mentioned above will be carried out in at least 3 locations over the peanut producing area.

7. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

None

8. APPROVED: W. C. Gregory
Project Leader.

Director.

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1948.
(Three copies to be given to the OES examiner)

1. PROJECT: (Fund, number, and title): **B-J Agron. BJ10-A10, Peanut Breeding and Cultural Investigations**

2. DEPARTMENTS AND COOPERATING AGENCIES: **Agronomy Department**

3. PERSONNEL: **W. C. Gregory, A. L. Barham**

4. NATURE OF WORK AND PRINCIPAL RESULTS OF THE YEAR (confidential information should be so marked):

Forty nine selected progenies of each of four out of the five crosses tested as F_2 plants in 1946-47 were tested in 4 replicate yield trials at the Upper Coastal Plains Station near Rocky Mount. Seven replications of eight F_2 populations were tested also. Each F_2 plot in all replications in the F_2 test and each F_2 progeny in the first replication of the F_3 tests was harvested by individual plants for determinations of the nature of variation in yield, pods/plant, seeds/pod, per cent diseased fruits, per cent immature fruits, etc.

Over 500 strains of local and introduced peanuts were grown in the maintenance and observational nursery.

Cross pollinations were repeated between different species of peanuts and fixations were made for morphological study 12, 24, 36, 48, 72, 96 hours and then at 5 day intervals to 40 days for the determination of the nature of interspecific cross sterility in the species now in the local collection.

Precise genetic interpretation of the variability encountered in the various characters studied in the commercial peanut is not as yet possible. However, estimates of the heritable portion of the variation in yield itself indicate that the probability of successful selection in segregating populations is sufficiently high to warrant further effort along these lines.

5. BENEFITS realized by farmers or the public through application of findings, stated in dollars, bushels, or other values, where possible:

None

6. WORK PLANNED FOR NEXT YEAR:

Progenies of selected F_3 material mentioned above will be evaluated under different systems of selection. Reciprocal interspecific crosses will be made on a large scale. Analysis of previous years' data will be brought forward.

7. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

None

8. APPROVED: W. C. Gregory
Project Leader

Director

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1946-47
(Two copies to be given to the OES examiner)

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

PROJECT: (Fund, number, and title): BJ10-A10, Peanut Breeding and Cultural Investigations.

DEPARTMENTS AND COOPERATING AGENCIES: Agronomy

PERSONNEL: W. C. Gregory

NATURE AND EXTENT OF WORK DONE THIS YEAR: Thirty seven hundred and fifty plant plots of 5 selected peanut crosses and their parents were grown in 25 replications on the Upper Coastal Plain Station near Rocky Mount. Heritable variability estimates for freedom from diseased seed, seed weight, seeds per pod, pods per plant, maturity and yield are in the process of determination.

Four hundred and thirty eight nursery rows were grown in the maintenance nursery on the McCullers Branch Station near Raleigh. These included all types received from the Bureau of Plant Industry in its peanut introduction program. The purpose of this nursery is for maintenance and observation, and involves no experimental work.

Thirty six single cross combinations were made in the crossing nursery maintained near this station. Three wild species of peanuts were introduced into the crossing program for the first time.

PRINCIPAL RESULTS OF THE YEAR (confidential information should be so marked):

Highly significant specific and general combining ability for yield and pods per plant were established from the data from all possible combinations of the lines involved in crossing. Highly significant general combining ability and non-significant specific combining ability were established for: percent diseased fruit and weight per seed. No significant general or specific combining ability was established for seeds per pod.

Clean disease free seed and pods, seed size, seed color, certain shell characters and plant type appear to be highly heritable. Further analysis will be necessary to establish heritability estimates on total production.

Interspecific crosses of wild type by cultivated peanuts set abortive seed but were successfully cross fertilized in all instances.

BENEFITS realized this year by farmers or the public through application of findings, stated as dollars, bushels, or other values, where possible:

None

PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

DIRECTOR

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1946.
(Two copies to be given to the O. E. S. examiner)

North Carolina AGRICULTURAL EXPERIMENT STATION.

PROJECT TITLE, NUMBER, AND FUND: BJ10-A10 S. Pn 1

DEPARTMENTS AND COOPERATING AGENCIES: Agronomy Department, N. C. State College

PERSONNEL: W. C. Gregory

NATURE AND EXTENT OF WORK DONE THIS YEAR:

Thirty seven hundred and fifty plant plots of five selected peanut crosses and their parents were grown in 25 replications on the Upper Coastal Plain Station near Rocky Mount. Heritable variability estimates for freedom from diseased seed, seed weight, seeds per pod, pods per plant, maturity and yield are in the process of determination.

Four hundred and thirty eight nursery rows were grown in the maintenance nursery on the McCullers Branch Station near Raleigh. These included all types received from the Bureau of Plant Industry in its peanut introduction program. The purpose of this nursery is for maintenance and observation, and involves no experimental work.

Thirty six single cross combinations were made in the crossing nursery maintained near this station. Three wild species of peanuts were introduced into the crossing program for the first time.

MAJOR RESULTS (confidential information should be so marked):

Highly significant specific and general combining ability for yield and pods per plant were established from the data from all possible combinations of the lines involved in crossing. Highly significant general combining ability and non-significant specific combining ability were established for: percent diseased fruit and weight per seed. No significant general or specific combining ability was established for seeds per pod.

Clean disease free seed and pods, seed size, seed color, certain shell characters and plant type appear to be highly heritable. Further analysis will be necessary to establish heritability estimates on total production.

Interspecific crosses of wild type by cultivated peanuts set abortive seed but were successfully cross fertilized in all instances.

PRACTICAL APPLICATIONS OF RESULTS OR PUBLIC BENEFITS: None

PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

DIRECTOR

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1945.
(Two copies to be given to the O. E. S. examiner)

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

PROJECT TITLE, NUMBER, AND FUND: Peanut Breeding and Cultural Investigations, BJ1C-A1C, Bankhead-J.

DEPARTMENTS AND COOPERATING AGENCIES:

PERSONNEL: W. C. Gregory

NATURE AND EXTENT OF WORK DONE THIS YEAR: On the Upper Coastal Plain Station and three private farms a total of 7.8 acres were used in testing 181 strains of peanuts, observation of 500 progeny rows, and conducting cultural and technical experiments. One potash-variety and two nitrogen-variety tests were conducted in cooperation with project BJ1B-A1B on two private farms. Fourteen acres were used for increasing foundation seed of four strains for release. Cultural and technical experiments were conducted on dates of planting, dates of harvest, spacing, and varietal competition.

MAJOR RESULTS (confidential information should be so marked): In advanced yield trials, strains selected for increase were not exceeded significantly in yield by any experimental entry. In preliminary trials several selections showed significant increases over these standards. There were no significant differences in early and late plantings. Abnormally early harvesting reduced yields up to 30%. Late harvest did not materially reduce yields. Significant increases were obtained with bunch grown in competition with Spanish and medium runner. Spanish and medium runner were not affected by competition with bunch, medium runner or Spanish. Under favorable conditions, spacings as low as 4" with 18" rows were effectively utilized.

PRACTICAL APPLICATIONS OF RESULTS OR PUBLIC BENEFITS: Approximately twelve hundred pounds of foundation seed of Spanish 2B were released through county agents in the southern part of the state where peanut growing has been emphasized recently and where this variety has performed especially well under the conditions of this area. Two bunch strains, N. C. 4 and N. C. 31, were released for the normal region of peanut production. These seed are to be grown as certified seed for sale in 1946.

PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

DIRECTOR

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1945-46
(Two copies to be given to the OES examiner)

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

PROJECT: (Fund, number, and title): **Bankhead-Jones Agron. BJ10-A10, Peanut Breeding and Cultural Investigations.**

DEPARTMENTS AND COOPERATING AGENCIES:

PERSONNEL: W. C. Gregory

NATURE AND EXTENT OF WORK DONE THIS YEAR:

Sixty strains, varieties and species of peanuts received from the office of plant exploration and introduction, PFI, USDA, and 194 local strains and varieties were grown in 476 -25 ft. nursery rows at McCullers branch station. 468 cross-pollinations involving all possible combinations of 10 highly divergent lines were made. By means of cuttings these F_1 hybrids were grown in a replicated yield trial at the Upper Coastal Plain Station at Rocky Mount. A yield trial of 36 selected strains was conducted at the Upper Coastal Plain Station. A total land area of approximately 3 acres was used. Detailed laboratory analyses of components of yield were made on all F_1 hybrids.

PRINCIPAL RESULTS OF THE YEAR (confidential information should be so marked):

Differences in general combining ability with respect to yield and its components have been established for the 10 lines studied. Likewise marked heterosis occurred in certain specific combinations. Large differences in the incidence of leaf spot, and the number of diseased, immature and aborted seeds occurred between hybrids. The significance of these studies cannot be fully pointed out until F_1, F_2, and F_3 correlations give a measure of the breeding potentialities involved.

BENEFITS realized this year by farmers or the public through application of findings, stated as dollars, bushels, or other values, where possible:

None

PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

None

DIRECTOR

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1944
(Two copies to be given to the O. E. S. examiner)

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

PROJECT TITLE, NUMBER, AND FUND: Peanut Breeding and Cultural Investigations, BJ10-A10, BJ.

DEPARTMENTS AND COOPERATING AGENCIES: Dept. of Agronomy, N. C. Agr. Exp. Sta., N. C. Dept. of Agr. and five farmer cooperators.

PERSONNEL: G. K. Middleton, E. F. Schultz, Jr., J. R. Piland.

NATURE AND EXTENT OF WORK DONE THIS YEAR: Breeding: (1) Yield trials included, (a) advanced tests with 36 strains at two locations and with 7 strains at one; (b) 16 selections from farmers stock (3rd year); (c) preliminary test on 49 strains, representing the 1st yield test on material originating from the local breeding program. Progenies numbering approximately 500 were advanced 1 generation for further selection. (2) Oil analyses were completed on samples from 1 25-strain test conducted in 1942 and on 7 of these strains from another location; also on graded samples representing large, medium, and small kernals of these 7 strains and on 4 strains harvested at different dates. Cultural studies: Four varieties were used in Fertility-Variety test on calcium deficient soils at 4 locations, in cooperation with workers on BJ18-A18. Date of planting studies involved 4 strains and 3 dates. A spacing experiment was conducted with Va. Bunch and Wh. Span., with width-of-row being 18, 24, 30, and 36 in. and spacings in the row varying from 4 to 16 in. by 4 in. intervals.

MAJOR RESULTS (confidential information should be so marked): Breeding: (1) Varietal yields were generally low, due to a late summer drought, and relative ranks were quite different from preceding season. (2) Studies on oil content (1942 crop) show: (a) a definite relationship between grade and oil content (within a variety the large, plump seed have higher oil content than low grade seed, though differences could not be completely accounted for by grade); (b) significant difference between varieties, between locations and a variety x location interaction. Cultural studies: (1) A variety x treatment interaction was obtained in Fertility-Variety tests. Va. Bunch peanuts gave a definite response to applications of calcium while Wh. Span. did not. N. C. Runner and Spanish 2B were intermediate in their reaction. (2) Results from Date-of-planting tests were in agreement with those of previous years, early plantings giving the highest yields. (3) In spacing tests Va. Bunch produced its highest yields in 24-in. rows and Wh. Span. in 18-in. rows. These widths are narrower than previously found, and were probably due to there being only a crown crop set.

PRACTICAL APPLICATIONS OF RESULTS OR PUBLIC BENEFIT: Breeding: Results from 20 tests conducted in northeastern counties since 1939 show Martin Co. Runner (medium-sized kernels) to have produced approximately 250 lbs. more nuts and 75 lbs. more oil per acre than strains of Va. Bunch, and it is being recommended for oil production in that area. Ga. strain 207-2, for an average of 6 tests conducted during the past 3 years has produced 77 lbs. more oil than has Martin Co. Runner. It is being increased for distribution after further testing. Cultural practices: In southern coastal plain counties higher yields of nuts and higher oil returns per acre were obtained with Va. type peanuts than with Spanish when the former received adequate applications of calcium and potash. On the basis of these results growers are being advised to plant Va. type peanuts and to fertilize with gypsum and potash.

PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

Harvey, Paul H., and Schultz, E. F., Jr. Multiplying peanut hybrids by vegetative propogation. Jour. A. S. A. 35: 637-639. 1943.

DIRECTOR

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1943.
(Two copies to be given to the O. E. S. examiner)

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

PROJECT TITLE, NUMBER, AND FUND: THE IMPROVEMENT OF PEANUTS BY BREEDING AND SELECTION. Bankhead-Jones. Agron. BJ10-A10.

DEPARTMENTS AND COOPERATING AGENCIES: Agronomy Department, N. C. Agr. Exp. Station and N. C. Department of Agriculture.

PERSONNEL: G. K. Middleton, P. H. Harvey, and E. F. Schultz, Jr.

NATURE AND EXTENT OF WORK DONE THIS YEAR: Advanced yield trials were conducted with 25 strains at 3 locations and preliminary trials on 86 strains at one location. The latter included a group of selections from farmers' seed stocks and material received from the Georgia and Florida Stations and from the Div. of Horticultural Crops and Diseases, Bureau of Plant Industry. Modern experimental designs were used for all tests. Selections from the local breeding program will be in the yield trials for the first time in 1943.

Work on breeding techniques consisted of: (1) the evaluation of the inherent yielding ability of peanut strains as measured by their performance in the F_1, and (2) the multiplication of peanut plants by cuttings to simplify the production of sufficient F_1 material for testing. Cultural tests, designed to determine the relative response of different types of peanuts included: date of planting, date of harvesting, bacterial inoculation and spacing. In all, the above work occupied some 11 acres of land. In the laboratory, the relation of variety and grade of peanuts to oil content is being studied.

MAJOR RESULTS (confidential information should be so marked):

Georgia sel. 207-2, in the advanced test for the first time, produced significantly higher yields than any other strain at the Upper Coastal Plain Station and higher average yields than any other small seeded strain in the Bladen County test. (Test in Perquimans County not harvested due to excessive rains). In shelling percent and oil content it is similar to Spanish.

The experiment with cuttings was satisfactory, it being found that cuttings started in the greenhouse and set to the field were as productive as plants grown from seed. The test on F_1s was partly spoiled due to poor stands. The multiplication of F_1s by cuttings would seem to make practical the testing of such F_1s.

Results from cultural experiments are in favor of: (1) early planting; (2) harvesting neither too early or too late for maximum yield and oil; and (3) different width rows for Spanish and Virginia types.

PRACTICAL APPLICATIONS OF RESULTS OR PUBLIC BENEFITS:

Virginia type peanuts have produced, as an average of 13 tests conducted in the northeastern counties of North Carolina during the past 4 years, approximately 350 pounds more nuts per acre than has the Improved Spanish, and slightly more oil and are recommended in this area for food and oil production. Three tests in Bladen County show gross yields in favor of Virginia Bunch types by 157 pounds per acre, but with the Improved Spanish producing more oil. Demonstrations in other areas (BJ18-A18) indicate that on sandy soils, and especially soils low in calcium, Spanish types may contribute more to the oil program than other types. Georgia 207-2, after further testing, may be found to produce more oil that either of these types. Early planting increases yields and spreads the harvest period. The latter is worth while with the present labor shortage. New techniques being developed should serve to speed up the breeding program.

PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

a. Producing peanuts for oil. Compiled by E. R. Collins, G. K. Middleton, W. E. Colwell, E. F. Schultz, Jr. and N. C. Brady. War Ser. Bul. 17, N. C. Agr. Ext. Service, 1943.

b. Multiplying peanut hybrids by vegetative propagation. P. H. Harvey and E. F. Schultz, Jr. News Note. In preparation March 1943.

DIRECTOR

ANNUAL PROGRESS REPORT, FEDERAL-GRANT PROJECTS, 1942.
(Two copies to be given to the O. E. S. examiner)

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

PROJECT TITLE, NUMBER, AND FUND: The improvement of peanuts by breeding and selection. Bankhead-Jones BJ10-A10 and Spn. 1

DEPARTMENTS AND COOPERATING AGENCIES: Agronomy

PERSONNEL: G. K. Middlet, P. H. Harvey and E. F. Schultz, Jr.

NATURE AND EXTENT OF WORK DONE THIS YEAR: I. Breeding: (1) One hundred and twenty F_4 progenies and 8000 F_3 plants were grown in the field at the Upper Coastal Plain Station; (2) A new series of crosses was started between high oil content strains and local varieties. II. Cultural experiments, in relation to varietal nursery work, were continued along the following lines: (1) date of planting; (2) bacterial inoculation; (3) spacing and (4) response of varieties to different fertility levels. III. Yield trials: (1) 16 advanced strains were tested at the Station and at 5 outlying points; (2) 4 tests at the Station included 131 new selections from farmers' stocks and 53 secured from the Georgia and Florida Experiment Stations and the Bureau of Plant Industry.

MAJOR RESULTS (confidential information should be so marked): (1) A larger percentage of promising lines were obtained from crosses where both parental strains were of the Virginia type than where smaller types were used as one parent. (2) Early planting has increased the yield in each of the last 3 years, with certain varieties responding more than others. (3) Bacterial inoculation of seed gave a slight increase in yield. (4) Due to the drought in August and September, all varieties responded to increase in width-of-row from 30 to 42 inches. (5) A differential response was found at one location between varieties and fertility levels as measured by shelling percent or by percent oil. (6) Varietal trials confirm results of earlier years, indicating a wider adaptation for Virginia Bunch than for Jumbo Runner types. (7) Promising strains, especially for oil production, were found in the groups from Georgia and Florida.

Information in (5) not for publication.

PRACTICAL APPLICATIONS OF RESULTS OR PUBLIC BENEFITS: (1) Planting 30 days early has given increased yields of nuts and hay worth $11 per acre as an average for the past 2 years, which if applied to one-half the acreage which North Carolina farmers are expected to grow this year (325,000) would amount to $1,787,500 increase in farm income. Early planting of part of the acreage would also stagger the harvest period, giving a more efficient use of both labor and machinery. (2) Varietal trials have indicated the areas in which different types should be grown, both for oil and for the edible trade. (3) Information gained on differential response of varieties to fertility levels will be of value in determining which varieties to use for oil under known fertility levels, or how to fertilize certain varieties under conditions where they are known to be best adapted.

PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:
Middleton, G. K. and Farrior, J. W. Response of peanut varieties to different fertility levels. Abs. Proceedings Assn. Sou. Agr. Workers 42nd Annual Convention, Feb. 1941.
Farrior, J. W. and Middleton, G. K. The improvement of Virginia type peanuts by mass selection. Abs. Proceedings Assn. of Sou. Agr. Workers 42nd Annual Con. Feb. 1941.
Harvey, Paul H. and Robinson, Harold F. Studies in field plot technique for peanuts. Abs. Proceedings Assn. Sou. Agr. Workers, 42nd Annual Convention, Feb. 1941.

DIRECTOR

PROJECT TITLE, NUMBER AND FUND: The improvement of peanuts by breeding and selection. Bankhead-Jones BJ10-A10 and Spnl.

PRACTICAL APPLICATIONS OF RESULTS OR PUBLIC BENEFITS:

(1) Planting 30 days early has given increased yields of nuts and hay worth $11 per acre as an average for the past 2 years, which if applied to one-half the acreage which North Carolina farmers are expected to grow this year (325,000) would amount to $1,787,500 increase in farm income. Early planting of part of the acreage would also stagger the harvest period, giving a more efficient use of both labor and machinery.

(2) Varietal trials have indicated the areas in which different types should be grown, both for oil and for the edible trade. In the old belt Virginia types have produced both higher yields and more oil than have Spanish. The latter should be used for oil in areas where the Virginia types do not fill well.

(3) Information gained on differential response of varieties to fertility levels will be of value in determining which varieties to use for oil under known fertility levels, or how to fertilize certain varieties under conditions where they are know to be best adapted.

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

PROJECT OUTLINE

Project No. H-50 ~~xxxxxxxxx~~

Date

Submitted .....

Approved .....

Revised .....

1. Title Peanut breeding and cultural investigations.

2. Objective(s)

a. To develop strains of peanuts with greater yielding ability, high oil content and superior disease resistance through:

(1) Hybridization and selection within strains now available.

(2) Development of polyploid types through the use of colchicine and other agents and evaluation of their potentialities for peanut improvement.

(3) Development and evaluation of various breeding techniques which appear to have value in peanut improvement.

(4) Determination of the relative oil content of different varieties when grown under the same conditions and the influence of grade within a variety on its oil content. (This information is required before the oil content of different strains can be compared satisfactorily).

b. To determine the relative response of different types or varieties of peanuts as measured by both yield and quality, on different soil types and to various cultural practices, including

(1) Date of planting (3) Spacing

(2) Date of harvest (4) Fertilization.

3. Reasons for Undertaking Investigations*

The center of production of Virginia type peanuts is in the northern Coastal Plain area of North Carolina and the southeastern counties of Virginia. In this area the crop, grown largely for the edible trade prior to the present emergency, ranks next to tobacco in cash value.

Until recently the annual acreage planted to this type of peanut in North Carolina was approximately 260,000 (1). War Production Goals (2) have raised this figure to slightly over 400,000 for 1943, the increase to be used for oil purposes; it seems likely that it will be still higher in 1944. Peanuts produce 2½ to 3 times as much oil per acre as either soybeans or cotton and should be further expanded in areas where it is economically possible.

If this enlarged program is to be successful it is important that the range of adaptation of different types of peanuts be determined and improved strains of these types developed for the respective areas and soils where they are to be grown. This will include varieties for both the edible trade and for oil. In the latter the yield of oil per acre as well as the percentage of oil is important.

(cont. on attached sheet)

(1) Agricultural Statistics, Cooperative Crop Reporting Service, U. S. Dept. of Agr. and the N. C. Dept. of Agr. March 1942.

(2) Mimeo. Rpt. U. S. D. A. National War Board.

*Including economic justification

4. Previous work and present status of investigations in the field of this project:

a. Breeding

(1) Variety and strain tests have been conducted each year since 1938, both at the Upper Coastal Plain Station and at several outlying points, and summaries of the results published (1) (2). With the exception of Bladen County, all tests were in the northeastern Coastal Plain. In this area Virginia type peanuts have, on the average, produced greater total yields and more oil per acre than have strains of Spanish or small runners. Within the Virginia type, bunch strains have shown a wider range of adaptation than strains of the Jumbo Runner. In these tests several Experiment Station selections of the Virginia Bunch type (selections made in 1930) have shown up well and two of these are being increased for possible distribution in 1944. (One of these produces medium size pods and the other pods of approximately the same size as Jumbo Runner).

Investigating further the possibility of improvement through selection within commercial varieties, seed was secured in 1939 from 32 growers and planted at the Upper Coastal Plain Station. Selections were made from these in the fall of that year and over 600 grown in progeny rows in 1940. At harvest time 120 of these progenies were selected, by observation, and have been carried in yield tests for the past two years. A number of these have produced higher average yields than have their parent stocks, but the differences have not been statistically significant. The most promising strains will go into the advanced test in 1943.

Improvement through mass selection has also been attempted in 10

(cont. on attached sheet)

5. Outline of Procedure:

a. Breeding

(1) Advanced yield trials will be continued on a group of standard varieties, including Virginia Bunch, Jumbo Runner, small runner and Spanish types, and promising new strains. The emphasis will, however, be shifted somewhat from the Old Belt to certain new areas. This seems important in view of the increased production of peanuts in these areas for oil. Data on total yield, grade and oil content will be secured on all advanced tests. For these advanced tests different experimental designs will be tried to determine their relative efficiency for peanut work. In general, individual plot size for these tests will be 225 square feet. These may be single rows 75 feet long and 3 feet apart, or 2 or 3 rows reduced in length to give approximately the same total area. Previous work with blank tests (3) has indicated this size of plot to be quite satisfactory for strain tests, and especially if the individual plot shape is such that one complete replication occupies an area which approximates a square.

Preliminary trials of new varieties and selections will be conducted only at the Upper Coastal Plain Station. Rigid selection will be made here, advancing to the above mentioned tests only those strains which give promise of being superior to the standard varieties and discarding the others as rapidly as possible to make room for other strains coming in from the breeding program. Modern experimental designs will also be used for the preliminary tests, but the size of plots will usually be somewhat smaller than that for the advanced test. Limitation in seed supplies and land will ordinarily make this necessary.

(continued on attached sheet)

3. Reasons for Undertaking Investigations (cont.)

Data to be obtained from the cultural investigations is needed not only from the standpoint of production but also for use in interpreting the response of various types in variety or strain tests.

4. Previous work and present status of investigations in the field of this project (cont):

of the above mentioned farmers' seed stocks, but failed to produce positive results (6).

In the general testing program, preliminary trials have been conducted on a rather large group of introductions received from the Division of Horticultural Crops and Diseases, Bureau of Plant Industry, and on a number of hybrid selections secured from the Georgia and Florida Experiment Stations. Several strains from these sources show promise. This is especially true of Georgia 207-2. This strain led in one of the preliminary strain tests in 1941 and when placed in the advanced test at the Upper Coastal Plain Station in 1942 produced significantly higher yields than any other strain in the test.

Notes on the prevalence of diseases in variety tests have shown that Spanish and Valencia types are more susceptible to certain root rot organisms than varieties of the Virginia type (1). Seed and plant inoculation studies, in which an attempt was made to induce heavy infection, have not been satisfactory due to the lack of a reliable technique. Investigations are now under way in the Department of Pathology (BJ27-B1) and if satisfactory techniques are developed these will be applied in the breeding program.

In the local breeding program a number of crosses have been made between bunch and runner strains of the Virginia type and between these and Spanish and other small seeded varieties. The most advanced of these were in the fifth generation in 1942. Selections from this group will be in the 1943 preliminary yield trials. Others range from the F_1 to the F_4.

Most of the above crosses were made at random, with a view to producing a wider range of material for selection. Some of the older crosses, however, and a special group made in 1942 are to be used in selecting for higher oil content in large seeded types. Reference is made especially to crosses between Spanish and Virginia Bunch strains.

(2) Preliminary work at this station with colchicine has shown that polyploid sectors are easily produced and a few seed have been developed but failed to reproduce. It is planned to continue this work in 1943.

(3) In 1942 it was found that cuttings made from branches were easily rooted when treated with a hormone solution and that such cuttings would develop into mature plants and produce a normal crop of seed (4). It seems feasible to so multiply F_1 plants in order to have sufficient material for a preliminary yield test on such F_1s, thus saving considerable time in a breeding program.

(4) Oil analyses of graded seed (shriveled seed passing a 15/64 inch screen having been removed) of 20 varieties and strains of peanuts showed maximum differences of 1.53 per cent between varieties as an average of four tests (1). Preliminary studies have recently shown a much greater difference between grades within a variety (3). Separated into large, medium and small kernels the oil content was found to vary from approximately 48 per cent for the large seed to as low as 35 for the small. This suggests that grade may be more of a factor in determining oil content than variety. This is now being checked by an analysis of both graded and ungraded seed from varieties carried in the 1942 advanced yield test and on seed from a date-of-harvest experiment (b2).

b. Cultural

(1) Date-of-planting studies have been made for the past 4 years on several varieties, but part of the 1942 crop was lost due to excessive rains in October. The data show earlier than normal planting increased yields each year while delayed planting (30 days late) reduced yields by approximately one-third. Similar results have been reported from the Mississippi Station (5). It is planned to continue this work for one or two more years and to obtain information on grade and oil content as well as on yield.

(2) In 1942 four varieties were planted at the same time but harvested at three different dates. Samples from each plot are being graded and analyzed to determine the relation between time of harvesting and quality (see A4 above).

(3) Three years' results from plantings made in 30, 36, 42 and 48 inch rows show decreased yields for Improved Spanish in rows wider than 36 inches and for strains of the Virginia type above 42 inches. As more White Spanish are now being grown for oil, it is proposed to test this variety against Virginia Bunch in 1943, in rows varying from 18 to 36 inches in width. Two years' work in spacing of hills of Virginia type peanuts within the row have shown very little reduction in yield up to 16 inches. One or two year's work is planned in which White Spanish will be included in the tests. Tests by the Alabama Station (5) have shown maximum yields from 4 inch spacings as compared with either 8 or 12 inches.

(4) Combination variety and fertilizer studies have been in progress for three years. No definite interactions have been found as measured by total yield, but have been demonstrated on a basis of grade, which in turn has been found related to oil content. Most of the tests conducted to date have been on soils with fairly high fertility levels. Demonstrations conducted by workers in soil fertility in 1942 on sandier soils indicated a very definite differential response of Spanish and Virginia types to calcium. This was in the southern part of the Coastal Plain. Tests are planned for this area again, in cooperation with the above mentioned workers (BJ18-A18, SPn2).

References

1. Peanut breeding and variety studies. G. K. Middleton, P. H. Harvey, H. F. Robinson and J. W. Farrior. Agron. Inf. Cir. 125, N. C. Agr. Exp. Sta., Mar. 1940 and supplement Sept. 1940.

2. Producing peanuts for oil. E. R. Collins et al. War Series Bul. No. 17, N. C. Agr. Ext. Service, Feb. 1943.

3. Unpublished data. N. C. Agr. Exp. Sta.

4. Multiplying peanut hybrids by vegetative propagation. P. H. Harvey and E. F. Schultz, Jr. News Note. Jour. Amer. Soc. of Agron. In press. 1943.

5. Peanut production. H. O. West. Bul. 366, Miss. Agr. Exp. Sta. 1942.

6. The improvement of peanuts by mass selection. J. W. Farrior and G. K. Middleton. Abs. Proc. of Sou. Agr. Workers. 1941.

5. Outline of Procedure: (cont.)

Selections from the hybrid combinations now on hand will be moved through the tests as rapidly as possible in order to make room for more definite work on the development of high oil strains which it is expected will be available from crosses made recently and which are to be made in the future.

(2) Growing points of young peanut plants will be treated with colchicine to induce the development of polyploid sectors (previous work has indicated that .02 per cent concentration will do this, though other strengths will be tried). Branches which show evidence of being affected will be cut off and rooted as suggested above. In the plants thus developed it is expected that some seed will be produced. Another method which will be used will be that of treating the young embryo itself by placing the gynophore in the solution. If fertile, polyploid types can be developed, they will be evaluated for yield and for oil, and for use in further improvement. Any cytological work required will be handled with the cooperation of Dr. B. W. Smith (SPnS).

(3) During the summer and fall of 1943, a series of crosses will be made between 4 varieties which vary rather widely in oil content and in seed size such as the Virginia Bunch, N. C. Bunch, Improved Spanish and White Spanish and other strains which appear promising (all combinations will be made). In the early spring of 1944 the F_1s will be grown in the greenhouse and the number of such plants increased by cuttings to the extent that a yield test can be conducted in the field on these F_1s. If the results are satisfactory, the method will be more generally used in future breeding work. The use of multiple crosses in the development of high yielding varieties, or the back cross method in developing higher oil content in large seeded varieties, or disease resistance in certain types will be tried later.

(4) Oil analyses will be run on samples of all 25 varieties which occurred in the advanced test conducted in Bladen County in 1942. Analyses will be on ungraded seed, but studies will be made to determine the degree of correlation between oil content and grade. Six of these varieties, including strains of Spanish, small runner and Virginia types, will then be graded into large, medium and small seed (separated by 20/64 and 15/64 inch mesh screens), and analyses run on the fractions to study further the effect of grade on oil content. For further information on the effect of grade, samples from all plots in the 1942 date-of-harvest experiment will be analyzed for oil and the results correlated with grade and yield. Analysis of similar samples from the 1943 tests is contemplated.

b. Cultural

(1) For date-of-planting studies 4 varieties will be used, namely, Virginia Bunch, Jumbo Runner, N. C. Runner and White Spanish. Plantings will be made in early April, May and June, May being the normal date in the vicinity of the Upper Coastal Plain Station. Whole plots will be used for dates, with subplots for varieties. Each plot will be harvested at as near its maturity date as possible. Data will be obtained upon both grade and yield of nuts.

5. Outline of Procedure: (cont.)

(2) The same varieties referred to in the paragraph above will be used in the date-of-harvest experiment. In this test, however, whole plots will be used for varieties and subplots for dates. The test will be planted in early May, but the harvest will extend over 4 periods. These will be at 21 day intervals, beginning about September 1, the exact date depending upon the development of the pods. Yields will be taken and a special study made as to the grade of the peanuts harvested at each period and the effects of time of harvest on oil content. (In cooperation with project BJ18-A18, SPn2).

(3) Only two varieties, Virginia Bunch and White Spanish, will be used in the spacing experiments. In the width-of-row experiment rows will be 18, 24, 30 and 36 inches apart, while for spacings within the row distances between hills will be 4, 8, 12 and 16 inches. Both experiments will be so set up as to show interactions between varieties and spacings if such exists.

(4) Combination fertilizer-variety tests will be conducted at 4 locations in the southern Coastal Plain, in cooperation with workers in soil fertility (BJ18-A18 and SPn2). Four varieties and 4 treatments will be arranged in a lattice design. The treatments will be: 1, none; 2, gypsum; 3, gypsum plus potash; and 4, lime plus potash. The choice of varieties will be: 1, Virginia Bunch; 2, N. C. Runner; 3, Improved Spanish 2B; and 4, White Spanish. By conducting these on sandier soils than have been used in the past, and especially soils low in calcium, it should be possible to determine if there is a differential response between varieties. Such information would be valuable in making recommendations for the fertilization of different types of peanuts when grown under similar conditions.

Project No. H-50

6. Probable Duration of Project: Revise in 1948.

7. Date of Initiation: January, 1938.

8. Personnel:

Name	Department	Relation to Project
C. K. Middleton	Agronomy	Leader
E. F. Schultz, Jr.	"	Assistant
W. E. Colwell	"	Adviser
J. R. Piland	"	Cooperator

9. Coöperation:

a. Interdepartmental

Department of Agronomy and Department of Agricultural Statistics

b. Other Agencies

N. C. Department of Agriculture.

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Project No. ~~BJ10-410,~~ ~~[illegible]~~

10. Financial Support:

a. Proposed Budget July 1,1943 to June 30, 1944

Items	ALLOCATION OF FUNDS					
	Bankhead-Jones	Purnell	Adams	State	Other	Total
1. Salaries	1240			2792		
2. Labor	150			650		
3. Travel	100			200		
4. Equipment & Supplies	185			240		
5. All Other	20			25		
Total	1605			3907		

b. Proposed Future Budgets:

Year	Salaries	Total Expenditures	Estimated Income

11. General Remarks:

Project No. H-50 ~~DJ10-H10~~

SIGNATURES OF APPROVAL

1. Approval of Project Leaders

Date May 24, 1943 — G. K. Middleton

Title Associate in Charge, Field Crops Investigations

Date .....

Title .....

Date .....

Title .....

2. Approval of Heads of Departments or Coöperating Agencies

Date June 2, 1943 — Ralph W. Cummings

Head, Dept. of Agronomy

Date .....

Head, ...

Date .....

Head, ...

3. Approval of Committee on Experiment Station Projects

Date .....

Chairman of Committee

4. Approval of Director

Date 6/22/43 — L. D. Baver

Director, North Carolina Agricultural Experiment Station

5. Approval of U. S. D. A.

Date .....

Approved

Chief, Office of Experiment Stations

Through error, yellow signature sheets not sent to Washington.