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AGRICULTURAL ECONOMICS

Cotton Production Practices: (1) USE OF FAMILY LABOR AND HIRED LABOR FOR HARVESTING COTTON, ALABAMA, 1947. (R. Wayne Robinson.) — Harvest labor requirements make up about half the total man labor required to produce an acre of cotton in Alabama. In 1947, 76 per cent of the operator cotton and 82 per cent of the cropper cotton was hand-picked by family labor. However, 48 and 47 per cent of the operators and croppers, respectively, used some hired labor for harvesting.

The proportion of cotton harvested by family labor varied by size of cotton enterprise. On farms with small cotton enterprises (1 to 9 acres), 79 and 83 per cent of the operator and cropper cotton, respectively, was harvested with family labor; on farms with medium-sized cotton enterprises (10 to 29 acres), 75 and 84 per cent of the operator and cropper cotton, respectively, was harvested with family labor; on farms with large cotton enterprises (30 acres or more), 44 and 77 per cent of the operator and cropper cotton, respectively, was harvested with family labor.

The use of hired labor for harvesting varied considerably among farmers with different sized cotton enterprises. On farms with small cotton enterprises, 43 and 34 per cent of the operators and croppers, respectively, used some hired labor for harvesting cotton; on farms with medium-sized cotton enterprises, 57 and 59 per cent of the operators and croppers, respectively, used some hired labor; on farms with large cotton enterprises, 84 and 45 per cent of the operators and croppers, respectively, used some hired labor.

Cotton producers on farms with large cotton enterprises used a greater amount of hired labor and harvested a larger proportion

of their cotton with hired labor than did farmers on farms with small- and medium-sized cotton enterprises.

(2) USE OF COTTON INSECTICIDES IN ALABAMA DURING THE TEN-YEAR PERIOD PRIOR TO 1948. — A relatively small percentage of the State's farmers attempted to properly control cotton insects before 1948. During the 10-year period 1938-47, only 26 per cent of the cotton producers applied poison and less than 4 per cent applied poison every year during the period.

Of the farmers who used poison, those with large cotton enterprises tended to use it in more years than did those with small cotton enterprises. During this period, however, nearly three-fourths of the farmers in the State used no poison.

The problem of insect infestation has become more serious in recent years. If farmers expect to maintain or increase cotton yields, insect infestation must be controlled.

TABLE 1. NUMBER OF YEARS FARMERS USED INSECTICIDES ON COTTON DURING THE 10-YEAR PERIOD BY SIZE OF COTTON ENTERPRISE, 1938-1947, ALABAMA[1]

Number years poison used in last ten	Size of cotton enterprise[2]			Total
	Small	Medium	Large	
	Per cent	*Per cent*	*Per cent*	*Per cent*
0	76.1	73.6	67.5	73.8
2	14.0	17.1	24.9	16.9
4	6.7	9.5	15.6	9.2
6	5.5	6.7	12.2	7.0
8	2.9	4.4	9.7	4.5
10	2.2	3.7	7.0	3.6

[1] Based on data from a study of cotton production practices in 1947.
[2] Size of cotton enterprise refers to farmers who had small (0-9 acres), medium (10-29 acres), and large (30 acres and over) cotton enterprises.

Cotton Marketing: (1) COTTON CONSUMPTION OF ALABAMA. (R. Wayne Robinson.) — Cotton mills in Alabama acquire a large proportion of their cotton requirements from local sources. Mills in Alabama consumed a total of 1,162,842 bales of cotton in 1947 and a total of 1,119,361 bales in 1948.

Alabama mills obtained 43 per cent of all the cotton they purchased in 1947 from Alabama and 46 per cent in 1948. This amounted to 52 per cent of all the cotton produced in the State in 1947 and 40 per cent of that produced in 1948. Actually, mills consumed more bales of Alabama cotton in 1948 than they consumed in 1947, although the proportion consumed decreased because of increase in Alabama production in 1948.

TABLE 2. TOTAL COTTON CONSUMPTION OF ALABAMA MILLS AND PROPORTION OF TOTAL CONSUMPTION ORIGINATING FROM ALABAMA, BY MILL SIZE GROUPS, ALABAMA, 1947-48[1]

Mill size group[2]	Mill consumption of cotton					
	Alabama cotton		Total		Proportion consumption of Alabama cotton is of total	
	1947	1948	1947	1948	1947	1948
	Bales	*Bales*	*Bales*	*Bales*	*Per cent*	*Per cent*
Small	56,159	49,439	69,625	62,034	80.7	79.7
Medium	98,964	86,887	222,805	199,881	44.4	43.5
Large	313,291	344,002	870,412	857,446	39.7	44.3
Total	468,414	480,328	1,162,842	1,119,361	43.3	46.2

[1] Data is based on a study of mill demands for raw cotton in 1947 and 1948.
[2] Small mills used less than 8,000 bales; medium, 8,001 to 20,000 bales; and large, 20,000 bales and over.

Small mills obtained a greater proportion of their cotton supply from Alabama than did medium and large mills. This was probably due to medium and large mills being unable to find in Alabama an adequate volume of the specific qualities of cotton desired.

(2) MAJOR QUALITIES OF COTTON CONSUMED BY ALABAMA IN 1947 AND 1948. — Cotton mills require specific qualities of raw cotton for manufacturing different end products. Of the cotton consumed by mills in Alabama in 1947 and 1948, the major pro-

TABLE 3. PROPORTION OF COTTON CONSUMED BY ALABAMA MILLS 1947 AND 1948 BY MAJOR GRADE AND STAPLE LENGTHS, ALABAMA[1]

Average grade and staple length	Proportion of cotton consumed	
	1947	1948
	Per cent	*Per cent*
M-1-1/16 inches	6.2	6.1
M-1 inch	16.0	17.2
M-31/32 inch	5.2	7.5
M-15/16 inch	17.9	14.9
SLM-1 inch	13.2	12.0
Sub-total	58.5	57.7
All other[2]	41.5	42.3
Grand total	100.0	100.0

[1] Only the grade and staple classifications that constituted the major proportion of cotton consumed are shown.
[2] "All other" consists of 31 other grade and staple classifications, each of which constituted less than 5 per cent of the total cotton consumption in each year.

portion consisted of only five grade and staple classifications: M – 1-1/16 inches, M – 1 inch, M – 31/32 inch, M – 15/16 inch, and SLM – 1 inch.

These five classes composed 59 per cent of the total cotton consumed in 1947 and 58 per cent of that consumed in 1948. Thirty-one other classes of cotton were used during the same 2-year period, but each class constituted less than 5 per cent of the total cotton consumed.

Milk Marketing. (S. W. Williams.) – In Alabama the school lunch program provides an important market for milk. Information obtained from records of the State Department of Education, Montgomery, suggests that further development of that outlet is possible.

In the 1949-50 school year, about 40 per cent of the public schools in Alabama served milk.

Some 70 per cent of the State's school children attended those schools, though not all of them drank milk there.

TABLE 4. NUMBERS AND 1948-49 ENROLLMENT OF ALABAMA SCHOOLS SERVING AND NOT SERVING MILK IN THE 1949-50 SCHOOL YEAR, BY SIZE AND COLOR

Size of school (Number of teachers)	Schools serving milk, 1949-50		Schools not serving milk, 1949-50	
	Number of schools	Net enrollment of those schools in 1948-49	Number of schools	Net enrollment of those schools in 1948-49
Number	*Number*	*Number*	*Number*	*Number*
		White schools		
1	11	270	118	2,655
2	78	4,006	130	6,892
3	116	9,525	63	5,096
4	94	10,845	26	3,349
5	61	8,801	10	1,437
6 or more	722	328,748	93	40,730
All	1,082	362,195	440	60,159
		Negro schools		
1	24	765	805	23,971
2	47	2,570	447	26,764
3	38	3,731	184	17,248
4	30	3,814	67	9,130
5	14	2,507	44	6,888
6 or more	172	88,600	133	48,656
All	325	101,987	1,680	132,657
Grand totals, white and negro	1,407	464,182	2,120	192,816

A greater proportion of the large schools than of the small ones served milk. Among schools of a given size, a smaller share of the negro schools than of the white schools served milk.

Some schools served ungraded fresh milk, while others served reconstituted milk. Many of these were small, remote schools. Those that were large schools were mostly at considerable distances from sources of graded milk.

AGRICULTURAL ENGINEERING

Design and Construction of Special Farm Machinery and Equipment: (1) APPLICATION OF ANHYYDROUS AMMONIA TO GROWING CROP. (F. A. Kummer, C. M. Stokes, and T. E. Corley.) — Experimental work pertaining to application of anhydrous ammonia was conducted on Lloyd clay loam at Auburn and on Norfolk sandy loam at the Wiregrass Substation, Headland. It was necessary to transport the material from Albany, Ga., the nearest source of supply.

It was found that unless the soil is properly prepared, it is difficult to obtain uniform application of anhydrous ammonia in heavier soils. The land must be plowed 6 inches deep if use of anhydrous ammonia application is contemplated. Such obstructions as large rocks and stumps should be removed. If properly instructed in the use of this equipment, most tractor operators will have no difficulty. Operators should be cautioned about the dangers involved in use of anhydrous ammonia. Where the soil was wet and tight, some of the material escaped.

(2) DEFOLIATION. — Dust and spray defoliants were applied by air and ground equipment. Although the results were very inconsistent, the most complete and dependable defoliation was obtained with dust applied by either plane or tractor applicators. Spray defoliants applied by tractor-mounted sprayers in rank cotton failed to produce adequate coverage on all leaves without getting excessive application on some, thereby resulting in very poor defoliation. Spray applied by plane gave good defoliation in rank cotton.

(3) MECHANICAL COTTON CHOPPERS. — Three types of mechanical cotton choppers were compared in four replications with hand chopping at Auburn. The machines were the Mayco, Winter-Wiess, and Eversman. In a stand of about 40,000 plants per acre, the machines left 14,000 to 21,000 plants per acre as compared with 14,000 plants per acre left by hand chopping. Drilling

to a heavy stand is necessary for successful operation of mechanical choppers. Analysis of the data from this study showed no significant difference in yield of mechanical-chopped versus hand-chopped cotton.

(4) INSECT CONTROL EQUIPMENT. — Studies of machinery for applying insecticides were conducted with emphasis on sprayers. Four different commercial tractor-mounted sprayers were field tested. Observations of performances revealed that all of the sprayers had undesirable mounting frames. The mounting frames with drawbar braces damaged the cotton plants considerably. Mounts for all of the sprayers were modified, increasing the ground clearance and eliminating the drawbar braces. With a few modifications, each of the sprayers was successfully used to spray cotton. To reduce damage to cotton plants while applying insecticides, tractor wheel fenders, which attach directly to the tractor axle housing, were developed. Parallel linkage allows the fenders to be raised and lowered vertically by means of cables attached to power cylinders or rocker arms. These fenders have proved very effective in minimizing tractor-wheel damage to cotton plants.

(5) SUPPLEMENTAL IRRIGATION STUDIES. (J. E. Coniff, F. A. Kummer.) — Infiltration rate studies were made on Lloyd clay loam. The rate was found to be 0.45 inch per hour for sprinkler irrigation and 1.43 inches per hour for furrow irrigation. The water-holding capacity was computed as 2.09 inches for the first 2 feet. All check plots and irrigated plots received the same preparation, fertilization, and cultivation.

North Carolina 1032 corn and Coker 100 Wilt cotton seed were planted to obtain a thick stand. Plant appearance was used as indication to determine the time to irrigate. After cultivation was discontinued, the soil crusted and the infiltration rate became almost negligible for subsequent furrow irrigation. The yield of sprinkler-irrigated corn was twice that of the check plot. One and 2-inch furrow irrigation yielded 50 per cent more and the 3-inch furrow irrigation produced 100 per cent more than the yield of the check plot. No favorable results were obtained from cotton with sprinkler and furrow irrigation.

Supplemental irrigation was applied to early-seeded alfalfa for winter grazing. There was little difference in yields for August 1 and August 15 seedings. The plots seeded on August 30 could have been grazed by November 15 but produced only

one-half the amount of green material as the August 1 and August 15 plantings. The early seeding produced twice as many weeds as the second seeding, while the late seeding (August 30) produced a pure stand of alfalfa.

Crop Residue and Seedbed Preparation. (F. A. Kummer, C. M. Stokes, and T. E. Corley.) – Comparative tests with the horizontal-blade rotary stalk cutter have shown this type to be equally as effective in shredding cotton stalks as the vertical type. The horizontal rotary cutter has also been used successfully to remove tops of green peanuts, cut weeds, briars, and small bushes in pastures and idle fields.

In addition to the tillage experiments at the Tennessee Valley Substation and in the Coastal Plain at Prattville, a third series of experimental tillage plots was initiated in the Piedmont Area at Auburn. This new tillage experiment consists of four treatments replicated four times as compared to 16 treatments replicated five times at the Tennessee Valley Substation and 10 treatments replicated four times at Prattville.

Analyses of data obtained are as follows: Yield analyses showed no significant differences at the Tennessee Valley and Auburn locations, but significant differences at Prattville where the deeply-tilled plots produced the highest yields and the shallow-tilled plots the lowest. There were significant differences in weediness at harvest time at the Prattville and Tennessee Valley locations but not at Auburn. In general, those treatments that most completely inverted the soil surface had the lowest weed count. No significant difference in plant height due to treatment was observed at Auburn. However, at the Tennessee Valley and Prattville locations, the deep tillage treatments appeared to produce taller plants. At all three locations, there was a significant correlation between plant height and yields. At Prattville, the deeper tillage resulted in deeper rooting, and the relative root depths were in general agreement with yields. There was very little difference in appearance or relative root depth at Auburn. At Prattville, the effects of deep tillage in increasing the porosity of the soil nearly disappeared 1 year after treatment.

Dynamics of Soil Erosion and Principles of Control. (J. E. Coniff, F. A. Kummer, and A. W. Cooper.) – Comparative tests with artificial rainfall (3.5 inches per hour) were made on plots of crimson clover and subterranean clover. The soil loss from

the crimson clover plots was 2,036 pounds compared to 349 pounds from the subterranean clover plot. The reduction in soil loss for the subterranean clover plot is attributed to the dense growth on the surface of the soil, whereas crimson clover has tall individual stems.

Processing and Storing of Seed, Grain, and Hay. (J. L. Butt, H. S. Ward and F. A. Kummer.) — Blue lupine seed were stored to depths of 3, 6, 9, and 24 inches at several different initial moisture contents. Where the seed were stored 3 inches deep, all samples reached the same moisture content after about 6 months. The final moisture was at equilibrium with prevailing atmospheric conditions. Seed stored for 6 months to depths greater than 3 inches showed less change in moisture as the depth increased. Below about 12 inches, no appreciable changes from initial storage moisture contents were found.

Germination of blue lupine seed containing up to 16 per cent moisture was not lowered when stored to a depth of 3 inches for 6 months. This was believed to be due to the rapid reduction in moisture content of the thin layer of seed. Lupine stored to greater depths showed reductions in germination at all moisture contents above 13 per cent.

An experiment was set up to study the effects of storage temperature, time, and moisture content on the germination of blue lupine seed. Decreases in germination during storage were affected as follows: (1) higher temperatures caused greater reduction; (2) higher moisture contents also resulted in greater reductions; and (3) all reductions increased with time.

Hay was artificially dried with heated air at an operating cost (fuel and electricity) of approximately $1.43 per ton. A comparative quantity of hay artificially dried with unheated air cost about $1.28 per ton. The time required for drying without heat was about four times that needed for drying with heated air. Drying with heated air eliminated occasional spoilage that occurred when extensive periods of inclement weather prevented rapid drying of hay.

Peanut Harvesting. (C. M. Stokes and F. A. Kummer.) — Results of experimental work with peanut harvesting during the 1950 season at the Wiregrass Substation have shown that it is now possible to combine peanuts directly from the windrow as efficiently as by any other method. Total labor requirements

for the three harvesting methods are as follows: combining from windrows 4.1 man-hours per acre, picking from piles 9.45 man-hours per acre and, picking from stacks 32.2 man-hours per acre. These figures constitute the total labor requirement for each method from the time the peanuts are dug until they are picked. If the windrows are properly prepared, there is no material difference in the grades obtained from peanuts cured in the windrows when compared with other methods of curing.

Peanut Curing. (J. L. Butt and F. A. Kummer.) — Nuts on the top surface of piled and windrowed peanuts were found to dry faster than those on the underside. The nuts on the underside, however, lost more moisture after sundown in good curing weather than those on the top surface. There was practically no difference in the drying rates between piled and windrowed peanuts in either the top or bottom layers. (The piles contained 6 to 15 peanut plants each.)

Relative humidity records were taken under and at the top of windrows and in a nearby weather station. There was a much faster climb after sundown at the top of the windrow than was found either under the windrow or in the weather station 4 feet above ground. Characteristic drying rates as affected by temperature were determined for use in artificial drying calculations. A test to study the effect of simply rotating peanuts as a means of drying lowered the moisture content of the batch from 15.7 to 13.4 per cent in 5 days of good drying weather.

AGRONOMY and SOILS

Cotton Breeding and Improvement Investigations. (H. B. Tisdale and A. L. Smith.) — Work is being continued on a number of old and new hybrid strains of cotton for improvement in yield, disease resistance, strength of fiber, and other important agronomic qualities. A new strain with fiber of high tensile strength has been developed from Hybrid 9531. This strain has shown very good yields and resistance to wilt in variety and strain tests. A new hybrid, strain 81, is being used to develop a type of cotton suitable for mechanical stripping. This strain is a very early prolific semi-cluster type of cotton that produces small bolls with 1 inch or better staple. It is resistant to wilt disease.

A new variety, given the name "Plains" in November 1949, has been developed by A. L. Smith, U.S.D.A. Division of Cotton and Other Fiber Crops and Diseases in cooperation with the Georgia and Alabama Agricultural Experiment Stations. The initial breeding work was done at the Georgia Agricultural Experiment Station, and was continued in 1947 at the Alabama Station's Plant Breeding Unit, Tallassee. This variety was previously designated as CSS 9, indicating its origin from Clevewilt crossed with Stoneville 2B and backcrossed with Stoneville 2B. On the average, Plains has been the highest yielding variety in cotton variety trials conducted over the State for the past 4 years, 1947-1950. It is a wilt-resistant variety, is medium in time of maturity, and produces medium- to large-sized bolls of 1 inch and better staple with 37 to 40 per cent lint turnout It was entered in commercial production in 1949. Approximately 2,500 acres were planted to this variety in 1950 and about 300 tons of seed were produced for distribution in 1951.

Another new strain, Hybrid 56, has been developed from crossing a strain of wilt-resistant Cook and Coker 100 and backcrossing several times with Coker 100 Wilt variety. This new strain has shown the highest yield with the most disease resistance of any variety or strain of cotton in tests conducted over the State for the past 4 years, 1947-1950. Hybrid 56 is medium early in maturity, produces medium-sized bolls with 1 inch or better staple, and 35 to 37 per cent lint turnout. The seed of this strain and its advanced strains were planted in increase blocks in 1950 on 30 acres at Prattville and approximately 5 acres at the Main Station, Auburn. Approximately 14 tons of seed from these increase blocks were saved separately for 1951 plantings.

Cotton Variety Tests. (H. B. Tisdale.) — Average results of cotton variety tests conducted on the Main Station, Substations, and Experiment Fields, for the past 3 years, 1948-1950, show that Plains, Stoneville 2B, Empire, Miller 610, Smith 78, Coker 100 Wilt, and Deltapine 15 are very satisfactory varieties for yield, staple length, and other fiber properties for planting in any section of Alabama that is free of the cotton wilt disease. Plains, Coker 100 Wilt, Stonewilt, and White Gold Wilt are the most satisfactory wilt-resistant varieties for production, staple lengths, and other fiber properties for planting in sections infested with cotton wilt.

Behavior of Potassium in Soils: (1) RESIDUAL VALUE OF POTASSIUM FOR COTTON. (R. D. Rouse.) — An experiment was conducted at the Sand Mountain Substation on Hartsells fine sandy loam to study the residual value of potassium for cotton. Results show that, where potash has been applied in normal amounts for a period of 18 years, yields cannot be maintained by residual effects for over 2 years on this soil type.

Yield records from 1941 to 1947 showed no response to applications greater than 36 pounds of K_2O. The first 2 years after the potash applications were omitted, there was no appreciable decrease in yield on the plots that had received the 36- or 48-pound rate. The third year the yields on these plots were 18 per cent less than those from plots receiving the 96-pound rate. The yield from the 96-pound rate was still as good the third year, without potash, as those that continued to receive 48 pounds annually.

(2) POTASSIUM STATUS OF SOILS FOLLOWING ALFALFA OR SERICEA. — Cotton has not been grown successfully following alfalfa and sericea at some locations. Results from experiments on Decatur clay loam, Chesterfield sandy loam, and Susquehanna very fine sandy loam show that the primary cause of poor cotton after these crops is potassium deficiency.

At the Tennessee Valley Substation, cotton was grown following alfalfa that had been grown for 5 years at a low rate of potassium fertilization on Decatur clay loam, a soil that normally is not very responsive to potash fertilization. Results show that, after 3 years of cotton fertilized with 600 pounds of 6-8-8 annually, a potassium deficiency was still preventing normal cotton growth. Where application of 600 pounds of 6-8-20 had been made for 3 years, the cotton appeared to be making normal growth.

At the Tuskegee Experiment Field where sericea was grown for 8 years at different rates of potash fertilization, similar results were obtained. After 3 years of fertilization at the recommended rate of 4-10-7, the cotton on all plots where sericea had received less than 120 pounds of K_2O annually showed potash deficiency.

At the Main Station on Chesterfield sandy loam, cotton fertilized with 500 pounds of 4-10-7 showed potassium deficiency on plots where the rate of potash to alfalfa had been less than

240 pounds of K_2O annually. There was no evidence of potassium deficiency on the plots receiving 240 pounds of K_2O.

The potassium status of these soils was determined by soil and plant analysis, foliar diagnosis, and yield of cotton.

(3) Release of Potassium by Electrodialysis. (R. W. Pearson.) – Electrodialysis has been reported to be a promising technique for evaluation of the sustained rate of supply of potassium from non-exchangeable sources. This technique was studied using eight Alabama soils, previously reported, which had been characterized as to minerological characteristics, exchangeable potassium, total potassium, and potassium removed by five crops in the greenhouse.

The results indicate that there is a fairly good relationship between the sustained rate of release of potassuim from non-exchangeable forms by cropping and the rate of release of non-exchangeable potassium in electrodialysis.

Six of the soils were selected for study of their relative intensities of potash fixation and rate of release of fixed potassium. In general the soils that contained montmorillonite fixed larger amounts of potassium than did the kaolinitic soils. On electrodialysis they also released larger percentages of the total fixed potassium than did the kaolinitic soils. There was an important difference in the rate of release between the two mineralogical types. The fixed potassium was released rapidly from the kaolinitic soil during the first few hours of electrodialysis followed by very little additional release. The montmorillonite soils, on the other hand, continued to release the fixed potassium throughout the course of the electrodialysis.

Samples from the residual potash study on Hartsells soil were subjected to electrodialysis. In addition to the difference in exchangeable potassium that resulted from the different past rates of application, this technique showed that there had been a measurable build-up of fixed potassium under field conditions and that this fixed potassium is somewhat more soluble than that contained in the native soil minerals.

Factors Affecting the Nature and Behavior of Native and Added Phosphates in Soils: (1) Adsorption of Phosphorus by Soils. (L. E. Ensminger.) – X-ray analyses of soil colloids and clay minerals show that an aluminum phosphate is formed on treating these materials with $NH_4H_2PO_4$ or KH_2PO_4 and that the in-

tensity of the aluminum phosphate lines increases with time of contact between the materials and the phosphating solutions. Chemical analyses show that the amount of phosphorus adsorbed increases with time of contact. These data indicate that the time of contact influences the magnitude of phosphorus fixation but not the type of fixation taking place.

(2) RATES OF MINERALS FOR CORN. — An experiment to study the response of corn to rates of phosphorus and potash has been conducted at nine locations since 1947. All plots received 80 pounds of nitrogen. The average yields at the nine locations from 1947 to 1950 show that phosphorus increased the yield of corn less than 3 bushels and that potassium increased the yield less than 2 bushels.

(3) RESIDUAL PHOSPHORUS STUDIES. — Yield data from greenhouse and field experiments show considerable residual value for applied phosphates. The residual value is usually in proportion to the amount of phosphorus previously applied. Lime increased the residual value of superphosphate appreciably.

Radioactive phosphorus was used to study the residual value of various sources of phosphorus at the Tennessee Valley Substation and the Prattville Experiment Field. Cotton was used as a test crop and plant samples were analyzed for P-32 uptake. The results show that the percentage of phosphorus taken up from the fertilizer was greater from check plots than from plots previously phosphated. At the Tennessee Valley Substation, plants on plots that had previously received Ammo-Phos A and heavy applications of rock phosphate showed a rather low uptake of fertilizer phosphorus, indicating a relatively high residual availability of these materials. At the Prattville Field, plants on basic slag and tricalcium phosphate plots showed a low uptake of fertilizer phosphorus, indicating a relatively high residual availability of these materials. Ammo-Phos A plots at Prattville showed the lowest residual availability of any of the phosphated plots as measured by P-32 uptake.

Iron Nutrition of Certain Plants with Special Reference to Conditions Obtained in Calcareous Soils. (John I. Wear.) — Peanuts, rice, common lespedeza, blue lupine and yellow lupine developed severe chlorosis when grown in Sumter (calcareous) soil. Peanuts, rice, and common lespedeza grew normally in pots containing puddled or compacted soil. Common lespedeza, the plant showing the greatest response to the puddling treat-

ment, produced an average of 16 times more green weight when grown in puddled calcareous soil than when grown in unpuddled soil. Autoclaving the calcareous soil prior to puddling prevented the increased iron accumulation and subsequent increase over the non-puddled soil.

Increased forage of Dallis grass and white Dutch clover was obtained on plots of Sumter soil at the Black Belt Substation when zinc, iron, copper, manganese, and borax were applied in a mixture. In separate applications, zinc increased yields and manganese decreased yields.

Iron was not found to be a limiting factor in peanut production in Norfolk sandy soil from the Wiregrass area. Iron added as a spray or to the soil in the form of soluble iron salts did not increase yields of peanuts in pot experiments. Lime and organic matter did increase yields on this highly acid soil.

Accumulation of Boron in Alabama Soils Under Various Conditions, and the Effect of This Accumulation on Crops which are Sensitive to Boron. (John I. Wear.) — The boron content of Norfolk sandy loam from Auburn and Kalmia sandy loam from Brewton Experiment Field is much lower than that in the clay soils from Tuskegee Experiment Field and the Piedmont Substation, Camp Hill. Soil tests show that boron applied to clay soils accumulated in the topsoil, but readily leached from the sandy topsoils into the subsoils.

Increase in yields of crimson clover seed was obtained from 10 pounds of borax per acre on the Norfolk and the Kalmia soils; however, no increase was obtained beyond this rate. From one year's results, borax did not increase crimson clover seed yields on Susquehanna clay at Tuskegee or Cecil clay at Camp Hill.

Methods of Breeding Crimson Clover. (T. H. Rogers.) — Research with crimson clover during the past 8 years has shown that: (1) hardness of seed is an inherited character; (2) different fertilizer, and lime applications have no effect on percentage of hard seed; (3) percentage of hard seed of a reseeding strain may be increased by selection; (4) hulling seed by rubbing between the hands is the most satisfactory method of preventing scarification; (5) hard-seeded characteristic is developed late in the maturity of the seed; (6) isolation of approximately 700 feet is needed to prevent cross fertilization; (7) artificial tripping

is necessary for the production of selfed seed; and (8) selfing for 1 to 3 years results in slight but significant decrease in vigor.

Production and Management of Alfalfa and Sericea: EFFECT OF FERTILIZERS, LIME, AND STAGE OF GROWTH ON TANNIN CONTENT OF SERICEA. (C. M. Wilson.) — Studies were conducted during 1950 to determine tannin content of sericea under various conditions. Sericea was sampled at a height of 12 to 15 inches from various fertilizer and lime treatments both in the greenhouse and in the field. Based on 1 year's results from two samplings in the greenhouse and two samplings each from five locations in the field, fertilizer and lime treatments did not affect the tannin content of sericea.

Sericea grown in the greenhouse and sampled at heights from 7 to 18 inches showed an increase in tannin content as height of the plant increase.

Pasture Studies. (1) EFFECT OF SOURCES AND RESIDUAL VALUE OF PHOSPHATES ON WHITE CLOVER GROWTH. (E. M. Evans and R. M. Patterson.) — Three year's data from experiments on a heavy-textured alkaline soil in the field and greenhouse show rock and colloidal phosphates to be of little value in supplying phosphorus for white clover establishment and maintenance. Plots that received as much as 1,152 pounds of P_2O_5 per acre from colloidal or 576 pounds of P_2O_5 per acre from rock phosphates produced yields no better than those of the untreated check plot. On a heavy-textured acid soil, 1 year's data show rock and colloidal phosphates at 640 pounds P_2O_5 per acre to be inferior to superphosphate at 160 pounds P_2O_5 per acre when applied without lime. With lime rock and colloidal phosphates were even less effective. Addition of 400 pounds of gypsum per acre did not improve the effectiveness of these materials when applied at the rate of 160 pounds of P_2O_5 per acre.

(2) SUPPLEMENTARY NITROGEN FOR COASTAL BERMUDA — RESEEDING CRIMSON CLOVER SUCCESSION. — Preliminary results from a cooperative experiment with the animal husbandry department indicate that timely applications of nitrogen to coastal Bermuda grass may give good yield increases even after a good crop of crimson clover. The application of 200 pounds of ammonium nitrate per acre as a top-dressing on July 18 increase the yield of forage by about 50 per cent over the following 3-month period. Yields of dry matter were increased from 2,900 pounds per acre

on the plot receiving no nitrogen to 4,400 pounds on the plot receiving the ammonium nitrate. Percentage of protein in the forage was also increased considerably by the nitrate application.

(3) Supplementary Irrigation for Pasture Crops. — Two year's results from an experiment on Norfolk sandy loam at Auburn show that supplementary irrigation may greatly increase forage yields under some conditions. By supplementing natural rainfall to 1½ inches of water per week during the growing season, the yield of a white clover-tall fescue combination was increased by about 60 per cent over that from natural rainfall alone. The yield of Ladino clover was increased by about 80 per cent under the same experimental conditions. It was noted, however, that irrigation during hot weather intensified disease injury from southern blight.

(4) Effect of Renovating Permanent Pastures. — Results of pasture renovation trials at three locations in 1949 show this practice to be very effective in restoring production of sod-bound permanent pastures. Pastures that have been well fertilized often lose the clover stand due to excessive grass competition. Disking in the late summer to reduce the grass population and followed by reseeding produced good stands of clover and grass. Renovation extended the grazing period by about 90 days, improved the quality of the forage, and increased total forage production.

Blast Furnace Slags as Agricultural Liming Materials. (F. L. Davis, B. L. Collier, and O. R. Carter.) — Three blast furnace slags having total neutralizing values of 86.5 per cent, 85.5 per cent, and 70.1 per cent calcium carbonate equivalent, respectively, were compared with calcitic limestone as agricultural liming material. Rates of application and grades of fineness were also compared. Alfalfa and crimson clover-corn were grown in the field and alfalfa and crimson clover-Sudan grass were grown in the greenhouse on Lloyd sandy clay, on Hartsells very fine sandy loam, and on Norfolk loamy sand over a 3-year period.

Alfalfa yields increased significantly with an increase in rate of application of slag from 1 to 2 tons per acre on all soils and from 2 to 4 tons per acre on Lloyd sandy clay loam. At rates of 2 tons per acre without additional boron, significantly larger yields of alfalfa were produced from slag than from lime on the Hartsells and Norfolk soils. This was due to a deficiency of boron

for alfalfa in these two soils. The yields of alfalfa and crimson clover from 2 tons of agricultural lime when borax was applied with the fertilizer were as good as those obtained from 2 tons of slag plus borax on all soils. The larger yields obtained from 2 tons per acre over those from the same rate of lime were due to the boron content of the blast furnace slags. Chemical analyses of soils and of plant tissues showed that all soils studied except Lloyd sandy clay were deficient in boron for alfalfa at the beginning of the experiment and that each of the soils, whether treated with slag or lime without borax applications, were near or below the critical level of soluble boron content for alfalfa by the end of the first year. The results showed blast furnace slags ground to meet the standards for agricultural lime were satisfactory liming materials.

Response of Runner Peanuts to Lime and Gypsum. (F. L. Davis.) — Cooperative field experiments on the effect of applications of lime and gypsum on runner peanuts have been conducted for two years in four counties in the Wiregrass area of Alabama. Field data were obtained from 18 tests in 1949 and from 26 tests in 1950. Of the 26 tests harvested in 1950, 12 were tests begun in 1949 and 14 were new tests.

In 1950, 46 per cent or 12 of the tests gave increases of 200 pounds per acre or more of cured peanuts from 400 pounds of gypsum (land plaster) per acre dusted on the peanut foliage at early blooming stage. The average increase in yield of these 12 tests was 342 pounds per acre from gypsum and 300 pounds per acre from 1 ton of lime applied at least 10 weeks before planting. Of the 30 different locations tested in the 2 years, four gave increases in yield from gypsum which exceeded 600 pounds of peanuts per acre. The larger increases in yields were obtained from soils that produced peanuts having the lower shelling percentages. Increases in yield from applications of lime or gysum were found to be limited by inadequate amounts of potash supplied by the soil and fertilizer. The use of large amounts of potash in the fertilizer or as a side-dressing resulted in decreased yield and lowered shelling percentage of peanuts on the plots receiving no calcium. On many of the soils, a maximum response to either calcium (applied as lime or gypsum) or increase applications of potash is dependent upon supplying both calcium and potash.

Corn Variety, Spacing, and Rate of Nitrogen Fertilization Tests. (Pryce B. Gibson and F. S. McCain.) — Two varieties of corn were grown at each of five different substations. Four different spacings (one plant every 12, 18, 24, and 30 inches in rows 42 inches apart) were used at each of four levels of nitrogen (30, 60, 90, and 120 pounds of nitrogen per acre). These 16-treatment combinations for each variety were randomized. The tests were replicated three times at each location. Phosphorus and potassium fertilizers were applied uniformly to all plots at the rates of 60 pounds of P_2O_5 and 60 pounds of K_2O per acre.

One variety grown on the Tennessee Valley and Sand Mountain Substations was of the single-ear type, while the other variety was a semi-prolific type. At each location there was a significant difference in the response of the two varieties to the different treatments.

Both varieties grown on the Gulf Coast, Wiregrass, and Lower Coastal Plain Substations were of the semi-prolific type. At each of these three locations there was no significant difference in the response of the two varieties to the different treatments.

The 1950 yields substantiate a recommended spacing of an average of one stalk every 18 to 24 inches.

Chemical Weed Control: (1) PRELIMINARY RESULTS WITH CHEROKEE ROSE, *Rosa bracteata.* (V. S. Searcy.) — Fifteen chemical treatments were tested for control of Cherokee rose. Sixty large rose plants were treated — four each per treatment. All plants receiving a solution were sprayed until thoroughly wet using a power sprayer. The treatments were as follows: Low volatile esters of 2,4-D[1] and 2,4,5-T[1] each mixed at the rate of 1½ pounds to 50 gallons of four different oils, and 1½ pounds to 100 gallons of water; TCA (sodium trichloroacetate 90 per cent), Ammate (ammonium sulfamate), and Polybor-Chlorate (sodium pentaborate decahydrate 55 per cent, borax 16 per cent and sodium chlorate 25 per cent) were each mixed at the rate of 1 pound per gallon of water; Borascu (anhydrous borax 89 per cent) at 20 pounds per 100 square feet; and E. H. No. 2 (dichloral urea) ¼ pound per gallon water.

No difference could be observed between the different oils carrying 2,4-D or 2,4,5-T. The oil solutions defoliated roses in a

[1] All forms of 2,4-D (2,4-dichlorophenoxyacetic acid); and 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) are expressed as pounds of acid equivalent.

shorter period than the water solutions. The water solutions were more effective than the oil. Roses receiving 2,4,5-T resprouted more than the ones receiving 2,4-D. Ammate and Borascu were the only treatments that appeared to have killed the Cherokee roses completely. TCA, Polybor-Chlorate, and E. H. No. 2 did not appear to be effective in this test.

Another test was conducted 30 days later on Cherokee roses ranging from medium to small in size. All treatments used in the first test were used in this test with the exception of E.H. No. 2. Polybor-Chlorate was reduced from 1 pound per gallon of water to ½ pound. In addition to the treatments previously referred to, the following six treatments were used: 2,4-D in the amine, and isopropyl ester forms; amine form of 2,4-D applied as a 1-to-1 mixture with the isopropyl ester; amine mixed 1-to-1 with the low volatile ester of 2,4-D; amine mixed with low volatile ester of 2,4-D; amine mixed with low volatile ester of 2,4,5-T; and a 1-to-1 mixture of the low volatile esters of 2,4-D and 2,4,5-T. Each treatment was mixed at the rate of 1½ pounds per 100 gallons of water. The effectiveness of treatments used in both tests appeared to be about alike with the exception of Ammate. Ammate was effective in the first test, but it did not appear to be effective in the later test. The amine form of 2,4-D was as good, if not better, than any of the 2,4-D's or 2,4,5-T. The isopropyl ester of 2,4-D was the least effective.

(2) Nutgrass Control with Methyl Bromide. — Nutgrass, *Cyperus rotendus,* was eradicated in a soil heavily infested with this pest. The soil was thoroughly loosened to a depth of 9 inches. A vapor-proof covering was placed over each plot before applying methyl bromide with a jiffy applicator. Each plot was covered for 24 hours. Methyl bromide was applied at the rate of 1, 2, and 4 pounds per 100 square feet. Tubers were dug from each treatment on one replication from the following depths: 0 to 3, 3 to 6, and 6 to 9 inches. All tubers from the treated plots failed to germinate. The germination from the check plot was as follows: 0 to 3 inches, 88 per cent; 3 to 6 inches, 84 per cent; and 6 to 9 inches, 100 per cent.

(3) Preliminary Results from Use of 2,4-D on Curled Dock, *Rumex crispus,* in White Clover Pasture. — The amine form of 2,4-D was applied in the spring to dock in a well established white clover pasture. The following rates of 2,4-D per acre

were tested: ½, 1, 2, and 3 pounds. The injury to dock and white clover increased as the rate of 2,4-D was increased. The 3-pound rate killed all dock in all plots. White clover was severely stunted in these plots but recovered late in the season. It was estimated that 95 per cent of the dock was killed on the plots receiving 2 pounds of 2,4-D. The ½- and 1-pound rates reduced the number of dock plants but was not satisfactory in this test.

(4) Effect of Chemicals on Kudzu. — During the summer of 1950, eight chemical treatments were applied to kudzu with a power sprayer. The treatments were as follows: TCA (sodium trichloroacetate 90 per cent) ½ pound per gallon of water; TCA ½ pound per gallon of water mixed with the low volatile ester of 2,4,5-T at 1½ pounds per 100 gallons of water; low volatile esters of 2,4,5-T and 2,4-D, the amine form of 2,4-D with and without 0.5 per cent Dreft, a 1-to-1 mixture of the low volatile esters of 2,4-D and 2,4,5-T, each at the rate of 1½ pounds per 100 gallons of water; and Polybor-Chlorate (sodium pentaborate decahydrate 55 per cent, borax 16 per cent and sodium chlorate 25 per cent) ½ pound per gallon of water. The kudzu was sprayed until thoroughly wet. Results obtained from this test showed that 2,4,5-T or any mixture containing 2,4,5-T would kill from 97.6 per cent to 99.6 per cent of the kudzu.

(5) Effect of Post-Emergence Chemical Applications on Weeds and Seedling Alfalfa. — Thirteen chemical treatments were applied to seedling alfalfa (three to five true leaf stage) in an attempt to control corn spurry, *Spergula arvensis.* The treatments per acre were as follows: Dow Selective (ammonium dinitro-o-sec-butylphenate, 1 pound per gallon) 3, 6, and 9 pints; Dow Selective, 3, 6, and 9 pints each mixed with ⅛ pound of 2,4-D amine; 2,4-D amine, ⅛ pound; Dowcide G (sodium pentachlorophenol 74 per cent), 1 and ½ pound; Dow Contact (dinitro-o-sec-butylphenol, ½ pound per gallon), 6 and 12 pints; and Chapman's Penta (pentachlorophenol), 1 and 2 gallons. Dow Selective at 3 and 6 pints, both rates of Dowcide G, and Penta at 1 gallon did not show any injury to alfalfa or corn spurry. All other treatments injured or killed alfalfa and corn spurry.

(6) Control of Broad-Leaf Weeds in Corn with 2,4-D After Lay-By Time. — Approximately 200 acres of corn were sprayed with the amine form of 2,4-D at the rate of 1⅓ pounds

per acre. The weeds ranged in size from seedlings to 24 inches high. The weeds in order of abundance were as follows: cocklebur, *Xanthium canadense;* coffee weed, *Cassia tora* and a small percentage of *C. occidentalis;* pusley, *Richardia scabra;* and pigweed, *Amaranthus hybridus* and *A. spinosus.* Many other species were present but not in large enough numbers to be of importance. Excellent kill was obtained on all of these species with the exception of one area where rain fell within 1 hour after application. Where 2,4-D had been applied 1 hour or longer prior to rain, excellent weed control was obtained. Corn plants were not injured.

(7) Weed Control in Cotton. — An experiment conducted in 1950 indicates that weeds in cotton can be controlled with chemicals. Chopping, hoeing, and three early cultivations were eliminated by the best treatments. The best results were obtained from a pre-emergence application of 1 or 2 pounds of an oil soluble dinitro (dinitro-o-sec-butylphenol) applied in diesel fuel or 2 pounds of a water soluble dinitro, followed with three post-emergence applications of LHH-1 oil [21.5 per cent aromatics (+ unsats) Lion Oil Company] at 5 gallons per acre per application. The 2-pound rate of water soluble dinitro injured cotton to some extent by dwarfing. The first post-emergence application was applied when the cotton was 1 week old and at weekly intervals thereafter. All pre-emergence treatments were applied at the rate of 5 gallons per acre. Both pre-emergence and post-emergence treatments were applied in an 8-inch band over the row in 42-inch rows.

(8) Pre-Emergence Chemical Weed Control on Runner Peanuts. — Results obtained from four experiments over a 3-year period strongly indicate that weeds in peanuts can be controlled with chemicals for a period of 4 to 7 weeks. Hand hoeing and two to three early cultivations were eliminated with the best treatments. The best results have been obtained from a mixture of a water soluble dinitro (dinitro-o-sec-butylphenol) and the sodium salt or amine form of 2,4-D. The dinitro was very effective for weed control if the soil was dry. The opposite results were obtained when the soil was wet. The effect of 2,4-D was opposite to that of the dinitro under the same conditions. Two pounds of 2,4-D were injurious to peanut plants if the soil was wet, while 4 pounds were not injurious when the soil was dry.

The dinitro was not injurious to peanut plants under any conditions or rates tested. The highest rate tested was 9 pounds DNOSBP per acre. It appears that 6 pounds of a water soluble dinitro mixed with 1 pound of 2,4-D amine per acre is about the correct mixture for weed control in peanuts. All treatments were applied as a blanket spray.

ANIMAL HUSBANDRY AND NUTRITION

Effect of Nitrogen Fertilization of Coastal Bermuda on Gains of Yearling Heifers. (W. D. Salmon and J. C. Grimes.) — An 8-acre paddock of coastal Bermuda was divided into two 4-acre paddocks. One paddock received an application of 200 pounds of ammonium nitrate per acre on July 18, 1950. The area in both paddocks had been planted to coastal Bermuda and reseeding crimson clover in September 1947 and had produced three good crops of clover that had been grazed. Eight open yearling heifers were placed on the unfertilized paddock and 11 comparable heifers on the nitrated paddock. It was necessary to add five more heifers to the fertilized area and one more was added to the unfertilized area. The gain in weight of the heifers from August 4 to October 27 was 195 pounds per acre on the unfertilized paddock and 304 pounds per acre on the fertilized paddock. This represented an increase of 109 pounds per acre resulting from the application of 200 pounds, or $7.20 worth of ammonium nitrate per acre.

Effect of Nitrogen Fertilization Upon the Biological Value and Amino Acid Content of Corn. (H. E. Sauberlich and W. D. Salmon.) — The protein content of corn kernels from a series of different varieties ranged from 6.8 per cent to 8.8 per cent when grown with low-nitrogen fertilization, but was significantly increased when grown with adequate nitrogen fertilization (ranged from 9.5 per cent to 12.0 per cent). Growth experiments with rats demonstrated that the low-protein samples were very inferior to the high-protein samples when used to supplement low-protein diets or as the sole source of protein in the diet. For example, when diets containing 95 per cent of corn as the only source of protein were supplemented with tryptophan and lysine, moderately good growth was obtained with the high-protein corn (20-25 gm./week), whereas growth was very inferior with

the low-protein corn (often only 1 to 2 gm./week). To obtain growth comparable to that of the high-protein corn, additional supplements of isoleucine, threonine, and valine were necessary. The main effect of nitrogen fertilization appeared to be on the quantity of protein in the corn rather than on the quality. Microbiological assays for individual amino acids confirmed the above results. The amounts of the individual amino acids varied with the protein content of the corn. The amino acids were present in the high-protein corn samples in amounts ranging from 25 per cent to 100 per cent higher than the values obtained for the low-protein corn.

The Toxicity of Caley Peas for Young and Mature Rats. (R. W. Engel and W. D. Salmon) — The seed of the Caley pea *(Lathyrus hirsutus)* contain a toxic principle that produces the disease known as lathyrism. When young rats (40 to 50 gm. body weight) were fed a mixture composed of equal parts of Caley pea seed and a normal diet, symptoms of the disease developed in 6 to 8 weeks. When the diets contained as much as 70 or 80 per cent of Caley pea seeds, symptoms occurred in 3 to 4 weeks and death often occurred in 2 to 3 months. Similar results were obtained if young rats were fed a normal diet to which was added an extract of Caley pea seeds containing the toxic principle.

In young rats the first symptom noted was the development of abnormal curvatures of the spine in the chest region and the lower back region in about 3 to 4 weeks. Somewhat later the legs became involved with gradual stiffening of the joints and with the forepaws gradually spreading outward. When the diet contained as much as 70 or 80 per cent of Caley pea seeds, about a third of the animals became paralyzed in the hind quarters in 2 to 3 months and died shortly after paralysis set in. When paralysis occurred there was usually evidence of hemorrhage and injury to the spinal cord in the chest region. Mature rats (200 to 240 gm. body weight) were considerably more resistant to the poisonous effects of Caley peas than were young rats. The severe abnormal curvatures of the spine, the characteristic symptom in young rats, never developed in mature rats, although slight abnormal curvatures were observed after the animals had been on experiment for 8 months. The characteristic symptom observed in mature rats after 6 months on a diet containing 80

per cent of Caley peas, was a stiffening of the knee joint. At the end of 8 months, the knee joint had become almost rigid in a flexed position so that it was impossible to straighten the leg. The animals walked in the manner of a kangaroo gait. Upon post mortem dissection, it was noted that the long bone joining the hip and the knee was shorter than normal. Since Caley pea-poisoning produces rather marked damage to the bony structures, it seems reasonable to conclude that the growing skeleton is more susceptible than the mature bone structure. This would explain the greater tolerance of mature animals and the greater susceptibility of young animals to the damaging action of Caley pea seed.

BOTANY AND PLANT PATHOLOGY

Investigations on Diseases of Forage Crops, Grain Crops, and Legumes. (J. A. Lyle.) — No variety of oats showed good resistance to helminthosporium blight and crown rust. In general, the Bond derivatives showed up better than the Victoria derivatives in disease reaction. Crown rust races 45, 57, 68, and 88 were present. Races 45 and 57 were the most common.

Good resistance to Diplodia and Gibberella stalk rots was lacking in about 90 corn varieties. Resistance to helminthosporium leaf spots, to brown spot, and to rust occurred in some varieties.

Results of studies on the microbial population of blue lupine seed stored at different moisture contents showed that combine-run seed, with an initial moisture content of 10 per cent, could be stored as well as combined seed that were cleaned or were cleaned and then artificially dried to the same moisture content. Furthermore, results from these studies showed that pathogenic species of fungi were the predominating molds at all initial moisture contents. With an increase in moisture content of seed, there was an increase in percentages of species of *Aspergillus* and *Penicillium.*

Under field conditions, disease reactions of crimson clover selections and commercial strains showed that only a few selections had good resistance to sooty blotch, *Cercospora* leafspot, and mosaic.

Tomato Disease Control. (R. L. Self.) — Randomized, replicated fungicidal tests were done with spring tomatoes at the Chilton Area Horticulture Substation, and with fall tomatoes

at the North Alabama Horticulture Substation and on an Etowah County farm. Five per cent active zineb dust gave good early and late blight control, was the least phytotoxic, and produced the highest yields of all dust treatments. Heavy, frequent applications of 7 per cent copper gave good early blight control. However, it produced some stunting and resulted in higher yields than the check treatments but less yield than the 5 per cent active zineb.

When the spray materials were tested in the same plot, Dithane D-14, Liquid Parzate, Z-78 and Parzate concentrates, Copper A, and Tribasic Copper gave good blight control. There was no yield difference between any of the sprays except Dithane D-14 and Z-78 concentrate, each of which produced over a ton per acre more than the other materials.

Phygon dust gave poor control of early blight at the Chilton Area Substation and Phygon spray gave poor late blight control in Etowah County. The only phytotoxicity observed with a zineb compound was with Parzate in Chilton County.

Effect of Method of Curing on Quality of Peanuts. (Henry S. Ward, Jr.) — Germinability, as measured by reactions of the germules to 2,3,5-triphenyltetrazolium chloride, was completely lost in Dixie Runner peanuts with an initial moisture content of more than 30 per cent (unshelled wet weight basis) when dried in thin layers at 46°C., 55°C., 63°C., 71°C., and 97°C. in a forced-draft oven. Total oil after drying at 55°C., 63°C., and 71°C. was reduced from 1 to 2 per cent as compared with total oil when dried at 46°C. Drying at 97°C. caused a reduction of 7 per cent in total oil as compared with drying at 46°C. The total oil content of 49 per cent (dry weight basis) of peanuts dried at 46°C. was comparable with total oil found in naturally cured peanuts.

Dixie Runner peanuts, when cured in the windrow, were found to reach a moisture of 7 per cent (kernels) in 9 days, whereas, peanuts cured by the stack method did not reach the 7 per cent level of moisture until 18 days. Germinability reached a maximum and free fatty acids a minimum after 2 weeks of curing in both the stacked and windrowed peanuts. After curing for 3, 4, 5, and 6 weeks, germinations declined and free fatty acids increased more in the windrowed peanuts than in the stacked peanuts.

With progressive dates of digging from September into October, the total oil of the Dixie Runner peanuts increased from 44.5

to 49.8 per cent (dry weight basis). After being allowed to cure, the final percentages of oil did not differ particularly as to time of digging, nor did the free fatty acid values.

Processing and Storing of Seeds, Grain, and Hay. (Henry S. Ward, Jr.)[2] – The botanical phases of this project have been concerned mainly with factors affecting the physiological behavior of blue lupine seed during curing storage. Significant results were: (1) Fluctuations in hygroscopic moisture of lupine seed (stored at depths of 6 inches or less) with atmospheric moisture changes in an open-type storage structure resulted in lowered germination; (2) storage for 10 months at relative humidities above 75 per cent caused the main reserve constituents (hemicelluloses and proteins) of lupine seed to be depleted and the available constituents (reducing sugars and sucrose) to be increased, resulting in a complete loss in germination; (3) storage relative humidities of 75 per cent or less caused a reversal in shift, i.e., reserves increased and available constituents decreased which caused no change in germination, except a decrease of 15 per cent at the 75 per cent humidity; (4) "bio-activity" of lupine seed (as measured by CO_2 evolution) was accelerated by increases in hygroscopic moisture and temperature and was at a maximum for any moisture-temperature combination during the curing stage; (5) "bio-activity" curves plotted with time at hygroscopic moistures above 15 per cent were strongly suggestive of microbial decomposition curves; and (6) a storage period of 4 months indicated that decreased germination of lupine seed was a function of source and initial moisture content, and was less affected by cleaning and method of drying.

The hygroscopic equilibrium curve of reseeding crimson clover was established and shown to be of the sigmoid type. Differences in hygroscopic moisture points of the Auburn and Autauga strains were not apparent. Germination of combined seed was decreased during 4 months of storage if stored at moistures above 13 per cent. Hard seediness was not affected except at moistures above 20 per cent. Method of drying did not significantly alter the response to storage humidities.

Studies on the Control of Cercospora Leafspot of Peanuts. (Coyt Wilson.) – The following fungicidal dusts were compared: (1) sulfur, (2) sulfur-copper containing 3.5 per cent metallic copper,

[2] Joint project between Departments of Agricultural Engineering and Botany and Plant Pathology.

(3) sulfur-Phygon containing 1.7 pounds Phygon XL and 1.7 pounds magnesium sulfate in 96.6 pounds dusting sulfur, and (4) sulfur-658 containing 5.0 pounds Crag Fungicide 658 in 95 pounds of dusting sulfur. All plots were dusted with 2.5 per cent DDT. The host control of leafspot, as shown by foliage symptoms, was obtained by using sulfur-copper dust. The other materials ranked in descending order were sulfur-658, sulfur, and sulfur-Phygon. However, highest yields were obtained from plots dusted with sulfur-658. The other materials ranked in descending order were sulfur-Phygon, sulfur-copper, and sulfur. Extremely dry weather prevailed during the growing season and there was some evidence of stunting on plots receiving sulfur-copper dust.

In an experiment where the number of applications of sulfur-copper-DDT was varied from none to six, the highest yields were obtained from five applications. Control as shown by foliage symptoms was directly proportional to the number of applications.

Peanut Seed Treatments. (Coyt Wilson.) — The average emergence of machine-shelled runner peanuts planted at Tallassee without treatment was 41 per cent. Emergence from seed treated with Ceresan M at the rate of 1½ ounces per 100 pounds of seed was 78 per cent. Smaller but significant increases in emergence were obtained by treating with Phygon W, Panogen, Yellow Cuprocide, Arasan, or Spergon. Vancide 51 was not effective.

DAIRY HUSBANDRY

Study of Efficiency of Milk Production and Feed Utilization in College Dairy Herd. (K. M. Autrey.) — A study was made of 87 DHIA records from the College dairy herd. The records were divided into four groups. The highest group averaged 9,896 pounds of milk; the second, 8,120 pounds; the third, 6,263 pounds; and the lowest, 4,249 pounds. Cows in the highest group used 57 per cent of the digestible nutrients consumed for milk production, whereas the lowest group converted only 36 per cent of the consumed digestible nutrients into milk.

Cows in the high group received 68 per cent of their nutrients from pasture and roughage. Those in the lowest group received 63 per cent of their nutrients from pasture and roughage.

The feed costs per 100 pounds of milk produced from highest to lowest group were $1.10, $1.15, $1.32 and $1.86, respectively.

Wood Molasses Versus Corn in Ration for Lactating Cows. (G. H. Rollins.) — A controlled feeding experiment was conducted to study the value of molasses as a replacement for corn in the grain ration for lactating cows. Twelve Jersey cows were used in this experiment. The triple reversal method was used. Grain rations were fed to each cow according to level of production. The cows were allowed to graze when pasture was available and were fed hay under herd conditions at other times. Analysis of variance on the amounts of 4 per cent fat-corrected milk produced and on liveweight changes revealed no significant differences between the two grain rations fed. Both groups of cows refused some of the wood molasses ration each time they received it. Analysis of variance on the amounts of each ration fed and each ration consumed revealed significant differences at the 1 per cent level.

Results of this feeding trial show that wood molasses is unpalatable to the extent that it may not comprise more than 10 to 15 per cent of the concentrate mixture of cows on pasture. On dry feed, cows apparently will consume larger quantities of the molasses.

Green Forage Versus Dry Roughage as Feed For Dairy Bulls in Artificial Breeding Service. (K. M. Autrey, W. E. Alston, Jr. and John M. Buckalew.) — A feeding experiment was conducted to study the value of grazing for dairy bulls in artificial breeding service. Two comparable groups of four bulls were used in this study. One group was kept on grazing 4 months, while the other was on dry feed. At the end of this period the groups were switched and kept on experiment an additional 4 months.

A study of conception rate based on 60- to 90-day non-returns and of sperm livability of all semen collected failed to show a significant difference between grazing and dry feed.

Pasture Irrigation. (K. M. Autrey and J. E. Conniff.) — A Ladino clover pasture irrigation study was conducted during the summer grazing season of 1949. Rainfall during this period, May 10 to October 9, amounted to 13.5 inches. On the irrigated plots, 13.5 acre-inches of additional water were applied. The irrigated plots yielded sufficient forage for 393 Jersey heifer-grazing-days per acre. This was 44 per cent more grazing than was provided by unirrigated plots.

Judging from increase in circumference at the heartgirth, growth rate of heifers on both irrigated and unirrigated areas was

slightly greater than normal. The heifers had no supplemental feed during the experiment.

Irrigated alfalfa plots under grazing conditions seemed to survive competition with fescue and Bermuda grass better than alfalfa not irrigated.

Supplemental Irrigation of Fall Pastures in the Piedmont (K. M. Autrey.) — A study involving supplemental irrigation of crimson clover-ryegrass pastures was started in July, 1950, as a continuation of earlier work with Ladino clover. The principal objective was to study the possibilities of establishing winter pasture early enough to provide late summer and fall grazing.

Four seedings of clover were made from July 11 to August 28 in a 20-acre field. Approximately half of the field was irrigated. Rainfall from July through December was 19.5 inches, with more than half of it coming in July and August. A total of 9 acre-inches of supplemental water was applied to the irrigated area by overhead sprinklers.

Early-seeded plots under irrigation suffered from serious weed competition and disease. The first planting of clover was almost completely destroyed. The last planting resulted in a good stand, making rapid growth in September. Very little clover survived early plantings in the unirrigated area. From the August 28 seeding about 50 per cent of the stand of unirrigated clover survived. However, due to the dry weather it made no appreciable growth prior to January 1, 1951.

The cost per acre-inch of water applied was $1.70.

FORESTRY

Fusiform Rust on Plantations of Cultivated and Fertilized Pine. (D. L. Westberg.) — An experiment was started in January 1945 at the Station's Forest Unit in Autauga County where loblolly pine and slash pine were planted, fertilized, and cultivated. The experiment was designed to check the incidence of fusiform rust on planted loblolly and slash pine that were given cultural treatments.

No rust cankers were found in June 1946, but percentages of trees with trunk or branch cankers increased sharply from June 1947 to March 1950. On the check plots, cankered loblolly pine increased from 2 per cent to 30 per cent and cankered slash pine from 6 per cent to 43 per cent. In the cultivated and fertilized

plots, cankered loblolly increased from 2 per cent to 32 per cent and cankered slash from 11 per cent to 67 per cent. The percentages of cankered loblolly were about the same on both the check and treated plots, but were considerably greater for slash on the treated plots. These findings substantiate results of an earlier study on slash pine made at the Main Station.

Alabama Farm Forestry Pilot Plant Study. (D. L. Westberg.) — An investigation of the proper place of farm woodland in the individual farm management plan was conducted during 1949 and 1950. Essentially, this was an economic study designed to determine the best combinations of farm and farm woodland. Based on limited data, it was determined that a cotton and woodland combination was preferable to either dairy-beef and woodland or beef and woodland. Further, it was found that a poorly stocked farm woodland that had mostly low quality material would not yield substantial cash returns at an early date. A farm woodland that was in poor condition required a period of rehabilitation.

Certain additional points were brought out in this study. Many factors are involved in the successful operation of a farm and farm woodland combination. These factors are so variable for different farms that realistic, quantitative analysis of data is questionable. One example of a variable factor among different farms is managerial ability. This factor cannot be given a meaningful quantitative value. Yet, it is a particularly important factor in the success of any farm and farm woodland management plan and in the analyses of farm and farm woodland combinations that are superior.

It is possible for a productive farm woodland to yield an annual cash income to the farm. In this study it was determined that by using good management practices in the woodland the usual annual cash return to labor, management, and capital could be increased over five times (1948-49 cost-price relationships were used in these calculations). In order to obtain such an increase as this, both the quantity and quality of the raw timber products grown had to be increased and improved, respectively.

Slash Pine and Hardwood Invasion on a Longleaf Pine Site. (W. B. DeVall) — A survey was made of the longleaf pine uplands in the extreme southern parts of Monroe County and a study begun within the Little River State Forest in 1947. The

site selected was adjacent to three slash pine seed-source areas. The overstory consisted of 56.2 per cent longleaf pine, 40.1 per cent hardwoods and 3.7 per cent slash pine.

The forest area studied had not been burned since 1934. During the 15 years without fire, plant succession had resumed and slash pine seedlings were established on this upland site. In 1949, when the last inventory was made, the average seedling population was 127 slash pines per acre and 79 longleaf pines. Hardwoods less than 15 years of age had likewise increased to account for 88.2 per cent of the total hardwood stems.

The presence of slash pine reproduction was attributed to an adequate number of seed trees — four trees per acre. The smaller hardwoods were largely sprouts and, over much of the area, they formed a thick ground cover less than 6 feet in height.

In the absence of fire and other biotic disturbances, slash pines and low quality, "scrub" hardwoods have increased on the site studied. This increase represents an invasion by these plants of a longleaf pine site.

Properties of Metal-Impregnated Wood. (F. H. Vogel.) — During 1950, 100 tupelo gum sapwood blocks were impregnated with Cerrobend alloy, following techniques developed in 1949. Samples of the treated blocks were tested for hardness, shear strength parallel-to-grain, hygroscopicity, water absorption, and dimensional stability.

The preliminary data indicate that metal-impregnated wood is significantly harder, less hygroscopic, less absorptive to free water, and less affected dimensionally by changes in moisture content than wood not treated with metal.

Some work was done during 1950 on the effect of increased pressure on metal retention. Contrary to earlier results, it was found that increase of pressure from 50 p.s.i. to 100 p.s.i. resulted in a very significant increase in retention when temperature drop and time were held constant; less increase was noted when the pressure was increased from 100 p.s.i. to 150 p.s.i.

As suggested by these results, the greater pressure gradient probably requires more time to equalize, even in the small blocks under test. Treatment with preliminary vacuum of 27 inches generally increased the retention, but the results varied widely.

Bug-Peeling Fence Posts. (Knox W. Livingston and Frank F. Smith.) — A project to investigate practical aspects of delaying

peeling fence posts until the bark has been loosened by insect activity was begun in July, 1949. Posts of three species-groups were included in the experiment. A delay in peeling of 90 days after cutting resulted in labor reductions of one-half for southern yellow pine posts and of two-thirds for scrub oak posts. Redgum posts, however, could be peeled more easily immediately after they were cut than later.

After sufficient seasoning, the pine and oak posts were given preservative treatment by cold-soaking in copper napthenate-fuel oil solution. In the case of the pine posts, the rate of preservative absorption was considerably higher in the bug-peeled posts than in those peeled while green. Extremely rapid initial absorption by the bug-peeled pine posts made control of the amount of preservative retained by the posts difficult. There was little difference in absorption between bug-peeled and green-peeled oak posts.

Strength tests were applied to all of the pine and oak posts and the results were statistically analyzed. No significant loss in strength due to bug-peeling was shown by the pine posts. However, there was a loss due to delay in peeling of about 25 per cent in strength of the oak posts. This, in itself, is probably of little consequence, since the bug-peeled posts remained adequately strong for most uses.

The posts have been placed in service to determine the effects of bug-peeling on durability of the treated posts.

Observations on Littleleaf Disease in Coosa County. (D. L. Westberg and G. I. Garin.) — On the experimental forest in Coosa County, observations were made and measurements of

TABLE 5. EVALUATION OF LITTLELEAF DISEASE ON SHORTLEAF AND LOBLOLLY PINE, COOSA COUNTY, 1941, 1944, and 1950

Year of observation	Tree species	All trees	Dead or missing	Apparently healthy	Apparently diseased	Diseased trees in living stand
		Number	*Number*	*Number*	*Number*	*Per cent*
1941	Shortleaf	127	--	78	49	39
1950	Shortleaf	127	9	97	21	18
1944	Shortleaf	119	--	50	69	58
1950	Shortleaf	119	8	105	6	5
1941	Loblolly	83	--	78	5	6
1950	Loblolly	83	11	70	2	3
1944	Loblolly	26	--	23	3	12
1950	Loblolly	26	0	26	0	0

littleleaf disease were taken in 1941, 1944, and 1950 on plots of shortleaf pine and loblolly pine. The data are summarized in Table 5.

Though definite conclusions based on these data alone are unwarranted, there does appear to be a consistent trend. Data obtained from the Coosa area plots show that fewer trees of both species showed signs of littleleaf disease in 1950 than in 1941 or 1944. Percentages of diseased trees in the living stand for 1950 were lower than in 1941 or 1944.

Effect of Dipping of Nursery Stock in Wax Solution. (G. I. Garin.) — It has been reported that survival of tree seedlings can be improved by dipping them in a wax solution. Arizona cypress plantations in Alabama frequently have high mortality. It was deemed necessary to develop some means of improving the survival of these seedlings. Dipping in a wax solution before seedlings were packed for shipment from the nursery was investigated.

Two lots of seedlings of Arizona cypress, 768 seedlings in all, were planted on eight experimental plots at Auburn. These seedlings were grown at the Alabama State Nursery. Half of these seedlings were dipped in a wax solution; the other half were not dipped. The growth of these seedlings was recorded at 3-month intervals. At the end of the first growing season, dipped seedlings showed 90 per cent survival and undipped seedlings 89 per cent.

The differences between the two lots of seedlings in survival, in growth rate, and in thriftiness were not significant. These results may not apply to different species, seasons, or planting and growing conditions. The dipping of tree seedlings in a wax solution, which adds considerably to the cost of producing nursery stock, is not recommended until substantial proof of its benefit can be obtained.

HOME ECONOMICS

Metabolism of Nicotinic Acid of College Women on Diets Varying in Levels and Sources of Protein: THE PHYSIOLOGICAL UTILIZATION OF NICOTINIC ACID FROM LEGUMES IN RELATION TO THE TRYPTOPHAN CONTENT OF THE DIET. (Ernestine I. Fraizer.) — A basal diet of natural foods providing a minimum of nicotinic acid (6.9 mg.) was planned and tested for the study of nicotinic

acid metabolism of college women. Data on nitrogen balances and urinary excretion of nicotinic acid and derivatives have been obtained on three college women during a metabolism study of 8 weeks. Another study of 6 weeks duration has been completed on three additional subjects.

These studies were divided into control and experimental periods of study. During the control period the subjects received a weighed diet designed to provide the recommended allowances of all nutrients from ordinary dietary sources. The intake of protein on the control diet was 58.2 gm. as compared with 47.0 gm. provided by the basal diet. The calorie values of the two diets were the same. Supplements of vitamins and minerals were given during the basal period in amounts sufficient to approximate intake during the control period. Both diets were supplemented with nicotinimide to provide similar intakes of 20 mg. per day.

An analysis of the data for the first three subjects shows similar metabolic performance on the two diets during the 8-week study.

Household Activities, Facilities and Preferences in Selected Areas of the South as a Basis for Development of Functional Rural House Plans: THE DEVELOPMENT OF MODULAR MOVABLE STORAGE WALLS TO MEET FAMILY STORAGE NEEDS. (Gladys S. Garrow.) — From inventories reported by homemakers interviewed in the Southern Regional Housing Survey, clothing, household linen, bedding, and small equipment were classified according to the type of facility best suited to the item requiring storage — rod, rack, shelf, drawer, or holding device. Families were grouped according to socio-economic score and family members classified according to sex and age groups. The median number of household items for each group was used as the basis for computing the quantity and type of storage required.

HORTICULTURE

Urea Sprays as a Source of Nitrogen for Apples. (T. B. Hagler.) — Urea sprays as a source of nitrogen have been used satisfactorily on certain fruit plants. This study was designed to compare the value of nitrogen sprays with soil applications.

The Red Delicious variety was used in this study. Treatments consisting of urea sprays and soil applications were arranged in a randomized block consisting of three replications. Urea was applied at the rate of 5 pounds per 100 gallons spray at the first, second, and third cover sprays. Soil applications on all treatments

consisted of 1½ pounds of 6-8-4 per tree per year of age. One-half of this amount was applied in the spring before growth began, and one-half was applied after fruit set. Nitrate of soda was applied at the rate of one-fourth pound per tree per year of age 3 weeks after the last application of complete fertilizer. The urea-spray plots received the same complete fertilizer but no extra nitrogen.

Leaf samples for analysis consisted of 40 of the most recently mature leaves on new shoots.

Total nitrogen was determined by a modification of the Kjeldahl method.

Trees responded well to both spray and soil applications of nitrogen. There was no apparent difference in the growth of the shoots and leaves in the two treatments. Leaf and twig color appeared to be about the same in each treatment.

Leaves from trees receiving urea sprays contained an average of 2.13 per cent nitrogen, while those from trees receiving soil applications of nitrogen contained an average of 2.40 per cent nitrogen.

Iron Deficiency in Apples. (T. B. Hagler.) — During the summer of 1949, apples growing under sod culture in experimental orchards on the Main Station exhibited a chlorosis of the young leaves. Extreme chlorosis developed on young leaves of practically all young shoots. Preliminary spray tests were designed to determine the cause.

Three rows of trees in a 15-year-old orchard were selected for the test. Each row had 12 trees about equal in vigor and uniformity. One row was sprayed with a ferrous sulfate at the rate of 3 pounds, 2 ounces per 100 gallons of spray. One row was sprayed with zinc sulfate at the rate of 8 pounds per 100 gallons spray. The other row was left as a check. A spreader and sticker was added to each of the sprays at the rate of 1 pound per 100 gallons. The trees were examined daily for a period of about 2 weeks to determine the effectiveness of the sprays in correcting the chlorosis.

Leaves on young shoots of the trees sprayed with ferrous sulfate became greener in appearance by the third day following spray applications. At the end of 2 weeks all the leaves appeared normal except one small area on one tree which obviously failed to receive a thorough spray application.

Chlorosis continued to develop on leaves of trees sprayed with zinc sulfate and on the row receiving no spray application.

Prolonged Dormancy in Peaches. (T. B. Hagler.) — When peaches go into dormancy in late fall, a certain amount of cold weather is required to produce normal growth and blossoms in the spring. The amount of chilling required depends on the variety. A general "rule of thumb" followed by most growers is that peaches require approximately 1,000 hours below 45 degrees F. by the middle of February for normal growth and blooming. If plants have not received sufficient chilling to break the rest period, they will not bloom even if subjected to temperatures favorable for growth. Such a condition described was experienced at Auburn following the warm winter of 1949-1950.

Observations were made on 68 peach varieties in the spring of 1950 to determine growth and fruiting response to the warm winter. The Mayflower variety, which requires 1,150 hours of chilling for flower buds and 1,250 hours for leaf buds, was just beginning to bloom and had no foliage on May 4. This variety normally ripens at Auburn from May 15 to May 30. The Jewel variety, which requires very little chilling, bloomed January 15. The fruit was killed by late spring frosts, but the tree was in normal foliage on May 4. Varieties with rather low chilling requirements (750 to 850 hours), such as Afterglow, Beva, Early Jubilee, Early Triogem, Elby, Fine, Fireglow, Golden Jubilee, Goodcheer, July Elberta, Laterose, Newday, Prairie Dawn, Prairie Daybreak, Redskin, Southland, Sunhigh, Summerrose, Take, Triogem and Wildrose had fruit ranging from one-fourth inch to one and one-fourth inches in diameter on May 4. Trees of these varieties had from one-half to three-fourths of their normal foliage. Other varieties with higher chilling requirements suffered seriously from prolonged dormancy. Some varieties had blooms, fruit three-fourths inch in diameter, and little or no foliage on May 4. Growth appeared to be normal about 1 month later, but most of the fruit had dropped.

Effect of Sod Culture on Nitrogen and Organic Carbon Content of Orchard Soils. (T. B. Hagler, J. C. Moore, and W. A. Johnson.) — Previous investigations on sod culture in orchards indicated that the amounts of organic matter and nitrogen in soils of lespedeza sericea and winter cover crop plots were increasing more rapidly than on clean-culture plots. Only growth measure-

ments, yield records, and observational notes were taken on trees in different culture treatments. This study was made to determine the effect of the different treatments on the nitrogen and organic carbon content of the soil.

The orchard in which this study was made was originally an integration planting of peaches, plums, and apples. Trees were planted in 1939. The peach and plum trees were removed in 1947, leaving the apple trees at normal spacing. Treatments consisted of lespedeza sericea, Southern bur clover and rescue grass, and clean culture.

A complete fertilizer was applied annually at the rate of 1 pound per tree per year of age. An additional fertilizer, consisting of 350 pounds of superphosphate and 75 pounds of muriate of potash, was applied to the sod every other year. Clean-culture plots also received this application of fertilizer.

Soil samples for analysis from each treatment were taken on terraces, between terraces, under trees, and between trees. Duplicate determinations were run on air-dry samples.

Soil from the plot on which lespedeza sericea was cut and left was high in total nitrogen and organic carbon. The total nitrogen content of this treatment averaged 819 p.p.m., and the organic carbon content averaged 2.95 per cent.

Total nitrogen and organic carbon contents of the bur clover and rescue grass plot were not as high as the lespedeza sericea plot, but they were much higher than the clean-culture treatment. Total nitrogen content averaged 674 p.p.m., and the organic carbon content averaged 2.53 per cent.

Soil from the clean-culture plots was low in total nitrogen and organic carbon. There was evidence of losses of soil, nitrogen, and organic matter due to erosion and leaching. Total nitrogen content averaged 281 p.p.m., and the organic carbon content averaged 1.79 per cent.

Factors Affecting Processing Time of Sweetpotato Confectionery Products. (Hubert Harris.) — In an effort to reduce the length of time required for drying and toasting sweetpotato puree and puree mixtures, four oven factors were varied independently and in combination. The factors — air velocity, tray load, dry-bulb temperature, and absolute humidity — were varied from standard values formerly used to highest practical values considered feasible.

The time required to toast the product at standard temperature of 270°F. or at increased temperatures up to 350°F. was decreased about 12 per cent by increasing absolute humidity from 0.039 to 0.727 pounds water vapor per pound of dry air and admitting superheated steam into the oven. The increased humidity also eliminated scorching of the product at increased temperatures up to 300°F.

By increasing the air velocity from 600 to 1,500 feet per minute, oven time was decreased 30 per cent at 270°F. and 21 per cent at 300°F. A similar effect was obtained by increasing tray surface from 2 to 6 square feet per pound of wet material.

Oven time was reduced approximately 60 per cent by simultaneously increasing the four factors from standard values to maximum values tested that resulted in satisfactory toasting.

Separation of Muscadine Pulp from Hulls by Vibrating Screen Process. (Hubert Harris.) — A vibrating screen proved to be an efficient means of separating muscadine pulp from hulls. The screen used in the tests was perforated with 7/16-inch circular holes spaced on 3/4-inch staggered centers. It was mounted horizontally on two 3/4-inch by 3/4-inch hardwood strips that were anchored at one end to a support made of 1-inch pipe. Vibration was accomplished by means of a Syntrone electric vibrator attached to the screen. An electric rheostat was used to regulate intensity of vibration.

When a mixture of muscadine hulls and pulp was raked across the vibrating screen, the pulp settled downward and dropped through the holes, while the hulls moved along the screen and dropped off at the end. One time over the screen resulted in 97 per cent separation.

A New Process for Shelling Chestnuts. (Hubert Harris.) — In studying processing qualities of chestnuts at Auburn, it was observed that hand shelling required an excessive amount of time, caused heavy breakage of the kernels, and resulted in rapid discoloration upon exposure of the shelled nuts to the atmosphere. These difficulties were overcome and excellent shelling obtained through the development of a new process for shelling chestnuts.

The process involves rapidly heating and partially burning of the shells by exposing the chestnuts to a hot flame for a short period of time. The shells are partially charred, and sufficient steam is generated to loosen the pellicles and blanch the surface

of the kernels sufficiently to prevent discoloration. The charred shells and pellicles are very easily removed by rubbing or pressing between the fingers.

The machine constructed for testing the process consists of an insulated cylinder, 8 inches i.d. by 6 feet long, mounted horizontally for rotating on its longitudinal axis at speeds ranging from 20 to 150 r.p.m. A gas burner with forced draft is mounted stationary at one end of the cylinder and the chestnuts are fed in at the opposite end. The rotating cylinder is provided with baffles on the inside which causes the chestnuts to tumble as they move through the cylinder and drop out at the burner end.

Time required for flaming varied from 15 to 60 seconds, depending upon intensity of heat and moisture content of chestnuts. Best results were obtained when the flame was adjusted for correct heating during an interval of 35 to 45 seconds.

When operating continuously, the machine flamed the chestnuts at the rate of 500 pounds per hour. At this capacity, it was necessary to reduce the supply of gas considerably because of heat generated in combustion of the hulls.

Storage and Preservation of Chinese Chestnuts. (Hubert Harris and J. C. Moore.) – It was found necessary to gather chestnuts at least three times per week to prevent spoilage in the field. Prompt handling was also essential. Eating qualities were improved by curing the chestnuts before storing or processing. Curing was accomplished by spreading the chestnuts on trays and holding them at room temperature for 2 to 3 days or at 40°F. for 10 to 15 days.

The chestnuts deteriorated rapidly in common storage but kept quite well in cold storage when packaged in almost airtight containers. Samples from 13 selections were stored in half-bushel baskets and in waxed paper cups provided with one small nail hole in the cover of each cup. After 90 days at 33°F., spoilage for those stored in waxed cups ranged from none to 25 per cent with an average of 7.4 per cent for all selections. Spoilage in the half-bushel baskets ranged from 4 per cent to 35 per cent with an average of 13.2 per cent for the 13 selections.

Of several canning treatments tested, best results were obtained by processing the kernels for 20 minutes in open jars in steam at 10 p.s.i. and sealing. The product rated good in texture and color and very good in flavor.

Frozen chestnuts rated higher than canned ones. Very good products were obtained by freezing the kernels without blanching and by heating them in steam for 10 minutes before freezing. Those frozen without blanching rated higher in color, but the blanched samples were slightly better in flavor.

Quality varied greatly with different seedling selections. The A.P.I. selections A-4-1, A-7-3, B-6-7, and the Jones No. 21 were among the best of 18 selections tested.

Developing and Adjusting Precision Methods of Growing Pot Plants and Cut Flowers for Southern Conditions: (1) TIME PINCHING OF CHRYSANTHEMUMS. (H. P. Orr and M. W. Clint, Jr.) — In 1949 four varieties of pompon chrysanthemums were grown at the Main Station, in a time-pinch study. In 1950 four additional varieties were used in a similar study. Both years four pinch dates were used: the recommended Ohio pinch date, and dates 5, 10, and 15 days later.

The following varietal differences in reaction to timed-pinches of chrysanthemums were experienced:

The varieties Red Rolinda, Dark Pink Valencia, and Galaxy responded most favorably to pinch dates 15 days later than recommended for Ohio.

The varieties Jane and Valencia responded most favorably to pinch dates 10 days later than the Ohio dates.

The variety Yellow Long Island Beauty demonstrated little response to variations in pinch dates.

The variety White Yuletide did not respond as favorably to later pinch dates as to that recommended in Ohio.

The variety Crystal Beauty produced terminal sprays of crown flowers regardless of pinch date used under Auburn, Alabama, conditions.

(2) CULTURAL STUDIES WITH SEVERAL NEW VARIETIES OF GREENHOUSE CHRYSANTHEMUMS. (M. W. Clint, Jr., and H. P. Orr.) — The following varieties of greenhouse chrysanthemums were planted June 1, 1950, in duplicated plots of several soils and soil mixtures: Jean Elizabeth, Anaconda, Albatross, Blazing Gold, Popcorn, Constellation, and Rubicon. The soils and mixtures used were: Decatur clay containing considerable sand; Norfolk sandy loam; mixture of equal parts Norfolk sandy loam and well-rotted cow manure; mixture of equal parts Decatur clay and well-rotted cow manure; and a mixture of two parts Decatur clay, two

parts Norfolk sandy loam and one part well-rotted cow manure. The plants in one series of plots were exposed to short-day treatments after pinching on June 21. The plants in the remaining series of plots were pinched on June 21, but short-day treatments did not begin until July 26.

Commercial cut-flower quality was not attained with pompon varieties pinched and subjected to short days on the same date.

Short-day treatments applied to standard varieties at the time of the pinch seemed to affect quality flowers only on the late flowering varieties, Jean Elizabeth and Anaconda.

Short-day treatments applied to standards or pompons 35 days after the pinch resulted in very high quality stem and flower production.

General quality of flowering stems increased on all varieties in plots with increased organic content.

Nitrates and potash were not leached as readily from the Decatur clay soil as from the Norfolk sandy loam, but were leached more rapidly from the clay soil alone than from either soil in combination with organic material in the form of well-rotted cow manure.

(3) PRODUCTION OF DOUBLE-PINCHED, INTERRUPTED-SHADED CHRYSANTHEMUMS. (H. P. Orr and M. W. Clint, Jr.) – From 1949 to 1950 chrysanthemum varieties Bronze Masterpiece, Golden Herald and Little America were grown with the following special cultural treatments:

Double-pinching method
- Planted – December 22, 1948 – November 22, 1949
- Lighted – From date of planting until one month following second pinch
- First Pinch – January 20 – December 22, 1949
- Second Pinch – February 22, 1949 – January 22, 1950

Interrupted-shading method
- Planted – December 22, 1948 – November 22, 1949
- Lighted – From date of planting to date of second pinch as given under double-pinch method
- First Pinch – January 20 – December 22, 1949
- Lights removed – February 22 to March 2, 1949 – January 22 to February 1, 1950
- Lighted – March 2 to March 22, 1949 – February 1 to February 22, 1950

A greater number of terminal flowers per plant was produced with varieties Golden Herald and Little America by the interrupted-shading method than by the double-pinching method. There was little difference in the terminal flower production of Bronze Masterpiece in either treatment. Date of 60 per cent effective flowering was not significantly changed by the method of culture with any variety. Stem length of flowers produced by the interrupted-shading method was greater than that of flowers produced by the double-pinching method.

(4) Studies with Cooled Greenhouse Roses. (H. P. Orr.) — Three varieties of roses were used: Better Times, Talisman and Peters' Briarcliff. Previous treatment of plants was as follows:

1. Received as XXX started-eye greenhouse plants by a commercial grower.
2. Grown under standard cultural conditions for greenhouse roses for 4 years.
3. Removed from commercial greenhouses for disposal.
4. Received by research worker, placed in 40°F. cooler for 6 weeks, removed and planted in field May-November.
5. Removed from field after standard field culture and placed again in 40°F. storage for 6 weeks.
6. Removed from storage and planted in ground bed in greenhouse January, 1950.

Two methods of pruning were used: one group of each variety was pruned to four buds per cane with all weak canes removed; another group was pruned to eight buds per cane with all weak canes removed. Two methods of pinching were practiced with each method of pruning: hard pinching and soft pinching. No plants were allowed to flower until June 1.

Plants that were low-pruned and soft-pinched of the Better Times and Talisman varieties were higher producers of salable flowers than plants given other combinations of pruning and pinching. Plants that were low-pruned but hard-pinched of the Peters' Briarcliff variety were higher producers of salable flowers than other combinations of pruning and pinching that variety. On all varieties the salable flower production of the high-producing prune-pinch combinations was sufficient to warrant the commercial use of cooled 4- to 6-year-old greenhouse roses.

(5) SUMMARY OF CULTURAL DETAILS INVOLVED IN GREENHOUSE FORCING OF TROPICAL FOLIAGE PLANTS. (M. W. Clint, Jr.) – The demand is strong for effective foliage plants for use within the home. Interest of the commercial grower has centered around the selection and care of tropical foliage plants for this purpose. During the past 2 years the following cultural pointers have been established with 85 foliage plants:

1. A warm, humid greenhouse is required to maintain excellent growth of most tropical foliage plants – night temperature 65° to 75°F.; a relative humidity of 60 to 70 per cent. Light conditions should be reduced considerably lower than that of full intensity in the South. Heavy applications of greenhouse shading compounds are necessary on greenhouses in the South.

2. In general, soils for tropical foliage plants should be well-drained and high in organic matter content. Best growth of these plants has been gained when the soil mixture contained at least one-third organic matter by volume. Equally satisfactory results have been obtained when the organic material was well-rotted manure, peanut hulls, or cotton mote residue. Organic soils, containing high amounts of ammonia or nitrate nitrogen (Spurway), should not be used as a potting medium for tropical foliage plants until 2 weeks have elapsed after steam sterilization. Some method of sterilization of the soil such as steam has been necessary for satisfactory growth of these plants due to susceptability to nematodes and various fungi.

3. Biweekly dilute fertilizer applications to the soil around established plants have been highly successful. Several soluble, complete fertilizers have been used in rotation with individual carriers of elements revealed to be low by the Spurway Method of quick soils tests.

4. Parathion, tetra-ethyl-pyro-phosphates, and sprays containing free nicotine (such as Nicofume liquid) have been used at commercially-recommended rates as needed for insect control without injury to the tropical foliage plants.

(6) THE CLOTH HOUSE, A TEMPORARY FORCING STRUCTURE OF VALUE TO THE SOUTHERN FLORIST. (H. P. Orr and M. W. Clint, Jr.) – A nylon cloth house was erected in 1949 and has been used continuously for rotation studies with various cut-flower crops. The growth for commercial purposes of asters, roses, stock, snapdragons, and the greenhouse-types of chrysanthemums has

consistently been of higher quality in bed culture in a nylon cloth house than in similar bed culture under outside conditions.

Aster varieties of the Early Royal, American Beauty and California Giant types produced quality flowers from June until July 15 in the cloth house. These varieties were seeded in flats in a greenhouse February 15, pricked off into 2¼-inch pots March 1, given additional illumination for approximately 6 weeks, and transplanted to the cloth house on April 15.

Rooted cuttings of several standard varieties of greenhouse chrysanthemums were spaced 6 by 6 inches apart in the cloth house beds on August 1, following the removal of the asters. The varieties used were: Friendly Rival, Chattanooga, Yellow Chattanooga, Mefo, Yellow Mefo and Oak Leaf. By allowing these plants to grow unpinched and by applying a short-day treatment of black cloth shading 1 to 2 weeks after planting, standard flowers were matured for commecial sale 79 to 102 days later. Effective cutting of all varieties was possible November 1-6.

It is believed that various cool-weather crops such as stock and snapdragon may be safely overwintered in cloth house beds for early spring flowering if black cloth, used for short day treatments in the summer, is utilized as a protective covering over beds of these plants during freezing weather. Stock and snapdragon plants (in a first-year study of this procedure) transplanted to the cloth house in early November survived 10°F. weather on November 25 and other later freezes. On December 31, the snapdragons were developing bloom spikes.

(7) Seasonal Flower Production of Miscellaneous Orchid Species and Hybrids. (Morris W. Clint, Jr.) 1947-1950. — Seasonal periods of bloom are of importance to commercial orchid growers; production in terms of the numbers of flowers per plant is also of major consideration. A comparison of flowering performance of orchid species and hybrids grown under Southern conditions has been made. Various orchid plants were grown in standard clay pots with one-half osmunda fiber and one-half broken crock drainage. Watering practices varied with season; during winter months watering was generally done less often than during the hot days of summer. A relative humidity of 65 to 70 per cent was maintained by an automatic overhead Binks humidifying system and a Skinner system located under each bench. The Skinner system was operated manually to fa-

cilitate syringing of walks. A night temperature of 70°F. was maintained in the greenhouse. Drying off of plants after bloom was carried out according to standard procedure. Records taken during a 3-year period ending December 31, 1950, show that Cattleya species produced an average of 1.86 blooms per plant, Cattleya hybrids produced 3.50 blooms per plant, Laelia-Cattleya hybrids produced 2.35 blooms per plant, Brasso-Cattleya hybrids produced .91 bloom per plant, and Brasso-Laelia-Cattleyas produced 2.03 blooms per plant. Where the number of plants was sufficient to provide a sample for observation, the following trends in blooming season were noted: Cattleya species seemed to bloom during moderately cool months of spring and autumn, and all types produced very few blooms during exceptionally hot weather in June, July, and August.

Commercial Production in Alabama of the Better Adapted and More Promising Bulb Crops. THE EFFECT OF FERTILIZERS, ORGANIC MATTER, AND IRRIGATION ON GLADIOLUS. (Henry P. Orr and Morris W. Clint, Jr.) 1948-1950 – This study embodied two phases: a fertilizer grade study on Decatur clay and Hartsells fine sandy loam soils; and a study of the independent and interrelated effects of irrigation, organic materials, and fertilizer rates on Norfolk soil. The purpose of the study was to determine the effect of the practices on both flower and corm production.

The Maid of Orleans variety was used. The study was conducted in field bins, one set filled with the Decatur and one with the Hartsells soil. Prior to 1948 these tiers had been used for a vegetable study and had a 10-year fertilizer treatment history.

In the fertilizer grade study, the following treatments were used: potash (K_2O) increased from zero to 135 pounds per acre in increments of 45 pounds, nitrogen (N) increased from zero to 120 pounds per acre in increments of 30 pounds, and phosphorus (P_2O_5) increased from zero to 160 pounds per acre in increments of 40 pounds on the Decatur soil, and one-half of these rates on the Hartsells soil. Irrigation was supplied by the ooze hose to maintain an average water supply equivalent to 1 inch of rainfall weekly.

The study showed that the Maid of Orleans variety responded to increased rates of potash and nitrogen fertilization in flower production on the Hartsells and Decatur soils. Greater responses

were obtained on the Hartsells soil. In corm production there was a response to potash and nitrogen fertilization on the Hartsells soil only. A response was obtained in flower and corm production between no phosphorus fertilization and the first increment on the Harsells soil.

The greatest response in flower production on the Norfolk soil was obtained from the highest rates of fertilization (1,000 pounds per acre of a 6-8-4), irrigation, and organic matter. There was very little difference in corm production resulting from the single or combined use of fertilizer rates, irrigation, and organic materials, although there was a definite decrease in corm production when nitrogen was omitted.

POULTRY HUSBANDRY

Decreasing Adult Mortality in the Domestic Fowl by Breeding. (D. F. King and G. J. Cottier.) — Since 1935 a project has been underway at the Main Station designed to develop a strain of single comb White Leghorns capable of resisting diseases. The adult mortality of the pullets housed each year has been gradually reduced from 89 per cent in 1935 to 16½ per cent in 1949.

Performance tests were carried on in 1948 to compare the Auburn Strain birds with chickens from four of the best Leghorn breeders in the United States. Chicks from breeders in California, New York, Minnesota and Florida were mixed with chicks from the Auburn Strain for a 155-day growing period and a 365-day laying period. All chickens received the same treatment and no culls were removed at any time.

Results were as follows:

1. The Auburn Strain had a growing mortality of 27 per cent compared to 23, 28, 39, and 40 per cent for the other strains tested.

2. Adult mortality for the Auburn Strain was 27 per cent compared to 44, 55, 56, and 65 per cent for the other strains tested.

3. The Auburn Strain hens that finished the laying year averaged 191 eggs each compared to 160, 164, 195, and 202 eggs per hen for the other strains.

4. When egg production was calculated on the number of hens starting the laying year, the Auburn Strain laid 144 eggs each compared to 88, 94, 108, and 117 for the other strains.

Egg Marketing with Special Emphasis on the Handling of Seasonal Surpluses. (D. F. King and R. F. Scofield.*) — During April, 1949 over 2,000 eggs were purchased at market price (32¢ per dozen) from 27 farmers in northeastern Alabama. These eggs were frozen with inexpensive equipment, stored in a quick-freeze locker plant until November, 1949, and sold to a local boarding house at market price for frozen eggs (40¢ per pound). The total expenditure for eggs, trucking, cans, labor in candling and breaking, and storage amounted to $68.14. The returns for frozen eggs amounted to $95.00. This left a return for management of $26.86 or 15 cents per dozen. In this case farmers could have been paid 42 cents per dozen instead of 32 cents to stabilize the market and the local locker plant would have had a 5 cents per dozen profit above all cost.

Breeding and Immunizing Chickens for Resistance to Coccidiosis. (D. F. King, S. A. Edgar, and L. W. Johnson.) — Auburn Strain Single Comb White Leghorn chickens have been selected and tested for resistance to cecal coccidiosis, *E. tenella,* for three generations. In five experiments, F-2 offspring from F-1 selected birds were tested for genetic resistance to coccidiosis in 1948. Their mortality rate was 17.2 per cent when artificially infected as compared to 27.9 per cent mortality among non-selected chicks. In all five tests, the surviving F-2 chickens made greater average weight gains than their respective controls for the 14-day period after infection. In 1949, the F-3 offspring from selected F-2 generation survivors had a mortality rate of 10.3 per cent as compared to 31.5 per cent mortality among non-selected controls. The F-3 offspring made greater average weight gains than their respective controls in four of the five tests during the 14-day period after infection. This was further evidence of greater genetic resistance, since decreased rate-of-growth is concurrent with coccidiosis infection.

The F-4 offspring from F-3 selected stock were artificially infected with coccidiosis, *E. tenella* and/or *E. necatrix* in seven replications during the fall of 1950. Their total mortality rate was 51 of 227, or 22.5 per cent as compared to 156 of 382, or 40.7 per cent among unselected controls. In one of the tests the F-4 chicks were infected with moderate doses of a pure culture of *E. necatrix,* causative organism of intestinal coccidiosis. Only one of 33, or 3.0 per cent died as compared to 6 of 48, or 12.5

* Resigned.

per cent of the controls. In another test the F-4 chicks were infected with moderate doses of a mixed culture of *E. Tenella* and *E. necatrix.* The damage of both species of parasite appeared about equal. Fourteen of 29, or 48.3 per cent of the F-4 chicks died as compared to 46 of 53 or 86.8 per cent of the controls. Thus it would appear that in breeding for resistance to cecal coccidiosis, the F-4 chicks also had greater resistance to intestinal coccidiosis than their respective non-selected controls.

In contrast to tests involving F-2 and F-3 off-spring, the F-4 chicks made lower averages in weight gains during the 14-day period following infection than their respective controls. Thus, it would appear that no progress in breeding for resistance had been made in the selection of F-3 stock. However, in four of the seven tests, where chicks were given large doses of coccidia, offspring of two families and particularly those from two hens had very low mortality rates. One of 21, or 5 per cent, and 1 of 16, or 6.3 per cent, of the offspring tested from these two hens died as compared to 136 of 240, or 56 per cent of the controls. Thus is would appear that additional headway had been made in the development of genetic resistance to coccidiosis.

The Effect of Mosquitoes on Poultry. (S. A. Edgar, O. M. Williams, J. E. Hill and E. Hester.) — Serological determinations revealed that 770 of 778 or 99 per cent of the female *Culex quinquefasciatus* from chicken houses from 129 farms, and 96 of 206 or 46.6 per cent of those tested from other farm buildings on 74 farms had fed on avian blood. This mosquito was seen most often in chicken houses rather than in adjacent stock barns. Surveys of terrain, animals and birds at farms lead the writers to believe that a high percentage of those positive for avian blood had fed on chickens. The blood meals have been determined of lesser numbers of 13 other species of mosquitoes collected in or near farm buildings.

The blood meals of several hundred mosquitoes having fed on known or unknown subjects, and after being stored dry in pill boxes for 1 to 4 years, have been determined with a high degree of accuracy by serological means. The technique consisted of placing whole, dried, specimens individually into 5 c.c. test tubes; each tube contained 1 c.c. of 0.9 per cent saline. Each specimen was or was not crushed with the aid of an applicator stick. Tubes were corked and were kept in a refrigerator until

specimens were tested 48 to 72 hours later. In some instances sediment was packed by centifugation. The clear sanguinous supernatant was poured from each tube into a compartment of a stainless steel "stair-step" rack. Specimens were tested in capillary pipette "cards."

It was found that mosquitoes need not be identified in the field and their fresh blood meals crushed immediately on filter paper, as has been the usual procedure. This method also eliminates debris and cloudiness. The investigator can test specimens that have been stored for long periods of time.

Data on the host-preference of two species of laboratory-reared mosquitoes are presented in Table 6. Mosquitoes were free to feed on the several species of animals. The majority of *C. quinquefasciatus*, in experiments II to VII, fed on chickens. In experiment II, V and VI in addition to *C. quinquefasciatus* feeding on the animals designated, several gave cross reactions for two or more types of blood. It is thought that these cross reactions occurred because a few mosquitoes had fed on more than one animal. A study of many smeared, stained, mosquito blood meals supports this opinion. Too few *Aedes triseriatus* were tested to determine its host preference.

Tests involving 16 pens of White Leghorn hens and 16 pens of controls, during a 3-year period, have revealed that mosquitoes caused a significant drop in egg production four times during the 3 years. The reductions in production commenced approximately 5 to 10 days after the harboring mosquito populations reached an average of 200 per pen. *C. quinquefasciatus* was the

TABLE 6. HOST PREFERENCE OF TWO SPECIES OF MOSQUITOES *Culex quinquefasciatus* AND *Aedes triseriatus*

No. of expt.	Species tested[1]	Animals exposed to[2]	Types of blood ingested						X reaction	Indistinguishable	Total no. mosquitoes tested
			A	H	B	E	C	P			
			No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
I	A. t.	CBDP	18	--	14	--	6	16	0	0	54
II	C. q.	CBDP	43	--	0	--	30	12	7	0	92
III	C. q.	CP	80	--	--	--	--	--	0	2	82
IV	C. q.	CB	200	--	6	--	--	--	0	4	210
V-VI	C. q.	CMBDP	191	4	1	--	5	7	26	10	244
VII	C. q.	CBE	14	--	0	0	--	--	1	--	15

[1] *A. t.* = *Aedes triseriatus*, *C. q.* = *Culex quinquefasciatus*.

[2] A—10 to 20 hens; H—one man; B—one cow, one goat; E—mule; C—1 or 2 dogs; P—2 pigs.

principal mosquito. The effect of small numbers of *C. quinquefasciatus* feeding on growing chickens in 6 experiments resulted in a significant retardation of weight gain when 300 *C. quinquefasciatus* (male and female) were placed each night for 7 to 10 days in a cage containing five 4- to 6-week-old chicks. One hundred mosquitoes per night resulted in a reduction in weight gain, but it was not significant. Farm surveys in Alabama revealed that populations of this mosquito at times have been in excess of the numbers found necessary, in laboratory studies, to cause economic losses.

C. quinquefasciatus transmitted fowl pox and fowl cholera from one chicken to another in several laboratory tests. Five per cent DDT spray applied once to half of 12 paired pens during an 11-month field test, reduced mosquitoes harboring in sprayed chicken houses to less than 1 per cent of their respective controls. Preliminary evidence indicates that DDT spraying of chicken houses not only reduces the "nuisance effect" of mosquitoes but it also may be a valuable supportive measure in the control of fowl pox.

ZOOLOGY-ENTOMOLOGY

Control of Cotton Insects. (F. S. Arant.) — The population of boll weevil, *Anthonomus grandis* Boh., was extremely high throughout the growing season of 1949 and 1950. Gains in yield of cotton resulting from insect control were also high in all experiments ranging from 403 to 1,598 pounds of seed cotton per acre. Low-gallonage sprays applied by tractor or airplane were as effective as dusts in the control of boll weevil and other cotton pests.

The most effective dusts in controlling insects and increasing yield were 2.5 per cent aldrin-5 per cent DDT; 3 per cent gamma BHC-5 per cent DDT; alternate applications of calcium arsenate and BHC-DDT mixture; alternate applications of calcium arsenate and calcium arsenate containing 2 per cent nicotine; 1.5 per cent dieldrin-5 per cent DDT; and 20 per cent toxaphene.

Spray materials giving excellent control at the rates indicated were: 0.25 pound aldrin and 0.5 pound DDT per acre; 0.36 pound gamma BHC and 0.6 pound DDT per acre; 0.15 pound dieldrin and 0.5 pound DDT per acre; 2 pounds toxaphene per acre; and 2 pounds toxaphene and 1 pound DDT per acre.

Four-year average results showed gain in yield ranging from 513

to 849 pounds of seed cotton per acre. Average gains in 1949 and 1950 were considerably higher. Net profits from the control operations with effective materials ranged from $50 to $75 per acre over the 4-year period.

Three to four applications of toxaphene and aldrin dusts and sprays applied at weekly intervals, beginning when the cotton was in the two-leaf stage, did not increase the yield of seed cotton. Three to four applications of dusts applied just before and after squaring began also failed to increase the yield of cotton over the 4-year period, 1947-1950, except in one experiment in 1950. A significant increase in yield resulted from three applications of toxaphene dust at weekly intervals just after the plants began squaring at Monroeville. Insecticidal control during the time the cotton crop was being set and matured was highly profitable in all experiments.

Control of Insect Pests of Legumes. (W. G. Eden) – Experiments were conducted on the control of the imported fire ant, *Solenopsis saevissima richteri* Forel, which is an important pest in southwestern Alabama. Two to 4 pounds of chlordane as a dust disked into the soil gave above 90 per cent control of the fire ant on an area basis. Two pounds of chlordane as a 2.5 per cent emulsion spray applied without disking gave almost as good control as the dusts disked into the soil. Two to 4 pounds of chlordane or 1 pound of aldrin applied as dusts without disking were much less effective.

Pea aphid, *Macrosiphum pisi* (Kltb.), on Caley peas was controlled by 1 per cent parathion, 3 per cent BHC, and 10 per cent DDT dusts with seed yield increases in the order named. A red mite, *Tetranychina apicalis* Banks, was present in large numbers on Caley peas in 1950. One per cent parathion dust was very effective in the control of this mite; 3 per cent BHC was less effective.

Twenty pounds of DDT per acre as a 50 per cent wettable powder dusted on young alfalfa being damaged by white grubs, *Cotinis nitida* (L.) gave excellent control. Ten pounds of chlordane was somewhat less effective.

Control of Insect Pests Attacking Corn and Grain Sorghum. (W. G. Eden.) – Twenty-seven species of insects were noted doing damage to corn in Alabama during the 2-year period 1949-50.

Experiments were conducted at three locations in Alabama on control of the corn rootworm, *Diabrotica undecimpunctata howardi* Barb., in corn by mixing insecticides with the fertilizer. Significant decreases in stalk damage resulted from the following insecticides and rates per acre: DDT, 5 pounds; DDT, 2.5 pounds; lindane, 2 pounds; lindane, 1 pound; toxaphene, 5 pounds; parathion, 0.5 pound; dieldrin, 1 pound; aldrin, 1 pound; chlordane, 2 pounds.

Fall armyworm, *Laphygma frugiperda* (A. & S.), did severe damage to corn in localized areas in Alabama in 1949 and 1950. Applications of 2.5 pounds of DDT per acre as dusts were effective on armyworm larvae before but not after the larvae had entered the stalks and ears.

Studies were made on the effects of nine factors on rice weevil, *Sitophilus oryza* (L.), damage to corn. Good husk cover was very effective in preventing damage to corn in the field as well as in storage. Entrance into the ears by corn earworm and fall armyworm was followed by a sharp increase in weevil damage. Ears with no worm holes had 14 per cent damage while those that had been entered by worms had 47 per cent damage. In general, the earlier corn was planted, the more weevil damage it suffered when left in the field until later-planted corn matured. For each pound of pressure increase required to penetrate kernels with a hollow punch, there was a 1 per cent decrease in weevil damage. In other words, the harder the corn, the lower the damage from weevils. There was no significant relationship between thickness of the kernel pericarp and weevil damage. The number of plants per acre was inversely proportional to weevil damage. There was no significant relationship between irrigation and weevil damage at harvest. There was no relationship between phosphatic and potassium fertilizers to corn and rice weevil damage, but weevil damage appeared to be worse at the higher levels of fertilization with nitrogen. Weevil damage appeared to be inversely proportional to the number of days required for corn varieties to mature, but this was probably due to the fact that shorter-maturing varieties generally have poorer husk covers. Varietal resistance studies showed that the most resistant varieties of corn to rice weevil are Dixie 18, Louisiana 1031, Cokers Coastal 811, and Georgia Coastal Plain 8,100. The most susceptible varieties included U.S. 13, P.A.G.-170, Funks G-711, and Dixie 44.

Tests with fumigants on stored grain revealed that HCN and acrylonitrile were both effective, but acrylonitrile was more effective in penetrating deep piles of grain. Fumigation of 1-, 2-, and 3-year-old seed of corn, grain sorghum, and cowpeas for 24 hours with 5 pounds per 1,000 cubic feet of a 50-50 mixture of acrylonitrile and carbon tetrachloride resulted in no deleterious effect on the germination 1 week after fumigation. The 3-year-old seed were stimulated to higher germination; however, this may be a temporary effect.

In tests with insecticidal dusts for rice weevil control in shelled corn, aldrin and dieldrin were highly effective at 1 p.p.m. Pyrethrins-piperonyl butoxide combination at 1.5-3.0 p.p.m. showed some promise.

Airplane application of 2 pounds of DDT per acre as dusts or sprays on grain sorghum gave excellent control of corn earworm and the sorghum webworm, *Celama sorghiella* (Riley). Grain sorghum suffered heavy losses throughout Alabama in 1950 from the sorghum midge, *Contarinia sorghicola* (Coq.).

Control of Peanut Insects. (F. S. Arant and Marvin E. Merkl.) — DDT and toxaphene were effective in control of leafhopper, *Empoasca fabae* (Harr.), on peanuts when applied as dusts at the rate of approximately 20 pounds per acre. Substantial increase in yield of Dixie runner peanuts resulted from the application of the insecticides with inert carriers or in mixtures with fungicides. The order of effectiveness for various mixtures from high to low efficiency was as follows: 10 per cent toxaphene in sulphur-copper; 2.5 per cent DDT in sulphur-copper; 10 per cent toxaphene in sulphur; 2.5 per cent DDT in sulphur; 10 per cent toxaphene in pyrophyllite; 2.5 per cent DDT in pyrophyllite; and untreated check.

Average gains from dusting over the 4-year period, 1947-1950, ranged from 222 to 857 pounds of dry peanuts per acre on land yielding approximately 1,600 pounds without treatment. Based on these experiments, 2.5 per cent DDT or 10 per cent toxaphene is recommended for use on peanuts in a mixture containing 3.4 per cent copper and at least 65 per cent sulphur.

Two soil fumigants, ethylene dibromide, and a dichloro-propane-dichloropene mixture, applied to soil 3 weeks prior to planting, resulted in gains in yield of 796 to 1,016 pounds of dry peanuts per acre. The increased yields were attributed to control

of soil insects and nematodes. On the untreated plots, 14.2 per cent of the peanuts were damaged by soil insects as compared with 1.3 to 4.1 per cent damage on the fumigated plots.

BHC applied in the drill before planting at the rate of 1 and 2 pounds of gamma per acre greatly reduced the stand of peanuts. The stand was not affected by 2 pounds aldrin per acre, but the application resulted in no increase in yield.

Control of Tomato Insects. (W. G. Eden.) — Experiments were conducted during 1950 for control of tomato fruitworm, *Heliothis armigera* (Hbn.) on fall tomatoes in Blount and Cullman Counties.

Five per cent DDD dust gave an average increase of 5,567 pounds per acre over no treatment; 5 per cent methoxychlor increased the yield 3,438 pounds. Plots dusted with 5 per cent DDT produced an average gain of 2,550 pounds per acre and 50 per cent cryolite produced 1,526 pounds per acre more than the untreated plots.

Three per cent nicotine dust controlled the aphid, *Macrosiphum solanifolii* (Ashm.). Control of this insect increased the yield of tomatoes 112 pounds per acre.

Toxicity of Aldrin, Chlordane, and Dieldrin to Chickens. (Helen Richards, Henry Turner, Glynn B. Wood, F. S. Arant, and W. G. Eden.) — Experiments were conducted to determine the acute and chronic toxic effects of aldrin, chlordane, and dieldrin on 3- and 6-week-old chicks. Symptoms of acute poisoning included extreme nervousness, loud chirping, running in circles, flailing of wings, spasms or convulsions, and mucous exudate from the mouth and nares at death. Chronic symptoms varied in intensity from failure to make proper growth to symptoms of acute poisoning terminating with death.

The LD-50's for the three chemicals were as follows: aldrin, between 10 and 15 mg. per kg. of body weight; chlordane, between 220 and 230 mg. per kg. of body weight; dieldrin, between 20 and 30 mg. per kg. of body weight. In the chronic feeding tests, all chickens died within a few weeks on a diet containing aldrin in amounts of 25 p.p.m. and above; some chickens survived 90 days on a ration containing chlordane in the amount of 250 p.p.m., although they failed to make satisfactory gains in weight; all chickens died on a ration containing dieldrin in

the amount of 50 p.p.m., but some survived over a 90-day period on a ration containing 75 p.p.m.; the growth rate of those surviving was retarded.

Wildlife. (A. O. Haugen and F. W. Fitch Jr.) – The summer food habits of the gray fox in Alabama consists of 45 per cent mammals, 39 per cent insects, plant foods 8 per cent, birds 6 per cent, and miscellaneous items 2 per cent. Only 3.5 per cent of the food of the fox consisted of quail.

A method was developed for sampling the abundance of food available in quail in bicolor lespedeza and partridge pea patches. It was found that a bicolor lespedeza patch even in late winter when other food is scarce, had as much as 350 pounds of seed to the acre available for ground-scratching birds. Partridge peas at this season had 140 pounds of seed to the acre available.

Captive deer are not affected by eating twigs and leaves of sweet gum and post oak that have wilted from the effect of ammate (ammonium sulfamate) introduced into the cambium layer. Each of the two deer fed this diet gained in weight during the experiment.

Mourning doves have suffered a severe die-off because of infection with *Trichomonas gallinae* in 1950. Forty of Alabama's 67 counties suffered some mortality.

Preliminary experiments show that Aldrin, one of the newer insecticides, is more toxic to quail than is toxaphene and lindane.

New partridge pea *(Chomaecrista fasciculata)* plantings are now used by covies of quail that could not be located on that site before the pea patches were established.

Farm Ponds. (H. S. Swingle, E. E. Prather, J. M. Lawrence, J. S. Dendy, I. B. Byrd, M. C. Johnson, J. R. Fielding, and A. L. Black.) – It was found possible to correct overcrowding and unbalance in ponds by partial poisoning with cube or emulsifiable rotenone. From one to three partial poisonings were usually necessary to correct overcrowding by forage fishes and to bring the population into balance. It was also found possible to correct unbalance due to overcrowded forage species by fall, winter, and spring supplemental feeding. Soybean meal or soybean cake appeared most effective for this purpose.

The slider turtle *(Pseudemys scripta scripta),* when stocked in ponds at the rate of 100 per acre, did not measurably affect fish production.

Channel catfish *(Ictalurus lacustris punctatus)* were raised to a size of 0.7 to 1.0 pound in 1 year by fertilization plus supplemental feeding. When stocked at the rate of 400 catfish per acre, the average production was 238.4 pounds per acre.

The golden shiner *(Notemigonus crysoleucas)* was raised as a bait minnow in experimental ponds and maximum production obtained was approximately 28,000 minnows per acre.

In an experiment lasting 8.3 months, a maximum of 2,255 pounds of goldfish was produced per acre by fertilization plus supplemental feeding with soybean meal or soybean cake. The presence of the fresh-water mussel, *Lampsilis claibornensis,* reduced goldfish production approximately 50 per cent.

Tests of the relative effectiveness of various rotenone compounds for killing fish indicated that emulsified forms were most effective, followed in order of decreasing toxicity by cube, derris, and wettable rotenone paste.

Fish kills in many ponds over the State appeared to be correlated with the disappearance of soluble phosphates in the water, followed by death of phytoplankton. The addition of superphosphate at the rate of 20 pounds per acre usually corrected this condition.

A spray of 0.5 per cent 2,4-D acetate in diesel fuel or kerosene effectively controlled pennywort, arrowhead, smartweed, sedge, and bullrushes.

A spray of 5.0 per cent TCA plus 1 per cent sodium salt, 2,4-D plus 0.5 per cent Tide in water controlled cattails effectively.

The Tombigbee River was found to be supporting an excellent population composed principally of blue cats, channel cats, and flathead cats. The use of slat boxes for taking catfish commercially as practiced in this river had not been detrimental and was probably beneficial to the population. This river was supporting approximately 400 to 500 pounds of fish per acre in the vicinity of Jackson, Alabama.

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No. 272 Consumer Reactions to Alayam "Snacks." Ben T. Lanham, Jr. 1950.

No. 273 Consumer Reactions to "Alayam" Breakfast Food. Ben T. Lanham, Jr. 1950.

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No. 44 Control of Cotton Insects with Dusts and Sprays. F. S. ARANT. 1950.

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December 31, 1950

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T. B. HAGLER, M.S.—*Assistant Horticulturist*
A. O. HAUGEN, Ph.D.—*Leader, Alabama Cooperative Wildlife Research Unit*
E. E. HUTTO, B.S.—*Asst. Supt., Sand Mountain Substation*
BEN T. LANHAM, JR., M.S.—*Agricultural Economist*
FARLEY A. LEE, M.A., A.B.L.S.—*Agricultural Librarian*
R. M. PATTERSON, M.S.—*Assistant Agronomist*
R. D. ROUSE, Ph.D.—*Associate Soil Chemist*
J. I. WEAR, Ph.D.—*Associate Soil Chemist*

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H. E. BREWER, Ph.D.—*Associate Botanist*
T. S. BRYARS, JR., B.S.—*Asst. Supt., Upper Coastal Plain Substation*
NINA HALL, A.B.—*Agricultural Librarian*
A. E. ROYER, M.S.—*Assistant Soil Chemist*
J. M. SCHOLL, Ph.D.—*Associate Agronomist*
H. J. SMITH, Ph.D.—*Assistant Animal Breeder*
A. L. SOMMER, Ph.D.—*Soil Chemist*
W. S. WISE, B.S.—*Greenhouse Manager*

Deceased

J. M. ROBINSON, M.A.—*Head, Department of Zoology-Entomology*
J. P. WILSON, B.S.—*Superintendent, Wiregrass Substation*

1950 Appointments

M. W. ALISON, B.S.—*Asst. Supt., Sand Mountain Substation*
M. J. BURNS, Ph.D.—*Associate Animal Husbandman*
M. W. CLINT, B.S.—*Greenhouse Manager*
J. T. COPE, Ph.D.—*Associate Soil Chemist*
WILBUR DEVALL, M.S.—*Acting Head of Department of Forestry*
GLADYS S. GARROW, M.S.—*Assistant Home Economist*
W. H. HEARN, B.S.—*Records Assistant*
G. R. INGRAM, Ph.D.—*Associate Poultry Husbandman*
E. W. JOHNSON, M.S.—*Assistant in Forestry*
C. L. KORNEGAY, B.S.—*Farm Superintendent*

ALLENE RAE LANCE, M.S.—*Assistant Human Nutritionist*
R. L. LIVINGSTON, M.F.—*Assistant Horticulturist*
F. S. MCCAIN, Ph.D.—*Associate Plant Breeder*
H. G. POSEY, M.S.F.—*Assistant Forester*
MAX C. SCONYERS, B.S.—*Asst. Supt., Wiregrass Substation*
V. S. SEARCY, M.S.—*Assistant Agronomist*
D. C. SHELTON, Ph.D.—*Associate Animal Nutritionist*
JOHN L. SNARE, M.S.—*Associate Agricultural Economist*
C. D. SQUIERS, Ph.D.—*Associate Animal Breeder*
MORRIS WHITE, Ph.D.—*Associate Agricultural Economist*

1950 Resignations

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FLORENCE PERAL DAVIS, M.S.—*Associate Home Economist*
W. W. GASKINS, M.S.F.—*Assistant Forester*
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T. P. WHITTEN, M.S.—*Assistant Horticulturist*

FINANCIAL REPORT

Fiscal Year Ended June 30, 1949

	Hatch	Adams	Purnell	Bankhead-Jones	Research & Mktg.	All Other
Balance July 1, 1948	.00	.00	.00	.00	6,999.61	310,773.61
Appropriations	15,000.00	15,000.00	60,000.00	96,152.81	97,819.41	893,376.86
Total Funds Available	15,000.00	15,000.00	60,000.00	96,152.81	104,819.02	1,204,150.47
Expenditures						
Personal Services	13,732.04	11,927.15	47,756.96	70,193.36	60,680.51	426,418.45
Travel	118.51	16.15	943.89	1,789.70	7,366.47	20,541.85
Trans. of Things	75.19	21.47	44.53	137.45	188.87	4,648.55
Communication Service	234.85	6.88	210.62	145.16	319.59	3,848.44
Rents & Utilities	51.70	852.14	1,594.75	1,514.07	1,367.31	10,837.12
Printing & Binding	.00	.00	1,242.15	2,349.40	.00	286.52
Other Contractual Services	24.12	.00	524.52	851.23	963.02	111,748.94
Supplies & Materials	663.84	589.63	3,913.89	12,698.85	6,387.99	231,762.97
Equipment	99.75	935.00	2,026.21	2,117.61	14,123.35	75,876.99
Land & Structures	.00	651.58	1,742.48	4,355.98	2,376.44	43,903.02
Total Expenditures	15,000.00	15,000.00	60,000.00	96,152.81	93,773.55	929,872.85
Balance on Hand June 30	.00	.00	.00	.00	11,045.47	274,277.62
Total Expenditures & Balance	15,000.00	15,000.00	60,000.00	96,152.81	104,819.02	1,204,150.47

FINANCIAL REPORT

Fiscal Year Ended June 30, 1950

	Hatch	Adams	Purnell	Bankhead-Jones	Research & Mktg.	All Other
Balance July 1, 1949	.00	.00	.00	.00	11,045.47	274,277.62
Appropriations	15,000.00	15,000.00	60,000.00	96,152.81	145,337.56	1,051,569.83
Total Funds Available	15,000.00	15,000.00	60,000.00	96,152.81	156,383.03	1,325,847.45
Expenditures						
Personal Services	14,007.05	11,319.35	45,367.02	66,897.03	72,391.72	498,374.88
Travel	111.31	303.72	797.14	2,352.79	8,178.66	23,189.08
Trans. of Things	81.47	15.51	301.79	260.02	479.98	5,980.69
Communication Service	127.98	11.10	204.88	182.57	415.15	4,625.97
Rents & Utilities	75.00	405.85	1,276.60	1,266.75	1,629.51	14,188.02
Printing & Binding	19.80	.00	1,556.99	2,000.41	915.36	3,698.50
Other Contractual Services	.00	71.70	404.12	1,112.47	1,242.53	53,337.02
Supplies & Materials	399.04	967.91	4,120.80	13,904.23	11,057.20	252,233.25
Equipment	178.35	1,904.86	5,970.66	5,789.54	15,290.01	88,697.39
Land & Structures	.00	.00	.00	2,387.00	3,698.91	39,193.76
Total Expenditures	15,000.00	15,000.00	60,000.00	96,152.81	115,299.03	983,518.56
Balance on Hand June 30	.00	.00	.00	.00	41,084.00	342,328.89
Total Expenditures & Balance	15,000.00	15,000.00	60,000.00	96,152.81	156,383.03	1,325,847.45