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AGRICULTURAL ECONOMICS

Egg Marketing Problems with Special Emphasis on Handling of Seasonal Surpluses. (J. H. Blackstone.) — The first phase of this project was a descriptive study of egg production and marketing practices. A total of 914 schedules were secured on a master sample basis in 23 counties. Of the 914 schedules, 277 were classified as producers and the remainder as non-producers. Producers expected to sell two dozen or more eggs in some one month in 1948, while non-producers' sales would be lower.

All households surveyed averaged 24 hens and pullets per flock, while producers averaged 51. Ten per cent of the producers averaged above 74 birds per flock. One-fourth of the producer flocks consisted only of hens. Eighty-eight per cent of all the households had roosters.

Egg production by producers in 1947 averaged 415 dozen, with sales averaging 6 dozen per week. Mash was fed all year by 62 producers, while 162 fed none. Practically all producers gathered eggs once a day. Metal pails or buckets were used by two-thirds of the producers for gathering eggs.

The bulk of the egg sales was made by white land owners. Before selling eggs, 95 producers made no attempt to clean dirty eggs, while 145 washed dirty eggs in water. Only 102 producers attempted to cool eggs before packing away for use or sale. The kitchen was the most common place of storage. Eggs were usually marketed in buckets, boxes, or paper sacks and were sold as current receipts and of mixed colors. Eggs were usually sold once a week with local prices seldom known ahead of the sale.

Most producers had no difficulty selling eggs at some price in 1947; however 51 reported some difficulty in the spring and summer. Country stores, rolling stores, and consumers were the principal type buyers or places at which producers sold the bulk of their eggs.

Farmers' Retail Curb Markets. (Joseph H. Yeager.) — Since 1923, 41 farmers' retail curb markets have been organized in Alabama, 22 of which were operating in 1946. Most of them have been located in towns of less than 11,000 persons. These markets are characterized by having farm people sell their products to local townspeople at retail prices.

While several own the buildings in which they are housed, most of the markets are housed in buildings provided by the county, city, or a civic organization. Markets vary widely in size, type of construction, facilities, and equipment.

Civic clubs, municipal groups, county extension workers, and interested farm folk often perform vital parts in organizing and operating the markets. Usually a market master is hired to manage the organization. Income and expenses are small. The income is principally from fees, while expenses are mainly salaries or wages. Produce must be grown by those who sell on the market.

Saturday is the heaviest selling day, though most markets operate three times weekly. Vegetables, poultry, eggs, and butter were sold on all markets. On a value basis, it was estimated that vegetables made up 58 per cent, flowers 11 per cent, eggs 10 per cent, poultry 9 per cent, butter 5 per cent, and miscellaneous items 2 per cent of the total. Such items as meats, canned goods, cake, handicraft, fruits, and berries constitute about one per cent each.

Evidently, larger total sales in the last few years have been due primarily to a higher price level and not because of a larger physical volume of product. The heaviest part of the volume comes seasonally during June, July, and August.

Sellers are predominantly women and they bring produce from an average distance of 13 miles. Though fewer services are performed, prices were about the same as regular store prices.

AGRICULTURAL ENGINEERING

Peanut Harvesting. (F. A. Kummer and C. M. Stokes.) — The 1948 results at the Wiregrass Substation indicate that peanuts produced entirely with machinery can be picked effectively with

either a combine or a peanut picker. Where tractor cultivation was used throughout the cultivation period, the average picked yield of peanuts was 1,856 pounds per acre. Where tractor cultivation and hand hoeing were employed to keep the drills clean, the average picked yield was 2,180 pounds per acre. This represents an increase of 300 pounds per acre for the extra hand labor involved in hoeing.

Where combines were used, the peanuts were harvested directly from the windrow. In one test, 4,390 pounds of peanuts were harvested in 3 hours and 28 minutes of continuous operation with a combine. Two men were required to accomplish this job. The picked weight per hour was 1,266 pounds, which constituted the yield from approximately one-half acre at the Wiregrass Substation. These peanuts were cured in the windrow and sold directly to the sheller for $205 per ton.

Results obtained during the past 2 years in Alabama show that it is more economical to permit peanuts to dry, at least partially, in the field before curing them artificially. It was found that occasional rains during the field-curing period do not necessarily affect the quality of peanuts. Artificial curing, therefore, should be resorted to only during prolonged periods of unfavorable weather when damage to quality becomes apparent.

Peanut Curing. (J. L. Butt and F. A. Kummer.) – Experiments were conducted to study some of the factors that influence the artificial curing of peanuts. Two commercial scale drying tests were conducted. The drying facilities consisted of 23 portable bins and a common air duct.

About 15 tons of peanuts were dried. Although the peanuts had been partially dried in the field, they were rained on before being taken to the drier. The moisture content before drying of three batches was 18.5 per cent, 20.0 per cent, and 17.2 per cent. They were dried to 7.8 per cent, 6.9 per cent, and 6.3 per cent, respectively. The average time required for the three tests was 10 hours and 10 minutes. The drying-air temperature was between 115° and 120° F. Free fatty acid tests made before and after each drying indicated no significant change. The damage was 2 per cent in all tests and was the same as in peanuts dried in the field after having been rained on. Peanuts from the same field that had not been rained on showed no damage.

The percentage of sound, mature kernels became progressively

less with successive batches and was lowest in the field-dried sample that had been rained on. This difference is partly explained by the fact that the last two batches dried artificially and the field-dried batch contained high percentages of shrivels, thereby reducing the percentage of sound, mature kernels. Another possible cause could be that the added moisture increased the respiration rates, thereby consuming part of the reserve food in the peanuts and reducing the total weight.

To establish its potential value, a rotary type potato dehydrator was also used to dry peanuts. Peanuts in these tests were left in the field during prolonged heavy rains. They contained as high as 35 per cent moisture and could not be shelled at this moisture content.

The air temperature was estimated between 150° and 200° F. and the temperature of the discharged peanuts from 130° to 170° F. The rate of flow of peanuts through the drier was about 1 ton per hour, with each peanut remaining in the drum about 20 minutes. The final moisture content of the peanuts ranged from 11 to 17 per cent. The cost of the operation would probably not exceed $8 per ton.

Since the peanuts used in these studies were oil stock, the primary considerations were: (1) moisture content, (2) shelling quality, and (3) oil content.

The optimum desirable moisture content for selling oil stock peanuts was 8 per cent. This value could have been reached by adjusting feeding rates, air flow, and air temperature or by running the peanuts through the drier a second time. Peanuts having more than about 17 per cent moisture content will not shell satisfactorily. Reduction to the proper moisture content for selling also eliminated the shelling problem. The temperatures used, although noticeably affecting the taste of the peanuts, did not change the total oil content. One peanut dealer estimated that the value of the peanuts in these tests had been increased about $30 per ton by artificial drying.

Mechanized Production of Cotton. (T. E. Corley and F. A. Kummer.) — In a preliminary study, it was found that the stripper will harvest a wide range of varieties fairly efficiently, and that the greatest efficiency was obtained by harvesting varieties having small stalks, short and high-fruiting limbs with somewhat storm resistant bolls and not too fluffy locks.

The stripper harvested the cotton at a rate of about 1 acre per

hour. There was very little difference in the ginning qualities of the varieties; however, Stormproof No. 1, which has a short staple, could be cleaned better than the others. A low grade was obtained from each variety. Although the cotton was well defoliated, there was some leaf trash present. Much of this was from the bract. Most of the trash in the lint was bark from the stems, which was extremely difficult to remove in ginning.

Design and Construction of Special Farm Machinery and Equipment. (F. A. Kummer and C. M. Stokes.) — Experimental work on specialized equipment and machinery was conducted on three problems: namely, (1) application of anhydrous ammonia as a source of nitrogen, (2) control of weeds and grasses in row crops by means of liquid petroleum gas flame cultivators, and (3) use of tractor-mounted devices for chopping cotton mechanically.

In order to determine the problems involved in the handling and application of anhydrous ammonia, a series of exploratory tests were conducted. Methods for transporting and handling the material were established so that recommendations could be made to farmers desiring to use anhydrous ammonia. Preliminary tests on nitrogen response showed that anhydrous ammonia compares favorably with other sources of nitrogen.

In the tests with flame cultivators, it was found that weeds of approximately the same size of the cotton plant could not be controlled without injuring the cotton. Grasses and weeds that emerge after the cotton plants have reached a height of 6 to 8 inches can be controlled by frequent flame cultivation.

Results of experiments with a tractor-mounted cotton chopper showed that the initial preparation of the seedbed greatly affected the performance of the machine. Soil clods and irregularities of surface will produce unsatisfactory results because of depth variation. Where conditions are suitable, the mechanical cotton chopper will chop approximately 1 acre of cotton per hour or the equivalent work of five to six choppers doing the same operation with hoes.

Processing and Storing of Seed, Grain, and Hay. (J. L. Butt and F. A. Kummer.) — In storage tests of blue lupine seed during 6 months of the normal lupine storage season, the germinability of seed stored under shelter at a depth of 3 inches was not reduced where the original moisture content of the seed was 16 per cent and below. Where the moisture content was above

16 per cent but below 19 per cent, the germination was affected but still remained above 90 per cent. When the moisture content exceeded 19 per cent, the germination suffered a heavier reduction. The moisture content after 6 months storage was about the same in all samples regardless of the initial amount.

In simulated bulk storage tests, seed stored at a depth of 2 feet for 6 months during the normal lupine storage season did not suffer a reduction in germination where the original moisture content was 13 per cent. When the original moisture content was 15.6 per cent and higher, the germinability was seriously affected. Samples for these tests were taken at a depth of 18 inches. The final moisture content of the various samples of seed did not vary appreciably from the original moisture content except for the samples at 21 per cent initial moisture, which had dropped to 17 per cent.

In an experiment designed to study the effect of constant humidity storage on seed of various initial moisture contents, seed at four moisture contents ranging from 10 to 21 per cent were used. They were stored for 6 months at relative humidities ranging from 60 to 100 per cent at intervals of 10 per cent. All seed, regardless of the initial moisture content, stored at 100 per cent relative humidity were completely covered with mold. The germination on all four samples stored at 90 per cent humidity was below 50 per cent; the two with the higher initial moisture contents being below 5 per cent. The germination was above 95 per cent on all samples stored at 80 per cent humidity, except the 21 per cent initial moisture sample which germinated less than 40 per cent. All samples of seed stored at 70 per cent humidity germinated above 95 per cent, except the 21 per cent moisture sample which germinated 85 per cent. All samples stored at 60 per cent humidity germinated 94 per cent or above.

A commercial drier was used to dry a 14 by 6.5-foot wagon loaded with 2,800 pounds of loose hay having a 20 per cent moisture content. The initial moisture content of the hay was 50 per cent. Air was distributed under the hay by an "A" frame of 2 x 4 inches. To produce the final product desired, 20.5 gallons of fuel oil for 5 hours of heat application plus 3 additional hours of fan operation were required. This resulted in an operating cost of $2.17 per ton of hay having a moisture content of 20 per cent. The thermal efficiency of the operation was 20.4 per cent where efficiency, moisture transfer coefficients, and wasted heat were not considered. The final product graded No. 2 Green

Leafy and would have probably graded higher except for the condition of the original product.

AGRONOMY and SOILS

Cotton Breeding and Improvement Investigations. (H. B. Tisdale and A. L. Smith.) — Work on improvement of the new Deltapine 1096 and hybrid strains of cotton for resistance to diseases and other important economic qualities was continued. A new hybrid strain, No. 1282, has been developed from a cross between Stoneville 5A and Clevewilt varieties of cotton. This strain was planted in all variety tests and several strain tests in 1947. Results showed that Hybrid 1282 was high yielding and early maturing, was highly resistant to wilt, and produced good quality staple of 1 to 1-1/16 inches in length.

Another new hybrid, CSS9 (Clevewilt X Stoneville 2B X Stoneville 2B), appeared promising in yield tests conducted in 1947 and 1948. This hybrid yielded higher than most commercial varieties at most locations in the variety trials. It has many of the desirable characteristics of Stoneville 2B and in addition is wilt resistant. Further improvement of this hybrid is being made at the Station's Plant Breeding Unit, Tallassee.

One of the strains of cotton included in this improvement work, No. 9531, was found to have high fiber tensile strength in tests made by the United States Fiber Laboratory, Knoxville, Tennessee. This strain is being used to develop a variety of cotton of high fiber tensile strength adapted to growing conditions in Alabama.

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, 1946-1948 show that Stoneville 2B, Stonewilt, Empire, Miller 610, White Gold, Coker 100 Wilt, and Deltapine 15 are very satisfactory varieties for production, staple length and other fiber properties for planting in any section of Alabama that is free of the cotton wilt disease. Coker 100 Wilt, Stonewilt, and White Gold Wilt are the most satisfactory wilt-resistant varieties for production, staple length, and other fiber properties for planting in sections infested with cotton wilt.

Cottonseed Treatment Materials. (A. L. Smith.) — Ceresan M and Dow 9B were superior dust disinfectants in tests for

treating cottonseed. Both materials were used at the rate of 1½ ounces per bushel. Ceresan M may also be used for treating with a slurry machine. Two per cent Ceresan was a satisfactory dust for cottonseed, but it is used at the rate of 3 ounces per bushel and is more expensive than the other two materials.

Emergence and Yield of Fuzzy, Reginned and Acid Delinted Cottonseed. (A. L. Smith.) — Acid delinted sinkers cottonseed gave an average of 24 per cent more seedlings than fuzzy seed when the same seed numbers were planted in tests conducted 2 years. Acid delinted seed were improved in germination by removal of floaters. Reginned seed emerged 3 to 5 per cent less than fuzzy seed. This difference is attributed to damage resulting from the reginning process. The average emergence for the 2 years for fuzzy, reginned, and acid delinted seed was 55, 52, and 69 per cent, respectively.

Increased yields were obtained from both reginned and acid delinted seed in 1948. Low soil moisture at planting time was a limiting factor for obtaining stands. Acre yields of lint from acid delinted, reginned, and fuzzy seed were 684, 609, and 573 pounds, respectively.

Soil Fumigants for Controlling Cotton Wilt and Nematodes. (A. L. Smith.) — Three soil fumigants, DD, Iscobrome D, and Dowfume, controlled both cotton wilt and nematodes and gave increased yields on a heavily infested soil at Tallassee. Row application of DD applied at the rate of 3½ gallons per acre increased the lint yield of Coker 100 Wilt from 410 to 596 pounds, a difference of 186 pounds. With Deltapine 15 the same treatment increased the yield from 156 to 459 pounds, a difference of 303 pounds of lint. Larger amounts of Iscobrome D and Dowfume W-20 were necessary to produce corresponding increases in yield.

Defoliants for Cotton. (A. L. Smith.) — Special grade Cyanamid gave the most satisfactory results of several defoliants tested. Satisfactory defoliation was obtained when Cyanamid was used as a dust at 30 pounds per acre. Heavy nightly dews are necessary for best results. Poor results were obtained during the latter part of August when soil moisture was low and dews did not occur.

Lime and Boron Investigation: (1) Effect of Fineness of Grinding Agricultural Lime. (F. L. Davis.) — The 7-year re-

sults of a field test in which relative efficiencies of calcitic and dolomitic limestones of different degrees of fineness were measured by the yields of crimson clover and Sudan grass show that:

1. The coarser grades, namely the 4 to 10- and 10 to 20-mesh, were relatively inefficient in comparison to the agricultural grade.
2. The grades of dolomitic lime finer than 20-mesh were relatively more efficient than the agricultural grade.
3. The finer grades of calcitic lime were less efficient than the agricultural grade of the same material due to alkaline reactions of the soil and reduced yields of the crops the first year or two after liming.

The average yields of Sudan grass and crimson clover produced by the agricultural grade and the relative efficiencies of all other grades are given in Tables 1 and 2.

TABLE 1. — RELATIVE YIELDS OF CRIMSON CLOVER AND SUDAN GRASS FROM DIFFERENT GRADES AND RATES OF DOLOMITIC LIMESTONE

Crops grown and rates of lime per acre	Yields from agricultural lime[1]	Relative yields from agricultural limestone	Relative yields from different fineness or grades of dolomitic limestone				
			4-10 mesh	10-20 mesh	20-60 mesh	60-100 mesh	100-200 mesh
	Lb.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Crimson clover							
1,500 lb.	12,146	100	65	67	114	115	110
3,000 lb.	17,832	100	44	67	108	111	96
Sudan grass							
1,500 lb.	6,075	100	44	81	78	106	106
3,000 lb.	7,584	100	44	45	107	104	107

[1] Green weight

TABLE 2. — RELATIVE YIELDS OF CRIMSON CLOVER AND SUDAN GRASS FROM DIFFERENT GRADES AND RATES OF CALCITIC LIMESTONE

Crops grown and rates of lime per acre	Yields from agr'l lime[1]	Relative yields from agr'l limestone	Relative yields from different fineness or grades of calcitic limestone					
			4-10 mesh	10-20 mesh	20-60 mesh	60-100 mesh	100-200 mesh	C. P. $CaCO_3$
	Lb.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Crimson clover								
1,500 lb.	12,268	100	57	58	95	84	87	103
3,000 lb.	17,509	100	45	63	79	91	82	87
Sudan grass								
1,500 lb.	6,386	100	62	71	118	85	92	87
3,000 lb.	8,305	100	62	84	87	110	108	103

[1] Green weight

(2) Boron Requirements of Alfalfa. (B. L. Collier and F. L. Davis.) — Results of chemical analyses of alfalfa grown on field tests of the comparative value of blast furnace slag and agricultural lime with and without additional applications of borax indicate that for normal growth alfalfa requires sufficient boron to provide 28 to 30 p.p.m. in the dry hay. Plots on which the alfalfa contained smaller amounts of boron gave decreased yields of hay. Alfalfa containing 28.3 p.p.m. of boron in the hay utilized approximately 2 pounds of borax per ton of hay produced.

(3) Borax for Crimson Clover Seed Production. (F. L. Davis.) — A recently completed experiment located on Norfolk loamy sand at Auburn, has shown that annual applications of 10 to 15 pounds per acre of borax in addition to 300 pounds per acre of an 0-14-10 fertilizer increased the average annual yield of mature crimson clover seed from 90 pounds per acre to 850 pounds per acre. These yields of seed were obtained by hand-harvesting and are somewhat higher than would be obtained by combining or by mowing and threshing the crimson clover. The vegetative growth, as measured by the weight of dry crimson clover straw, was increased only 36 per cent or from 2,885 pounds per acre to 3,912 pounds per acre.

(4) Lime Increases Yield and Shelling Percentage of Peanuts. (F. L. Davis.) — Applications of 1,500 and 3,000 pounds per acre of several different sources of lime to a Norfolk loamy sand at Auburn produced 6-year average yields of 1,135 and 1,409 pounds per acre of cured Spanish peanuts. These yields represented average annual increases of 571 and 845 pounds of peanuts per acre, respectively, from the two rates of liming. Average shelling percentages for the last 3 years of the test (1946-1948) were 76.7 per cent for the 1,500-pound per acre application and 78.1 per cent for the 3,000-pound application. The largest average annual yield produced by the natural sources of lime was obtained from dolomitic lime.

Behavior of Potassium in Soils. (Robert W. Pearson.) — Results of a study of the potassium-fixing capacities of five different Alabama soils varying widely in chemical, physical, and mineralogical characteristics has showed that this property is strongly influenced by the clay mineral type. Highest fixation was found in soils containing an unidentified mineral having a 14.3 A° fixed spacing, as determined by the X-ray diffraction procedure.

A very close relationship was found between the original exchangeable potassium in eight Alabama soils and the amounts of potassium removed by five crops grown under greenhouse conditions. The amounts of potassium converted from non-exchangeable to exchangeable form in the soils during this period varied from 0 to 40 p.p.m. No relationship could be found between the rate of release of potassium and total amounts of this element present in the soil, and between the original supply in the exchangeable form and the distribution of the total supply among the soil particle size separates. Total potassium content of the soils varied from only 355 to 7,831 p.p.m. Of the soils being studied, the highly acid montmorillonitic types showed lowest potassium release, and the one calcareous soil containing montmorillonite had the highest. The kaolinitic soils were intermediate in this respect.

Factors Affecting the Nature and Behavior of Native and Added Phosphates in Soils. (1) ADSORPTION OF PHOSPHORUS BY SOILS. (L. E. Ensminger.) — Factors affecting the adsorption capacity of a number of minerals and soils have been studied. The adsorption capacity of minerals vary considerably. However, there are indications that this variation may be due as much to crystal size as to the composition and structure of the mineral. Also, some of the clay minerals contain free iron and aluminum oxides, which make it difficult to determine the capacity of the mineral itself. In general, the phosphorus adsorption capacity of minerals and soils increases with increase in acidity of the saturating solution.

Preliminary data showed that water was released when minerals adsorbed phosphates. After refining the technique for determining loss of water, additional data were obtained showing the relationship between water lost and phosphate adsorbed for several minerals and soil colloids at three pH levels. The ratios (H_2O/PO_4) obtained should indicate the valence of the phosphate ion adsorbed. On the theoretical basis if phosphorus is taken up as the H_2PO_4 ion by a material containing hydroxyl groups, one mole of water should be released for every mole of phosphorus taken up. If phosphorus is taken up as the HPO_4 ion, the ratio should be 2 and if taken up as the PO_4 ion, the ratio should be 3. The theoretical ratios for the oxides should be one half as large in each case.

The ratios (H_2O/PO_4) for hematite and Al_2O_3 were 0.54 and 0.57, respectively, at pH 4.25. These ratios are close to

the theoretical ratio of 0.5 for oxides fixing phosphorus as the H_2PO_4 ion. The ratio for Al_2O_3 increased with increasing pH, showing an average valence of 2.7 at pH 7.0. The data for bauxite and hydrated alumina showed an average valence of 1.34 and 1.53, respectively, at pH 4.25. In case of hydrated alumina, the ratio increased with increasing pH to 3.01 at pH 7.0. The ratios for soil colloids also show an increase with pH. These ratios indicate that the valence of the adsorbed phosphate ion depends on the pH of the saturating solution.

Powder X-ray diffraction patterns were made of some of the phosphated materials. The X-ray data show that an aluminum phosphate compound is formed on phosphating kaolinite similar to the compounds formed on phosphating aluminum oxide and aluminum hydrate. The type of pattern obtained on phosphating the materials depends on the conditions maintained during the phosphating process.

Many soils adsorb or fix phosphorus as measured chemically. Field plot work, however, has shown that much of the so-called fixed phosphorus is still available to plants. Results of residual phosphorus studies showed that cotton grown on soils that had accumulated an appreciable amount of applied phosphorus, gave little response to phosphate fertilization. There seems to be little or no relation between the phosphorus fixing capacity of soils and the residual value of phosphorus as measured by crop yields.

Zinc Content of Soil Extracts and Occurrence of Zinc Deficiency Symptoms. (Anna L. Sommer and John I. Wear.) — A method was devised whereby soil extracts could be made and the zinc therein determined within a working day. Extracts and zinc determinations were made on samples of 15 soils by this method. Zinc deficiency symptoms had been observed on eight of these soils and the maximum concentration of zinc in the extract of any of these soils was 0.9 parts per million. The minimum found for soils where the corn showed no deficiency symptoms was 1.2 parts per million.

Iron Nutrition of Certain Plants with Special Reference to Conditions Obtained in Calcareous Soils. (Anna L. Sommer and John I. Wear.) — Peanuts and rice were grown in drip cultures of different hydrogen ion concentrations and in calcareous soil under different conditions. It was found easier to obtain chlorosis with rice than with peanuts under drip culture conditions.

In continuing the study of inoculated and uninoculated peanut plants growing in calcareous soil, the marked differences of the year before were not obtained. Uninoculated plants were not as chlorotic as they were in the preceding year nor were the inoculated ones as green.

Tightly compacting the soil was found to be as efficient a way to prevent chlorosis in rice as it had been previously found for peanuts. Rice was grown in puddled and normally loose soil with ammonium sulfate as a source of nitrogen. It was also grown at the same time in the loose soil, with sodium nitrate as the nitrogen source. All plants grown in the puddled soil made excellent growth and showed no signs of chlorosis. In the series grown during the summer, plants with nitrate nitrogen were more chlorotic than those with ammonium nitrogen. The opposite was the case in the series grown in the late fall and in the early winter. Plants in the ammonium series were so chlorotic as to make very little growth where the soil was loose, while the nitrated plants, though chlorotic, made considerably more growth.

Effects of Magnesium and Other Minor Elements on Growth and Yield of Various Crops Under Field Conditions. (D. G. Sturkie.) — The elements tested were zinc, manganese, copper, boron, and magnesium. On the soil used the only element that appeared to be deficient for the crops tested was zinc, and the only crop responding to zinc was corn. The crops tested were peanuts, cotton, corn, lupines, crimson clover, vetch, and Austrian winter peas. The response of corn to zinc in some years was very marked. The average (1946-48) increase in yield from an application of 10 pounds of zinc sulfate has been 10 bushels of corn per acre.

Magnesium and Minor Element Deficiencies in Some Alabama Soils and Methods for Their Determination. (Anna L. Sommer and John I. Wear.) — In field experiments cotton and corn were found to respond to magnesium and to a minor-element mixture of boron, copper, manganese, and zinc on a number of the sandy soils in Alabama. Zinc appeared to be the element most likely to be deficient for the two crops on the soils studied. Increase in yield due to boron in most cases and to manganese in all cases was of doubtful significance. No increase due to applications of copper was found.

Since cotton and corn do not make normal growth in pots in the greenhouse, an attempt was made to find what plants, when

grown in the greenhouse, would respond to magnesium and minor element treatments as did cotton and corn under field conditions. The plants investigated were turnips, crotalaria, sorghum, oats, common lespedeza, buckwheat, rape, millet, wild buckwheat *Fagopunum tartaricum,* blue lupine, and flax.

The response of crotalaria to magnesium correlated well with that of cotton and corn on the same soil in the field. In the case of the minor element mixture, there was no correlation between cotton and corn, and any of the plants studied. The growing of cotton and corn in 4-gallon pots out of doors also failed to give a good correlation with the results obtained under field conditions.

In a study to determine if there was a relationship between the minor element content of the soil and satisfactory plant growth, a method was devised for obtaining soil extract of relatively soluble zinc and analysis thereof. A good correlation was obtained between the amount of zinc so determined and the occurrence of zinc deficiency symptoms of corn on corresponding soils during the year the method was developed. Zinc deficiency symptoms did not appear every year in corn grown on the same soil, and increases in yield from zinc fertilization were not consistent from year to year. During years in which deficiency symptoms were more pronounced, a high correlation was obtained between the amount of zinc in the soil and the zinc deficiency symptoms of corn grown on that soil.

Auburn Reseeding Crimson Clover. (T. H. Rogers.) — A new strain of hard-seeded crimson clover has been released by this Station through the Alabama Crop Improvement Association.

This new strain of clover, designated as Auburn Reseeding Crimson Clover, was developed from crimson clover that had been volunteering at the Main Station in a Bermuda grass sod for about 25 years. Auburn Reseeding Crimson Clover has produced satisfactory volunteer stands at a number of locations in the State when grown in rotation with grain sorghum, Johnson grass, Sudan grass, soybeans, and in pasture sod. Plants of this strain can not be distinguished from those of ordinary crimson clover. However, the percentage of hard seed in the new strain is considerably greater than that of commercial crimson clover; furthermore, the hard seed content is maintained until late summer or early fall.

During the fall of 1947 approximately 2,600 pounds of Auburn Reseeding Crimson Clover seed were distributed to 34 members

of the Alabama Crop Improvement Association. Farmers receiving this seed agreed to grow it under the regulations of the Crop Improvement Association. Approximately 30,000 pounds of seed were harvested during the spring of 1948.

Experiment on Maintaining Soil Fertility and Crop Production in Cropping Systems Involving Harvested Peanuts. (D. G. Sturkie.) — Several cropping systems and fertilizer applications involving harvested Spanish peanuts have been studied over the 6-year period, 1943-1948. The results indicate that for Spanish peanuts:

1. Application of 300 pounds of 0-14-10 increased the yield of peanuts 429 pounds per acre.
2. Use of good cropping system and application of 300 pounds of 0-14-10 increased the yield 1,010 pounds per acre.
3. The best cropping system tested was peanuts followed by oats harvested for grain followed by vetch, which was turned under ahead of peanuts.
4. Turning under oats as a green manure crop was either injurious or of no benefit to cotton or peanuts.
5. Hogging peanuts or plowing under peanuts for soil improvement increased the yield of cotton only a little over 100 pounds of seed cotton per acre.

Production and Management of Alfalfa. (D. G. Sturkie.) — Studies at Auburn and at most other localities in Alabama show a dominant need for potash for alfalfa. Annual applications of 200 or more pounds per acre of muriate of potash are needed. In some cases on sandy soils, applications as large as 600 pounds per acre are necessary for maximum yields.

Lime is essential for alfalfa. In most cases applications of 2 to 3 tons of lime per acre are sufficient, but in some instances 4 to 8 tons are needed.

An application of 300 to 400 pounds of superphosphate annually is sufficient.

On most soils alfalfa responded to applications of borax; 15 pounds per acre annually appears to be sufficient.

Grazing during the winter reduces the yield of alfalfa the following summer.

Pasture Studies: (1) INFLUENCE OF LIME, FERTILIZER, AND MANAGEMENT PRACTICES ON PRODUCTIVITY OF PERMANENT PASTURES. (E. H. Stewart and J. M. Scholl.) — Results from a rate-of-lime study conducted at 11 widely separated locations have

shown that white clover pastures respond favorably for at least 5 years to the following amounts of lime: 2 to 3 tons per acre on heavy-textured acid Black Belt soils, 1 to 2 tons per acre on alluvial creek-bottom or flood-plain soils, and 1½ tons on sandy soils.

The data from 19 tests at several locations indicate that white clover yields from plots receiving basic slag and colloidal phosphate were 93 per cent and 53 per cent, respectively, when compared with superphosphate.

Productive white clover-grass pastures can be established usually on soils to which they are adapted by following recommended cultural, fertility, and seeding practices. After a period (3 to 5 years) of good clover growth, during which time recommended fertilizers are applied, many of the white clover stands become materially reduced. It has been observed that these white clover failures are usually associated with heavy grass competition and that under these close grazing of the grass in the late summer is beneficial.

(2) Ladino Clover.—Experiments with Ladino clover seeded in September 1946, in both heavy- and light-textured soils, with and without grass companions and in comparison with white Dutch clover have shown that:

1. Following the establishment of good stands of both clovers on the two soils, Ladino produced 10 per cent more green material in 1947, but approximately the same amount of dry material.
2. White Dutch clover was a much more prolific seed producer.
3. Good stands of perennial plants of both clovers survived the extremely dry summer of 1947.

Success with Ladino clover depends to a large extent upon recognizing the following facts about its growth behavior:

1. It requires high levels of fertility and moisture for best results because of its capacity to produce high yields.
2. It is one of the most palatable crops.
3. Ladino clover is susceptible to injury from insects and from overgrazing by livestock because of its high palatability.
4. It is slower to recover from close grazing than is common white clover.

(3) Winter Grazing Crops. — The incorporation of such reseeding winter legumes as crimson and bur clovers into Bermuda grass sods resulted in more productive upland pastures by ex-

tending the grazing period and by furnishing much needed nitrogen to the grass. After establishment in thoroughly-disked Bermuda grass pastures, these clovers have successfully volunteered and have furnished winter grazing for 2 successive years in six tests on soils varying from light loamy sands to clay loams. Good stands were produced in the fall of 1947, which was generally unfavorable for winter legumes. In these tests crimson clover was productive only where the Bermuda grass was closely grazed or renovated in the fall.

Subterranean clover, *Trifolium subterraneum* (L.), an annual reseeding winter clover, has about the same soil and fertility requirements as white Dutch clover. It has shown promise on Susquehanna clay at the Tuskegee Experiment Field and on a Mallory very fine sandy loam at the Alexandria Experiment Field. This clover has volunteered to excellent stands for 2 successive years and has furnished grazing as early in the fall as crimson or bur clover and produced more grazing in the spring of 1947. Subterranean clover appears to be more tolerant to wet soils than crimson and bur clovers. Its seed-forming habit is unique in that the seed are produced on or below the soil surface, thus allowing for greater reproduction under closer grazing conditions than the more upright-growing clovers. Seedlings make more rapid growth than those of white clover; hence, this legume may have a definite place in pastures where white clover cannot be maintained as a perennial due to dry summer conditions.

Effect of Sources of Phosphate on the Growth of White Clover. (J. M. Scholl.) — Field and greenhouse tests established in 1947 on both acid and alkaline soils have shown that rock and colloidal phosphates are ineffective for supplying the phosphorus required to establish productive white clover pastures. Colloidal phosphate, when applied at rates of 288, 576, and 1,152 pounds of P_2O_5 per acre, was inferior in all tests to superphosphate at 144 pounds of P_2O_5 per acre in the establishment and first year's growth of white clover. Superphosphate to supply 144 pounds of P_2O_5 per acre was superior to rock phosphate supplying 576 and 1,152 pounds of P_2O_5 per acre. The tests in subsequent years will furnish data to show when and in what measure phosphorus from colloidal and rock phosphates become available to the plants.

Tall Fescue for Alabama Pastures. (J. M. Scholl.) — Tall fescues, viz., Kentucky 31 and Alta, have been gaining in popularity

in Alabama. Observations and experimental data have indicated the following:

1. Tall fescues are more widely adapted in Alabama than any of the present perennial winter grasses and usually provide more forage.
2. They possess a considerable degree of summer dormancy and should be grown in combination with summer legumes or with summer grasses that are supplied with commercial nitrogen.
3. They apparently have a higher palatability rating in the South than in northern states.
4. Tall fescues can successfully compete with many of the serious pasture weeds, such as dock and thistle, and they make possible the establishment of productive pastures on moist, weed-infested soils.

ANIMAL HUSBANDRY

Production and Utilization of Pasture and Feed Crops in East Alabama. (J. C. Grimes and D. G. Sturkie.) — Ten beef cows and 25 acres of pasture and hay crops were used in a feed production and utilization study in 1948.

The 25 acres of crops consisted of 10 acres of lespedeza sericea, 7 acres of alfalfa, and 8 acres of a combination of Johnson grass, reseeding crimson and manganese bur clovers. The ten cows and eight calves they raised received all their feed from crops grown on the 25 acres of land. The surplus crops were converted into hay and sold or fed to other stock.

Returns from the 25 acres were as follows: (1) eight calves weighing 4,115 pounds at 20 cents per pound, $822; (2) 21 tons of surplus alfalfa hay at $40 per ton, $840; (3) two and one-half tons of surplus Johnson grass hay at $20 per ton, $50; (4) gross returns, $1,712; (5) gross returns per acre, $68.48; (6) cost of fertilizer per acre, $9.94; and (7) return per acre to capital and labor, $58.54.

Grazing and Forage Crop Studies. (J. C. Grimes and A. E. Cullison.) — Results of studies of grazing and management of pasture crops indicate that the most reliable grazing crops for November, December, and January are oats or rye grass and annual crimson clover. If these crops are planted from the first to the fifteenth of September on a well prepared seedbed and are properly fertilized, they will nearly always furnish good grazing by the first of November.

Once they are established, reseeding crops such as hard-seeded crimson and manganese bur clover require less labor and are cheaper to grow than grazing crops that must be planted each year. If temperature and moisture conditions are favorable during the fall, reseeding crops will provide grazing in November, December, and January. However, they cannot be relied upon always for grazing during these months. In the fall of 1946 these crops were ready to graze by November 1, but in the fall and winter of 1947-48 they were not ready until February 1. These crops make their greatest growth from the middle of February to the middle of May.

Reseeding clovers have been grown successfully in combination with Johnson grass, sudan grass, or grain sorghum.

It has proved difficult to provide all of the feed needed by cows throughout the entire year from grazing crops alone. It seems wise to store some hay, grain sorghum, stover, or other dry feed for winter use. The beef herd on the Main Station farm, in recent years, has been wintered on grazing crops and hay fed from the stack.

Hogging Off Grain Sorghum. (H. J. Smith and J. C. Grimes.) — Twelve pigs averaging 107.3 pounds were moved into a field of 4 acres of Early Hegari on September 28. Five more pigs, averaging 118.2 pounds, were added to the test on October 25. The grain sorghum was exhausted by November 8, and all pigs were removed from the field on that date.

The yield of grain was estimated by sampling methods at 35 bushels per acre. A protein supplement consisting of equal parts of cottonseed meal (36 per cent) and tankage (50 per cent) was self-fed. A mineral mixture (2 parts steamed bone meal and 1 part salt) was also available at all times.

The 4 acres of grain sorghum plus 608 pounds of supplement furnished 574 hog days of feed and grazing. Total gain was 949 pounds, and the average daily gain was 1.65 pounds. The feed required per 100 pounds of gain was 866.3 pounds of grain and 67.4 pounds of supplement. The rate of gain is regarded as satisfactory, but the feed required per unit of gain is extremely high.

Although no accurate check on losses due to various factors could be made, it was evident that a considerable amount of grain was lost to birds and to weather damage from shattered grain falling on the ground and sprouting.

One acre of grain sorghum and 152 pounds of supplement produced 237 pounds of gain on the hogs.

The supplement cost $.05 per pound or $7.60, and the gain produced on the hogs was worth $.20 per pound or $47.49.

After subtracting the cost of the supplement, there was left a gross return of $39.80 per acre from the grain sorghum.

Relation of Diet to Development and Growth of Liver Tumors Induced by p-Dimethylaminoazobenzene (Butter Yellow). (R. W. Engel, D. H. Copeland, and W. D. Salmon.) — In initial studies concerned with the relation of diet to development of butter-yellow-induced liver tumors, those diet ingredients reported by other investigators to have positive effects in either enhancing or inhibiting liver tumor development have been studied.

Increasing the riboflavin from 1 mg/kilo to 20 mg/kilo of diet delayed the development of liver tumors and reduced the severity of the liver lesions considerably. Increasing the pyridoxine from 2 mg/kilo to 10 mg/kilo of diet failed to influence tumor development. Other workers have reported that high-pyridoxine diets enhance tumor development.

Supplementing the basal diet with DL-methionine or with choline chloride failed to prevent tumor formation. When both of these nutrients were included in the diet, tumor development was not prevented but no metastases to other tissues were observed, whereas liver tumor metastases to other tissues were observed in 50 per cent of the animals receiving either of these nutrients singly.

When hydrogenated coconut fat, corn oil, or coconut oil served as sources of fat in the diet, the tumor incidence was 100 per cent regardless of type of fat in the diet. Other investigators have reported a delay in tumor formation when hydrogenated coconut fat served as dietary fat source. Liver tumor metastases to other tissues were absent in the animals receiving hydrogenated coconut fat. Metastases were observed in one of three animals receiving corn oil and two of four animals receiving coconut oil.

It has also been reported by other investigators that the inclusion in the diet of mineral oil or detergents inhibited tumor development.

A detergent was added to the diet at four levels: 0.0, 0.25, 1.0, and 3.0 per cent of the diet. A 100 per cent incidence of liver tumors was observed in all animals, indicating that the detergent did not retard liver tumor formation.

BOTANY AND PLANT PATHOLOGY

Studies on Control of Late Blight (Phytophthora infestans) of Irish Potato. (Coyt Wilson, Otto Brown, and Frank E. Garrett.) — Late blight did not become a limiting factor in the test area in 1947. However, there was considerable early blight in the area at the time the plots were harvested. While late blight appeared in the plots one month before harvest in 1948, fair weather retarded its development. Potato yields were increased from 19 to 28 bags per acre as a result of five applications of fungicides at the Gulf Coast Substation in 1948. The test consisted of seven fungicidal treatments and an untreated check. Insects were controlled on all plots by use of DDT. There were four replications of each treatment, with the plots being six rows wide by 60 feet long. All fungicides tested, except Phygon, increased yields. Although Phygon controlled late blight as effectively as any other fungicide, the yields were practically the same as those of the check.

The treatments and the yields, expressed as bags per acre, were as follows: no fungicide, 129; Phygon spray (2 pounds per 100 gallons), 129; Z-78 dust (containing 3.9 per cent zinc ethylene bisdithiocarbamate), 148; General Chemical dust (containing 6 per cent zinc-nitro-dithioacetate and 6 per cent copper-nitro dithioacetate), 149; Parzate dust (containing 6 per cent zinc ethylene bisdithiocarbamate), 153; COCS dust (containing 6 per cent metallic copper), 154; Z-78 dust (containing 6 per cent zinc ethylene bisdithiocarbamate), 156; and Dithane D-14 spray (2 quarts per 100 gallons), 157.

Peanut Seed Treatments. (Coyt Wilson.) — Average emergence from machine-shelled runner peanuts planted at the Wiregrass Substation without treatment was 47 per cent. Treatment with Ceresan M at the rate of 1½ ounces per 100 pounds of seed increased the emergence to 78 per cent. Smaller, but significant increases in emergence were obtained by treating the seed with any one of the following rates of fungicides per 100 pounds of seed: Arasan, 2 to 3 ounces; Phygon, 3 to 6 ounces; wettable Phygon, wettable Spergon or regular Spergon, 3 ounces; Dow 9B, 2 to 3 ounces; and red copper oxide, 16 ounces. Seedox at either 2 or 3 ounces per 100 pounds of seed did not increase emergence; neither did Dow 9B when applied at the rate of 1 ounce per 100 pounds of seed.

Ceresan M applied at greater dosages than 1½ ounces per 100 pounds of seed reduced emergence.

Studies on Control of Fruit and Foliage Diseases of Tomato. (Coyt Wilson, Harold F. Yates, and L. M. Ware.) — Dithane D-14 spray containing 2 quarts of Dithane; Bordeaux spray, 4-4-50; Parzate dust containing 8.0 per cent zinc ethylene bisdithiocarbamate; and Copper A Compound dust containing 6.3 per cent metallic copper were tested on tomatoes against an untreated check at the Gulf Coast Substation and at Auburn. Late blight was present but not destructive at the Gulf Coast Substation. There was no late blight at Auburn. Early blight was present in both tests.

The greatest increases were obtained with Parzate dust or with Copper A Compound dust. The yield of marketable tomatoes at the Gulf Coast Substation was increased from 5.0 tons per acre to 8.8 tons per acre by Parzate dust and to 8.9 tons per acre by Copper A dust. There was no significant increase from either of the two sprays. At Auburn, Parzate dust and Copper A dust treatments each resulted in 5.2 tons of marketable tomatoes per acre, while the check plots produced only 3.1 tons per acre. No yield records were obtained on the spray plots at Auburn.

Blue Lupine Seed Treatments. (Coyt Wilson and James A. Lyle.) — The following materials were tested on blue lupine seed for their effect on emergence and on nodulation: 2 per cent Ceresan, Phygon, Arasan, Spergon, Dow 9B, and Mercan A. All materials were applied at the rate of 4 ounces per 100 pounds of seed except Phygon and 2 per cent Ceresan, which were applied at the rate of 2 ounces per 100 pounds of seed. Treatments were applied about one week before planting time. At planting the seed were inoculated with the appropriate strain of Nitragin. Plantings were made at Auburn and at the Gulf Coast Substation. All materials except Mercan A increased emergence. Spergon increased emergence from 54.5 per cent to 65.9 per cent. Phygon and Arasan gave 64.9 and 61.4 per cent emergence, respectively. None of the materials interfered with nodulation.

Studies on Control of Cercospora Leafspot of Peanuts. (Coyt Wilson.) — Tests on Spanish peanuts with different fungicides proved that the two best fungicides for control of leafspot were dusting sulphur and dusting sulphur containing 3.5 per cent metallic copper.

The average yield of runner peanuts during the 2-year period, 1947-48, was 2,675 pounds per acre of cured peanuts when dusted four times with copper-sulphur as compared with 1,971 pounds per acre for undusted peanuts. Plots that received one, two, or three applications produced 2,346, 2,451, and 2,509 pounds per acre, respectively.

DAIRY HUSBANDRY

Relative Accuracy of Milk Yields Estimated from Four-Day, Two-Day and One-Day Weighings. (K. M. Autrey.) — For the dairyman monthly milk production yields estimated from weights taken one day during a given month are adequate for his use in identifying profitable cows and culling "boarders." In DHIA production testing work, this procedure is customarily used. However, for obtaining milk yield estimates on cows used in experimental units, will one-day's milk weights each month be sufficiently accurate? To obtain daily milk weights on each cow in a dairy herd is a time-consuming chore.

This study was designed to compare the relative accuracy of milk yields estimated from 4-day, 2-day, and 1-day weighings as compared with actual milk yields. For the 4-day estimates, milk weights were taken 1 day each week; for 2-day estimates, weights were taken 1 day every 2 weeks; and for 1-day estimates, 1 day every 4 weeks. Production records on 29 Jersey cows of the API College herd during the 4-month period, beginning March 1, 1948, were involved. Daily production records were kept on each cow during the experimental period.

An analysis of variance was made on actual production records for comparison with estimates obtained by each of the other three methods. The mean monthly production per cow, as determined by the various methods, was as follows: actual record, 715.1 pounds; 4-day weighings, 717.2 pounds; 2-day weighings, 720.5 pounds; and 1-day weighings, 738.5 pounds. Statistical analysis shows that there is a significant difference between actual milk weights and those obtained by estimates from one-day weighings, although the latter estimate is in this case only about 3 per cent greater than the actual record.

Estimates based on 4-day weighings per month were only slightly different from actual records, and those based on 2-day weighings were almost as accurate. It seems that, unless an exacting comparative trial is involved, milk weights taken 2 days

each month will provide a satisfactory estimate of milk production in experimental dairy herds.

Techniques in Artificial Insemination of Dairy Cattle. (K. M. Autrey and Pete B. Turnham.) — In order that a reasonably large percentage of Alabama dairy cows may eventually benefit from artificial insemination, a simplified technique must be developed — one that the farmer himself may apply. Using the conventional technique, it is necessary that a skilled technician be employed to breed cows, and only counties with relatively large dairy cow numbers can support such a technician.

In 1947 an experiment was designed to compare three methods of inseminating cattle. The API College dairy herd was separated at random into three groups. In the first group diluted semen was placed in the vagina in the same relative position a bull would deposit raw semen in natural service. Conception rate on first service was 57 per cent. Cows in the next group were inseminated by depositing at the base of the cow's cervix with a balling gun a 2-cc. capsule filled with dilute semen. Thirty-one (31) per cent conceived on first service by this method. Cows in the last group were bred by the conventional speculum and light method. Conception on first service was 63 per cent by this technique.

Because of inadequate cow numbers, results obtained were not conclusive. However, they did indicate that the capsule method is less effective than the other two.

FORESTRY

Growth of Southern Pine Plantations at Various Spacings. (L.M. Ware and R. Stahelin.) — An experiment was started at the Main Station, Auburn, in the spring of 1932 to study the influence of spacing and time of later thinnings on the yield of slash, longleaf, and loblolly pine plantations established on abandoned fields. The spacings were 4 by 4 feet, 6 by 6 feet, 8 by 8 feet, 9.6 by 9.6 feet, 12 by 12 feet, and 16 by 16 feet. Some of the 4 by 4-foot plots were thinned to approximately 8 by 8-foot spacing when they were 8 years old, and some of the 6 by 6-foot plots were thinned to 400 to 600 trees per acre at the age of 12 years. All trees very badly cankered by cronartium were removed in a sanitation cutting during the winter of 1942-43.

Measurements at the end of the fourteenth growing season warrant the following conclusions:

1. Total wood production was roughly related to density of stocking.

2. Spacing had no important influence on the height growth of the dominant trees.

3. Spacings of 6 by 6 feet to 8 by 8 feet and 10 by 10 feet provided an adequate number of trees for a good final crop.

4. Trees spaced 6 by 6 feet or closer and thinned at 12 years to 500 trees per acre left a stand equal in quantity and far superior in quality to unthinned 8 by 8-foot or 10 by 10-foot spacings.

5. With a good pulpwood market, an early thinning would pay for the investment in a 6 by 6-foot planting.

6. A 4 by 4-foot spacing led to early overcrowding with consequent slowing down of individual tree growth.

7. Spacings wider than 10 by 10 feet gave insufficient desirable crop trees and incomplete use of the growing space for at least the first 14 years.

8. Spacings of 5 by 5 feet and 9 by 9 feet were the two extremes suitable for slash and loblolly pines on abandoned fields in central Alabama.

9. Crowding retarded and wide spacing stimulated both diameter and volume growth of loblolly pines more than of slash pines on this site.

10. Longleaf pine apparently should always be planted closer than slash or loblolly pines because of its different growth habits and frequently lower survival.

1947 Fence Post Treating Experiment. (W. R. Boggess and R. R. Newman.) — Work done during 1947 on the preservative treatment of fence posts was a part of the cooperative treating experiment between the Tennessee Valley Authority and the Alabama, Mississippi, Virginia, and Tennessee agricultural experiment stations.

The species used in this experiment consisted of shortleaf pine that showed symptoms of little leaf disease, plantation-grown slash pine, sweetgum, and post oak.

The posts were immersed horizontally in an unheated solution of 5 per cent pentachlorophenol dissolved in No. 2 fuel oil. The 9 by 3 by 2.5-foot metal tank used for treating was furnished by the Tennessee Valley Authority as a part of the cooperative agreement.

Twenty-eight posts of a given species and diameter group[1] were measured to determine average diameter and length and then weighed. During the soaking period, the sample posts were weighed until: (1) 6 pounds of preservative per cubic foot of wood was absorbed, or (2) the posts showed no further increase in weight. All posts were removed from the preservative and weighed, and absorption per cubic foot was calculated, Table 3.

TABLE 3. — SIZE, WEIGHT, AND ABSORPTION OF PRESERVATIVE OF 28 POSTS EACH OF SHORTLEAF PINE, POST OAK, SWEET GUM, AND SLASH PINE

Species	Average post		Absorb. per cu. foot	Time in solution	Temperature
	Mid.-diam.	Volume			
	In.	*Cu. ft.*	*Lb.*	*Hr.*	*° F.*
Post oak	3.3	.405	3.24	46:00	88-91°
Post oak	4.8	.875	4.18	71:30	90-92°
Sweetgum	3.6	.511	4.95	5:30	94-96°
Sweetgum	5.5	1.144	5.47	23:30	85-86°
Shortleaf pine	3.8	.557	3.88	7:00	84-90°
Shortleaf pine	5.2	1.019	5.13	23:00	90-96°
Slash pine	3.5	.415	6.99	1:00	68-74°

Effect of Spacing on Quality of Lumber. (R. Stahelin.) — Prices of forest products depend largely on their quality. Number and size of knots are a major factor determining quality of lumber. One of the reasons for close spacing in plantations is that trees develop larger branches with wide than with narrow spacings. Natural pruning progresses more rapidly with close spacings, Table 4.

The cross section of the branches or stubs refers to their sectional area outside bark at the point where the branches leave the stem. Knots that were completely healed over by growing wood were not counted, since it was not possible to determine their number and size. Not only size, but also condition of the branches must be considered in judging the effect of branches on quality of the wood that will be produced. Only live limbs and sound dead limbs will continue to form knots in the growing annual wood layer of the stem of the tree. Where advanced decomposition of the branches has softened their structure, the growing wood tissue pinches them off. For small knots, the scars

[1] Posts were divided into two diameter groups — 2.5 to 4.5 inches, top diameter; and 4.6 to 6.0 inches, top diameter.

TABLE 4. — RELATION BETWEEN SPACING AND DEGREE OF KNOTTINESS, FIRST 16-FOOT LOG OF 16-YEAR-OLD PLANTATION, AUBURN

Item	Spacing in feet						Average	
	4 x 4	6 x 6	8 x 8	10 x 10	12 x 12	16 x 16	Loblolly	Slash
Av. diameter breast high	6.8	7.6	8.0	9.0	10.2	10.3	8.9	8.4
Total cross section of branches or stubs in square inches	12	15	21	22	26	31	22	20
Av. diameter per branch or stub in inches	.79	.81	.89	.90	.99	1.13	.97	.88
Percentage of knots impairing quality of future growth	10	11	44	35	48	62	44	37

left by the disappearing branch stubs soon heal over. Only living branches, sound dead branches, and rotten branch stubs of over one inch in diameter will seriously influence the quality of the future wood growth. The bottom line of Table 4 shows the percentage of the total cross section that belongs to branches or stubs that will continue to cause knotty wood for many years. A comparison of the top and bottom lines of the table shows further that with 4 by 4- and 6 by 6-foot spacings the wood growing around the present 7- to 8-inch core will furnish practically clear lumber in the 16-foot butt log. With the 12 by 12- and 16 by 16-foot spacings, wood growing around the present 10-inch core will still be low grade lumber. Slash pine crop trees are slightly clearer of limbs than the loblolly pine crop trees.

Forest Fire Damage to Pines Planted in Hardwood Stands. (R. Stahelin.) — An 80-acre tract stocked with young hardwoods near Talladega was underplanted with slash and loblolly pines in 1941. In 1944 and 1945, the hardwoods were cut on a portion of this tract to release the planted pines. Results of this experiment were reported in the annual report for 1946. A wild fire burned over the whole tract in February 1947. The following observations are of importance in relation to the conversion of hardwood to pine stands:

1. The fires had no visible effect on the vigor of the uncut hardwoods, even on areas where they killed practically all pines.

2. The damage to pines was on an average inversely related to the size and vigor of the trees.

3. The percentage of trees killed by the fire was greater for loblolly than for slash pines.

4. Suppressed trees, both slash and loblolly, were generally killed by the fire even where the surrounding forest litter was hardly touched.

5. Practically all new hardwood sprouts were killed back on the clear-cut plots, but very few hardwood clumps failed to send out new sprouts in the spring following the fire.

HORTICULTURE

Influence of Fertilizer, Organic Matter, and Irrigation on Yield of Pole Beans. (L. M. Ware and W. A. Johnson.) — The study was conducted for 4 years in composited field bins on a Chesterfield soil of average fertility. Irrigation gave large increases in yields during the seasons of inadequate rainfall but gave small increases or lower yields during seasons of adequate rainfall.

Pole beans receiving 1,000 pounds per acre of a 6-10-4 fertilizer in the two dry seasons of 1946 and 1948 yielded 120 bushels per acre; irrigation increased the yield to 217 bushels, animal manure to 210, and rye to 152 bushels per acre. Irrigation in these 2 years increased the yield from 210 to 311 bushels per acre on plots receiving 1,000 pounds of commercial fertilizer and 12 tons of animal manure. The yield of plots receiving 1,000 pounds of commercial fertilizer and vetch turned under was increased from 122 to 202 bushels with irrigation. Irrigation increased the yield of plots receiving 1,000 pounds of commercial fertilizer and rye turned under from 152 to 265 bushels per acre. The yield of plots receiving 1,500 pounds per acre of commercial fertilizer, 12 tons of animal manure, a turned-under crop of vetch, and irrigation was 305 bushels per acre for the two dry seasons.

Effects of Fertilizers, Organic Matter, and Irrigation on Production of Broccoli. (L. M. Ware and W. A. Johnson.) — In a study involving different rates of fertilizer, different kinds of organic matter, and irrigation, yields of broccoli increased with each added practice. The per acre yields of broccoli (flower heads) from different treatments were as follows: no treatment, 154 pounds; 500 pounds per acre of fertilizer, 1,297 pounds; 1,000 pounds per acre of fertilizer, 1,680 pounds; 1,000 pounds of fertilizer plus a legume, 3,492; and 1,000 pounds of fertilizer, a legume, and irrigation, 4,365 pounds. Corresponding yields of the total top were

423, 4,139, 6,287, 15,321, and 19,601 pounds per acre. The legumes consisted of 2 tons of dry lespedeza added in February and 6 tons of green crotalaria applied in August. Irrigation consisted of one inch of water per week if rain did not supply this amount.

Effects of Legume on Nitrogen Requirements of Vegetable Crops. (1) EFFECTS OF SUMMER LEGUMES ON FALL TURNIPS. (L. M. Ware and W. A. Johnson.) — The study has extended over a period of 5 years. Turnips were grown on plots receiving 0, 20, 40, 60, and 80 pounds per acre of nitrogen with and without a summer legume turned under.

By turning the legume, total yield of turnips (tops and roots) over the 5-year period was increased from 10,626 to 27,053 pounds per acre on plots receiving no commercial nitrogen, from 14,281 to 32,021 pounds on plots receiving 20 pounds per acre of nitrogen, and from 29,986 to 36,401 pounds on plots receiving 40 pounds per acre of nitrogen. Yields of plots receiving 60 pounds of nitrogen without a legume was 36,290 and with a legume 38,676 pounds. Plots receiving 80 pounds of nitrogen but without a legume yielded 37,373 pounds per acre and with a legume 38,993 pounds.

(2) EFFECTS OF WINTER LEGUMES ON SWEET CORN. (W. A. Johnson and L. M. Ware.) — Over a 5-year period, the yield of marketable corn was increased from 747 pounds per acre to 5,648 pounds by turning under a winter legume on plots that received no commercial nitrogen. On plots that received 20 pounds of commercial nitrogen, turning under a winter legume increased the yield from 2,095 to 7,533 pounds per acre. Yields were increased from 3,589 to 7,598 and from 5,893 to 7,702 by turning a winter legume on plots receiving 40 to 60 pounds of commercial nitrogen, respectively. The yield was 7,216 pounds without a legume and 6,958 pounds with a legume on plots receiving 80 pounds per acre of commercial nitrogen.

(3) EFFECTS OF SUMMER LEGUMES TURNED UNDER IN FALL ON YIELD OF IRISH POTATOES THE FOLLOWING SPRING. (W. A. Johnson and L. M. Ware.) — Yields of potatoes were measured after an intervening crop of fall turnips was grown.

The total yield and the yield of No. 1 potatoes increased at each higher nitrogen rate from 0 to 80 pounds per acre of commercial nitrogen. There was, however, no significant difference in the yield of potatoes on plots receiving and not receiving a turned-under crop of summer legumes at any rate of nitrogen.

Comparative Study of Tilford Wilt-Resistant and Royal Asters in the Cloth House. (Henry P. Orr.) — Fusarium wilt causes failure of many aster plantings unless the planting site is selected in an area where asters have not been previously grown or when the soil is sterilized or wilt resistant varieties are used. The latter method of control would be the most economical.

In a comparative study in 1948 of the Tilford wilt-resistant asters and the Royal asters under cloth house conditions at the Main Station, Auburn, the Tilford varieties were 46 per cent susceptible to fusarium wilt, whereas the Royal varieties were 5 per cent susceptible.

The remaining plants of the Tilford varieties produced more salable flowers per plant than the non-wilt resistant types.

Effects of Short-day Treatment on Several Varieties of Chrysanthemum in Cloth House. (William S. Wise.) — By reducing the day-length to a 10-hour day from August 5 until the buds showed color, 15 varieties of chrysanthemums flowered an average of 24 days earlier than an untreated plot. In the reduced-day length plots, the pompoms produced practically all terminal bud formations. In the check plot the pompoms produced practically all crown bud formations.

Effects of Methods of Peeling and Processing on Color of Sweetpotatoes. (Hubert Harris.) — A study was made to determine the cause of discoloration in canned sweetpotatoes. Treatments included peeling by the lye-bath and the steam pressure methods; solid pack and syrup pack; processing at 240° F. for 115 minutes and at 250° F. for 90 minutes; and packing immediately and leaving exposed 1 hour before canning.

All steam-peeled lots were of good color, including those canned immediately and those left exposed for 1 hour. Lye peeling resulted in some discoloration when packed immediately and in considerable discoloration when left exposed 1 hour. Discoloration following a lye dip was attributed to the effect of the alkaline bath. Quick handling after peeling and processing reduced discoloration. It would appear that an acid wash will be necessary following the lye dip if discoloration is to be prevented. The higher processing temperature gave a little better flavor with solid pack, but the lower processing temperature was better with syrup pack.

Suitability of Alabama-Grown Irish Potatoes for Potato Chips and Effect of Length and Temperature of Storage of the Tubers on Quality of Chips. (L. M. Ware, Mildred S. Van de Mark, and Hubert Harris.) — Tests conducted on five varieties of Irish potatoes stored for different periods at four different temperatures showed marked differences in the suitability of different varieties of Alabama-grown potatoes for chip manufacture, and in the length of time high-quality chips could be made from tubers stored at different temperatures.

The sugar content of tubers stored at 37° and 44° F. increased rapidly; chips made from these tubers were brown in color and low in quality.

The best chips at all temperatures for the longest period were produced from the Sebago variety. The Chippewa variety was second, the Irish Cobbler and the Katahdin varieties were third, and the Triumph variety was poorest in the quality of chips produced.

Chips from the Sebago variety were good in color and flavor for 30 days at all temperatures. By the 46th day, a brown color and a bitter taste had developed at a storage temperature of 37° F.

Chips made from the Chippewa variety were light in color and of good flavor for a period of 46 days at storage temperatures of 54° and 78° F. and of fair quality with medium brown color at storage temperatures of 44° F. for 46 days. They had developed a bitter taste by the 19th day at a storage temperature of 37° F.

Chips from Katahdin and Irish Cobbler varieties began to develop a dark color and a bitter taste by the 19th day at storage temperatures of 54° or below.

Chips made from the Triumph variety were bitter and discolored at the end of 12 days at storage temperature of 44° F. or lower.

The quality of chips made from tubers transferred from low storage temperatures to high temperatures were not as high as those made from potatoes that had been stored continuously at high temperatures.

New Products made from Irish Potatoes. (L. M. Ware and Mildred S. Van de Mark.) — A number of new products have been made from Irish potatoes by essentially the same process developed for the preparation of new sweetpotato products. The process as adapted to the Irish potato consists of boiling, peeling,

and pulping the potato, extruding the puree on trays, and toasting at carefully controlled temperatures until crisp.

By adding other ingredients, two types of products have been prepared. One type consisted of salted products, the other type of candies.

Four very satisfactory salted products were made. They were a peppered Irish potato crisp, a potato cheese straw, a potato-pimiento-cheese straw, and a peanut straw or crisp.

Of the salted products, one of the best was a peppered Irish potato crisp. This product was prepared in the form of a thin wafer. It was tender and crisp and left a satisfying "after taste" in the mouth. The taste appeal and the texture of this product was rated very good.

The Irish potato-pimiento-cheese straw was rated very good in quality and had a very attractive color. It was generally felt, however, that the added cost of the pimiento was hardly justified.

A number of candies were made with the Irish potato used as a base. Two of these were rated good to very good. One of the best candies was made of Irish potatoes, coconut, and sugar. It was extruded in the form of a ribbon. The product was crisp and of very good quality. Another candy product made of Irish potatoes, peanut butter, and sugar, was rated good.

Effects of Different Sources of Nitrogen on Soil Acidity and Yields of Index Truck Crops. (W. A. Johnson and L. M. Ware.) — This experiment was conducted in field bins. The soil was a Chesterfield sandy loam. Four different sources of nitrogen were used. Other treatments consisted of adding limestone to the soil to effect different degrees of lime saturation and to the fertilizers to effect different degrees of neutralization of the potential acidity developed by the added nitrogen materials. The soil in all bins was composited and treatments were replicated four times. The materials were nitrate of soda, uramon, ammonium sulphate, and calcium cyanamid.

The pH of the soil at the start of the experiment was 6.20. Mustard has been grown as a fall crop and lettuce as a spring crop. An application of 80 pounds per acre of nitrogen (N) has been added annually.

Repeated applications of acid-forming fertilizers developed within a few years enough acidity to reduce the yield of both lettuce and mustard. With ammonium sulphate, yields began to drop by the 2nd and 3rd years. By the 4th year yields from ammonium sulphate were low.

Addition of lime to the fertilizer, to the soil, or to both prevented development of excessive acidity in plots receiving acid-forming fertilizers and resulted in good crop yields.

Nitrate of soda or combinations of nitrate of soda and ammonium sulphate produced the highest yields of mustard the 6th year. Good yields of lettuce were obtained from applications of ammonium sulphate with lime additions.

The two highest yields of head lettuce the 6th year came from the use of calcium cyanamid and from nitrate of soda with the addition of lime to the soil.

The highest yields of leaf lettuce the 6th year were obtained from the use of ammonium sulphate with full neutralization of the potential acidity of the fertilizer plus lime to the soil to effect 60 to 100 per cent calcium saturation.

By the 6th year plots receiving ammonium sulphate without lime added to the soil or to the fertilizer had a pH of 4.53. The pH of the soil was 5.66 in plots that received ammonium sulphate with lime added only to the fertilizer to effect complete neutralization. By the 6th year the pH of the soil was 5.82 in plots receiving limestone to effect 100 per cent calcium saturation of the soil and 100 per cent neutralization of the acidity of the fertilizer. Plots receiving nitrate of soda had a pH of 6.14 and those receiving calcium cyanamid 6.68.

Laboratory Tests with Muscadine Grapes. (T. B. Hagler.) — Fruit from 15 varieties and selections was tested in the laboratory to determine the quality and size of muscadine grapes.

One-pound samples of grapes, as nearly uniform in maturity as possible, were selected from field samples. The number of fruit per pound was recorded. The grapes were crushed by hand, and the juice was strained through several thicknesses of cheese cloth. A 50-cc. sample of juice was used for each test.

Refractive index was determined by the use of a hand refractometer capable of reading total dissolved solids according to the International Sugar Scale of 1936.

Electrical resistance was determined by the use of the Wheatstone Bridge.

The pH was determined by the Beckman's pH meter, and the acidity was determined by diluting 10 cc. and neutralizing with 1/10 N NaOH. Phenolphthalein was used as an indicator.

Results of the tests on each variety are recorded in Table 5.

TABLE 5. — CHARACTERISTICS OF MUSCADINE VARIETIES, MAIN STATION, 1948

Variety	Acidity[1]	pH	Electric resistance	Per cent solids in solution	Berries per pound	Date tested
Dulcet	3.9	3.40	253	19.30	159	9/ 6/47
Howard	3.5	3.35	275	16.85	69	9/ 6/47
Hunt	5.1	3.33	182	16.90	116	9/ 6/47
Dawn	4.1	3.30	272	17.90	92	9/ 6/47
Thomas	4.0	3.20	272	18.90	151	9/ 6/47
Scott	3.4	3.28	281	16.10	88	9/ 8/47
Scuppernong	6.7	3.05	203	16.30	99	9/ 8/47
Tarheel	8.6	2.98	150	15.60	244	9/ 8/47
Spalding	7.3	3.00	153	15.10	108	9/ 8/47
Ala. No. 193	5.6	3.08	225	14.65	56	9/18/47
Ala. No. 166	4.7	3.08	293	14.20	80	9/18/47
Ala. No. 125	3.9	3.21	263	15.70	63	9/18/47
San Alba	4.3	3.40	250	16.40	142	10/ 1/47
Yuga	5.6	3.40	241	19.00	170	10/ 1/47
Creek	8.3	3.30	201	18.20	201	10/ 1/47

[1] Number of cc. of 1/10 N. NaOH to neutralize 10 cc. juice. Phenolphthalein used as indicator (3 drops).

Comparison of Harvesting Methods for Muscadine Grapes and Characteristics of Varieties. (T. B. Hagler.) — One of the largest costs in muscadine grape production is that of harvesting the fruit. Preliminary tests were conducted in 1947 to determine the cost of "shaking" or "jarring" compared to hand picking.

Two sheets approximately 8 by 20 feet were used to catch the grapes. They were placed (one on each side) parallel to the trellis, covering the ground under the vine. Four men were used to handle the sheets, two on each side of the vine. Each of the arms or canes of the vine was shaken with a quick jerk. The amount of shaking necessary varied with the variety, Table 6. Heavy trash was removed from the sheets by hand, and the grapes were poured into bushel baskets.

TABLE 6. — SHAKING TESTS ON MUSCADINE GRAPES, MAIN STATION, 1947

Variety	Average time required per vine	Ease of separation of berries	Amount of bleeding
	Minutes		
Howard	8	Easy	Slight
Scott	8	Easy	Slight
Hunt	8	Easy	Slight
Thomas	10	Difficult	Slight
Spalding	10	Difficult	Very bad
Dulcet	12	Very difficult	Slight
Dawn	10	Difficult	Very little
Creek	10	Difficult	Very bad

Approximately, 143 man-hours per ton were required for hand harvesting, whereas only 35.7 man-hours per ton were required for harvesting by shaking. Cost per ton at present farm prices for labor (35 cents per hour) would be $50.05 and $12.49, respectively, for the two methods. Average yield per vine in the shaking tests was about 40 pounds.

Since there would be no material difference in the time required to harvest the crop with an 80-pound yield or a 40-pound yield per vine, the cost of harvesting by shaking could be reduced to about $6 to $7 per ton for high-producing vineyards.

Effects of Extra Straw and Extra Nitrogen on Yield of Crops and Available Nitrogen in Garden Soils. (L. M. Ware and W. A. Johnson.) — Field bin studies over a period of 9 years have provided evidence to show that extra amounts of straw in excess of that generally supplied with manures did not reduce materially nitrates available for plant growth. Furthermore, the extra nitrogen added to the soil to offset that supposedly "locked up" by increased bacterial activity resulted in greater yields.

During the last 4 years of the experiment, the average yield of lettuce from plots getting 4 extra tons of dry straw but no extra nitrogen was 1,945 pounds per acre more than the yield of plots receiving no extra straw or extra nitrogen. Four extra tons of straw plus 80 pounds per acre of extra nitrogen increased the yield 3,335 pounds per acre over the no extra-straw or extra-nitrogen plots.

Average yield of mustard during the last 4 years of the experiment from 4 extra tons of dry straw but no extra nitrogen was 4,317 pounds per acre and from 4 tons of extra straw plus 80 pounds per acre of nitrogen 8,423 pounds per acre more than plots receiving no extra straw or extra nitrogen.

Endive Studies. (C. L. Isbell.) — To compare the growth habits, winter hardiness, and reseeding possibilities of different varieties of endive, small plantings of seed of six varieties were made October 1, November 1, and December 1, 1945.

Results from these plantings and from their volunteer reseedings through 1947 indicate the following:

1. The White Curled variety grew slowly and produced weak plants as compared with the other varieties. The green varieties, Large Curled and Green Curled which are quite similar, grew well.

2. The green thick leaved varieties, Broadleaf, Deep Heart,

and Cos, grew very well, with leaves of the Cos growing more upright than the others.

3. Plants from October seeding started to grow well by December 31, but were not large enough for table use. Later plantings had made very little growth by this date.

4. All varieties survived winter with comparatively little cold injury.

5. Plants from reseedings began to come up freely in late July and August and were large enough for table use in early fall.

POULTRY HUSBANDRY

Decreasing Adult Mortality in the Domestic Fowl by Breeding. (D. F. King and G. J. Cottier.) — Since 1935 there has had underway at this Station a project designed to develop a strain of single comb White Leghorns that would be capable of resisting diseases. The adult mortality of the pullets housed each year from 1935 to 1947 was: 89, 91, 54, 48, 27, 41, 32, 47, 39, 32, 22, and 18 per cent. Variations from year to year were partly due to different degrees of exposure.

Performance tests were carried on in 1946 and 1947 to compare the Auburn Strain with five other strains of White Leghorns being produced in the State. Each year chicks from these breeders were mixed with chicks of 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 produced eggs as early or earlier than any of the five tested strains in both 1946 and 1947.

2. It was superior in egg weight to four of the five strains in 1946. Although eggs of the Auburn Strain weighed over 24 ounces per dozen in 1947, they were slightly smaller than the other five strains tested.

3. The Auburn Strain ranked second from standpoint of low growing mortality in 1946, fourth in 1947, and ranked first by a considerable margin in low adult mortality for both years.

4. It produced more eggs per hen than any of the other strains tested both in 1946 and 1947.

Effect of Mosquitoes on Poultry. (S. A. Edgar and O. M. Williams.) — Surveys made at the Station's poultry farm and at numerous other farms throughout the State during 1947 and 1948

revealed that the common pest mospuito, *Culex quinquefasciatus*, has a high preference for the blood of the domestic fowl, *Gallus domesticus*. This species comprised over 99 per cent of the mosquitoes seen or collected in or near chicken houses. Determination revealed that blood meals of over 97 per cent of the engorged females collected in chicken houses and 90 per cent of those collected from other farm buildings were of avian blood. On general farms this species was found most often in chicken houses rather than adjacent stock barns. Evidence was also gathered indicating that this mosquito may cause a loss in egg production during the peak of the mosquito season (September, October, and early November), and is capable of transmitting fowl pox and fowl cholera.

Green Feed as a Supplement to Grain for Laying Hens. (J. G. Goodman.) — Green forage crops were used as a substitute for three-fourths of the laying mash that is normally consumed by layers when the mash-grain feeding system is used.

In a 2 year test, 1947-1948, egg production from such green crops as alfalfa, crimson clover, soybeans, or irrigated white Dutch clover was as good as that from hens fed a full ration of mash and grain without green feed. Similar results were obtained from green crops whether grazed or cut and fed daily. Good leafy-quality, artificially-cured alfalfa hay was as satisfactory as succulent green crops.

In 1948 non-irrigated white Dutch clover did not give as good egg production as irrigated clover. Non-irrigated white clover was not grazed in 1947 because of insufficient growth.

Hens grazing rape and sudan grass did not lay as many eggs as hens fed a full ration. Eggs laid by these hens were observed to be lower in market quality. Olive-green yolks were obtained in 43 per cent of the eggs from hens grazed on these two crops.

Grazing periods of alfalfa and a combination of crimson clover and soybeans were 5 to 8 months, while white Dutch clover periods were only half as long.

Artificially cured alfalfa hay or succulent green crops fed in the ration as a partial substitute for laying mash saved 40 to 50 per cent of the feed costs per dozen eggs produced.

All birds were vigorous and of good body weight at the end of each year. No detrimental effects were observed when the rations of the hens were changed from a green-feed schedule to full mash feeding.

Breeding and Immunizing Chickens for Resistance to Coccidiosis. (1) BREEDING. (D. F. King, S. A. Edgar, and L. W. Johnson.) — First generation offspring of parents selected as being resistant to cecal coccidiosis showed a 10 per cent greater livability when exposed to the disease than offspring from unselected parents. The resistant offspring also showed a greater rate of growth for a 14-day period following infection than the offspring from unselected stock. This is further evidence of greater genetic resistance, since decreased rate of growth is concurrent with coccidiosis infection.

(2) ARTIFICIAL IMMUNIZATION. (D. F. King, S. A. Edgar, and L. W. Johnson.) — Laboratory tests indicate that chicks may be immunized against coccidiosis without excessive losses. Four-day old chicks were infected by feeding mash moistened with a dilute culture of oocysts of *Eimeria tenella,* and successive cycles of the disease were controlled by stirring the litter or feeding sulfa-drugs. Chicks so treated had a mortality of 6 to 11 per cent from all causes up to 30 days of age, and were 99 per cent immune to a lethal dose of cecal coccidiosis when 1 month old.

Raising Broilers on Used Litter. (G. J. Cottier.) — Five pens of broilers were raised on clean litter and another five pens were raised on dirty litter. Broilers grown out on clean litter were slightly heavier at 10 to 11 weeks of age and were less infested with large round worms in the intestines than broilers produced on dirty litter. Average *Ascaridia galli* count per broiler was 1.1 and 31.7, respectively.

Another test was conducted using the same litter for a third time in the broiler house for one pen. As a control, a pen of broilers was raised on clean litter. Average number of ascarids in the intestines was 132.7 per bird in the dirty-litter pen as compared to 0.1 per broiler in the pen started on clean litter. In one 10-week-old broiler, 346 worms were counted, 239 of which were mature ascarids.

Egg Marketing with Special Emphasis on the Handling of Seasonal Surpluses. (D. F. King and R. F. Scofield cooperating with Department of Agricultural Economics.) — Results of experiments with storing seasonal surplus eggs by freezing in local quick freezing plants show that keeping the bacterial count low with a minimum of equipment is possible. Eggs frozen at 10 degrees below zero had a lower bacterial count than eggs frozen at 0 or

10 degrees above zero. Dirty eggs resulted in a frozen product of much higher bacterial count than clean eggs, especially when the eggs were frozen at 10 degrees above zero. It was also found that eggs frozen in small containers had lower bacterial counts than those frozen in larger containers. High quality frozen eggs were obtained with inexpensive equipment when clean eggs, small containers, and low temperatures were used.

Survey of Parasites of Alabama Chickens. (S. A. Edgar.) — A total of 221 chickens of various ages and breeds, a few turkeys and one peafowl, were examined during 1948. These birds came from 52 different farm flocks from widely scattered points over the State. Parasites found included nematodes, cestodes, protozoa, and ectoparasites, or a total of 49 species in all; 40 of these were from the chicken alone.

ZOOLOGY-ENTOMOLOGY

Control of Cotton Insects. (F. S. Arant.) — Replicated small-plot and field-scale dusting experiments were done for control of the boll weevil, *Anthonomous grandis* (Boh.), and the associated cotton pests, bollworm, *Heliothis armigera* (Hbn.), and cotton aphid, *Aphis gossypii* (Glov.). Heavy infestation of all three species occurred in 1947. During 1948 infestations were light.

Effective control of boll weevil resulted from the use of calcium arsenate alone or with nicotine, benzene hexachloride (BHC) alone or with DDT (3 per cent gamma — 5 per cent DDT), and 20 per cent toxaphene. Five and 10 per cent chlordane and 10 per cent toxaphene were less effective; 2 per cent parathion was ineffective against boll weevil.

Excellent control of bollworm resulted from the use of toxaphene and BHC-DDT, 3-5 mixture. Other dusts were less effective; more bollworm damage occurred on plots dusted with parathion, BHC (without DDT), and 5 to 10 per cent chlordane than on undusted plots.

Parathion, and BHC alone or with DDT gave excellent control of cotton aphids. Toxaphene dust and applications of calcium arsenate alternated with either BHC-DDT mixture or calcium arsenate containing 2 per cent nicotine resulted in satisfactory suppression of cotton aphids. Serious aphid damage developed on plots dusted with calcium arsenate without nicotine.

Three dusting treatments were found suitable for general use and have been recommended to farmers. These treatments are:

(1) 20 per cent toxaphene; (2) BHC-DDT mixture (3 per cent gamma – 5 per cent DDT); and (3) alternate applications of calcium arsenate and calcium arsenate containing 2 per cent nicotine, or alternate applications of calcium arsenate and BHC-DDT 3-5 mixture.

Over a 2-year period, 51 replications of 20 per cent toxaphene resulted in an average gain of 532 pounds of seed cotton per acre over undusted cotton; 26 replications of BHC-DDT, 3-5 mixture, resulted in a gain of 440 pounds per acre; 3 applications of an effective insecticide applied just as the cotton began squaring failed to increase the yield, whereas 5 dustings made while the crop was being set and matured increased the yield of seed cotton 431 pounds per acre in the same experiment.

Laboratory experiments were conducted for control of boll weevil and other major pests of cotton. Benzene hexachloride was much faster in toxic action against boll weevil than any other insecticide tested. Its residual action was sufficient to cause 100 per cent mortality of weevils placed on dusted cotton exposed 2 days to sunshine and wind. Toxaphene was somewhat slower in action than benzene hexachloride, but its residual action was sufficient to cause a net mortality of 85 per cent to boll weevil adults placed on foliage 4 days after dusting. Chlordane and calcium arsenate were slow in action. The residual effect of calcium arsenate was of the same order as toxaphene, while residual effect of chlordane was shorter than that of benzene hexachloride. The experiment was conducted during a period when maximum daily temperatures did not exceed 92° F.

DDT Residues on Alfalfa. (W. G. Eden and F. S. Arant.) – Experiments were conducted in 1947 to determine DDT residues on alfalfa foliage following application of 3 per cent dust at the rates of 15 and 30 pounds per acre. The foliage was so harvested by hand that all leaves were retained during curing. DDT was present in significant amounts on all foliage 40 days after dusting. The lowest residue of 10 p.p.m. occurred on alfalfa dusted once with 3 per cent dust at the rate of 15 pounds per acre.

Hemocytes of the Common Yellow Mealworm. (Jack Colvard Jones and F. S. Arant.) – The hemocytes of the common yellow mealworm, *Tenebrio molitor* (Linnaeus) were studied with regard to the following points: (1) cell shape and size, (2) nuclear-cytoplasmic dimensions, (3) structure of the cytoplasm, (4) type and degree of cytoplasmic granulation, and (5) number of cytoplas-

mic cysts. As a result of this study, the hemocytes were divided into eight classes and 23 types. Differential counts were made of the different classes of cells in an effort to establish a normal blood picture of the insect.

Influence of Nitrogen on the Susceptibility and Resistance of Certain Plants to Injury by Insects. (Calvin M. Jones and Gerald W. Naylor.) — A study was made on the relation of aphid population to fertilizer treatment on oats. There were more aphids, *Toxoptera graminum* (Rondani), per unit of leaf surface on plants grown in soil without added nitrogen than at higher levels of this nutrient. The number of aphids decreased as the rate of nitrogen was increased. These population differences were more pronounced where no lime was applied.

Preliminary data on the aphid, *Myzus persicae* (Sulzer), infesting turnips showed no marked differences that can be correlated with fertilizer treatments.

Control of Peanut Insects. (F. S. Arant.) — DDT and toxaphene dusts were effective in control of thrips, *Frankliniella fusca* (Hinds), and leafhopper, *Empoasca fabae* (Harr.), on peanuts. Gains in yield resulting from thrips control were not consistent. Yield increase of Spanish peanuts resulting from four applications of dust for leafhopper control ranged from 182 to 316 pounds per acre. On runners the gains varied from 220 to 705 pounds of peanuts per acre. Where sulfur-copper dust was applied with the insecticide, dusted runner peanuts yielded 369 to 1,589 pounds per acre more than undusted areas. Based on these experiments, it is recommended that four dustings with 2½ per cent DDT or 10 per cent toxaphene be made at 10-day intervals for control of leafhopper. The last dust should be applied one month before harvest. The insecticide should be blended with a mixture containing 3.4 per cent copper and 65 per cent sulfur or with dusting sulfur.

Fall armyworm, *Laphygma frugiperda* (A. & S.), was effectively controlled by the following dusts applied at the rate of 25 pounds per acre: 10 per cent toxaphene, 5 per cent DDT, cryolite, and 1 per cent parathion. Less effective control resulted from the use of 5 per cent toxaphene, 5 per cent methoxychlor, and 2½ per cent DDT.

Velvetbean caterpillar, *Anticarsia gemmatilis* (Hbn.), was satisfactorily controlled by the following dusts applied at the rate of 25 pounds per acre: 1 per cent parathion, 2½ per cent Hyman

118, 5 per cent DDD (TDE), cryolite, 5 per cent toxaphene, and 5 per cent methoxychlor.

Increased yields of peanuts resulting from protecting foliage from fall armyworm and velvetbean caterpillar varied from 453 to 501 pounds per acre.

Control of Insects Attacking Stored Corn. (F. S. Arant and W. G. Eden.) — Experiments were continued in 1947 and 1948 to determine the effectiveness and feasibility of insecticidal dusts in the control of rice weevil, *Sitophilus oryza* (L.), in stored corn.

Benzene hexachloride, pure gamma isomer of benzene hexachloride, DDT, and chlordane were highly effective against the rice weevil in shelled corn. Methoxychlor was somewhat less efficient. Benzene hexachloride containing 2 parts gamma isomer per million parts of corn gave excellent control over a 3-month period; smaller amounts gave good control for shorter periods. Pure gamma isomer at the rate of 1 p.p.m. appeared as effective as 2 p.p.m. of gamma in the mixed isomers, 10 p.p.m. of DDT, 4 to 6 p.p.m. of chlordane, and 40 p.p.m. of methoxychlor over a 3-month period. Basic slag at concentrations up to 2,000 p.p.m., cryolite at 40 p.p.m., and toxaphene at 20 p.p.m. were ineffective. *Magnesia No. 2663* (MgO) at concentrations of 500 and 1,000 p.p.m. was also ineffective in shelled corn at average moisture content of 12.5 and 19 per cent. The higher moisture level greatly decreased the residual action of benzene hexachloride.

Corn in the shuck required much higher dosages of insecticides for control of rice weevil than did shelled corn. Best control in unshucked corn was obtained from the following: DDT, 100 p.p.m., in open metal cans, 67.3 per cent control; pure gamma isomer, 20 p.p.m., in open metal cans, 80.2 per cent; pure gamma isomer, 20 p.p.m., in open fiberboard boxes with perforated walls, 66.7 per cent control. Pure gamma isomer, 20 p.p.m. in shelled corn, was not detrimental to germination over a 5-month period.

Field plot and airplane dusting of corn for weevil control with 1 per cent gamma benzene hexachloride resulted in from 5 to 7 per cent reduction in kernal damage at harvest. Studies on 28 varieties of corn at harvest showed variations from 12.1 per cent damage on Florida W-1 variety to 87.1 per cent on U. S. 13.

Control of Legume Insects. (W. G. Eden.) — Studies in 1948 revealed that at least 13 species of insects were doing economic damage to alfalfa, nine to sericea, and five to kudzu. Five per cent DDT dust gave excellent control of the clover leafhopper,

Aceratagallia sanguinolenta (Prov.); the fall armyworm, *Laphygma frugiperda* (A. & S.); and the tarnished plant bug, *Lygus pratensis* (Say), on alfalfa. Ten per cent toxaphene was nearly as good. The three-cornered alfalfa hopper, *Stictocephala festina* (Stal.), was not effectively controlled by 5 per cent DDT, 10 per cent toxaphene, or 10 per cent sabadilla dusts. Ten per cent DDT and 2 per cent parathion dusts gave excellent control of the striped blister beetle, *Epicauta vitatta* (Fab.), on alfalfa. Twenty per cent toxaphene was not effective.

Farm Ponds. (H. S. Swingle, E. E. Prather and J. M. Lawrence.) — When speckled bullhead catfish fingerlings were added to a pond prior to stocking the pond with bass, the catfish spawned before the bass were large enough to eat the young catfish. As a result, the pond became so overcrowded the first year that neither the bluegills nor the catfish reached edible size.

When fishing was begun in new ponds before the bass had spawned the first time, an unbalanced population usually resulted due to removal of too many bass. When fishing was delayed until bass had spawned the first time, the ponds remained in balance regardless of the amount of fish removed by pole-and-line fishing.

Green sunfish were practically eliminated from a pond within 1 year when they were in combination with largemouth black bass. These fish can maintain themselves for a longer period in a pond with bass if bluegills or some other buffer species is present. However, eventually they are eliminated unless restocking occurs.

The crappie in a bass-bluegill-crappie combination were practically eliminated from a 1-acre pond by 2 years of fishing. Only eight crappie remained when the pond was drained at the end of a 3-year experiment.

A method was developed for reduction of stunted fish populations by partially poisoning the pond with derris. The most effective method was to use one pound of derris (5 per cent rotenone) per 300 feet of shore line. The derris was mixed to a thin paste and applied in a continuous line in the water approximately 15 feet from the bank. This killed large numbers of small stunted fish without killing appreciable numbers of large fish. Several treatments per year, followed by restocking with bass, were necessary to correct unbalanced ponds.

Shad, *Dorosoma cepedianum*, were found to be very detrimental to the production of bluegills and bass in small ponds.

Shad overcrowded such ponds, preventing reproduction of both other species.

The natural mortality of largemouth bass in a pond was found to be 52 per cent during a 3-year period.

Jackfish, *Esox niger*, were able to reproduce in farm ponds. They began to spawn at a temperature below 74° F., and continued producing young in small numbers over a period of several months.

It was found necessary to use 100 bass per acre to balance fertilized ponds containing 1,000 bluegills per acre even when the bluegills were stocked as late as June 27.

Smallmouth bass, *Micropterus dolomieu*, used in a combination with bluegills failed to spawn the second year. They grew slowly even in an overcrowded bluegill population, indicating that they probably fed largely upon insects rather than fish. At the end of 1 year of fishing, it was found that of the original stock of smallmouth 50 per cent had been caught, 40 per cent had died, and 10 per cent remained in the pond.

Stocking ponds with three adult bluegills per acre in the winter followed by 100 bass fry per acre the next spring resulted in unbalanced ponds overcrowded with bluegills during the second year. When no bass fishing was allowed until the third year, the bass were able to balance one pond that contained little cover, but were unable to balance another that contained considerable amounts of cover for bluegills.

Bluegill fingerlings in small concrete pools were fed grain sorghum, cracked corn, cottonseed cake, trout food, white bread, hog supplement, laying mash (pellets), wheat, and a mixed fish food (containing cottonseed meal 35 per cent, soybean meal 35 per cent, and dry skim milk 30 per cent). The foods utilized most efficiently were the following: mixed food – 7.6 pounds required to make 1 pound of gain; laying mash – 7.7 pounds to make 1 pound of gain; cottonseed cake – 8.7 pounds to make 1 pound of gain.

Carp utilized turkey growing mash as a food, making 1 pound of gain for each 3.1 pounds of mash added to the pond.

Bluegills and bass were fed a mixture of cottonseed meal (35 per cent), soybean meal (35 per cent), and dry skim milk (30 per cent). They made 1 pound of gain for each 14 pounds of food added to the pond.

In bass-feeding experiments, the weight of fathead minnows required to produce a pound of bass varied from 1.8 to 8.7

pounds. The 10 bass making the most efficient gains were selected for brood stock for the 1949 experiments.

A total of over 300,000 bait-sized goldfish minnows was produced per acre by feeding and fertilization. The total weight of fish was 1,450 pounds per acre. Figuring only the cost of food and fertilizer used, the cost of producing goldfish in this pond was about 1/28 of a cent per minnow.

The anchor parasite *Lernaea* (sp.), which attacks bait minnows and almost every other species of pond fish, may be eliminated by poisoning the water of infested ponds with 5 per cent rotenone compounds, killing all fish present, draining the ponds, refilling with new water, and restocking with parasite-free fish.

Fathead minnow *Pimephales promelas* (Rafinesque) eggs will not hatch when transferred from brood ponds to rearing ponds unless the guarding male is also transferred to keep the eggs clean and aerated.

Fathead minnows, when transferred from brood ponds to rearing ponds as fry, sustained a 22 per cent mortality. However, those that survived reached bait size within 2 months. The fathead brood pond stocked at the rate of 4,000 adults per acre in a 4-month period produced 131,000 young fatheads that weighed 176 pounds.

In a largemouth black bass-bream combination, where the bream population consisted of 50 per cent bluegills and 50 per cent shellcrackers, the bluegills comprised 65 to 75 per cent of the total catch of bream.

In a largemouth black bass-bluegill-black crappie combination stocked with 100 crappie fingerlings per acre prior to stocking with bass, a 1.3 acre pond produced a total of 481.7 pounds of fish per acre when drained at the end of 2 years. Total production of edible-sized fish was 95.6 pounds per acre. Bluegills caught in this pond during its second summer averaged 0.1 pound in weight. The small size of the bluegills was caused by competition between bluegills and small crappie.

Freshwater mussels *Lampsilis claibornensis* (Lea.) in excess of 1,000 pounds per acre were produced in a 2-acre fertilized pond 6 years after stocking; there was no apparent effect on fish production. Results of other experiments have indicated that a like poundage can be grown in 1 year in a fertilized pond.

Sprays of various 2,4-D formulations successfully controlled several species of emergent weeds including arrowhead, cattail,

needlerush, and knotgrass. From one to three applications of a 0.25 per cent 2,4-D solution (butyl ester form) were necessary for control of most emergent pond weeds. However, the ester forms of 2,4-D were found to be rather toxic to both bass and bluegills. Practically complete mortality of bluegills resulted when ponds were refilled and stocked one day after the bottoms were sprayed with a 1 per cent water solution of 2,4-D in the butyl ester form applied at a rate of 400 gallons per acre. Also, indications were that in fertilized ponds, the use of the above mentioned amount of 2,4-D, either in the salt or ester form, reduced the weight of fish produced by about 60 pounds per acre. Bottom sprays of 2,4-D were ineffective in controlling several species of submerged weeds, such as Najas, fine-leaf Potamogeton, cabomba, and coontail. They materially aided in control of water grass, *Hydrochloa carolinensis*, when applied to the pond bottom at a rate of 300 to 400 gallons per acre of a 0.25 per cent solution of 2,4-D (butyl ester form). The latter treatment was not lethal to fish when an interval of 5 to 7 days elapsed between application of the treatment and restocking the refilled ponds.

In preliminary tests indications were that DDT emulsifiable solutions in concentrations greater than 0.01 p.p.m. were toxic to small bluegills and adult largemouth black bass.

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No. 254 Management of Farm Fish Ponds. H. S. SWINGLE AND E. V. SMITH, (Revised) 1947.

No. 260 Farm Power and Equipment Costs in Northern Alabama. BEN T. LANHAM, JR. 1947.

No. 261 Types of Houses for Laying Hens. D. F. KING, S. E. GISSENDANNER, AND R. C. CHRISTOPHER. 1947.

No. 262 Fruit and Vegetable Concentration Markets in North Carolina, South Carolina, Georgia, and Alabama. 1947.

No. 263 Effects of Some Environmental Factors on the Seed and Lint of Cotton. D. G. STURKIE. 1947.

No. 264 Experiments on Pond Fertilization. H. S. SWINGLE. 1947.

No. 265 Cost of Producing Fluid Milk in Alabama. J. HOMER BLACKSTONE. 1948.

No. 266 Improved Pastures and Grazing Crops for Increased Vitamin A Content of Milk and Butter. C. J. KOEHN AND W. D. SALMON. 1948.

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No. 94 Occurrence of Little Leaf Disease of Pine and Its Effects on Forestry in Alabama. W. R. BOGGESS AND R. R. NEWMAN. 1947.

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No. 23 Seed Treatment for Peanuts. COYT WILSON. 1947.

No. 24 New Dusts for Cotton Insect Control. F. S. ARANT AND W. A. RUFFIN. 1948.

No. 25 Effects of Time of Planting and Digging on Yield and Grade of Sweetpotatoes in Southern Alabama. T. P. WHITTEN. 1948.

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No. 30 Green Feed as a Substitute for Laying Mash for Hens. D. F. KING. 1947.

No. 31 Time of Planting Cotton in Alabama. W. T. WILLIAMSON. 1947.

No. 32 Studies of the Control of Peanut Leafspot. J. P. WILSON AND COYT WILSON. 1947.

No. 33 Determining Cost of Tractor and Machinery Use. BEN T. LANHAM. 1947.

No. 34 Grain Sorghum Production in Alabama. D. G. STURKIE AND T. H. ROGERS. 1947.

No. 35 Alabama Farm Flock Laying Houses. D. F. KING. 1947.

No. 36 White Dutch Clover-Dallis Grass Pasture for the Gulf Coast Area of Alabama. OTTO BROWN AND HAROLD F. YATES. 1947.

No. 37 Milk Production from a Year Around Feed and Forage Cropping System in the Piedmont and Upper Coastal Plain Areas. J. C. GRIMES, D. G. STURKIE AND A. H. QUINN. 1947.

No. 38 Comparative Performance of the Auburn Strain of White Leghorn. D. F. KING AND G. J. COTTIER. 1948.

No. 39 Size and Shape of Plots and Distribution of Plot Yield for Field Experiments with Peanuts. T. A. BANCROFT, COYT WILSON, AND J. P. WILSON. 1948.

No. 40 How to Establish Stands of Crimson Clover - Sericea Combination for Grazing in the Tennessee Valley. FRED STEWART. 1948.

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Officers and Staff

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Alabama Polytechnic Institute

December 31, 1948

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R. W. ENGEL, Ph.D. — *Animal Nutritionist*
E. L. HOVE, Ph.D. — *Animal Nutritionist*
W. D. SALMON, M.A. — *Animal Nutritionist*
D. H. COPELAND, B.S. — *Associate Animal Nutritionist*
H. E. SAUBERLICH, Ph.D. — *Associate Animal Nutritionist*
A. E. SCHAEFER, Ph.D. — *Associate Animal Nutritionist*
H. J. SMITH, Ph.D. — *Assistant Animal Breeder*

Botany and Plant Pathology

J. L. SEAL, Ph.D. — *Head of Department*
COYT WILSON, Ph.D. — *Plant Pathologist*
H. E. BREWER, Ph.D. — *Associate Botanist*
J. A. LYLE, M.S. — *Assistant Plant Pathologist*

Dairy Husbandry

K. M. AUTREY, Ph.D. — *Head of Department*
W. E. ALSTON, B.S. — *Dairy Husbandman*
W. B. PRATHER, B.S. — *Assistant Dairy Husbandman*

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* Leave of absence

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T. D. Stevens, Ph.D. — *Head of Department*
F. H. Vogel, M.S. — *Forester*
H. E. Christen, M.F. — *Associate Forester*
Wilbur DeVall, M.S. — *Associate Forester*
Henry Dorr, Jr., M.S. — *Associate Forester*
G. I. Garin, Ph.D. — *Associate Forester*
F. F. Smith, M.F., M.A. — *Associate Forester*
J. F. Goggans, M.F. — *Assistant Forester*
C. W. Leach, M.F. — *Assistant Forester*
K. W. Livingston, M.F. — *Assistant in Forestry*
W. W. Gaskins, M.S.F. — *Assistant in Forestry*

Home Economics

Florence Pearl Davis, M.S. — *Associate Home Economist*

Horticulture

L. M. Ware, M.S. — *Head of Department*
Walter Greenleaf, Ph.D. — *Vegetable Breeder*
C. L. Isbell, Ph.D. — *Horticulturist*
Hubert Harris, M.S. — *Associate Horticulturist*
*T. B. Hagler, M.S. — *Assistant Horticulturist*
H. P. Orr, M.S. — *Assistant Horticulturist*
T. P. Whitten, M.S. — *Assistant Horticulturist*
Frank Garrett — *Part-Time Assistant in Horticulture*
W. A. Johnson, M.S. — *Laboratory Technician*
W. S. Wise, B.S. — *Greenhouse Manager*

Poultry Husbandry

D. F. King, M.S. — *Head of Department*
G. J. Cottier, M.S., D.V.M. — *Associate Poultry Husbandman*
*S. A. Edgar, Ph.D. — *Associate Poultry Pathologist*
J. G. Goodman, M.S. — *Associate Poultry Husbandman*
*G. R. Ingram, B.S. — *Assistant Poultry Husbandman*

Publications

K. B. Roy, B.J. — *Head of Department*
J. O. Cooper, B.S. — *Assistant Agricultural Editor*

Zoology-Entomology

J. M. Robinson, M.A. — *Head of Department*
F. S. Arant, Ph.D. — *Entomologist*

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* Leave of absence

H. S. SWINGLE, M.S. ..... *Fish Culturist*
J. S. DENDY, Ph.D. ..... *Associate Zoologist*
J. M. LAWRENCE, M.S. ..... *Assistant Fish Culturist*
E. E. PRATHER, M.S. ..... *Assistant Fish Culturist*
W. G. EDEN, M.S. ..... *Assistant Entomologist*
A. L. BLACK ..... *Superintendent of Ponds*

Substations

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K. G. BAKER, B.S. ..... *Superintendent*
W. B. KELLEY ..... *Assistant Superintendent*

CHILTON AREA HORTICULTURE, Clanton, Chilton County

C. C. CARLTON, B.S. ..... *Superintendent*

GULF COAST, Fairhope, Baldwin County

OTTO BROWN, M.S. ..... *Superintendent*
J. E. BARRETT, JR., B.S. ..... *Assistant Superintendent*
HAROLD YATES, B.S. ..... *Assistant Superintendent*

NORTH ALABAMA HORTICULTURE, Cullman, Cullman County

T. S. MORROW, B.S. ..... *Superintendent*

PIEDMONT, Camp Hill, Tallapoosa County

E. L. MAYTON, M.S. ..... *Superintendent*

SAND MOUNTAIN, Crossville, DeKalb County

S. E. GISSENDANNER, B.S. ..... *Superintendent*
W. S. KIRKSEY, B.S. ..... *Assistant Superintendent*

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FRED STEWART, B.S. ..... *Superintendent*
J. K. BOSECK, B.S. ..... *Assistant Superintendent*
C. H. JOHNSTON, B.S. ..... *Assistant Superintendent*

UPPER COASTAL PLAIN, Winfield, Fayette County

W. W. COTNEY, B.S. ..... *Superintendent*
T. S. BRYARS, B.S. ..... *Assistant Superintendent*

WIREGRASS, Headland, Henry County

J. P. WILSON, B.S. ..... *Superintendent*
C. A. BROGDEN, B.S. ..... *Assistant Superintendent*
J. G. STARLING, B.S. ..... *Assistant Superintendent*

CHANGES in STATION STAFF

1947 Appointments

K. M. AUTREY, Ph.D.—*Head, Department of Dairy Husbandry*
F. L. DAVIS, Ph.D.—*Soil Chemist*
J. S. DENDY, Ph.D.—*Associate Zoologist*
J. F. GOGGANS, M.F.—*Assistant Forester*
W. H. GREENLEAF, Ph.D.—*Vegetable Breeder*
C. W. LEACH, M.F.—*Assistant Forester*
J. A. LYLE, M.S.—*Assistant Plant Pathologist*
H. P. ORR, M.S.—*Assistant Horticulturist*
J. P. RIDGEWAY—*Superintendent of Ponds*
A. E. ROYER, M.S.—*Assistant Soil Chemist*
A. E. SCHAEFER, Ph.D.—*Associate Animal Nutritionist*
J. M. SCHOLL, Ph.D.—*Associate Agronomist*
J. F. SEGREST, JR., B.S.—*Assistant Agronomist*
H. J. SMITH, Ph.D.—*Assistant Animal Breeder*
T. D. STEVENS, Ph.D.—*Head, Department of Forestry*
C. M. STOKES, M.S.—*Associate Agricultural Engineer*
S. W. WILLIAMS, Ph.D.—*Associate Agricultural Economist*

1947 Resignations

W. R. BOGGESS, M.F.—*Associate Forester*
F. E. JOHNSTONE, Ph.D.—*Vegetable Breeder*
C. J. KOEHN, Ph.D.—*Animal Nutritionist*
J. W. MCLENDON, B.S.—*Assistant Superintendent, Piedmont Substation*
E. W. MCELWEE, M.S.—*Horticulturist*
J. P. RIDGEWAY—*Superintendent of Ponds*
W. C. SHERMAN, Ph.D.—*Animal Nutritionist*
J. W. WEBB, M.S.—*Superintendent of Ponds*
R. H. WESTVELD, Ph.D.—*Head, Department of Forestry*

1948 Appointments

J. E. BARRETT, JR., B.S.—*Asst. Supt., Gulf Coast Substation*
A. L. BLACK—*Superintendent of Ponds*
T. S. BRYARS, B.S.—*Asst. Supt., Upper Coastal Plain Substation*
J. L. BUTT, B.S.—*Assistant Agricultural Engineer*
C. C. CARLTON, B.S.—*Supt., Chilton Area Horticulture Substation*
J. O. COOPER, B.S.—*Assistant Agricultural Editor*
T. E. CORLEY, B.S.—*Assistant Agricultural Engineer*
FLORENCE P. DAVIS, M.S.—*Associate Home Economist*
HENRY DORR, JR., M.S.—*Associate Forester*
W. G. EDEN, M.S.—*Assistant Entomologist*
G. I. GARIN, Ph.D.—*Associate Forester*
W. W. GASKINS, M.S.F.—*Assistant in Forestry*
E. L. HOVE, Ph.D.—*Animal Nutritionist*

C. H. JOHNSTON, B.S.—*Asst. Supt., Tennessee Valley Substation*
W. S. KIRKSEY, B.S.—*Asst. Supt., Sand Mountain Substation*
K. W. LIVINGSTON, M.F.—*Assistant in Forestry*
T. S. MORROW, B.S.—*Supt., North Alabama Horticulture Substation*
W. B. PRATHER, B.S.—*Assistant Dairy Husbandman*
R. W. ROBINSON, B.S.—*Assistant Agricultural Economist*
H. E. SAUBERLICH, Ph.D.—*Associate Animal Nutritionist*
J. G. STARLING, B.S.—*Asst. Supt., Wiregrass Substation*
J. G. THOMAS, JR., M.S.—*Assistant Agricultural Economist*
F. H. VOGEL, M.S.—*Forester*
W. S. WISE, B.S.—*Greenhouse Manager*

1948 Resignations

B. W. APPLETON, B.S.—*Asst. Supt., Sand Mountain Substation*
W. V. CHANDLER, M.S.—*Assistant Soil Chemist*
A. E. CULLISON, M.S.—*Animal Husbandman*
R. R. NEWMAN—*Assistant in Forestry*
R. B. POLK, B.S.F.—*Assistant in Forestry*
E. H. STEWART, M.S.—*Assistant Agronomist*
A. G. WILLIAMS, M.S., D.V.M.—*Associate Poultry Husbandman*

FINANCIAL REPORT

Fiscal Year Ended June 30, 1947

	Hatch	Adams	Purnell	Bankhead-Jones	Research & Mktg.	All Other Funds[1]
Balance July 1, 1946	.00	.00	.00	.00		243,191.62
Appropriation	15,000.00	15,000.00	60,000.00	89,423.98		591,984.72
Total	15,000.00	15,000.00	60,000.00	89,423.98		835,176.34
Expenditures						
Personal Services	12,486.14	12,798.62	46,713.84	67,800.28		279,873.74
Travel	154.01	159.00	606.92	1,089.59		16,970.70
Transportation	15.67	34.11	116.46	436.57		4,802.29
Communication	292.57	.76	154.61	131.35		2,559.52
Rents & Utilities		469.17	1,648.47	1,639.65		7,968.35
Printing & Binding	578.51		86.24	893.64		2,407.98
Other Contractual Services	32.95	47.24	406.05	1,621.65		76,029.84
Supplies & Materials	977.55	1,066.15	4,184.68	11,827.78		124,019.46
Equipment	462.60	424.95	6,000.14	3,983.47		46,672.03
Lands & Structures			82.59			40,771.64
Total Expenditures	15,000.00	15,000.00	60,000.00	89,423.98		602,075.55
Balance June 30, 1947	.00	.00	.00	.00		233,100.79
Total	15,000.00	15,000.00	60,000.00	89,423.98		835,176.34

[1] Includes State appropriations, sales, and grant funds exclusive of T. V. A.

Prepared November 12, 1949, A. P. I. Business Office, W. T. Ingram, Business Mgr., By A. C. Pearson, Auditor.

FINANCIAL REPORT

Fiscal Year Ended June 30, 1948

	Hatch	Adams	Purnell	Bankhead-Jones	Research & Mktg.	All Other Funds[1]
Balance July 1, 1947	.00	.00	.00	.00	.00	231,023.89
Appropriation	15,000.00	15,000.00	60,000.00	89,423.99	71,168.78	814,511.79
Total	15,000.00	15,000.00	60,000.00	89,423.99	71,168.78	1,045,535.68
Expenditures						
Personal Services	13,912.02	11,248.22	44,399.36	63,864.31	31,346.35	374,596.47
Travel	43.05	89.35	1,023.95	1,435.50	6,166.12	17,218.58
Transportation	23.09	40.93	176.76	383.36	310.81	6,021.92
Communication	94.67	.16	87.75	83.81	166.40	4,264.33
Rents & Utilities	144.00	410.32	1,641.75	1,596.79	1,201.33	8,872.91
Printing & Binding	50.89		485.27	217.32		1,603.17
Other Contractual Services	27.58	505.40	920.85	4,356.56	1,311.90	36,364.43
Supplies & Materials	543.40	1,789.91	6,883.29	13,618.76	5,282.85	182,372.76
Equipment	161.30	915.71	2,361.51	3,274.18	17,880.96	70,449.65
Lands & Structures			2,019.51	593.40	502.45	32,997.85
Total Expenditures	15,000.00	15,000.00	60,000.00	89,423.99	64,169.17	734,762.07
Balance June 30, 1948	.00	.00	.00	.00	6,999.61	310,773.61
Total	15,000.00	15,000.00	60,000.00	89,423.99	71,168.78	1,045,535.68

[1] Includes State appropriations, sales, and grant funds.

Prepared November 12, 1949, A. P. I. Business Office, W. T. Ingram, Business Mgr., By A. C. Pearson, Auditor.