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AGRICULTURAL ECONOMICS

Economics of Feed Production and Utilization: BARN FEEDING VS. PASTURES AS A SOURCE OF FEED FOR MILK PRODUCTION. (Wade F. Gregory.) — Records of selected Piedmont dairy farms for the 3-year period, October 1948-September 1951, showed the usual relationship of milk production increasing as more feed (TDN) was fed. However, a relationship existed in feeding practices by farm operators that was not expected. As more TDN was fed, not only did the percentage of TDN from grazed forage decrease, but the actual pounds of TDN from pasture (residual) decreased as cows were fed at higher levels. This might have been expected if rates of production had been very high, but production ranged from around 4,000 to about 7,000 pounds of 4 per cent milk, the average of all farms being 5,700 pounds. At these rates, stomach capacity for feed should not have been the limiting factor in determining the amount of feed consumed from grazed forage.

These data do not explain why this relationship existed, but some possible explanations might be that (1) farmers thought "good" cows must be liberally fed at the barn in order to produce at "high" rates; (2) the custom or habit of barn feeding, which was acquired before improved methods of pasture development were generally adopted, still existed; and (3) there was insufficient knowledge and skill by dairymen in the areas of pasture production and farm financing to establish and maintain adequate pasture programs.

Cows on farms where most of the feed was from grazed forage were probably underfed for optimum production, since barn feeding on these farms for the 3-year period (which included

the winter of 1950-51 when no grazing was available) averaged about 1,300 pounds of concentrates and 1,500 pounds of hay. These farmers believed that milk could be produced most economically with little or no barn feeding. In most cases, however, pasture programs were not developed to the extent that pastures provided enough feed for cows to produce to the level of their inherent ability.

AGRICULTURAL ENGINEERING

Processing and Storing of Seeds, Grain, and Hay. (J. L. Butt, H. S. Ward, and F. A. Kummer.) — The germination of shelled corn stored in a galvanized steel bin at 10.5 per cent moisture did not change after 8 months storage except where a leak occurred. The weight, fat acidity, and pH values of shelled corn did not change while stored in bins of aluminum, galvanized steel, or galvanized steel painted white between January and June at moistures not exceeding 13.2 per cent.

Shelled corn stored in 1950-51 at 12.1 per cent moisture was stored for 4 months with no loss in weight or germination. The value increased considerably during the storage period. Two batches of shelled corn were artificially dried from about 18 per cent moisture for 2.77 and 2.28 cents per bushel.

Initial germination values were low but no further decrease in germination of cotton seed was found after storage from March to August at 9 per cent moisture.

Crimson clover with mature but high-moisture seed was mowed, dried on a hay drier, and then run through a combine. For such a procedure to be feasible, the conclusion was that one or more of the following conditions must exist: (1) Seed prices must be very high; (2) weather conditions make direct combining risky; (3) failure of combines to gather a high percentage of available seed; and (4) labor-saving, hay-handling, and processing equipment must be at hand.

Hay crushing reduced the time required for field curing Johnson grass hay by ½ to ⅔ that required for uncrushed hay. Crushed soybeans dried in 6 hours to the same moisture content that required 25 hours for uncrushed hay. Some advantages in quality for the crushed hay were less leaf shatter, more tender stems, and higher carotene content. Baled alfalfa hay was dried at a cost of $7.34 per ton. Major disadvantages to baled hay drying were: (1) management and labor required for stacking bales on drier, (2) uneven drying, and (3) high costs.

Scarified sericea lespedeza seed stored for 1 year had as high germination as unhulled seed when kept at 8 per cent moisture. At moistures above 8 per cent, unhulled seed had higher germinations. The hygroscopic equilibrium curves for hulled and scarified sericea seed and for alfalfa hay were determined.

Crop Residue and Seedbed Preparation, and Cotton Harvesting. (F. A. Kummer, C. M. Stokes, and T. E. Corley.) — Analysis of average seed cotton yields at Prattville showed no real difference between tillage treatments. By the use of radio active phosphorus, no differences in the absorptive rooting depths or rate of root development were found between plants in the TNT (9-inch preparation) and Disk Plow (5-inch preparation) treatments. Definite trends of root development were established.

Adverse conditions at the Wiregrass and Tennessee Valley, especially the lack of defoliation and the numerous knotty bolls, limited the test work with stripper-type harvesters and caused low picker efficiency.

Conditions at the Sand Mountain Substation permitted good replicated tests of 3 strippers and 2 pickers. Both spindle pickers performed very efficiently with the barbed-type spindle slightly more efficient than the smooth type spindle. The harvested cotton from both machines gave an average lint grade of middling. The steel roll strippers were highly efficient and continued operation without clogging was possible. The regional project brush stripper gave considerable trouble in cotton clinging to the brushes, resulting in high field losses. All of the stripper harvested cotton contained large amounts of foreign matter, resulting in relatively low grades (LM+) and considerable trouble in the actual ginning process. Picker and stripper efficiencies were considerably higher for Empire and Coker than for Hi-Bred. Thicker spacing resulted in slightly higher stripper and picker efficiencies.

Engineering Phases of Supplemental Irrigation. (M. W. Loupo and F. A. Kummer.) — Studies were made on the Agricultural Engineering Farm Unit to determine the effect of sprinkler irrigation on the yield of cotton and corn, and to determine the consumptive-use of water for cotton and corn when irrigated. All plots had the same treatments except for water applied. The irrigated cotton yielded 2,538 pounds of seed cotton per acre and the non-irrigated cotton yielded 1,449 pounds per acre. The yield

of the irrigated corn was 54 bushels as compared to 1 bushel per acre from the non-irrigated corn. The consumptive-use of water for cotton and corn varied slightly from calculated values but not enough to change recommendations with 1 year's results.

Soil physical measurements needed for irrigation design were continued with tests being made on 14 soils types. These tests included infiltration rate, available water-holding capacity, permeability, and mechanical analysis as well as descriptions of soil surface conditions of previous treatment and of the soil profile.

Consumptive-use of water by fescue and Ladino clover sod was determined under irrigation at the Lower Coastal Plain Substation, Camden, Alabama. The use of water was extremely low during the dormant period for this pasture mixture in July, August, and September.

The Effect of Various Vegetative Covers, Rotations, Mulches, and Seedbed Preparation on Runoff Water and Soil Losses From Various Slopes. (M. W. Loupo and F. A. Kummer.) — Water and soil loss measurements were continued on a 2-year rotation of cotton, ryegrass and crimson clover-Sudangrass; a 2-year rotation of cotton, crimson clover-corn on 5 per cent slope plots; a 3-year rotation of cotton, oats, fescue, Ladino clover-oats, fescue, Ladino-fescue, Ladino; and a 2-year rotation of cotton, crimson clover-corn on 10 per cent slope plots; and highly productive continuous corn as compared to medium productive continuous corn on 20 per cent slope plots. Because of a drought in June (2.72 inches) and July (1.46 inches), the crop production was low. Due to rains of fairly low intensity, the runoff was low and the soil losses extremely low in 1952.

Terraces were constructed on the west half of the Agricultural Engineering Farm Unit where outlets had been established with vegetation the previous year. All terraces were put in parallel and the entire area with slopes up to 5 per cent was planted with 4-row equipment. Five new W meadow outlets were constructed and seeded in draws on the east half of the farm. The entire water disposal system is being studied to evaluate its effectiveness in controlling erosion and the ease of using machinery in the production program.

AGRONOMY and SOILS

Cotton Breeding and Improvement Investigations. (H. B. Tisdale and A. L. Smith.) — Work is being continued with breeding material of 4 leading varieties and hybrid strains of cotton toward

improvement in more disease resistance, higher fiber tensile strength, and a more suitable type for mechanical picking. A new variety, previously designated as Auburn Hybrid 56, has been released and given the name, "Auburn 56", by the seed stocks committee of the Alabama Polytechnic Institute, Agricultural Experiment Station in December, 1952. Auburn 56 has shown the highest disease resistance combined with high yield of any variety or strain in variety and strains tests conducted over the State for the past 4 years. It is classed as a medium-early maturing variety of cotton, producing medium to large sized bolls with 35 to 37 per cent lint of 1 to 1 1/16-inch staple length.

Plains, a relatively new variety developed at the Georgia and Alabama Agricultural Experiment Stations in cooperation with U. S. D. A., and released in November, 1949, has expanded rapidly in production over the State. In 1952, there were 10,000 acres of Plains cotton certified for seed production in Alabama which produced around 2,500 tons of seed for planting in 1953.

Several new strains of Auburn hybrids 9531 and 81 showing qualities of higher fiber tensile strength and types for mechanical picking have been isolated for further testing and improvement.

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, 1950-1952, show that Plains, Fox (D&PL), Auburn 56, Coker 100 Wilt, Smith 78, Empire, Paula, and Stoneville 2B are the most satisfactory varieties for planting in any section of Alabama that is free of the cotton wilt disease. Plains, Auburn 56, Smith 78, Coker 100 Wilt, and Stonewilt are the most satisfactory wilt-resistant varieties for planting in areas of the State where cotton wilt generally occurs.

Response of Cotton to Sulfur (Cooperative with TVA). (J. T. Williamson, deceased, and L. E. Ensminger.) — Tests were conducted at 10 locations in 1951 and 1952 to study the value of several nitric phosphates produced by the Tennessee Valley Authority. Cotton was used as a test crop. One of the fertilizers tested was a 14-14-14 made by acidulating rock phosphate with nitric acid and then adding muriate of potash. This was compared with an 11-11-11 made by acidulating rock phosphate with a mixture of nitric acid and sulfuric acid. The 14-14-14 was sulfur free, while the 11-11-11 contained about 10 per cent sulfur (SO_3). Each fertilizer was applied at rates to furnish 48

pounds per acre each of N, P_2O_5 and K_2O. Average results for the 2-year period show that the 11-11-11 containing sulfur produced 157 pounds per acre more seed cotton than the 14-14-14 which did not contain sulfur.

Behavior of Potassium in Soils: (1) POTASSIUM STATUS OF SOILS FOR COTTON PRODUCTION FOLLOWING ALFALFA AND SERICEA. (R. D. Rouse.) — Additional information has been obtained which shows that the primary cause of poor cotton after alfalfa and sericea is a lack of adequate potassium.

At the Main Station on Chesterfield sandy loam, yield and chemical analysis of cotton plants showed that where alfalfa had been grown for 7 years and potash application had been 120 pounds of K_2O annually or less, as high as 96 pounds of K_2O applied in the drill was needed to correct potash deficiency and produce maximum yields. The same situation was found on Boswell fine sandy loam at the Tuskegee Experiment Field where sericea had been grown for 8 years and potash applications had been 60 pounds of K_2O annually or less. At these locations, where 240 pounds of K_2O had been applied to alfalfa, or 120 pounds of K_2O had been applied to sericea, potash deficiency was not observed.

(2) COTTON GROWN IN A COTTON-PEANUT ROTATION. (R. D. Rouse.) — At the Wiregrass Substation where cotton had been grown on Norfolk fine sandy loam in a 2-year rotation with peanuts, cotton yields had been very low for the past several years even when rates of potash as high as 96 pounds of K_2O per acre were applied to the cotton. Soil analysis showed that the soil was very low in both exchangeable calcium and potassium. Dolomitic limestone was applied at the rate of 1 ton per acre and the following yields of seed cotton were obtained for the different rates of potash: 12 pounds K_2O, 162 pounds; 24 pounds K_2O, 330 pounds; 48 pounds K_2O, 708 pounds; and 96 pounds K_2O, 1,378 pounds. In another comparison, plots were used which had received no potash from 1930 until 1947, but since that time had received 48 pounds of K_2O per acre to cotton. In 1951, one ton of dolomitic limestone per acre was applied, and where 600 pounds of muriate of potash was applied broadcast prior to planting, the yield was increased 630 pounds of seed cotton per acre over that obtained without the additional potash.

(3) Fertilizer Effects on Botanical and Chemical Composition of White Clover-Dallisgrass Associations Grown on Sumter Clay. (R. D. Rouse and J. M. Brown.) — Yields from a greenhouse pot experiment and the potassium and calcium analysis of plant material showed that the persistence of clover in white clover-Dallisgrass associations on Sumter clay is highly dependent on potash, minor elements and nitrogen fertilization.

The application of potash and minor elements resulted in an increase in clover and a decrease in grass content of the herbage without affecting the total clover-grass yields for 20 months' clippings. The application of nitrogen increased the total yields as a result of increased grass yields. The total yields of clover were not significantly affected by nitrogen application but there was a decrease in clover yields associated with increasing rates of nitrogen as the stand became older.

Based on potassium removed in the herbage of 5 clippings, the grass removed more potassium in all cases than the clover except where no nitrogen was applied and the potash rates were 90 to 120 pounds per acre with minor elements. Potash fertilization increased the potassium content of both clover and grass but it did not appreciably affect the amount of potassium removed by grass.

The results of this experiment indicate that Dallisgrass has a greater ability than white clover to absorb potassium from the soil. Thus it was necessary to apply potash in excess of what is needed by the grass to enable the clover to more successfully compete with grass in clover-grass association.

Factors Affecting the Nature and Behavior of Native and Added Phosphates in Soils: (1) Loss of Phosphorus by Erosion. (L. E. Ensminger.) — A study was made of the phosphorus status of soils which had received phosphate applications over a period of years to determine the loss of phosphorus by erosion. Phosphorus that could not be accounted for by analysis of the surface 16 inches of soil and by crop removal was assumed to be lost by erosion.

Where corn and cotton were used as the rotation, an average of 63 per cent of the phosphorus applied during a 16-year period to a Hartsells fine sandy loam soil with a 2 to 4 per cent slope had been lost by erosion as compared to 40 per cent for a corn, cotton, and winter legume rotation. The results show that most of the accumulated phosphorus could be extracted by a HCl-

NH_4F solution. Three plots in the corn, cotton, and winter legume rotation contained 7 to 8 per cent <2 μ material in the surface 0 to 8 inches originally, but after 16 years of cropping the < 2 μ material had been reduced to 5 to 6 per cent. The clay fraction contained 25 to 30 per cent of the total phosphorus. These results indicate that only a small part of the phosphorus was lost along with the clay fraction.

A study of 22 fields in Baldwin County that had been in potatoes from 5 to 30 years shows that the surface soil accumulated an average of 103 pounds P_2O_5 per acre per year in potatoes, although an estimated 200 pounds of P_2O_5 was added each year potatoes were grown.

An inventory of the phosphorus status of soils in cement bins after 12 years of phosphate applications shows that 80 per cent or more of the applied phosphorus could be accounted for on the basis of soil analysis and crop removal. The plots were enclosed by cement walls which prevented run-off except during very heavy rains.

(2) Availability of Rock Phosphate in Greenhouse Experiments as Measured by Radiophosphorus Uptake. (L. E. Ensminger.) — The exact availability of rock phosphate is still open to question even though a great deal of field work has been conducted to answer the question. The availability of rock phosphate can be determined by measuring the effect of various rates of rock phosphate on the uptake of phosphorus from a uniform application of radioactive superphosphate. An experiment of this nature was started in 1951 using two soils of different clay mineral composition. Both soils had a pH of about 5.0 and were low in soluble phosphorus. The radiophosphorus uptake data showed that when rock phosphate was applied to a Eutaw clay that 20 to 40 per cent of its phosphorus was available for Ladino clover. In case of the Cecil clay loam radiophosphorus uptake data showed that rock phosphate had an availability of 14 per cent or less.

Iron Nutrition of Certain Plants with Special Reference to Conditions Obtained in Calcareous Soils. (John I. Wear.) — Rice, common lespedeza, and peanuts developed severe iron chlorosis when grown in Sumter (calcareous) clay soil. Plants made normal growth when they were sprayed with soluble iron salts, or when the soil was puddled so that more CO_2 was retained by the soil. The growth of peanuts in this highly calcareous soil

was also improved by sealing the top of the soil with paraffin and by mulching with organic matter. In the rice experiment there was a much larger concentration of CO_2 in the puddled soil than in the unpuddled soil. Lima beans and field peas, which grow normally in calcareous soils, excrete larger quantities of CO_2 into the soil than the peanut plant, which develops severe iron chlorosis when grown in a highly calcareous soil.

When Sumter clay was sterilized by autoclaving, puddling the soil did not prevent iron deficiency. This gave evidence that puddling made the soil a reducing medium in which autotrophic microorganisms possibly cause a reduction of ferric to ferrous iron.

The chlorotic condition of peanuts was improved when grown with wheat in a highly calcareous soil.

Breeding of Legumes for Forage and Soil Improvement: (1) VETCH BREEDING. (E. D. Donnelly, Pryce B. Gibson and E. B. Minton.) – The Auburn strain of woollypod vetch has been outstanding in the production of green manure in the lower two-thirds of Alabama. In from 2 to 7 trials at each of 9 locations in this part of the State the above vetch has produced as follows, using Hairy vetch as 100 per cent: 177, 141, 177, 138, 188, 84, 108, 203, and 147 per cent, respectively. Auburn woollypod is widely adapted. It was one of the most productive vetches included in cooperative tests conducted throughout the Southern Region in 1950-51 and 1951-52.

(2) SERICEA BREEDING – Data from studies designed to obtain information pertaining to the best method of handling plant material of sericea lespedeza selections from the time of harvest and drying to the time of analysis of the material for its tannin content indicated the following: (a) There was no breakdown of the tannin in the ground leaves of 12 sericea plants when this material was analyzed on October 12, November 10, December 15, and June 19. (b)Temperature had no effect on the tannin content of plants stored at 12° C. and room temperature for 9 months. (c) The method of storage had no effect on the tannin content of samples stored in sealed and unsealed containers for 4 months.

Stems and leaves of 44 sericea plants were analyzed separately for their tannin content. The leaves of these plants ranged from 5.1 to 11.5 per cent tannin and the stems from 1.2 to 3.8. Plants with leaves containing 6.24 per cent tannin or less pro-

duced stems with 2 per cent tannin or less. However, stems from 2 plants contained less than 2 per cent tannin even though the leaves from these plants contained 8.9 per cent. A highly significant correlation coefficient of r = 0.8 was obtained when the percentage tannin in the leaves was compared with that in the stems for all 44 individual plants, indicating a very close association between the tannin of the leaves and that of the stems. Considering this association and the data indicating that tannin content of the stems is relatively low as compared to that of the leaves, the tannin content of the latter should furnish a good criterion for separating low and high tannin plants.

Variation in tannin content of the same plant from year to year and between clippings within a given year has been measured. However, when the percentage tannin of 96 plants cut in August, 1950 was compared to the percentage tannin of these same plants cut in May, 1951, a highly significant correlation coefficient of r = 0.39 was obtained. When this comparison was made using tannin percentages on May 4, 1951 and on June 8, 1951, a highly significant correlation coefficient of r = 0.55 was obtained. This indicates that genotype conditions the tannin content of sericea plants considerably.

(3) White Clover Breeding. — White clover (*Trifolium repens L.*) may be grouped into three agronomic types; namely, large, intermediate and small. Classifying plants into these types is difficult since other than size the gross morphological characteristics are similar. The use of the number of vascular bundles per petiole was proposed as a means of distinguishing between plants of Ladino (the accepted example of the large type) and the intermediate type. This method was studied at the Alabama Polytechnic Institute by counting the number of vascular bundles per petiole in 12 clonal lines each of Ladino and intermediate white clovers growing in three different environments.

The number of vascular bundles per petiole was determined for plants of each line growing (1) in the greenhouse, (2) in the field during cool moist weather, and (3) in the field during hot dry weather. The variation caused by the different environments was significant for each change of environment for each type. This variation was so large that the mean number of vascular bundles per petiole for the 12 Ladino clones in the field during hot dry weather and the corresponding mean for the 12 intermediate white clones in the field during cool moist weather were the same. Variation in the number of vascular bundles per petiole

was so large among the clones within the types that overlapping values for the two types were found in each environment. These results indicate that the reliability of vascular bundle counts as a criterion for grouping white clover plants into types is questionable.

Production and Management of Alfalfa and Sericea: (1) EFFECT OF FERTILIZERS AND LIME ON TANNIN CONTENT OF SERICEA. (Clarence M. Wilson.) — Field and greenhouse studies during the period 1950-52 indicated that the tannin content of sericea was not affected by additions of calcium, nitrogen, phosphorus and potassium provided these elements were not deficient to the point where sericea growth was limited. In some cases where phosphorus or potassium was extremely low in the soil, sericea growth was increased and the tannin content was decreased by adding these elements at rates of 60 pounds of P_2O_5 and K_2O per acre.

(2) DEPTH OF PLACEMENT AND RATES OF LIME FOR ALFALFA. (Clarence M. Wilson.) — During 1951-52 field tests were conducted with depths of placement and rates of lime for alfalfa on Lloyd, Cecil and Susquehanna soils. Depths of placement ranged from 0-6 to 0-18 inches, and rates included 2, 4, and 8 tons of lime per acre. For the Susquehanna soil lime was incorporated with the entire soil layers indicated. For the Cecil and Lloyd soils lime was incorporated with the surface 6 inches, but deeper placements were applied as plow sole applications. So far, no significant differences in alfalfa yields have occurred on the Lloyd soil due to lime treatment.

The 4-ton rate of lime has produced the best yields of any rate applied to the surface 6 inches of Cecil soil. All rates have shown increases in yields where the application was split to put one half in the surface 6 inches and the remainder at lower depths in the Cecil soil.

On the very acid Susquehanna soil, the surface application of 8 tons of lime gave significantly higher alfalfa yields than either the 2- or 4-ton surface application. The use of 8 tons of lime applied at 0-12 inches was the best lime treatment used on the Susquehanna soil.

Subsoiling to a depth of 12 inches did not improve alfalfa yields on any of the 3 soils studied.

(3) EFFECT OF SOIL FUMIGATION ON ALFALFA YIELDS. (Clarence M. Wilson.) — The use of Dowfume W-40 at the rate of 15

gallons per acre applied in March, 1951, on a Norfolk loamy sand gave an average increase of about 300 pounds of alfalfa hay per acre in 1951 and an increase of about 500 pounds per acre in 1952 over the plots receiving no fumigant. Although these increases were not significant by statistical methods, the alfalfa stands on the non-treated plots appeared considerably weakened at the end of the 1952 growing season. The fumigant offers promise of increasing the longevity of alfalfa stands on light, sandy soils.

Pasture Studies: (1) PERFORMANCE OF ANNUAL WINTER GRASSES. (J. D. Burns and R. M. Patterson.) — Five annual winter grasses were tested in the 1951-52 growing season at the Lower Coastal Plain Substation and the Plant Breeding Unit. The grasses tested and the average yields of dry forage per acre for the 2 locations were domestic rescue, 4,544; Texas 46 rescue, 4,200; common ryegrass, 3,564; *Phalaris minor*, 2,888; and Tifton 14 rustproof oats, 2,885 pounds.

(2) SUPPLEMENTARY NITROGEN FOR PERMANENT PASTURES. (R. M. Patterson and J. D. Burns.) — Recent results from experiments designed to determine the value of applying nitrogen to permanent pastures are:

a. Under irrigation, no increases in yield were obtained from applications up to 128 pounds of nitrogen per acre when a high percentage of clover remained vegetative throughout the year. The average production of forage in this experiment was approximately 6 tons of dry matter per acre. The predominant species were white clover, Bermuda-grass, crabgrass and other annual native summer grasses.

b. Trends toward increased yields from increasing nitrogen rates up to 128 pounds per acre were obtained when the clover population of the mixture was low except during the peak clover season in the spring. The predominant species were fescue, white clover, crabgrass and barnyard grass.

c. The application of nitrogen to a fescue sod containing no clover gave a marked increase in yield of grass.

d. Bahiagrass following a good growth of crimson clover did not respond to nitrogen fertilization during the dry summer of 1952.

Effect of Nitrogen Fertilization on the Seed Yield of Tall Fescue. (R. M. Patterson, J. D. Burns and E. M. Evans.) — An experiment to determine the effects of time and rate of nitrogen applications

on the seed yield of tall fescue that was clipped to simulate grazing until March 1 each year was conducted at the Black Belt Substation on Sumter clay. The test was laid out on an established fescue sod that had received adequate phosphorus and potassium fertilization.

The 2-year average fescue seed yield from the plots which received no nitrogen was 90 pounds per acre. Plots receiving 48 pounds of nitrogen per acre on September 1 and no nitrogen in the spring produced 140 pounds of seed per acre. Application of 48 and 64 pounds of nitrogen per acre on March 1 increased the yields to 212 and 240 pounds per acre, respectively. Plots receiving 32 and 48 pounds of nitrogen per acre both on September 1 and on March 1 produced 169 and 223 pounds of seed per acre, respectively. These 2-year results show that:

1. Spring applications of nitrogen were more effective in increasing seed yields than fall applications.
2. The yield of seed is almost directly proportional to the amount of nitrogen applied in the spring up to 64 pounds per acre.
3. Forage yields were proportional to the amount of nitrogen applied in the fall during the 1950-51 grazing season. No forage yields were obtained during the 1951-52 grazing season, but the area was clipped to simulate grazing when sufficient growth was obtained.

Method for Determining the Lime Requirements of Soils. (F. L. Davis and H. L. Musen.) — A study was made of laboratory methods for determining the lime requirements of light, sandy soils. This was prompted by the need for a quick and reliable method for determining the lime requirements of the weakly buffered soils of southern Alabama. The cation exchange capacity and exchangeable calcium of 143 soil samples were determined. The amounts of limestone needed to bring these soils to 75 per cent saturation were used as a criterion for comparing the results obtained from methods for determining lime requirements for soils. Methods based upon the partial neutralization of total soil acidity, or exchangeable hydrogen, were found to give the most reliable results.

Minor Element Status of Alabama Soils and the Requirements of These Elements for Plant Growth: (1) THE ACCUMULATION OF BORON IN ALABAMA SOILS UNDER VARIOUS CONDITIONS AND THE EFFECT OF THE ACCUMULATION ON CROPS WHICH ARE SENSITIVE

TO BORON. (John I. Wear.) — Substantial increases of crimson clover seed have been obtained with borax at 4 locations on Alabama sandy soils. In 1952 10 pounds of borax per acre increased the seed yields from 121 pounds to 384 pounds at Auburn; 229 to 587 pounds at Brewton; 108 to 617 at the Sand Mountain Substation; and at the Lower Coastal Plain Substation, from 89 pounds to 401 pounds. From 1 year's results, these substantial increases were not found on heavier clay soils. The water soluble borax found in the sandy soils was lower than that found in the clay soils. Boron added to these soils leached out much more rapidly in the sandy soils than in the clay soils.

(2) ZINC REQUIREMENTS FOR CORN. (John I. Wear.) — In 1951 zinc sulfate increased corn yields on zinc-deficient land at the Wiregrass Substation. The yields obtained from 0, 5, 10, and 15 pounds of zinc sulfate per acre were 29.9, 31.5, 33.7, and 35.4 bushels of corn per acre, respectively. When this soil was limed and no zinc applied, the yield was reduced to 24.7 bushels per acre, but increased to 34.5 bushels of corn per acre when lime and zinc were applied. Due to very low yields from extreme dry weather in 1952, the yields obtained were not significantly different.

(3) A STUDY OF MATERIALS OF LOW BORON SOLUBILITY WHICH MAY BE UTILIZED AS A SOURCE OF BORON FOR PLANT GROWTH. (John I. Wear and C. M. Wilson.) — A study of two materials (Colemanite and Howlite) is in progress to determine if either material could be used as a slowly available source of boron for plant growth. It was found that Colemanite was only 19 per cent as soluble as high grade fertilizer borax and Howlite only 4 per cent as soluble, based on hot-water soluble standards. Turnips and soybeans were grown under greenhouse conditions with different rates of these materials. Turnips showed little toxicity up to 24 pounds of borax, 60 pounds of Colemanite, and 150 pounds of Howlite per acre. Soybeans showed little toxicity up to 8 pounds of borax, 10 pounds of Colemanite, and 50 pounds of Howlite. Field applications of these materials were made within small rims. Applications of 10, 20, and 40 pounds per acre of each material were made in the spring. After 6 months the soils were analyzed for boron at three depths, 0-8, 8-16, and 16-24 inches. Results from the first 6 months' sampling shows that borax is leaching out of the topsoil faster than the lesser soluble materials.

Response of Runner Peanuts to Lime and Gypsum. (F. L. Davis.) — Cooperative field experiments on the effect of lime and gypsum on the yield of runner peanuts have been conducted for 4 years in 4 counties of the Wiregrass area of southeastern Alabama. Lime was applied in every test at the rate of 1 ton per acre at least 6 weeks before planting, and gypsum at the rate of 400 pounds per acre was dusted on the peanut vines during the early blooming stage. Yield data have been obtained for one or more years from 35 locations with a total of 57 yields.

Increases in peanut yields of 200 pounds or more per acre were obtained from lime or gypsum at 21 of the locations. Twelve locations gave increases in yields of 400 pounds or more per acre from lime or gypsum, and 4 produced increases in yields of 600 pounds per acre from lime or gypsum. The average increases in yield of peanuts obtained from these tests are given in Table 1.

TABLE 1. AVERAGE INCREASES IN YIELDS OF RUNNER PEANUTS FROM LIME AND GYPSUM

Tests giving increases in yields over—		Treatment and average increase in yield per acre		
		1 ton lime	400 pounds gypsum	1 ton lime plus 400 pounds gypsum
Lb. per acre	*No. tests*	*Lb.*	*Lb.*	*Lb.*
		Year of highest yield		
600	4	370	584	635
400	12	333	390	536
200	21	227	293	392
		Average of all years[1]		
600	5	269	468	490
400	17	245	320	404
200	33	173	235	279

[1] Includes yields obtained in 1951 which was a very dry season and in which very low yields were produced.

The data obtained indicate that approximately 40 per cent of the soils on which peanuts are grown would give a profitable increase in yield of nuts from an application of lime or gypsum. A calcium deficiency of soils for peanuts can be determined by a soil test of exchange calcium. A low shelling percentage or high percentage of "pops" is also a good indication of a deficiency of calcium in the soil or of the need for applications of lime or gypsum. The larger increases in yields were obtained from soils that produced peanuts having the lower shelling percentage.

Chemical Weed Control: (1) CHEROKEE ROSE (*Rosa bracteata*) CONTROL. (V. S. Searcy.) — In a time of application

study, ammate (ammonium sulfamate) at the rate of 1 and 2 pounds per gallon of water, the low volatile ester and amine form of 2,4-D[1] each at the rate of 2 and 4 pounds per 100 gallons of water, and Concentrated Borascu (B_2O_3 equivalent 62.4 per cent) at the rate of 10 and 15 pounds per 100 square feet were applied to old clumps of Cherokee rose during the four seasons of the year.

Concentrated Borascu at both rates and at all dates killed Cherokee rose. All other treatments at all dates failed to kill Cherokee rose.

In another test the following treatments were applied per 100 square feet of area unless otherwise specified: Concentrated Borascu 7½, 10.0, and 12½ pounds; Borascu (B_2O_3 equivalent 34 per cent) 15, 20, and 25 pounds; Polybor Chlorate (Na pentaborate decahydrate 55 per cent, borax 16 per cent, and Na chlorate 25 per cent) 2, 4, and 6 pounds; NaCl (common table salt) 25, 50, and 100 pounds; Gerstley Borate (B_2O_3 equivalent 36.5 per cent, ranges from 28.0 per cent to 36.5 per cent) 15 and 20 pounds; and CMU (3-p-chlorophenyl-1, 1 dimethylurea) at the rate of 25, 50, and 75 pounds per acre.

One year after application, all rates of Borascu, Concentrated Borascu, Gerstley Borate, the 6-pound rate of Polybor Chlorate and the 75-pound rate of CMU had killed the roses. All other treatments were ineffective.

In another experiment an established stand of Cherokee rose was removed with a rotary type mechanical cutter. The desirable species in the area were common lespedeza and Dallisgrass. When the new growth of Cherokee rose had reached a length of 12 to 18 inches the following treatments were applied: The low volatile ester and amine forms of 2,4-D each at the rate of 1 and 2 pounds per acre. All treatments have killed the new growth and seedlings of Cherokee roses. It has been necessary to apply 3 applications during the growing season to kill back the new growth. Dallisgrass appears to be spreading on all chemically treated plots. Apparently common lespedeza was not injured except when the chemicals were applied during the seedling stage. One pound of the low volatile ester of 2,4-D appears to be equal to 2 pounds of the amine form. Marsh elder (*Iva ciliata*) and bitter weed (*Helinium tenuifolium*) have disappeared from all chemically treated plots. There are many old Cherokee roses still sprouting after two summers of treatment.

[1] 2,4-dichlorophenoxyacetic acid, expressed as pounds of acid equivalent.

(2) WEED CONTROL IN COTTON. (V. S. Searcy.) — Experiments conducted for the past 2 years have shown that annual weeds can be controlled in cotton for a period of 4 to 8 weeks. The best results have been obtained by applying either CIPC [isapropyl-N-(3-chlorophenyl) carbamate] or dinitro (dinitro-o-sec-butyphenol) at the rate of 1 to 1½ pounds per acre to a 12-inch band in 40-inch rows on sandy soils, and 2 to 2½ pounds on heavy soils as a pre-emergence treatment, followed by post-emergence herbicidal oil when needed at the rate of 5 gallons per acre per application to the band.

(3) PRE-EMERGENCE CHEMICAL WEED CONTROL ON RUNNER PEANUTS. (V. S. Searcy.) — The dinitro compounds (dinitro-o-sec-butylphenol) at rates of 2½ to 3½ pounds per acre applied to a 12-inch band, in 36-inch rows have consistently controlled annual weeds for a period of 4 to 7 weeks without any injury to peanut plants. However, where heavy beating rains fall soon after application, the effectiveness of the dinitros is reduced. Recent results have shown that 1 pound of 2,4-D applied immediately after planting delays emergence and dwarfs the peanut plants where enough rain falls, soon after application, to leach the chemical to the root zone.

BOTANY and PLANT PATHOLOGY

Investigations on Diseases of Forage Crops, Grain Crops, and Legumes. (J. A. Lyle.) — From a laboratory study of 51 single basidiospore isolates of the fungus *Sclerotium rolfsii* Sacc., it was shown that (1) *Sclerotium delphinii* Welch is invalid as a species; (2) *Sclerotium rolfsii* is homothallic; (3) sclerotial formation in asclerotial isolates of *S. rolfsii* may be induced with the addition of thiamine hydrochloride; and (4) a temperature of approximately 30° C. was closely associated with maximum expression of vegetative growth and hymenial formation of the single basidiospore isolates.

Data obtained from intermediate and Ladino white clover clones grown under semi-controlled conditions demonstrated that (1) *Pseudoplea trifolii, Stemphylium botryosum, Curvularia trifolii,* and *Colletotrichum graminicolum* were the principal disease organisms attacking the foliage; (2) *P. trifolii, C. graminicolum, Rhizoctonia* sp., *Fusarium* sp., and nematodes were the major disease organisms attacking the stolons and roots; (3) no correlation existed between flowering of the white clover clones and

disease susceptibility; (4) intermediate white clover clones were more susceptible than Ladino clover clones to all diseases except Curvularia leaf spot; and (5) climatic records, particularly precipitation, humidity, and temperature, could be correlated with severity of disease infestations.

Seed treatment experiments indicated that the application of specific chemical seed protectants increased the field stand of oats and rescuegrass by controlling seed-borne and soil-borne diseases. Although no significant increases in field stand were obtained with crimson clover, white clover, soybean, and vetch seed treated with similar seed protectants, it was shown that the chemical seed treatments did not interfere with nodule formation.

Factors Affecting the Quality of Peanut Seed. (H. S. Ward, Jr., J. L. Butt, J. H. Blackstone, and I. F. Reed.)[2] — The objectives of this investigation were to determine whether variability in germination of peanuts was the result of factors which occurred on the farm, during storage, or during machine shelling. To answer the above objectives, studies were conducted on the effects of farm site, storage, and machine shelling.

Statistical analysis was carried out on data pertaining to spring germination as related to fall free fatty acids, moisture, maturity, and federal grade of samples of cured peanuts taken from 135 farms in 11 counties of the peanut area of Alabama. The results on a basis of 1 year's data only (1950) showed that spring germinations of 80 per cent or higher were obtainable from peanuts grown in any of the 11 counties provided that the fall cured peanuts had: (1) a grade of above 65 per cent S.M.K., less than 5 per cent shrivels, and 1 per cent or less damage, (2) kernel moistures of 7 per cent or less, (3) kernel free fatty acids of 0.30 per cent or less, and (4) as a measure of maturity 76 per cent of all peanuts with black or red coloring inside the shell. Differences in spring germination were not shown to be affected by soil type, fertilizer management practices, and geographical location.

The effects of moisture and temperature during storage on germination and free fatty acids of peanut kernels were studied under controlled conditions of the two above variables in the laboratory. Both unshelled and shelled samples were used. Following 5 months of storage, the results showed that: (1) at any

[2] Joint project between the Departments of Botany and Plant Pathology, Agricultural Engineering, Agricultural Economics and the USDA Tillage Laboratory.

moisture level below 9 per cent, germinations were 20 to 30 per cent higher in unshelled than in shelled peanuts, (2) highest germinations were at 6 per cent kernel moisture, (3) germinability was reduced to zero in 5 weeks if kernel moisture was above 8 per cent, (4) per cent free fatty acids was less than 1 per cent in kernel moistures below 8 per cent, (5) germinations could be held above 80 per cent in peanuts for 1 year if stored at a temperature of 20°C, and (6) per cent free fatty acids within a given moisture level reached a maximum at 30°C. and was less at 20°C or 35°C.

The effect of the sheller on germination of mature unsplit kernels was shown mainly to be the result of various degrees of skin removal damage. If skin damaged peanuts were removed by picking table operation, germination of the picked mature kernels was as good as hand shelled peanuts. Sheller design and operational factors affected the number of splits and capacity of the sheller. The number of splits was not only affected by speed and cylinder arrangements but by kernel moisture content. Splits were least within the moisture range of 11.3 to 14.0 per cent kernel moisture.

Processing and Storing of Seeds, Grain, and Hay. (H. S. Ward, Jr.)[3] – The botanical phases of this project have been concerned with the storage behavior of *Lespedeza sericea* seed. The objectives were to determine the moisture content of scarified and non-scarified *Lespedeza sericea* seed at which high germinability was maintained during storage and whether scarified seed deteriorated more rapidly than did the non-scarified seed.

The initial study was to establish the hygroscopic equilibrium curve for scarified and non-scarified seed. At all relative humidities (92, 86, 80, 75, 65, 54, 43, 33, 22, 11, and 0 per cents) the hygroscopic moistures for scarified seed were higher than for non-scarified seed. The curves were of the sigmoid type as was shown previously for blue lupine and crimson clover seeds.

Following 12 months storage in controlled humidity chambers, non-scarified seed had germinations of 80 per cent or higher at storage relative humidities of 75, 65, and 54 per cents while scarified seed had germinations of 80 per cent or higher only at the 54 per cent storage relative humidity. Both the non-scarified and scarified seed at the end of 12 months of storage had 92

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

per cent germination when stored at 54 per cent relative humidity. These results show that *Lespedeza sericea* seed, if the moisture of scarified seed is 8.1 per cent or less, will maintain as high germinability after a 12-month storage period as do non-scarified seed. At moistures above 8.1 per cent scarified seed do not maintain longevity as well as do the non-scarified seed.

DAIRY HUSBANDRY

Evaluation of Feeds and Feeding Systems for Fall and Winter Milk Production in Alabama: A COMPARISON OF WINTER PASTURE, MOLASSES-SPRAYED PEANUT HAY, AND CORN SILAGE. (George E. Hawkins, Jr. and K. M. Autrey.) — A double-change-over feeding experiment involving 3 groups of 6 milking cows each was conducted early in 1952. The ration variables were crimson clover-ryegrass pasture, molasses-sprayed peanut hay, and corn silage. The average weekly milk production per cow was: (1) pasture, 642 pounds; (2) peanut hay, 539 pounds; and (3) corn silage, 443 pounds. From the standpoint of feed cost per unit of milk produced, the three rations ranked as follows: pasture, lowest; corn silage, second; and peanut hay, highest. The low dry matter intake by cows on corn silage indicates that corn silage is not satisfactory as the only roughage feed for milking cows.

Feeding and Management of Young Dairy Animals Under Alabama Conditions: THE VALUE OF GRAIN FOR DAIRY HEIFERS ON PASTURE. (George E. Hawkins, Jr.) — This study will involve 90 heifers divided into three equal groups. The animals in 1 group receive no grain after 6 months of age. Animals in a second group receive grain up to 12 months and those in a third group receive grain up to the time of calving.

Only 30 animals have been placed on experiment up to December 31, 1952. Preliminary results show that the average gains in body weight, in heartgirth, and in barrelgirth of calves receiving grain were significantly greater than those of calves receiving no grain.

Feeding and Management of Young Dairy Animals Under Alabama Conditions: INDIVIDUAL OUTSIDE PENS VERSUS BARN PENS FOR DAIRY CALVES. (K. M. Autrey, George E. Hawkins, Jr., and L. R. Davis.) — An experiment was started in 1950 to study the relative merits of raising dairy calves from birth to 6 months of

age in conventional barn pens and in portable outside pens. The latter method has been recommended by the USDA Regional Animal Disease Laboratory at Auburn as a plan for eliminating the hazard of coccidiosis in young calves.

Studies involving 16 animals during each of 2 years showed that calves grown up to 6 months of age in the outside pens made significantly greater gains in body weight and at the heart-girth than those grown in barn pens. The "outside" calves were consistently more vigorous, and suffered much less from respiratory and digestive disorders (mainly coccidiosis) than did the controls.

Feeds and Feeding Systems for Fall and Winter Milk Production in Alabama. (K. M. Autrey and George E. Hawkins, Jr.) — In a fall pasture grazing experiment with milking cows 3 pastures ranked as follows for maintaining milk flow: crimson clover-ryegrass, first; oats-crimson clover, second; and tall fescue-Ladino, third. The last named pasture was easily the poorest of the 3 in this 8-week test.

A 28-ton stack of crimson clover silage was harvested in April, 1952 at an estimated cost of $2.30 per ton. Good quality silage resulted from both long and chopped clover. The silage as fed had 80 per cent moisture and proved to be a very palatable feed. Cows consumed 45 pounds daily while receiving oat-vetch hay *ad libitum* at night and while being fed a limited amount of concentrate. Cows receiving silage had a persistency of milk flow equal to that of cows on the oat-clover pasture and superior to that of cows on fescue-Ladino clover pasture.

A Study of Factors Affecting the Nutritive Value of Lespedeza Sericea for Dairy Animals. (George E. Hawkins, Jr.) — In a study to determine whether tannic acid is an important palatability factor in sericea, digestion trials were conducted with dairy calves in which the following rations were compared: (1) alfalfa hay plus 5 per cent crystalline tannic acid; (2) alfalfa hay alone; and (3) sericea hay (containing approximately 5 per cent tannic acid). Digestibility of dry matter and of protein in the alfalfa hay was not affected by the added tannin. Alfalfa hay with or without tannic acid added was superior to the sericea hay fed.

Ground oats and cottonseed meal were compared as supplements to sericea hay in the rations of calves. Cottonseed meal seemed

to be the better supplement, indicating that the sericea hay was not providing adequate digestible protein to the animals.

Supplemental Irrigation of Fall Pastures in the Piedmont. (K. M. Autrey.) — In 1951 irrigation studies were conducted at the Dairy Production Unit to determine the value of irrigation of crimson clover-ryegrass pasture seeded following subsoiling and following plowing. Clover and ryegrass seeded August 14, 1951 came up to a good stand where irrigated. The stand was poor on unirrigated areas. Much of the clover under irrigation was smothered out by summer grasses and weeds. Grass was the more serious pest on subsoiled areas, while weeds were more serious on the plowed areas.

Based on 2 years' results, it seems safe to conclude that unless a field is relatively free of weeds and grass, it is not practical to irrigate early-seeded (prior to mid-August) crimson clover-ryegrass pastures.

Quality and Flavor of Milk as Received at the Plant as Affected by Methods of Handling Milk at the Barn, Cleaning Procedures, and Feeding Management of the Cows: Effect of Various Methods of Handling Milk on the Farm on Bacterial Count, Keeping Properties, and Flavor of Milk as Received at the Plant. (Robert Y. Cannon.) — Five methods of handling milk on the farm were employed. Two of these used a combine milker and two involved carrying the milk to the milk room in the milker pails. These were subdivided into aerated and non-aerated trials. Where no aeration was used, empty cans were submerged in an immersion type cooler, and filled in the cooler. The fifth method involved pouring of milk into cans in the barn then transferring the full cans to the immersion cooler.

No differences were noted in the flavor, sediment or coliform count of the milk handled by the various methods, as it was received at the plant. Milk poured in the barn required 1 hour for cooling, while the remainder cooled in 30 minutes. There was no significant difference in the standard plate counts of the milk as received at the plant, but after incubation at 21°C. for 6 hours the milk poured in the barn showed a considerable increase in count while the others remained about constant.

The Effect of Certain Antibiotics on the Reproductive Efficiency of Dairy Bulls Used in Artifical Breeding. (W. E. Alston, Jr.) — A combination of penicillin, streptomycin, and sulfanilamide was

added to half the semen produced by 12 bulls at the Artificial Insemination Unit in 1951. A study of records on 4,161 cows bred with the treated and untreated semen revealed no significant differences in fertility that could be attributed to the addition of antibiotics.

Factors that might affect conception slightly are rapid technicians' turn-over in certain counties, extremely hot or cold periods of weather, which was experienced during the period of this experiment, and health of both males and females. None of these factors were taken into consideration during this experiment.

FORESTRY

Yields and Returns from Thinnings of Southern Pines Planted at Various Spacings. (K. W. Livingston.) — Plantations of loblolly, slash, and longleaf pine were established on abandoned fields at the Main Station, Auburn, in the spring of 1932. Planting spacings of 4 x 4 feet, 6 x 6 feet, 8 x 8 feet, 9.6 x 9.6 feet, 12 x 12 feet, and 16 x 16 feet were used. Thinnings of loblolly and slash pine have been made as follows: 4 x 4-foot plots, some to approximately 8 x 8 feet at plantation age 8 and again for adequate crown release at age 19, some for adequate crown release at age 19, and some never thinned; 6 x 6-foot plots, some to 400 trees per acre at age 12 and again for adequate crown release at age 19, some to 600 trees per acre at age 12 and again for adequate crown release at age 19, some for adequate crown release at age 19, and some never thinned; other spacings, all plots for adequate crown release at age 19. Because of poor survival and slow early growth, no longleaf pine plots were thinned until age 19; and yields from thinning at that time were light.

For the first 19 years, total wood production was roughly proportional to density of stocking. The same is true of merchantable pulpwood production, but differences were somewhat smaller.

Thinnings of loblolly and slash pine made at age 12 were commercially practical and profitable. They did, however, somewhat reduce total yields during the first 19 years; but quicker financial returns from early thinnings at least partially compensate for the reduced yields. Furthermore, plots given early thinning appear to be in better condition for producing valuable sawlogs and other products that will be harvested in future cuttings.

Based on currently prevailing costs and prices, the returns on the total investment have been 6½ per cent annually from lob-

lolly pine planted at 6 x 6 feet, 8 per cent from slash pine planted at 6 x 6 feet, and 6 per cent from loblolly and slash pine planted at 8 x 8 feet.

Survival, Growth, and Returns from Thinning of Four Southern Pines in Relation to Site Variations Due to Minor Topographic Changes. (K. W. Livingston.) — Loblolly, longleaf, shortleaf, and slash pines were planted at 6 x 6 feet in the years 1932-34 on an area of the Upper Coastal Plain bordering the Piedmont Plateau, at Auburn. The area was divided into 4 topographic classes according to the following definitions: hill — dry knolls and steep, eroded upper and middle slopes, with sparse, grassy ground cover; slope — gently rolling lower slopes, not severely eroded, with little to scattered ground cover of young hardwoods; flat — low, level, moist, well drained ground, with dense undergrowth of sweetgum and honeysuckle; and swamp — permanently wet ground, with rank growth of gum, willow, yellow poplar, other hardwoods, cane, and vines.

Loblolly and slash pines were first thinned at age 12; and all species were thinned in 1951, at ages 17 for loblolly, 18 for longleaf, and 19 for shortleaf and slash pines. Total pulpwood yields per acre at these ages were as follows: loblolly, hill, 17.3 cords; loblolly, slope, 32.3 cords; loblolly, flat, 29.7 cords; loblolly, swamp, 28.7 cords; longleaf, hill, 12.2 cords; longleaf, slope, 6.9 cords; longleaf, flat, 5.6 cords; longleaf, swamp, practically zero; shortleaf, hill, 10.9 cords; shortleaf, slope, 18.4 cords; shortleaf, flat, 11.8 cords; shortleaf, swamp, 1.2 cords; slash, hill, 31.6 cords; slash, slope, 44.0 cords; slash, flat, 49.8 cords; and slash, swamp, 12.1 cords.

Based on currently prevailing costs and prices, the annual returns on the total investment have been 7 per cent for loblolly pine and 9 per cent for slash pine on all topographic classes combined.

The Effects of Cultivation and Fertilization on the Growth of Arizona Cypress. (G. I. Garin.) — Treatments were applied during the second and third growing seasons to Arizona cypress which had been planted as 1-0 stock at a 5 x 5-foot spacing on the Upper Coastal Plain bordering the Piedmont Plateau at Auburn. The cultivation treatment consisted of hoeing around the trees often enough to keep down the growth of grass, weeds, and brush. Lime, at the rate of 2 tons per acre, was applied to half the plots at the beginning of the second growing season. The

following fertilizer treatments in various combinations were applied each growing season: nitrogen at the rates of 25 pounds of N per acre in one application, 50 pounds in 2 applications, and 75 pounds in 3 applications; phosphorous at the rate of 75 pounds of P_2O_5 per acre in one application; potash at the rate of 75 pounds of K_2O per acre in one application; and minor elements at the rate of 75 pounds of Esminol per acre in one application.

Analysis of results showed that the only treatments which significantly affected height growth of the trees were cultivation and nitrogen application. Cultivation caused an increase of 0.4 foot and nitrogen application an increase of 0.7 foot in average height growth during the two seasons. There were no differences in response to the three rates of nitrogen application. Effects of cultivation and nitrogen were apparently independent of each other.

Feasibility of Using Photographic Measurements to Determine Pulpwood Volume in Rick-Piled Woodyards. (E. W. Johnson.) — The primary problem in estimating the volume of ricks of pulpwood involves the following steps: (1) developing profiles of the stacks, (2) measuring the end-area of these profiles, and (3) dividing this total end-area by the end-area of the pulpwood unit being used to determine the number of units in the stack. A study to determine the feasibility of using photogrammetric methods to develop such rick profiles was begun in January, 1952.

The most feasible method of obtaining such profiles photogrammetrically is to use a precise stereoplotting machine such as the Zeiss Stereoplanigraph or the Wild A-5 Autograph. With such machines, the Y and Z motion drive-shafts are reversed so that the machine can plot a continuous profile rather than a contour.

At the present time costs of such an analysis are too high, being approximately twice as high as conventional ground techniques. If cost could be brought down to competitive levels, the precise plotters would find wide use.

Somewhat poorer estimates would result from the use of a stereometer to measure spot heights along the length of the rick. Such spot heights would be plotted to form the profile. Large scale photographs would be essential. These could be obtained using long focal length cameras, but in such a case the stereoscopic displacement would be reduced resulting in less precise height measurements. Photographs taken with individual frame image-motion-compensation cameras would solve the problem,

but as yet such cameras have not been released for civilian use in the United States. The use of a helicopter has been considered, but the cost of helicopter operation is so great that this procedure must be ruled out.

Sonne continuous strip photography has not been investigated as yet but may prove to be a useful technique.

Neither aerial nor terrestrial oblique photography will produce desirable results since the bases and portions of the tops of many ricks are hidden behind other ricks making height measurements impossible. In addition, the analysis of oblique photographs is relatively crude compared to that possible on vertical photographs using parallax methods.

Release of Pine and Desirable Hardwoods from Defective and Low Grade Hardwoods by Poisoning. (Frank F. Smith.) — An 18-acre stand of desirable hardwood and pine reproduction was released from an overstory of poor quality hardwoods in February and March, 1951. Randomized plots in the stand indicate the overstory had an average basal area of 49.88 square feet per acre of which only 6.50 square feet were of desirable species. The understory averaged 800 desirable hardwood and pine stems per acre. The undesirable trees in the overstory were poisoned with ammate crystals applied in chopped cups at the root collars. An average of 3 man-hours and 13 pounds of ammate was used per acre. At the end of the second growing season, the mortality was as follows: blackjack oak, 100 per cent; white and post oaks, 84 per cent; southern red, black and scarlet oaks, 72 per cent; and, red and black gums, 64 per cent. Stems under 10 inches in diameter for the above species had even higher mortality. The hickories were not affected by the poison.

HORTICULTURE

Effects of Fertilizers, Organic Materials, Irrigation, and Culture on Asparagus Yields. (L. M. Ware and W. A. Johnson.) — Results are based on yields from 1949 through 1952. Yields from use of a 6-10-6 fertilizer divided into 3 equal applications were 1,843 pounds from 1,500 pounds per acre, 1,994 pounds from 2,000 pounds, and 2,708 from 2,500 pounds. Yield was 2,692 pounds from 2,000 pounds of fertilizer and 12 tons of stable manure. Increasing the manure from 12 to 18 tons per acre increased yield only 184 pounds per acre. Irrigation did not increase yields. At the 2,000-pound fertilizer rate, applications at

2 rather than 3 periods increased yields from 1,994 to 2,385 pounds, but reducing applications to 1 period reduced yields to 1,918 pounds per acre. Fertilizer, when added at 1 period, was applied just after cutting; when added at 2 periods one-half was applied March 1 and one-half after cutting; when added at 3 periods, one-third was applied on March 1, one-third after cutting, and one-third on August 1.

Effects of Soil Fumigation on Vegetable Crop Production. (L. M. Ware and W. A. Johnson.) — Results are based on experiments in 1950, 1951, and 1952 on the same soil. Materials were ethylene dibromide (EDB) and dichloropropene-dichloropropane mixture (DD). Applications were made in rows and broadcast or solid in each of 3 successive years and broadcast in alternate years. Stands were poor in 1952.

Yields of beets were increased by row treatment of EDB in successive years, 35 per cent the first year and 211 per cent the second year; yields were increased by solid treatment 41 per cent the first year and 169 per cent the second year. Increases from solid treatments in alternate years were 68 per cent the first year and 340 per cent the second or residual year.

Yields of beets were reduced 10 per cent the first year by row treatment of DD but increased 162 per cent the second year. Yields the first year from solid treatment each year were reduced 30 per cent but increased 86 per cent the second year. Increases were 269 per cent the second year from solid treatment in alternate years.

Results with carrots were somewhat similar to results with beets except that yields were not reduced the first year from any treatment. Increases in yield of potatoes and turnips from soil fumigation were less pronounced than those of beets.

The Effect of Minor Elements and Side Applications of Fertilizers on Nutritional Deficiency in Potatoes. (W. A. Johnson, John Wear, and Frank Garrett.) — In the spring of 1952, experiments were conducted on five farms in Baldwin County. Soils in three of the fields were of light sandy texture while in two other fields they were of heavy texture. The tests were on a cooperative basis with the farmer; the farmer applied the original base fertilizer, planted and cultivated the crop, and aided in harvesting the potatoes. The base fertilizer applied did not have magnesium added. Seven treatments replicated three times were used at each location.

Average differences necessary for significance between treatments for all locations at the .05 level was 1,116 pounds or 11 bags and at the 0.1 level 1,538 pounds or 15 bags per acre.

The average yield of all fields without side dressing was 89 bags of marketable potatoes per acre; the yield was 100 bags per acre when 32 pounds of nitrogen was applied as a side dressing; this increase was significant at the .05 level. Fields 1, 2, and 3 with light sandy soil showed marked increases from the nitrogen application; whereas, Fields 4 and 5 with heavy soils showed no increase from side applications of nitrogen during this relatively dry year. When the potatoes were side dressed with 32 pounds of N and 56 pounds of K_2O, 109 bags were produced; this difference was slightly below significance. When 800 pounds of 4-10-7 was used as a side dressing, the yield was 113 bags per acre. Therefore, the side application of complete fertilizer gave a significant increase over the nitrogen side dress. When magnesium was omitted from the fertilizer, there was a reduction of 11 bags per acre which was significant at the .05 level. No significant increase in yield resulted from addition of boron and zinc. Yield of potatoes, side dressed with 4-10-7, was not affected when minor elements were left out.

Observational Studies on Peach Varieties. (W. A. Johnson, T. B. Hagler, and H. G. Barwood.) — Two-year yield results have been obtained on 56 varieties of peaches at Auburn. Data were obtained on ripening dates, fruit size, firmness of flesh, stone freeness, flesh color, eating quality, and yields.

Cherryred and Early Jubilee ripen approximately 1 week after Mayflower, produce more and larger fruit, and have better quality than Mayflower. Both have yellow flesh. The Cherryred is a clingstone; and early Jubilee is a freestone. Jerseyland and Missouri, both semi-cling peaches, show some promise of being good peaches for home use; they ripen about the time of the Golden Jubilee and Dixigem. These two varieties are larger than Dixigem and are of similar quality.

Following the ripening dates of Halehaven is Newday, a semi-cling peach of large size, which yields well and has good quality; this is an excellent variety for home use. Both Early Triogem and Triogem, which ripen approximately 1 week before Halehaven, show promise for both home and the fresh market use. Sunhigh is a good variety that can be grown for the fresh market and also for processing. It is a freestone peach, produces fairly

large fruit, has very good quality, and produces excellent yields. Other varieties showing promise are Burbank Elberta, Redcrest, Summer Crest, and Brackett.

Suitability of Alabama-Grown Blackberries of the Trailing Type for Commercial Jams and Jellies. (V. C. Zimmer and Hubert Harris.) — Samples of berries of the Boysen and other varieties grown in Alabama were tested and compared with similar berry samples of the Evergreen variety grown in the State of Washington. The Evergreen berries were obtained from frozen stock used by commercial preservers. The Alabama-grown samples of the Boysen variety possessed ideal pH and total acidity for jam and jelly making, while the Washington-grown Evergreen berries were too low in acidity for a satisfactory gel set without the addition of commercial fruit acid.

For 2 seasons samples of jellies and jams prepared from the 2 sources of berries were tested and scored for flavor. The samples were tested under code numbers by panels. Possible scores ranged from 1 as very poor and unacceptable to 25 as excellent and highly acceptable.

Average scores on jam products gave the Washington-grown Evergreen jam a value of 15.1 as compared to 19.1 for the Alabama-grown Boysen jam. Similar panel tests on jelly products resulted in an average score of 15.2 for the Washington-grown Evergeen jelly as compared to 18.7 for the Alabama-grown Boysen jelly.

These tests indicate that Alabama-grown trailing type blackberries are better suited for jam and jelly products than the Washington-grown Evergreen variety.

Retaining Volatile Flavors in Fruit Jellies and Jams. (Hubert Harris.) — Better retention of volatile flavors in fruit jellies was obtained by certain modifications of the common methods of heating and boiling the products. Flavor losses from muscadines and apples in extracting the juice were reduced considerably by modifying the hot-extraction process. The fruits were cold-pressed to obtain 75 to 80 per cent of the available juice; the press cake was then heated in a steam chamber and pressed a second time to obtain the remainder of the juice together with pectin and coloring.

In finishing the jelly, flavor losses were reduced by cooking the jelly in relatively small batches with short heating periods as compared to larger batches and longer heating periods.

Flavor losses from larger batches were also reduced considerably by the fraction batch soil. By this process, 40 per cent by weight of a batch of standard juice was boiled long enough for the necessary concentration of the entire batch and the remaining 60 per cent was heated to only 190°F. in compounding the jelly. Average scores on jellies prepared by this process were only slightly lower than the scores on jellies prepared from the same juices by the vacuum process.

The highest retention of flavors by any of the methods studied was obtained by the dilute fraction batch boil. By this process, standard juice was separated into dilute and concentrated fractions by freezing and centrifuging and only the dilute fraction was boiled in finishing the jelly as explained above. The dilute fraction of juice represented approximately 40 per cent of the total weight of the batch of juice but only approximately 12 per cent of the soluble solids in the batch.

Due to the shorter heating and boiling time, flavor losses were less by the open-kettle process when a standard strength juice was used than when a sub-standard strength juice was used.

Freezing Qualities of Strawberry Varieties. (Hubert Harris.) — In a study of freezing qualities of strawberry varieties on test at the North Alabama Horticulture Substation, the Tennessee Shipper, Tennessee Beauty, Tennessee Supreme, and Blakemore were superior to several other varieties tested. The Tennessee Shipper rated excellent in texture and very good in color and flavor. Tennessee Beauty and Tennessee Supreme rated excellent in flavor and color and good to very good in texture. Blakemore rated very good in flavor and color and good in texture. Varieties that for one or more reasons failed to rate well in these tests included Aroma, Klonmore, Missionary, and Klondike. However, the Aroma rated high in flavor and the Klondike rated high in color.

Effects of Fertilizers on Flavor of Cantaloupes (Hubert Harris.) — Soluble solids and flavor tests were made on cantaloupe samples from certain treatments in a fertilizer and irrigation study. A total of 9 cantaloupes was tested from each treatment studied and the cantaloupes were taken from 3 different harvests. With commercial fertilizers used at the rate of 1,000 pounds of 6-10-6 per acre in each case, the average soluble solids were 10.74 per cent on plots receiving the fertilizer alone, 10.29 per cent on plots receiving organic materials in addition to the fertilizer, and 9.76

per cent on plots receiving irrigation, fertilizer, and organic materials.

Panel tests on flavor indicated measurable flavor differences between individual cantaloupes within treatments, but these tests did not show any consistent differences between treatments.

Lettuce Variety Improvements. (C. L. Isbell.) — As the result of crossings made using the crisp head variety Imperial 847 and a winter hardy receding unnamed loose leaf strain obtained from a farmer in northeastern Alabama, several reseeding winter hardy kinds have been developed. The different kinds vary greatly in plant characteristics. Color of the leaves range from various shades of green to various shades of purple. Some have leaves greatly savoyed while leaves of others are smooth. Some are crisp while others are butter types. Most of the plants are large to very large and of good table quality. Consumer preference tests indicate that a good many people would grow some of these newer kinds if seed were available, or would buy the fresh product if it were available on the market. The large plants of high quality are especially adapted for use in cut salads or as wilted lettuce. Some of the highly colored kinds are decidedly promising as ornamental plants or for use in flower vegetable arrangements.

Improved Varieties of Southern or Table Peas. (C. L. Isbell.) — By means of crossing and selection, five improved varieties of Southern or table peas have been developed, named and released. Their characteristics briefly stated are as follows:

(1) ALABUNCH. — This variety produces a tall bunch type plant, with pods on long stems held well above the vine. The root system is large and comparatively free of diseases. It produces well on a wide variety of soils. It is early with green peas large enough for use in 45 to 55 days from planting. The yield tends to be heavy. Pods are long and well filled with medium to large white peas. The eyes are dark gray and appear black when canned or frozen. Green peas shell well and are of good to excellent quality, fresh, canned, or frozen. Matured peas tend to be somewhat starchy and do not weather well if not harvested soon after they are well dry.

(2) ALABROWNEYE. — This variety produces a medium to large plant that is semi-vining to quite vining when grown on heavy or moist soil from spring planting, but from summer plantings it

tends to be a tall bunch type. It is well suited to follow oats. It has a large deep root system. It is a mid-season variety with green peas large enough for use from 60 to 75 days from planting. The yield tends to be large especially when the soil is not too moist. Pods are medium in size and length, well filled with white peas that have brown eyes. The peas shell easily and are of high quality when green or mature. Plants tend to retain the green leaves until most of the peas are dry. Mature peas tend to weather well.

(3) ALACROWDER. — This variety produces a stocky bunch plant with pods on relatively long stems. The root system sometimes develops slowly from early spring plantings apparently due to some disease, but as the weather gets warm the root system develops well. It is early with green peas ready for use 50 to 60 days from planting. The yield is good. Pods are medium length, almost straight, quite large and contain large to very large white peas with black eyes quite crowded in the pod. Green peas shell well but pods both green and mature are noticeably tough. The peas are of excellent quality, fresh, frozen, canned or mature.

(4) ALALONG. — This variety produces a large, semi-vining plant. It is mid-season to late with green peas ready for use from 70 to 90 days from planting. It fruits over a relatively very long period. Pods are large, long and well filled with large white peas that have brown eyes. The peas shell quite easily in the green or mature state. The mature peas tend to weather well. The quality of the peas is very good, fresh, canned, or frozen. It is an excellent variety for home use or fresh market but does not lend itself as well to mechanical harvest as do some other varieties.

(5) EARLY DIXIE QUEEN. — This variety produces a medium-sized plant that tends to bunch, and fruits heavily when grown on thin or drouthy soil. It produces large vines and is less fruitful on heavy soils or under quite moist conditions. Its root system is relatively free of diseases and very well developed. It is quite early with green peas ready for use in 45 to 50 days from planting. Pods are medium in length and size. The peas are medium in size, white with brown eyes. They shell well and are of good table quality, fresh, frozen, canned or dry.

Poinsettia Studies. (Tok Furuta.) — Results of tests show that the normal flower bud initiation date in Auburn is between September 20 to October 1. For this reason, the use of supple-

mentary lights to delay bract initiation should begin before or on September 15. By using supplementary lights to October 5, bract development will not be too advanced for Christmas.

Studies with Greenhouse Chrysanthemums. (Tok Furuta.) — Tests indicate that normal flower bud initiation occurs on greenhouse varieties of chrysanthemums between August 8 to 15 in Auburn. The length of time from the start of photoinduction to flowering did not change this date. In addition, to May 1, the natural daylength is short enough for flower buds to initiate.

Published schedules on chrysanthemum culture is well suited to this area. It was also found that the length of the period of long photoperiods before photoinduction, or planting distance did not influence flower size. Stem length varied with a change in both factors. In general closer spacing resulted in increased stem length but less production.

Fertilizer Trials with Azaleas and Camellias. (Henry P. Orr and Tok Furuta.) — Tests for 2 years with rooted cuttings of Camellias and Azaleas indicated the following rates and analysis to be superior: Camellias — 2,000 pounds of a 6-10-8 per year and Azaleas — 6,000 pounds of a 6-10-4 per year. The rates are based on an acre unit. Since this work was carried out in pots in a greenhouse, free application to field plots should be avoided.

Hydrangea Variety Trials. (Morris Clint, Jr.) — Variety Trials made during the winter and spring of 1951 showed that, for Easter and Mother's Day, the varieties Strafford and Merveille were the best to grow. Longer time was required for these plants to come to full bloom for Easter. However, the strong, vigorous growth, hard foliage, and full, large flower clusters made these two varieties much superior to the others tested.

Regula was the best white variety tested.

The Use of Supplementary Illumination to Induce Earlier Flowering of *Camellia japonica.* (Henry P. Orr and Tok Furuta.) — Well developed plants of several camellia varieties were treated during the fall to attempt to flower the plants earlier. Supplementary illumination was supplied to one series beginning September 1 to December 1, and to another series on October 1 to December 1. The check plot consisted of normal daylength only. The supplementary illumination consisted of 100-watt bulbs suspended 3 feet above the plants.

Although flower production was low, the use of supplementary light did not seem to induce earliness of flowering. Rather, in several cases the early production had decreased when supplementary lights were used. And in all cases, maximum production occurred at the same time whatever the treatment.

Other workers have reported that long days delayed flowering or did not materially influence the date of flowering.

Storage and Cultural Treatments on the Growth of Easter Lilies. (Tok Furuta and Morris Clint, Jr.) — Commercial varieties of Easter lilies were stored at 32° and 45° F. for 5 to 20 weeks before forcing. Increasing storage time reduced the length of forcing, decreased the final height and decreased the number of flowers. These effects were more noticeable at 45°F. In general, storage at 45°F. resulted in shorter plants and shorter forcing period.

Storage in moist peat resulted in quicker growth and shorter forcing period. Forcing temperature (50°F., 60°F. or a combination) did not influence the height or number of flowers. Forcing at 60°F. resulted in faster flowering.

Less than normal watering resulted in shorter plants of the Croft lily. The number of leaf spots may also be reduced by this method. Flower count was not influenced.

POULTRY HUSBANDRY

Breeding and Immunizing Chickens for Resistance to Coccidiosis: (1) IMMUNIZING CHICKENS AGAINST COCCIDIOSIS. (S. A. Edgar and D. F. King.) — A practical method of immunizing chickens against cecal coccidiosis (*Eimeria tenella*) has been developed. Chicks are inoculated with coccidia via the feed at 3 days of age, then fed a sulfa drug in the water or feed for 48 hours starting the 13th day after inoculation. In field tests involving more than 30,000 birds in flocks near Auburn, Alabama, mortality from coccidiosis during the first 4 weeks, the immunization period, averaged less than 1 per cent. Average mortality for all but one flock was less than 0.35 per cent. Representatives from immunized flocks were challenged at 4 weeks of age with a dosage of oocysts that killed 50 per cent of the non-immune controls. None of the immunized chicks were killed by the challenge dose and they made normal weight gains following challenging. This indicated that birds immunized by the method developed in this laboratory had sufficient resistance at 4 weeks of age to with-

stand damage from ordinary exposure to cecal coccidiosis that a bird might encounter in the field after it is 4 weeks old.

Immunization against cecal coccidiosis does not give immunity against other types. The cecal coccidiosis "vaccine" is being marketed and has now been used with considerable success on more than 11 million birds throughout the country. The immunization procedure, which includes inoculum and sufficient sulfa drug for a 2-day medication period costs the grower 1 cent per bird. This is less than the usual cost of cecal coccidiosis medication.

Several experiments were conducted in which birds were immunized for cecal and one of the most important intestinal types (*E. necatix*) at the same time. In the first 6 experiments, results of which have been summarized, the immunized chickens (807 birds started) averaged 0.155 pounds more per bird at 8 weeks than the equal number of non-immunized controls. There was one third the mortality from coccidiosis in immunized pens as compared to non-immunized pens even though the latter were treated for coccidiosis at the first sign of the disease. Evidence obtained indicated that it is economically feasible to immunize chickens for intestinal as well as for cecal coccidiosis.

(2) Life Cycle of *Eimeria tenella.* (S. A. Edgar and Mrs. C. Flanagan.) — Several aspects of the life cycle of *E. tenella,* which has been known for 25 years, have been re-investigated.

The sporulation time of oocysts, the time necessary for unsporulated oocysts to reach the infective stage after passage from the host, had been established by several workers as being 48 hours at room temperature. That room temperatures vary and are not necessarily characteristic of temperature conditions in nature where the disease occurs in poultry operations, led to a more critical determination of sporulation time of *E. tenella* at specific temperatures. Fecal specimens with freshly passed oocysts were divided and lots were sporulated at temperatures ranging from 8° to 37.5° C. It was found that at the optimum-sporulation temperature, 28°C. ± 1°, that some oocysts were infective at 21 hours, the shortest period tested. Infectiveness of oocysts was determined by passage of oocysts through susceptible chicks at definite time intervals after oocysts had been harvested from freshly-killed infected birds. Oocysts were infective at 24 hours at all temperatures tested, ranging from 20° to 32°C. The greatest percentage of infective oocysts at 24 hours, however, was in suspensions sporulated at 28°C. ± 1°. Microscopic examination revealed that at 28°C., 42 per cent of the fertile oocysts were

infective at 21 hours and 82 per cent were infective at 24 hours. It is possible that some oocysts may become infective in less than 21 hours under optimum conditions. Sporulation was slow and poor at extreme temperatures of 8° to 37°C.

Stored suspensions were subjected to different temperatures to ascertain the effect of temperature on viability of infective oocysts. At 37.5°C. oocysts remained viable for 2 weeks but were dead at 4 weeks. At 1.5°C. oocysts were unchanged at 8 weeks. Viable suspensions have been maintained for 4 years under refrigeration, the longest period tested; suspensions kept at room temperatures ranging from 65° to 85°C. remained viable as long as 2½ years.

Birds that have been starved over night and inoculated with a lethal dose of infective oocysts of *E. tenella* passed copious bloody droppings as early as between 4 days 12 hours and 4 days 22 hours. Fertile oocysts were passed as early as between 5½ and 6 days after inoculation. Large numbers of oocysts were being passed by 6¼ days after inoculation. These two findings are not in agreement with reports in the literature. Other specific developmental stages of the parasite and its storage are being investigated.

(3) Chemotherapy of Cecal Coccidiosis. (S. A. Edgar.) — Several experiments have been conducted in which the therapeutic value of several sulfa drugs and other compounds, used in preventing mortality from coccidiosis, were compared. Of drugs tested, sulfaquinoxaline and nitrophenide were the most effective. At 0.1 per cent of the ration, fed from 72 hours through the seventh day after oocyst inoculation, sulfaquinoxaline appeared to be slightly inferior to nitrophenide in preventing mortality, but the latter retarded weight gain. Chicks fed 0.1 per cent nitrophenide in the ration for more than 48 hours exhibited nervous symptoms which became progressively worse as the drug was continued. Feed intake was reduced. Sulfaquinoxaline was not toxic when administered for 4 days at the same level.

The action of sulfaquinoxaline on the parasite has been studied. The drug inhibits the normal asexual development of the second generation schizonts with their second generation merozoites. The profuse growth of these stages in heavily infected non-medicated chicks is the cause of the capillary damage and mucosal sloughing in the cecal pouches which results in profuse hemorrhage and death of birds.

The Effect of Mosquitoes on Poultry. (S. A. Edgar and J. F. Herndon.) — During 1951 and 1952 additional data were obtained regarding the host preference of wild mosquitoes collected from buildings on Alabama farms. The blood meals of mosquitoes were determined by the serological method reported earlier.

The previous report on the host preference of *Culex quinquefasciatus* was substantiated, that it preferred avian blood to that of mammals. The number of engorged females found in harborages was roughly proportional to the nearness and availability of avian hosts. *Anopheles quadrimaculatis, A. crucians* and *A. punctipennis* fed readily on all domestic mammals depending upon their availability. They preferred mammalian to avian blood. *Culex erraticus* fed predominantly on chickens, cows, and pigs and to a lesser extent on other animals. Fewer mosquitoes were observed in harborages on Alabama farms in 1951 and 1952 than in the 3 previous years.

A new rotary type, host-preference mosquito trap was designed and constructed. It was constructed to facilitate making more accurate host-preference determinations at less cost than the conventional serological method. The trap was designed to study the host, color, light, odor, etc. preferences of mosquitoes. It can be used to study repellants and attractants for not only mosquitoes but other flight insects of medical importance. It should be applicable to the study of certain crop insects.

Decreasing Adult Mortality in the Domestic Fowl by Breeding. (Fred Moultrie, G. J. Cottier, and D. F. King.) — During the 3-year period, 1948-1951, crosses were made between a disease-resistant strain (Auburn Strain White Leghorn) and a relatively susceptible strain (Strain D) of the same breed. The crosses were made in 1949 and 1951 mating sires of the susceptible strain with dams of the resistant strain; in 1950 reciprocal crosses were made. Birds of the pure strains and strain crosses received the same treatment and no culls were removed at any time. A summary of mortality follows:

Per Cent Pullet Mortality of

Period	Pure strains		Inter-strain hybrids	
	A	D	AD	DA
1-155 days	16.7	21.1	39.4	12.4
156-500 days	16.2	30.8	29.8	16.9

The F_1 inter-strain hybrid pullets produced by susceptible sires and resistant dams consistently showed evidence of heterosis in viability during both the growing and laying periods. In the 1 year in which reciprocal crosses were made, the F_1 inter-strain hybrid pullets produced by resistant sires and susceptible dams exhibited no evidence of heterosis in viability but died in both the growing and laying periods at rates significantly higher than birds produced by the reciprocal cross. In no instance did adult mortality of the F_1 inter-strain hybrids differ significantly from adult mortality of the female line used to produce the hybrids.

The Nutritional Requirements of Broilers. (G. R. Ingram.) — A series of tests has been conducted with growing chicks in batteries and in floor pens in an effort to develop a simple formula for a broiler ration.

These tests indicate that an all-plant ration supplemented with minerals, vitamins A, D, riboflavin, and choline and containing 36 grams of aureomycin per ton is equal to or better than a good standard commercial broiler ration for supporting chick growth.

Soybean oil meal, soy-corn gluten meal, and soy-cottonseed meal have been tested as the protein supplement with about equal results. No growth response was obtained by the addition of milk, whey, fish solubles, fish meal, or yeast. A slight increase in feed efficiency was obtained by adding either methionine or the hydroxy analogue of methionine.

Epidemic Tremors (*Avian Encephalomyelitis*), **Epidemiology and Control Among Chickens.** (S. A. Edgar, C. L. Strickland and Mrs. C. Flanagan.) — During the past year representative birds from 25 flocks suspected of having epidemic tremors were submitted for diagnosis. Of those submitted, a total of 82 were autopsied. Sections of brains were made and studied from 45 birds from the 25 flocks. Principal findings were as follows:

A. Sixteen flocks, or 66 per cent of the 25 suspected flocks from which brains were sectioned, had epidemic tremors as defined by the presence of characteristic lesions in nerve tissues.

B. Of the 16 flocks determined as having epidemic tremors, it was estimated that an average of 10 per cent, or 4,017 of the flocks totaling 40,170 birds were affected. Fifteen flocks were New Hampshires; one flock was White Leghorn.

C. Sources of New Hampshire chicks studied were from 9 hatcheries in Alabama, Georgia, and Mississippi. Source of White Leghorns was from one hatchery in Alabama.

D. Fourteen attempts were made to transmit the virus agent from pooled and single brain samples from field infected chickens to susceptible birds. Takes were obtained in possibly two instances. In no instance was there transmission by contact.

ZOOLOGY-ENTOMOLOGY

Control of Cotton Insects. (F. S. Arant.) — Infestations of the boll weevil, *Anthonomus grandis* Boh., were generally light in both 1951 and 1952 as a result of extremely dry weather. Except for localized damage late in the season, infestations of bollworm, *Heliothis armigera* (Hbn.), were also light. Thrips, *Frankliniella fusca* (Hinds), were abundant on seedling cotton in localized areas in northern Alabama in 1951, and red spider mites, *Tetranychus atlanticus* McG., were extremely abundant in the late summer in the northern part of the State.

Replicated plot experiments for insect control were conducted in southeastern, central, and northern Alabama. There were no increased yields from 2 applications of the insecticide when the cotton was in the 2-leaf stage followed by 2 additional applications at the appearance of first squares. Moderate gains resulted from treatment of plots during July and August. Dusts and sprays applied at the rate of 0.25 pound heptachlor and 0.5 pound DDT per acre were as effective in control of cotton insects as aldrin-DDT treatments at the same rate. Dieldrin applied at the rate of 0.15 to 0.25 pounds plus 0.5 pound DDT per acre was slightly more effective than aldrin-DDT. Two to 3 applications of 1 per cent parathion dust at the rate of 25 pounds per acre gave effective control of red spider mites on cotton but failed to increase the yield. The weather was so extremely dry that the cotton plants were incapable of producing additional fruit after the mites were controlled. Effective treatments currently recommended for use in Alabama as dusts at the rate of 10 to 15 pounds per acre or equivalent amounts of sprays are as follows: 2.5 per cent aldrin-5 per cent DDT, 3 per cent gamma BHC-5 per cent DDT, 3 per cent gamma BHC-5 per cent DDT alternated with calcium arsenate, 0.15 per cent dieldrin-5 per cent DDT, 0.25 per cent heptachlor-5 per cent DDT, and 20 per cent toxaphene.

Effect of Certain Organic Insecticides on Beneficial Insects of Cotton. (R. L. Robertson and F. S. Arant.) — Studies on insect populations in cotton fields treated for insect control with aldrin-DDT, BHC-DDT, dieldrin-DDT, heptachlor-DDT, and toxaphene revealed that all insecticides applied reduced the number of beneficial insects. Sixteen species of beneficial insects were collected from fields in central Alabama.

Control of Peanut Insects. (F. S. Arant and B. W. Arthur.) — The peanut-growing season in 1951 was extremely dry and insect damage was generally light except for extensive injury caused by lesser cornstalk borer, *Elasmopalus lignosellus* (Zell.). The 1952 season was also dry but favorable for production of a satisfactory crop.

Four applications of 10 per cent DDT applied to the foliage of peanuts at weekly intervals during July and August reduced the infestation of lesser cornstalk borer and more than doubled the yield of peanuts as compared with the untreated checks. However, the season was so unfavorable that the yield on the treated plots was less than 300 pounds per acre. Aldrin, BHC (gamma), dieldrin, and heptachlor applied to the soil at the rates of 1 and 2 pounds per acre for control of soil insects reduced slightly the damage to pods from underground pests. However, the yield of peanuts was not increased by the use of any insecticide over the 2-year period. Systox and schradan applied to the soil and the foliage at rates of ½ to 1 pound per acre reduced the population of thrips, *Frankliniella fusca* (Hinds), but failed to increase the yield of peanuts. There was some evidence of decreased yields where thrips were controlled. Applications of 10 per cent toxaphene, 2.5 per cent DDT, 1 per cent parathion, and 2.5 per cent aldrin made during July and August resulted in substantial increase in yields of peanuts as compared with the untreated checks.

Control of Insect Pests Attacking Corn and Grain Sorghum. (W. G. Eden.) — Experiments were conducted at four locations in Alabama on control of the southern corn rootworm, *Diabrotica undecimpunctata howardi* Barb., in corn. One pound of aldrin per acre applied in the fertilizer at planting time gave the best control. Lindane seed treatment showed promise but was not as effective as 1 pound of aldrin in the fertilizer.

Experiments were conducted at several locations on control of the corn earworm, *Heliothis armigera* (Hbn.), in sweet corn

during 1951 and 1952. DDT was the most effective insecticide tested. Four applications of DDT in emulsion sprays applied with ground machinery at 3-day intervals at the rate of 2 pounds technical per acre in 12.5 to 50 gallons of spray gave excellent control of earworm. Spraying was begun when 10 per cent of the plants were in silk. Four pounds of DDT per acre per application as a dust or spray by airplane was ineffective. Mineral oil included in DDT emulsion sprays did not significantly increase the control obtained and caused foliage injury when the temperature was high and the humidity was low for extended periods of time. Quick-breaking DDT-mineral oil emulsions appeared to give slightly better control and less foliage injury than stable emulsions. In heavy earworm infestations, spraying to prevent earworm damage was futile when the first application was delayed until all the stalks were in silk.

Studies were conducted on control of insect pests of stored grain, especially the rice weevil, *Sitophilus oryza* (L.), in corn. Effective fumigation was obtained on shelled corn in steel bins with a formulation containing 7.4 per cent ethylene dibromide, 27.7 per cent propylene dichloride, and 64.9 per cent carbon tetrachloride. Four gallons of 10 per cent bromotrichloromethane in carbon tetrachloride per 1,000 cubic feet was also effective. A dust formulation containing 0.8 per cent piperonyl butoxide and 0.05 per cent pyrethrins was tested at the rate of 1 pound per 10 bushels of corn as a protectant against stored grain pests. Little protection was obtained with the dust on corn in the shuck. Good protection was obtained on clean or slightly infested, dry corn that was shucked or shelled. No correlation was found between the rate of nitrogen fertilizer or the spacing of corn on rice weevil damage. The weevil damage was low, and if these factors had any effects on weevil damage they were overshadowed by others. Corn varieties found to be the most resistant to rice weevil were Dixie 18, Coker 811, Woods S-210, and La. 521. The most susceptible varieties were U. S. 13, Paymaster, Dixie 17, and Pioneer 302.

Dusting grain sorghum in the blooming stage with 5 per cent DDT appeared to reduce damage by the sorghum midge, *Contarinia sorghicola* (Coq.). Good control of the corn earworm in grain sorghum was obtained with 2 applications of 2 pounds of DDT per acre as a dust or spray.

Control of Insect Pests of Vegetable and Truck Crops. (W. G. Eden.) – Experiments were conducted at 3 locations on control of the tomato fruitworm, *Heliothis armigera* (Hbn.), on tomatoes. Good control was obtained with 5 per cent dusts of TDE and methoxychlor; 50 per cent cryolite dust was somewhat less effective. In preliminary tests with wettable powder sprays, the following rates of insecticides per 100 gallons of water showed promise: endrin, 0.2 pound; isodrin, 0.2; and dilan, 0.5.

Residue analyses were made on tomatoes treated with malathon and Systox. No malathon was found on fruits analyzed 2 weeks after the eighth weekly treatment of plants with 25 pounds of 5 per cent dust or 2 pounds of 25 per cent wettable powder per 100 gallons of spray. One-tenth p.p.m. of Systox was found in fruits harvested 3 weeks after the fourth application of Systox. The Systox was applied at 2-week intervals at the rate of 1 pound per 100 gallons of water.

An experiment was conducted at Cullman in 1952 on control of the cowpea curculio, *Chalcodermus aeneus* Boh., on cowpeas with insecticidal dusts. Effective control was obtained with dusts of 5 per cent DDT, 5 per cent chlordane, 20 per cent toxaphene, and 2.5 per cent aldrin.

The lesser cornstalk borer, *Elasmopalpus lignosellus* (Zell.), caused considerable injury to vegetable crops, especially beans and cowpeas, in Alabama in 1951 and 1952. Experiments showed that the damage could be lessened by dusting emerging seedlings with insecticides. The most promising insecticidal dusts were 10 per cent DDT, 20 per cent toxaphene, 2 per cent dieldrin, and 2.5 per cent heptachlor; however, none of them gave effective control.

Control of the Peach Tree Borer. (W. G. Eden.) – An experiment was conducted at Clanton in 1952 to compare the effectiveness of summer trunk sprays with fall mound treatments for control of the peach tree borer, *Sanninoidea exitiosa* Say. Wettable powder sprays were applied to the trunks and lower limbs of the peach trees on July 1, August 1, and September 1. The following rates of insecticides were used per 100 gallons of spray: parathion, 2 pounds of 15 per cent; DDT, 4 pounds of 50 per cent; EPN, 2 pounds of 25 per cent; and dieldrin, 1 pound of 50 per cent. Equally effective control was obtained with all of the trunk sprays and with the fall mound treatments of PDB and ethylene dichloride.

Taxonomy of Flies Collected from Chicken Manure and a Study of the Toxicity of Several Chemicals to Housefly Larvae. (H. B. Cunningham and W. G. Eden.) — Flies from chicken manure were collected by means of emergence traps at several locations near Auburn, Alabama, in 1952. Collections were made two or more times during each month of the year. Of the 7,695 flies collected, 60 per cent were the housefly, *Musca domestica* L., 19 per cent *Fannia pusio* Wied., 6 per cent *Muscina stabulans* (Fallen), 5 per cent *Fannia canicularis* (L.), 2 per cent *Stomoxys calcitrans* (L.), and 1 per cent *Hermetia illucens* (L.). A total of 25 species belonging to 14 families were collected. Laboratory tests were conducted on the larvacidal activity of five insecticides to third instar larvae of the housefly. The LD-50's in p.p.m. of insecticide in the culture medium were as follows: endrin, 135; dieldrin, 325; aldrin, 360; chlordane, 1,400; and DDT, 2,075.

Control of Wireworms Attacking Sweetpotatoes. (J. A. Griffin and W. G. Eden.) — Experiments were conducted at several locations in 1951 and 1952 on control of the Gulf wireworm, *Conoderus amplicollis* (Gyll.), in sweetpotatoes. The following insecticides were tested at various rates by applying them in the fertilizer: chlordane, lindane, heptachlor, aldrin, dieldrin, parathion, toxaphene, benzene hexachloride (gamma isomer), and ethylene dibromide. Good control was obtained with 2 pounds per acre of aldrin, dieldrin, heptachlor, lindane, and gamma benzene hexachloride. None of the insecticides caused off flavor in the sweetpotatoes.

Toxicity of Aldrin, Dieldrin, and Toxaphene to Rabbits by Skin Absorption. (Barbara Johnston and W. G. Eden.) — The toxicity of aldrin, dieldrin, and toxaphene to rabbits by skin absorption was determined by immersing rabbits in water suspensions of wettable powders. The LD-50 of aldrin was 15 to 25 mg. per kg.; of dieldrin, 400 to 500 mg. per kg.; and of toxaphene, 1,025 to 1,075 mg. per kg. Symptoms of poisoning, which were the same for all three insecticides, were loss of appetite, extreme nervousness, convulsions, and muscular spasms.

Control of Insect Pests of Legumes. (G. H. Blake, Jr.) — In experiments for control of the vetch bruchid, *Bruchus brachialis* Fahr., 2, 3, and 4 applications of both 2.5 per cent aldrin and 10 per cent DDT were applied to vetch during the blooming

period. The control obtained with either insecticide increased as the number of applications increased. The number of bruchids emerging per pound of seed decreased from 369 on the checks to 38 on plots receiving 4 applications of 10 per cent DDT.

The pea aphid, *Macrosiphum pisi* (Kltb.) was effectively controlled on Caley peas by 2 applications of 5 per cent gamma BHC, 1 per cent parathion, and 10 per cent DDT dusts, with seed yield increases of 356, 329, and 235 pounds per acre, respectively. In a second experiment in which the above insecticides were used, one application of the BHC and parathion caused significant increases in the seed yields.

Experiments conducted on the survival of sericea plants girdled by the three-cornered alfalfa hopper, *Stictocephala festina* Say, indicated that the girdles had no effect on the over-winter survival of sericea plants but that death of some plants during the growing season was due to damage by the hopper. The three-cornered alfalfa hopper was controlled on sericea by dusts of 5 per cent DDT, 1 per cent parathion, and 10 per cent methoxychlor; however, no increase in hay yields were obtained by controlling the insect.

The lesser clover leaf weevil, *Hypera nigrirostris* (F.), was controlled on crimson clover by 3 per cent gamma BHC, 2.5 per cent aldrin, 20 per cent toxaphene, and 5 per cent DDT dusts (treatments listed in order of effectiveness); however, no significant increases in seed yields were obtained as a result of the treatments.

Experiments have been conducted for 2 years to determine the effect of honey bees for pollination on seed yields of crimson clover. The presence of bees caused seed yield increases of from 260 to 1,020 pounds per acre over yields where no honey bees were present. Some of the differences in yields were found to be due to partial shading and wind exclusion in the caged areas.

Control of Insect Pests of Livestock. (G. H. Blake, Jr.) — Experiments have shown that sprays of 1.5 per cent DDT, 1.2 per cent DDT-0.03 per cent lindane, 1.5 per cent methoxychlor, and 0.5 per cent toxaphene effectively controlled horn flies, *Siphona irritans* (L.), on beef cattle for a period of 1 month or more.

The larvae of several species of flies were controlled in cow manure by applications of 2.5 per cent dieldrin and 2.5 per cent heptachlor sprays. Manure was added to the piles at 3-day inter-

vals, and insecticidal applications were made before and after each application of manure.

Several insecticides were tested for control of the cattle grub, *Hypoderma lineatum* (De Vill.) in beef cattle, and several intervals between spray applications were tried. Sprays containing 0.047 per cent rotenone applied at intervals of 4 or 5 weeks were found to be the most effective for control of grubs.

Houseflies, *Musca domestica* L., were killed by contact with dieldrin-treated strings suspended in a milking shed; however, the degree of control was poor.

Wildlife. (A. O. Haugen and F. W. Fitch, Jr.) — There is little breeding of the gray squirrels in Alabama in November and December. This coupled with the absence of bot fly larvae in the squirrel during this period makes the present hunting season, Oct. 15 - Dec. 15 in northern Alabama, and Nov. 1 - Jan. 1 in southern Alabama biologically sound.

Appreciable damage by muskrats to farm pond dams with 12-foot top widths was found in very few instances. The pattern of burrowing was such that the holes in no case penetrated even to the center of the dam. Well-constructed dams with 12-foot top widths and slopes that had a rise of 1 foot or less for each 2 feet of horizontal distance were found to be the best insurance against damage by muskrats.

The value of raw furs harvested in Alabama in the 1950-51 season was calculated at $411,114, with an average income of $125 per trapper. In terms of greatest value, mink ranked first; muskrats, second; beaver, third; and raccoon, fourth.

The order of toxicity of some insecticides to quail when given orally is aldrin, dieldrin, toxaphene and lindane. On an average, doves required doses about three times as great as did quail before death occurred. The breeding potential of quail which received sublethal doses seemed unaffected.

Mortality of mourning doves from trichomoniasis in Alabama subsided some in 1952, after a serious die-off in 1950 and 1951. Indications are that the population recovered some in numbers in 1952, but that doves were not yet as abundant as they were in 1949, the year before the disease outbreak.

Established bicolor patches have been found to provide a dependable food supply at all seasons of the year and to contain a surplus that has accumulated for more than 1 year.

Farm Ponds. (H. S. Swingle, J. R. Fielding, M. C. Johnson, J. M. Lawrence, J. S. Dendy, J. H. Padfield Jr., E. W. Shell, and A. L. Black.) – Supplemental feeding of bluegill-bass population during the fall, winter, and early spring caused unbalanced populations by rapidly increasing the size of small fish while the weather was too cold for adequate predation by bass. Summer supplemental feeding with soybean cake at rates of 10 pounds or more per acre per day caused deaths of fish from low oxygen.

Pithophora, a branched summer type of filamentous alga, could not be controlled by copper sulfate applied in the water; when this chemical was applied on the pond bottom subsequent to draining a pond, it prevented regrowth of the alga. Rosin amine D acetate was effective in killing *Pithophora* when present in mats floating on the surface. Coloring the pond waters with Nigrosine dye followed by heavy fertilization was effective in ridding ponds of this alga.

The Alabama River near Choctaw Bluff was found to contain 58 pounds of fish per acre; the Tensaw River near Stockton, 1,500 pounds per acre; and the Black Warrior near Lock 4, 1,000 pounds per acre. Lake Jordan was found to be supporting an average of from 200 to 300 pounds of fish per acre, approximately 25 per cent of which were game species. Lake Martin was supporting 22 to 26 pounds of fish per acre, while the Tallapoosa river which forms this lake was supporting 46 pounds per acre.

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No. 281 How Alabama Farmers Buy and Sell Livestock. M. J. DANNER. 1952.

No. 282 Supplies and Use of Milk in Alabama. SHELDON W. WILLIAMS. 1952.

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FRANK GARRETT — *Part-Time Assistant in Horticulture*
W. C. MARTIN, JR., B.S. — *Greenhouse Manager*

Poultry Department

D. F. KING, M.S. — *Head of Department*
G. J. COTTIER, M.A., D.V.M. — *Poultry Husbandman*
S. A. EDGAR, Ph.D. — *Poultry Pathologist*
J. G. GOODMAN, M.S. — *Associate Poultry Husbandman*
G. R. INGRAM, Ph.D. — *Associate Poultry Husbandman*
FRED MOULTRIE, M.S. — *Associate Poultry Husbandman*

Publications

KENNETH B. ROY, B.J. — *Head of Department*
J. OLAN COOPER, B.S. — *Associate Agricultural Editor*

Zoology-Entomology

F. S. ARANT, Ph.D. — *Head of Department*
A. O. HAUGEN, Ph.D. — *Leader, Alabama Cooperative Wildlife Research Unit*
H. S. SWINGLE, M.S. — *Fish Culturist*
J. S. DENDY, Ph.D. — *Associate Entomologist*
W. G. EDEN, Ph.D. — *Associate Entomologist*
**E. E. PRATHER, M.S. — *Associate Fish Culturist*
G. H. BLAKE, JR., M.S. — *Assistant Entomologist*
J. M. LAWRENCE, M.S. — *Assistant Fish Culturist*
A. L. BLACK — *Superintendent of Ponds*

Substations

W. H. HEARN, B.S. — *Records Assistant*

BLACK BELT, Marion Junction, Dallas County
W. B. KELLEY — *Superintendent*
L. A. SMITH, B.S. — *Assistant Superintendent*

* Leave of absence.
** Military leave.

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, B.S. — *Assistant Superintendent*
H. F. YATES, B.S. — *Assistant Superintendent*

LOWER COASTAL PLAIN, Camden, Wilcox County
LAVERN BROWN, B.S. — *Superintendent*
P. R. SATTERWHITE, 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*
C. J. JACOBS, B.S. — *Assistant Superintendent*

SAND MOUNTAIN, Crossville, DeKalb County
S. E. GISSENDANNER, B.S. — *Superintendent*
M. W. ALISON, B.S. — *Assistant Superintendent*

TENNESSEE VALLEY, Belle Mina, Limestone County
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*
F. D. ROBINSON, B.S. — *Assistant Superintendent*

WIREGRASS, Headland, Henry County
C. A. BROGDON, B.S. — *Superintendent*
MAX SCONYERS, B.S. — *Assistant Superintendent*
J. G. STARLING, B.S. — *Assistant Superintendent*

CHANGES IN STATION STAFF

1951 Appointments

G. H. BLAKE, JR., M.S. — *Assistant Entomologist*
J. D. BURNS, M.S. — *Assistant Agronomist*
R. S. DAVIDSON, Ph.D. — *Plant Pathologist*
E. D. DONNELLY, Ph.D. — *Associate Plant Breeder*
TOKUJI FURUTA, Ph.D. — *Associate Horticulturist*
K. E. GREGORY, Ph.D. — *Associate Animal Breeder*
W. C. MARTIN, JR., B.S. — *Greenhouse Manager*
G. B. MEADOWS, M.S. — *Assistant Animal Husbandman*
FRED MOULTRIE, M.S. — *Associate Poultry Husbandman*
D. M. PRESLEY, B.S. — *Research Assistant*

D. B. RICHARDS, Ph.D.—*Forester*
HOWARD T. ROGERS, Ph.D.—*Head, Department of Agronomy and Soils*
L. A. SMITH, B.S.—*Assistant Superintendent, Black Belt Substation*
J. H. YEAGER, Ph.D.—*Associate Agricultural Economist*

1951 Resignations

M. W. CLINT, B.S.—*Greenhouse Manager*
J. E. CONNIFF, M.S.—*Assistant Agricultural Engineer*
HENRY DORR, JR., M.S.—*Associate Forester*
GLADYS S. GARROW, M.S.—*Assistant Home Economist*
E. E. HUTTO, B.S.—*Assistant Superintendent, Sand Mountain Substation*
A. E. SCHAEFER, Ph.D.—*Associate Animal Nutritionist*
D. C. SHELTON, Ph.D.—*Associate Animal Nutritionist*
ALLENE L. STUTTS, M.S.—*Assistant Human Nutritionist*
CAROLYN K. TAMBLYN, M.S.—*Assistant Human Nutritionist*
F. H. VOGEL, Ph.D.—*Forester*

Deceased

K. G. BAKER, B.S.—*Superintendent, Black Belt Substation*

1952 Appointments

F. B. ANDERSON, M.S.—*Assistant Agricultural Economist*
B. M. COOL, M.S.—*Assistant Forester*
U. L. DIENER, M.S.—*Assistant Plant Pathologist*
G. E. HAWKINS, JR., Ph.D.—*Assistant Dairy Husbandman*
H. A. HENDERSON, M.S.—*Assistant Agricultural Economist*
E. J. HODGKINS, JR., M.S.—*Associate Forester*
C. J. JACOBS, B.S.—*Assistant Superintendent, Piedmont Substation*
M. W. LOUPO, M.S.—*Assistant Agricultural Engineer*
C. M. MARTIN, Ph.D.—*Associate Animal Husbandman*
F. D. ROBINSON, B.S.—*Asst. Supt., Upper Coastal Plain Substation*
P. R. SATTERWHITE, B.S.—*Asst. Supt., Lower Coastal Plain Substation*
G. T. SHARMAN, JR., B.S.—*Assistant in Agronomy*
H. F. TUCKER, M.S.—*Assistant in Animal Husbandry*

1952 Resignations

R. S. DAVIDSON, Ph.D.—*Plant Pathologist*
R. W. ENGEL, Ph.D.—*Animal Nutritionist*
W. B. PRATHER, B.S.—*Assistant Dairy Husbandman*
J. F. SEGREST, JR., B.S.—*Field Superintendent*
S. W. WILLIAMS, Ph.D.—*Agricultural Economist*

Deceased

JOHN T. WILLIAMSON, B.S.—*Agronomist*

FINANCIAL REPORT

Fiscal Year Ended June 30, 1951

	Hatch	Adams	Purnell	Bankhead-Jones	Research & Marketing	All Other
Balance July 1, 1950	.00	.00	.00	.00	41,084.00	342,328.89
Income	15,000.00	15,000.00	60,000.00	96,152.81	141,959.56	1,118,586.25
Total Funds Available	15,000.00	15,000.00	60,000.00	96,152.81	183,043.56	1,460,915.14
Expenditures						
Personal Services	13,994.02	10,442.69	48,388.13	73,833.07	98,995.94	549,081.30
Travel	92.10	288.91	631.84	2,107.91	7,813.50	29,435.43
Transportation of Things	64.90	22.28	76.54	146.80	1,392.39	6,994.10
Communication Service	12.56	16.90	203.91	105.04	408.99	5,411.98
Rents & Utilities	76.52	777.29	1,892.16	745.44	1,614.95	19,147.50
Printing & Binding	.00	.00	1,130.51	290.00	750.69	4,282.67
Other Contractual Services	80.45	58.45	694.21	817.05	3,634.95	75,837.94
Supplies & Materials	551.99	1,307.04	3,758.65	13,624.13	19,314.93	346,851.38
Equipment	127.46	1,386.44	2,824.05	3,120.66	22,352.05	100,769.78
Land & Structures	.00	700.00	400.00	1,362.71	2,041.29	36,801.75
Total Expenditures	15,000.00	15,000.00	60,000.00	96,152.81	158,319.68	1,174,613.83
Balance on Hand June 30, 1951	.00	.00	.00	.00	24,723.88	286,301.31
Total Expenditures & Balance	15,000.00	15,000.00	60,000.00	96,152.81	183,043.56	1,460,915.14

FINANCIAL REPORT

Fiscal Year Ended June 30, 1952

	Hatch	Adams	Purnell	Bankhead-Jones	Research & Marketing	All Other
Balance July 1, 1951	.00	.00	.00	.00	24,723.88	286,301.31
Income	15,000.00	15,000.00	60,000.00	88,305.89	137,129.35	1,346,281.35
Total Funds Available	15,000.00	15,000.00	60,000.00	88,305.89	161,853.23	1,632,582.66
Expenditures						
Personal Services	13,958.28	11,738.33	43,948.38	71,960.65	101,384.38	623,729.62
Travel	139.06	382.88	1,319.47	1,612.68	6,589.84	37,908.15
Transportation of Things	76.22	16.75	19.68	59.84	538.15	7,849.89
Communication Service	29.30	33.50	123.28	140.43	453.83	7,092.76
Rents & Utilities	76.45	525.00	1,352.60	937.98	1,760.71	19,116.96
Printing & Binding	.00	.00	1,451.62	.00	2,107.00	4,272.32
Other Contractual Services	4.50	167.83	459.40	442.41	2,363.61	40,717.76
Supplies & Materials	584.79	992.43	4,915.07	11,432.34	22,611.91	390,912.60
Equipment	131.40	741.98	6,410.50	1,719.56	17,497.15	101,964.42
Land & Structures	.00	401.30	.00	.00	6,546.65	34,052.30
Total Expenditures	15,000.00	15,000.00	60,000.00	88,305.89	161,853.23	1,267,616.78
Balance on Hand June 30, 1952	.00	.00	.00	.00	.00	364,965.88
Total Expenditures & Balance	15,000.00	15,000.00	60,000.00	88,305.89	161,853.23	1,632,582.66