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AGRICULTURAL ECONOMICS

Pricing Efficiency of Slaughter Cattle at Alabama Livestock Auction Markets. (M. J. Danner.) — An extremely wide spread was found between prices paid for the different grades of slaughter cattle at six Alabama auctions in 1953 and 1954. During the 2 years, nearly 11,000 animals were graded at the six auctions. The range in spread varied from 50 to 100 per cent between Utility and Choice grades during any one season. For the fall grading period of 1954, the average price per hundredweight paid at all markets was $10.94 for Utility steers and $17.80 for Choice steers. During the fall of 1954, steers grading Choice or better accounted for less than 2 per cent of the total number graded. Utility and lower grades accounted for more than half of all steers graded at the six auctions. Auctions selected had different volumes, but 3 of the 6 were large auctions.

AGRICULTURAL ENGINEERING

Engineering Phases of Supplemental Irrigation. (Loyd Johnson, H. S. Weaver, and F. A. Kummer.) — Previous data on physical properties of selected Alabama soils were summarized in a special report. These data were used in preparing a sprinkler irrigation guide for Alabama. A bipod to prevent toppling of high risers for corn irrigation was developed. A method of moving lateral lines in row crops was developed by omitting 2 rows at 80-foot intervals and constructing a pipe rack for a tractor-drawn trailer. Seventy-five years of monthly rainfall records were assembled, analyzed, and presented in table form to establish a guide for rainfall expectancy. Cost analyses were made on the operation of the irrigation system on the Agricultural Engi-

neering Farm at Auburn. Measured values of evapo-transpiration from corn, cotton, and pastures at two locations in the State were compared with evaporation from a water surface and compared with computed values.

The Effect of Various Vegetative Covers, Rotations, Mulches, and Seedbed Preparation on Runoff Water and Soil Losses from Various Slopes. (F. A. Kummer and Loyd Johnson.) — A system of field layout for complete mechanization on sloping land was developed on the Agricultural Engineering Farm. Outlets were constructed so that machinery could operate across them with ease. This, in effect, made continuous rows possible even though the fields were divided by outlets.

Point rows and sharp turns were eliminated, and the use of parallel rows was made possible. Whenever possible, terraces were constructed parallel to a key terrace. All rows were laid out parallel to the terraces. Where parallel terraces were not possible, rows were laid out parallel to one terrace, and areas where point rows occurred were vegetated.

All terraces were constructed of sufficient width to permit 4 rows between the channel and ridge. Twenty-foot borders were provided to allow easy access to rows and turning of equipment in the field without damaging crops. A parallel-row system permitted use of multiple-row equipment, approaching conditions usually encountered only on nearly level land with long continuous rows. Acreage unsuitable for row crops was seeded to permanent vegetation.

Mechanization of the Harvesting of Cotton. (T. E. Corley, C. M. Stokes, and F. A. Kummer.) — Harvesting tests were conducted at three locations in the State and with three commercial machines (spindle picker, brush stripper, and steel roll stripper). The average harvesting efficiency of the strippers was about 3 per cent greater than that of the spindle picker, but the stripper-harvested cotton contained about four times as much trash as the spindle-picked cotton. A ribbed plate attachment increased the spindle picker efficiency 2.7 per cent in fluffy cotton and 5 per cent in hard-lock cotton.

Auburn 56 variety had a significantly lower preharvest loss, a high yield, and a high harvesting efficiency, resulting in significantly more cotton (240 pounds per acre) harvested by all machines. There was a significant difference in efficiency be-

tween machines for some varieties but not for all varieties tested.

Plant population had little effect on harvesting efficiency of the three machines. Increased plant populations gave significant decreases in plant height and limb length at all locations, yield at one location, and significant increases in height of fruiting, preharvest loss, and trash content at all locations. Cultural treatments had no effect on yield and harvesting efficiency, but the rotary-hoed and chemically-treated plots required 50 per cent and 80 per cent less hand hoe labor, respectively, than the hand-hoed check.

Defoliation had no effect on yield, staple, harvesting efficiency of the three machines, and grade of spindle-picked cotton. Desiccation resulted in a lower grade for both strippers.

Processing and Storing of Seed, Grain, and Hay. (J. L. Butt, H. S. Ward, Jr., and F. A. Kummer.) — Experiments were conducted comparing machine-harvestable yield of corn picked at approximately 20 per cent moisture with corn field-cured to about 12 per cent moisture before picking. In 1953, rains and high winds between early and late harvest resulted in a reduction in yield from 4,176 pounds for early- to 2,686 pounds per acre for late-harvested corn. The 1954 test plots, which were irrigated, averaged 66.5 bushels per acre, but excellent weather prevailed between early and late harvest, and there was no measurable difference between the yields of early- and late-harvested corn.

Oats containing 11 per cent moisture were stored in a tight plywood bin and a tight steel bin from September, 1952, to July, 1953, with no changes in moisture, weight per bushel, or germination except that indications of a slight reduction in germination appeared in specific, small areas.

Engineering data were obtained on coefficient of friction, angle of flow, and emptying angle of repose for several Alabama crops. The angles above the horizontal required for certain crops to flow from a smooth wood surface were: oats, 22.9°; shelled peanuts, 24.1°; sudangrass, 23.0°; corn, 20.3°; unshelled peanuts, 22.4°; and rescuegrass, 25.4°. The angle between the horizontal and the surface of grain when the grain was permitted to flow from a container was: oats, 34.1°; shelled peanuts, 34.6°; sudangrass, 26.0°; corn, 26.3°; unshelled peanuts, 41.7°; and rescuegrass, 73.5°.

A hay-drying and self-feeding structure for chopped hay was designed in cooperation with the structures project. The hay

was handled mechanically from field to mow to animal with a minimum of labor used. Cost of drying the partly cured hay was $3.16 per ton. The hay was self-fed to animals from the drying mow.

AGRONOMY and SOILS

Minor Element Status of Alabama Soils and the Requirement of These Elements for Plant Growth. (John I. Wear.) — Water-soluble boron was determined for 133 soil samples selected at random from samples sent to the State Soil Testing Laboratory. The results of the analyses were subdivided on basis of soil regions and soil types. Order of increasing amounts of water-soluble boron present in the soils by regions was: Lower Coastal Plain, 0.057; Sand Mountain, 0.069; Upper Coastal Plain, 0.073; Piedmont Plateau, 0.109; Black Belt, 0.116; and Tennessee Valley, 0.156 p.p.m. Order of increasing amounts of water-soluble boron present in soils, according to texture, was from lighter to heavier soils.

Correlation of Soil Test Results with Yield Response on Peanuts. (C. E. Scarsbrook.) — Laboratory tests were made on soils from southeastern Alabama where peanut fertility experiments were conducted during 1952-54.

Gypsum applied to unfertilized plots at the rate of 500 pounds per acre gave an average increase of 159 pounds of peanuts where calcium was low. No increase was obtained where the soil test for calcium was medium.

Gypsum applied to plots fertilized at the rate of 40 pounds of P_2O_5 and 60 pounds of K_2O per acre gave an increase of 343 pounds over plots that received fertilizer but no gypsum when the soil test for calcium was low. When calcium was medium, the average increase was 77 pounds. A high test for calcium was obtained at only 1 of the 18 locations. No increase was shown from gypsum on this location.

Sixty pounds of K_2O increased the yield an average of 153 pounds per acre where the soil test was low. No increases were obtained when the soil tested medium. A high test for K_2O was not obtained at any of the locations.

Forty pounds of P_2O_5 had no effect on yields, regardless of the levels of P_2O_5 in the soil. Therefore, a relationship between peanut yields and soil-test phosphorus could not be shown.

Behavior of Potassium in Soils. (1) EFFECT OF MOISTURE CONTENT AND TEMPERATURE OF DRYING ON CERTAIN EXCHANGE CHARACTERISTICS OF VAIDEN CLAY. (R. D. Rouse and E. M. Stickney.) — A study was made of the effect of moisture content and temperature of drying on some exchange characteristics of Vaiden clay to obtain a clearer insight into the phenomena of potassium release and fixation of soils.

The cation exchange capacity decreased on drying and exchangeable potassium and sodium increased. Exchangeable calcium and magnesium were not affected by drying. In this study, temperature had no effect on these exchange characteristics if the soils were dried to a comparable moisture content.

At present no theory of soil chemistry explains this increase in exchangeable potassium and sodium on drying. However, these findings emphasize the need for uniform drying of samples of these soils before making a correlation analysis for soil testing purposes.

(2) EFFECT OF SODIUM, CATIONIC RATIOS, AND AERATION ON EARLY FRUITING AND YIELD OF COTTON. (R. D. Rouse, A. B. Ernest, F. L. Selman, and W. F. Sowell.) — The effects of sodium and root aeration on the cotton plant have been studied in the greenhouse using solution culture techniques during the past 4 years. Addition of sodium to the nutrient solution hastened blooming and boll setting of cotton grown under conditions of poor root aeration, but this effect was not generally obtained with cotton grown under conditions of good aeration. However, certain cationic ratios appear to be critical for maximum boll setting of cotton even when none of the essential elements are deficient; the addition of sodium to solutions containing these critical ratios resulted in increased boll setting even under good root aeration.

A plant growth chamber has been constructed and further studies are being conducted under controlled conditions to establish specifically the critical ratios so that likelihood of their occurrence in the field can be determined.

In two field experiments, one conducted on Norfolk loamy sand and the other on Kalmia sandy loam, no value from the application of sodium was found when potassium was adequate. At inadequate potassium levels, however, sodium was found to substitute for some of the potassium needs of the cotton plant.

(3) THE EFFECT OF MINERAL PLANT NUTRIENTS ON THE MAINTENANCE OF CLOVER IN PASTURES ON BLACK BELT SOILS. (R. D. Rouse.) — A 5-year study has been made to explain the disappearance of clover in clover-grass pastures on Black Belt soils. Field experiments during this period were relatively uninformative because of adverse weather conditions, but a combination of greenhouse, field, and laboratory experiments and observations of pastures permits the formulation of a theory with considerable confidence as to its validity.

Two greenhouse experiments on Sumter clay, one using a white clover-Dallisgrass mixture and a second using a Ladino clover-Kentucky 31 fescue mixture, provided data showing that a high nitrogen level at low potash hastens clover failure. These studies also show that a high phosphorus level increases iron deficiency in clover and, when this was not corrected by iron spray, clover failure resulted during the summer.

In a greenhouse study on Vaiden clay, potash became deficient after a few clippings when phosphorus was added. This soil had given only a slight response to potash in a field test. All studies also showed that grass could produce good growth at a lower level of available potassium than clover. Laboratory studies indicated that both the acid and lime soils have a relatively high potassium supplying power; therefore, the available potash may be maintained under low production or when the forage is not removed from the soil.

These studies indicate, and this was borne out by field observations, that when pastures are first established on these soils and weather conditions are favorable, phosphorus fertilization alone may produce good clover growth on all Black Belt soils except the high lime soils where potassium is needed for establishment. However, continued applications of only phosphorus can create potash deficiency as a result of forage removal even on the least potash-deficient soils of this area. Since grass is able to grow at lower levels of available potassium than clover, it continues to thrive after the clover stands are largely lost. The grass is stimulated by the nitrogen build-up by the clover, and this growth provides further competition for reestablishment of clover in the undisturbed sod. On the lime soils, clover failure may also be hastened by the application of phosphorus even with adequate potassium application because of the tie-up of iron in the surface soil.

It is recognized that the effect of these factors on clover failure is intensified by an environmental condition that favors grass over clover, such as the hot dry summers of the past few years.

Some Factors Affecting the Adsorption of Sulfate by Alabama Soils (Cooperative with TVA). (L. E. Ensminger.) — Results from numerous field tests show that cotton often responds to applied sulfate. However, results from several locations show that deep-rooted legumes such as sericea and alfalfa did not respond to sulfate applications. The sulfate content of a number of soils was determined by extracting with various solutions in an effort to explain the differential response obtained in field experiments.

Approximately the same amount of sulfate was extracted by neutral sodium acetate, sodium acetate buffered at pH 4.8, KH_2PO_4 solution containing 100 p.p.m. phosphorus, and KH_2PO_4 containing 500 p.p.m. phosphorus. However, 0.1N HCl solution extracted little or no sulfate. The samples contained only small quantities of water-soluble sulfate except where sulfate had been recently applied.

The results show that sulfate is retained to a considerable extent by most soils. The heavier subsurface layers usually contain more sulfate and are capable of adsorbing more sulfate than the surface layers. The capacity of soils to adsorb sulfate is affected by certain soil treatments. Increasing amounts of superphosphate applied to a Cecil clay loam resulted in decreasing amounts of soluble sulfate. Superphosphate decreased the capacity of this soil to adsorb sulfate from a $CaSO_4$ solution. Liming also resulted in a decrease in the retention of sulfate.

The sulfate adsorption capacity of a number of materials was determined in an attempt to show what fractions of soils may be responsible for the retention of sulfate. The data show that dehydrated Al_2O_3 adsorbed much more sulfate than any of the other materials. The iron minerals adsorbed rather small amounts of sulfate, whereas Davidson colloid, kaolinite, and bauxite were intermediate.

Analysis of soil samples from areas where response of alfalfa and sericea to sulfate was tested shows that the subsurface layers contained appreciable quantities of sulfate. Evidently, deep-rooted crops can obtain sufficient sulfate from these layers.

Factors Affecting the Nature and Behavior of Native and Added Phosphates in Soils: (1) RESIDUAL EFFECTS OF VARIOUS PHOSPHATES AS MEASURED BY YIELDS, P-32 UPTAKE, AND EXTRACTABLE PHOSPHORUS. (L. E. Ensminger and R. W. Pearson.) — In 1930 an experiment was started on a Decatur silt loam and on a Greenville fine sandy loam to compare the efficiency of seven sources of phosphorus in a rotation of corn and cotton with vetch. At the end of 16 years, phosphate applications were discontinued in order to study residual effects as measured by yields. In 1950 and 1951, 24 pounds of P_2O_5 per acre from tagged superphosphate was applied to all treatments. Available phosphorus based on P-32 uptake was calculated and expressed as A values.

For the Greenville fine sandy loam, A values show that superphosphate had a greater residual availability than rock or colloidal phosphate applied at the same rate, but not as great as basic slag. The availability of the 96-pound rate of rock phosphate was greater than for the 48-pound rate but not as great as for 48 pounds of P_2O_5 from superphosphate. The A values for 24 pounds of P_2O_5 from superphosphate plus periodic applications of either slag or rock phosphate were considerably greater than for 24 pounds of superphosphate alone.

For the Decatur silt loam, A values show that superphosphate had about the same residual availability as the raw phosphates, concentrated superphosphate, and precipitated tricalcium phosphate applied at the same rate of P_2O_5, but less than basic slag. The A value for the 96-pound rate of rock phosphate was greater than for 48 pounds of P_2O_5 from superphosphate. The A value for 24 pounds of P_2O_5 from superphosphate alone was 76 as compared with 313 for 24 pounds of P_2O_5 from superphosphate, plus periodic applications of rock phosphate.

Yield data for the first 4 years of the residual period show only a general relationship with A values. Soluble phosphorus was determined by three different extracting solutions to determine the amount and nature of the phosphorus accumulated.

(2) RESPONSE OF COTTON TO PHOSPHATES IN RELATION TO pH. (L. E. Ensminger.) — To study the effect of soil reaction on the response of cotton to phosphates, results from 109 field tests were divided into three groups on the basis of soil pH. The soils were divided into groups as follows: pH 5.0 or less; pH 5.0 to 5.5; and pH of greater than 5.5. Average yields for unphosphated plots

were 610, 704, and 908 pounds per acre of seed cotton for soils of pH 5.0 or less, 5.0 to 5.5, and greater than 5.5, respectively. Increased yields of seed cotton from the use of 60 pounds of P_2O_5 from superphosphate averaged 264, 231, and 183 pounds per acre for the low, medium, and high pH groups, respectively. Concentrated superphosphate, dicalcium phosphate, and tricalcium phosphate were also included in these tests; the effect of soil pH on response of cotton to these phosphates was similar to results obtained with superphosphate.

The use of dolomite along with superphosphate and concentrated superphosphate increased yields of cotton on soils with a pH of less than 5.5 but had little or no effect on the response of soils with a pH greater than 5.5. Sufficient dolomite was used to neutralize residual acidity of the nitrogen applied.

Effects of Manure, Vetch, and Commercial Nitrogen on Yields of Cotton and Corn. (J. T. Cope, Jr.) — In 1925 an experiment was begun at Auburn to compare the effects of 5 tons of manure annually, vetch each winter, and 52 pounds of nitrogen annually from sodium nitrate on yields of cotton and corn in a 2-year rotation. These treatments were applied for 18 years and discontinued for 5 years to determine their residual effect on yields. After the residual study, all plots were planted to corn and received 80 pounds of commercial nitrogen annually from 1948 through 1952. Yields are presented in the table.

Manure produced 271 pounds more seed cotton and 3.5 bushels of corn more than did 325 pounds of $NaNO_3$ for the initial 18-

SUMMARY OF COTTON AND CORN YIELDS FROM MANURE, VETCH, AND COMMERCIAL NITROGEN AND THEIR RESIDUES, 1925-52

Treatment	1925-42[1]		1943-47[2]		1948-52[3]
	Seed cotton	Corn	Seed cotton	Corn	Corn
	Pounds	*Bushels*	*Pounds*	*Bushels*	*Bushels*
No nitrogen	392	7.9	214	5.6	45.8
5 tons manure annually	1,713	42.1	1,027	29.0	53.7
325 lb. $NaNO_3$ annually	1,442	38.6	468	14.4	48.5
Vetch each winter	1,358	32.8	524	16.0	49.9
No nitrogen	439	6.6	671	24.2[4]	47.9

[1] All plots received 600 pounds of superphosphate and 100 pounds of muriate of potash per acre annually.
[2] Residue study, 1943-47. All plots received 300 pounds of 0-14-10 annually.
[3] All plots were planted in corn and received annual applications of 400 pounds of 4-10-7 and 200 pounds of ammonium nitrate.
[4] This treatment received 225 pounds of $NaNO_3$ annually from 1943 through 1947.

year period. Vetch produced 84 pounds of seed cotton and 5.8 bushels of corn less than did the $NaNO_3$. Average yields from vetch were low because of large fluctuations in amounts of vetch produced from year to year. Average yields of green vetch turned were 7,000 pounds for cotton and 6,351 pounds for corn. Yields of cotton and corn on plots that received only phosphorus and potassium were extremely low.

During the residual study, the effect of manure was outstanding. The average residual effect of manure for 5 years was 813 pounds of seed cotton and 23.4 bushels of corn. Sodium nitrate and vetch had about the same residual effect but much less than the effect of manure.

When 80 pounds of nitrogen was applied to all plots in 1948, yields were increased tremendously on all plots. Check plots that had averaged 6.3 bushels of corn for 23 years produced 50.6 bushels of corn in 1948. The effect of manure was still present in 1950, 8 years after the last application .

Soil Testing Studies. (Clarence M. Wilson.) — The soil testing laboratory was put into operation February 1, 1953. During that year 3,340 soil samples were analyzed as compared with 9,118 samples in 1954. All samples were tested for available phosphorus and potash and for pH and lime requirement. Exchangeable calcium was also determined on all samples when peanuts were to be grown.

A summary of the results of analysis for the 2-year period for all samples (except unusual samples such as for gardens) showed that 73 per cent of the samples had a pH of 6.0 or less, and 35 per cent had a pH of 5.5 or less. Fifty to 60 per cent of the samples were low to medium in available phosphorus as compared with 80 to 90 per cent for potash. This indicates that potash is more often a limiting factor in crop growth than is phosphorus.

Cotton Breeding and Improvement Investigations. (H. B. Tisdale and A. L. Smith.) — Plains and Auburn 56 varieties of cotton developed by the API Agricultural Experiment Station were released for commercial production in 1949 and 1952, respectively. These varieties were planted in alternate rows in partial isolation to determine possible hybrid vigor from natural cross-pollination between two high yielding varieties of cotton. The two varieties were harvested together in bulk and the mixed seed were grown in partial isolation for three generations — 1952, 1953, and 1954.

A part of the seed from each generation was entered with the parental material in all variety tests over the State in 1952, 1953, and 1954. The second generation showed a significant increase of 7 per cent over the parental material in yield of lint per acre in 1953. The first and third generation seed gave no increase over the parental material in 1952 and 1954. The results indicate that in favorable seasons seed grown from a mechanical mixture offer a practical method for using hybrid vigor from natural cross-pollination for commercial production of cotton.

The inheritance of resistance to fusarium wilt in upland cotton was found to be determined by a single dominant factor. This resistance was enhanced by undetermined factors for increased root-knot nematode tolerance. Seabrook sea island cotton (*Gossypium barbadense*), when crossed with upland Rowden (*G. hirsutum*), was found to have two dominant factors for fusarium wilt resistance. Sea island resistance amounts to essential immunity to fusarium wilt and is not reduced by nematode activity.

White Clover Improvement: (1) EFFECTS OF SOIL MOISTURE AND CLIPPING ON THE INCIDENCE OF DISEASES AND THE PERSISTENCE OF WHITE CLOVER UNDER ALABAMA CONDITIONS. (Foy Campbell and Pryce B. Gibson.) — The relative importance of stolon and leaf damage to the persistence of white clover growing in a Dallisgrass sod under the following treatments was studied: (1) irrigated and harvested for seed, (2) irrigated and clipped to simulate grazing, (3) not irrigated and harvested for seed, and (4) not irrigated and clipped to simulate grazing.

A uniform stand of Dallisgrass was obtained by setting plants on 1-foot centers over the test area. Forty different clonal lines of white clover were used. Twenty of these were of the intermediate type and 20 were of the large type or Ladino clover. This latter group included 10 lines that produced few or no flowers and 10 lines that produced some flowers under Alabama conditions. The white clover plants were spaced 4 feet apart. A plant of each of the 40 clonal lines was set in each plot. The test area was limed and fertilized for optimum clover growth. Ethylene dichloride was applied to the soil in an effort to eliminate nematodes as a variable.

The persistence of the white clover was measured in terms of damage to leaves and to stolons. Since the value of white clover depends on the production of foliage, measurements of damage to both leaves and stolons were reported in terms of foliage lost.

Damage to stolons was found to be more important than damage to leaves in the persistence of the clover. The greatest amount of damage occurred on the nonirrigated plots that were clipped to simulate grazing. Apparently, high soil temperature was an important pre-disposing factor to the stolon damage. The least amount of damage occurred on the irrigated plots that were harvested for seed. Under all conditions the nonflowering large type plants persisted best; flowering large type plants, second; and intermediate type plants, third.

(2) Root Systems of Ladino and Intermediate White Clover Grown as Spaced Plants and in Sod. (Charles Cooper King, Jr., Pryce B. Gibson, and L. E. Ensminger.) — In an effort to determine the cause of the variation in the persistence of white clover, root systems under spaced plants and sod were studied by measuring the roots in the soil under the plants and by placing radioactive phosphorus at vertical intervals of 6 inches in the soil to a depth of 30 inches. Cores of soil in 3-inch intervals to a depth of 24 inches were taken with a steel cylinder sampler. The roots in the cores were separated from the soil and weighed. Root penetration as measured by the uptake of radioactive phosphorus was checked at weekly intervals with a survey meter. The readings were taken by wrapping a clump of leaves at each placement location around the tube of the field survey meter.

The root systems under spaced plants of intermediate white clover, Ladino plants that produce none or very few flowers, and Ladino plants that produce some flowers under Alabama conditions were studied. The study of the root systems under a sod was limited to plots planted with seed from one source of intermediate white and from one source of Ladino. These studies were conducted on a Norfolk sandy loam soil.

The differences in the root systems under the white clovers included in this study were too small and insignificant to indicate that the persistence of a variety of white clover could be predicted by studying its root system.

Breeding of Sericea Lespedeza. (E. D. Donnelly.) — The sericea breeding project was begun in 1950. In 1951 and 1952, studies were made to determine: (a) effects of temperature, types of containers, and length of storage period on the tannin content of ground leaves of individual plants; (b) relationship of tannin in leaves to that in stems of individual plants; and (c) relative

effects of plant genotype and environment on the tannin content of a given plant from year to year and between clippings within a given year.

Results of tests conducted in 1952 indicate that both stem type and tannin content affect palatability of sericea.

In 1953 and 1954, experiments were conducted to determine the effects of season, stage of plant maturity, and plant height on the selection of low tannin plants, and effects of heterosis on forage and seed yields.

Data from these tests indicate: (a) tannin content increased as mean day temperature increased and as precipitation decreased; (b) tannin content did not decrease in the cuttings taken during the latter part of the growing season; the third cutting was as high or higher than the preceding cutting; (c) stage of maturity has a considerable influence on the tannin content of sericea; (d) plant height apparently is not associated with tannin content; (e) chasmogamous (either cross- or self-pollinated) progeny of 10 randomly selected individual plants yielded more forage and seed than cleistogamous (self-pollinated) progeny; the former produced 25 per cent more dry herbage and 40 per cent more seed than the latter. The range of this increase between types of progeny varied from no increase to 41 per cent for forage, and from no increase to 52 per cent for seed; (f) families varied considerably in forage and seed yields and in persistence; (g) no difference between the stands of the two types of progeny was indicated at the end of the fourth year in the field; (h) forage and seed yields were not closely associated.

Corn Breeding. (F. S. McCain.) — Several promising corn inbreds have been developed. Three of these go into Ala. 3212, an experimental variety. Data from tests conducted in 1952 and 1953 indicate that Ala. 3212 possesses a satisfactory combination of yielding ability, lodging resistance, weevil resistance, and quality of grain that make it suitable to central and southern Alabama. This hybrid has yielded as much as North Carolina 27 and has been as resistant to lodging as Dixie 18, the two top-performing hybrids in these respects. Ala. 3212 is made up of inbred lines Ab 2, Ab 12, Ab 8, and F44. Several seed production problems must be solved before this hybrid can be released.

Soil Fumigation Studies with Corn. (F. S. McCain.) — "Gall" or "sand" spots in fields at the Plant Breeding Unit sometimes

interfere with the selection of good locations for corn yield tests. Attempts to eliminate these spots by fertilizer applications and other methods have failed. A test was conducted in 1953 to determine if these "gall" spots might be caused by the presence of nematodes in the soil. Four rates of Dowfume W85, 1, 2, 3, and 4 gallons per acre, were compared with no soil fumgiant for the control of nematodes attacking corn. Each rate of fumigant resulted in a small increase in yield of corn (approximately 4 bushels per acre) over the next lower rate. These differences were not statistically significant except between zero and 4 gallons of fumigant per acre. The difference between treated and untreated plots was most striking in the early stages of growth. Plants growing on untreated plots showed a definite stunting and yellowing effect as compared with normal plants growing on treated plots. As growth progressed, the plants on untreated plots recovered from the stunted effect and appeared normal. The corn on untreated plots silked and tasseled about 3 days later than that on treated plots. At no time during the growth period was there any visible difference between plants growing on plots receiving different rates of fumigant.

Comparison of Feed Produced by Oat Varieties Clipped to Simulate Grazing with the Same Varieties Not Clipped. (C. C. King and F. S. McCain.) — Clipping tests to simulate grazing were superimposed on the regular small grain variety tests at several locations in the State. Three years' data (1952-54) indicate that greater feed value is obtained when small grains are grazed and then allowed to produce grain than when managed for grain

FEED PRODUCED BY OAT VARIETIES CLIPPED TO SIMULATE GRAZING AND BY THE SAME VARIETIES NOT CLIPPED, 1952-54

Item	Yield per acre			
	Clipped			Not clipped
	Bushels	*Equivalent bushels*[1]	*Total bushels*[2]	*Bushels*
Average of 8 varieties in northern Alabama	66.2	29.7	95.9	64.1
Average of 10 varieties in central Alabama	49.7	49.6	99.3	63.9
Average of 12 varieties in southern Alabama	26.7	56.8	83.5	41.8

[1] Each 100 pounds of dry forage evaluated as worth 3 bushels of oat grain if utilized by cattle as green pasturage.
[2] Sum of grain plus grain equivalent of forage from clipped tests.

only. Clipping until March 1 did not affect grain yields in northern Alabama, but yields were materially reduced in central and southern Alabama as a result of clipping until the same date. Forage yields were greatest in southern Alabama and decreased progressively to northern Alabama. Greatest total feed units were obtained in northern and central Alabama. It appears that the exceptionally good growth of forage produced in southern Alabama must be utilized by cattle if small grains grown in this area are to compete satisfactorily with those grown in other areas of the State.

Adaptation of Forage Crops to Alabama Conditions. (1) TEMPORARY GRAZING CROPS. (W. R. Langford.) — In tests of winter annual grazing crops, adapted varieties of small grains produced more forage during fall and early winter than any other annually seeded winter crop. Abruzzi rye, Coker 47-27 wheat, and Southland oats have been among the most productive fall grazing crops. Crimson clover, ryegrass, and rescuegrass each produced as much total forage, but the growth was much later than that of rye, wheat, or oats. A high percentage of the growth made by crimson clover, ryegrass, and rescuegrass was produced after late February.

Crimson clover planted with well-fertilized small grain made little growth, but in mixture with ryegrass it constituted about one-half of the forage.

(2) SERICEA-GRASS AND ALFALFA-GRASS MIXTURES. (W. R. Langford.) — Rescuegrass planted on an established stand of sericea and nitrated in the fall and late winter increased the total forage yield, but it thinned the stand and reduced the sericea yield during the summer.

Addition of orchardgrass or tall fescue to sericea also thinned the stand and reduced the sericea yield during the summer.

Orchardgrass, tall fescue, and rescuegrass each failed to persist in mixtures with alfalfa that were mowed each time alfalfa reached early bloom.

Pasture Studies. (1) RESPONSE OF PERMANENT PASTURE TO IRRIGATION AND FERTILIZATION. (E. M. Evans and L. J. Chapman.) — A 3-year average increase in dry forage yield of 2,800 pounds per acre was obtained from supplemental irrigation of replicated grazing paddocks at the Lower Coastal Plain Substation on Leaf fine sandy loam soil seeded to a mixture of tall

fescue, Dallisgrass, and white clover and fertilized with adequate amounts of lime, phosphorus, and potassium. Additions of 120 pounds of nitrogen per acre from ammonium nitrate split equally between February and September applications did not increase forage yields of irrigated paddocks on which white clover performed satisfactorily. Additions of nitrogen to nonirrigated paddocks caused a shift in the botanical composition to a predominantly tall fescue pasture and increased the yield of dry forage by about 2,200 pounds per acre. Irrigation of nitrated paddocks resulted in a yield increase of 1,400 pounds of dry forage per acre, lengthened the grazing season considerably, and maintained a good botanical composition. The pastures required some supplemental irrigation during the period of June to October each year. The average amount of water required was enough to bring the total of rainfall plus irrigation for the 5-month period to around 35 inches, or about 5 inches per month. About one-half of this amount was supplied by irrigation during the period under study.

(2) Response of Perennial Warm-Season Grasses to Nitrogen Under Grazing. (W. R. Langford and E. M. Evans.) – Two years' results from a replicated grazing experiment on Norfolk sandy loam soil at the Wiregrass Substation shows Coastal Bermudagrass to be more responsive to high rates of nitrogen and more productive at all levels of nitrogen than common Bermudagrass or Pensacola Bahiagrass where other fertilizers were adequately supplied. With no supplemental nitrogen, Coastal Bermuda produced 6,113 pounds of dry forage per acre, common Bermuda produced 2,212 pounds, and Pensacola Bahia produced 3,742 pounds. Addition of 80 pounds of nitrogen from ammonium nitrate increased production of each species by about 1 ton of dry forage per acre. The second 80-pound increment of nitrogen, giving a rate of 160 pounds per acre, increased the yield of dry forage from Coastal by about 2 tons per acre more than the 80-pound rate, but increased the yield of common Bermuda and Bahia by only ½ ton. The average yield of Coastal Bermuda at the 160-pound rate of nitrogen was 6 tons, the yield from common Bermuda was 3 tons, and that from Pensacola Bahia about 3⅓ tons.

The amount of dry forage produced per pound of gain by yearling steers was 23.1 for Coastal Bermuda, 20.6 for common Bermuda, and 17.0 for Pensacola Bahia.

ANIMAL HUSBANDRY and NUTRITION

Vitamin E in Farm Animal Nutrition. (E. L. Hove.) — When fed certain rations in dry lot, young growing swine need a vitamin E supplement to prevent liver damage and sudden death. This has been shown by the results of experiments in which weanling pigs were fed a ration containing 12 per cent soybean meal as the protein source, complete minerals and B-vitamins, carbohydrate, 6 per cent lard, and 2 per cent cod-liver oil to supply vitamins A and D. The rate of gain on this ration was only 0.67 pound per day, although the animals appeared to be in excellent condition. Of the six pigs on this diet, three dropped dead, with no warning, between the second and fifth month after weaning. They had acute hemorrhagic necrosis of the liver, with some hemorrhage into the stomach, colon, and lymph nodes. When slaughtered, the remaining three animals had badly damaged and nodular livers, yellowish back-fat, and poorly developed genitalia. With 0.02 per cent vitamin E added to the ration, five litter-mate control pigs lived to slaughter age and had no liver damage. Fresh green grass, clover, and alfalfa are among the best known sources of vitamin E.

The Comparative Nutritive Values of Corn of High and Low Protein Contents. (H. E. Sauberlich, Wan-Yuin Chang, and W. D. Salmon.) — A series of grain corn samples ranging in protein content from 6.8 to 13.6 per cent were tested in feeding experiments with laboratory rats and chicks. The protein contents of the low-protein varieties (6.8 to 9.1 per cent) were increased markedly (9.5 to 13.6 per cent) by high nitrogen fertilization. The high-protein corn samples were superior to the low-protein samples when fed in equal proportions in the diet. The low-protein corn was found to be deficient in at least the following amino acids: lysine, tryptophan, isoleucine, threonine, and valine. In contrast, the high-protein corn was deficient in only lysine and tryptophan, although not as severely deficient as the low-protein corn. However, when the corn was fed on the basis of equal protein content in the diet, the high-protein corn was slightly inferior to the low-protein corn, reflecting a greater proportion of zein in the protein. Studies on the supplementation of corn diets with various natural protein materials indicated that soybean meal is the most satisfactory of those tested. The corn samples also were analyzed for 18 amino acids.

Investigation of the Changes in Chemical and Physical Properties of Pasture Herbage That Influence Their Utilization and Nutritive Value for Grazing Animals: (1) SUMMER GRASSES — RATES OF NITROGEN GRAZING EXPERIMENT — WIREGRASS AREA. (W. B. Anthony, W. R. Langford, J. G. Starling, C. A. Brogden, and C. M. Martin.) — The grasses included in this study are common and Coastal Bermudagrass and Pensacola Bahiagrass. Although white clover was seeded in all paddocks, the swards as grazed were almost pure stands of grass.

The experimental design is the randomized complete block with two replications, and the paddocks are 1.75 acres in size. Common Bermuda and Pensacola Bahiagrass were treated with 0, 80, and 160 pounds of nitrogen per acre; Coastal received an additional treatment of 320 pounds of nitrogen per acre. The experimental animals were Good to Choice feeder steers and weighed about 500 pounds each at the beginning of spring grazing. The paddocks have been grazed for 2 complete seasons, and results for the 2 years have been combined and summarized.

Beef gain produced annually on Coastal Bermuda totaled 308, 383, 476, and 675 pounds per acre, respectively, for nitrogen treatments per acre of 0, 80, 160, and 320 pounds. Pensacola Bahia produced 259, 334, and 369 pounds of gain when nitrogen was 0, 80, and 160 pounds per acre, respectively. Comparable data for common Bermuda are 77, 200, and 291 pounds of gain. For the three grasses, animal daily gains were satisfactory in the spring and early summer but were unsatisfactory in late summer. Dry matter digestibility was similar for the three grasses and was greatly improved by nitrogen. Protein content of the grasses was adequate in the spring but declined in late summer.

(2) IRRIGATION-FERTILIZATION GRAZING EXPERIMENT — FESCUE-WHITE CLOVER-DALLISGRASS — CAMDEN AREA. (C. M. Martin, W. B. Anthony, E. M. Evans, and L. V. Brown.) — Irrigation was effective in increasing beef production and carrying capacity and extending the length of the grazing season. Quality of forage, as determined by digestibility, was maintained satisfactorily in hot, dry periods with irrigation.

BOTANY AND PLANT PATHOLOGY

Cause and Control of Collar Rot of Peanuts. (J. A. Lyle.) — Experiments were conducted to evaluate the effectiveness of soil treatments for the control of collar rot of peanuts in southeastern

Alabama. Effectiveness of collar rot control was determined by (1) increases in stand, growth measurements, and yield; and (2) indices of collar rot and root-knot nematode.

Only one soil treatment, ethylene dibromide (EDB), gave significant control of this disease in 1953 when rated by these standards of control. The material was applied broadcast and in row treatments. EDB, applied broadcast at the rate of 4½ gallons per acre, gave an increase of 1,025 pounds of peanuts over no treatment. EDB at the rate of 9 gallons broadcast and 2 gallons and 4 gallons in the row gave an increased yield of 772, 925, and 663 pounds of peanuts, respectively. Control of collar rot was directly correlated with control of root-knot nematodes, *Meloidogyne hapla* in particular.

In 1954, severe drought conditions prevailed. However, EDB again gave significant control of collar rot when measured by the various disease control standards. This material, applied broadcast at the rate of 4½ gallons per acre, gave an average increase of 689 pounds of peanuts in two experiments. Pentachloronitrobenzene (PCNB), applied broadcast at the rate of 45 and 90 pounds per acre, resulted in significant increases in stand and decreases in incidence of collar rot, but no increases in yield.

Control of Foliage Diseases of Peanuts. (J. A. Lyle.) — Investigations were conducted to determine effectiveness of (1) different fungicidal materials and (2) time of application of sulfur-copper-toxaphene dust in the control of foliage diseases of peanuts. All of the different fungicidal materials used were applied as dusts at regular intervals to the foliage.

Each of the different fungicidal materials gave significant control of peanut foliage diseases. Vancide 958 and 5 per cent Crag plus sulfur gave very significant control of these diseases.

Five and two applications of sulfur-copper-toxaphene also gave significant control of foliage diseases of peanuts. One application of this dust material applied late in the season, although it did not control foliage diseases, resulted in significant yield increases of peanuts when compared with the two former treatments and no treatment.

Investigations on Diseases of Forage Crops, Grain Crops, and Legumes. (J. A. Lyle.) — Tests were conducted to evaluate ef-

fectiveness of chemical seed protectants in the control of head smut, *Ustilago bullata,* of rescuegrass, and Victoria blight, *Helminthosporium victoriae,* and leaf blotch, *H. avenae,* of oats. Disease control in rescuegrass was based on (1) increased emergence and (2) absence of smutted heads at maturity, and in oats on increased emergence.

Laboratory, greenhouse, and field experiments were correlated to show effective control of head smut in rescuegrass seed with use of Agrox, Ceresan M, Orthocide 75, and Thiram 50. Results of greenhouse tests at Auburn and field tests at six locations in the State showed that Agrox and Ceresan M were effective in controlling Victoria blight and leaf blotch of oats. There was some evidence that disease control could be correlated with forage and grain yields of oats.

Causes of Variability in the Activity of Herbicides. (D. E. Davis.) — Experiments were conducted on the phytotoxicity of the alkanolamine salts of 2,4-dinitro-o-secondary butyl phenol (DNOSBP), isopropyl N 3-chlorophenylcarbamate (CIPC) and 1:1 mixtures of these two chemical compounds under various environmental conditions. These chemicals were applied as a preemergence spray for cotton grown in a Norfolk sandy loam soil in which crabgrass, *Digitaria* spp., and Florida pusley, *Richardia scabra,* were the most important annual weeds.

In these experiments, cotton stands were more often reduced by DNOSBP than by CIPC or mixtures of the two. Nevertheless, injury was produced by mixtures containing as little as 2.5 pounds of DNOSBP per acre (broadcast basis) when the temperatures were over 100° F. Florida pusley was controlled more effectively by DNOSBP or by the mixture than by an equal rate of CIPC alone. Crabgrass was sometimes better controlled by CIPC than by DNOSBP, but the results were inconsistent. The mixture did not seem to be any more effective than an equal rate of DNOSBP alone.

A Study of Factors Affecting the Phytotoxiciy of Preemergence Weed Killers. (D. E. Davis and F. L. Davis.) — The alkanolamine salts of 2,4-dinitro-o-secondary butyl phenol (DNOSBP) were used as a preemergence herbicide for cotton grown in a Norfolk sandy loam soil under various environmental conditions. These experiments were concerned with the effects of rainfall and lime on the phytotoxicity of DNOSBP to cotton.

One-half inch of simulated rain had three different effects on phytotoxicity: (1) When rain fell within a few hours after the cotton was planted and before it had germinated, it leached sufficient DNOSBP down around the seed to retard germination and reduce stands if a high rate (9 pounds per acre) of DNOSBP was used; this effect was not observed at the 4.5-pound rate. (2) When rain fell after the cotton had germinated but before emergence, cotton injury was decreased due to a decrease in active chemical on the surface, which could volatilize and burn the emergent cotton. (3) When the first rain occurred 3 or 4 days after the cotton had emerged, cotton injury was greatly increased by increasing the vaporization of the chemical.

When 50 pounds per acre or more of slaked lime was applied to the chemically-treated surface anytime before 3 days after cotton had emerged, cotton injury by vapor burn was greatly decreased.

Conrol of Diseases of Fruit Crops. (Urban L. Diener.) — Experiments to control peach bacteriosis, scab, and brown rot by fungicidal sprays were conducted at the Chilton Area Horticulture Substation. Zinc-lime-sulfur and captan gave significant control of bacteriosis and scab on peach fruit in 1953. None of the treatments gave significant control of bacteriosis in 1954, although trees sprayed with captan, Agrimycin-sulfur, and zinc-lime-sulfur yielded less diseased fruit than trees sprayed with sulfur only. In the experimental Elberta orchard, there was virtually no brown rot in 1953 and 1954, little scab in 1954, and the incidence of bacteriosis in 1954 was the lowest in 3 years.

Control of Diseases of Vegetable Crops. (Urban L. Diener.) — Investigations were conducted on the effectiveness of soil treatments in the control of southern blight, *Sclerotium rolfsii,* of tomatoes and peppers at three locations in 1953 and 1954. PCNB and captan dust applications to the furrow before planting gave consistently lower counts of diseased plants when compared to untreated check at all locations both years, although the results were seldom significant. Shell CBP and drench applications of PCNB also reduced disease losses in some instances.

The effectiveness of fungicidal slip treatments and resistant varieties in the control of stem-rot of sweet potatoes was evaluated at three locations. In 1953, Spergon, Phygon XL, Semesan

Bel, and Dithane D-14 gave significant disease control. At two locations in 1954, Goldrush and Allgold averaged 95.9 and 88.3 per cent healthy plants, respectively, as compared with 41 per cent for the Porto Rico variety. In these same experiments the best slip treatments, captan and Spergon, averaged 59.9 and 51.8 per cent, respectively. Slip treatment results varied widely with weather conditions, soil type, and location.

Studies on seed extraction, processing, and treating were initiated in research on gummy-stem blight of watermelon. Two years' data indicated that mercuric chloride caused watermelon seedling injury. Field stands were less affected than germination counts. One to 3 days fermentation of seed and pulp from mature watermelons had no detrimental effect on germinability. Application of the fungicidal treatment at extraction time or after the seed had dried 2 weeks had no effect on the germinability of 1- or 3-day fermented seed. The addition of diseased leaves and vines and cultures of the gummy-stem blight fungus to seed and pulp during fermentation failed to infect the seed. Fermentations in vats at high temperatures for as long as 10 or 12 days reduced viability to 2 per cent.

Plant Disease Survey and Exploration. (Urban L. Diener.) — A summary of the plant disease record showed that 116 plant disease specimens were received, causal agent diagnosed, and control measures recommended by the staff of the Botany and Plant Pathology Department in 1954.

Methyl bromide fumigation was found to be toxic to damping-off fungi, *Sclerotium rolfsii* (the causal agent of southern blight), insects, nematodes, and weeds in tomato and sweetpotato seedbeds and garden areas.

The Ecology and Parasitism of the Principal Fungal Pathogens of White Clover in Alabama. (K. H. Garren.) — Investigations were conducted to determine the ecologic nature of pathogenic fungi attacking leaf and stolon tissue of white clover. A method was developed for rating disease damage by visual estimates of leaf damage plus measurements of dead areas. The results of periodic isolations from diseased plant tissues indicated that five "societies" of fungi were active on white clover. These were designated as the high temperature society on leaves and stolons, the low temperature society on leaves only, the all-year society on

leaves only, the medium temperature society on stolons only, and the debility indicators society. *Colletotrichum destructivum* and *Stemphylium* spp., fungi in the all-year society, were the principal causal organisms in disease damage to leaves. Species of *Rhizoctonia* and *Fusarium*, fungi in the high temperature society, were most prevalent on dying stolons. Stolon damage was greater than leaf damage. The low rate of vegetative growth of white clover from July through December was attributed to stolon damage. An increase in stolon damage following high temperatures suggested that heat injury was a predisposing factor.

Processing and Storing of Seed, Grain, and Hay. (H. S. Ward, Jr.)[1] — Hygroscopic moisture equilibria curves were established by the method of saturated salt solutions for watermelon and fescue seed. The curves were of the sigmoid type, as was shown previously with blue lupine, crimson clover, and lespedeza sericea seed. From these curves and germination behavior, safe storage moisture contents for watermelon and fescue seeds were 8.4 and 11.2 per cent, respectively.

Viability of watermelon seed after storage for 1 year was shown to be determined by maturity and number of days the seed remained in the fermenting pulp. Highest germination was for seed from mature and postmature melons that were fermented for 3 days. Seed that remained in contact with the fermenting pulp for more than 5 days had 50 per cent reduction in germination. The pH of the fermenting pulp was 3.5 on the third day and remained at this level for 10 days. It appears that watermelon seed allowed to remain in this highly acid pulp will lose their viability.

Oat seed of 11.8, 10.46, and 9.0 per cent moisture contents were stored for 1 year at 76°, 86°, 95°, 99°, and 104° F. At temperatures above 86° F., loss in germination did not occur at 9.0 per cent moisture content except at 104° F., where a 14 per cent reduction occurred. At seed moisture content of 10.46 per cent and above, germinations were reduced 54 per cent to 100 per cent by storage temperatures of 95° F. and above.

After 6 months of storage, crimson clover seed were analyzed for sugars, starch, protein nitrogen, nonprotein nitrogen, and cell-wall carbohydrates. As seed moisture content was increased, total

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

sugars and nonprotein nitrogen increased while starch and protein nitrogen decreased. Cell-wall carbohydrates did not change.

The Effect of Method of Curing on the Quality of Peanuts. (H. S. Ward, Jr., and J. L. Butt.)[2] — Peanuts harvested at kernel moisture contents ranges of 30-35, 20-30, 15-20, and 10-15 per cent were artifically dried by forced air and heated air at 100°, 110°, 120°, 130°, and 140° F. Artificial drying of peanuts at the above moistures and temperatures did not cause the total oil, free fatty acids, and carbonyl content to differ from that of naturally cured peanuts. Peanuts artificially cured from moistures above 20 per cent had less total sugars and proteins than did naturally cured peanuts.

At kernel moistures above 30 per cent, artificial drying will cause reductions in germination. At kernel moistures of 15 and 30 per cent, heated air at 110° F. did not cause a loss in viability. Peanuts harvested at less than 15 per cent kernel moisture were dried with heated air at 120° F. without lowering germination.

Peanuts harvested at moisture contents above 25 per cent could not be artificially dried by either unheated or heated air without increasing mechanical damage (splits plus skin removal) by machine shelling. At moisture contents of less than 25 per cent, mechanical damage was not greater than naturally cured peanuts if dried by heated air of 110° F. or less. Mechanical damage was increased from 5 to 44 per cent above naturally cured peanuts by heated air at 120° F. or above.

Free fatty acids, carbonyls, and peroxide number did not differ for peanuts cured in stacks, piles, and windrows. Mechanical damage was slightly higher for peanuts cured in the windrow. Germination of peanuts harvested in 1952 and 1953 that were cured in stacks, piles, and windrows did not show consistent differences that would indicate either of the three methods of natural curing as being superior for producing seed peanuts.

DAIRY HUSBANDRY

Effect of Grass and Sanitation on Rate of Growth of Young Calves. (George E. Hawkins, Jr., and K. M. Autrey.) — Under controlled feeding and management conditions, the growth response of calves raised in a conventional calf barn was similar to

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

that of calves raised in portable outside pens. However, the total digestible nutrient requirements per pound of gain by calves raised in portable outside pens was greater than that of calves raised in conventional housing.

Calves raised in portable outside pens located on an area frequented by older cattle made less gain in body weight and in height at the withers than calves raised in similar pens on an area that was not accessible to older cattle. Differences in coccidia infestations did not appear to be great enough to account for the differences in growth of these two groups of calves. Also, a spot check of the feces of calves on the area frequented by older cattle indicated that the stomach worm count was low.

The growth rate of calves fed 1 pound of freshly cut grass daily was similar to that of calves fed the basal diet.

Performance of Dairy Cows on Immature Oat Forage. (George E. Hawkins, Jr., and K. M. Autrey.) — The lactation response of dairy cows fed green oat forage, 6 to 12 inches high, was compared with that of cows fed alfalfa hay in three trials. Crude protein content of the oat forage ranged from 12 to 27 per cent. Mean digestibility of dry matter of the alfalfa hay was 58.8 per cent and that of the oat forage was 79.4 per cent, similar to digestibility of the concentrate fed. During the experimental periods, digestible dry matter from immature oat forage was substituted at 0, 50, and 100 per cent levels for digestible dry matter provided by alfalfa hay during the preceding standardization period. Persistency index of milk flow in Trials 1 and 2 averaged 88, 99, and 99 per cent for the 0, 50, and 100 per cent levels of oat forage. Cows fed alfalfa hay as the only roughage did not consume their full allowance of hay. Production of 4 per cent fat corrected milk per pound of digestible dry matter consumed above maintenance requirements was similar for all diets.

At the end of Trial 2, one-half of the cows assigned to each diet were turned on oat pasture that was approximately 12 inches high, whereas the other cows remained on the same diet as in Trial 2. The cows that were turned out to graze produced more milk than the cows that were barn-fed alfalfa hay, clipped green oat forage, or a combination of both. This greater milk flow from the grazing cows probably was due to a greater intake of digestible nutrients under grazing conditions.

Supplements to Sericea Pasture. (George E. Hawkins, Jr., and K. M. Autrey.) — A grazing experiment involving 35 cows was conducted to investigate practical methods of using sericea lespedeza as the basic pasture for lactating cows. The methods investigated were: (1) irrigation of sericea to produce a plant of maximal quality, (2) feeding oat hay as a supplement to sericea grazing, and (3) grazing a millet-sudangrass pasture during the day and grazing sericea pasture at night. In addition, one group of cows grazed sericea and another group grazed alfalfa.

During a 6-week grazing period, which extended through a drought, cows in all groups declined in milk production. The level of milk production remained relatively constant during the next 6 weeks, except for cows on alfalfa, whose level increased. The persistency of milk production by groups at the end of 6 and 12 weeks, respectively, was as follows: sericea, 56.0 and 58.6 per cent; irrigated sericea, 50.9 and 50.8 per cent; sericea supplemented with oat hay, 62.0 and 60.7 per cent; sericea plus millet-sudangrass grazing, 73.6 and 70.9 per cent; and alfalfa, 76.6 and 83.1 per cent.

The results of this study show: (1) sericea is inferior to alfalfa as a grazing crop; (2) irrigation of sericea and feeding oat hay as a supplement to sericea were not profitable; and (3) sericea pasture may be utilized in a dairy program without depressing milk production significantly provided the cows have access to a high quality grazing crop during a part of the day.

Johnsongrass Silage and Johnsongrass Hay in the Ration of Dairy Cows. (W. B. Kelley, L. A. Smith, and George E. Hawkins, Jr.) — Johnsongrass hay and Johnsongrass silage cut from the same field on the same date were compared as roughages for lactating cows. The moisture content of the ensiled forage was 66.8 per cent when stored. The dry matter content of the silage was 60 per cent digestible, whereas that of the hay was 57 per cent. The crude protein content of both hay and silage was approximately 7 per cent.

The 27 cows involved in this study were assigned according to milk production to three groups of nine cows each. The roughage rations of the three groups were: I, Johnsongrass silage; II, Johnsongrass silage and Johnsongrass hay; and III, Johnsongrass hay. Concentrate feeding was equalized between the three groups. The roughage was fed free choice to the cows in individual stalls.

Cows in Groups II and III produced significantly more milk than cows in Group I. Analysis of the milk production data with forage dry matter intake as a covariable indicates that differences in production of 4 per cent fat corrected milk between groups were related to differences in forage dry matter intake.

During the first week of the study, cows fed Johnsongrass silage as the only roughage consumed only 0.64 pounds of forage dry matter per 100 pounds of body weight. However, 6 weeks later the same cows were consuming an average of 2.22 pounds of silage dry matter per 100 pounds of body weight, which was greater than the 1.82 pounds consumed by cows on Johnsongrass hay as the only roughage.

Consumption of Alfalfa Silage. (George E. Hawkins, Jr., and K. M. Autrey.) – Considerable interest has developed in the storage of silage in horizontal silos designed to permit self-feeding of silage. A study was conducted to compare consumption by dairy cows of hand-fed long alfalfa silage with that of the same silage self-fed from a horizontal silo. Six lactating cows weighing between 675 and 1,025 pounds were assigned at random to the two systems of feeding. During the first period, three of the cows were hand-fed and three self-fed. The method of feeding during the second period was switched, thus each group of three cows was subjected to both methods of feeding. The quantity of alfalfa silage consumed during hand-feeding was weighed, whereas the intakes during self-feeding were estimated by the chromic oxide method. The moisture content of the silage averaged 79.2 per cent.

The average daily consumption of the long alfalfa silage per hundredweight of the cows was 8.32 pounds and 9.08 pounds during the hand-feeding and self-feeding periods, respectively. During hand-feeding, consumption of the silage per hundredweight by all cows was relatively uniform; however, the intakes varied greatly among individual cows during self-feeding.

Self-feeding of silage required less labor than hand-feeding, but the amount of silage wasted was greater when the cows were self-fed.

Palatability of Sericea Lespedeza from Five Locations in Alabama. (George E. Hawkins, Jr., and E. D. Donnelly.) – Dairy steers weighing approximately 600 pounds each were fed sericea

hay grown at five locations in Alabama to determine the effect of geographic location of growth on palatability of the forage. First and second cuttings of hay from each location were used in this study. The mean daily intakes of sericea hay by the steers per 100 pounds of body weight from the five locations were as follows: Auburn, 2.6 pounds; Camp Hill, 2.7 pounds; Belle Mina, 3.1 pounds; Winfield, 3.2 pounds; and Crossville, 3.2 pounds. The daily intakes of forage varied markedly from steer to steer on hay from the same location. Differences in consumption associated with location of growth were not statistically significant. The mean intake of all first cuttings of sericea hay was 2.95 pounds per 100 pounds of body weight of the steers as compared with 2.96 pounds for the second cuttings of hay.

Steers used in this study had received sericea hay for an extended period. The intakes of sericea hay from all locations was similar to consumption that would be expected on a good forage. Since the steers were in a thin state of flesh, however, the intakes per 100 pounds of body weight were approximately 20 per cent greater than they would have been for the same steers in good flesh.

FORESTRY

End Joints in Southern Pine Lumber. (D. B. Richards) — Various methods were studied for curing the glue in fingered scarf end joints. For the Auburn joint, hot pressing cycles of 20 to 30 seconds produced satisfactory joints, but joints of the highest strength were not produced in less than 40 to 45 minutes in the hot press. Heating cycles using a radio frequency electrical field did not give any shorter cycles than did hot pressing.

Studies on the end-jointing of normal heartwood of southern pines indicated that the Auburn joint gives about 70 per cent of the strength of clear wood when tested in static bending. Practically no adhesion or strength is obtained if very resinous heartwood (so-called "lighted pine") is used.

Two by fours can be made from short 1 × 4's by simultaneously end-jointing and laminating 1 × 4's in a cold press. When placed on edge and broken as a beam at one of the joints the strength of such a 2 × 4 is about 70 per cent of the strength of a clear, solid control beam. This strength ratio is high enough to allow this type of jointing to be used in No. 1 and No. 2 grade dimension

lumber. Under 1953 price conditions it would be economical to salvage No. 2 grade 1 × 4's as short as 15 inches by end-jointing and laminating them into 2 × 4's.

A cooperative study with a private company investigated the strength of an end joint that they had designed using some, but not all, of the ideas developed at Auburn for the design of end joints. Their design employed fairly broad tips and fairly closely spaced fingers. This combination of conditions resulted in such a high concentration of stresses at the tips of the fingers that the joints broke largely in the wood near the tips of the fingers but gave strengths of only about 50 per cent of that of solid controls when tested in static bending. These results indicate the importance of the spacing and design of the tips in end joints of the fingered scarf joint type.

Cold Soaking of Fence Posts With Preservative Materials. (K. W. Livingston.) — In the first test of fence posts treated by cold soaking, the posts had been in service 6 years and 2 months at the last annual inspection. Included are southern pine, sweetgum, and post oak posts of two size classes (3 to 4½ inches and 4½ to 6 inches top diameter) treated with a 5 per cent solution of pentachlorophenol in fuel oil, with untreated pine posts set alongside the test fence to serve as checks. All 58 untreated posts have failed. Their average life was less than 2 years. All 28 large and 85 small treated pine posts were good, as were the 26 small oak posts. One of 27 large oak posts was damaged by decay but still serviceable; the other 26 were good. Of 27 small sweetgum posts, 21 were good, 1 was serviceable but damaged by insects, and 5 had failed. All 28 large sweetgum posts were good.

The second test had been in existence 4 years and 10 months at the last annual inspection. All posts are of southern pine, with 25 posts of each size class treated with 5 per cent pentachlorophenol in fuel oil, 25 of each class treated with a solution of copper naphthenate in fuel oil containing 0.5 per cent copper, and 25 of each class untreated. Only one small and two large untreated posts were serviceable, and these showed damage from decay or insects. One small copper naphthenate-treated post had failed after 3½ years. The other 24 were good at the last inspection. All large posts treated with copper naphthenate and all of both size classes treated with pentachlorophenol were good.

The Influence of Certain Soil Management Practices in a Forest Tree Nursery on Loblolly Pine Seed Germination and Seedling Development. (Jack T. May.) — The effects of methyl bromide, Karmex W, sawdust, and mineral fertilizers are being tested in the Auburn Nursery.

Methyl bromide, applied at the rate of 1 pound per 100 square feet, did not significantly influence the germination of loblolly pine seed or the survival of pine seedlings in the seedbed.

On a fallow area having a heavy stand of nutgrass, Johnsongrass, and miscellaneous weeds, Karmex W was applied 9 months prior to sowing pine seed. Application rates were 6.8, 13.6, 27.2, and 54.4 pounds per acre. Seed germination was excellent on treated plots and check plots. Within 60 days after germination, seedlings on the plots receiving the two heaviest treatments began to die. The lateral roots were killed at a depth of 2 to 3 inches. Seedlings that did not die remained stunted and undeveloped. The mortality of seedlings on plots receiving the two lightest treatments was no greater than on the check plots. The percentage of cull seedlings was 12.0 for the check plots, 15.0 for the 6.8-pound treatment, and 25.2 for the 13.6-pound treatment. Only the 54.4-pound application was effective in killing some of the nutgrass. The applications at other rates were partially effective on Johnsongrass and weeds.

Sawdust was tested as a seedbed mulch and as a form of organic matter incorporated in the soil. In 1953 and 1954, germination under ¼-inch sawdust mulch was, respectively, 8.7 per cent and 10.4 per cent higher than under pine straw and burlap mulches. Under a sawdust mulch, appreciably lower maximum surface soil temperatures occurred than where no mulch was maintained after the germination period. A ¼-inch sawdust mulch reduced mortality of established seedlings.

Sawdust was incorporated in the soil at rates of 15 tons and 30 tons per acre. When sawdust was throughly mixed with the soil and sufficient amounts of nitrogen, phosphorus, and potassium were applied, seed germination was not significantly affected. An application of 30 tons of sawdust resulted in a lower seedbed survival (85.4 per cent) than 15 tons of sawdust (90.6 per cent) or no sawdust (90.1 per cent). The shoot to root ratio was decreased by 15- and 30-ton applications of sawdust. When the sawdust was not thoroughly mixed with the soil, seedling growth was stunted and pronounced deficiency symptoms de-

veloped. Within 1 year the organic matter content of the soil increased from 1.81 per cent for plots receiving no sawdust to 1.99 per cent and 2.16 per cent, respectively, for the plots receiving 15 tons and 30 tons of sawdust.

Fertilizer levels were 150, 300, and 450 pounds of P_2O_5 per acre and 80, 160, and 240 pounds of K_2O per acre. Phosphorus and potassium were applied prior to sowing of pine seed or prior to sowing of a cover crop. Nitrogen was applied prior to sowing of seed and again during the growing season. Between these levels of phosphorus and potassium, there was no significant difference in the germination of seed or the development of plants. After one growing season the available phosphorus content of the soil was 89, 103, and 108 p.p.m., respectively, for 150, 300, and 450 pounds of P_2O_5. The available potassium content of the soil was 86, 98, and 102 p.p.m., respectively, for plots receiving 80, 160, and 240 pounds K_2O.

First-year survival of outplanted seedlings was practically the same regardless of treatments applied to the nursery seedbeds. Survival was 97.9 per cent in May and 77.2 per cent in November, although rainfall between planting and the November survival count was about 50 per cent below normal. Results to date indicate that high-quality nursery stock can be produced in the Auburn Nursery using smaller amounts of fertilizer than shown above.

Survival of 2-Year-Old Pine Seedlings. (Jack T. May and A. R. Gilmore.) — The objective of this investigation was to determine whether seedlings that remained in the nursery for 2 years survived better after outplanting than 1-year-old seedlings. Longleaf and loblolly pine seedlings were left in the nursery beds for 2 years. Some seedlings were root pruned at the end of the first growing season. Other seedlings were not root pruned.

Longleaf pine seedlings naturally develop a long tap root with few laterals. Roots of 1-year seedlings that were pruned frequently did not callous over during the second growing season. Some new lateral roots were developed after pruning, but an extensive lateral root system did not develop.

Root-pruned and nonroot-pruned 2-year-old longleaf seedlings and nonroot-pruned 1-year-old longleaf seedlings were outplanted. Two-year-old and 1-year-old loblolly pine seedlings were outplanted. Two of the outplanting sites were on a sandy clay loam and three sites were on a deep sand.

Survival percentages after 1 season in the field were: (1) 2-year-old root-pruned longleaf, 20.4 per cent; (2) 2-year-old non-root-pruned longleaf, 24.0 per cent; (3) 1-year-old longleaf, 42.6 per cent; (4) 2-year-old loblolly, 49.8 per cent; and (5) 1-year-old loblolly, 69.8 per cent.

Effects of Site Preparation and Culivation on Growth of Old Field Plantings of Yellow Poplar. (Frank F. Smith) — Yellow poplar seedlings were planted on an old field in alluvial sandy soil. The planting stock was poor, averaging only 0.41 feet in height. Two soil preparation treatments and a check were tested: (1) Seedlings were planted in rows to permit a tractor-drawn disc harrow to cultivate the middles; (2) a furrow 4 inches deep and 16 inches wide was plowed with a middle breaker and seedlings planted in the bottom of the furrow; and (3) seedlings were planted in rough, undisurbed soil. Each treatment was replicated 4 times. The cultivated plots were plowed and hoed 3 times annually to control competing weeds and grasses. The other plots received no treatment after planting.

Survival was poor and height growth was limited in all 3 tests at the end of the second year. A late killing frost and a dry summer the first year and another extremely dry summer the second year account for the high mortality and poor growth. All seedlings that died the first year were replaced. Average survival by treatments at the end of the second year was: cultivation, 39.6 per cent; furrow, 8.7 per cent; and no treatment, 2.9 per cent. Average height at the end of the second year was: cultivation, 1.86 feet; furrow, 0.94 feet; and no treatment, 1.11 feet.

Survival and height growth were extremely poor as a result of adverse weather conditions. Two years' results indicate that control of competing weeds and grasses during the first 2 years greatly increases both survival and height growth of yellow poplar seedlings.

HORTICULTURE

Studies of Fertilizers, Organic Materials, and Culture for Vegetable Crops: (1) Effects of Rates and Times of Application of Nitrogen, Phosphorus, and Potash on Yield of Potatoes. (L. M. Ware and W. A. Johnson.) — Rates of application were 1,500, 2,000, and 2,500 pounds per acre of a 4-10-7 fertilizer.

Fertilizers were added in single and in three applications. Side applications of nitrogen, potash, and phosphorus were individually omitted from the 2,500-pound rate after 1,000, 1,500, and 2,000 pounds of the complete fertilizer had been added.

The amount of rainfall greatly influenced the effects of dividing the fertilizer application. In the dry year, 1954, yields were increased about 20 per cent by dividing the fertilizer application; in the very wet year, 1953, yields were increased about 500 per cent, and in 1952, a year of average rainfall, about 100 per cent.

Increasing the rate of fertilizer from 1,500 to 2,500 pounds did not significantly increase yields where all fertilizer was added in one application. Yields were significantly increased by increased rates where the fertilizer was added in three applications.

Yields were reduced by omitting side applications of phosphorus, or phosphorus and potash, or nitrogen, phosphorus and potash from the 2,500-pound rate after 1,000 or 1,500 pounds of a 4-10-7 fertilizer had been added.

(2) Recovery of Nitrogen, Potash, and Phosphorus in Potatoes at Harvest Time from Different Rates and Times of Application of Fertilizer Materials. (L. M. Ware and W. A. Johnson.) — Plants and tubers were analyzed for nitrogen, phosphorus, and potassium. The amount of nitrogen recovered was not affected by different rates of complete fertilizer (4-10-7) when all was added at planting time. The amount of nitrogen recovered was significantly increased (1) by increased rates of a complete fertilizer added in three applications, (2) by side applications of nitrogen alone, or (3) by side applications of nitrogen and potash. The addition of potash as a side application, when only 70 pounds K_2O had been added in the initial application, greatly increased nitrogen recovery.

Potash recovery was very low in plots receiving high side applications of nitrogen but a low amount of potash in the initial application and no side application. Side applications of potash along with nitrogen gave significant increases in potash recovery over a side application of nitrogen alone.

Phosphorus recovery was markedly increased by increased applications of phosphorus in three applications but not in one application. Recovery of phosphorus was greatly reduced by a high rate of nitrogen in side applications but increased by a side application of nitrogen and potash.

(3) Effects of Different Rates and Times of Application of Fertilizer Materials on Yield of Potatoes on Soils of Different Texture. (L. M. Ware and W. A. Johnson.) – The soils were a Cecil clay and a sandy loam Chesterfield. Rates of application were 1,000, 1,500, and 2,000 pounds per acre of a 6-8-4 fertilizer. Yields from single applications of a complete fertilizer in 1953, under conditions of high rainfall, were 300 per cent higher on the heavy soil than on the light soil; in 1954, with low rainfall, there were only small differences in yield between the two.

In 1953, yields from split applications of fertilizer on the light soil were increased 100 to 300 per cent over those from one application. Yields on the heavy soils were increased only a small extent by dividing the application.

In 1954, with low rainfall, yields were about the same on the two soils from the several fertilizer rates whether the fertilizer was applied in one or in three applications.

(4) Effect of Plant Size and Spacing on Yield of Green Onions Under Intensive Methods. (L. M. Ware and W. A. Johnson.) – All plots received 2,000 pounds per acre of 8-10-7 fertilizer, 12 tons of animal manure, and irrigation. Spacings were 1, 2, and 4 inches in the drill in rows 12, 24, and 36 inches apart; sets were of three sizes. Average yields over a 3-year period varied from 1,948 pounds per acre with small sets at widest spacings to 22,643 pounds with large sets at the closest spacings. Each factor affected yields with each combination of the other factors; closer spacing and larger sets increased yields with all combinations. Weight of sets planted per acre varied from 97 pounds for the smallest sets with the widest spacings to 5,894 pounds for the largest sets and closest spacings. Costs of sets varied from $11 to $63 per acre.

(5) Effects of Fertilizer Rates, Organic Materials, Irrigation, and Size of Set on Green Onion Production. (L. M. Ware and W. A. Johnson.) – Fertilizer rates were 1,000, 1,500, and 2,000 pounds of 8-10-7 per acre; organic materials consisted of animal manure, vetch, and rye; irrigation consisted of 1 inch per week if rain did not supply this amount; sets were of three sizes. The 3-year average yield from large size sets varied from 9,547 pounds to 41,602 pounds as the several treatments were added. Yields for the medium size sets ranged from 6,269 to 31,398 pounds and for the smallest sets from 3,178 to 22,360

pounds. Yield from the largest sets and from 1,000 pounds of fertilizer was 9,547 pounds. When successively added, 12 tons of manure increased yields to 17,291 pounds, irrigation to 28,968 pounds, vetch to 32,110 pounds, 500 pounds of additional fertilizer (1,500 total) to 39,729 pounds, and a second 500 pounds of fertilizer (2,000 total) to 41,602 pounds.

(6) Effects of Rates of Fertilizer, Organic Materials, and Irrigation on Yield of Cantaloupes. (L. M. Ware and W. A. Johnson.) — Results are based on marketable yields from 1952 through 1954. When fertilized with 1,000 pounds of a 6-10-7 fertilizer per acre, marketable yields were increased 953 pounds per acre by irrigation, 11,884 pounds by 12 tons of manure, 22,859 pounds by irrigation and manure, and 24,597 pounds by irrigation, manure, and vetch.

Irrigation increased yields 953 pounds without organic materials, 8,097 with 6 tons green vetch, 8,184 with 6 tons green rye, 10,975 with 12 tons of manure, and 17,199 pounds per acre with 12 tons manure and 6 tons of green vetch.

(7) Effects of Irrigation, Fertilizers, and Organic Materials on Watermelons. (L. M. Ware and W. A. Johnson.) — Results are based on yields obtained in 1953 and 1954. Fertilizer rates were 400, 800, and 1,200 pounds of 6-10-7 per acre. Organic materials were animal manure and vetch. Each treatment was used with and without irrigation. Rainfall was high in 1953 and very low in 1954. In 1953, yields of melons 20 pounds or over in size were increased from 6,464 to 26,496 to 49,760 pounds per acre without irrigation and organic materials as the fertilizer rates were increased from 400 to 800 to 1,200 pounds per acre; in 1954, the respective yields were 6,160, 11,744, and 26,352 pounds per acre. At the 800-pound rate of fertilizer and without irrigation, 6 tons of manure increased yields from 26,496 to 53,792 in 1953, and from 11,744 to 28,131 in 1954. A similar increase was obtained from 6 tons of vetch. With 800 pounds of fertilizer and 6 tons of manure, irrigation increased yields of marketable melons from 53,792 to 57,408 pounds per acre in 1953 and from 28,131 to 73,344 pounds per acre in 1954. In 1953, the highest yield of melons, 72,704 pounds per acre, was produced from treatment receiving 1,200 pounds of fertilizer, 6 tons of manure and irrigation; whereas in 1954, the highest yield, 73,344 pounds, was produced from treatment receiving 800 pounds of fertilizer, 6 tons of manure, and irrigation.

Freeze Concentration Process for Making Fruit Jellies and Jams. (Hubert Harris.) — A new process has been developed for making fruit jellies and jam with high retention of aromatic flavors. Retention of these flavors is accomplished by a freeze concentration process that eliminates the conventional boiling process.

By the new process, the fruit is concentrated by separating a dilute icy fraction from partially frozen juice, pulp, or whole fruit after it has been removed from frozen storage and conditioned to a suitable temperature. The concentrated fraction, representing approximately 60 per cent of the total batch, contains approximately 90 per cent of the total solids and practically all of the volatile flavor constituents. This fraction is never subjected to boiling. The dilute fraction of juice or pulp, containing the remaining 10 per cent of fruit solids, is boiled to remove excess water and returned to the concentrated product. In finishing the jelly or jam, the concentrated juice or pulp is heated rapidly in an open kettle to 190° F. and maintained at this temperature while pectin, sugar, and acid are added and dissolved. The product is then packaged and sealed as rapidly as possible.

Flavors in blackberry jellies and jams have been further improved through the extraction of desirable flavor constituents from the seed. This extraction may be made by boiling the seed with the dilute fraction of juice or pulp and pressing or pulping to remove the seed.

Hydrocooling Peaches. (Hubert Harris and R. L. Spigner.) — During 1953 and 1954, studies were made at Auburn on hydrocooling peaches to obtain basic information on the relationship of cooling rates to fruit size, position in basket, temperature of cooling water, rate of circulation of water, addition of wetting agent to water, and other factors. These studies have shown that, when water was circulated at the rate of 8 gallons per minute per square foot of conveyor belt surface and no wetting agent used, the fruit in the middle of the basket cooled very slowly. The cooling rate throughout the basket was comparatively low. The addition of 250 p.p.m of the wetting agent Triton to the cooling water, with the same rate of circulation, resulted in considerably faster cooling and more uniform cooling throughout the basket. The rate and uniformity of cooling were also increased by increasing the rate of circulation of water without the wetting agent, but it was necessary to increase the water rate

to approximately 24 gallons per minute in order to obtain as good results as were obtained with 8 gallons per minute with the wetting agent. Foaming that was caused by the wetting agent was satisfactorily controlled by using a commercial anti-foam material.

The cooling rate was increased by maintaining a comparatively low temperature in the cooling water by crushing the ice finely. Small fruits cooled more rapidly than large fruits.

New Processes for Making Frozen Sweetpotato Products. (Hubert Harris.) — In laboratory tests, the jumbo grade of sweetpotato has been used for making a sugar-blanched, frozen strip that has proved excellent for candying purposes. In laboratory and pilot plant tests, jumbo, No. 2, and cull grades have proved satisfactory for making frozen puree. This puree has been prepared by baking or by cooking in a sugar medium. It has been tested in local dining halls and school lunchrooms where it has been rated as excellent for making souffles and puddings.

In pilot plant studies involving approximately 50,000 pounds of sweetpotatoes, a considerable amount of data has been obtained on methods, labor requirements, recoveries, and costs for the different grades of potatoes. In one test of 21,822 pounds prepared by the sugar-cook process and packaged in 60-pound cans, the requirements per 100 pounds of frozen puree were: 124 pounds of sweetpotatoes (No. 2 grade, 87 pounds trimmed weight), 14.4 pounds of sugar, 1.56 hours of labor, 84 cents for cost of can, and 12 cents for cost of utilities. The total cost on these items was $8.18 per 100 pounds of puree. Twenty per cent of the labor was required for unloading, peeling, and washing; 35 per cent for trimming; 30 per cent for cooking, pulping, and packaging; and 15 per cent for miscellaneous services.

Effect of Irrigation, Manure, and Fertilizer on Qualities and Yields of Blackberries. (Robert L. Spigner.) — This study was conducted at the Main Station to determine the effects of supplementary cultural and fertilizer treatments on the qualities of the fresh berries and processed products.

The fertilizer treatment in common use by commercial growers in Chilton County was used as the standard and applied to all plots. The supplementary treatments applied singly or in combination consisted of irrigation at the rate of 1 inch per week

when needed, 12 tons of animal manure per acre, and 200 pounds of sodium nitrate, applied during summer.

Properties of fresh berries and finished jellies were determined by standard laboratory methods.

Irrigation as the only supplementary treatment resulted in larger and firmer berries with slightly lower soluble solids when compared with the standard treatment. Neither manure nor summer applications of nitrogen used supplementary to the standard affected the properties of the berries.

When manure, summer nitrogen, and irrigation were used in combination supplementary to the standard, the berries were larger and firmer but lower in soluble solids than those of the standard treatment.

There were no differences in the quality of jelly prepared from berries of different treatments.

The highest yield of total solids was obtained from a combination of all three supplementary treatments. This treatment produced 1,190 pounds per acre. The standard treatment produced 538 pounds.

Relation of the Nutrient-Element Content of Pecan Leaves to the Yield of Nuts. (T. B. Hagler and W. A. Johnson.) — Leaf samples were collected from the 176 pecan orchards surveyed in 1951 and 1952. These samples were analyzed in 1953 and 1954 to determine the relation of nutrient-element content to the yield of nuts. Each sample was analyzed for nitrogen, phosphorus, potassium, calcium ,and magnesium. Seven yield classes were set up on basis of the average yield per tree for the last 5 years or more. The highest yielding class produced 56 pounds or more per tree; the lowest class produced 5 pounds or less per tree. The other yield classes were separated by a difference of 10 pounds per tree.

Data from the foliar analyses show that nitrogen and calcium increased in the leaves as the average yield of nuts per tree increased. There was quite a variation in the calcium content of the leaves between the different yield classes. Even some leaves from trees in the low yield classes had a relatively high calcium content. This probably was due to increased use of legumes and fertilizer in the orchards, but these improved practices had not been in effect long enough to affect the yields.

The potassium, magnesium, and phosphorus contents of the

foliage were not significantly different between any two of the yield classes. There was a slight increase in the potassium content of leaves from the lowest yielding class to the highest yielding class, indicating little response to potassium.

Magnesium Deficiency in Pecan Orchards. (T. B. Hagler and W. A. Johnson.) — Leaf deficiency symptoms similar to those reported for other crops with a lack of magnesium were found on many of the trees in southern Alabama pecan orchards.

Results of the leaf analyses indicate that the magnesium content of the leaves may be satisfactorily used to determine the magnesium status of pecans. The magnesium content of the foliage varied more than leaf content for any other element. This was particularly true for the sandy soils of southeastern Alabama. The magnesium content on a dry weight basis ranged from 0.002 per cent in leaves from trees showing extreme magnesium deficiency to 0.630 per cent in leaves showing no magnesium deficiency symptoms. From 0.25 to 0.52 per cent magnesium in the leaves is considered optimum for normal growth and production. Nineteen per cent of the leaves analyzed had a magnesium content below 0.25 per cent.

Commercial Production in Alabama of the Better Adapted and More Promising Bulb Crops: (1) LIQUID FERTILIZATION OF GLADIOLUS. (Henry P. Orr and Tok Furuta.) — Applying fertilizer dissolved in the irrigation water to a field of gladiolus was shown to be practical. Sodium nitrate was found to be a better source of nitrogen than ammonium sulfate. Ammonia fertilizer in any form reduced yields.

(2) FORCING OF THE EASTER LILY. (Tok Furuta.) — The shortest Easter lily plants at flowering resulted when the following treatment was given: After potting, the plants were grown in full sun at 50° F. with very little water. The amount of water was increased to normal as flower bud initiation began, and the temperature raised to 60° F. to insure flowering for Easter. All plants were grown in full sunlight. Approximately 100 days were required from potting to flowering.

Developing and Adjusting Precision Methods of Growing Pot Plants and Cut Flowers for Southern Conditions: (1) CARNATIONS IN ALABAMA. (Tok Furuta.) — Although carnations are not an

important greenhouse crop in Alabama today, experiments conducted during the past 4 years indicate that more can be profitably grown. Excellent quality is possible, especially during the months of November through April. Careful selection of varieties is necessary as tests indicate that some of the leading varieties do poorly under local conditions. The chief difficulty to date has been low production to the point where the crop may be unprofitable.

(2) YEAR-ROUND SNAPDRAGON CULTURE IN GREENHOUSES. (Tok Furuta.) — Snapdragons can be profitably grown in Alabama greenhouses throughout the year. Some of the newer F_1 hybrid varieties were not as good as many of the older inbred varieties for Alabama conditions. The length of time from seeding to flowering varied from 2 months in the summer to 4 months in the winter. Quality decreased as the temperature increased.

(3) PHOTOPERIOD AND FLOWERING OF CHRYSANTHEMUMS. (Tok Furuta.) — The photoperiod at which chrysanthemums initiate flower buds and at which flower bud development is most rapid varied with the variety. Maximum rate of development required shorter photoperiods than initiation. All initiation resulted in photoperiods of 13 hours or less, and development at the maximum rate resulted at 12 hours or less.

(4) YEAR-ROUND GREENHOUSE ASTERS. (Tok Furuta.) — Experiments showed that the China aster can be grown successfully and profitably in a greenhouse throughout the year. The growing temperature was not critical as equally good flowers were produced at 50° and 60° F. The time to flower was also the same at both temperatures.

The Propagation, Culture, Storage, and Marketing of the Camellia: (1) INFLUENCE OF BORON ON CAMELLIA. (Tok Furuta.) — Pink Perfection variety of camellias was tolerant to applications of boron. In Norfolk sandy loam, an application of 40 pounds of borax per acre was necessary before damage occurred. In Decatur clay loam, an application of 80 pounds of borax per acre was necessary before damage occurred. Poultry manure treated with borax, at the rate of 4 tons per acre, caused damage. Whenever the foliage was damaged, leaf abscission resulted, but the plants survived and continued to grow normally.

POULTRY HUSBANDRY

The Effects of Light on Gonad Development and Sexual Maturity of Chickens. (Fred Moultrie and G. R. McDaniel.) — Three groups of broiler strain New Hampshire chicks grown from 1 day of age with 7.5, 15, and 22.5 hours of daily light showed no significant between-treatment differences in the gonad weights of birds killed at the end of each 4-week period through 24 weeks of age. Also, there was no significant difference between treatments in age at first egg. These ages for treatments were 143, 142, and 140 days, respectively.

At 12 weeks of age, a sample of birds was taken from the 7.5-hour group and grown to maturity with 15 hours of light daily. At the same time a similar sample was reduced from 22.5 to 15 hours, and a third sample that originated from the 15-hour group was left on 15 hours. Under 15 hours of light, females that received 7.5, 15, and 22.5 hours of daily light up to 12 weeks averaged 137, 147, and 153 days, respectively, at age of first egg, these differences being statistically significant.

Double-Shift Method of Management of Laying Hens. (D. F. King.) — It was found that a modified laying house could be used for a day-shift and a night-shift flock of laying hens. One flock roosts while the other flock utilizes the remaining area for feeding, laying, and exercise. The roosting area must be darkened and fan-ventilated for the flock that sleeps during the daytime. Artificial lights are used in the feeding-laying area during the night. The flocks are shifted daily at 6 a.m. and 6 p.m. This results in doubling the capacity of the house and equipment and practically doubling the income since the hens laying at night produce at about the same rate as the normal day-shift flock.

Nutritional Requirements of Broilers. (G. R. Ingram and Thomas V. Hester.) — In a study of the nutritional deficiencies of peanut meal for broiler rations, the primary deficiency was found to be lysine.

Contrary to previous reports, no response was obtained from the addition of methionine to a corn-peanut meal ration. A growth response was obtained from the addition of dried milk, fish meal, or soybean oil meal to such a basal. This response was in direct proportion to the lysine level of the tested ingredient.

Protein and Amino Acid Requirements of the Laying and Breeding Hen. (G. R. Ingram and E. J. Day.) — In a series of tests with laying hens in cages, it has been found that higher levels of protein are required than the level commonly accepted for maximum egg production.

Seventeen and 19 per cent protein rations have supported higher egg production than a 15 per cent protein ration. Egg production from hens fed 13 per cent protein was so poor that the experiment was discontinued.

These tests indicate that the protein requirement of the laying hen in cages is approximately 17 per cent.

Cage Rickets. (G. R. Ingram, T. V. Hester, E. J. Day, and G. J. Cottier.) — A condition similar to rickets has been observed in caged layers. The condition usually develops in pullets that have been in production for only 6 or 8 weeks and affects high-producing birds.

At first, the pullet begins showing signs of leg weakness. This condition gets worse rapidly until the bird is paralyzed. Egg production usually continues as long as the bird can get water and feed. The bird may recover rapidly if egg production ceases, either when left in the cage or placed on the floor. If the bird does not recover rapidly, she usually dies in 4 or 5 days after egg production ceases.

The blood, calcium, and phosphorus levels are lowered. Beading of the ribs occurs, and the bones become weak and brittle. Bone ash is lowered slightly.

The calcium and vitamin D level of the feed does not seem to be the important factor.

Breeding and Immunizing Chickens for Resistance to Coccidiosis: (1) BREEDING CHICKENS FOR RESISTANCE TO COCCIDIOSIS. (Fred Moultrie, S. A. Edgar, and D. F. King.) — A coccidiosis-resistant strain originating from the Auburn Strain White Leghorn has been selected for eight generations for genetic resistance to the cecal coccidiosis organism, *Eimeria tenella.* A coccidiosis-susceptible strain, of the same origin, has been selected for three generations.

During the 1954 brooding season, 313 resistant, 207 susceptible, and 158 nonselected control chicks were artifically infected at 2 weeks of age with approximately 10,000 *E. tenella* oocysts per chick. Mortality from acute cecal coccidiosis to 6 weeks of

age was 15, 72, and 54 per cent, respectively, in the resistant, susceptible, and nonselected control strains.

(2) IMMUNIZING PHASE. (S. A. Edgar, D. F. King, and C. Flanagan.) — A practical method of immunizing chickens against cecal and three species of intestinal coccidiosis has been developed. The procedure and inoculum for immunization are essentially the same as that reported in 1952 for cecal coccidiosis except for the addition of *Eimeria acervulina, E. necatrix,* and *E. hagani.* Sulfaquinoxaline is administered for 48 hours, starting 13 days after inoculation. Immunized birds challenged at 28 days of age showed marked resistance to all species in the inoculum.

In field tests involving more than 20,000 birds in eight flocks in Alabama, Georgia, and Mississippi, mortality from all types of coccidiosis was less than 0.5 per cent during the first 8 weeks and mortality from all causes averaged 1.92 per cent. The new vaccine was used on more than 15 million birds during late 1954 and early 1955. Field evidence indicates that the addition of one or two other species of intestinal coccidia may be justified.

(3) RELATED ASPECTS. (S. A. Edgar and C. Flanagan.) — *Effects of Coccidiosis on Chickens of Different Ages.* When chickens of different ages were inoculated with numbers of coccidia oocysts in proportion to body weight at the time of inoculation, the effect on 9- to 12-week weights increased with age of inoculation up through 6 weeks. White Leghorn cockerels inoculated with *E. acervulina* at 3 days of age averaged 2.6 pounds at 9 weeks as compared with 2.5, 2.4, and 2.1 pounds for those inoculated at 2, 4, and 6 weeks, respectively. This effect was true for *E. acervulina,* an intestinal species, used alone or in combination with *E. tenella.* The effect on weight retardation also occurred when chickens were fed 0.0125 per cent sulfaquinoxaline continuously in the ration. The degree of immunity acquired by chickens inoculated with *E. tenella* oocysts in proportion to body weight at 3 days, 2, 4, 6, and 8 weeks was the same.

Acquired Resistance. Two inoculations of 400 oocysts of *E. tenella* per bird, inoculations 10 days apart, in feed resulted in greater immunity than one inoculation of 400 or 800 oocysts. Day-old chicks that received 1,600 oocysts and were fed 0.0125 per cent sulfaquinoxaline in the feed for 10 days after inoculation were solidly immune by 12 days of age. One inoculation of 1,600

oocysts per bird that received 0.1 per cent sulfaquinoxaline in the feed during the 4 or 5 days after inoculation resulted in a higher degree of immunity than when birds were inoculated with 800 oocysts each and received no drug. Chickens that experienced food passing through their digestive tracts before inoculation developed greater immunity than those inoculated before having eaten food. Two inoculations of 1,000 oocysts per chicken, 10 days apart, resulted in greater immunity by 37 days of age than one inoculation of 400 or 5,000 oocysts or 1,000 oocysts per bird daily for 14 days.

Drug resistance. Although certain field strains of *E. tenella* have appeared to become resistant to sulfaquinoxaline, laboratory strains subjected for 10 generations to low levels of sulfaquinoxaline, nitrophenide, or nitrofurazone failed to exhibit marked drug resistance.

Chemotherapy Studies. Experiments comparing the efficacy of several coccidiostats failed to confirm reports of others that PARABIS, at usable levels, was as efficacious as several other drugs, for example, sulfaquinoxaline. Birds tolerated 0.0055 per cent nitrofurazone in the feed, but feed intake was reduced and growth retarded when the drug was fed continuously at 4 or 8 times the above level. Birds exhibited marked toxic symptoms within a few days when fed the highest level.

Poultry Anthelmintics. (S. A. Edgar.) — Experiments were conducted testing two piperazine compounds against several species of poultry helminths. In a preliminary experiment, piperazine adipate at 150 mg. per bird by capsule caused the elimination of 99 per cent of the adults and 73 per cent of the larvae of *Ascaridia galli.* At 248 mg. per bird piperazine hexahydrate caused the elimination of 100 per cent of the adults and 53 per cent of the larvae.

In subsequent experiments piperazine hexahydrate, a water soluble form, was administered in water at levels ranging from 0.2 to 1.6 per cent resulting in a high degree of elimination of *A. galli* and approximately 50 per cent elimination of *Heterakis gallinae.* The drug was non-toxic when fed as 0.8 per cent of the water for 3 days or for longer periods at lower concentrations, but 1.6 per cent was toxic causing marked reduction in weight gain when administered even for 1 day. Recovery was prompt when the drug was removed. The drug was well tolerated by

growing birds when as much as 3 grams was consumed during several days at the lower levels. Effective treatment levels were nontoxic to laying hens. At levels tested, the drug has little activity against tapeworms or other helminths.

ZOOLOGY-ENTOMOLOGY

Control of Cotton Insects. (F. S. Arant, R. L. Robertson, and R. H. Mount.) — In field experiments with new insecticides for control of cotton insects, endrin at the rate of 0.37 pound per acre reduced the infestation of boll weevil, *Anthonomus grandis* Boh., and resulted in increased yields of cotton. It also controlled bollworm, *Heliothis armigera* (Hbn.). Chlorthion at 0.75 pound per acre, methyl parathion at 0.37 pound per acre, and malathion at 3.0 pounds per acre, each in mixtures containing 0.75 pound DDT per acre, gave satisfactory control of boll weevil and bollworm.

In a combination laboratory-field experiment, Bayer 17147 (a benzo triazine derivative of a dithio phosphoric acid methyl ester) was highly effective against the boll weevil. Five per cent dust of the Bayer compound was faster in its toxic action and had a longer residual in the field than 20 per cent toxaphene.

Three per cent gamma dusts prepared from high (41 per cent) gamma and low (15 per cent) gamma benzene hexachloride and lindane were about equally effective in controlling cotton aphids, *Aphis gossypii* Glover, in field experiments. Three per cent and 5 per cent aramite, 3 per cent chlorthion, 5 per cent malathion, 3 per cent methyl parathion, and 1 per cent parathion applied as dusts at the rate of approximately 20 pounds per acre were more effective in controlling the desert mite, *Tetranychus desertorum* Banks, than was sulfur. Sprays were also effective when applied at the following rates per acre: chlorthion, 0.50 pound; demeton, 0.25 pound; malathion, 0.50 pound; methyl parathion, 0.25 pound; parathion, 0.25 pound, and Ovotran, 2.00 pounds. These sprays were also effective in control of strawberry mite, *T. atlanticus* McG.

Control of Insect Pests Attacking Corn and Grain Sorghum. (W. G. Eden.) — Experiments were conducted in 1953 and 1954 on control of the corn earworm, *Heliothis armigera* (Hbn.), in sweet corn at the substations at Fairhope and Clanton. In several experiments with DDT and mineral oil, it was found that the

use of 1.75 gallons of mineral oil in addition to DDT increased the percentage of worm-free ears. At a 1-pound per acre application rate of DDT, the use of mineral oil increased the worm-free ears from 17.5 to 58.8 per cent. At the 2.5-pound rate of DDT, the mineral oil increased the worm-free ears from 64.5 to 86.8 per cent. Increasing the DDT to 3 or 4 pounds per acre per application without mineral oil failed to result in significant increases in earworm control. Foliage injury resulted from the use of mineral oil when temperatures were high and humidity low. One pound of endrin per acre per application gave approximately the same earworm control as 2 pounds of DDT.

An experiment was conducted at Tallassee on control of the corn earworm in single-cross hybrid seed corn. Five or more spray applications of 2 pounds of DDT plus mineral oil resulted in the highest percentage of undamaged ears; however, the highest yield of clean, saleable seed resulted from four applications of DDT without oil. Four to seven applications of DDT with and without mineral oil resulted in the same significant reduction in damage by stored grain pests at harvest.

Experiments conducted at Headland showed that the corn earworm and the fall armyworm, *Laphygma frugiperda* (A. & S.), were the two most important insects attacking corn in the field. Corn planted in April yielded more than corn planted in May when no insect control measures were applied. The May corn required one to two more applications of insecticide than the April-planted corn. Even with additional insecticidal applications to the May corn, generally, the April corn still produced higher yields. In a field of late-planted corn that was severely attacked by the fall armyworm, one or more sprays of 2 pounds of DDT per acre more than doubled the yield.

An experiment on control of the lesser cornstalk borer, *Elasmopalpus lignosellus* (Zell.), in corn was conducted at Prattville. Endrin, dieldrin, and heptachlor at 1 pound per acre, DDT at 2 pounds and toxaphene at 4 pounds per acre as sprays, and 1 pound of dieldrin as granules were applied four times at weekly intervals, beginning as the plants were emerging. All treatments except endrin resulted in significant yield increases over the untreated check. The use of dieldrin granules resulted in the highest yield of any treatment.

The sugarcane beetle, *Eutheola rugiceps* (Lec.), did an unusual amount of damage to corn in Alabama in 1954. An experi-

ment on control of the insect in corn was conducted at Camden. Aldrin, 1 pound per acre as spray, or granules, applied on top of the row immediately after planting, was effective in preventing damage.

An experiment on control of the tobacco thrips, *Frankliniella fusca* (Hinds), on seedling corn with sprays was conducted in Baldwin County. Excellent control was obtained with emulsion sprays containing the following insecticides and rates in pounds per acre: DDT, 2; toxaphene, 4; dieldrin, 1; and malathion, 1.

Corn varieties found to be most resistant to stored grain insects were Dixie 18, La. 521, Dixie 11, Coker 811, and McCurdy 1001-A and 1003. The most susceptible hybrids were U.S. 13, Dixie 17, Pioneer 301-A, 309, and 510.

Control of Insect Pests of Vegetable and Truck Crops: (1) CONTROL OF INSECTS OF SWEETPOTATOES. (Lacy Hyche and W. G. Eden.) — Experiments were conducted in 1953 and 1954 on methods of applying insecticides for control of wireworms on sweetpotatoes. Over 90 per cent of the wireworms collected from sweetpotato fields were the tobacco wireworm, *Conoderus vespertinus* (F.). At Cullman, where aldrin and dieldrin were used at 2 pounds per acre, emulsions in the transplant water were ineffective for control of wireworms. Broadcast applications of dusts and granules appeared to be slightly more effective than dust-fertilizer mixtures; however, granule-fertilizer mixtures were equal to the broadcast treatments in effectiveness. There was no difference in the effectiveness of the two insecticides when applied in the same manner. At Clanton, where heptachlor and aldrin were used, all treatments were effective in reducing wireworm damage. All treatments except heptachlor granules resulted in over 90 per cent undamaged sweetpotatoes, with no difference between insecticides. Subsequent analysis of the heptachlor granules revealed that most of the insecticidal activity had been lost. At Ashford where aldrin and lindane were used, all insecticidal treatments were effective in reducing wireworm injury. There was no difference in effectiveness between the methods of application. At all locations, with the exception of lindane emulsion in the transplant water at Ashford, which depressed the sweetpotato yields, none of the insecticidal treatments affected the yields of sweetpotatoes.

The most prevalent insects found feeding on the foliage of

sweetpotatoes were leafhoppers of the genus *Empoasca.* At Ashford in 1953 an outbreak of the hornworm, *Herse cingulata* (F.), occurred and caused light damage to the foliage of untreated plants. Dusts of 5 per cent DDT, TDE, and methoxychlor and 20 per cent toxaphene applied at 7- to 10-day intervals during the growing season have given good yield increases when there was enough rain to produce a normal crop.

(2) CONTROL OF LESSER CORNSTALK BORER ON BEANS AND PEAS. (Lacy Hyche and W. G. Eden). — An experiment was conducted at Ashford on control of the lesser cornstalk borer, *Elasmopalpus lignosellus* (Zell.), on cowpeas. One pound of endrin per acre applied to the row as spray or granules or as granules broadcast as the plants were emerging and two subsequent applications at weekly intervals were effective in maintaining a stand; 15 per cent of the plants in untreated plots were killed by the borer. DDT, dieldrin, heptachlor, and toxaphene were slightly less effective.

(3) CONTROL OF FLOWER THRIPS ON BLACKBERRIES. (Lacy Hyche and H. H. Tippins.) — An experiment was conducted at Clanton in 1954 on control of flower thrips, *Frankliniella tritici* (Fitch), on blackberries. One application of 1 pint of 25 per cent emulsifiable parathion or 1.5 pints of 50 per cent emulsifiable malathion per 100 gallons of spray applied 5 days before the first picking was highly effective in controlling flower thrips throughout the picking season. A slightly higher degree of control was obtained in plots that received two applications but differences were not significant. Less than 1 p.p.m. of these compounds was found on berries 4 days after the second application of the insecticide.

Control of Mites Infesting Earthworm Beds. (Lacy Hyche and W. G. Eden.) — An experiment was conducted at Auburn in 1954 to determine the effects of several miticides on mites infesting earthworm beds and on earthworms. The mite that occurred in the greatest numbers in the earthworm medium was *Caloglyphus anomalus* Nesbitt (Family Acaridae). Two less numerous species were identified as *Macrocheles* sp. (Family Macrochelidae) and *Parasitus* sp. (Family Parasitidae). Compounds tested were Metacide, malathion, parathion, and Aramite. All treatments with the exception of Aramite greatly reduced the mite populations. Metacide at the rate of 1 pint of 50 per cent emulsifiable

per 100 gallons of water gave a high degree of control without killing the worms.

The Toxicity of Several Insecticides to Two Strains of the House Fly. (A. D. Oliver, M. W. Marsh, and W. G. Eden.) — A series of experiments was conducted at Auburn to determine the extent of resistance of native house flies to insecticides and to test the effectiveness of promising organic phosphates as residual insecticides for house fly control. The LD-50's of 11 insecticides were determined for a native (Auburn) strain and a nonresistant (Orlando) strain. The LD-50's in micrograms per fly for the Auburn and Orlando strains respectively, were: isochlorthion, 0.031 and 0.024; Diazinon, 0.057 and 0.096; chlorthion, 0.135 and 0.210; TEPP, 0.240 and 0.190; malathion, 1.070 and 0.870; lindane, 1.250 and 0.750; endrin, 2.100 and 1.900; methoxychlor, 2.325 and 1.925; DDT, 6.400 and 0.450; heptachlor, 13.000 and 11.000; and chlordane, 29.000 and 42.000.

There were no statistically significant differences between the LD-50's of the 11 insecticides to the two strains of flies with the exception of DDT and Diazinon. It required over 14 times as much DDT to kill the Auburn strain as the nonresistant strain. For Diazinon, it appeared that nearly twice as much of the insecticide was required to kill the nonresistant flies as the native strain.

Malathion residues of 100 mg. per square foot on plywood boards exposed to inside weathering gave over 50 per cent kill of flies for about 20 days; the same rate exposed to outside weathering gave less than 10 per cent kill after 4 days. At 200 mg. per square foot and outside weathering, malathion gave over 50 per cent kill for 12 days; with inside weathering this deposit was giving over 90 per cent kill at 44 days. Diazinon residues of 150 mg. per square foot exposed to outside weathering became ineffective in 24 days; however, it revived and continued to give over 75 per cent kill for 36 days. The 300 mg. per square foot rate with outside weathering gave over 90 per cent kill of house flies for 36 days; with inside weathering this deposit gave complete kill for 52 days.

Toxicity of Miticides and Insecticides to the House Cricket. (W. L. Seal and W. G. Eden.) — Experiments were conducted in 1953 on the toxicity of several miticides to the house cricket,

Acheta domestica L. Wettable powder formulations of the miticides Aramite (15 per cent), Dimite (40 per cent), Karathane (25 per cent), and Ovotran (50 per cent) at concentrations up to 10 pounds per 100 gallons of water were sprayed on adult crickets with no adverse effects. Experiments were conducted in 1954 to determine the toxicity of residues of four chlorinated hydrocarbon insecticides to the house cricket. The LD-50 deposits on plywood boards for 1-hour exposures of house crickets to the four insecticides in micrograms per square centimeter were: lindane, 7.75; heptachlor, 12.9; chlordane, 100.2; and endrin, 128.

The Effect of Systemic Insecticides on Bloodsucking Ectoparasites. (F. S. Arant, T. R. Adkins, Jr., W. L. Sowell, and J. L. Dusi.) — Experiments were conducted (1) to find chemicals that will kill bloodsucking ectoparasites when administered orally to rabbits without causing severe toxic symptoms in the host, (2) to determine the acute toxicity of L13/59 (0,0-dimethyl-1-hydroxy-2,2-trichloroethylphosphonate) and 21/116 (0-[2-(ethyl mercapto) ethyl]-0,0-dimethyl thiophosphate) to domestic rabbits, and (3) to study in detail the effect of L13/59 on bed bugs feeding on rabbits treated orally with the chemical.

Five of the 13 chemicals studied had systemic action against test arthropods feeding on rabbits dosed orally with the chemicals. Four materials gave 100 per cent mortality of fifth-instar bed bugs, *Cimex lectularius* L., at the dosages indicated as follows: L13/59, 200 mg. per kilogram of rabbit; 18/178 (0-[2-(ethylmercapto) methyl]-0,0-dimethyl thiophosphate), 130 mg. per kilogram; 21/116, 95 mg. per kilogram; schradan, 20 mg. per kilogram. A fifth, hexamethylphosphoramide, killed 63 per cent of the bed bugs at a dose of 1,300 mg. per kilogram, although the test insects failed to feed to repletion. Nymphs of the lone star tick, *Amblyomma americanum* (L.), died while attached to rabbits dosed with L13/59, 18/178, and 21/116 at the rates given for bed bugs. A tick mortality of 100 per cent also resulted from the use of hexamethylphosphoramide, but the ticks dropped from the rabbits before dying. The test rabbits exhibited no severe symptoms of poisoning.

In acute toxicity experiments with rabbits, the oral LD-50 of L13/59 was determined as 298 mg. per kilogram. The LD-50 of 21/116 was 125 mg. per kilogram. Toxic symptoms were similar

from the two chemicals and included nervousness and muscular fibrilation, salivation, lacrimation, diarrhea, and prostration. Gross pathology from 21/116 poisoning included edema and congestion of the lungs. The only histopathology found consisted of slight fatty changes in the liver.

Replicated experiments were conducted on the systemic effect of L13/59 on fifth-instar bed bugs that fed on rabbits dosed orally with the chemical. Sixty-four rabbits and 2,100 bed bugs were used. Where the insects fed 2 hours after rabbits were dosed, mortalities of bed bugs were: on rabbits receiving 0 mg. per kilogram of body weight, 0 per cent mortality; 10 mg. per kilogram, 25.6 per cent; 20 mg. per kilogram, 61.3 per cent; 30 mg. per kilogram, 81.9 per cent; and 40 mg. per kilogram, 100 per cent. Test rabbits showed no toxic symptoms.

Preliminary experiments with nymphs of the lone star tick indicated that the LD-50 to the test arthropod was between 30 and 100 mg. of L13/59 per kilogram of rabbit.

Control of Peanut Insects. (B. Wayne Arthur.) — Field experiments were conducted on sandy soil at Headland and clay soil at Troy for the control of soil and foliage insect pests of peanuts in 1953 and 1954. Damage from subterranean insects was greater at Headland than at Troy. Granular formulations of toxaphene, 6 pounds per acre, and aldrin and dieldrin, each 2 pounds per acre, applied to the soil at pegging down time, reduced insect damage to pods with subsequent increases in yield. No increase in yield resulted from the application of the materials in the fertilizer at planting time. Soil applications of aldrin and dieldrin granules also effectively controlled thrips, *Frankliniella fusca* (Hinds), on peanut seedlings.

Significant control of the red-necked peanut worm, *Stegasta bosquella* (Chamb.), was obtained from dust applications of 20 per cent toxaphene, 10 per cent DDT, 2 per cent endrin, 2 per cent dieldrin, and 3.75 per cent heptachlor.

Results of a soil sampling program revealed a wireworm, *Conoderus vespertinus* (Fab.), damaging peanut pods.

Research was conducted on insect pests of stored peanuts and their control.

Twenty-six species of insects were collected from storage bins. The flour beetles, *Tribolium castaneum* (Hbst.), and *T. confusum* (Duv.), the corn sap beetle, *Carpophilus dimidiatus* (F.), the for-

eign grain beetle, *Ahasverus advena* (Waltl.), and the Indian meal moth, *Plodia interpunctella* (Hbn.), were the most common and abundant species collected.

Pyrenone grain protectant dust was effective in reducing damage to peanuts in storage for 8 months. Methyl bromide, ethylene dichloride-carbon tetrachloride, carbon disulfide-carbon tetrachloride, EB5 (ethylene dibromide), and Acrylon were effective for control of insects in stored peanuts immediately after fumigation. Peanut kernels absorbed approximately 10 p.p.m. of total bromide as a result of fumigation with methyl bromide. There was an accumulation of bromide residues from successive fumigations. Germination of peanuts was not affected.

DDT, methoxychlor, TDE, and lindane dusts and sprays were effective in cleaning up insect infestations in stored bins prior to placing peanuts in storage. Initial moisture at which peanuts were stored had little effect on insect abundance. Peanuts with sound hulls were not damaged by insects but those with split hulls were subject to infestation.

Control of Insect Pests of Ornamental Plants. (B. Wayne Arthur.) — Experiments were conducted at the Ornamental Horticulture Field Station, Spring Hill, and at Auburn on the control of insect pests and spider mites attacking ornamental plants. Some of the major pests encountered were: tea scale, *Fiorinia theae* Green; camellia scale, *Lepidosaphes camelliae* Hoke; barnacle scale, *Ceroplastes cirripediformis* Comst.; ground pearl, *Margarodes meridionalis* Morr.; whitefly, *Dialeurodes citri* (Ash.); lace bug, *Stephanitis pyrioides* Scott; and southern mite, *Paratetranychus ilicis* McG.

Two applications of demeton (Systox) or meta-systox, 1 pint of 50 per cent emulsifiable concentrate per 100 gallons of water, gave good control of tea scale when applied to the soil or foliage of Ilex and camellia plants growing under lath house and field conditions. Demeton effectively controlled camellia scale on potted camellia liners. Foliage applications of parathion or malathion, 0.5 pounds and 1.5 pounds, respectively, of technical material per 100 gallons of water, also effectively reduced tea scales and camellia scale infestations. Control of barnacle scale on gardenia was obtained with soil applications of demeton applied at a concentration of 2 pints of 50 per cent emulsifiable concentrate per 100 gallons of water. Ground pearl populations in lawn

grasses were reduced with granules of heptachlor or dieldrin, 20 pounds of technical material per acre, and chlordane or toxaphene, 40 pounds of technical material per acre, incorporated into the infested soil. Fumigation with 1 pound of methyl bromide per 100 square feet of soil gave 100 per cent control of ground pearl. Foliage applications of 1 pint of 50 per cent demeton, 0.5 pounds of parathion or 1.5 pounds of malathion per 100 gallons of water gave effective control of whitefly on gardenia plants and lace bug on azaleas.

The following materials applied at the indicated concentrations per 100 gallons of water were highly effective in reducing spider mite infestations: demeton or meta-systox, 2 pints of 50 per cent emulsifiable concentrate; Ovotran, 2 pounds of 50 per cent wettable powder plus 1 pound of 15 per cent wettable powder parathion; and malathion, 3 pints of 50 per cent emulsifiable concentrate.

Control of Black Turpentine Beetle in Pine Trees. (George H. Blake, Jr.) — An experiment was conducted on control of the black turpentine beetle, *Dendroctonus terebrans* (Oliv.), in pine trees. A spray containing 1 pound of 25 per cent wettable lindane and 4 pounds of 50 per cent wettable DDT in 50 gallons of water was applied to infested trees to a height of 25 to 30 feet. One month later no new pitch tubes were evident. Three months after the spray application, however, a few of the trees were reinfested. This indicated that for most effective control all trees in an infested area should be treated.

Control of Insect Pests of Legumes. (George H. Blake, Jr.) — Experiments on control of the pea aphid, *Macrosiphum pisi* (Kltb.) on Caley peas revealed that two applications of 10 per cent DDT, 3 per cent gamma BHC, or 1 per cent parathion were effective for control of these pests. Aphid populations were reduced by these insecticides, but no differences in seed yields were obtained due to extreme drought conditions.

The imported fire ant, *Solenopsis saevissima* v. *richteri* Forel, has been controlled for 2 years by single broadcast applications of dieldrin, as spray or granule, at a rate of 2 pounds of technical material per acre. Heptachlor and dieldrin at rates of 0.5, 1.0, and 2.0 pounds per acre and chlordane at 4 pounds per acre as granular formulations have been effective for fire ant control for at least 1 year.

Experiments on pollination of crimson clover by honey bees have revealed that 2 colonies of bees per acre of clover should be used for most efficient seed production. Bees are not needed for production of enough seed to maintain the clover stand.

An experiment was conducted to determine the amount of dieldrin in the milk of cows grazed on pastures treated with dieldrin granules. Dieldrin, 2.5 pounds of technical material per acre, as granules was applied to pastures and cows were allowed to graze on the area. Milk samples were taken immediately and at intervals after application for analyses for dieldrin residues. The highest residues were found after cows had grazed on the treated area for 60 hours, and at that time, the residue of dieldrin in the milk was only 0.31 parts per million parts of milk. Twenty-eight days after treatment, residues were less than 0.10 p.p.m.

Toxicity of Several Insecticides to Sheep and Cattle Grazed on Pastures Treated for Insect Control. (George H. Blake, Jr.) — An experiment was conducted to determine the toxicity of several insecticides to livestock when insecticides were applied to pastures and the livestock were allowed to graze on the treated forage. Toxaphene dust and granules at 4 pounds per acre and toxaphene sprays at 2, 4, 6, and 8 pounds per acre, DDT and methoxychlor dusts at 2 pounds per acre, and cryolite dust at 40 pounds per acre were applied to the pastures. Livestock were placed on the pastures immediately and 1, 2, and 3 weeks after the insecticidal applications. Forage samples were taken immediately after treatment and at weekly intervals after treatment to determine insecticidal residues. Fat samples were taken from the animals after they had grazed on the treated area for 28 days, and 28 days after they were removed from the experiment to determine insecticidal residues following grazing and the persistence of the residues in the fat.

None of the animals were killed by the insecticides. Animals placed on pastures immediately after treating with 6 and 8 pounds of toxaphene per acre showed symptoms of poisoning; however, these symptoms disappeared after a few days. There were no significant differences between weight changes of animals on the treatments.

Initial insecticidal deposits on the forage were very high. These residues declined rapidly during the first week and rather slowly during the rest of the test period. Light rains during the test period reduced the residues only slightly.

Considerable amounts of insecticidal residues were found in fatty tissues of all animals after they had grazed on treated areas for 28 days. However, practically all of the residues were eliminated if the animals were allowed to graze on an untreated area for an additional 28 days.

Histological studies of the various animal tissues revealed no pathological changes due to the insecticides.

Control of Insect Pests of Livestock. (George H. Blake, Jr.) — Experiments were conducted using malathion as water suspensions and emulsions and in blackstrap molasses as a bait for house fly control. Two gallons of a 57 per cent emulsifiable concentrate or 16 pounds of a 25 per cent wettable powder were used in 100 gallons of water. One and one-half pounds of 25 per cent wettable malathion were mixed with 5 gallons of molasses for the bait preparation. All formulations of the malathion controlled flies for approximately 10 days. Spray applications to young calves had no ill effect on them.

An experiment was conducted on control of horn and house flies on dairy cattle using pyrenone concentrate applied with a treadle-type sprayer. Cattle were sprayed when the horn fly infestation reached approximately 10 to 15 flies per animal. Three initial daily applications and applications at weekly intervals throughout the fly season were highly effective for fly control. Only 1 gallon of the concentrate was used to control flies on 40 cows for a period of 3 months.

Farm Ponds. (H. S. Swingle, J. M. Lawrence, J. E. Padfield, E. E. Prather, J. S. Dendy, E. W. Shell, and A. L. Black.) — The bigmouth buffalo, *Megastomatobus cyprinella,* and smallmouth buffalo, *Ictiobus bubalus,* were induced to spawn by transferring ripe males and females into ponds of fresh water when the water temperature was 60° F. or above. Also effective was the placement of brood fish in a pond containing 1 or 2 feet of water and then filling it rapidly with fresh water when the water temperature reached 60° to 65° F.

Smallmouth buffalo weighing less than 2 pounds failed to develop eggs when held in ponds.

In ponds stocked with both smallmouth and bigmouth buffalo at the rate of 400 per acre and fertilized with inorganic fertilizers, production up to 622 pounds of fish per acre was obtained in 1

year. The cost of fertilizer was from 5 to 7 cents per pound of fish produced.

Deaths of goldfish in dense populations that were being fed soybean cake or peanut meal appeared due to nutritional deficiency and apparently was corrected by feeding fish meal (ratio: soybean cake or peanut meal, 6 parts; fish meal, 1 part) as a supplement.

Partial control of *Pithophora* in ponds was obtained by applying Delrad 70 at the rate of 3 to 4 pounds per surface acre. The material can be applied as a spray, by towing in a sack, or by placing in a float-box with a burlap bottom and allowing water currents to distribute it. Two to five applications were necessary for effective control of heavy infestations.

Sodium arsenite, applied in pond waters at a concentration of 4 p.p.m., was effective in the control of *Hydrodictyon* and *Pithophora* when applied to ponds during fall turnover.

Fertilization of ponds was successfully accomplished by use of water currents to distribute the fertilizer. Opened sacks of fertilizer were placed or poured on platforms about 1 foot under water, using one platform per 8 acres or less of water. The platforms were located on points about 10 feet from the pond edge. The normal water circulation due to winds and temperature changes was sufficient to give adequate distribution of fertilizer over the entire pond. Results appeared superior to broadcasting fertilizer over the shallow areas of the pond as is normally practiced.

A disease of pond fish new to the Southeast was found on fish from ponds in Alabama, Georgia, Mississippi, and possibly South Carolina. This is a bacterial gill disease caused by *Chrondococcus columnaris*, and called columnaris disease. It killed large and small bass, large bluegills, shellcrackers, speckled bullheads, crappie, goldfish, and golden shiners. The disease apparently is spread by use of infected bait minnows and by aquatic birds.

Lexone used at a concentration of 0.1 p.p.m. gamma BHC gave 100 per cent control of fish lice without injury to goldfish brood stock or young goldfish.

In aquaria experiments, carp fed on a diet of peanut meal and fish meal developed a "popeye" condition that apparently was cured by injections of folic acid, pyridoxine, and calcium pantothenate. Another dietary deficiency produced blindness, fin rot, loss of equilibrium, and nervousness. This condition was corrected by injections of the vitamin B complex.

The chlorine content of city water was found to be sufficiently high during the winter months to be toxic to most species of pondfish. Concentrations of 0.02 to 0.04 p.p.m. were toxic to most species. The most effective methods of eliminating chlorine appeared to be the use of activated carbon filters or the addition of sodium thiosulphate to the water.

Experiments were started with the Asiatic pondfish, *Tilapia mossambica*. In comparable tests with bluegills, *Tilapia* gave 50 to 100 per cent higher production in ponds that received manure, inorganic fertilizer or feeding. However, *Tilapia* appeared highly susceptible to cold weather and all those left outdoors were killed in October when water temperatures dropped to 52° to 48° F.

Experiments using potassium permanganate to counteract the toxicity of rotenone to fish appeared promising. This technique will be of considerable use in stream population studies, in partial poisoning, and in restocking waters where the fish populations have been eliminated by rotenone poisoning.

PUBLICATIONS

Experiment Station Bulletins

No. 285 Alabama Cotton Mills – A Study of Requirements, Buying, Procedures, and Practices. R. WAYNE ROBINSON. 1953.

No. 286 Alabama Agriculture – Its Characteristics and Farming Areas. BEN T. LANHAM, JR., J. H. YEAGER, and BEN F. ALVORD. 1953.

No. 287 Costs and Returns to Alabama Milk Distributors. SHELDON W. WILLIAMS. 1953.

No. 288 Production and Sale of Milk for Manufacture in Alabama's Piedmont Area. J. H. YEAGER. 1953.

No. 289 Factors Affecting Germination of Runner Peanuts. J. HOMER BLACKSTONE, HENRY S. WARD, JR., J. L. BUTT, I. F. REED, and WILLIAM F. MCCREERY. 1954.

No. 290 Costs and Returns to Commercial Egg Producers. J. HOMER BLACKSTONE and H. A. HENDERSON. 1954.

No. 291 Marketing Practices of Commercial Egg Producers in Alabama. H. A. HENDERSON. 1954.

No. 292 Factors Affecting Handling Costs of Cottonseed at Gins in Alabama. FRED B. ANDERSON. 1954.

Experiment Station Circulars

No. 112 Production of Bait Minnows in the Southeast. E. E. PRATHER, J. R. FIELDING, M. C. JOHNSON, and H. S. SWINGLE. 1953.

No. 113 Partial Poisoning of Overcrowded Fish Populations. H. S. SWINGLE, E. E. PRATHER, and J. M. LAWRENCE. 1953.

No. 114 Studies with Pickling Cucumbers in Alabama. L. M. WARE, C. L. ISBELL, HUBERT HARRIS, and W. A. JOHNSON. 1953.

No. 115 Factors Affecting Pecan Yields. T. B. HAGLER, W. A. JOHNSON, and H. G. BARWOOD. 1953.

No. 116 Single-Deck Cages for Laying Hens. DALE F. KING. 1954.

Experiment Station Leaflets

No. 34 Control of Corn Rootworm in Corn. W. G. EDEN and F. S. ARANT. 1953.

No. 35 Suggestions for Pruning Southern Pines. GEORGE I. GARIN. 1953.

No. 36 Control of Vetch Bruchid in Alabama. GEORGE H. BLAKE, JR., and W. G. EDEN. 1953.

No. 37 Rates and Methods of Planting Fuzzy, Reginned, and Acid Delinted Cotton Seed. H. B. TISDALE, J. T. WILLIAMSON, J. T. COPE, JR., and I. F. REED. 1953.

No. 38 Control of Wireworms Attacking Sweet Potatoes. J. A. GRIFFIN, JR., and W. G. EDEN. 1953.

No. 39 End Joints for Southern Pine. D. B. RICHARDS and B. M. COOL. 1953.

No. 40 Control of Insects in Stored Grain. W. G. EDEN. 1953.

No. 41 Storing Shelled Corn in Alabama. J. L. BUTT, H. S. WARD, and W. G. EDEN. 1954.

No. 42 Some Effects of Sawdust Mulching of Pine Seedlings. H. G. POSEY and JACK T. MAY. 1954.

No. 43 Chemical Control of Cherokee Rose, Alder and Certain Other Pasture Weeds. V. S. SEARCY. 1954.

No. 44 Suggestions for Improving Farm Woodlots by Girdling and Poisoning Weed Trees. GEORGE I. GARIN and FRANK F. SMITH. 1954.

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C. H. YEAGER, B.S.—*Assistant Superintendent*
UPPER COASTAL PLAIN, Winfield, Fayette County
W. W. COTNEY, B.S.—*Superintendent*
WIREGRASS, Headland, Henry County
C. A. BROGDEN, B.S.—*Superintendent*
MAX SCONYERS, B.S.—*Assistant Superintendent*
J. G. STARLING, B.S.—*Assistant Superintendent*

CHANGES IN STATION STAFF

1953 Appointments

W. B. ANTHONY, Ph.D.—*Associate Animal Nutritionist*
W. M. ARRINGTON, B.S.—*Asst. Supt., Lower Coastal Plain Substation*
B. W. ARTHUR, M.S.—*Assistant Entomologist*
ORUS L. BENNETT, B.S.—*Assistant in Agronomy*
J. M. BROWN, M.S.—*Assistant Agronomist*
D. E. DAVIS, Ph.D.—*Associate Botanist*
C. W. DOMBY, Ph.D.—*Soil Scientist (Coop. USDA)*
K. H. GARREN, Ph.D.—*Associate Plant Pathologist*
A. R. GILMORE, M.F.—*Assistant Forester*
R. D. HICKS, B.S.—*Asst. Supt., Lower Coastal Plain Substation*
ANNA ELISABETH HOENE, Ph.D.—*Assistant Human Nutritionist*
W. R. LANGFORD, Ph.D.—*Associate Agronomist*
M. E. MERKL, Ph.D.—*Assistant Entomologist*
KATHRYN PHILSON, Ph.D.—*Associate Home Economist*

C. E. SCARSBROOK, Ph.D.—*Associate Soil Chemist*
W. R. WILLIAMS, B.S.—*Asst. Supt., Tennessee Valley Substation*

1953 Resignations

W. M. ARRINGTON, B.S.—*Asst. Supt., Lower Coastal Plain Substation*
C. J. JACOBS, B.S.—*Asst. Supt., Piedmont Substation*
C. H. JOHNSTON, B.S.—*Asst. Supt., Tennessee Valley Substation*
M. W. LOUPO, M.S.—*Assistant Agricultural Engineer*
W. C. MARTIN, JR., B.S.—*Greenhouse Manager*
M. E. MERKL, Ph.D.—*Assistant Entomologist*
J. H. PADFIELD, M.S.—*Assistant Fish Culturist*
D. M. PRESLEY, B.S.—*Field Superintendent*
C. W. REYNOLDS, M.S.—*Associate Horticulturist*
F. D. ROBINSON, B.S.—*Asst. Supt., Upper Coastal Plain Substation*
P. R. SATTERWHITE, B.S.—*Asst. Supt., Lower Coastal Plain Substation*

Deceased

M. J. FUNCHESS—*Dean Emeritus*

1954 Appointments

E. J. CAIRNS, Ph.D.—*Nematologist*
J. E. CAROTHERS, M.S.—*Assistant Forester*
LOUIE J. CHAPMAN, B.S.—*Assistant in Agronomy*
E. A. CURL, Ph.D.—*Assistant Plant Pathologist*
W. L. DORRIES, M.S.—*Assistant Agricultural Economist*
T. M. EDEN, JR., B.S.—*Assistant in Horticulture*
F. T. GLAZE, B.S.—*Field Superintendent*
J. A. GRIFFIN, JR., M.S.—*Assistant Entomologist*
WALTER GRUB, M.S.—*Associate Agricultural Engineer*
CLAIRE F. JONES, B.S.—*Assistant in Agricultural Economics*
JULIAN M. JONES, B.S.—*Assistant in Agricultural Economics*
SAM T. JONES, Ph.D.—*Associate Horticulturist*
C. C. KING, M.S.—*Assistant Agronomist*
J. W. LANGFORD, B.S.—*Superintendent, Plant Breeding Unit*
C. K. LAURENT, Ph.D.—*Associate Agricultural Economist*
C. S. ROBERTS, D.V.M., M.S.—*Animal Pathologist*
R. L. ROBERTSON, M.S.—*Assistant Entomologist*
F. L. SELMAN, M.S.—*Assistant Agronomist*
W. F. SOWELL, B.S.—*Assistant in Agronomy*
C. H. YEAGER, B.S.—*Asst. Supt., Tennessee Valley Substation*

1954 Resignations

W. E. ALSTON, JR., B.S.—*Dairy Husbandman*
F. B. ANDERSON, M.S.—*Assistant Agricultural Economist*

F. W. FITCH, JR., M.S.—*Asst. Leader, Ala. Coop. Wildlife Res. Unit (Coop. USDA)*
ERNESTINE I. FRAZIER, Ph.D.—*Head, Department of Home Economics*
K. H. GARREN, Ph.D.—*Associate Plant Pathologist*
H. A. HENDERSON, M.S.—*Assistant Agricultural Economist*
ANNA ELISABETH HOENE, Ph.D.—*Assistant Human Nutritionist*
C. L. KORNEGAY, B.S.—*Superintendent, Plant Breeding Unit*
MARY ELIZABETH PRATHER, B.S.—*Assistant in Human Nutrition*
R. W. ROBINSON, M.S.—*Assistant Agricultural Economist*
J. L. SNARE, M.S.—*Associate Agricultural Economist*
FRED STEWART, B.S. (Retired)—*Supt., Tennessee Valley Substation*
M. D. WILLIAMS, B.S.—*Assistant in Forestry*
W. R. WILLIAMS, B.S.—*Asst. Supt., Tennessee Valley Substation*
W. W. WILLS, B.S.—*Assistant in Forestry*

Deceased

F. L. DAVIS, Ph.D.—*Soil Chemist*

FINANCIAL REPORT

Fiscal Year Ended June 30, 1953

	Hatch	Adams	Purnell	Bankhead-Jones	Research & Marketing	All Other
Balance July 1, 1952	.00	.00	.00	.00	.00	364,965.88
Income	15,000.00	15,000.00	60,000.00	88,305.89	131,760.58	1,402,516.37
Total Funds Available	15,000.00	15,000.00	60,000.00	88,305.89	131,760.58	1,767,482.25
Expenditures						
Personal Services	13,946.14	12,001.75	48,319.78	69,780.51	97,835.01	782,048.20
Travel	188.77	619.20	1,478.02	2,608.49	8,557.13	42,666.26
Transportation of Things	13.41	4.29	24.51	61.33	437.06	6,847.13
Communication Service	18.28	38.10	294.40	71.35	515.74	7,970.24
Rents & Utilities		430.05	1,088.06	755.08	2,078.59	22,151.88
Printing & Binding			1,828.09	209.68	1,501.69	6,720.14
Other Contractural Services	16.74	8.75	397.81	185.23	763.54	65,937.15
Supplies and Materials	732.96	1,372.11	4,194.07	12,671.43	14,323.39	386,963.84
Equipment	83.70	525.75	2,375.26	1,734.79	5,098.43	135,783.57
Land & Structures				228.00	650.00	30,859.99
Taxes & Assessments						3,808.35
Total Expenditures	15,000.00	15,000.00	60,000.00	88,305.89	131,760.58	1,491,756.75
Balance on Hand June 30, 1953	.00	.00	.00	.00	.00	275,725.50
Total Expenditures & Balance	15,000.00	15,000.00	60,000.00	88,305.89	131,760.58	1,767,482.25

FINANCIAL REPORT

Fiscal Year Ended June 30, 1954

	Hatch	Adams	Purnell	Bankhead-Jones	Research & Marketing	All Other
Balance July 1, 1953	.00	.00	.00	.00	.00	275,725.50
Income	15,000.00	15,000.00	60,000.00	88,305.89	169,250.70	1,561,569.81
Total Funds Available	15,000.00	15,000.00	60,000.00	88,305.89	169,250.70	1,837,295.31
Expenditures						
Personal Services	13,838.74	12,619.96	50,487.05	74,655.44	121,383.88	795,698.53
Travel	196.09	525.25	1,276.21	3,570.00	10,028.06	40,280.85
Transportation of Things	86.22	31.77	20.95	83.25	60.94	7,640.60
Communication Service	36.80	41.00	158.30	101.25	790.19	8,102.23
Rents & Utilities	244.43	542.02	807.76	688.44	2,909.24	29,158.80
Printing & Binding			688.20		2,671.17	4,239.68
Other Contractural Services	20.06	92.50	572.81	470.72	1,172.71	98,332.61
Supplies and Materials	532.91	1,108.50	3,287.62	5,998.99	15,043.94	369,718.07
Equipment	44.75	39.00	2,701.10	2,737.80	15,190.57	136,494.69
Land & Structures						25,802.04
Taxes & Assessments						6,857.69
Total Expenditures	15,000.00	15,000.00	60,000.00	88,305.89	169,250.70	1,522,325.79
Balance on Hand June 30, 1954	.00	.00	.00	.00	.00	314,969.52
Total Expenditures & Balance	15,000.00	15,000.00	60,000.00	88,305.89	169,250.70	1,837,295.31